TIVERTON HIGH SCHOOL

KNOWLEDGE ORGANISER
YEAR 9
2024 - 2025

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Year 9: How to use your Knowledge Organiser book

This book contains **knowledge organisers** for all of your subjects.

Each knowledge organiser has the key information which needs to be memorised to help you master your subjects and be successful in lessons.

Self- quizzing this key information promotes **retrieval strength**. This is your ability to **quickly recall key facts** related to your subject or topic from your **long term memory**.

There are lots of different ways to learn the information in your knowledge organiser. You will be using your **class books** to complete homework and write down and learn the information. You **must** bring your **class books** to school **on each day you have the lesson timetabled** and so packing your school bag the evening before is important.

If you lose your knowledge organiser book you will need to talk to your Head of Year and order a new one at a cost of £1.

CURRICULUM COMMAND WORDS

Knowing how to respond to a question, in any subject, is absolutely critical to successfully demonstrate your knowledge! Listed below, are the equally important but less frequent command words that you are likely to face from across your subjects. It is important to know that quite often, a single question can have multiple commands embedded—which will all need your attention in your work.

Command	How do I respond in my writing ?
Acknowledge	Music: To give credit for, recognise, and highlight something, such as a selected source or the work of others.
Apply	Music: To use knowledge, skills and understanding and to employ appropriate techniques when developing and progressing ideas.
Arrange	History: Put the factors in an order and then justify your choices
Change	Maths: Usually convert from one unit to another; either using known metric unit conversions or the use of a conversion graph.
Collate	Gather and organise your ideas logically
Comment	Write an informed opinion
Consider	To think through, review, reflect on, and respond to given information
Convert	Computing: change the form, character or function of something
Demonstrate	Music: To show, exhibit, prove or express such things as subject specific knowledge, understanding and skills.
Design	Computing: produce a plan, simulation or model
Determine	Science: Use given data or information to obtain an answer
Develop	Music: To take forward, change, improve or build on an idea, theme or starting point.
Draw	Produce a diagram or picture. Note: this command is often linked with 'label' or 'annotate'.
Estimate	Science: Assign an approximate value
Evidence	To show, prove, support and make clear or verify something.
Expand	Maths:Remove brackets
Expand and simplify	Maths: Remove brackets and the collect like terms.

Command	How do I respond in my writing ?
Explore	Music: To investigate, examine and look into with an open mind about what might be found and developed.
Express	Maths: Re-write in another form, some working may be needed.
Factorise	Maths: Insert brackets by taking out common factors.
Factorise fully	Maths: Insert brackets by taking out all the common factors.
Find	Maths: Some working will be needed to get to the final answer.
Give	Typically a very short, undeveloped answer Synonyms: state, name and identify.
Give a reason	Maths: Must be clear and accurate reasons. If the reasons are geometrical then make sure you: provide a reason for each stage of working (if required), use correct geometric terminology
How far do you agree...	History: Examine the evidence and form a detailed opinion
How important was...	History: Judge the importance of the factor and then compare relative to others
Identify	Provide an answer from a number of possibilities
Interpret	Dance: Translate information into recognisable form. Other subjects: examine information for patterns and causation
List	Provide the information in a list rather than continuous writing
Match	Link or pair-up a definition to the a key term
Plan	Science: Write a method used extended bullet point method—unique to writing in Science!
Predict	Science: Suggest the most likely outcome
Present	Music: To give a response to an idea, theme or starting point that shows a personal, meaningful and organised fulfilment of intentions.
Produce	D&T: Draw or design an isometric or orthographic drawing

Command	How do I respond in my writing ?
Produce	D&T: Draw or design an isometric or orthographic drawing
Prove	Maths: More formal than 'show', all steps must be present. In the case of a geometrical proof, reasons must be given.
Prove algebraically	Maths: Use algebra in the proof.
Realise	Music: To achieve, attain and/or accomplish your intentions.
Recommend	Put forward or suggest an answer that is suitable for the question
Record	Music: To document ideas, thoughts, insights and responses to starting points in visual and written annotated form.
Refine	Music: To improve, enhance and change elements of your work for the better.
Research	Music: To study in detail, discover and find information about.
Respond	Music: To produce personal work generated by a subject, theme, starting point, or design brief.
Review	Review is to explain/evaluate e.g. write about and assess the importance, quality or value of the topic
Show	Show structured steps or evidence or all workings needed to get to a given answer
Simplify	Maths: Simplify the given expression
Simplify fully	Maths: Simplify the given expression. Answer must be given in its simplest form
Solve	Maths: Find the solution of an equation or inequality. Computing: Obtain the answer(s) using algebraic/numeric/graphical methods.
State	Music: to express clearly and briefly your intentions.
Tick	Put a mark to indicate that something is correct
Use	Answer must be based on or include the information given within the question
What	Suggest a suitable idea

COMMON CURRICULUM COMMAND WORDS

TOP 20

Knowing how to respond to a question, in any subject, is absolutely critical to successfully demonstrate your knowledge. Responding in the correct way to a command word within a question makes the difference between accessing all the marks, or getting none at all! You must be secure in knowing how you should write according to these 'Top 20' highest frequency command words from across the curriculum. Almost all subjects have additional command words you must know too, so check the subject specific command word KOs for further advice on how to master responding to the full range of commands.

Command	How do I respond in my writing ?
Analyse	Systematically break down the theme of the question into parts and examine each in turn. You should include description, explanations and evidence to reach conclusions.
Annotate	Annotations are extended labels. When annotating, you should write brief descriptive or explanatory sentences linked to features referenced in the question.
Assess	Like analyse, assess means to break the theme of the question down into parts but offer your opinion on the successes ands failures to reach an informed judgement.
Calculate	You need to use the data (numbers) within the question, or resource that the question is based on, and apply a mathematical function to get your answer.
Compare	An effective comparison will make clear references to both similarities and differences between the items within the questions.
Complete	You are directed to use information available to you (a resource with the question or your knowledge) to finish a task. This is most commonly linked to cloze paragraphs (a.k.a. gap-fill) style questions.
Contrast	Writing to show contrast will make clear references to just differences between the items within the questions.
Define	Give a definition (precise meaning) of the feature or item referenced in the question., such as a word, phrase, concept or physical quantity.
Describe	Write details of what the feature/item or theme are like within the question. *Do not explain* as a description requires no explanation.
Discuss	Describe and explain a balance of the similarities and differences, or positives and negatives of whatever the question is about. Evidence is important to include—as is your opinion. Always add a conclusion to summarise your discussion.

Command	How do I respond in my writing ?
Evaluate	Systematically break down the theme of the question to make an informed judgement supported by evidence for the strengths, weaknesses (or limitations), opportunities to improve a way of working or concept, to reach conclusions.
Explain	Give reasons for **how** or **why** something is like it is. Write in a way that shows cause and effect. The words 'because', '…as a result', '…this is due to', 'consequently' should be in your writing.
Justify	Write a convincing argument to reach a conclusion supported by evidence.
Label	Labelling is simply naming features or parts of something; these are not sentences
Outline	Give a brief overview of the whole theme of the question. You can describe or explain just the main points in limited detail. The amount you write depends on the amount of content within the question.
Plot	Add data (results or values) onto a graph. Read the axis labels carefully to understand the units. If present, your plotted data should 'look' like the other data already present on the graph.
State	Give the name of a feature or item referenced in the question. *Synonyms are: give/name or identify.*
Study	This command will often be linked to a resource within a question such as a map, photo or diagram; you are being encouraged to look at and understanding this resource for inclusion in an answer.
Suggest	Explain a possible reason for theme of the question. 'Suggest' questions are asking you to put forward an idea you have.
To what extent	The question is asking how far you agree with something—from fully agree to totally disagree—often a statement or a quote for example. Give your opinion immediately and examine arguments that support and discount your opinion. Support with evidence to reach a conclusion.

QUESTION DECONSTRUCTION SKILLS

BUGS

Box around the command word

Underline the key words

Go over the question again

Spare a line/time for planning

Example of using BUGS:

Explain a valid reason — This means a method of working

Q: Suggest why using BUGS is a good technique for writing successful answers to exam-style questions (6)

Writing that demonstrates what I know suitable to the question — I only earn marks for writing in the appropriate way in exam questions

THE 'TRIPLE C' TECHNIQUE

The 'Triple C' technique for question deconstruction stands for '**C**olour **C**ode **C**omplex' questions. This technique is a more in-depth take on using BUGS, which is more effective for longer answer essay questions, or with more complex command words such as: evaluate, discuss, analyse and assess for example. Get your highlighters out and use a different colour for the different clauses and keyword phrases within the question. This will ensure you respond to all parts of the question and paragraph effectively to demonstrate your writing stamina.

Example of using 'TRIPLE C':

Two commands: Must use real examples, and must evaluate (judge something).

Judge the effectiveness by evaluating strengths, weaknesses and opportunities to change something

Q: Using examples you have studied, evaluate the effectiveness of using question deconstruction techniques to write successful answers (9)

A detailed, evaluative paragraph on each techniques : BUGS' and 'Triple C'

Conclude on the effectiveness of whether the technique makes for successful written answers

THS Tier 2 Vocabulary

Tier 2 words are words that you wouldn't normally use in your everyday speech and aren't subject specific terminology. You are likely to find them when you are reading, or you might use them in your writing. Our THS 100 Word List is made up of 100 words that are often used in exam questions and texts. They are divided into sublists: sublist 1 has the most common words and sublist 10 has rarer words. Recognising these words will help you to understand the texts that you might be given in your different lessons and exams.

Sublist 1
1. process
2. individual
3. specific
4. source
5. identified
6. create
7. derived
8. factors
9. definition
10. interpretation
11. consistent
12. structure
13. analysis
14. indicate
15. response
16. context
17. significant

Sublist 2
1. community
2. relevant
3. impact
4. consequences
5. participation
6. cultural
7. affect
8. effect
9. complex

Sublist 3
1. convention
2. implies
3. dominant
4. constant
5. justification
6. alternative
7. initial
8. validity
9. sequence
10. corresponding
11. circumstances

Sublist 4
1. overall
2. emerged
3. approximate
4. implications
5. commitment
6. promote
7. access
8. contrast
9. resolution
10. adequate

Sublist 5
1. energy
2. symbolic
3. decline
4. facilitate
5. logic
6. sustainable
7. equivalent
8. generated
9. conflict

Sublist 6
1. presumption
2. enhanced
3. capable
4. revealed
5. explicit
6. underlying
7. exceed

Sublist 7
1. intervention
2. definite
3. ultimately
4. converted
5. hierarchical
6. comprehensive
7. eliminate
8. contrary
9. successive
10. prohibited

Sublist 8
1. eventually
2. exploitation
3. virtually
4. predominantly
5. implicit
6. ambiguous
7. conformity
8. contemporary
9. deviation
10. minimises
11. radical
12. inevitably
13. complement
14. manipulation

Sublist 9
1. commenced
2. anticipated
3. incompatible
4. integral
5. conversely
6. temporary
7. assurance
8. inherent
9. duration

Sublist 10
1. convinced
2. persistent
3. integrity
4. conceived

Most common → Least common

ART

Knowledge

1.
Identity
Identity is all about who we are. This is complex and ever changing and can be linked to where we come from, our religions/traditions, our families and our friends. We might also be influenced by our ambitions and hopes for the future. We have individual identities but we also have collective identities, what it means to be British, or female, for example.

2.
Portraiture
Portraits are images about people. They might contain the face, the full body or sometimes neither! They can be made in various different media and they are often attempting to capture the essence of the person through their expression, posture, clothing/styling.

3. Symbolism
https://youtu.be/ep9-An5DTiU

Objects can represent other things for example an extinguished candle represents how life can end at any moment.

4.
Alexander Calder
https://youtu.be/CIEqg-nSu7M

Prolific artist who made continuous line, wire sculptures of faces. These can lay flat or be made more 3D by using a stand.

5. Shepard Fairey
Frank Shepard Fairey is an American contemporary artist, activist and founder of OBEY Clothing who emerged from the skateboarding scene. In 1989 he designed the "Andre the Giant Has a Posse" sticker campaign while attending the Rhode Island School of Design

Shepard Fairey: Obey This Film (youtube.com)

6.
Artist analysis
Your page should you have a title, an image and a study/copy of their work. Use in keeping colours and materials that show your understanding of the artist.

Content – What is the work about?
- What is the work about/of? Are there any clues/evidence to support this?
- What is the purpose or meaning of the work?
- Who would the intended audience be for this artwork? Why? How do you know?

Process – How was the work made?
- What materials do you think the artist has used…and why?
- How have they been used? (layering)
- What are the stages the artist has gone through to get to the final outcome? (designing/drawing/Maquettes etc.)

Form – How has the artist used composition/basic elements?
- Describe how the artist has used the basic elements? (How have they been used to convey meaning?). What effect does this create?
- Describe the composition of the work (fore/mid/back ground, Rule of thirds, landscape/portrait). What effect does this create?

Connections – links and ideas
- How does their work connect to your project?
- How will this work inspire the development of your final outcome? (AO2)
- What are your next steps?

ART

Experimenting

7.

Developing your ideas through experiments and different materials

Understanding the properties of different materials can help you make effective choices in art and design work. Try different materials to find out which you enjoy working with, and which produce effects you are interested in. Even if something is unsuccessful, you will have shown that you have tried and learned valuable lessons.

8.

Recording your experiments through annotation

https://youtu.be/cfQrwIsiAVs?list=PLqYzJxUXOdUgrNosQ0sov62LZRsEMiq2i

It is important to record your experiments with materials and techniques. Concentrate on those that worked well - these can be useful later on when presenting and evaluating your work. Keep a reference to the unsuccessful experiments too - these can be useful to look back on and reflect on your choices.

9.

Dry media - Materials which are used dry include: pencil, charcoal, pen and pastels.

Pencil

Graphite pencils come in different grades: 6H (very hard) to 6B (very soft). The harder pencils can be used to create very precise lines. They are useful for detailed design work. Softer pencils are less good for detail as the marks they make tend to be thicker and less precise. Using a softer pencil allows you to produce very dark tones or to blend tones.

Techniques

- Vary the pressure of the pencil or use the pencil on its side.
- Create graduated tone by blending from light to dark.
- Cross-hatch – build up criss-cross lines to create different tonal values.
- Directional line – curve your lines and shading with the shape of the object.

10.

https://youtu.be/ppBdIj2pEUc

Collage

Gluing tissue, newspaper and other papers down onto your surface to create your artwork. Papers can be torn or cut and bring texture to your work.

11.

Ink

https://youtu.be/ca-pPUmS6bw

Ink comes as a liquid and has many of the same properties as watercolour. It is good for creating images with vibrant colours. You could try using sticks, twigs or other objects instead of a brush..

12.

Watercolour

https://youtu.be/aOSaQ50xeAM

The paint is transparent and works best on light paper. Colours can be lightened by adding water rather than adding white.

Techniques

- Use watercolour or ink as a wash all across your paper to create a coloured background.
- Experiment with painting into wet watercolour and dry watercolour.

13.

Mixed media

https://youtu.be/rQp9DLiIcoc

Using a combination of different media. This may be as simple as combining drawing and painting, oil pastel with paint or creating a background of different papers to work over with paint or ink.

14.

Acrylic https://youtu.be/cDzcoyeaRKI

Acrylic paint is opaque and therefore you can layer light colours over dark ones as well. This allows you to add down a background first then layer your colours and tones over the top. It also means that you can easily rectify any mistakes.

ART

Skill

15.
Recording
Recording in Art can be done by drawing, taking photographs and annotating.

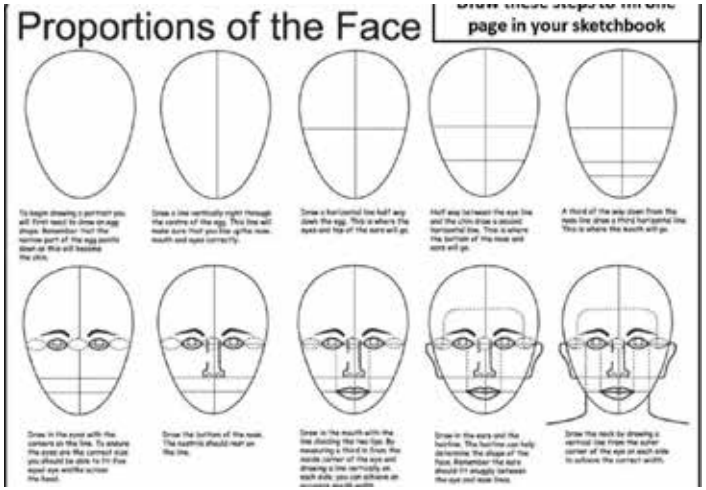
16.
How to annotate
Explaining your ideas and thinking using subject specific language and terminology. Labelling and evaluating yours and other peoples work and how it links into your project.

17.
Drawing
Drawing is a key part of developing any art, craft or design work. It is an important method of researching, investigating, developing and communicating ideas.
Drawing and mark making can be used to:
- record observations about a subject
- experiment and develop use of formal elements such as line and colour
- work out and present your ideas

18.
Checklist for a successful drawing
Choice of object – In drawing this object you will be able to demonstrate your skills
Sharp pencil – To help you add accurate detail
Size – work large so you can fit in more visual information
Shape – ensure the shape is accurate
Sketching you have used a sketched line rather than a heavy solid line
Detail - from observations you have included every aspect of the object.
Tone – It is important to use a large range of tone in your drawings, especially when drawing shiny objects such as bottles and glasses.

19.
Facial Proportion
https://youtu.be/cdSzAOgSuew

There are lots of rules when drawing the face that can help us be accurate in our representation.
Faces are generally symmetrical.
Drawing out feint guide lines to map out where the facial features sit on the face is a great way to start a portrait.



20. Drawing faces from different angles.

21. Drawing Facial features
https://youtu.be/u6-bCgRmcko?list=PLtG4P3Iq8RHHFhiyjXP4UT-yUo7pC13GQ

ART

Creativity

22.

AO4 – Final outcomes and bodies of work.

"Present a personal and meaningful response that realises intentions and demonstrates understanding of visual language"

All of your prepatory work leads up to your personal response or final piece. To make a successful final piece, you must:

- Clearly link your final piece with your preparatory work.
- Make sure your final piece links to your artist research.
- Review and refine your ideas so that you are completely happy with them.
- Complete your experiments with materials, composition and construction so that you feel in control of what you are doing before you start your final piece.

23.

Elements of composition in art https://youtu.be/VwUZ3PivD6I

- **Unity:** Do all the parts of the composition feel as if they belong together, or does something feel awkwardly out of place?
- **Balance:** Balance is the sense that the painting "feels right" and not heavier on one side. Having a symmetrical arrangement adds a sense of calm, whereas an asymmetrical arrangement creates a more dynamic feeling.
- **Movement:** There are many ways to give a sense of movement in a painting, such as the arrangement of objects, the position of figures, the flow of a river. You can also use leading lines (a photography term applicable to painting).
- **Rhythm:** In much the same way music does, a piece of art can have a rhythm or underlying beat that leads your eye to view the artwork at a certain pace. Look for the large underlying shapes (squares, triangles, etc.) and repeated color.
- **Focus**: The viewer's eye ultimately wants to rest on the "most important" thing or focal point in the painting, otherwise the eye feels lost, wandering around in space.
- **Contrast:** Paintings with high contrast—strong differences between light and dark, for example—have a different feel than paintings with minimal contrast in light and dark. In addition to light and dark, contrast can be differences in shape, color, size, texture, type of line, etc.
- **Pattern:** A regular repetition of lines, shapes, colors, or values in a composition.
- **Proportion:** How things fit together and relate to each other in terms of size and scale; whether big or small, nearby or distant.

24.

Foreground, Midground, Background

Foreground
The part of a scene that is nearest to the viewer. It doesn't have to be front and center in a composition.

Background
The scene behind the main object of the composition, which gives context and a framework for the piece.

Middle ground
The middle ground is everything between the foreground and background.

25.

Leading lines

Leading lines can be used to direct the viewer's eye into and around the painting. Leading lines can be actual lines, such as the lines of a fence or railroad, or they can be implied lines, such as a row of trees or curve of stones or circles.

26.

Rule of odds

The "rule of odds" suggests that an odd number of subjects in an image is more interesting than an even number. So if you have more than one subject in your picture, the suggestion is to choose an arrangement with at least three subjects.

27.

Rule of thirds

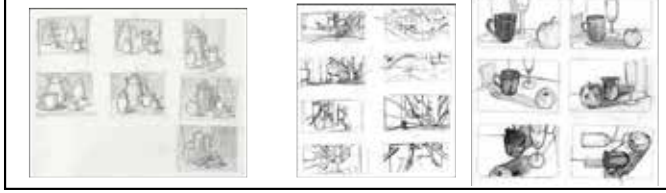
The rule of thirds is a composition guide that states that arranging the important features of an image on or near the horizontal and vertical lines that would divide the image into thirds horizontally and vertically is visually pleasing.

ART

Photography skills

28.
Planning a photoshoot using thumbnail drawings

- Draw a rectangular box either landscape or portrait
- Sktech the objects lightly in pencil in the composition you want
- Add shading
- Add notes to explain your ideas – viewpoint/composition/lighting etc



29.
Using the photography room

IBOOKS

Instead of sketchbooks, for photography you have IBOOKs on your computer. You need to present your work clearly on pages within this IBOOK.

Uploading

In order to put your photos into your IBOOK you must upload them. To do this use a USB lead to connect your camera to the computer. Make sure the camera is switched on. Click on the application 'photos'. Click on the photos you want to upload then click 'upload selected items'

Editing photographs

Tutorials on how to use photoshop are in student resources. To access these follow the instructions below:
Sign into 365, then go to sharepoint.
Click on student resources and find the 'photography GCSE' folder.
You can then look through the tutorials in the folder 'Photoshop tutorials'.

30.
Photographers toolkit

- View point: Birds eye view, from below or straight on…
- Location: Inside, outside…
- Lighting: Natural sunlight, spotlight, torch…
- Props: Objects that suggest something to the viewer
- Camera mode: Automatic, landscape, close up, manual…

31.
DSLR Cameras

A digital single-lens reflex camera (digital SLR or DSLR) is a digital camera that combines the optics and the mechanisms of a single-lens reflex camera with a digital imaging sensor.

32.
AO1 – image analysis

Your page should you have a title, an image and a study/copy of their work. Use in keeping colours/backgrounds/fonts that show your understanding of the photographer.

Content – What is the work about?

- What is the work about/of? Are there any clues/evidence to support this?
- Who would the intended audience be for this work? Why? How do you know?

Process – How was the work made?

- How was the work made…and why?
- What are the stages the photographer has gone through to get to the final outcome?

Form – How has the photographer used composition/basic elements?

- Describe how the photographer has used the basic elements? (How have they been used to convey meaning?). What effect does this create?
- Describe the composition of the work (fore/mid/back ground, Rule of thirds, landscape/portrait). What effect does this create?

Connections – links and ideas

- How does their work connect to your project?
- How will this work inspire the development of your work? (AO2)
- What is the purpose or meaning of the work?
- What are your next steps?

ART

3D Design skills

33.
Developing your ideas through experiments and different materials

Understanding the properties of different materials can help you make effective choices in art and design work. Try different materials to find out which you enjoy working with, and which produce effects you are interested in. Even if something is unsuccessful, you will have shown that you have tried and learned valuable lessons.

34.
Recording your experiments through annotation

It is important to record your experiments with materials and techniques. Concentrate on those that worked well - these can be useful later on when presenting and evaluating your work. Keep a reference to the unsuccessful experiments too - these can be useful to look back on and reflect on your choices.

35.
Cardboard Construction

https://youtu.be/mlOabQ1_98I

Different types of cardboard:
Corrugated – good for curves
Single layer – good for modelling easy to cut
2 ply Easier to cut – quite sturdy
3 ply Hard to cut – very strong

- Fold – lightly score with a knife and then bend
- Slot - create two slots on the pieces you want top join and move one into the other.
- Flange - Cut strips around the shape to bend bac
- Bend – score lines down the cardboard to allow i

Adhesives:

- Hot glue
- PVA glue
- Sticky tape
- Masking tape

36.
Mod roc

Mod roc bandages are fabric that is covered in plaster of paris. The plaster of paris is wetted and then dries to a hard finish. This is great for casting around objects.

Health and safety

Gloves and an apron. Use vaseline or cling film. Make sure you don't put any thing down the sink.

37.
Wire sculpting

Wire can be used to create some interesting frameworks and shapes. It's like 3d drawing! through bending and joining.

Health & Safety

Use of pliers- must be counted back in.

Use of goggles to protect eyes.

Gloves must be worn.

38.
Mixed media

Using a combination of different media. This may be as simple as combining cardboard and wire, clay and mod roc with paint or creating a framework that you cover in another material.

39.
Clay

Clay or ceramics can be used to create a wide range of sculptures and effects. We have a kiln in school which fires the clay to a hard finish.

Health and safety

Clay knives must be counted back in.

Clay dust must be kept to a minimum.

ART

Graphic communication skills

40.

Graphic Design

The term graphic design can refer to a number of artistic and professional disciplines which focus on visual communication and presentation. Various methods are used to create and combine symbols, images and/or words to create a visual representation of ideas and messages. A graphic designer may use typography, visual arts and page layout techniques to produce the final result. Common uses of graphic design include magazines, advertisements, product packaging and web design. For example, a product package might include a logo or other artwork, organized text and pure design elements such as shapes and color which unify the piece.

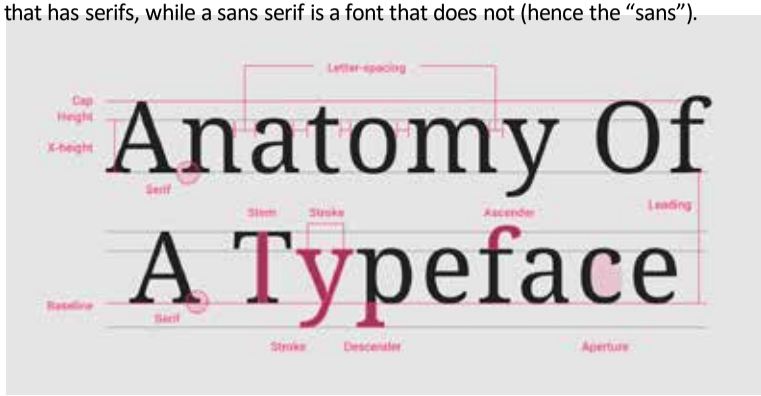
41.

Typography

https://youtu.be/xic_5zduz1A

Typography is the art and technique of arranging type to make written language legible, readable, and appealing when displayed. The arrangement of type involves selecting typefaces, point sizes, line lengths, line-spacing, and letter-spacing, and adjusting the space between pairs of letters.

A serif is a decorative stroke that finishes off the end of a letters stem (sometimes also called the “feet” of the letters). In turn, a serif font is a font that has serifs, while a sans serif is a font that does not (hence the “sans”).



42.

Meaning of colour

Colour theory is a term used to describe the collection of rules and guidelines regarding the use of color in art and design. Colour theory informs the design of color schemes, aiming at aesthetic appeal and the effective communication of a design message on both the visual level and the psychological level.

Key terms

Harmonious: based on three colours located next to each other on the wheel
Complementary: one or more pairs of colours that, when combined, cancel each other out (i.e., they produce high contrast)

ART

Sketchbook skills

43.
Presenting work

You don't get loads of marks for presentation so you don't want to spend too long on it and you want to keep it fairly simple. It is meant to enhance your work and show it off, not distract from it. To the side are some examples of students who have successfully linked their presentation with the artist they are looking at.

'In-keeping' presentation

'In-Keeping' means that the choices you make on how to present your work need to reflect what you trying to present. For example if you are doing a page on an artist who uses collage, then your background and title could be made from collage. Another example would be that you are presenting a design idea for your final piece and this design idea uses light blues in watercolour, therefore you use that colour and media for your background and title.

Titles

Think about the font and the media you use for your titles,

Backgrounds

In keeping colour scheme and materials. Do not just paint your page one colour in acrylic paint. Look carefully at the work you are presenting for inspiration.

44.
Annotating your sketchbook pages

Annotations are written explanations or critical comments added to art or design work that record and communicate your thoughts. Annotations can be used for your own reference.

They can also be used to communicate information to the examiner that will help explain your thoughts and decision-making processes.

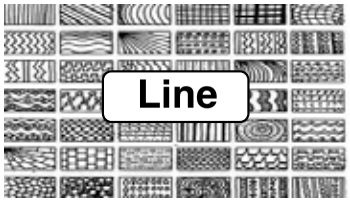
There are several reasons annotation may be used, for example to:
- analyse the work of an inspirational artist or designer
- analyse the success of a technique, idea or **composition**
- record a technique or explain an idea
- explain how a particular artist style or technique has influenced your work

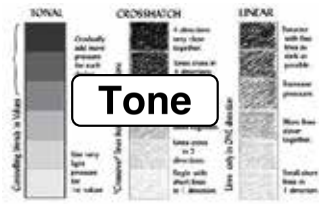
What to include in annotation

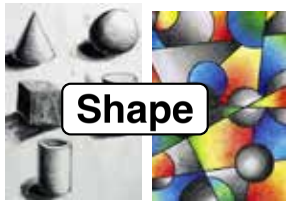
Carefully placed annotation can complement your visual work as well as explaining it

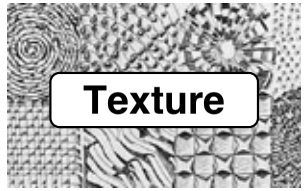
To annotate your work successfully, you should explain:
- what you have done and why you did it
- how you did it, such as the **media** and techniques used
- why you chose a particular medium or technique
- how an artwork or design fits in with your project
- what aspects you like
- how you could improve the work
- what you think you will do next

BASIC ELEMENTS









Tiverton High School Year 9 **Computing**
Autumn Term Knowledge Organiser **Part 1**
Number Bases and Data Representation

Number bases and units of storage | Key Construct 5: **Data Representation**

Binary means base-2

Denary means base-10

Hexadecimal means base-16

Humans traditionally use **denary (base 10)** when dealing with numbers.
Computers always use **binary (base 2)** to store and process digital data.

Electronic computers contain millions of tiny **transistor** components.
A transistor behaves like a **switch**, that can only be turned **on** or **off**.
Because binary only uses two possible digits, these closely match the on/off states of the transistors that computers are made of.
The **on** or **off states** of transistors can be used to represent the two different number symbols that binary uses:

off means **0**
on means **1**

A **bit** is the **smallest** amount that a computer can store - one **binary digit**.

8-bit binary means a **pattern** of exactly **8 binary-digits**.

8-bits allow **256 possible combinations** between **00000000** and **11111111**.

This is why 8 bits can represent between **0** and **255** in base ten.

1 byte	=	**8 bits** (an ASCII character takes 1 byte)
1 kilobyte	=	**1000 bytes**
1 megabyte	=	**1000 kilobytes** (or 1000 x 1000 bytes)
1 gigabyte	=	**1000 megabytes** (or 1000 x 1000 x 1000 bytes)
1 terabyte	=	**1000 gigabytes** (or 1000 x 1000 x 1000 x 1000 bytes)

Converting Binary (base two) to Denary (base ten)

128	64	32	16	8	4	2	1
0	**1**	**0**	**0**	**1**	**0**	**1**	**0**

(**1** x 64) + (**1** x 8) + (**1** x 2) = **74** in base ten

Converting Hexadecimal (base sixteen) to Denary (base ten)

Hexadecimal is a more **compact** and **convenient** way to represent **large** numbers than binary.

Large numbers can be represented using **fewer** hexadecimal digits.

Hexadecimal numbers can only uses the symbols **0123456789ABCDEF**

A means **10**
B means **11**
C means **12**
D means **13**
E means **14**
F means **15**

16	1
2	**D**

2 groups of 16, plus **D** units.
(**2** x 16) + (**D** x 1)
(**2** x 16) + (**13** x 1)
32 + 13
45 in base 10.

How computers store text | Key Construct 5: **Data Representation**

A **character** is a **symbol** that can be represented and stored by the computer system.
The full collection of ALL of the characters that a computer can represent/store is called a **character set**.
Each character symbol is represented using a **special number** called a **character code**.

ASCII is the **American Standard Code for Information Interchange**. It can be used for writing in the English language.
Plain **ASCII text** is often stored using **7 bits** per character.

A better version of ASCII is **Extended ASCII**. This can be used for writing in **English**, **French**, **German**, **Spanish** or **Italian**.
Extended ASCII allows more characters than original ASCII, but uses **8 bits (1 byte)** to store each different character code.

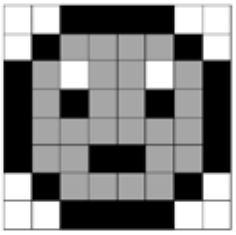
Lächeln **bonjour à tous** **¡Rápidamente!**

Unicode is a better character set. It can represent **any** language in the world, including Russian and Chinese, not just English.
Unicode uses up to **32 bits (4 bytes)** to store each character code.
Emoji pictures are character symbols from the Unicode character set. ASCII and Extended-ASCII do not contain any emojis.

中文 **русский** **日本語** ☺

How computers store images | Key Construct 5: **Data Representation**

Bitmap images are **pictures** that are made up of **pixels** (picture elements).



A **pixel** is a small coloured dot in a picture.

All of the pixels are arranged in a grid, a little bit like a mosaic.

The **colour** of each pixel is stored in the memory of the computer using binary digits... **1**s and **0**s.

The **bit-depth** of an image means **how many binary digits are used to store each pixel**.

A **1-bit image** uses exactly **1 bit to store each pixel** in the picture. This allows **2 possible colours**.
A **2-bit image** uses exactly **2 bits to store each pixel** in the picture. This allows **4 possible colours**.
An **8-bit image** uses exactly **8 bits to store each pixel** in the picture. This allows **256 possible colours**.

Photoshop uses **24-bit images**. It uses **24 bits to store each pixel**. This allows **16,777,216 possible colours** for **realistic** pictures.

Resolution means the **density** of the pixels in an image: **how many pixels will fit into a certain area**.
The **resolution** of an image defines how large the individual pixels are drawn.
The higher the resolution, the more life-like the image/better quality, but the more data will be included in the bitmap file.

Most computer **screens** use **72 dots per inch** - large pixels.
Many **printers** use **150 dots per inch** or **300 dots per inch** - the smaller pixels produce a more **detailed** picture on paper.

The **colour-model** used by a program controls **how colours are mixed together** to make pictures.

Most computer programs use the **RGB (Red-Green-Blue) colour model** to display images on the screen.
The colour of any pixel can be made by mixing **red light**, **green light** and **blue light** togther in varying amounts.

Many printers use the **CMYK model**. They combine the colours **Cyan**, **Magenta**, **Yellow** and **Black** in different amounts.

Many image files contain **extra data**, as well as the pixel data. The extra data is called **meta-data**.

Meta-data can be used by programs to **reconstruct** and display images from a file of binary data:
It includes the **width**, the **height**, the **resolution** and the **bit-depth** of the image.

Extra meta-data can also be included in an image file, such as the **file format**, the **date/time it was created**, **who owns the copyright** and the **GPS coordinates of where a photo was taken**.

How computer store audio (sounds and music) | Key Construct 5: **Data Representation**

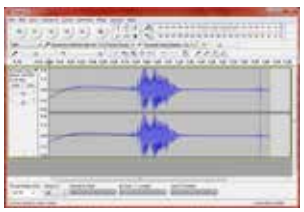
To represent audio/sound inside a computer, soundwaves are converted to digital data.

First of all, a sound wave must be captured by a microphone as electrical signals.
The **height of the sound wave** can then be **measured** at regular intervals. We call each measurement a **sample**.
The **number of sample measurements that are generated each second** is called the **sample-rate**. This is **measured** in **Hertz (Hz)**.
Each sample/measurement is stored in the computer using a binary number.
The **number of binary digits used in each sample** is called the **sample-size**.

A higher sample rate and sample size, leads to a larger audio-file, but a better-quality recording.
A realistic audio file will need to use thousands of samples a second. Common sample rates include **22050 Hz** or **44100 Hz**.

To reconstruct a sound from binary data, a audio file needs to contain extra meta-data that describes how the binary data is structured and how to play it back:

- **Duration** of the sound (how many **seconds** the recording lasts).
- **Sample-Rate** (**how many samples were used each second** e.g. **8000 Hz**).
- **Sample-Size** (**how many bits each sample contains** e.g. **32 bits**).
- **Channels** (**how many speakers are needed** e.g. **1 for mono**, **2 for stereo**).
- **Date & time** that the audio file was **created** or **last changed**.
- **Author**, **genre** or **copyright information** about **who** created the recording.



Tiverton High School Year 9 **Computing** **Spring Term** Knowledge Organiser

Decomposing problems and developing solutions | Key Construct 6: **Problem Solving and Programming**

A **program** is a **sequence of instructions** that the computer will carry out (**execute**).
Most programs need to be **planned** out very carefully in advance to make sure they don't crash or do the wrong thing.

Decomposition means **breaking a problem down into smaller parts**, until each part is easy enough to understand and solve.

Abstraction means **choosing only the most important details that are relevant to solving the problem**, while **ignoring** other details. When working out how to solve a problem, abstraction helps you avoid getting bogged down in too much detail.

An **algorithm** is a precise set of written steps that describe exactly how to solve a problem.

A **flowchart** is a diagram that shows how an algorithm works.

You can **plan** out the steps of a new program using **pseudo-code**... "false" code.
Pseudo-code is **not** a real **programming language** - you can't type pseudo-code into a computer and then run it.

The point of pseudo-code is that it lets you write out the **precise** steps that will solve a problem.
It helps people make sure they really **understand** the problem they are trying to solve **before** writing real program code.

Once you have written out a pseudo-code solution and checked it is correct, you are **much** less likely to build errors into your real program code.

You can then use your pseudo-code solution as a guide to help you to develop your real computer program using a programming language, such as **Python**, **BASIC**, **C**, **C++**, **C#** or **Java**.

Writing solutions to problems using pseudo-code | Key Construct 6: **Problem Solving and Programming**

A **sequence** is a group of program statements that are executed in the correct order, one after the other.

Input means gathering some data from the keyboard or other input device and storing it in a **variable**:

```
INPUT width
```

Output means displaying something on the screen:

```
PRINT "Your final score is"
PRINT score
PRINT "You have", lives, " left"
```

A **variable** is a **named value** that can **change** while your program is running e.g. **score**

Assignment means **giving a value to a variable**:

```
x =  3
password = "orR1bLe"
```

Iteration means **repeatedly** executing parts of the program again and again in a **loop**:

```
FOR time = 1 TO 10

WHILE time < 60
```

Selection means making a **decision**.
Your program can select which part of the program code should be executed next:

```
IF lives > 0 THEN
      PRINT "Lost a life"
ELSE
      PRINT "Game Over"
ENDIF
```

Developing computer programs using Python | Key Construct 6: **Problem Solving and Programming**

Python is a **high-level programming language**. It can be used by beginners to create computer programs.

Many people use **IDLE** to create Python code. This is an **Integrated Development Environment**. It contains a **text-editor** for writing Python code and other tools that are helpful to programmers.

When you **save** a new Python program, the filename needs to end in **.py** so the computer knows it can be **executed** using Python.

If you make a mistake or type an error in your program, the code may not make sense when Python tries to execute it.
Python will stop running your program and try to show you **where** the error is in your code so you can fix it.
This is called a **syntax error**.

A **comment** is a line of text in your program code that the computer **will not execute**. It will be used by the computer when running a Python program. It is used as a **reminder** or as an **explanation** to someone about how your code works.
To make text into a comment, type in the the **#** symbol at the start of the line of text.

```
# Main menu starts here
```

Your programs can work with different **kinds** of data values. We call these **data-types**.

Integer	a **whole number**	e.g. `32`, `-7`, `0`
Real	a number that can contain a **decimal point**, these are called "float" values in Python	e.g. `3.14`
Boolean	a value that can only hold one of two possible states, either `True` or `False`	
Character	a **SINGLE character symbol**.	e.g. one **letter**, one **digit**, a **punctuation mark**. `'?'`
String	a **sequence** of **characters**.	e.g. `'This cheese smells.'`

Most Python programs use **variables**. A variable is a named value that can be **changed** during the execution of a program.
When we set the value for a variable, we call this **assignment** (we are assigning a value).
Use the **`=` assignment operator** to **set a value** e.g. `password = '5ecRet123'`

A **print** statement **displays a line of text on the screen**. This is an **output**.
Text enclosed by `' '` quotes will literally be displayed. Anything without quotes will display the value of a variable.

```
print( 'Hello' )
print( password )
print( 'You have ', lives, ' lives left.' )
```

An **input** statement allows people to type useful data **into** a program once it is running.
Whenever you type a data value into the computer, the value must be **stored** in a **variable** (so the computer does not lose it).

```
surname = input( 'Type in your surname... ' )
```

A program can make **decisions** while it is running to **choose** what should happen next. This is called **selection**.
It can **decide** whether or not something should happen, depending on whether a **condition** is found to be **True** or **False**.

```
if guesses <= 5 :
      print( 'Try again.' )
```

```
if guesses <= 5 :
      print( 'Try again.' )
else :
      print( 'No guesses left.' )
```

Iteration means to carry out instructions **more than once**.

You can carry them out a certain, definite number of times using a `for` loop.
A `for` loop always **counts** how many times something has happened.

```
for num in range( 1, 6 )  :
      print( num * 10 )
```

You can also carry out a sequence of instructions only while a certain **condition** holds **True**, using a `while` loop.

```
while keepGoing == 'yes' :
      keepGoing = input( 'Do you want to keep running this program?' )
```

Arithmetic operators

`+`	**Addition**
`-`	**Subtraction**
`*`	**Multiplication**
`/`	**Division**

Relational Operator Symbols when making comparisons

`<`	**less than**	`>`	**greater than**
`<=`	**less than** or **equal to**	`>=`	**greater than** or **equal to**
`==`	**is the same as**	`!=`	**not the same as**

Tiverton High School Year 9 **Computing** **Summer Term** Knowledge Organiser

Storage devices | Key Construct 3: **Computer Systems**

Secondary storage devices are used for **long term storage** of data and instructions.

Programs and data are stored in **files**. Files are stored **even when the computer is switched off**.

We say that secondary storage is "**persistent**" or "**non-volatile**".

Magnetic Hard Disk Drive	A **high capacity** device that can often store as much as **8 TB** of data on one drive. Data is stored using tiny **magnetised** areas on a rapidly spinning metal disk. Magnetic hard-disks can be **damaged** accidentally by a **sudden impacts** or if it is dropped. Data can be **corrupted** or **erased** accidentally by **magnetic fields** from **speakers**, or **heat**.
Solid State Drive	An alternative to using a magnetic hard disk drive, but does not contain any moving parts. Data is stored using **tiny components** in **solid-state circuits** called **flash memory**. Solid-state drives are not affected by magnetic fields or extreme temperatures. They are very **lightweight** and **impact-proof**, making them ideal for use in laptops. They cannot hold quite as much data as magnetic disk drives and are **more expensive per GB**. Solid State Drives can sometimes start to **wear out** after data has been written to the same area a large number of times. Areas of the drive can then become **less reliable** for storing your data.
Flash Memory Card	A tiny, **portable memory card** that can be used to **transfer data between devices**. They can usually store between **64 GB** and **512 GB** of data, although some hold even more. They are used in **digital cameras** and **mobile phones**, but can be read by many laptops and PCs. They are **impact-proof** but can be damaged by **static-electricity** if not handled carefully.
USB Flash-Drive	A **removable storage device** that can be used to **transfer files from one computer to another.** They are similar to solid-state drives and flash memory cards. Their data is held in **flash memory**. Flash drives are often **encrypted** to prevent **breaches of sensitive data** if they are lost.
CD-ROM	A **removable optical disk** that stores data as tiny **pits**, burnt into the surface by a **laser beam**. A single CD-ROM can store as much as **900 MB** of data. Highly **portable**, making it ideal for **backing up files** or **transferring data** to other computers. Very **cheap to manufacture**, making them ideal to **distribute software utilities** and **audio**. CDs are **not very durable**. A **scratch** can make individual files or the whole disk **unreadable**.
DVD-ROM	A **removable optical disk**, similar to a CD-ROM, but with a much larger storage capacity. A single DVD-ROM can store enough compressed data for a **whole feature-length movie**. It can usually store at least **4.7 GB** of data, although some types of DVD can store much more. Because a DVD can hold more data than a CD, they are used as **installation disks** for software.
Blu-ray	An **removable optical disk** that can store enough data for **several hours of HD video**.

Laws that govern how we use computer technology | Key Construct 1: **Impact of Digital Technology**

The **Data Protection Act 2018** covers **how personal data may be used by companies and organisations**.
It describes **the type of data can be collected**, **how long data can be kept for** and the need to **keep data up to date/accurate**.
It sets out **restrictions on sending and using data**. It also **defines who is allowed to view or make use of data**.

The **Computer Misuse Act 1990 makes it illegal to use or to attempt to use computers to access computer systems without permission**. It also **make it illegal to access computer systems with intent to commit a criminal offence**, or to **alter data without permission** (e.g. through the use of viruses, physical deletion etc).

Compression and file-types | Key Construct 5: **Data Representation**

Music and video files can contain a lot of data. Large files and streams of data can take a long time to transfer over the Internet. If the file can be **compressed**, either by **reorganising** or **reducing the amount of data**, then it can be sent and received **faster**.

Compression re-organises a file of data and saves it as a new compressed file.
The compressed file usually has a **smaller file size** than the original.

It takes the computer **time** to compress the data – it's got to work out how to organise the data in a more **efficient** way.
Before you can use the data again, the computer needs to **de-compress** the file.
It must **re-organise the data** again into a form that can be used easily.

Sometimes, parts of the original data are **removed** during compression. When the file is uncompressed again, some of the data will be **lost forever**. This is called **lossy compression**. The data that was removed can **never** be recovered again.

When compressing **executable programs** and **text documents** we need to use **loss-less compression**. Otherwise, if a program instruction was lost, **the program would not be the same**. The **meaning** of a text document could also be **changed**.

Text Documents

.txt is an uncompressed **plain text document**. The text file contains only **unformatted text characters**.

.rtf is an uncompressed **rich-text file**.
The text file contains characters which can be **formatted** using **bold**, **italics**, **colour**, **font sizes** etc.

.pdf is an Adobe **Portable Document Format** file.
It can hold **rich-text**, **font definitions** and high-quality **vector diagrams**.
Because the file contains the **font definitions** for each font face used it is **portable** - the document will look the same, regardless of the type of computer or phone being used.
PDF files can also compress text and pictures to reduce the amount of data that they hold.

Images

.bmp is an uncompressed **bitmap image** format used widely by Microsoft Windows programs.

.tif is an uncompressed **high-quality bitmap image** that can contain **millions of colours**.
TIFF file sizes can be very large as they often contain so much uncompressed data.

.jpg is a bitmap image that uses **lossy compression**.
JPEGs are used widely for **photographs** and can include **millions of colours**, making pictures very **realistic**.

.gif is a compressed bitmap image that can only use up to **256 different colours**.
This is only suitable for **simple graphics** and **animations**, or regions of **flat colour** that are all the same.

.png is a **Portable Network Graphic**. This stores high-quality graphics using one or more separate layers.

Audio/Sound/Music

.wav is an **uncompressed audio waveform**. These files are often very large, but result in high-quality audio.

.mp3 is an **audio file** that uses **lossy compression**.
The MP3 file is usually approximately 10 times smaller than their original. The sound quality can be quite low.

Video/Movies

.avi is an **uncompressed video file** used widely by Microsoft Windows programs.

.mp4 is a **video file** that uses **lossy compression**.

Programs

.exe is an uncompressed **executable program file**.

Year 9 Drama specific vocabulary

Theatrical skills (1)

Freeze frame: A frozen moment in time expressing a character / scenario.
Still image: frozen image that symbolises an idea or relationship
Thought tracking: a character saying their thoughts aloud
Hot seating: a character is asked questions and the actor responds in role
Narration: telling the audience what is happening
Mime: suggesting action, character, or emotion without words
Improvisation: creating a scene without a script
Proxemics: the use of space on stage to create meaning
Levels: the use of height to show status
Status: the power one character has over another
Physical Theatre: creating objects, set or meaning through the use of the body

Vocal skills (2)

Pace: how fast or how slow the character speaks
Power: how loud or how quiet a character speaks
Pitch: how high our how low a character speaks
Pause: moments where the character stops talking
Tone: shows what the character thinking or how they are feeling
Intonation: the rise and fall of the voice. For example a clear movement up at the end of a sentence when we ask questions, intonation also helps us to show what we mean
Accent: people from different countries or areas speak with different accents – this can help communicate the background of a character

Physical skills (3)

Facial expression: showing emotion of the character through the face
Body Language: using your body to show the characters emotion
Physicality: using your body to show the character
Gesture: a movement of part of the body to show meaning.
Mannerisms: habitual gesture or way of speaking or behaving in role
Gait: the way a character walks
Posture: How straight or slouched a character stands
Stillness: lack of movement for a dramatic affect
Timing: exactly when something is done of the stage
Eye contact: looking directly at a character or choosing not to look at them
Spatial Awareness: the ability to be aware of props and other actors around you
Interaction with others: This could include touch or use of close proxemics to show the audience something
Choral movement: where a group of actors move in the same way at the same time (synchronized)

A sample of Rehearsal techniques: (4)

Thought tracking: stopping the action at any moment in rehearsal, then characters speak their thoughts
Creating unseen scenes: improvise a scene to see how your character responds. The scene need not be part of the final performance.
Research: you may look at videos, sound clips or other internet research, particularly if you are playing a real person.
Character physicality: walk around the space in neutral. Gradually experiment with your posture until you settle on one which may work for your character. Then your movement. Then your facial expressions – remember if you are multi-rolling each character has to be completely different from one another.
Role on the wall: a stick figure on paper, where you gradually add character information to create a profile (age hobbies, family, background, occupation, personality, significant life events etc) this builds up a well-rounded picture of the character
Levels: create a scene and rehearse through it, each time you repeat the scene you exaggerate the movement and the dialogue to the next level (working on a scale of 1-10)

Command words: (5)

IDENTIFY	Can you find where in the performance they have used a particular skill?
ANALYSE	Why have they used this technique / skill, what was the effect?
EVAULATE	Were they successful when using this techniques / skill? If so why? If not why not?

Year 9: Roles & Responsibilities:

Theatre Maker: Understudy
What they do:
Learning a part, including lines and movements, so they are able to take over a role for someone if needed when there is a planned or unexpected absence.

1

Theatre Maker: Playwright
What they do:
Writing the script of the play, including the dialogue and stage direction

2

Theatre Maker: Puppet Designer
What they do:
Designing the puppets for a production, taking into account the style of puppets and how they will be operated.

3

Theatre Maker: Costume Designer
What they do:
Designing what the actors wear on stage. Making sure that costumes are appropriate for the style and period of the piece. Ensuring the costumes fit the audience.

4

Theatre Maker: Theatre Manager
What they do:
Running the theatre building, including overseeing the front of house staff (ushers) and the box office staff who sell tickets.

5

Theatre Maker: Director
What they do:
Overseeing the creative aspects of the production. Developing a 'concept' or central unifying idea for the production. Liaising with designers, rehearsing the actors and ensuring that all technical elements of the play are ready. Giving 'notes' to the actors to help improve their performances and agreeing the blocking (or movement) of the actors

6

Theatre Maker: Technician
What they do:
Operating the technical equipment, such as the lighting and sound boards, during the performance.

7

Theatre Maker: Performer
What they do:
Appearing in a production, for example by acting, dancing or singing. Creating a performance or assuming a role on stage in front of the audience.

8

Theatre Maker: Sound Designer
What they do:
Designing the sound required for the performance, which may include music and sound effects. Considering if amplification, such as the use of microphones, is needed, and creating a sound plot.

9

Theatre Maker: Set Designer
What they do:
Designing the set of the play and the set dressing (objects placed on the stage). Providing sketches and other design materials before overseeing the creation of the set.

10

Theatre Maker: Stage Manager
What they do:
Running the backstage elements of the play and supervising the backstage crew. Organising the rehearsal schedule and keeping lists of props and other technical needs. Creating a prompt book and calling the cues for the performance.

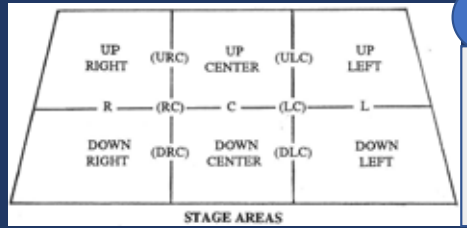
11

Theatre Maker: Lighting Designer
What they do:
Designing the lighting states and effects that will be used in a performance. Understanding the technical capabilities of the theatre and creating a lighting plot.

12

13

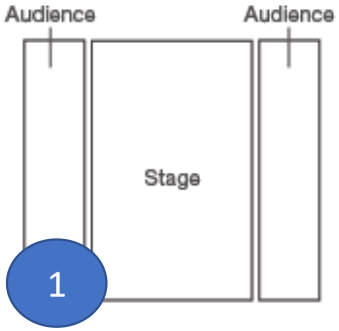
Stage Positioning:



Year 9: Stage Configurations:

Traverse:

The acting area is a long, central space with the audience seated on either side facing each other



Advantages:

Audience feel close to the stage

They can see the reactions of the other audience members – helping with **audience interaction**

Extreme ends of the stage can be used to create extra acting areas.

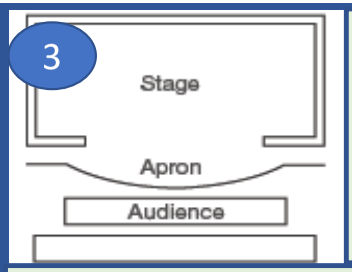
Disadvantages:

Big pieces of **scenery, backdrops or set** can block **sightlines**

Blocking can be challenging

Actos can struggle with making themselves visible to both side of the audience

Lighting needs to be carefully designed to avoid shining lights in the audience's eyes.



Proscenium arch:

Is a common form of theatre, popular for larger theatres. The proscenium refers to the frame around the stage.

Advantages:

Stage pictures are easily created

Backdrops / scenery can be used

There may be **fly space** and **wing space** for storing scenery

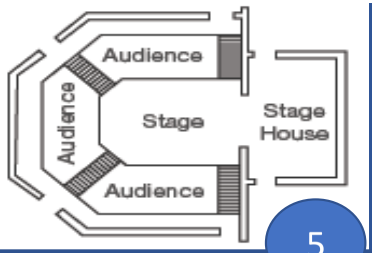
Fourth wall easily created.

Disadvantages:

Some audience members may feel distant from the stage.

The auditorium could seem very formal and rigid.

Audience interaction may be more difficult.



Thrust stage:

Protrudes into the auditorium with the audience on three sides.

Advantages:

Combine advantages of proscenium and theatre in the round

Backdrops, flats and large scenery can be used.

Audience may feel closer to the stage

Disadvantages:

Sightlines for those on the extreme sides may be limited or obstructed

The audience on the right and left have each other in their view

Box sets (where three sides of a room are constructed) cannot be used as this would block views for much of the audience

Advantages:

Directors and actors often find it very dynamic, interesting space because the audience is close to the stage

Actors enter and exit through the audience, engaging them

There is no easily achieved 'artificial **fourth wall**' separating the audience from the acting area

Disadvantages:

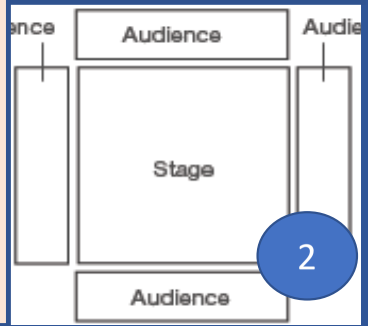
Cannot use **backdrops** or **flats** that would obscure the view of the audience

Stage furniture has to be chosen carefully so **sightlines** aren't blocked

Actors have to be carefully **blocked** so that audience aren't blocked for extended periods of time.

Theatre in the round:

is a stage configuration when the audience are seated around all sides of the stage



Advantages:

It is interactive and exciting – the audience may feel more involved.

Disadvantages:

The audience moving difficult or get tired of standing

Actors/crew need to be skilled at moving the audience around/controlling their focus

Promenade theatre:

Is when the audience stand or follow the actors through the performance.

Brief plot Summery: 1

Blood Brothers, a musical by Liverpudlian playwright Willy Russell, revolves around twin boys (Mickey and Edward) who are separated at birth and brought up in completely different environments in the city. The play, set in the 1960s, is divided into two acts, with songs throughout.

Mickey is brought up with his seven older siblings by his struggling single mother, Mrs Johnstone. His twin brother, Edward, however is brought up as the only child of the wealthy Lyons family, who live nearby, after Mrs Lyons persuaded Mrs Johnstone to hand over one of her twins at birth. Mickey and Edward don't meet each other until they're seven years old, but immediately become best friends and blood brothers. The bond continues when the boys are teenagers and both live in the countryside, despite them both being in love with Mickey's neighbour Linda. However, as they get older, the huge difference in their backgrounds pulls them apart and eventually leads to their tragic deaths.

Contextual information: 2

- Willy Russell wrote Blood Brothers in 1981.
- It was first performed in Liverpool before transferring to the West End.
- It was first performed as a musical in 1983.
- Conservative Prime Minister Margaret Thatcher was in power at this time.
- There was a very high rate of unemployment at this time.
- The play is set in Liverpool, as areas of high unemployment within the industrial working class.

KEY QUOTES: 4

- 'Y'know the devil's got your number'
- 'And do we blame superstition for what came to pass? Or could it be what we, the English, have come to know as class?'
- 'The welfare have already been onto me'
- 'See this means that we're blood brothers, an' that we always have to stand by each other'

Key characters: 5

Narrator – takes on multiple roles
Mrs Johnstone – Mother of the twins, impoverished.
Mrs Lyons – takes Eddie, privileged.
Mickey – poor twin, frequently downtrodden
Eddie – rich twin, not streetwise
Sammy - delinquent brother to Mickey
Linda – Mickey's girlfriend and Eddie's secret love
Mr Lyons – Father of Edward

Genre: 6

Book Musical.
Links to Epic Theatre

Themes: 7

Nature vs nurture
Class divide
Superstition
Motherhood
Fate/destiny
Power
Judgement
Love
Violence

Stylistic features and symbols: 3

Reprise – a song or part of a song that is repeated. Often it is intermingled with a new song. E.g. Marilyn Monroe.
Motif – A dominant or recurring image or idea in a text e.g. the gun.
Juxtaposition – Two opposite ideas are near each other in a piece of writing.
Foreshadowing – when the author alludes to what is to come in the text.
Parallel – two corresponding things that run side by side, e.g. the school scenes.
Cyclical – the structure of the play is cyclical as it starts and ends in the same place.
Soliloquy – when a character speaks their thoughts aloud, to themselves. It is different to a monologue which is one-character speaking, but in front of others
Antihero – a central character in a story, film, or drama who lacks conventional heroic attributes.
Narrator – echoes the function of the Greek Chorus, asks the audience to detach and judge.
Stage Directions – used prolifically by Russell to describe the movement and actions of characters.

How to approach question: 8

Technical language – use the accurate terminology to describe each aspect of a production, such as performance skills, design features and stage configurations
Examples from the play – include examples (e.g. quotes, context or events) that demonstrate understanding of the play and support the point your making.
Detailed suggestions- give specific details on how you would perform, design and direct a production that will help the examiner to visualise your ideas.
Effect on the audience – describe the desired effect of a production on the audience., as well as how this effect might be created using theatrical techniques.

Year 9 Drama

Structuring written responses: Live Theatre Review

2

Describe: pick out performance skills you see being used by a given actor, describe using the name of these skills what was done, include a quote if you can. Each paragraph should contain **8 skills (The Magic 8)**

Analyse: linking to the skills you have just identified, what did these skills communicate to you as an audience member? What meaning or effects or atmosphere was created through the inclusion of these skills?

Evaluation: was the use of these skills successful, did it clearly create meaning for you as an audience member? If yes how? If not why not?

4. Common feature of a play:

1

Genre: a category of drama, such as historical drama or musical.
Dialogue: what the characters say.
Monologue: a long speech spoken by one character.
Plot: the main events of the play presented in a particular sequence by the playwright.
Dramatic climax: the moment of greatest dramatic tension in a play.
Resolution: the end of the plot when the problems of the play are resolved.
Stage directions: descriptions of aspects of the play not conveyed by the actos' speeches. These may include a description of what the set or characters look like, and the actions of the characters and how certain lines of dialogue are spoken. It may also not pauses, silences or beats to indicate when the characters are not speaking.
Character list: a list of the characters that appear in the play. Some lists include a short description of the characters, such as their age or occupation.
Character: a person or other being (such as a talking animal) in a play, novel or film.
Performance style: the way in which something is performed. A realistic performance has a believable or life-like performance style, or a comedy might feature multi-role or physical comedy as its performance style.

Important things to think about when evaluating a moment:

3

- What did you learn about the characters and the story from their performance.
- What do you think the aim was? Was it funny? Sad? Compelling?
- Unpick the theatrical skills one performer used and think why? What was the purpose? What affect did it have on you?
- If they were successful why? If they weren't why not?
- What could they have done differently?
- What was good about there personal performance and how could they improve?
- LINK TO THREATRICAL SKILLS USED THROUGHOUT!

Important things to think about when analysing a moment:

4

- Explain in detail the meaning created by the moment, relating to the audience.
  - E.g. how it made the audience understand the character, themes or story, how it created empathy, comedy, tension or communicated a message for the audience etc.
- Your personal opinion– how did you: think/feel/react/respond/engage as an audience member?
- What meaning was communicated to you at this point.

Year 9 Drama

1 LIGHTING:

-Fresnel = soft edged light, with a diffused lens. Its useful for good overall light. Coloured gels can be added

-Spotlight = fixed light with a hard edge effect, used to light characters or set pieces. Can create a restricted space. Gels can be used.

-Follow Spot = same as a spot light but can follow the movement around the stage

-Flood light = clear wide-angled light, with little control over its spread. Gels can be added

-Birdie = lantern that can be place on the set or at the front of the stage (not very strong) this can also be called P**ractical lighting**

-Gobo = projects a shape onto the stage in order to create an effect

-Gel = a coloured film that can be added to specific lights to change the colour

-Focus = where on the stage is being lit up (e.g. center stage)

-Intensity = how bright or dim the lights are, high intensity = bright lights

2 SET:

- **Positioning:** scale, perspective, sightlines, levels, entrances/exits, location (SL/SR/CS/US/DS), relationship, to stage space (**Stage Configurations:** proscenium, in the round, traverse, thrust, promenade, end-on)
- **Furniture:** style, period, material, colour

Key Terms:

- **Truck =** A moveable piece of staging that is on wheels.
- **Projection on a cyclorama =** a projected image is shone onto the back of the stage creating a location (this image can be changed during the show)
- **Flats =** can be used to create temporary back drops for scenes. A flat can be decorated in any way to depict locations.
- **Backdrop =** a painted background used at the back of the stage to create location
- **Revolving stage =** the stage can revolve allowing for quick scene changes or to suggest movement
- **Automation =** this is a piece of furniture that is controlled with a controller and can therefore move around the stage seemingly independently
- **Naturalistic set design =** attempts to create a completely realistic representation of the location – absolute attention to detail.
- **Mminimalistic set design =** used symbols to emphasize themes, used props to represent location e.g. bed = bedroom

3 COSTUME:

- **Material =** communicates the context of a performance (the period, the year, the time frame)
- **Fit and Condition =** communicates background information, for example if their clothes is obviously too big and has holes in it, it could be a sign that it is a hand-me-down item given by an older sibling, perhaps suggesting they don't have much money.
- **Colour =** Can foreshadow elements about a character, for example: violent= red, or innocent=white.
- **Link to character = Costume** can be used to reveal information about the characters in the play. For example, where the characters come from, their background and the surrounding context. It can also be used to **communicate status** to your audiences showing who has power / money / authority or not.
- **Things to describe:**
- **Hair, makeup,** (are integral to costume design – special effects can be used to age an actor or complete the look.), **shoes, whole outfit, personal props**

4 SOUND:

- **Live sound:** actor voice, on-stage action, live instruments, vocals.
- **Recorded sound:** music, sound effects, soundscape
- **Effects:** echo, distortion, volume, amplification, pitch, reverb, fade, crossfade.
- **Diegetic sound:** sound within the world of the play, both the audience and the characters can hear it.
- **Non-Diegetic sound:** sound outside the world of the play, only the audience can hear it: used to create atmosphere
- **Underscoring** – Sound and music can be used to underscore a scene, adding tension and atmosphere to a particular moment. For example: A low drone played underneath a scene that foreshadows something bad happening.
- **Ambient Sound –** or 'background' sound. This can be used to help the audience understand the setting or location. For example, a scene set in a train station might have the sound of a train engine huffing and the conductors whistle blowing.
- **Direction of sound –** Sound can be used to focus the audience's attention. You could use speakers coming from behind the audience to make them feel like they are part of the action. Or you might have the sound coming from off stage to signify something happening in an area that we as the audience can not see.

The Lord of the Flies:

Context: 1

Golding's personal experiences of war inspired Lord of the Flies, written in 1954. It explores the idea of human nature and how brutal and uncompromising it can be. Golding is attempting to present a commentary on human struggle between being evil and following rules to acting selfishly and indulging in violence

Main Characters: 2

Ralph: one of the oldest boys; leader of the group, careful/mature. Represents law & order.
Piggy: bullied by the boys due to his weight. Represents science and intellect.
Roger: on the cusp of respectability and savagery. Becomes violent and unrestrained by the end.
Jack: the leader of the second tribe, impulsive, violent. Represents anarchy and human nature.
Sam and Eric: twin boys who do everything together. On the cusp of respectability and savagery.
Simon: hallucinates and thinks he see the Lord of the Flies. Victim of the other boys.

4 mark questions: this question will always be on **design: Lighting design, Costume design, Set design or Sound design**. You will be given a scene and will have to describe how you would design a given element (1 of the 4 design elements). 3

Answering the 4 mark question:

- You must start with the context of the given scene, what is happening and what you are aiming to achieve through your design
- Provide a detailed description of your design using as many design specific pieces of terminology as possible, these should be linked back to what you are trying to achieve.

8 mark questions: this question will also be about how you would perform a given line from a given scene. You must also provide information surrounding the effects you want to create and how you are going to achieve these.

Answering the 8 mark question: your answer must be written in the 1st person.

- You must start with the context of the given scene, what is happening and the effects you want to create through your performance of the given line
- Complete a magic 8 paragraph: describing 8 theatrical skills in detail, how you would use them and the effects they would have. Linking back to the given character and given line throughout.

Themes: 4

- **Peace vs Violence**
- **Nature vs Nurture**
- **Democracy**
- **Rivalry**
- **Anarchy**
- **Power**

Brief plot summary: 5

A group of boys find themselves alone without any adults on an uninhabited island. Ralph and Piggy find a conch shell and use it to summon all of the other boys on the island together. Ralph is nominated as leader and another boy, Jack, is appointed as the leader of the hunters. Ralph decides that the best action is to light a signal fire on top of the mountains for passing ships. They miss a passing ship because the fire is left unsupervised. Ralph calls a meeting and tried to reinforce the rules. Some of the younger boys share their fear about a beast. A dead parachutist descends on the island. Sam and Eric see the silhouette of the parachute and believe it to be the beast. Jack thinks Ralph is a coward and names himself as the leader of the new tribe of hunters. Simon sees the head of the sow that the tribe hunted and while hallucinating thinks it is Lord of the Flies talking to him. He tells him that the beast is not a real creature, but something that is found in all men. He returns to the camp to tell the others, but they kill him with their hands and teeth. Ralph and Piggy go to talk to Jack but the tribe kill Piggy. Ralph realises that his own life is in danger and hides before being driven down towards the beach where he finds himself at the feet of a British naval officer who is shocked to see the **savages that the children have become.**

Practitioners:

Year 9 Drama

Berkoff:

1 **'Total theatre is a use of the imagination. Actors express the genius of the body. Express the story without a set'.**

2 **Total Theatre:** is a belief that all elements of theatre are EQUAL and have the same value in affecting the audience. Every aspect of theatre must have a purpose with conveying emotion often being at the centre.

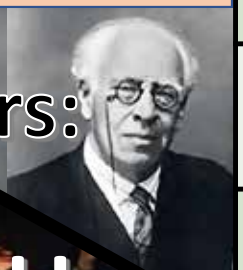
3 **Techniques:**

- Exaggerated & Stylised mime
- Physicalisation of objects
- Stylised movement/speech patterns (slow motion/ robotic)
- Exaggerated facial expression
- Rhythm through voice and body
- Abstract use of voice and ensemble work
- Externalising emotions
- Exaggerated vocal work
- Body props
- Narrative
- Tableaux
- Gesture / pose
- Direct address
- Monologue

Aim: To create thrilling, energetic and unforgettable theatre. Their physical style combines, movement, design, music and text. 7

Stanislavski:

4 **Naturalism** – the performers present the action realistically, using the 4th wall to pretend the audience don't exist and they are merely going about their daily lives.



5 **The System:**

Given Circumstances	The information about the character and the play provided through the script, research and context
Emotional memory	The actor finds a real past experience where they felt the emotion of their character. They 'borrow' those feeling to bring to the role.
Subtext	The script is the text. The subtext is the meaning / motivation behind the lines spoken and the actions taken.
Magic if	As an actor ask yourself: what would I do if I was in this situation? You then put yourself into the character's situation making the action more real.
Objective Super-objective	Objective = reason for action Super-objective = over-arching objective, what they want throughout the whole play

Frantic Assembly:

6 **Techniques:**

Push Hands: Enhances partnership and teamwork. Actors move together with joined hands (placed palm to palm), the person with their hands on top is 'leader' and should explore space and levels with their partner.

Chair Duets: Physical movement based on and around chairs – includes touches, reaction, embraces, etc

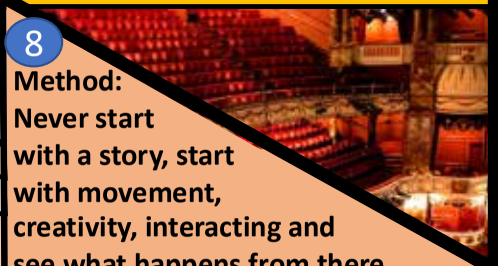
Round-By-Through: A string of movement: **Round =** Any move that involves passing closely around the partner. **By =** movement that is neat and efficient. **Through =** Passing through the partner

Walk the grid: Walking in unison, in beats of 5, in a grid sequence

Body as Props: Creating shapes and movements with your body to replicate objects.

Music: used in the devising process to create atmosphere, mood and storylines.

8 **Method:**



Never start with a story, start with movement, creativity, interacting and see what happens from there.

A.1

1.Properties of Metals

STRENGTH
The ability of a material to stand up to forces being applied without it bending, breaking, shattering or deforming in any way.

ELASTICITY
The ability of a material to absorb force and flex in different directions, returning to its original position.

PLASTICITY
The ability of a material to be change in shape permanently.

MALLEABILITY
The ability of a material to be reshaped in all directions without cracking

DUCTILITY
The ability of a material to change shape (deform) usually by stretching along its length.

TOUGHNESS
A characteristic of a material that does not break or shatter when receiving a blow or under a sudden shock.

TENSILE STRENGTH
The ability of a material to stretch without breaking or snapping.

HARDNESS
The ability of a material to resist scratching, wear and tear and indentation.

CONDUCTIVITY
The ability of a material to conduct electricity.

2. An alloy is a metal (parent metal) combined with other substances (alloying agents), resulting in superior properties such as; strength, hardness, durability, ductility, tensile strength and toughness. The parent metal is the majority of the alloy. For example, mild steel is 0.1 - 0.3% Carbon and 99.9 - 99.7% Iron.

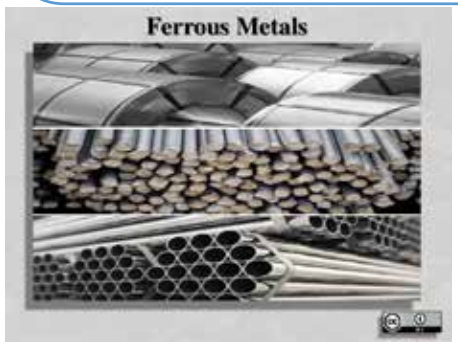
Metal lifecycle

Metals

Metals are a **finite** resource that are extracted from the ground. Because of this, it is more important to recycle our waste metal. If we don't this could have a massive impact on our living world.

2. Ferrous Metals
Ferrous metals contain iron, and are known for their strength. Think steel, stainless steel, carbon steel, cast iron. Ferrous metals are used in both architectural and industrial fabrication, such as skyscrapers, bridges, vehicles, and railroads. Thanks to their magnetic properties, ferrous metals are also used in appliances and engines. Ferrous metals also have a high carbon content, which generally makes them prone to rust. The exceptions are stainless steel, because of chromium, and wrought iron because of its high pure iron content.

2. Non-Ferrous Metals
Non-ferrous metals have been used since the Copper Age, around 5,000 B.C. Since non-ferrous metals don't contain iron, they're usually more corrosion-resistant than ferrous metals. Some examples of non-ferrous metals are aluminium, aluminium alloys, and copper, which are often used in industrial applications such as gutters, roofing, pipes, and electrical. Non-ferrous metals also include brass, gold, nickel, silver, tin, lead, and zinc. Other common properties of non-ferrous metals are non-magnetic, malleable, and lightweight. This makes them ideal for use in aircraft and other applications.

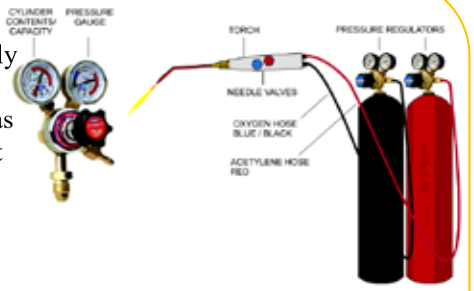


Examples of ferrous metals are:
•Steel: Iron plus carbon; widely used in construction and industrial metal fabrication
•Carbon steel: Even higher carbon content added to iron; exceptionally hard metal
•Stainless steel: An alloy steel made with added chromium,
•Cast iron: Iron, carbon, silicon; heavy, hard metal that is resistant to wear

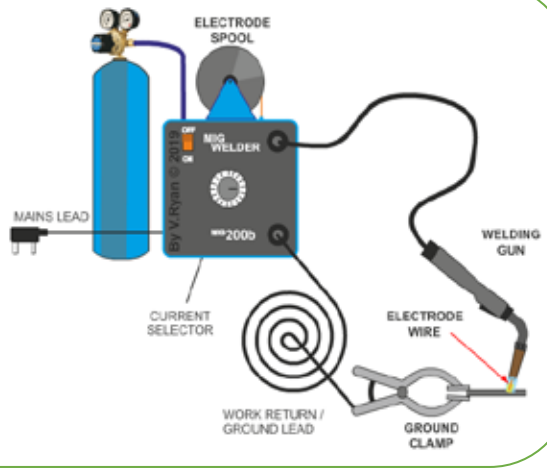
A.2

Oxyacetylene gas welding is commonly used to permanently join mild steel. A mixture of oxygen and acetylene, burns as an intense / focussed flame, at approximately 3,500 degrees centigrade. When the flame comes in contact with steel, it melts the surface forming a molten pool, allowing welding to take place.

This type of welding is suitable for the prefabrication of steel sheet, tubes and plates.

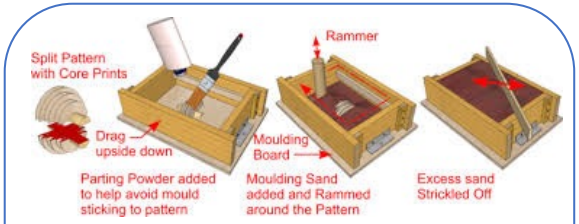


MIG welding. The electrode is a continuous stream of wire, with a direct current source, fed at a continuous rate through the welding gun. Carbon dioxide gas is supplied directly to the welding zone, which acts to protect the area from atmospheric contaminants. The wire electrode, produces an 'arc', which heats the welding area and fuses the wire electrode with the base metal (metal being welded). MIG welding is ideal for aluminium, mild steel, stainless steel, copper and copper alloys.



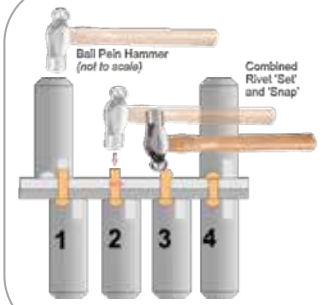
Processes

Metals

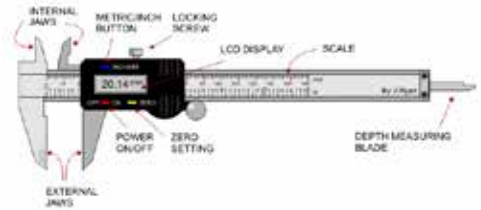


Sand casting is a process in which molten metal is poured into a mould cavity made by forming damp *(i.e. **Green**)* sand around a Pattern.

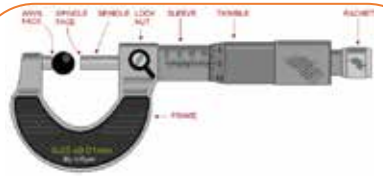
Nuts and Bolts are available in a wide variety of sizes, types of screw thread, shapes of head and materials to provide a very commonly used means of fastening components together such that they can be removed if needed.



Rivets *(aka Rivits)* have various designs of head at one end and are used to fasten materials together by being passed through a punched or drilled hole and hammered over *(usually)* to form a head on the reverse side. They are available in several materials and sizes, can be solid or hollow and specialised designs also exist *(e.g. 'Pop' Rivets).*

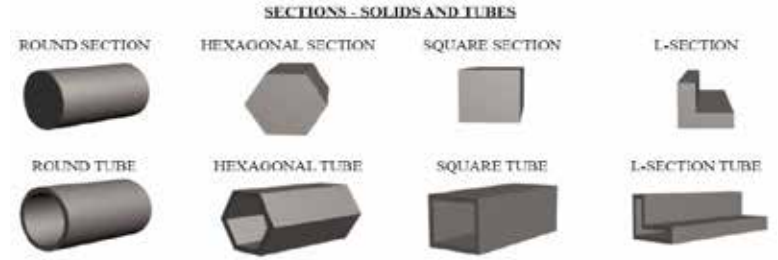


The Digital Caliper (sometimes incorrectly called the Digital Vernier Caliper) is a precision instrument that can be used to measure internal and external distances extremely accurately



The Micrometer is a precision measuring instrument, used by engineers. Each revolution of the ratchet moves the spindle face 0.5mm towards the anvil face

Stock Forms



Metal Finishes

These are needed not only to make the metal look nice, but more importantly to stop ferrous metals from corrosion.

B

YEAR 9. Design and Technology. Knowledge Organiser; Sustainability- Boards and Plastics.

Natural Plastics....

Natural sources of plastics include:

- plants - from which cellulose can be extracted
- trees - from which latex, amber and resin come
- animals - from which horn and milk (used to make glues) are obtained
- insects - from which shellac (used to make polish) is obtained

Synthetic

Synthetic plastics are chemically manufactured from:

-Crude oil..... -Coal..... -Natural gas

Acrylic .. Stiff and brittle. Used to make signs and small 2D and 3D forms

Polyvinyl sheet (PVC) Stiff, strong, tough and resists scratching. Used to make 2D and 3D shapes and may be used for vacuum-forming

High-density PVC foam..... Stiff, hard, tough and lightweight, with a good resistance to chemicals. Machining of 2D and 3D shapes

Polystyrene sheet (or styrene sheet) Lightweight, hard, stiff, transparent and brittle. Good water resistance. Used for vacuum-forming

Corrugated polypropylene Lightweight and tough. Stiff, but not very strong. Hard but scratches easily. Resistant to chemicals. Used for making large constructions

Acrylonitrile butadiene styrene (ABS) Strong, tough, hard, lightweight, and durable. A good surface finish and resistant to chemicals. Used to make square or round shaped tubes and is good for making structures. Corrugated polypropylene is available in a range of shapes and colours

Polystyrene foam (Styrofoam) Brittle in tension, lightweight, with good heat and sound insulation. Available in blocks and used for product-modelling

Cellophane Tough, hard, stiff, lightweight, transparent, and non-flammable. Used for wrapping round products

Polythene Hard, stiff and able to be sterilised. Used to make bottles and for shrink-wrapping products.

Social and moral issues

When creating a product, the designer should also consider how it will be made and how it will be used. Many of these decisions have implications for society as a whole and are based on moral judgements. This means that the designer has to be very aware of what is acceptable and what is not acceptable to society.

Polymer

The correct term for plastics is polymers. Most polymers are good insulators. Some of the stronger polymers compare favourably with metals. They are not normally painted, but their colour can be changed by adding pigments to them.

Most polymers are **made from oil**, which is a non-renewable resource. They are made by a chemical reaction called **polymerisation.**

There are two main types of polymer: **thermosets and thermoplastics**.

Thermosets are normally made into products by moulding. Once moulded, they cannot be reshaped and they cannot be recycled.

Thermoplastics soften when heated and can be shaped when hot. The shape will harden when it is cooled, but can be reshaped when heated up again. Thermoplastics are softer and more flexible than thermosets. They can normally be recycled

Fair trade

The result of the pattern of world trade is that the workers in primary industries in LEDCs often lose out. They receive low wages and often have poor standards of living. They cannot afford education for their children and many children are required to work to help their families earn a living.

Fair trade means that the producer receives a guaranteed and fair price for their product regardless of the price on the world market. This means their quality of life should improve, as well as the long-term prospects for their children.

Fair trade sets minimum standards for the pay and conditions of workers. The Fair Trade Organisation promotes Global Citizenship by guaranteeing a fair, minimum price for products. About 5 million people benefit from Fair Trade in 58 countries.

The life of the product

Electrical equipment awaiting recycling in a tip

Most products are only expected to last for so long before they stop working, are worn out or are thrown away. How long a product will last is an important design consideration.

The longer the product's life, the fewer new materials will be needed for replacements. However, a longer life also means that the manufacturer will sell fewer replacement products.

The life of a product can be extended by using materials with better properties: eg by using stronger materials or materials that resist corrosion. Another way is through design that allows product life to be extended by maintenance

Environmental and social impact

Making products uses resources, including the materials used in the product and the energy needed to make it. Using these resources has an impact on the environment and society.

The designer of electronic products should consider a number of factors in order to reduce environmental impact, including:

- the material used to make the product
- the life of the product
- disposal: what happens to the product at the end of its life?

One-off production is when only one product is made at a time. Every product is different so it is labour intensive. Products may be made by hand or a combination of hand and machine methods.

Batch production is when a small quantity of identical products are made. Batch production may also be labour intensive, but jigs and templates are used to aid production. Batches of the product can be made as often as required. The machines can be easily changed to produce a batch of a different product.

Mass production is when hundreds of identical products are made, usually on a production line. Mass production often involves the assembly of a number of sub-assemblies of individual components. Parts may be bought from other companies. There is usually some automation of tasks (eg by using Computer Numerical Control machines) and this enables a smaller number of workers to output more products.

Continuous flow production is when many thousands of identical products are made. The difference between this and mass production is that the production line is kept running 24 hours a day, seven days a week to maximise production and eliminate the extra costs of starting and stopping the production process. The process is highly automated and few workers are required

C Year 9 Knowledge Organiser… Mechanisms, Systems and Motions

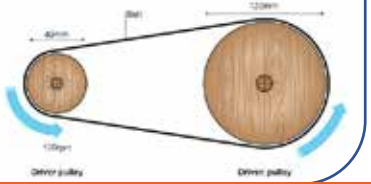
Pulley systems

Pulleys are used to change the speed, direction of rotation, or turning force or torque.

A pulley system consists of two pulley wheels each on a shaft, connected by a belt. This transmits rotary motion and force from the input, or driver shaft, to the output, or driven shaft.

A pulley system with one 40mm diameter pulley and a 120mm pulley, connected by a belt. The smaller pulley is rotating at 100rpm

If the pulley wheels are different sizes, the smaller one will spin faster than the larger one. The difference in speed is called the velocity ratio.



Types of motion

There are four basic types of motion in mechanical systems:

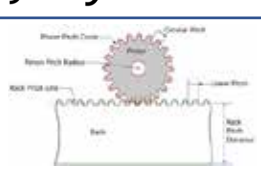
Rotary motion is turning round in a circle, such as a wheel turning.

Linear motion is moving in a straight line, such as on a paper trimmer.

Reciprocating motion is moving backwards and forwards in a straight line, as in cutting with a saw.

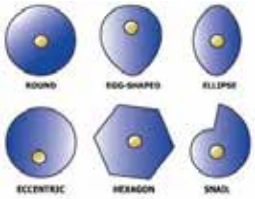
Oscillating motion is swinging from side to side, like a pendulum in a clock.

Many mechanisms take one type of input motion, and output it as a different type of motion.



Rack and pinion

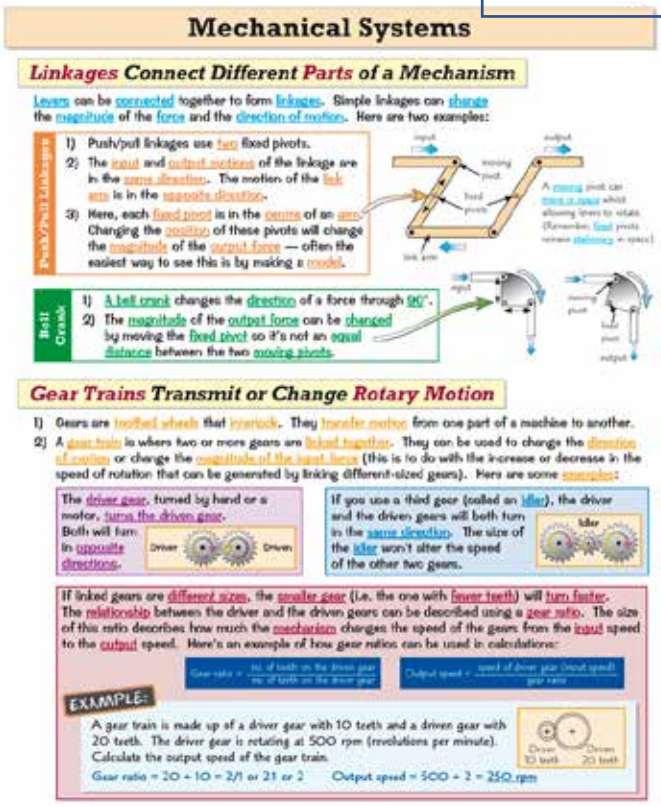
A pinion is a round cog and the rack is a flat bar with teeth. The driver cog either moves along the rack, as in a rack and pinion (funicular) railway - or else the driver cog moves the rack, as in the steering system in cars. Rack and pinion changes rotary motion into linear motion.



Microcontrollers are widely used in everyday items such as washing machines, remote controls, microwave ovens, mobile phones and vending machines. A modern car can contain around 40 of them. Several different types are commonly used in school electronics projects, including PICs, PICAXE and GENIE microcontrollers.

Gears consist of toothed wheels fixed to shafts. The teeth interlock with each other, and as the first shaft (the driver shaft) rotates, the motion is transmitted to the second or driven shaft. The motion output at the driven shaft will be different from the motion input at the driver shaft - in place, speed, direction and other ways.

A number of gears connected together are called a gear train. The input (eg a motor) is connected to the driver gear. The output, (eg the wheel of a buggy) is connected to the driven gear.



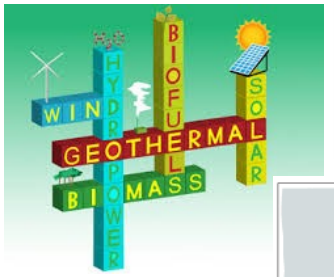
D Year 9 Design Technology. Materials and Product Analysis, Paper and Card, CADCAM

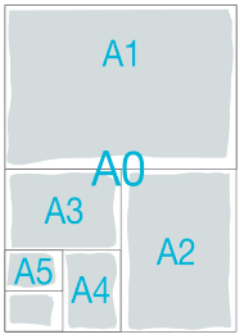
Type of paper and board.	Functional properties
Layout paper	Light weight, thin white paper. It is used for initial ideas. It also take colour media well and it is also cheap.
Tracing paper	This is thin translucent paper. Which is used to make copies of drawings. However it is also quite expensive. Its made buy reducing the fibres concentration by prolonged beating in water.
Copier paper	Similar properties to cartridge paper. Its cheap when bought in bulk. The pulp is fed into the paper machine while the pulp is in the screen the water with in the pulp drops away letting the fibres bonded together.
Recycled paper	Made from reused paper products. Used for most documents including reports, memo paper and forms. This has a positive effect on the environment due to it being recycled
Corrugated board	Good impact resistance. It has a good strength for weight and is also recyclable. From the paper mill it is sent to the corrugating plant and then it is then glued between two more sheets of non corrugated card
Folding box board	Excellent for scoring, bending and creasing without splitting. It also is a excellent printing surface. Its made up of multiple layers of chemical and mechanical pulp.
Cartridge paper	This is good quality white paper which is available in different weights. Medium cost.
Mounting board	Good quality thick card which is used for final models and is used for mounting work.

The reason why cardboard is so popular is because it has several unique properties:

A sheet of corrugated cardboard is made out of three sheets of ordinary Kraft paper glued together with glue made of corn starch. Paper and glue are relatively inexpensive, so cardboard is inexpensive.

- Cardboard is completely recyclable and biodegradable.
- Cardboard is about half air, making it very light for its size.
- Compared to a sheet of paper, cardboard is incredibly rigid.
- Cardboard has some give, so it provides a little padding for the things inside the box.
- Cardboard is strong and resists punctures, but it is also easy to cut with a knife.
- When a box gets crushed it tends to stay together rather than shattering like wood would.
- Cardboard boxes fold flat for shipping without losing strength, making transportation much easier and less expensive. It is also very easy to put the boxes together.





CAD/CAM (computer-aided design and computer-aided manufacturing) refers to computer software that is used to both design and manufacture products. **CAD** is the use of computer technology for design. We use 2D design. **CAD/CAM** applications are used to both design a product and program manufacturing processes. We use a Laser Cutter as a manufacturing machine.

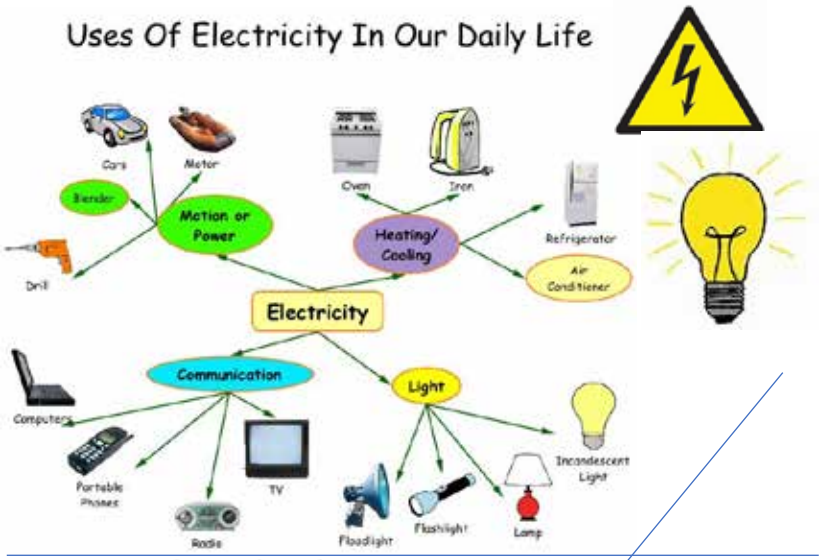
1. **Never Leave Your Laser Unattended When Firing**
2. **Never Cut Material with Unknown Properties**
3. **Always Keep A Clean Workshop**
4. **Be Informed**
5. **Be Alert**

Computer Numerical Control

CNC means **Computer Numerical Control**. This means a computer converts the design produced by Computer Aided Design software (CAD), into numbers. The numbers can be considered to be the coordinates of a graph and they control the movement of the cutter.

E

Year 9 Knowledge Organiser… Electronics

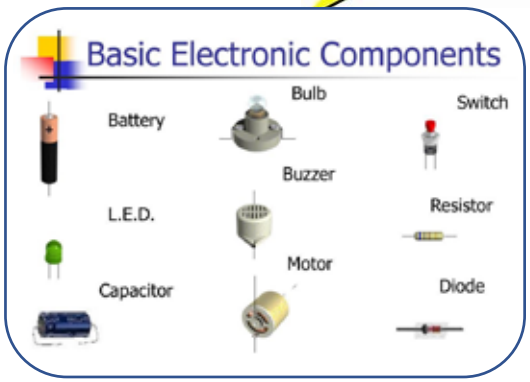


Electronics is the technology concerned with the design of circuits using transistors and microchips, and with the behaviour and movement of electrons.

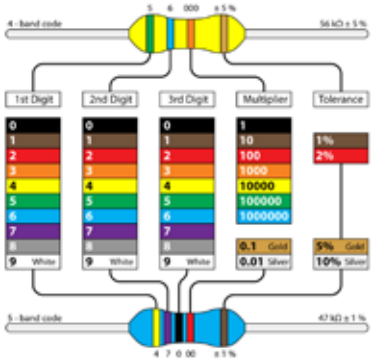
There are many different types of electrical and electronic components, including resistors, capacitors and diodes. Each of these has a specific use in a circuit.

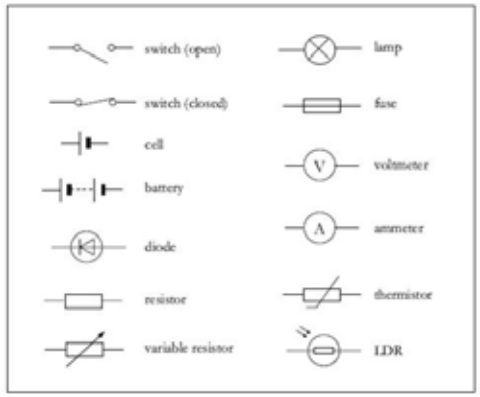
Discrete electronic components

Discrete (meaning separate) electronic components can be selected individually and put together to make a circuit. Examples of discrete components include resistors, capacitors, diodes and transistors.



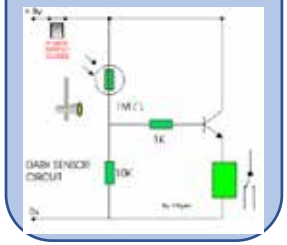
Resistor colour code





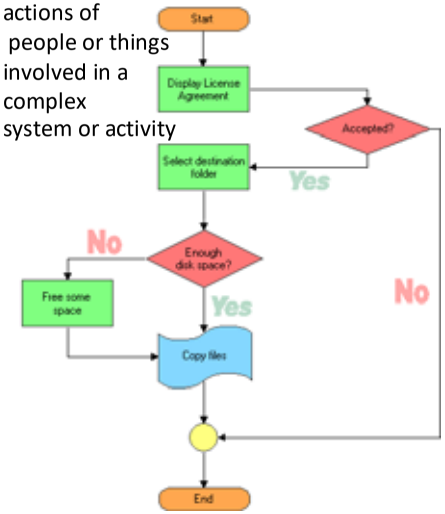
Soldering is a process in which two or more items (usually metal) are joined together by melting and putting a filler metal-solder into the joint. The filler metal having a lower melting point than the joining metal.

CAD is not only used to design and manufacture products. It is also used to create circuits for use in electronics.



flow chart noun

a diagram of the sequence of movements or actions of people or things involved in a complex system or activity



There are many different types of electrical and electronic components, including resistors, capacitors and diodes. Each of these has a specific use in a circuit.

Components

Electronic components can be divided into two groups: discrete electronic components and integrated circuits (ICs).

Discrete electronic components

Discrete (meaning separate) electronic components can be selected individually and put together to make a circuit. Examples of discrete components include resistors, capacitors, diodes and transistors.

Discrete components can also be used as components in circuits that include an integrated circuit.

Integrated circuits

The circuits inside integrated circuits are arranged in different configurations depending upon the type of chip and its function. The most common type of configuration is called the dual-in-line or DIL package, which has two rows of connecting 'legs', one on each side.

You don't need to understand how the circuit inside a silicon chip works. It's best to think of ICs simply in terms of their function: eg as timers, counters, logic gates or operational amplifiers (op-amps).

When using ICs you need to know:

- which pins have to be connected
- the function of each pin

1. Context

Can you link context to a specific moment in a text and help you understand the writer's intentions at this point?

- **Author information:** What do they usually write about, what influenced them, what was their life experience?
- **Era:** When was it written? What did people at the time believe about the world that was different to today?
- **Historical Events:** Were there any big events that will have affected the characters in the story?
- **Location:** Where was the book written or set? How does this affect what we can expect from the characters in terms of how they act the way they do and why?
- **Genre** Are there any techniques that are used in the story that are common in this particular style of novel?
- **Audience** How would an audience in this time/location react differently to us?

2. he Curious Incident of the Dog in the Night-time

- **Author**: Simon Stephens, a contemporary British playwright.
- **A**dapted from the 2003 novel of the same name written by Mark Haddon.
- **Premiere**: The play premiered at the National Theatre in London in 2012.

Themes

- **Autism**: The protagonist, Christopher, is on the autism spectrum. This theme is central to understanding his perspective and interactions.
- **Truth and Lies**: The investigation into the death of the dog, Wellington, reveals hidden truths and lies within Christopher's family.
- **Isolation and Connection**: Christopher's journey highlights his isolation due to his condition and his attempts to connect with the world around him.
- **Family Dynamics**: The complex relationships within Christopher's family are crucial to the narrative.
- **Setting** The play is set in Swindon, England, and moves to London as Christopher embarks on his journey. The staging often reflects Christopher's unique view of the world, using innovative lighting, sound, and set design to depict his experiences.
- **Understanding Autism:** Neuro-divergence (a term which includes conditions like Autism, ADHD and others) is better understood since the novel and play were published. It is important to understand that individuals on the autism spectrum are as different from each other as people without autism. Knowing one autistic person and what they're like doesn't mean you know anything about another autistic person and how their autism impacts them.

3. To Kill a Mockingbird (America in the 1930s)

- **Author: Harper Lee** (1926 -2016) grew up in **Alabama,** in the **American south**.
- *To Kill a Mockingbird,* **first published in 1960**, was an instant success and won the Pulitzer prize for fiction. It has sold over **40 million copies.**
- The **plot and characters** are loosely based on Lee's observations of her **family, her neighbours and a real-life event** that occurred when she was a young girl.
- **The Great Depression** started with Wall Street Crash in October **1929**. At the height of the depression, **25%** of the America's workforce was **unemployed**. Desperate for work, **people travelled the country** looking for employment. This led to **terrible poverty and suspicion** in communities, and a general **distrust** of strangers.
- **Racism**:
- **Segregation** in the **American South** meant that **black and white people were separated** in schools, public transport, restaurants and even churches.
- **Jim Crow Laws** were introduced in 1865. According to these laws, **black people** were denied the right to vote and considered **second class citizens.**
- **The Ku Klux Klan** was a **secret society** of white supremacists. The KKK was often made up of **powerful and influential people** who disguised their identity by wearing white robes. They would often **kill black people instead of** giving them the opportunity for a **fair trial**. **Lynching** (illegal hanging) was a common occurrence in the American South.
- **Inequality: Patriarchy and sexism** was very **common** in the **30s and 60s.** Women were treated as **inferior** to men. **Domestic violence** was **common** and considered part of **every-day life**.
- TKAM is celebrated as a study of **class, courage, gender and tolerance.**

English Knowledge Organiser Glossary

1. Short Stories and Novels

1. allusion
2. antagonist
3. character
4. climax
5. conflict
6. development
7. exposition
8. foreshadowing
9. first person
10. hook
11. implicit
12. irony
13. motif
14. narrator
15. pathetic fallacy
16. plot
17. prose
18. protagonist
19. resolution
20. second person
21. setting
22. tension
23. theme
24. third person

2. Plays

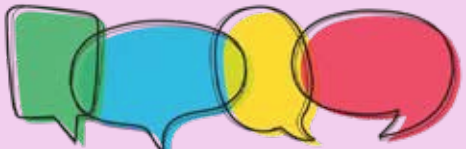
1. act
2. audience
3. cast
4. comedy
5. dialogue
6. director
7. dramatic irony
8. monologue
9. playwright
10. protagonist
11. scene
12. script
13. situational irony
14. soliloquy
15. stage directions
16. staging
17. tragedy
18. romance

3. Poetry

1. anadiplosis
2. anaphora
3. caesura
4. dramatic monologue
5. end stop
6. enjambment
7. alliteration
8. free verse
9. half rhyme
10. metaphor
11. meter
12. ode
13. onomatopoeia
14. personification
15. rhyme
16. rhythm
17. rhyming couplets
18. sibilance
19. simile
20. sonnet
21. stanza
22. volta

4. Persuasive writing

1. alliteration
2. anecdote
3. pronouns
4. facts
5. opinions
6. rhetorical questions
7. repetition
8. exaggeration
9. emotive language
10. statistics
11. threes
12. ethos
13. expert opinions
14. flattery
15. humour
16. imperatives
17. logos
18. pathos
19. sarcasm
20. rhetoric



1. Commonly misspelled words

1. accommodate
2. achievement
3. apparent
4. beginning
5. believe
6. commit
7. conscience
8. convenient
9. definitely
10. disappear
11. embarrass
12. experience
13. grateful
14. independent
15. judgement
16. knowledge
17. leisure
18. license
19. mischievous
20. necessary
21. occasion
22. opportunity
23. privilege
24. receive
25. recommend
26. rhythm
27. separate
28. surprise
29. until
30. weird

2. The Curious Incident of the Dog in the Night-time

Ed

1. caring
2. conflicted
3. deceptive
4. frustrated
5. imperfect
6. loving
7. overwhelmed
8. patient
9. protective
10. supportive

Christopher

1. analytical
2. brilliant
3. determined
4. honest
5. intelligent
6. logical
7. obsessive
8. perceptive
9. resilient
10. unrelenting

3. Analytical words

1. alludes
2. conveys
3. demonstrates
4. depicts
5. emphasises
6. evokes
7. exemplifies
8. highlights
9. hints
10. illustrates
11. implies
12. indicates
13. interpret
14. portrays
15. represents
16. reveals
17. signifies
18. suggests
19. symbolises
20. impression

4. To Kill a Mockingbird

Scout

1. adventurous
2. compassionate
3. courageous
4. empathetic
5. headstrong
6. honest
7. impulsive
8. independent
9. innocent
10. inquisitive
11. loyal
12. naïve
13. observant
14. outspoken
15. rebellious

Atticus

1. brave
2. confident
3. controlled
4. courageous
5. determined
6. focused
7. gentle
8. honest
9. humble
10. intelligent
11. patient
12. principled
13. protective
14. reluctant
15. respectful

FOOD YR 9

NUTRITION | FOOD SAFETY | FOOD CHOICE | FOOD SCIENCE | FOOD IN INDUSTRY | FOOD PROVENANCE | COOKING AND FOOD PREPARATION

Nutrition
The 5 main nutrients are:
Carbohydrate *(Sugar, Starch, Fibre)*
Fat
Protein
Vitamins *(A, B, C, D, E, K)*
Minerals *(Iron, Sodium, Flouride, Calcium)*

Macro Nutrients: *Carbohydrate, Fat, Protein*
Micro Nutrients: *Vitamins and Minerals*

Non Nutrients:
FIBRE – Vegetables, wholemeal flours/ pasta – aids digestion
WATER - Water, juice, fruit, vegetables - hydration of all cells

A

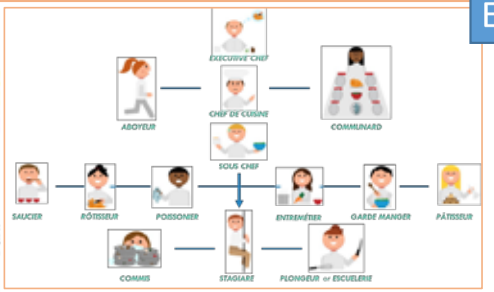
NEA1 – if you choose GCSE Food Preparation you will do a Non-examination Assessment (coursework & Practical)
NEA1 called Food Science – this would account for 15% of your GCSE. You would start it in Sept Yr11.
Example of task title: Investigate the chemical and functional role of yeast in bread making

C

Raising Agents
A raising agent is an ingredient or process that introduces a gas into a mixture so that it rises when cooked
The gases introduced are air (a mixture of gases), steam (water in its gaseous state), or carbon dioxide (CO_2
There are 3 ways this can be done
Mechanically e.g. whisking, sieving, folding
Chemically e.g. baking powder, bicarbonate of soda, cream of tartare
Biologically e.g. yeast

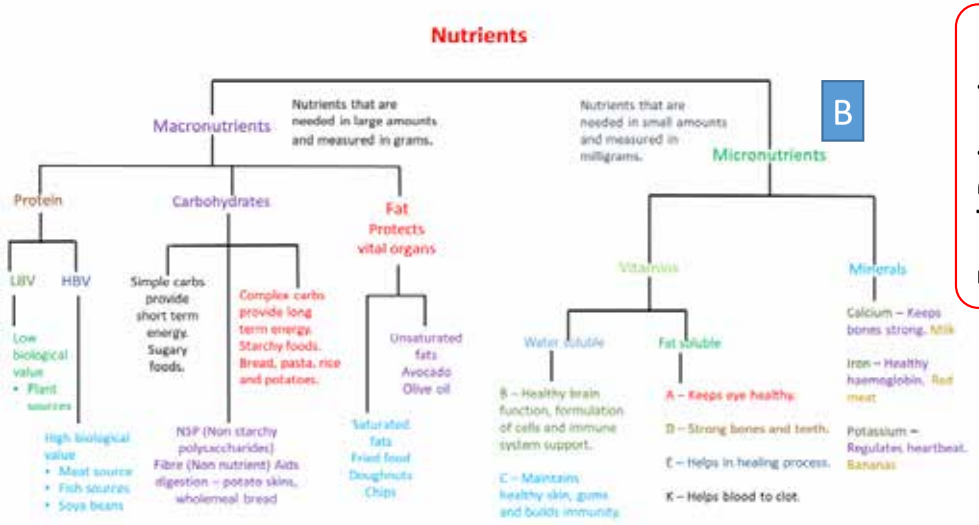
D

Hospitality & Catering. The Front of House system, kitchen layouts and different chefs.
Residential – You can sleep there
Non –residential – You can't sleep there
Commercial – makes a profit (Costa, Travel Lodge)
Non-commercial - doesn't make a profit (Hospitals, Schools, Prisons)
Head chef, sous chef, saucier etc



E

Service types
Table
Silver
Vending
Family
Counter
Buffet



B

Food Poisoning

F

	SYMPTOMS	SOURCE	GOOD PRACTICE
LISTERIA	diarrhea, fever, muscle aches	unpasteurized milk, soft cheeses	cooking raw food thoroughly
CAMPYLOBACTER	nausea, fever, cramps, diarrhea	raw milk, raw meat	cooking raw food thoroughly
CLOSTRIDIUM PERFRINGENS	nausea, vomiting, pain, diarrhea	stews, soups, gravies held at warm temperature	hold food at below 40°F (4°C) or above 140°F (60°C)
SALMONELLA	diarrhea, chills, fever, vomiting, cramps	undercooked poultry, eggs or products containing eggs	cooking raw food thoroughly
ESCHERICHIA COLI	cramps, diarrhea, fever, vomiting	contaminated ground beef, unpasteurized juice, milk	cooking raw food thoroughly, eat pasteurized food

The Environmental Health Officer
- Inspecting business for food safety standards
- Follow up complaints
- Follow up outbreaks of food poisoning
- Collecting samples for testing
- Giving evidence in prosecutions
- Maintaining evidence
- Submitting reports

G

Knife Skills – Bridge, Claw, Cross-cutting.
Chefs knife, vegetable knife. Cuts – julienne, dice, brunoise
Sauce making – Roux, bechamel, reduction, emulsion

H

Sauces classification
Kitchen sauces are prepared in the kitchen by Chefs for the preparation & completion of various dishes.
Proprietary sauces are ones available in shops & are usually prepared commercially. These are usually served on the table in restaurants as a part of accompaniments to certain dishes. The Chef may use some of these sauces in marinades, as seasoning and in preparation of certain dishes.
Kitchen sauces may be further classified as: Mother/Leading sauces, Dessert sauces, Miscellaneous sauces and Compound Butters.
Mother or leading sauces may be divided into Hot, Warm and Cold sauces
Hot Sauces: Béchamel, Veloute, Espagnole & Tomato sauce.
Warm Sauces: Hollandaise/ Béarnaise (Emulsion sauce)
Cold Sauces: Mayonnaise sauce (Emulsion sauce)

FOOD YR 9

NUTRITION | FOOD SAFETY | FOOD CHOICE | FOOD SCIENCE | FOOD IN INDUSTRY | FOOD PROVENANCE | COOKING AND FOOD PREPARATION

There are many job roles available in the Hospitality & Catering Industry. There are a number of training courses available for different industry sectors..

I

City & Guilds
Examples of courses ;
- **Introduction to the H&C industry**
- **Cooking & Service for the Hospitality industry**
- **Culinary skills**
- **Food & Beverage service**

Springboard UK
Examples of courses ;
- **Springboard FutureChef work in schools**
- **FutureChef competitions & awards**
- **Mentoring industry visits, visiting speakers etc.**

Universities & Colleges Admissions service (UCAS)
Examples of courses;
Higher National Certificates & Diplomas & degrees
- Hospitality management
- Professional Cookery
- Culinary Industry Management
- Food & Culinary Arts

Chartered Institue of Environmental Health (CIEH)
Examples of courses;
- Level 1 introductory Certificate in Food Safety
- Level 2 Foundation certificate in Food Safety

What personal attributes do you need to work in the industry?

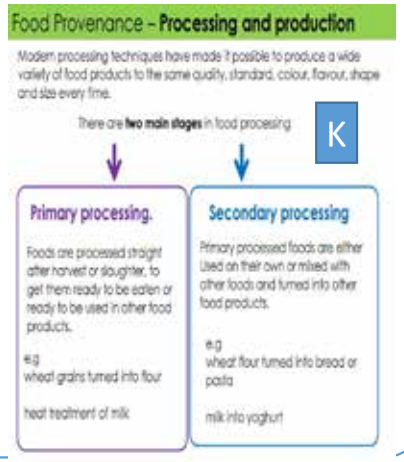
Enthusiastic, hard working, punctual & reliable, wiling to learn & develop skills, ability to take initiative, helpful & approachable, sense of humor, ability to take criticism & act on it, good team member, calm & composed, good commitment, good communicator

The food that we eat is either:

Grown

Reared

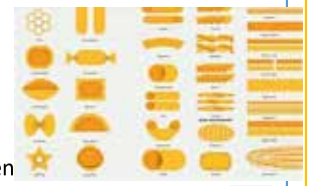
or Caught



K

Pasta

Pasta is an Italian type of food typically made from an unleavened dough of wheat flour or 00 flour (gluten) mixed with water or eggs, and formed into sheets or other shapes, then cooked by boiling or baking



L

Careers - employment contracts

Full-time: hours of work & start/end times are specified. Any shift work is specified. The employee qualifies for sick pay and holiday pay

Part-time: days of the week & start/end times specific. Reduced sick and holiday pay

Casual work: seasonal or available through an agency e.g. to cover someone who is away due to illness. No sick or holiday pay

Zero hours: is an agreement between worker & employer, no specific hours/end/finish times. No sick or holiday pay.

J

Type of diet	Reason for following diet	Foods that can be eaten	Foods to avoid
Vegan	Health, religious, ethical or other	All plant foods, Protein alternatives: tofu, tempeh, TVP	All animal foods including fish and shellfish
Lacto-ovo Vegetarian	Health, religious, ethical or other	All plant foods, Milk & dairy foods, eggs	Any animal food where the animal has been killed, including fish and shellfish
Lacto-vegetarian	Health, religious, ethical or other	All plant foods Milk & dairy foods	Any animal food where the animal has been killed, including fish and shellfish, eggs
Gluten free	Coeliac disease	Rice, rice products, soya, maize (corn), Cassava (tapioca), linseeds, polenta, beans, peas, lentils, quinoa, sorghum, agar, nuts	Wheat and wheat products, bread, cakes, biscuits, pastries, barley, oats, rye products
Lactose free	Lactose intolerance	Specially produced lactose-free dairy products. All foods with no dairy in them	Mil, milk products (cream, yogurt, cheese, butter), foods containing milk products
High fibre	Diseases of the intestines e.g. constipation, diverticular disease	Fruits, vegetables, wholegrain cereals, breads, pasta, rice, peas, beans, lentils	White flour and white flour products, white rice, smooth fruit juice
Low sugar	Diabetes, weight reduction diet	Fresh vegetables and fruit, milk, unsweetened milk products	Free sugars that have been added to cakes, biscuits, drinks, confectionary, desserts, sauces, ice cream, breakfast cereals, honey, syrup, jam, etc.
Fat reduced	Heart disease, weight reduction diet	Naturally low-fat foods, e.g. fruits, vegetables, cereals, white fish, fat reduce cheese, spreads, milk, etc.	Full-fat dairy foods, pastries, meats, crisps, chips, doughnuts, cakes, biscuits, fried foods, desserts, ice cream
Low sodium (salt)	Heart disease, high blood pressure, kidney disease	Fruits, vegetables, milk, eggs, poultry, unprocessed meat	Yeast extract, cheese, dried fish, canned fish, soy sauce, ketchup, pickles, ready meals, snack foods, cakes, biscuits, scones, ham, bacon, processed meats, e.g. sausages

M

FOOD YR 9

NUTRITION | FOOD SAFETY | FOOD CHOICE | FOOD SCIENCE | FOOD IN INDUSTRY | FOOD PROVENANCE | COOKING AND FOOD PREPARATION

Advantages and disadvantages of buying local and seasonal food

Can you list which fruits and vegetables are in each season in the UK?

O

Advantages	Disadvantages
Fresher	May not be much choice
Fewer food miles	Some people do not like the food being different sizes
Reduce carbon footprint	Sometimes more expensive
Less energy used in transporting	
Supports local farmers/UK farmers	

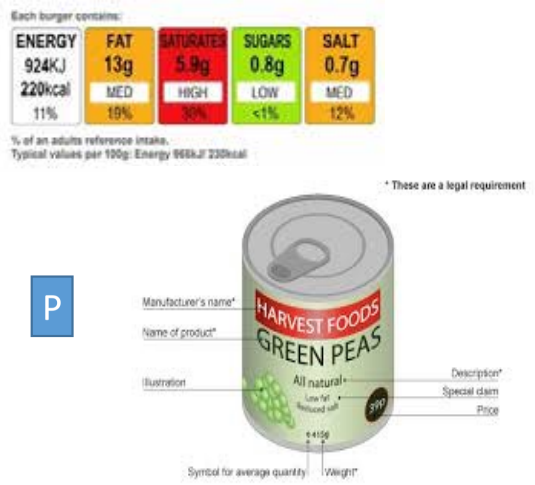
Red Tractor
Organic
Fairtrade
GM free

N

You need to know what these terms mean and how they link to food choice

Food packaging and labelling

P



Information required by law:

Q

The name of the food
A 'best before' or 'use by' date (or instructions on where to find it)
Any necessary warnings
Net quantity information
A list of ingredients (if there is more than 1)
The name and address of the UK business responsible for the information on the food or, if the business is not established in the UK, the name and address of the importer
the country of origin, if required
the lot number or use-by date
any special storage conditions
instructions for use or cooking, if necessary

Types of pastry

There are four main types of pastry that we use in school:

R

Shortcrust	Rough Puff/ flaky	Choux	Filo
			
			

Baking blind

Means to partly cook the pastry case before adding the filling.

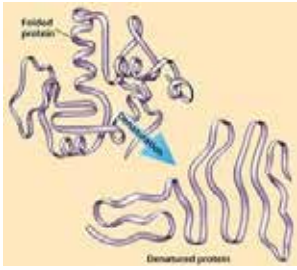
Fillings can make the pastry very soggy. YOU DON'T WANT A SOGGY BOTTOM!!!

Baking beans on paper are used to stop the pastry rising, then lifted out.

S

Denaturation

T



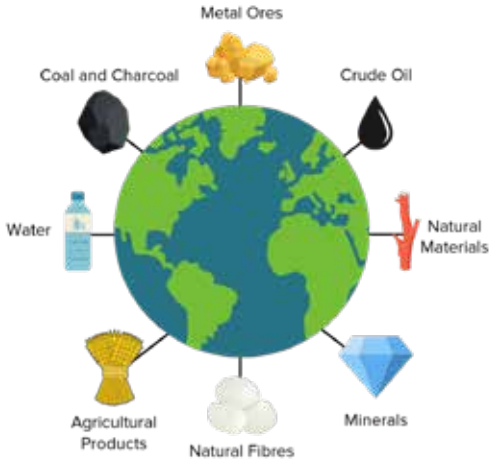
Food Science:
Gelatinisation
Denaturation
Shortening
Aeration
Layering
Elasticity
Glazing

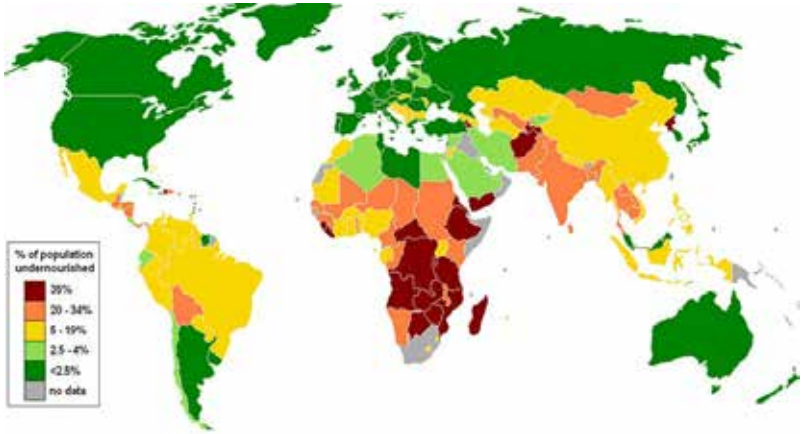
GEOGRAPHY 9.3 Resources & Issues

1. Resources are anything that we use to meet our wants and needs

We all consume resources on a constant basis as we go about our daily lives. Some are essential—such as food, water and energy, whilst others are important for economic reasons as they are valuable. Resources are useful for a massive variety of reasons depending on what they are.

Water, for example, is used for drinking, washing, sanitation, energy production, clothes manufacturing, cement and concrete making, agriculture, leisure, fishing, heating, transport... and so on!





2. Uneven global access to resources

The distribution of resources is very uneven across the world. For example, some countries have huge reserves of energy resources such as coal and oil, whilst others rely on importing it from others. The choropleth map above show the % of country's population who are undernourished; this means the amount of people who have an insufficient amount and/or quality of food to be healthy. You will notice that the wealthier countries (see North America or western Europe) have no issues with undernourishment, whilst the poorest countries of the world (see sub-Saharan Africa) clearly do not have the wealth to access the basic resources—such as food in this case.

3. 4. & 5. Environmental impacts

Air Pollution (CLIMATE CHANGE)

Deforestation for human use of land clearance, is changing the natural balance of life on Earth. The removal of vast forested areas changes biodiversity, changes the composition of the atmosphere, and changes the local and global climates of Earth.

Water Pollution (OCEAN HEALTH)

Industrial areas in many LICs and NEEs can create major river pollution when chemicals used in factories is dumped into the rivers. In other cases, rivers after often treated by people as places to dispose of their waste. Ultimately, pollution ends up in the sea. 6% of the world's plastic waste ends up in the oceans. In addition, climate change is causing stress to the fragile marine environment—especially coral reefs.

Land degradation (DESRTIFICATION)

Desertification means to make an area of land (usually on the fringes of existing deserts) become a desert. Desertification is not a natural process, but as a result of human activity; degrading the soil to the point of ecological failure by over grazing, poor land management, over cultivation and deforestation for fuel wood.

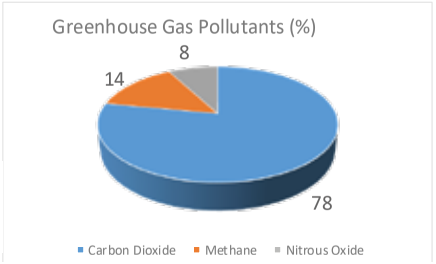
6. Human Activity is creating climate change

The Enhanced Greenhouse Effect

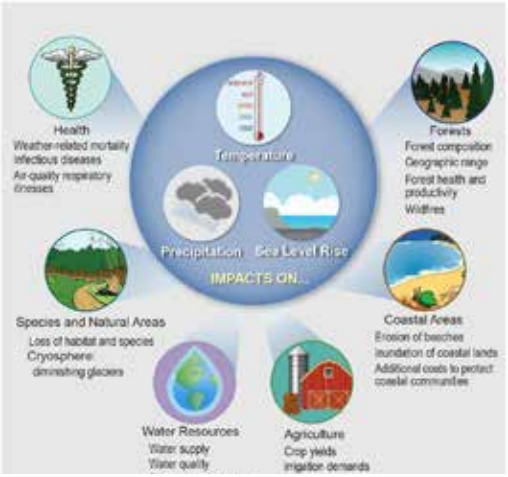
The thin atmosphere around Earth acts like the glass on a greenhouse. Incoming UV radiation passes through the glass and outgoing IR radiation (heat) does not. The outcome is heat gets trapped inside the greenhouse. This process happens naturally thanks to the greenhouse gases such as CO_2 (Carbon Dioxide) and CH_4 (Methane) being in the atmosphere absorbing heat (like the glass prevents heat from leaving the greenhouse). The process is becoming more **enhanced** due to human activity changing the balance of these gases; the consequence is climate change.

Sources of greenhouse gases from Human Activity (Economic Sector):

Our demand for fossil fuels for energy, transport and industry lead to vast amounts of CO and NOx being released into the atmosphere. At the same time, our use of the land through agriculture, water use and forestry create huge amounts of emissions in CH—as well as the other two key greenhouse gases. It is our resource use that is changing the concentration of these gases in the atmosphere; thus changing the climate in the shortest time ever recorded.



7. Impacts of climate change



8. Mitigation or Adaptation?

The concept: Why do we put a seatbelt on in a car? Well, it won't prevent a crash, but it will reduce the impact of one. This is how **mitigation** works; it is the act of reducing the (negative) impacts of an event. **Adaptation** is knowing an event is happening (or going to happen) and adjusting what we do to prevent the event or, change the way we operate because it is having an impact.

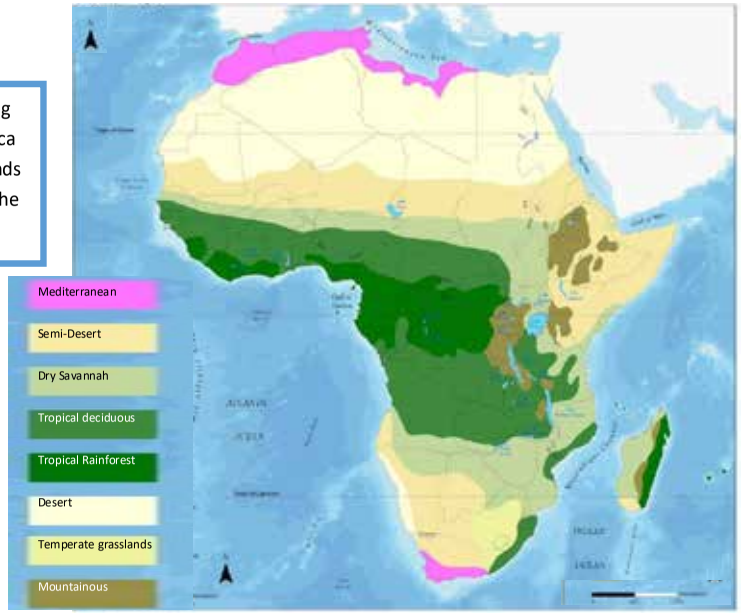
Take climate change for example; it is happening in the present, and will continue to do so into the future. Therefore we need to **mitigate** against the causes of climate change by switching energy sources away from fossil fuels to renewable sources, and go about a global afforestation scheme. Meanwhile, countries particularly at risk to sea level rise (as a result of climate change) have to **adapt** their landscapes to cope with higher future sea levels by defending the coastline.

GEOGRAPHY 9.2. Africa

2. Relief Map of Africa

2. Africa is the second largest continent on Earth (after Asia), occupying about 20% of the total land area on Earth. Much of the interior of Africa is fairly high altitude—with the East Africa Highlands reaching thousands of metres above sea level down the length of the east. It is here that the great Rift Valley is located, created by tectonic processes.

1. Biomes of Africa

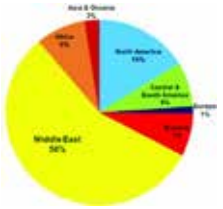


8. The Middle East case study

The Middle-east is a trans-continental region of the world mainly in western Asia.

The Middle East generally has a hot, dry climate, with several major rivers providing irrigation to support agriculture in limited areas such as the Nile Delta in Egypt, the Tigris and Euphrates watersheds of Iraq, Kuwait and eastern Syria.

Most of the countries that border the Persian Gulf have vast reserves of **crude oil (see pie chart)** with the countries of the Arabian Peninsula in particular benefiting economically from petroleum exports.



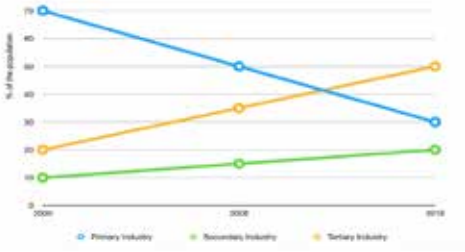
Generally, wealth and life expectancy in the region has improved massively in recent decades but continued political unrest has lead to uneven development. Unemployment is particularly high in the young adult population—raising tensions in numerous countries

The most stable countries in the region have developing banking and tourism industries to spread out the economic activity from the oil industry.

7. Lagos, Nigeria - case study

Lagos City is Nigeria's largest city and its economic capital. It is located on Africa's Atlantic Ocean coastline. It is the 7th fastest growing city in the world. It has a population of 21 million. The population grows at an annual rate of 2 to 3 %. Unlike other states dependent on oil revenues, Lagos has a diversified economy with prosperous manufacturing, transport, construction, service, wholesale, and retail sectors. Lagos State generates $90 billion in goods and services annually. If it were a country, the Lagos State economy would be the 7th largest one in Africa. Two-thirds of the population in Lagos are slum dwellers. Crime is also a problem in the city. Kidnappings, extortion, carjacks, assaults, armed muggings, and burglaries are common in the city.

6. Changing Economic Structures in Nigeria



3. Historical events have shaped modern Africa. In the past, powerful European countries established colonies all over the world (see map above)—especially in Africa—taking control of them. The colonised countries were exploited by the dominant Europeans, leaving a legacy of challenges in present day Africa.

3. Historical events in Africa

4. The Akie people: Hunter-gatherers

The Akie are one of the last actual hunter-gather groups left on the African savannah. Beside the dangers of hunting they collect honey, which involves 'steaming' out the bees, making it possible for to reach into the hive and grab the honey—a task requiring nerves of steel, and the ability to cope with brutal stings from the bees. Due to competition for land with the dominant Maasai people, they have recently been more reliant on growing maize, although this rarely produces enough food to last year around.

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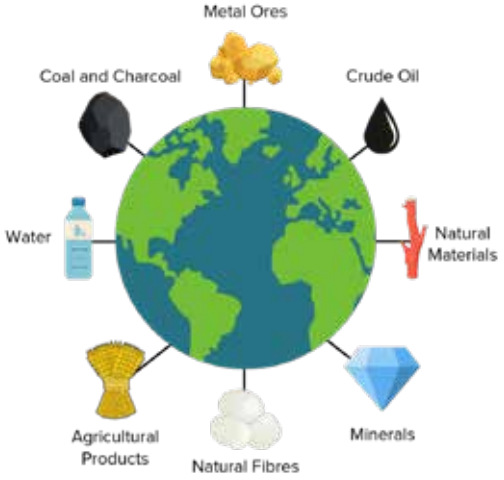

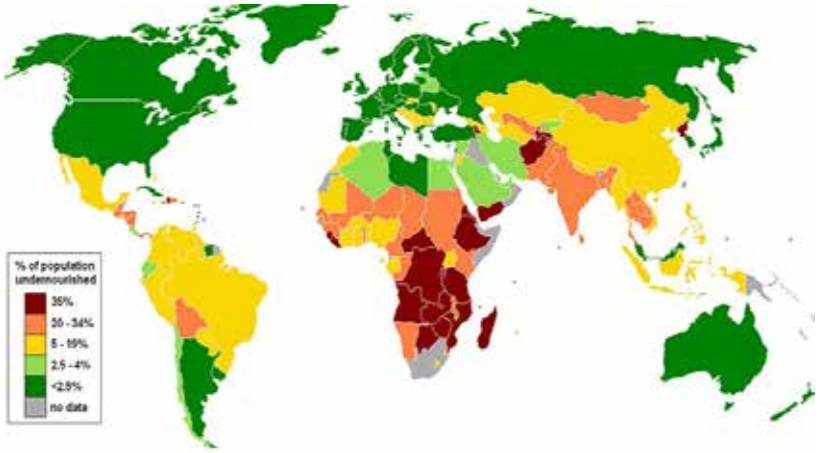

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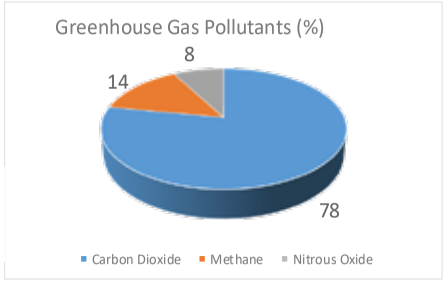

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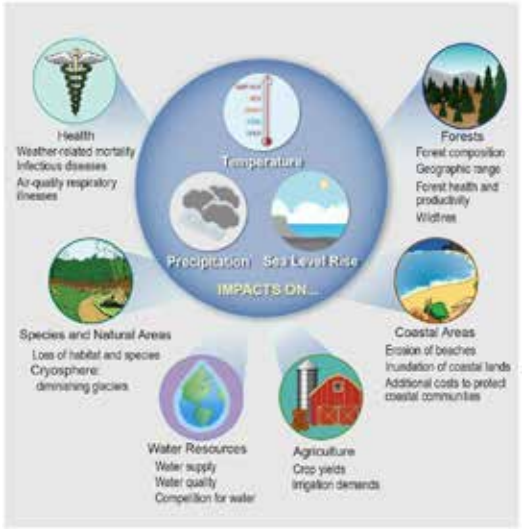

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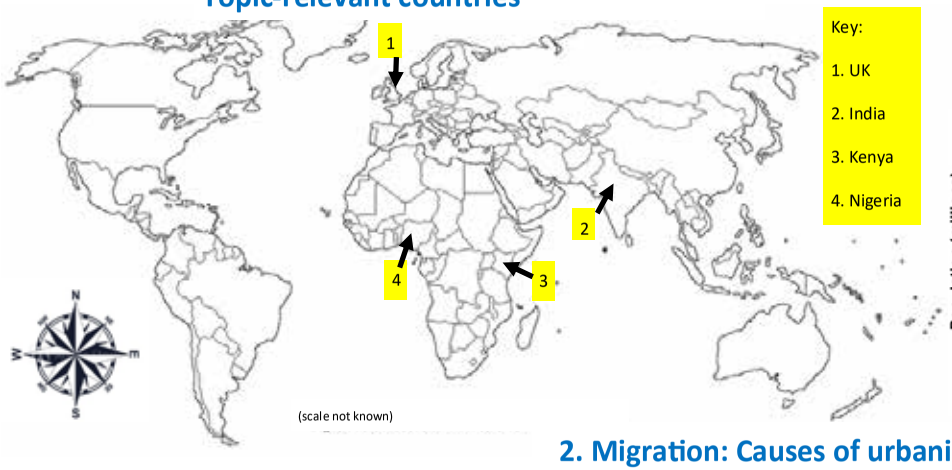
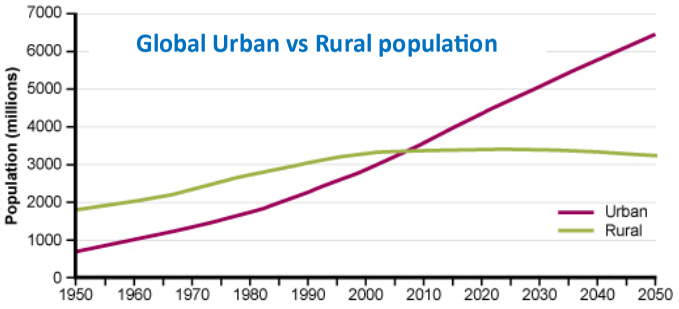
GEOGRAPHY 9.4. Urbanisation

Topic-relevant countries



1. Global trends of urbanisation

Urbanisation is the proportion of population that live in cities. Cities then predominantly grow horizontally or vertically. In 2007 a critical change happened; more people now live in urban areas compared to those that remain in the countryside. Urban living is the future for most humans.



3. Settlement hierarchy

4. Settlement Interdependence

Settlements rely on each other; this relationship is called interdependence. For example, cities draw in huge amounts of workers—who live in neighbouring towns and villages—who commute to work daily in the city. However, a village may well be in a National Park for example, and attract city residents as tourists who want to get away from the city.

Urbanisation key terms

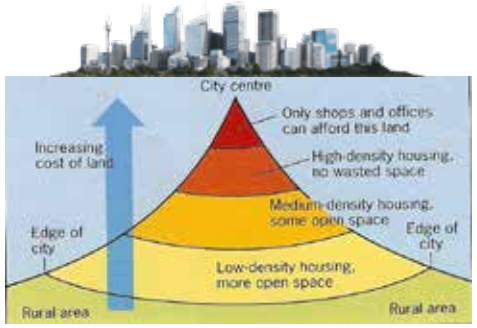
urban rural population urbanisation hierarchy urban sprawl expansion density urban fringe suburbs hamlet village town city conurbation megacity commuter redevelopment regeneration gentrification slum NEE (Newly Emerging Economy)

2. Migration: Causes of urbanisation

- few services
- lack of job opportunities
- unhappy life
- poor transport links
- natural disasters
- wars
- shortage of food

- access to services
- better job opportunities
- more entertainment facilities
- better transport links
- improved living conditions
- hope for a better way of life
- family links

City land use and land value



7. Tiverton's EUE

Eastern Urban Expansion

With the completion of the new junction near Gornhay Cross off of the A361, the Tiverton Eastern Urban Expansion (EUE) will begin in the Autumn 2019.

- Over 2000 new homes
- Community Centre
- Local shops
- Primary School (420 places)
- New employment land

Regeneration	Economic revival of a city centre
Redevelopment	The demolition and rebuilding of brownfield sites (sometimes combined with gentrification)
Gentrification	Modernising a building/area to meet expectations
Mixed Use	Combining urban retail with hospitality and entertainment
Urban Sprawl	The outward expansion of urban areas from new developments being built on the rural-urban fringe.
CBD	The Central Business District

5. Urban Redevelopment—Exeter City Centre's Princesshay

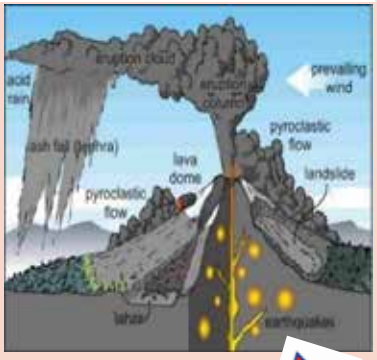
	Buildings and Land use	Transport
Exeter Before 2007	The Princesshay area of Exeter was originally redeveloped in 1950 after bomb damage during WW2. Shops were small and over time, the buildings began to suffer 'concrete cancer' and fall apart. By 2005, most shops were empty and the area was economically dead.	1950s Princesshay was the first pedestrianised shopping area in the UK— a revolution at the time. However, the High Street was still heavily used by buses.
Exeter In 2019	The hugely successful regeneration of Princhesshay was opened in 2007 containing new buildings (redeveloped) with larger shops combined with restaurants, cafes and accommodation to broaden the appeal to meet modern expectations of retail, leisure and urban living. Some buildings were 'gentrified' (given a make-over) to bring them up to standard and blend the older with the new. Most however, were flattened and rebuilt. John Lewis gentrified the former Debenhams tower and moved into the city in 2012.	Pedestrian shopping is still key to modern Princesshay and the High Street remains a bus route—although much restricted. Exeter's bus station is the latest phase of urban change currently underway in the city.

The structure of the Earth

The Crust	Varies in thickness (5-10km) beneath the ocean. Made up of several large plates.
The Mantle	Widest layer (2900km thick). The heat and pressure means the rock is in a liquid state that is in a state of convection.
The Inner and outer Core	Hottest section (5000 degrees). Mostly made of iron and nickel and is 4x denser than the crust. Inner section is solid whereas outer layer is liquid.

Volcanic Hazards

Ash cloud	Small pieces of pulverised rock and glass which are thrown into the atmosphere.
Gas	Sulphur dioxide, water vapour and carbon dioxide come out of the volcano.
Lahar	A volcanic mudflow which usually runs down a valley side on the volcano.
Pyroclastic flow	A fast moving current of super-heated gas and ash (1000°C). They travel at 450mph.
Volcanic bomb	A thick (viscous) lava fragment that is ejected from the volcano.



Managing Volcanic Eruptions

Warning signs	Monitoring techniques
Small earthquakes are caused as magma rises up.	Seismometers are used to detect earthquakes.
Temperatures around the volcano rise as activity increases.	Thermal imaging and satellite cameras can be used to detect heat around a volcano.
When a volcano is close to erupting it starts to release gases.	Gas samples may be taken and chemical sensors used to measure sulphur levels.

Preparation	
Creating an exclusion zone around the volcano.	Being ready and able to evacuate residents.
Having an emergency supply of basic provisions, such as food	Trained emergency services and a good communication system.

Convection Currents

The crust is divided into tectonic plates which are moving due to convection currents in the mantle.

1	Radioactive decay of some of the elements in the core and mantle generate a lot of heat.
2	When lower parts of the mantle molten rock (Magma) heat up they become **less dense** and **slowly rise**.
3	As they move towards the top they cool down, become **more dense** and **slowly sink**.
4	These **circular movements** of semi-molten rock are **convection currents**
5	Convection currents create **drag** on the base of the tectonic plates and this causes them to move.

LIC -CS: Nepal Earthquake 2015

Causes
On a destructive plate margin, involving the Indo Australian and Eurasian plates. The magnitude 7.9 earthquake was 50 miles to the north west of Nepal's capital Kathmandu. The plates are colliding at about 45mm per year. .

Effects
9000 people died and 8 million affected.
Many **emotionally affected**.
3 million homeless.
7000 schools destroyed
Avalanche on Mt Everest killed at least 19 people along with **landslides**

Management
Search and recue teams inc. helicopters for those trapped on Mt Everest.
Hall a million tents.
300 000 people migrated to Kathmandu.
June 2015 International conference to discuss rebuilding.

Earthquake Management

PREDICTING

Methods include:
- Satellite surveying (tracks changes in the earth's surface)
- Laser reflector (surveys movement across fault lines)
- Radon gas sensor (radon gas is released when plates move so this finds that)
- Seismometer
- Water table level (water levels fluctuate before an earthquake).
- Scientists also use seismic records to predict when the next event will occur.

PROTECTION

You can't stop earthquakes, so earthquake-prone regions follow these three methods to reduce potential damage:
- Building earthquake-resistant buildings
- Raising public awareness
- Improving earthquake prediction

Unit 1a

AQA

The Challenges of Natural Hazards

What is a Natural Hazard

A natural hazard is a natural process which could cause death, injury or disruption to humans, property and possessions.

Geological Hazard	Meteorological Hazard
These are hazards caused by land and tectonic processes.	**These are hazards caused by weather and climate.**

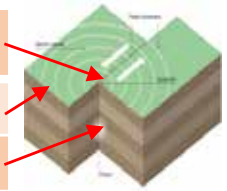
Causes of Earthquakes

Earthquakes are caused when two plates become **locked** causing **friction** to build up. From this **stress**, the **pressure** will eventually be released, triggering the plates to move into a new position. This movement causes energy in the form of **seismic waves**, to travel from the **focus** towards the **epicentre**. As a result, the crust vibrates triggering an earthquake.

The point directly above the focus, where the seismic waves reach first, is called the **EPICENTRE**.

SEISMIC WAVES (energy waves) travel out from the focus.

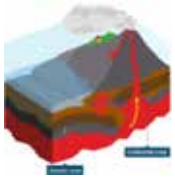
The point at which pressure is released is called the **FOCUS**.



Types of Plate Margins

Destructive Plate Margin

When the denser plate subducts beneath the other, friction causes it to **melt and become molten magma**. The magma forces its ways up to the surface to form a volcano. This margin is also responsible for **devastating earthquakes**.

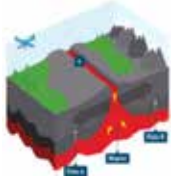


Constructive Plate Margin

Here two plates are **moving apart** causing new magma to reach the surface through the gap. Volcanoes formed along this crack cause a submarine mountain range such as those in the **Mid Atlantic Ridge**.

Conservative Plate Margin

A conservative plate boundary occurs where plates **slide past each other** in opposite directions, or in the same direction but at different speeds. This is responsible for earthquakes such as the ones happening along the San Andreas Fault, USA.



HIC - CS: Chile 2010

Causes
Formed on a destructive plate boundary involving the Nazca and South American plate. The magnitude was 8.8 on the Richter scale. The earthquake struck just of the coast of Chile causing a tsunami warning to be issued.

Effects
Around **500 people** killed. 12 000 injured and **800 000 people** affected.
220 000 homes and **4500 schools** destroyed.
Cost of **US$30 billion**.
1500 km of roads destroyed.
Several coastal towns devastated by tsunami waves.

Management
Emergency services quick to act.
Temporary repairs happened within 24 hours. Power restored to **90% of homes** in 10 days.
Housing reconstruction plan to help 200 000 homes affected.
Strong copper economy rebuilt without foreign aid.

Global pattern of air circulation

Atmospheric circulation is the large-scale movement of air by which heat is distributed on the surface of the Earth.

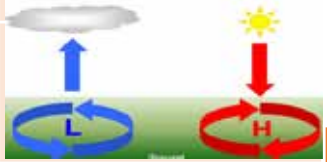
Hadley cell	Largest cell which extends from the **Equator** to between **30° to 40° north & south**.
Ferrel cell	Middle cell where air flows **poleward** between **60° & 70°** latitude.
Polar cell	**Smallest & weakness** cell that occurs from the poles to the Ferrel cell.

Distribution of Tropical Storms.

They are known by many names, including hurricanes (North America), cyclones (India) and typhoons (Japan and East Asia). They all occur in a band that lies roughly 5-15° either side of the Equator.

High and Low Pressure

Low Pressure	High Pressure
Caused by hot air rising. Causes stormy, cloudy weather.	**Caused by cold air sinking. Causes clear and calm weather.**



Formation of Tropical Storms

1	The sun's rays heats large areas of ocean in the summer and autumn. This causes **warm, moist air** to rise over the particular spots
2	Once the **temperature is 27°**, the rising warm moist air leads to a **low pressure**. This eventually turns into a thunderstorm. This causes air to be sucked in from the **trade winds**.
3	With trade winds blowing in the opposite direction and the rotation of earth involved (Coriolis effect), the thunderstorm will eventually start to **spin**.
4	When the storm begins to **spin faster than 74mph**, a tropical storm (such as a hurricane) is officially born.
5	With the tropical storm growing in power, **more cool air sinks** in the centre of the storm, creating calm, clear condition called the **eye of the storm**.
6	When the tropical storm hits land, it **loses its energy source** (the warm ocean) and it begins to lose strength. Eventually it will 'blow itself out'.

Changing pattern of Tropical Storms

Scientist believe that global warming is having an impact on the frequency and strength of tropical storms. This may be due to an increase in ocean temperatures.

Management of Tropical Storms

Protection Preparing for a tropical storm may involve construction projects that will improve protection.	**Aid** Aid involves assisting after the storm, commonly in LIDs.
Development The scale of the impacts depends on the whether the country has the resources cope with the storm.	**Planning** Involves getting people and the emergency services ready to deal with the impacts.
Prediction Constant monitoring can help to give advanced warning of a tropical storm	**Education** Teaching people about what to do in a tropical storm.

Primary Effects of Tropical Storms

- The intense winds of tropical storms can destroy whole **communities, buildings** and **communication networks**.
- As well as their own destructive energy, the winds can generate abnormally high waves called **storm surges**.
- Sometimes the most destructive elements of a storm are these subsequent **high seas and flooding** they cause to coastal areas.

Secondary Effects of Tropical Storms

- People are **left homeless**, which can cause distress, poverty and ill health due to lack of shelter.
- **Shortage of clean water** and **lack of proper sanitation** makes it easier for diseases to spread.
- **Businesses are damaged** or destroyed causing employment.
- Shortage of food as **crops are damaged**.

Case Study: Typhoon Haiyan 2013

Causes

Started as a tropical depression on **2rd November 2013** and gained strength. Became a Category 5 **"super typhoon"** and made landfall on the Pacific islands of the Philippines.

Effects

- Almost **6,500 deaths**.
- **130,000 homes destroyed.**
- Water and sewage systems destroyed had caused **diseases**.
- **Emotional grief** for dead.

Management

- The UN raised **£190m in aid**.
- USA & UK **sent helicopter carrier ships** deliver aid remote areas.
- **Education** on typhoon preparedness.

Case Study: Somerset Levels 2014

Causes

Wettest January on record (since 1910) caused by a succession of depressions over the Atlantic Ocean. 350mm rain fell in Jan and Feb 100mm more than average. High tides and storm surges in the Bristol Channel. Rivers had not been dredged in 20 years.

Effect

- Over 600 house flooded.
- Many people cut off from supplies.
- Cost of the flood £10 million
- 1000 livestock evacuated.
- Floodwater heavily contaminated with pollutants.
- Local roads and railway blocked.

Management

- Villages cut off were accessed by boats.
- £20 million flood action planned by Somerset County Council – To include: 8Km of river Tone and Parret dredged; Road levels raised; River banks raised; by 2024 consideration will be given to a tidal barrage at Bridgewater.

What is Climate Change?

Climate change is a large-scale, long-term shift in the planet's weather patterns or average temperatures. Earth has had tropical climates and ice ages many times in its 4.5 billion years.

Recent Evidence for climate change.

Global temperature	Average global temperatures have increased by more than **0.6°C since 1950**.
Ice sheets & glaciers	Many of the world's glaciers and ice sheets are melting. E.g. the Arctic sea ice has declined by **10% in 30 years**.
Sea Level Change	Average global **sea level has risen by 10-20cms** in the past 100 years. This is due to the additional water from ice and thermal expansion.

Enhanced Greenhouse Effect

Recently there has been an increase in **humans burning fossil fuels** for energy. These fuels (gas, coal and oil) emit **greenhouse gases**. This is making the Earth's atmosphere thicker, therefore trapping more solar radiation and causing **less to be reflected**. As a result, the Earth is becoming warmer.

Evidence of natural change

Orbital Changes	Some argue that climate change is linked to how the Earth orbits the Sun, and the way it wobbles and tilts as it does it.
Sun Spots	Dark spots on the Sun are called Sun spots. They increase the **amount of energy Earth receives** from the Sun.
Volcanic Eruptions	Volcanoes release large amounts of **dust containing gases**. These can **block sunlight** and results in cooler temperatures.

Managing Climate Change

Carbon Capture This involves new technology designed to reduce climate change.	**Planting Trees** Planting trees increase the amount of carbon is absorbed from atmosphere.
International Agreements Countries aim to cut emissions by signing international deals and by setting targets.	**Renewable Energy** Replacing fossil fuels based energy with clean/natural sources of energy.

History Year 9 Knowledge Organiser Autumn Term

1)The Rise of the Nazi Party

Weimar: The name of the government set up after WW1

Article 48: Emergency powers for the president in a crisis

28TH June 1919 - The signing of the treaty of Versailles
1923 - Hyperinflation (Money becomes worthless)
8th November 1923 - Munich Putsch (Hitler tries to seize power=Failure=Prison)
1924 - The Dawes Plan (USA lends Germany money=good times return)
October 1929 -The Wall Street Crash=The Great Depression (There is NO Money)
July 1932 - Nazis are most popular Party in Germany
30th January 1933 - Hitler made Chancellor of Germany (2nd in command)
27th February 1933 - The Reichstag Fire (Communists blamed)
23rd March 1933 - The Enabling Act/Article 48 gives Hitler complete control

2) 1929: Wall Street Crash causes Depression in Germany

1928	Nazis have 12 seats in The Reichstag
1930	107 (rises due to The Depression)
July 1932	230 (even more popular. Hitler promises them Work and Bread)
Nov 1932	196 (many feel they are too violent)
March 1933	288 (after the Communists are blamed for the Reichstag Fire)

3) Steps to World War II after Hitler takes control

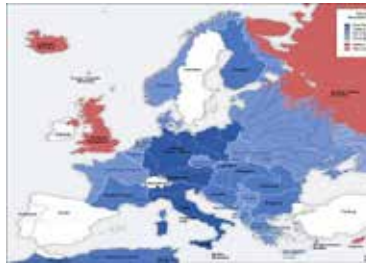
1936	Invasion of the Rhineland
1938	Anschluss with Austria
Sep 1938	Invasion of Sudetenland
March 1939	Invasion of the rest of Czechoslovakia
Sep 1939	Invasion of Poland

4) Key Turning Points of World War Two

Home Front	Men were conscripted into the army. Food was rationed. Air raid shelters were built so that people could take shelter from bombs dropped in the Blitz. The Battle of Britain was fought in the skies between the RAF and Luftwaffe. Britain managed to avoid defeat which prevented a full-scale German invasion.	Rationing – Limiting the food that people can eat. Conscription – forcing men to join the military.
Operation Barbarossa	Hitler attacked Russia to take land and resources. This was called Operation Barbarossa. It started in 1941. Hitler expected a quick victory. Instead, the Germans lost. Many soldiers died in the Russian winter as they were not equipped properly. The Germans lost 800,000 men at the Battle of	Turning point – an event that changes the course of History.
Pearl Harbour	In 1941, the Japanese attacked Pearl Harbour in Hawaii. This was an American naval base. 2,400 people died including 68 civilians. 1,178 were wounded. America declared war on Japan. America had joined WWII.	Ambush – surprise attack. Civilians – people not part of the military
Dropping of the A bomb	America dropped two atomic bombs on Japanese cities, Hiroshima and Nagasaki, in August 1945. Japan surrendered, ending WWII. People were killed instantly. Some died afterwards for diseases caused by the radiation. 140,000 people are estimated to have been killed by the bomb dropped on Hiroshima.	A-bomb – a powerful bomb that uses nuclear power to explode. It releases harmful radiation. Inevitable – bound to happen.

Europe in 1919

Europe in 1941



Europe in 1946

History Year 9 Knowledge Organiser Spring Term

1) War of two halves: the first half is a disaster for the Allies

3rd September 1939. Britain declares war	May 1940. Dukirk	Summer of 1940. Battle of Britain.	1941. Invasion of USSR (Operation Barbarossa)

War of two halves: the second half is a disaster for Germany

1942-43. Siege of Stalingrad.	1943. Total War declared in Germany.	6th June 1944. D-Day.	30th April 1945. Hitler ends his own life.

Split of interests:

Allies want to rebuild. Soviets want revenge

2) After World War II Germany is divided

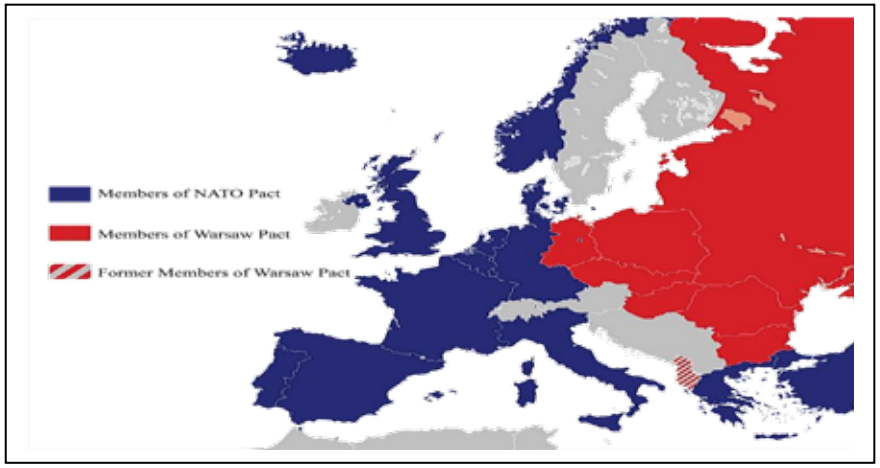
3) Key events after World War II

1947: The Marshall Plan (US Loans) Help West Germany rebuild and revitalise.

24th June 1948: Stalin blockades Berlin which causes the Berlin Airlift.

12th May 1949: Stalin calls off the Berlin Blockade but **Cold War** begins.

1955: West Germany Joins NATO and East Germany joins Soviet Pact.



History Year 9 Knowledge Organiser Summer Term

1)

2) A Cold War of Two Halves: The first half is full of tension

1945: USA drops atomic bombs on Japan	1949: USSR tests first nuclear weapon	1950: USA tests first hydrogen bomb	1962: Cuban Missile Crisis

In the second half tensions continue and finally ease

1963: Hot Line between USA and USSR	1965- 1973: USA involved in Vietnam War	1989: Berlin Wall comes down	1991: Collapse of the Soviet Union

3) Current world issues. NATO and Russia in 2024

4) Key Constructs in our learning this year

Political actions have created positive and negative change	**Hitler's political aims to create a Greater Germany caused WW2**
Certain events in history are turning points	**Dunkirk, The Battle of Britain, Invasion of USSR and D-Day**
Across history there have been periods of continuity and change	**Everything we have learnt about in history has shaped our world**
Societies have changed and this has impacted people's lives	**The Twentieth Century was dominated by war**
Over time authority has been accepted, challenged and altered	**Many people now live in free, democratic societies. Unfortunately many still do not**
Religion has been a driving force throughout history	**Far less in the modern era with some big events still linked**

YEAR 9 - DEVELOPING NUMBER...

Standard Form

What do I need to be able to do?

By the end of this unit you should be able to:

- Write numbers in standard form and as ordinary numbers
- Order numbers in standard form
- Add/ Subtract with standard from
- Multiply/ Divide with standard form
- Use a calculator with standard form

Keywords

Standard (index) Form: A system of writing very big or very small numbers
Commutative: an operation is commutative if changing the order does not change the result
Base: The number that gets multiplied by a power
Power: The exponent – or the number that tells you how many times to use the number in multiplication
Exponent: The power – or the number that tells you how many times to use the number in multiplication
Indices: The power or the exponent
Negative: A value below zero

Positive powers of 10

1 billion – 1 000 000 000
$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^9$

Addition rule for indices $10^a \times 10^b = 10^{a+b}$

Subtraction rule for indices $10^a \div 10^b = 10^{a-b}$

Standard form with numbers > 1

Any number between 1 and less than 10 → $A \times 10^n$ ← Any integer

Example
3.2×10^4
$= 3.2 \times 10 \times 10 \times 10 \times 10$
$= 32000$

Non-example
0.8×10^4
$5.3 \times 10^{0.7}$

Negative powers of 10

0.001	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
$1 \times \frac{1}{1000}$	10^1	10^0	10^{-1}	10^{-2}	10^{-3}
1×10^{-3}	0	0	0	0	1

Any value to the power 0 always = 1

Negative powers do not indicate negative solutions

Numbers between 0 and 1

$0.054 = 5.4 \times 10^{-2}$

1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
10^0	10^{-1}	10^{-2}	10^{-3}
0	0	5	4

A negative power does not mean a negative answer – it means a number closer to 0

Order numbers in standard form

10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}

6.4×10^{-2}	2.4×10^2	3.3×10^0	1.3×10^{-1}
0.064	240	1	0.13

Look at the power first will the number be = > or < than 1

Use a place value grid to compare the numbers for ordering

Mental calculations

$6.4 \times 10^2 \times 1000$ Not in Standard Form
$= 6.4 \times 10^2 \times 10^3$ Use addition for indices rule
$= 6.4 \times 10^5$

$(8) \times 10^5 \times (3)$
$= 24 \times 10^5$ Not in Standard Form
$= 2.4 \times 10^1 \times 10^5$ Use addition for indices rule
$= 2.4 \times 10^6$

$(2 \times 10^3) \div 4$ Divide the values
$= (2 \div 4) \times 10^3$
$= 0.5 \times 10^3$

Remember the layout for standard form

Any number between 1 and less than 10 → $A \times 10^n$ ← Any integer

Addition and Subtraction

Tip: Convert into ordinary numbers first and back to standard from at the end

$6 \times 10^5 + 8 \times 10^5$

Method 1
$= 600000 + 800000$
$= 1400000$
$= 1.4 \times 10^5$

More robust method
Less room for misconceptions
Easier to do calculations with negative indices
Can use for different powers

Method 2
$= (6 + 8) \times 10^5$
$= 14 \times 10^5$
$= 1.4 \times 10^1 \times 10^5$
$= 1.4 \times 10^5$

This is not the final answer

Only works if the powers are the same

Multiplication and division

$\frac{1.5 \times 10^5}{0.3 \times 10^3}$ Division questions can look like this

$(1.5 \times 10^5) \div (0.3 \times 10^3)$

$1.5 \div 0.3 \times 10^5 \div 10^3$

$= 5 \times 10^2$

For multiplication and division you can look at the values for A and the powers of 10 as two separate calculations

Revisit addition and subtraction laws for indices – they are needed for the calculations

Addition law for indices: $a^m \times a^n = a^{m+n}$

Subtraction law for indices: $a^m \div a^n = a^{m-n}$

Using a calculator

$1.4 \times 10^5 \times 3.9 \times 10^3$

Use a calculator to work out this question to a suitable degree of accuracy

Input 1.4 and press [×10^x] Then press 5 (for the power)
Press [×]
Input 3.9 and press: [×10^x] Then press 3 (for the power)
Press [=]

This gives you the solution

Click calculator for video tutorial

To put into standard form and a suitable degree of accuracy

Press [SHIFT] [SETUP] and then press 7 for sci mode
Choose a degree of accuracy so in most cases press 2

Answer: 5.5×10^8

YEAR 9 - REASONING WITH NUMBER...

Numbers

What do I need to be able to do?

By the end of this unit you should be able to:

- Identify integers, real and rational numbers
- Work with directed number
- Solve problems with number
- Find HCF/ LCM
- Add/ Subtract fractions
- Multiply/ Divide fractions
- Write numbers in standard form

Keywords

Integer: a whole number that is positive or negative
Rational: a number that can be made by dividing two integers
Irrational: a number that cannot be made by dividing two integers
Inverse operation: the operation that reverses the action
Quotient: the result of a division
Product: the result of a multiplication
Multiples: found by multiplying any number by positive integers
Factor: integers that multiply together to get another number

Integers, real and rational numbers

Rational – root word: ratio

Real numbers: $\frac{2}{3}$ stems from 2: 1 ($\frac{2}{3}$ of the whole)

Irrational numbers: $\sqrt{2}$ the solution is a decimal that never ends and does not repeat.

The square root of a negative is not a real number and cannot be found.

HCF/LCM (R)

1 is a common factor of all numbers

Common factors are factors two or more numbers share.

HCF – Highest common factor

HCF of 18 and 30

18: 1, 2, 3, 6, 9, 18
30: 1, 2, 3, 5, 6, 10, 15, 30

HCF = 6

LCM – Lowest common multiple

LCM of 9 and 12

9: 9, 18, 27, 36, 45, 54
12: 12, 24, 36, 48, 60

LCM = 36

The first time their multiples match

Standard form (R)

Any number between 1 and less than 10 × 10^{n} ← Any integer

$6 \times 10^5 + 8 \times 10^5$

$= 600000 + 800000$

$= 1400000$

$= 1.4 \times 10^5$

$(1.5 \times 10^5) \div (0.3 \times 10^3)$

$1.5 \div 0.3 \times 10^5 \div 10^3$

$= 5 \times 10^2$

Directed number (R)

Addition

$2 + -4 = -2$

Zero pair ($-1 + 1 = 0$)

Two "−1" left = −2

Generalisation: + − = −

Subtraction

$= 2$

Representation for calculation

"Subtract" – means take away or remove

$2 - -1 = 3$

Take away one

$= 3$

Start with the representation of 2

Generalisation: − − = +

Multiplication

= −1
= 1

$-2 \times -3 = 6$

The act of making counters into their negative is turning them over

Divisions are the inverse operations

a = 5

b = −4

Brackets around negative substitutions helps remove calculation errors

$2a - b = 2 \times 5 - (-4) = 10 + 4 = 14$

Addition/ Subtraction of fractions (R)

$\frac{4}{5} - \frac{2}{3}$

$\frac{12}{15} - \frac{10}{15} = \frac{2}{15}$

Use equivalent fractions to find a common multiple for both denominators

Multiplication/ Division of fractions (R)

$\frac{3}{4} \times \frac{2}{3}$

Shade in 3 parts

Repeat it on this many rows

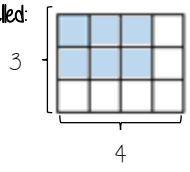
This many columns

This many rows

$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$ ← Parts shaded

Total number of parts in the diagram

Modelled:



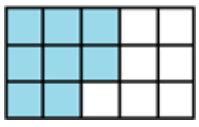
Remember to use reciprocals

$\frac{2}{5} \div \frac{3}{4}$

$\frac{2}{5} \times \frac{4}{3}$

Multiplying by a reciprocal gives the same outcome

Represented



$= \frac{8}{15}$

YEAR 9 - REASONING WITH NUMBER...

Using Percentages

What do I need to be able to do?

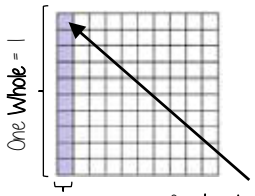
By the end of this unit you should be able to:

- Use FDP equivalence
- Calculate percentage increase and decrease
- Express percentage change
- Solve reverse percentage problems
- Solve percentage problems (calculator and non calculator problems)

Keywords

Percent: parts per 100 – written using the % symbol
Decimal: a number in our base 10 number system. Numbers to the right of the decimal place are called decimals.
Fraction: a fraction represents how many parts of a whole value you have.
Equivalent: of equal value.
Reduce: to make smaller in value.
Growth: to increase/ to grow.
Integer: whole number, can be positive, negative or zero.
Invest: use money with the goal of it increasing in value over time (usually in a bank).
Multiplier: the number you are multiplying by.
Profit: the income take away any expenses/ costs.

FDP Equivalence (R)



Percentage
100% = a whole = 100 hundredths

10 hundredths
10 out of 100
10%

$\frac{10}{100} = \frac{1}{10} = 0.10$

One **hundredth**
(one whole split into 100 equal parts)

ones	tenths	hundredths
●	●	

Converting FDP (R)

$\frac{70}{100}$ → This also means 70 ÷ 100 → 70 out of 100 squares → **70 "hundredths"** = 7 "tenths" = 0.7 →  → 70 hundredths = 70%

Using a **calculator**

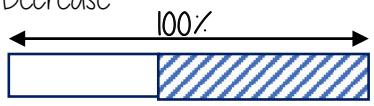
$\frac{\blacksquare}{\square}$ → S⇔D Convert to a decimal

× **100** converts to a percentage

Be careful of recurring decimals
e.g $\frac{1}{3}$ = 0.3333333
= $0.\dot{3}$
The dot above the 3

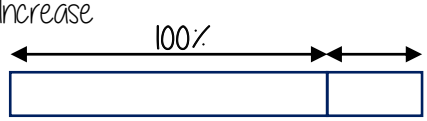
Percentage Increase/ Decrease (R)

Decrease



Decrease by 58%

Increase



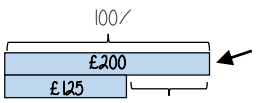
Increase by 12%

100 – 0.58 = 0.42 ← **Multiplier** Less than 1

100% + 12% = 112%
1.00 + 0.12 = 1.12 ← **Multiplier** More than 1

Percentage change (R)

I bought a phone for £200. A year later sold it for £125.



All values of change compare to the ORIGINAL value

Percentage loss

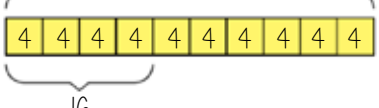
$\frac{75}{200} \times 100 = 37.5\%$

$$\frac{\textit{Difference in values}}{\textit{Original value}} \times 100$$

Reverse Percentages

40% of my number is 16. What am I thinking of?

Original Number (100%)

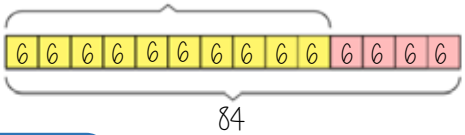


16

40% = 16
10% = 4
100% = 40

140% of my number is 84. What is the original number?

Original Number (100%)

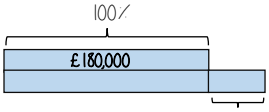


84

140% = 84
10% = 6
100% = 60

Try to scale down to 10% or 1% and then scale back up to 100%

I bought a house for £180,000, I later sold it for £216,000.



Percentage profit

Money made (profit value) → $\frac{36000}{180000} \times 100 = 20\%$

YEAR 9 - REASONING WITH NUMBER...

Maths & Money

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve problems with bills and bank statements
- Calculate simple interest
- Calculate compound interest
- Calculate wages and taxes
- Solve problems with exchange rates
- Solve unit pricing problems

Keywords

Credit: money being placed into a bank account
Debit: money that leaves a bank account
Balance: the amount of money in a bank account
Expense: a cost/ outgoing
Deposit: an initial payment (often a way of securing an item you will later pay for)
Multiplier: a number you are multiplying by. (Multiplier more than 1 = increasing, less than 1 = decreasing)
Per Annum: each year
Currency: the type of money a country uses.
Unitary: one – the cost of one.

Bills and Bank Statements

Bills – tell you the amount items cost and can show how much money you need to pay.

Some can include a total

Look for different units (Is it in pence or pounds)

Menu	Price
Milk	89p
Tea	£1.50

Bank Statements

Bank statement can have negative balances if the money spent is higher than the money coming into the account

Date	Description	Credit	Debit	Balance
19th Sept	Salary	£1500		£1500
19th Sept	Mortgage		£600	£900
25th Setp	Bday Money	£15		£915

Simple Interest

For each year of investment the interest remains the same

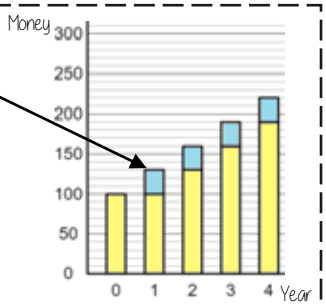
$$\frac{\text{Principal amount} \times \text{Interest Rate} \times \text{Years}}{100}$$

Principal amount is the amount invested in the account

e.g Invest £100 at 30% simple interest for 4 years

$\frac{100 \times 30 \times 4}{100} = £120$

This account earned **£120** interest.
At the end of year 4 they have **£220**



Compound Interest

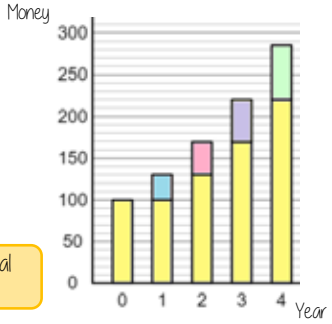
Interest is added to the current value of investment at the end of each year so the next year's interest is greater.

$$\text{Principal amount} \times \text{Multiplier}^{\text{Years}}$$

e.g Invest £100 at 30% compound interest for 4 years

$100 \times 1.3^4 = £285.61$

This account has **£285.61** in total at the end of the 4 years.



Value Added Tax (VAT)

VAT is payable to the government by a business. In the UK VAT is 20% and added to items that are bought.

Essential items such as food do not include VAT.

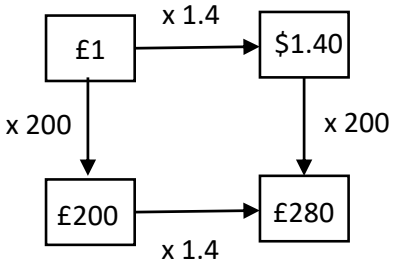
Wages and Taxes

Salaries fall into tax brackets – which means they pay this much each month from their salary.

Taxable Income	Tax Rate
£12 501 to £50 000	20%
£50 001 to £150 000	40%
over £150 000	45%

Over time:
Time and a half – means 1.5 times their hourly rate
Double – 2 times their hourly rate

Exchange Rates



When making estimates it is also useful to use estimates to check if our solution is reasonable.

Use inverse operations to reverse the exchange process

Common Currencies

United Kingdom	£	Pounds
United States of America	$	Dollars
Europe	€	Euros

Unit Pricing

4 Oranges	5 cupcakes
£1	£1.20

$4 = £1.00$ $\div 2$ $2 = £0.50$ $\div 2$ $1 = £0.25$

$5 = £1.20$ $\div 5$ $1 = £0.20$

Cost per Unit

To calculate unit per cost you divide by the cost.

Cupcakes are the best value as one item has the cheapest value

There is a directly proportional relationship between the cost and number of units.

YEAR 9 - DEVELOPING NUMBER...

Number Sense

What do I need to be able to do?

By the end of this unit you should be able to:

- Round numbers to powers of 10 and 1 sf
- Round numbers to any dp
- Estimate solutions
- Calculate using order of operations
- Calculate with money, units of measurement and time

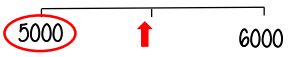
Keywords

Significant: Place value of importance
Round: Making a number simpler but keeping its value close to what it was.
Decimal: Place holders after the decimal point
Overestimate: Rounding up – gives a solution higher than the actual value
Underestimate: Rounding down – gives a solution lower than the actual value
Metric: A system of measurement
Balance: The amount of money in a bank account
Deposit: Putting money into a bank account

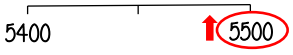
Round to powers of 10 and 1 sig. figure

R If the number is halfway between we "**round up**"

5495 to the nearest 1000



5475 to the nearest 100



5475 to the nearest 10

370 to 1 significant figure is 400
37 to 1 significant figure is 40
3.7 to 1 significant figure is 4
0.37 to 1 significant figure is 0.4
0.00037 to 1 significant figure is 0.0004

Round to the first non-zero number

Round to decimal places

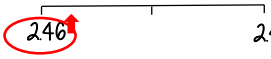
2.46192 ← Focus on the numbers **after** the decimal point

"To 1dp" – to one number after the decimal
"To 2dp" – to two numbers after the decimal

2.46192 (to 1dp) - Is this closer to 24 or 25

2.4 6192 This shows the number is closer to 25

2.46192 (to 2dp) - Is this closer to 246 or 247



2.46 192 This shows the number is closer to 246

Estimate the calculation

Round to 1 significant figure to estimate

$4.2 + 6.7 \approx 4 + 7 \approx 11$ This is an **overestimate** because the 6.7 was rounded up more

The equal sign changes to show it is an estimation

$21.4 \times 3.1 \approx 20 \times 3 \approx 60$ This is an **underestimate** because both values were rounded down

It is good to check all calculations with an estimate in all aspects of maths – it helps you identify calculation errors.

Order of operations

R

Brackets Operations in brackets are calculated first
Other operations e.g powers, roots,
Multiplication/ Division
They are carried out in the order from left to right in the question
Addition/ Subtraction
They are carried out in the order from left to right in the question

Calculations with money

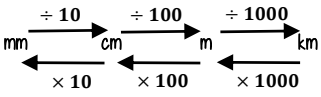
Debit - You have £0 or more in an account
Credit - You have less than £0 in an account

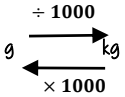
Money calculations are to 2dp

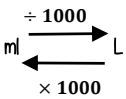
Using a calculator – ensure you are working in the correct units.
£1.30 + 50p = 130 + 50 (in pence)
= 1.30 + 0.50 (in pounds)

£1 = 100p

Units are important: Useful Conversions







Metric measures of length

Kilo = 1000 x meter
Centi - $\frac{1}{100}$ x meter
Milli - $\frac{1}{1000}$ x meter

Units of weight/ capacity

Weight = g, kg, t
Capacity (volume of liquid) = ml, L

Time and the calendar

1 Year – the amount of time it takes Earth to go around the sun **365** (and a quarter) **days**
Leap Year – **366 days** (every 4 years)

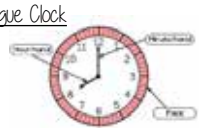
12 Months - one year = 52 weeks
31 days – **Jan, March, May, July Aug, Oct, Dec**
30 days – **April, June, Sept, Nov**
28 days – **Feb** (29 leap year)

1 week – 7 days
Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday

1 day – 24 hours
1 hour - 60 minutes
1 minute – 60 seconds

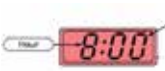
Use a number line for time calculations!

Analogue Clock



12-hour clock
- Use am (morning) and pm (afternoon)
- Only use hour times up to 12

Digital Clock (24-hour times)



24-hour clock
- 0-11 (morning hours)
- 12-23 (afternoon hours)

YEAR 9 - REASONING WITH GEOMETRY...

Solving ratio & proportion problems

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve problems with direct proportion
- Use conversion graphs
- Solve problems with inverse proportion
- Solve ratio problems
- Solve 'best buy' problems

Keywords

Proportion: a comparison between two numbers
Ratio: a ratio shows the relative size of two variables
Direct proportion: as one variable is multiplied by a scale factor the other variable is multiplied by the same scale factor.
Inverse proportion:: as one variable is multiplied by a scale factor the other is divided by the same scale factor.

Direct Proportion

As one variable changes the other changes at the same rate

4 cans of pop = £2.40

4 cans of pop = £2.40 → (x 0.5) → 2 cans of pop = £1.20 → (x 0.5)

This multiplier is the same In the same way that this would be for ratio

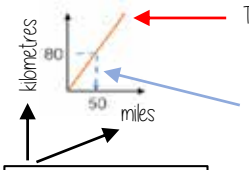
This is a multiplicative change

4 cans of pop = £2.40 → (x 3) → 12 cans of pop = £7.20 → (x 3)

Sometimes this is easiest if you work out how much one unit is worth first
e.g. **1 can of pop = £0.60**

Conversion Graphs

Compare two variables



This is always a straight line because as one variable increases so does the other at the same rate

Labelling of both axes is vital

To make conversions between units you need to find the point to compare – then find the associated point by using your graph
Using a ruler helps for accuracy
Showing your conversion lines help as a "check" for solutions

Inverse Proportion

As one variable is multiplied by a scale factor the other is divided by the same scale factor

Examples of inversely proportional relationships

Time taken to fill a pool and the number of taps running

Time taken to paint a room and the number of workers

T is inversely proportional to G. When T=2 then G=20

T	1	2	8
G	40	20	5

(÷ 2, × 4 above; × 2, ÷ 4 below)

Best Buys

Have a directly proportional relationship

To calculate best buys you need to be able to compare the cost of one unit or units of equal amounts

	Shop A	Shop B
	4 cans for £1.20	3 cans for 93p
	£1.20 ÷ 4	£0.93 ÷ 3
Cost per item	1 can is £0.30 Or 30p	1 can is £0.31 Or 31p

Shop A is the best value as it is 1p cheaper per can of pop

	Shop A	
	4 cans for £1.20	3 cans for 93p
	4 ÷ £1.20	3 ÷ £0.93
Cost per pound	£1 buys 3.333 cans of pop	£1 buys 3.23 cans of pop

Shop A is still shown as being the best value but pay attention to the unit you are calculating, per item or per pound

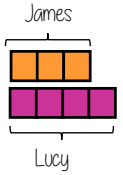
Best value is the most product for the lowest price per unit

Sharing a whole into a given ratio

James and Lucy share £350 in the ratio 3:4. Work out how much each person earns

Model the Question

James : Lucy
3 : 4



Find the value of one part

Whole: £350
7 parts to share between
(3 James, 4 Lucy)

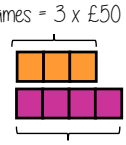
£350 ÷ 7 = £50

□ = one part = £50

Put back into the question

James : Lucy
(x 50) 3 : 4 (x 50)
£150 : £200

James = 3 x £50 = £150
Lucy = 4 x £50 = £200



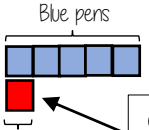
Finding a value given 1:n (or n:1)

Inside a box are blue and red pens in the ratio 5:1 If there are 10 red pens how many blue pens are there?

Model the Question

Blue : Red
5 : 1

□ = one part = 10 pens

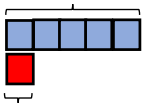


One unit = 10 pens

Put back into the question

Blue : Red
(x 10) 5 : 1 (x 10)
50 : 10

Blue pens = 5 x 10 = 50 pens



Red pens = 1 x 10 = 10 pens

There are 50 Blue Pens

YEAR 9 - REASONING WITH GEOMETRY...

Rates

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve speed, distance, time questions
- Use distance time graphs
- Solve density, mass, volume problems
- Solve flow problems
- Use flow graphs
- Interpret rates of change and their units

Keywords

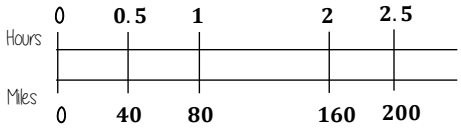
Convert: change
Mass: a measure of how much matter is in an object. Commonly measured by weight
Origin: the coordinate (0, 0)
Volume: the amount of 3D space a shape takes up
Substitute: putting numbers where letters are – replacing numbers into a formula

Speed, Distance, Time

"per" for every
e.g. 80 miles per hour (mph)
Travel 80 miles every hour

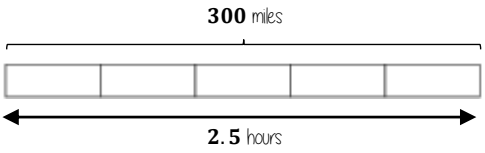
$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

You can use a double number line to help you calculate distance



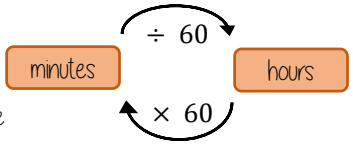
e.g. A boat travels at a constant speed for 2.5 hours
It travels 300 miles.

Bar models can help to calculate mph



Each part is half an hour
Each part is 60 miles

Speed, Distance, Time



Before calculations – make sure you are working in the same units as the speed

Learn or learn how to rearrange the formular for speed, distance and time

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

Substitute in the variables given

$$\text{distance} = \text{speed} \times \text{time}$$

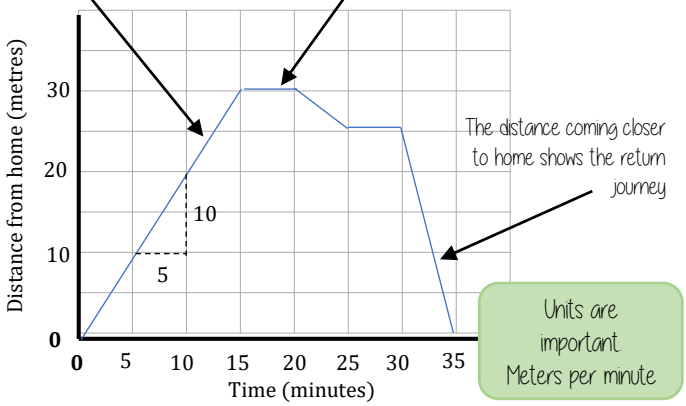
Distance – Time graphs

Gradient = speed

The steeper a gradient the faster the speed

$\frac{10}{5} = 2$ metres per min

Horizontal lines represent staying still



The distance coming closer to home shows the return journey

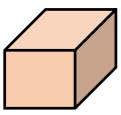
Units are important.
Meters per minute

Density, Mass, Volume

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{volume} = \frac{\text{mass}}{\text{density}}$$

$$\text{mass} = \text{volume} \times \text{density}$$



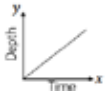
volume of prism = Area of cross section × Depth

R

Flow problems & graphs

This will fill at a constant rate, then as the space decreases it will speed up and the neck of the bottle fill at a faster constant speed

The cylinder will fill at a constant speed



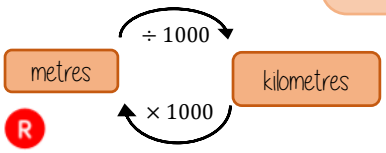
Units are important.
Ensure any volume calculations are the same unit as the rate of flow

Rates of change & units

Common rates of change relationships

Revisit your conversions between units of length and capacity

Speed: miles **per** hour
Exchange rates: euros **per** pounds
Density: mass **per** volume



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YEAR 9 - REASONING WITH ALGEBRA...

Forming and Solving Equations

What do I need to be able to do?

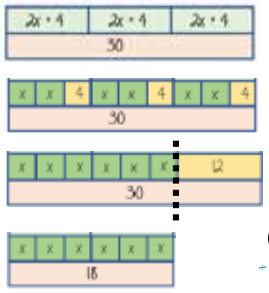
By the end of this unit you should be able to:

- Solve inequalities with negative numbers
- Solve equations with unknowns on both sides
- Solve inequalities with unknowns on both sides
- Substitute into formulae and equations
- Rearrange formulae

Keywords

Inequality: an inequality compares who values showing if one is greater than, less than or equal to another
Variable: a quantity that may change within the context of the problem
Rearrange: Change the order
Inverse operation: the operation that reverses the action
Substitute: replace a variable with a numerical value
Solve: find a numerical value that satisfies an equation

Solve equations with brackets (R)



$3(2x + 4) = 30$

Expand the brackets

$6x + 12 = 30$

$-12 \quad -12$

$6x = 18$

$\div 6 \quad \div 6$

$x = 3$

Form and solve inequalities (R)

Two more than treble my number is greater than 11

Find the possible range of values

$3x + 2 > 11$

Solve

$x \leftarrow -3 \leftarrow -2 \leftarrow 11$

$x > 3$

Inequalities with negatives

Method 1 Make x positive first

$2 - 3x > 17$

$+3x \quad +3x$

$2 > 17 + 3x$

$-17 \quad -17$

$-15 > 3x$

$\div 3 \quad \div 3$

$-5 > x$

x is true for any value smaller than -5

Smaller ← → Bigger

-7 -5 -3

✓ CHECK IT!
$2 - 3(-6) = 20$
TRUE/ CORRECT

Method 2 Keep the negative x

$2 - 3x > 17$

$-2 \quad -2$

$-3x > 15$

$\div -3 \quad \div -3$

$x > -5$

x is true for any value bigger than -5

This cannot be true...

$x < -5$

When you multiply or divide x by a negative you need to reverse the inequality

Equations with unknown on both sides

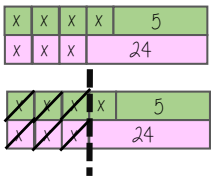
$4x + 5 = 3x + 24$

$-3x \quad -3x$

$x + 5 = 24$

$-5 \quad -5$

$x = 19$



Inequalities with unknown on both sides

Solving inequalities has the same method as equations

$5(x + 4) < 3(x + 2)$

$5x + 20 < 3x + 6$

$2x + 20 < 6$

$2x < -14$

$x < -7$

Check it!

$5(-8 + 4) < 3(-8 + 2)$

$5(-4) < 3(-6)$

$-20 < -18$

✓ -20 IS smaller than -18

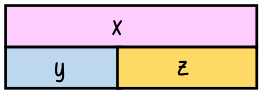
Formulae and Equations

Formulae – all expressed in symbols

Substitute in values

Equations – include numbers and can be solved

Rearranging Formulae (one step)



$x = y + z$

Rearrange to make y the subject

$y = x - z$

$y \rightarrow +z \rightarrow x$

$y \leftarrow -z \leftarrow x$

Using inverse operations or fact families will guide you through rearranging formulae

Rearranging can also be checked by substitution

Language of rearranging...

Make XXX the subject

Change the subject

Rearrange

Rearranging Formulae (two step)

In an equation (find x)

$4x - 3 = 9$

$+3 \quad +3$

$4x = 12$

$\div 4 \quad \div 4$

$x = 3$

In a formula (make x the subject)

$xy - s = a$

$+s \quad +s$

$xy = a + s$

$\div y \quad \div y$

$x = \frac{a + s}{y}$

The steps are the same for solving and rearranging

Rearranging is often needed when using $y = mx + c$

e.g. Find the gradient of the line $2y - 4x = 9$

Make y the subject first $y = \frac{4x + 9}{2}$

Gradient $= \frac{4}{2} = 2$

YEAR 9 - REASONING WITH ALGEBRA...

Straight Line Graphs

What do I need to be able to do?

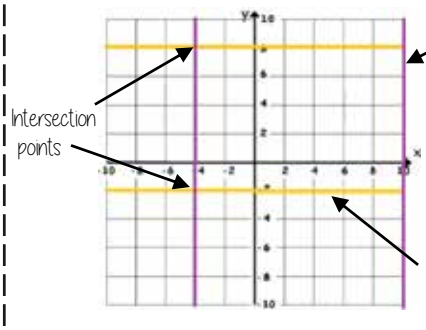
By the end of this unit you should be able to:

- Compare gradients
- Compare intercepts
- Understand and use y= mx + c
- Find the equation of a line from a graph
- Interpret gradient and intercepts of real-life graphs

Keywords

Gradient: the steepness of a line
Intercept: where two lines cross. The y-intercept: where the line meets the y-axis.
Parallel: two lines that never meet with the same gradient.
Co-ordinate: a set of values that show an exact position on a graph.
Linear: linear graphs (straight line) – linear common difference by addition/ subtraction
Asymptote: a straight line that a graph will never meet.
Reciprocal: a pair of numbers that multiply together to give 1.
Perpendicular: two lines that meet at a right angle.

Lines parallel to the axes (R)



All the points on this line have a x coordinate of 10

'a' can be ANY positive or negative value including 0

Lines parallel to the **y axis** take the form **x = a** and are **vertical**

Lines parallel to the **x axis** take the form **y = a** and are **horizontal**

All the points on this line have a y coordinate of -2

e.g. (3, -2) (7, -2) (-2, -2) all lay on this line because the y coordinate is -2

Plotting y = mx + c graphs (R)

$y = 3x - 1$ → 3 x the x coordinate then – 1

x	-3	0	3
y	-10	-1	8

Draw a table to display this information

This represents a coordinate pair (-3, -10)

You only need two points to form a straight line

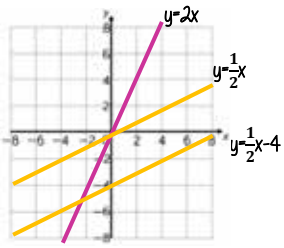
Plotting more points helps you decide if your calculations are correct (if they do make a straight line)

Remember to join the points to make a line

Compare Gradients

$y = mx + c$

The **coefficient** of x (the number in front of x) tells us the gradient of the line



The **greater** the gradient – the **steeper** the line

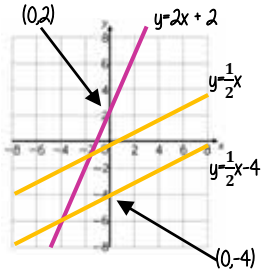
Positive gradients

Negative gradients

Parallel lines have the **same** gradient

Compare Intercepts

$y = mx + c$ ← The value of **c** is the point at which the line crosses the y-axis. **Y intercept**



The coordinate of a y intercept will always be (0,c)

Lines with the **same** y-intercept cross in the **same** place

y = mx + c

The **coefficient** of x (the number in front of x) tells us the gradient of the line

$y = mx + c$ ← The value of **c** is the point at which the line crosses the y-axis. **Y intercept**

y and x are **coordinates**

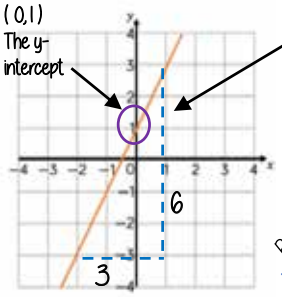
The equation of a line can be rearranged. E.g.

$y = c + mx$

$c = y - mx$

Identify which coefficient you are identifying or comparing

Find the equation from a graph



$y = 2x + 1$

The direction of the line indicates a positive gradient

Positive gradients

Negative gradients

Real life graphs

A plumber charges a £25 callout fee, and then £12.50 for every hour. Complete the table of values to show the cost of hiring the plumber.

Time (h)	0	1	2	3	8
Cost (£)	£25				£125

The y-intercept shows the minimum charge. The gradient represents the price per mile

In real life graphs like this values will always be positive because they measure distances or objects which cannot be negative.

Direct Proportion graphs To represent direct proportion the graph must start at the origin.

When you have 0 pens this has 0 cost. The gradient shows the price per pen

A box of pens costs £2.30
Complete the table of values to show the cost of buying boxes of pens.

Boxes	0	1	2	3	8
Cost (£)		£2.30			

YEAR 9 - REPRESENTATIONS...

Algebraic Representation

What do I need to be able to do?

By the end of this unit you should be able to:

- Draw quadratic graphs
- Interpret quadratic graphs
- Interpret other graphs including reciprocals
- Represent inequalities

Keywords

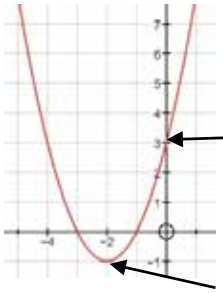
Quadratic: a curved graph with the highest power being 2. Square power.
Inequality: makes a non equal comparison between two numbers
Reciprocal: a reciprocal is 1 divided by the number
Cubic: a curved graph with the highest power being 3. Cubic power.
Origin: the coordinate (0, 0)
Parabola: a 'u' shaped curve that has mirror symmetry

Quadratic Graphs

$y = x^2 + 4x + 3$

If x^2 is the highest power in your equation then you have a quadratic graph

It will have a parabola shape



Intersection with the y axis

Quadratic graphs are always symmetrical with the turning point in the middle

Substitute the x values into the equation of your line to find the y coordinates

x	-4	-3	-2	-1	0	1
y	3	0	-1	0	3	8

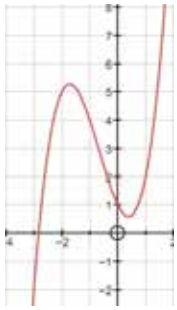
Coordinate pairs for plotting $(-3, 0)$

Plot all of the coordinate pairs and join the points with a curve (freehand)

Interpret other graphs

Cubic Graphs

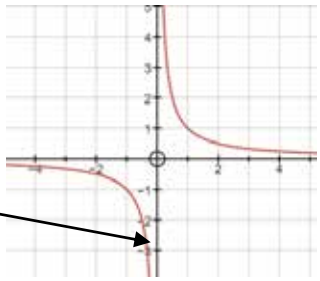
$y = x^3 + 2x^2 - 2x + 1$



If x^3 is the highest power in your equation then you have a cubic graph

Reciprocal Graphs

$y = \frac{1}{x}$

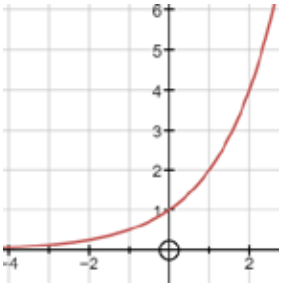


Reciprocal graphs never touch the y axis.
This is because x cannot be 0
This is an asymptote

Exponential Graphs

$y = 2^x$

Exponential graphs have a power of x

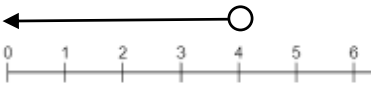


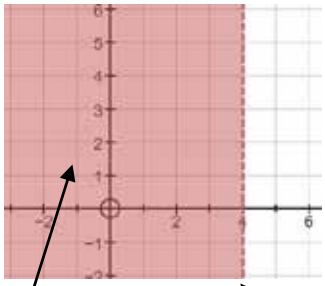
Represent Inequalities

Multiple methods of representing inequalities

$x < 4$

All values are less than 4



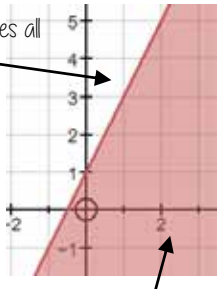


The shaded area indicates all possible values of x

The dotted line shows that the inequality does not include these points

The solid line shows that the inequality includes all the points on this line

$y \geq 2x + 1$



The shaded area indicates all possible solutions to this inequality

YEAR 9 - DEVELOPING GEOMETRY...

Line symmetry and reflection

What do I need to be able to do?

By the end of this unit you should be able to:

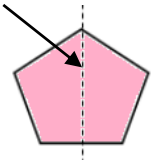
- Recognise line symmetry
- Reflect in a horizontal line
- Reflect in a vertical line
- Reflect in a diagonal line

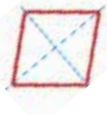
Keywords

Mirror line: a line that passes through the center of a shape with a mirror image on either side of the line
Line of symmetry: same definition as the mirror line
Reflect: mapping of one object from one position to another of equal distance from a given line.
Vertex: a point where two or more-line segments meet.
Perpendicular: lines that cross at 90°
Horizontal: a straight line from left to right (parallel to the x axis)
Vertical: a straight line from top to bottom (parallel to the y axis)

Lines of symmetry

Mirror line (line of reflection)





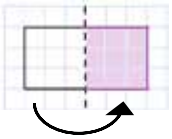
Rhombus
two lines of symmetry

Parallelogram
No lines of symmetry

Shapes can have more than one line of symmetry....
This regular polygon (a regular pentagon has 5 lines of symmetry)

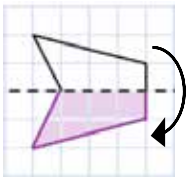
A circle has an infinite amount of lines of symmetry

Reflect horizontally/ vertically (1)



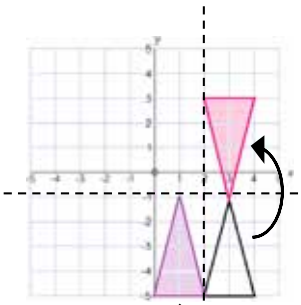
Note: a reflection doubles the area of the original shape

Reflection in a vertical line



Reflection in a horizontal line

Reflection on an axis grid

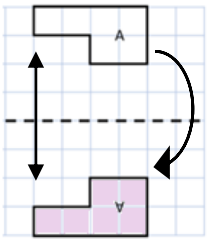


Reflection in the line y=-2

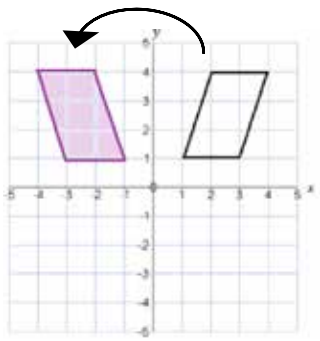
Reflection in the line x=2

Reflect horizontally/ vertically (2)

All points need to be the same distance away from the line of reflection



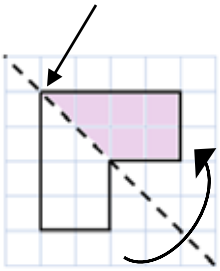
Reflection in the line y axis – this is also a reflection in the line x=0



Lines parallel to the x and y axis
REMEMBER
Lines parallel to the x-axis are y = ____
Lines parallel to the y-axis are x = ____

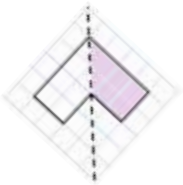
Reflect Diagonally (1)

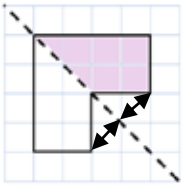
Points on the mirror line don't change position



Fold along the line of symmetry to check the direction of the reflection

Turn your image
If you turn your image it becomes a vertical/ horizontal reflection (also good to check your answer this way)



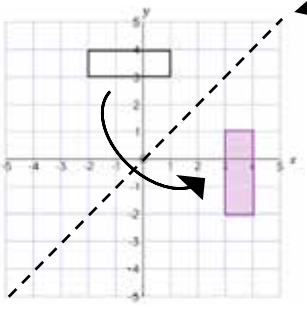


Drawing perpendicular lines

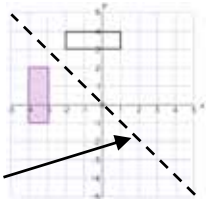
Perpendicular lines to and from the mirror line can help you to plot diagonal reflections

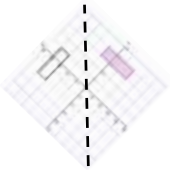
Reflect Diagonally (2)

This is the line **y = x** (every y coordinate is the same as the x coordinate along this line)



This is the line **y = - x**
The x and y coordinate have the same value but opposite sign





Turn your image
If you turn your image it becomes a vertical/ horizontal reflection (also good to check your answer this way)

YEAR 9 - REASONING WITH GEOMETRY...

Rotation & Translation

What do I need to be able to do?

By the end of this unit you should be able to:

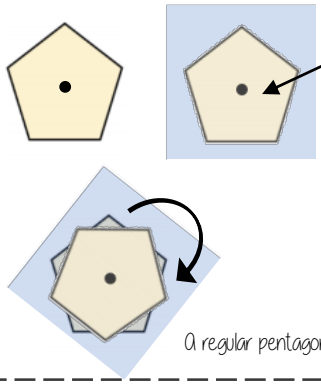
- Identify the order of rotational symmetry
- Rotate a shape about a point on the shape
- Rotate a shape about a point not on a shape
- Translate by a given vector
- Compare rotations and reflections

Keywords

Rotate: a rotation is a circular movement.
Symmetry: when two or more parts are identical after a transformation.
Regular: a regular shape has angles and sides of equal lengths.
Invariant: a point that does not move after a transformation.
Vertex: a point two edges meet.
Horizontal: from side to side
Vertical: from up to down

Rotational Symmetry

Tracing paper helps check rotational symmetry.



1. Trace your shape (mark the centre point)
2. Rotate your tracing paper on top of the original through 360°
3. Count the times it fits back into itself

A regular pentagon has rotational symmetry of order 5

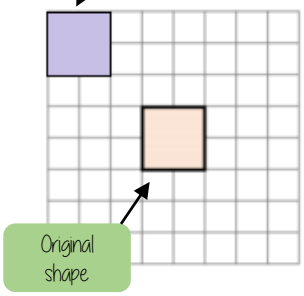
Translation and vector notation

Vector Notation $\begin{pmatrix}1\\-2\end{pmatrix}$

How far left or right to move
Negative value (left)
Positive value (right)

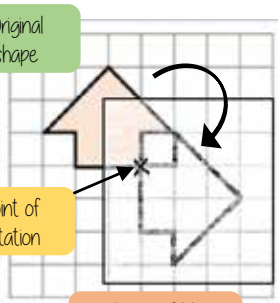
How far up or down to move
Negative value (down)
Positive value (up)

Translation $\begin{pmatrix}-3\\3\end{pmatrix}$



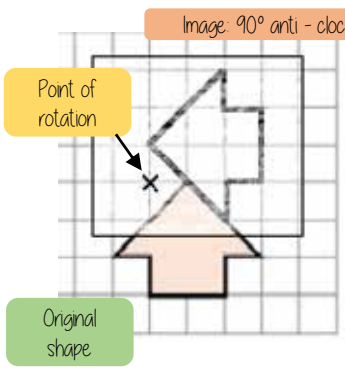
Every vertex has been translated by the same amount

Rotate from a point (in a shape)



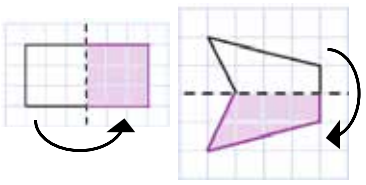
1. Trace the original shape (mark the point of rotation)
2. Keep the point in the same place and turn the tracing paper
3. Draw the new shape

Rotate from a point (outside a shape)



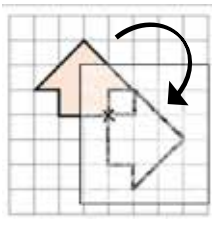
1. Trace the original shape (mark the point of rotation)
2. Keep the point in the same place and turn the tracing paper
3. Draw the new shape

Compare rotations and reflections



R Reflections are a mirror image of the original shape.

Information needed to perform a reflection:
- Line of reflection (Mirror line)



Rotations are the movement of a shape in a circular motion

Information needed to perform a rotation:
- Point of rotation
- Direction of rotation
- Degrees of rotation

YEAR 9 - REASONING WITH GEOMETRY...

Enlargement & Similarity

What do I need to be able to do?

By the end of this unit you should be able to:

- Recognise enlargement and similarity
- Enlarge a shape by a positive SF
- Enlarge a shape from a point
- Enlarge a shape by a fractional SF
- Work out missing sides and angles in a pair of similar shapes.

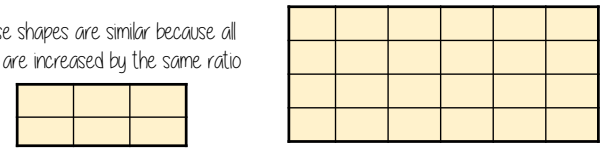
Keywords

Similar Shapes: shapes of different sizes that have corresponding sides in equal proportion and identical corresponding angles.
Scale Factor: the multiple describing how much a shape has been enlarged
Enlarge: to change the size of a shape (enlargement is not always making a shape bigger)
Corresponding: objects (or sides) that appear in the same place in two similar situations.
Image: the picture or visual representation of the shape

Recognise enlargement & similarity

Shapes are similar if all pairs of corresponding sides are in the same ratio

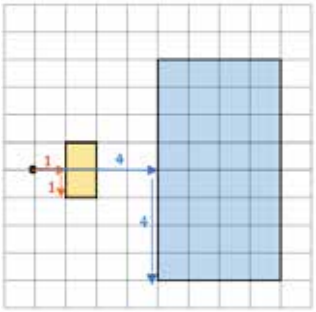
These shapes are similar because all sides are increased by the same ratio



Enlargements are similar shapes with a ratio other than 1

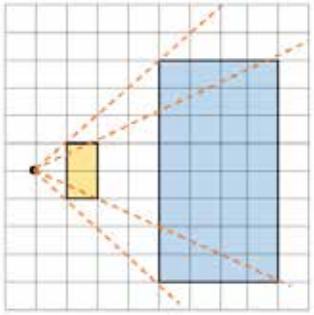
Enlarge a shape from a point

Scaled distances method



Scale the distance between the point of enlargement and each corresponding vertices

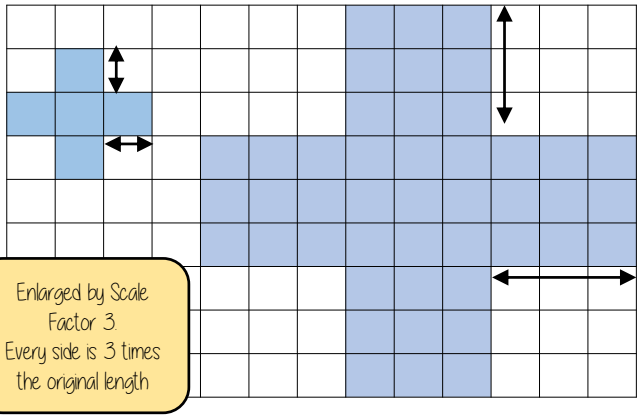
Rays method



Multiply the distance from the centre of corresponding vertices by the scale factor along the ray

Enlarge by a positive scale factor

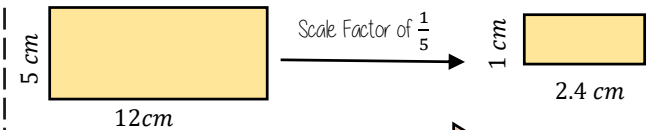
With a scale factor larger than 1 it makes the shape **bigger**

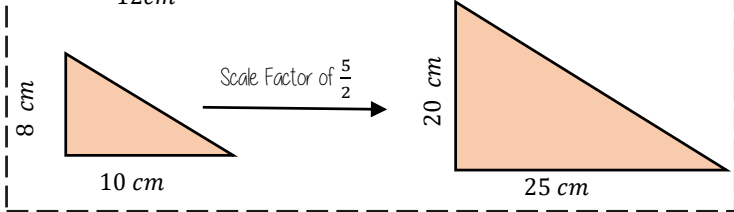


Enlarged by Scale Factor 3.
Every side is 3 times the original length

Positive fractional scale factor

With a scale factor between 0 and 1 it makes the shape **smaller**

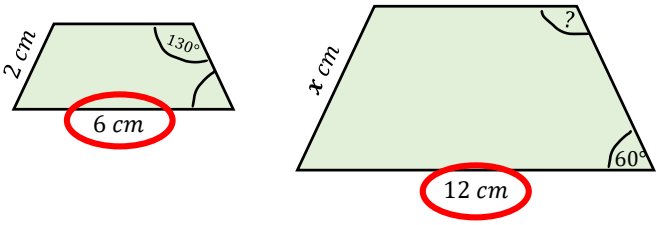




Calculations in similar shapes

Don't forget that properties of shapes don't change with enlargements or in similar shapes

The two trapezium are similar find the missing side and angle



Corresponding sides identify the scale factor

$\frac{12}{6} = 2$ Scale Factor = **2**

Calculate the missing side

Length (corresponding side) x scale factor

$2cm \times 2$

$x = 4cm$

Enlargement does not change angle size

Calculate the missing angle

Corresponding angles remain the same

$130°$

YEAR 9 - CONSTRUCTING IN 2D/3D...

3D Shapes

What do I need to be able to do?

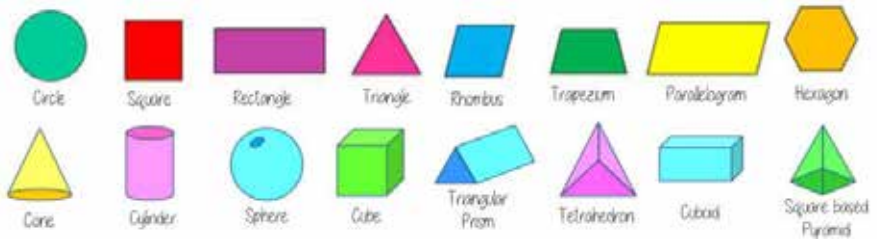
By the end of this unit you should be able to:

- Name 2D & 3D shapes
- Recognise Prisms
- Sketch and recognise nets
- Draw plans and elevations
- Find areas of 2D shapes
- Find Surface area for cubes, cuboids, triangular prisms and cylinders
- Find the volume of 3D shapes

Keywords

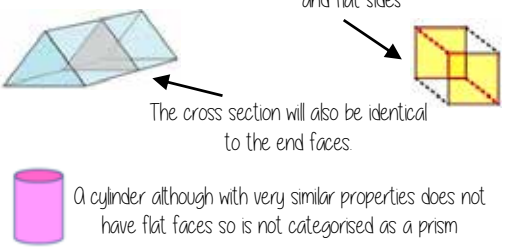
2D: two dimensions to the shape e.g. length and width
3D: three dimensions to the shape e.g. length, width and height
Vertex: a point where two or more line segments meet
Edge a line on the boundary joining two vertex
Face: a flat surface on a solid object
Cross-section: a view inside a solid shape made by cutting through it
Plan: a drawing of something when drawn from above (sometimes birds eye view)
Perspective: a way to give illustration of a 3D shape when drawn on a flat surface.

Name 2D & 3D shapes



Recognise prisms

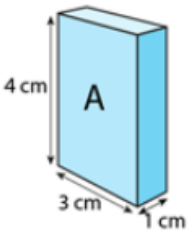
A solid object with two identical ends and flat sides

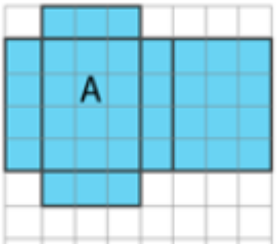


The cross section will also be identical to the end faces.

A cylinder although with very similar properties does not have flat faces so is not categorised as a prism

Nets of cuboids

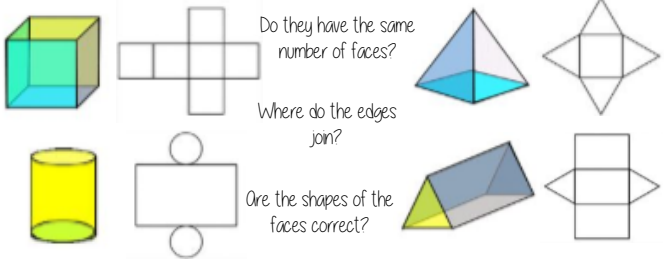




1cm grids help to draw accurately

Visualise the folding of the net. Will it make the cuboid with all sides touching

Sketch and recognise nets

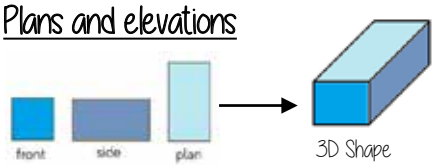


Do they have the same number of faces?

Where do the edges join?

Are the shapes of the faces correct?

Plans and elevations



The direction you are considering the shape from determines the front and side views

Area of 2D shapes

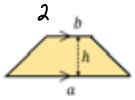
R

Rectangle
Base x Height

Triangle
½ x Base x Perpendicular height

Parallelogram/ Rhombus
Base x Perpendicular height

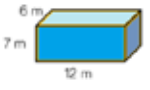
Area of a trapezium
$\frac{(a+b)\times h}{2}$



Area of a circle
π x radius^2

Surface area

Sketching nets first helps you visualise all the sides that will form the overall surface area

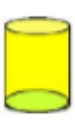


For cubes and cuboids you can also find one of each face and double it

Sides	6 x 7 6 x 7	Sum of all sides = surface area
Front and back	12 x 7 12 x 7	
Top and Bottom	12 x 6 12 x 6	

For other shapes - not all the sides are the same, so calculate the individually

Surface area - cylinders



The area of the circle
π x radius^2

The width of this face is the same as the circumference
π x diameter x height

$2 \times \pi \times \text{radius}^2 + \pi \times \text{diameter} \times \text{height}$

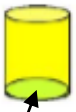
Volumes

Volume is the 3D space it takes up – also known as capacity if using liquids to fill the space

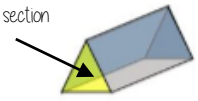
Counting cubes
Some 3D shape volumes can be calculated by counting the number of cubes that fit inside the shape.

Cubes/ Cuboids = base x width x height

Remember multiplication is commutative



Cross section



Cross section

Prisms and cylinders = area cross section x height

Height can also be described as depth

Areas – square units
Volumes – cube units

Areas and volumes can be left in terms of pi π

YEAR 9 - CONSTRUCTING IN 2D/3D...

Constructions & congruency

What do I need to be able to do?

By the end of this unit you should be able to:

- Draw and measure angles
- Construct scale drawings
- Find locus of distance from points, lines, two lines
- Construct perpendiculars from points, lines, angles
- Identify congruence
- Identify congruent triangles

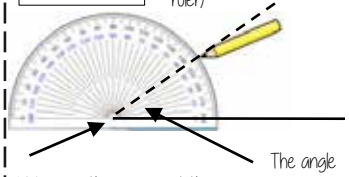
Keywords

Protractor: piece of equipment used to measure and draw angles
Locus: set of points with a common property
Equidistant: the same distance
Discorectangle: (a stadium) – a rectangle with semi circles at either end
Perpendicular: lines that meet at 90°
Arc: part of a curve
Bisector: a line that divides something into two equal parts
Congruent: the same shape and size

Draw and measure angles (R)

Draw a 35° angle

Make a mark at 35° with a pencil and join to the angle point (use a ruler)



The angle

Make sure the cross is at the end of the line (where you want the angle)

Scale drawings (R)

A picture of a car is drawn with a scale of 1:30

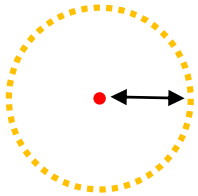
For every 1cm on my image is 30cm in real life

The car image is 10cm

Image	Real life
1cm	30cm
10cm	300cm

(×10 / ×10)

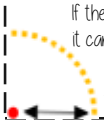
Locus of a distance from a point



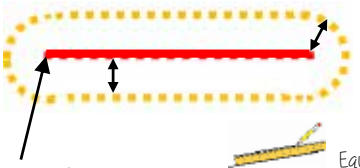
All points are equidistant (the same distance) from the fixed point in the middle

Equipment needed
The radius is the distance from the fixed point

If the point is in the corner it can only make a quarter circle



Locus of a distance from a straight line

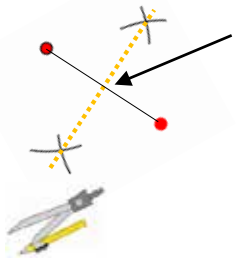


All points are equidistant (the same distance) from line

The ends of the line are fixed points

Equipment needed
The line is straight so a ruler is used for the straight lines parallel to your original line

Locus equidistant from two points



Also a perpendicular bisector
Because if the points are joined, this new line intersects it at a 90°

Keep the compass the same size and draw two arcs from each point

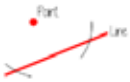
Join the intersections with a ruler.
All points on this line are equidistant from both points

Construct a perpendicular from a point

Point

Line

Use a compass and draw an arc that cuts the line. Use the point to place the compass

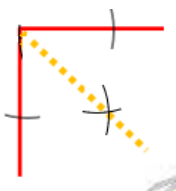


Keep the compass the same distance and now use your new points to make new interconnecting arcs

Connecting the arcs makes the bisector

If P is a point on the line the steps are the same

Locus of a distance from two lines



Also an angle bisector
This cuts the angle in half

From the angle vertex draw two arcs that cut the lines forming the angle

Keep the compass the same size and use the new arcs as centres to draw intersecting arcs in the middle

Join the vertex to the intersection

Congruent figures

Congruent figures are identical in size and shape – they can be reflections or rotations of each other

Congruent shapes are identical – all corresponding sides and angles are the same size

$A\hat{C}B = K\hat{M}L$

Because all the angles are the same and AC=KM BC=LM triangles ABC and KLM are **congruent**

Congruent triangles

Side-side-side

All three sides on the triangle are the same size

Angle-side-angle

Two angles and the side connecting them are equal in two triangles

Side-angle-side

Two sides and the angle in-between them are equal in two triangles (it will also mean the third side is the same size on both shapes)

Right angle-hypotenuse-side

The triangles both have a right angle, the hypotenuse and one side are the same

Constructing Triangles (R)

Link to steps

Side, Angle, Angle

Side, Angle, Side

Side, Side, Side

YEAR 9 – Trigonometry

Using sine to find sides and angles

Key point

The side opposite the chosen angle (angle θ in this diagram) is called the **opposite** side. The side next to θ is called the **adjacent** side.

Key point

The ratio of the opposite side to the hypotenuse is called the **sine** of the angle.

The sine of angle θ is written as **sin θ**.

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

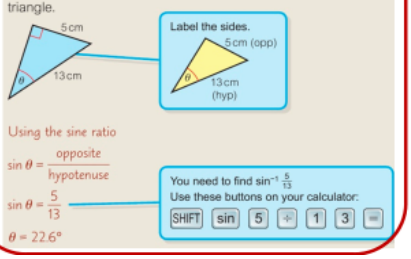
Key point

You can use **inverse** trigonometric functions to work out unknown angles.

$\sin\theta = x$, so $\theta = \sin^{-1} x$

Worked example

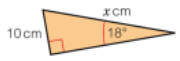
Use the sine ratio to find the missing angle in this right-angled triangle.



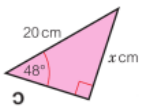
Questions

Work out the value of x, correct to 1 d.p.

a

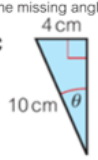


b



c

Work out the missing angle



Corbett Maths
Videos 329, 330 and 331

Answers: a 32.4 b 14.9 c 23.6°

$$S\frac{O}{H}C\frac{A}{H}T\frac{O}{A}$$

Using cosine to find sides and angles

Key point

The side opposite the chosen angle (angle θ in this diagram) is called the **opposite** side. The side next to θ is called the **adjacent** side.

Key point

The ratio of the adjacent side to the hypotenuse is called the **cosine** of the angle.

The cosine of angle θ is written as **cos θ**.

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

Key point

You can use **inverse** trigonometric functions to work out unknown angles.

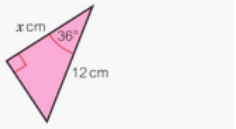
$\cos\theta = x$, so $\theta = \cos^{-1} x$

For examples look at 9.1 'using tan' and 9.2 'using sine'

Questions:

5 Work out the length of side x for each triangle, correct to 1 d.p.

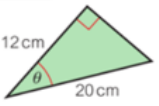
a



b

Work out the missing angle

c



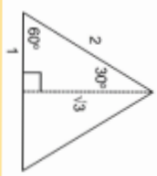
Answers:

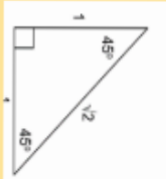
a 9.7
b 15.3°
c 53.1°

Corbett Maths
Videos 329, 330 and 331

Exact Trig values

Angle (θ)	sin(θ)	cos(θ)	tan(θ)
0°	0	1	0
30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
45°	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1
60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
90°	1	0	undefined

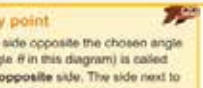




Using tangent to find sides and angles

Key point

The side opposite the chosen angle (angle θ in this diagram) is called the **opposite** side. The side next to θ is called the **adjacent** side.



Key point

The ratio of the opposite side to the adjacent side is called the **tangent** of the angle.

The tangent of angle θ is written as **tan θ**.

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$

Key point

You can use **inverse** trigonometric functions to work out unknown angles. $\tan\theta = x$, so $\theta = \tan^{-1} x$

Hint for Qb:

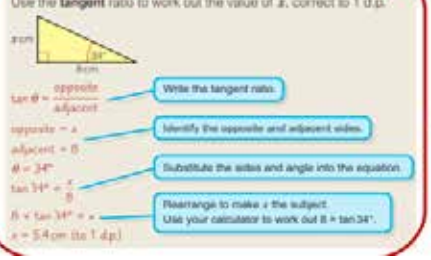
$\text{Tan}53 = \frac{5}{x}$

Rearranges to $x = \frac{5}{\text{tan}53}$

For a worked example to find a missing angle in a right-angle triangle, look at 9.2 'using sine'

Worked example

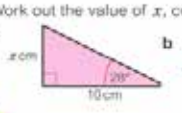
Use the **tangent** ratio to work out the value of x, correct to 1 d.p.



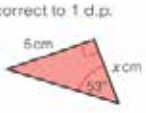
Questions

Work out the value of x, correct to 1 d.p.

a



b



Work out the missing angle

c

Corbett Maths
Videos 329, 330 and 331

Answers:

a 5.3
b 3.8
c 53.1°

YEAR 9 - REPRESENTATIONS...

Probability

What do I need to be able to do?

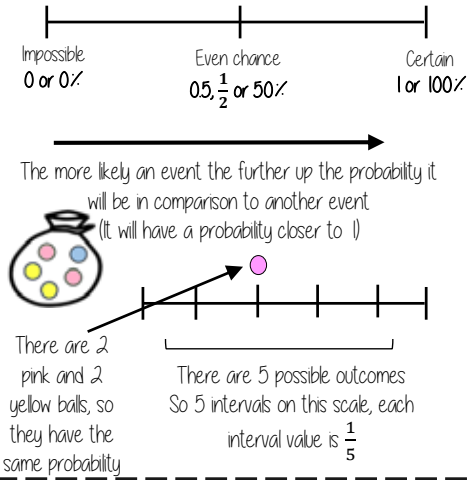
By the end of this unit you should be able to:

- Find single event probability
- Find relative frequency
- Find expected outcomes
- Find independent events
- Use diagrams to work out probabilities

Keywords

Probability: the chance that something will happen
Relative Frequency: how often something happens divided by the outcomes
Independent: an event that is not effected by any other events.
Chance: the likelihood of a particular outcome.
Event: the outcome of a probability – a set of possible outcomes.
Biased: a built in error that makes all values wrong by a certain amount.

The probability scale



Single event probability

Probability is always a value between 0 and 1

The probability of getting a blue ball is $\frac{1}{5}$
∴The probability of **NOT** getting a blue ball is $\frac{4}{5}$

The sum of the probabilities is **1**

The table shows the probability of selecting a type of chocolate

Dark	Milk	White
0.15	0.35	

P(White chocolate) = 1 – 0.15 – 0.35
= 0.5

Relative Frequency

$$\frac{\text{Frequency of event}}{\text{Total number of outcomes}}$$

Remember to calculate or identify the overall number of outcomes!

Colour	Frequency	Relative Frequency
Green	6	0.3
Yellow	12	0.6
Blue	2	0.1
	20	

Relative frequency can be used to find expected outcomes

e.g. Use the relative probability to find the expected outcome for green if there are 100 selections.

Relative frequency x Number of times
$0.3 \times 100 = 30$

Expected outcomes

Expected outcomes are estimations. It is a long term average rather than a prediction.

Dark	Milk	White
0.15	0.35	0.5

The sum of the probabilities is **1**

An experiment is carried out **400** times.
Show that dark chocolate is expected to be selected **60** times

$0.15 \times 400 = 60$

Independent events

The rolling of one dice has no impact on the rolling of the other. The individual probabilities should be calculated separately.

Probability of event 1 × Probability of event 2

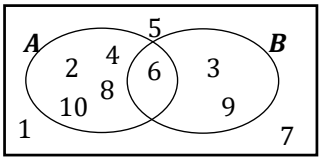
$P(5) = \frac{1}{6}$ $P(R) = \frac{1}{4}$

Find the probability of getting a 5 and a red

$P(5 \text{ and } R) = \frac{1}{6} \times \frac{1}{4} = \frac{1}{24}$

Using diagrams

Recap Venn diagrams, Sample space diagrams and Two-way tables



	Car	Bus	Walk	Total
Boys	15	24	14	53
Girls	6	20	21	47
Total	21	44	35	100

The possible outcomes from rolling a dice

The possible outcomes from tossing a coin

	1	2	3	4	5	6
H	1,H	2,H	3,H	4,H	5,H	6,H
T	1,T	2,T	3,T	4,T	5,T	6,T

Y9 French: KO1: The essentials

Grammar

G1: Infinitive verbs

Regular verbs (follow patterns)

Écouter	to listen
Regarder	to watch
Bavarder	to chat
Visiter	to visit
Étudier	to study
Nager	to swim
Manger	to eat
Commencer	to start
Enseigner	to teach
Porter	to wear
Finir	to finish
Apprendre	to learn

Irregular verbs (break pattern rules)

Aller	to go
Faire	to do
Avoir	to have
Être	to be
Lire	to read
Voir	to see

Modal verbs (use these verbs with an infinitive)

Pouvoir	to be able to
Devoir	to have to

Vocabulary

G2: Articles and genders

M	F	Pl	meaning
Le	La	Les	The
Un	Une		A
Du	De la	des	some

An adjective modifies a noun.

G3: Adjectives

M	MPL	F	Fpl	Meaning
bavard	bavards	bavarde	bavarde	chatty
sympa	sympa	sympa	sympa	Nice
creatif	créatifs	créative	créatives	Creative
ennuyeux	ennuyeux	ennuyeuse	ennuyeuses	Boring
gentil	gentils	gentille	gentille	Kind
ancien	anciens	ancienne	anciennes	old

Pronunciation

Pronunciation (you see/say) P1

a	“ah”	r	“ruh”	th	“tuh”
à	“ah”	rr	“rrrr”	gn	“nuh”
y	“ee”	ç	“ss”	ien	“eeahn”

V1: Connectives

et and	car because
mais but	ou or
parce que	because
cependant	however

V2 Intensifiers

Vraiment	truly/really
Vachement	really
Absolument	absolutely
Complètement	completely
Totalement	totally
Tellement	so/rather
Très	very
Assez	quite
Un peu	a bit

Y9 French KO2: The essenctials: Tenses: The present tense (for actions happening at the moment)

Grammar

Vocabulary

jouer, visiter, bavarder, écouter, regarder, manger, vendre, finir

V1: adverbs of time

Aujourd'hui	Today
Normalement	Normally
D'habitude	Typically

G1: The present tense of regular verbs

These are verbs that follow a pattern

ER verbs Jouer (to play)	Ir verbs Finir (to finish)	RE verbs Vendre (to sell)
Remove last 2 letters from each infinitive to make the verb stem and then add the following endings.		
Je_____e	Je_____is	Je_____s
Tu_____es	Tu_____is	Tu_____s
Il/elle/on____e	Il/elle/on___it	Il/elle/on_____
Nous_____ons	Nous___issons	Nous_____ons
Vous_____ez	Vous____issez	Vous_____ez
Ils/elles_____ent	Ils/elles_issent	Ils/elles_____ent

Example sentence

Normalement je joue au tennis.

Normally I play tennis.

avoir, être, faire, aller

G2: The present tense of irregular verbs

These are verbs that DO NOT follow a pattern

Avoir To have	Être To be	Faire To do/make	Aller To go
J'ai	Je suis	Je fais	Je vais
Tu as	Tu es	Tu fais	Tu vas
Il/elle/on a	Il/elle/on est	Il/elle/ on fait	Il/elle va
Nous avons	Nous sommes	Nous faisons	Nous allons
Vous avez	Vous êtes	Vous faites	Vous allez
Ils/elles ont	Ils/elles sont	Ils/elles font	Ils/ells vont

Example sentence

J'ai une soeur elle est grande.

I have a sister and she is tall

pouvoir, devoir

G3: The present tense of modal verbs

Pouvoir To be able to	Devoir To have to
These verbs are always followed by an infinitive verb.	
Je peux	Je dois
Tu peux	Tu dois
Il/elle/on peut	Il/elle/on doit
Nous pouvons	Nous devons
Vous_pouvez	Vous devez
Ils/elles peuvent	Ils/elles doivent

Example sentence

Normalement on peut aller en ville

Normally we can go into town

Y9 French KO3: The essenctials: Tenses: The perfect, near future and conditional tenses

Grammar

Vocabulary

V2: past adverbs of time

Hier	Yesterday
Le weekend dernier	Last weekend
La semaine dernière	Last week

V3: future adverbs of time

Demain	Tomorrow
Le weekend prochain	Next weekend
La semaine prochaine	Next weekend

V4: In an ideal world

Dans un monde idéale	In an ideal world
Dans la ville de mes rêves	In the town of my dreams
Si c'était possible	If it were possible

G4: The perfect tense

Describes an action that is finished or completed.

Take a bit of avoir	Add a past participle
J'ai	joué (played), Visité (visited), Bavardé (chatted), Regardé (watched), Écouté (listened), Mangé (ate), Fait (did/made), Lu (read), Vu (saw), Bu (drank)
Tu as	
Il/elle/on a	
Nous avons	
Vous avez	
Ils/elles ont	

Take a bit of être	Add a past participle
Je suis	Allé (e) (s) (went)
Tu es	Sorti (e) (s) went out
Il/elle/on est	
Nous sommes	These past participles need agreements
Vous êtes	
Ils/elles sont	

Example sentence

Hier je suis allée en ville and j'ai visité le musée.

Yesterday I went into town and I visited the museum.

G5: The near future tense

Describes an action that is going to happen in the near future

Take a bit of aller	Add an infinitive
Je vais	Jouer (to play), Visitier (to visit), Bavarder (to chat), Regarder (to watch), Écouter (to listen), Manger (to eat), Faire (to do/make), Lire (to read), Voir (to see), Boire (to drink), Aller (to go), Sortir (to go out)
Tu vas	
Il/elle/on va	
Nous allons	
Vous allez	
Ils/elles vont	

Example sentence

Demain je vais regarder un fim

Tomorrow I am going to watch a film.

G6: The conditional tense

Describes an action that would happen in an ideals situattion

Add the infinitive to the pronoun E.g: jouer	Add an these conditional tense endings
Je jouer	Je……ais Tu……ais Il/elle/on……ait Nous……ions Vous……iez Ils/elles……aient
Tu jouer	
Il/elle/on jouer	
Nous jouer	
Vous jouer	
Ils/elles jouer	

These verbs have irregular stems. Use the stem then add the ending above:

Aller-------ir être-----ser

Faire--------fer avoir------aur

Example sentence

Si c'était possible, je jouerais au tennis.

If iit were possible, I would play tennis..

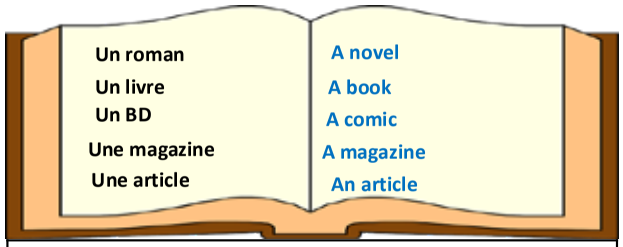
Y9 French KO4: Que fais-tu pendant ton temps libre? (What do you do in your free time ?)

Grammar

Grammar G1: key verbs Jouer & faire with prepositions

Jouer + au + ball sport Jouer au rugby	Faire du + sport Faire du canoe-Kayak
Jouer + à la + ball sport Jouer à la pétanque	Faire de la + sport Faire de la natation
Jouer + aux Jouer aux boules	Faire de l' + sport Faire de l'équitation
	Faire des + sport Faire des randonnés

Book genres V2



Un roman	A novel
Un livre	A book
Un BD	A comic
Une magazine	A magazine
Une article	An article

Pronunciation (you see, you say) P1

gn	"nuh"
th	"tuh"
r	"ruh"
Silent final s/t	nothing

Vocabulary

TV programmes V1

Les feuilltons	Soap operas
Les jeux télévisés	Game shows
Les actualités	The news
Les publicités	The adverts
Les series américaines	American series
Les émissions de télé réalité	Reality TV shows

G3: adjectives

Rigolo *funny*	Passionnant *exciting*	Génial *great*	Ennuyeux *boring*	Nul *rubbish*

Adverbs of frequency V3

Tous les jours	every day
Toujours	always
Souvent	often
Quelquefois/parfois	sometimes
De temps en temps	from time to time
Une fois par semaine	once a week
Rarement	rarely
Jamais	never

Pronunciation

G2 Places (at the / in/ on/ at the house of)

Au Au terrain de foot Au centre sportif	À la À la piscine À la biblithèque
En En ville En ligne	Sur Sur l'internet Sur mon portable Sur WhatsApp
Dans Dans ma chambre Dans un café	Chez Chez moi / nous Chez elle / lui

Sequencers V4

D'abord	firstly	puis	then
Ensuite	next	finalement	finally

Opinions V5

Je pense que	I think that
Je trouve que	I find that
J'ai horreur de	I cannot stand
Je crois que	I believe that
A mon avis	In my opinion
Je le/la/les trouve…	I find it/them

Y9 French KO5: Comment est la vie au collège? (what is school life like?)

Grammar

V1: school subjects

Les matières	*School subjects*		
L 'anglais	*English*	La musique	*music*
L' espagnol	*Spanish*	La cuisine	*Food tech*
L' allemande	*German*	Les maths	*maths*
La téchnologie	*DT*	Le théâtre	*drama*
L'informatique	*ICT*	L'EPS	*PE*
Les sciences	*science*		
Le français	French		
Le dessin	*art*		
Les arts plastiques	*art*		
L'emploi du temps	*timetable*		
La récréation	*breaktime*		

V2: numbers

10	Dix
20	Vingt
30	Trente
40	Quarante
50	cinquante

V3: telling the time

Vocabulary

V4 : Opinions

Je pense que	I think that
Je trouve que	I find that
J'ai horreur de	I cannot stand
Je crois que	I believe that
A mon avis	In my opinion
Je le/la/les trouve…	I find it/them
Ma matière préférée	My favourite subject

G3: Key verbs

étudier	*to study*
apprendre	*to learn*
enseigner	*to teach*

G1: Modal verbs (can, must, it is necessary to)

Modal verb	Infinitive phrase
On peut ✓	porter un uniforme scolaire
On doit ✓	arriver à l'heure
Il faut ✓	utiliser les portables
	harcéler les autres
On ne peut pas ✗	porter des bijoux
On ne doit pas ✗	avoir du maquillage
Il ne faut pas ✗	avoir son équipement

G2: Adjectives

Compréhensif (ve)	*understanding*	Barbant	*boring*
Rigolo	*funny*	Sévère	strict
Sympa	*nice*	Stressé (e)	*stressed*
Utile	*useful*	Agaçant (e)	*annoying*
Facile	*easy*	Inutile	*useless*
Stimulant (e)	*stimulating*	Compliqué(e)	*complicated*
Pratique	practical		

Pronunciation

Pronunciation P1

th	"tuh"
gn	"nuh"
r	"ruh"
Silent final s,t, x	Nothing

Y9 French KO6 Comment est ta ville? (what is your town like?)

Grammar

Vocabulary

Pronunciation

V1: places in town

Un château	*a castle*
Un musée	*a museum*
Un théâtre	*a theatre*
Un jardin publique	*a public garden*
Un collège	*a high school*
Une église	*a church*
Une stade	*a stadium*
Une cathédrale	*a cathedral*
Une centre commerciale	*a business centre*
Une grande surface	*a shopping mall*
Une piscine	*a swimming pool*
Des magasins	*some shops*
Des bâtiments	*some buildings*
Des installations sportives	*some sports facilities*

G1: Key verbs

Il y a	*there is/are*
avoir	*to have*
être	*to be*
voir	*to see*
visiter	*to visit*
pouvoir	*to be able to*
se relaxer	*to relax*
se promener	*to walk*

G2: Adjectives

animé(e)	*lively*	bruyant(e)	*noisy*
agréable	*pleasant*	désagréable	*unpleasant*
divertissant(e)	*entertaining*	déprimant(e)	*depressing*
tranquille	*peaceful*	affreux (euse)	*awful*
passionant(e)	*exciting*	laid(e)	*ugly*
pittoresque	*picturesque*	ancien(ne)	*old*
beau (belle)	*beautiful*		

V2 Opinions

Je pense que	I think that
Je trouve que	I find that
J'ai horreur de	I cannot stand
Je crois que	I believe that
A mon avis	In my opinion
Je le/la/les trouve…	I find it/ them
Une perte de temps	A waste of time

G3 Comparative adjectives

Plus…que	More…than
Moins…que	Less…than
Aussi …que	as…as
Meilleur(e) que	better than
Pire que	worse than

V2: Connectives

Pourtant	*yet*
Ou	*or*
Où	*where*
Quand	*when*
Si/ s'	*if*

V3: Weather

	Il y a du soleil		Il fait du vent
	Il y a des nuages		Il neige
	Il y a des orages		Il pleut
	Il fait chaud		
	Il fait froid		

P1 Pronunciation

Y	"ee"
ien	"eeahn"
th	"tuh"
Silent final s, t, d, x	nothing

G4: Negatives

Ne…pas	Not
Ne …rien	nothing
Ne…ni	neither, nor
Ne….jamais	never
Ne…plus	no longer
Ne … aucun(e)	not a single
Ne…que	only

Y9 French KO7: Quel film as-tu vu récemment? (what film have you seen recently?)

Grammar

Vocabulary

Pronunciation

V1: Film genres

Un film policer	*a thriller*
Un film comique	*a comedy*
Un film d'horreur	*a horror film*
Un fim d'action	*an action film*
Un film de science-fiction	*a sci-fi film*
Un film de guerre	*a war film*
Un film d'animation	*an animated film*
Un film d'amour	*a romantic film*
Un film fantasique	*a fantasy film*
Un film d'aventure	*an adventure film*

G1: Adjectives

divertissant(e)	*entertaining*	effrayant(e)	*scary*
exceptionnel (le)	*exceptional*	Choquant (e)	*shocking*
passionant(e)	*exciting*	Terrible	*terrible*
Incroyable	*incredible*	Imprévisible	*unpredictable*
prenant(e)	*gripping*	agaçant(e)	*annoying*
fascinant(e)	*fascinating*	peu convaincant(e)	*unconvincing*
prévisible	*predictable*	ennuyeux (euse)	*boring*
Sensationnel (le)	*sensational*		
drôle	*funny*		

P1 Pronunciation

	
a	"ah"
rr	"rrr"
ç	"ss"
y	"ee"
Silent final s, t, x	nothing

V1: The specifics of a film

Le conflit	*conflict*	la violence	*the violence*
L'amour	*love*	la politique	*the politics*
Le début	*the start*	la romance	*the romance*
L'histoire	*the story*	La bande sonore	*the sound track*
La lutte	*the fight*	les effets spéciaux	*the special effects*
L'amitié	*friendship*	les blaques	*the jokes*
L'histoire	*the story*	les vedettes	the stars
La suspense	*the suspense*	les acteurs	*the actors*
La fin	*the ending*	les extras	the extras



V2 Opinions

Je pense que	I think that
Je trouve que	I find that
J'ai horreur de	I cannot stand
Selon moi	according to me
A mon avis	In my opinion
Je le/la/les trouve…	I find it/ them
Il me semble que	it seems to me that

G2: Key verbs

voir	*to see*
regarder	*to watch*
jouer	*to play*
se dérouler	*to take place*
conseiller	*to advise*
recommander	*to recommend*

KO1. German Essentials.

Grammar.

G1. Essential Verbs. (present tense)

Pronoun	haben = to have	sein = to be	werden = to become
ich *(I)*	habe *(I have)*	bin *(I am)*	werde *(I become)*
du *(you) informal)*	hast *(you have)*	bist *(you are)*	wirst (you become)
er/sie/es *(he/she/it)*	hat *(he/she it has)*	ist *(he/she/it is)*	wird (he/she/it becomes)
wir *(we)*	haben *(we have)*	sind *(we are)*	werden *(we become)*
ihr *(you plural)*	habt *(you have)*	seid *(you are)*	werdet *(you become)*
Sie/sie *(you polite/they)*	haben *(you polite/they have)*	sind *(you polite/they are)*	werden *(you polite/they become)*

G2. Definite & Indefinite Articles & Genders.

Gender	the	a
masculine	der	ein(en)
feminine	die	eine
neuter	das	ein
plural	die	viele (a lot)

Vocabulary.

V1. Vocabulary Essentials.

Intensifiers	Connectives
besonders *(especially)*	aber *(but)*
ein bisschen *(a bit)*	auch *(also)*
sehr *(very)*	denn *(because)*
wirklich *(really)*	deshalb *(therefore)*
ziemlich *(quite)*	jedoch *(however)*
zu *(too)*	und *(and)*
Subordinating Conjunctions (Verb Kickers)	
da *(because)*	dass *(that)*
obwohl *(although)*	weil *(because)*
wenn *(if/when)*	wo *(where)*

V2. Numbers.

0 = null	1 = eins	2 = zwei	3 = drei	4 = vier
5 = fünf	6 = sechs	7 = sieben	8 = acht	9 = neun
10 = zehn	11 = elf	12 = zwölf	13 = dreizehn	14 = vierzehn
15 = fünfzehn	16 = sechzehn	17 = siebzehn	18 = achtzehn	19 = neunzehn
20 = zwanzig	30 = dreißig	40 = vierzig	50 = fünfzig	60 = sechzig
70 = siebzig	80 = achtzig	90 = neunzig	100 = hundert	1000 = tausend

Pronunciation.

P1. Das Alphabet.

A = ah	B = bay	C = tsay	D = day
E = ey	F = eff	G = gay	H = hah
I = ee	J = yot	K = car	L = ell
M = emm	N = enn	O = oh	P = pay
Q = kuh	R = air	S = ess	T = tay
U = ooh	V = fow	W = vay	X = eeks
Y = oopsi-lon	Z = tsett		

P2. Commonly Mispronounced German Words.

habe (harbour)	viele (feeler)	weil (vile)	meine (miner)
Schule (shooler)	neunzehn (n-oin say-n)	Deutsch (doi-t-sh)	Englisch (eng-lish)
Mädchen (maid-tshun)	Schildkröte (sh-ild-kr-u-te)	Brüder (broo-der)	heiße (hi-sur)

KO1.1 German Essentials 2.

Grammar

G1. Possessive Pronouns

Gender	my	his	her
masculine	mein	sein	ihr
feminine	meine	seine	ihre
neuter	mein	sein	ihr
plural	meine	seine	ihre

Vocabulary.

V1. Colours

blau	blue	braun	brown
grau	grey	grün	green
lila	purple	rot	red
schwarz	black	weiß	white

V2. Common Questions Words

Was	*What*	Wer	*Who*
Wie	*How*	Wo	*Where*
Wann	*When*	Welche	*Which*

Vocabulary.

V3. Adverbs of frequency & time markers.

Deutsch	English
am Wochenende	*at the weekend*
Heute Abend	*this evening*
Morgen früh	*this morning*
zweimal pro Woche	*twice per week*
dreimal pro Monat	*three times a month*
immer	*always*
häufig	*frequently*
manchmal	*sometimes*
nicht so oft	*not so often*
selten	*rarely*
fast nie	*hardly ever*
nie	*never*

Pronunciation.

P1. Key Sounds

you see	you say	example
ei	eye	eins (eye-ns)
ie	ee	sieben (see-bun)
au	ow!	blau (bl-ow)
eu/äu	oi	neun (noin)
w	v	wie (v-ee)
j	y	Ja! (ya!)
sch	sh	Schuh (shoe)
___e	uh	habe (har-buh)
ä	ey/e	Bär (bear)
ö	urr	schön (sh-urn)
ü	ooh	grün (g-ooh-n)
ß	ss	weiß (v-eye-ss)

KO2. Grammar Focus. Das Perfekt. (The perfect (past) tense.)

Grammar.

G1. Auxiliary verbs to form perfect tense.

Pronoun	haben = to have	* sein = to be
ich *(I)*	habe *(I have)*	bin *(I am)*
du *(you) informal)*	hast *(you have)*	bist *(you are)*
er/sie/es *(he/she/it)*	hat *(he/she it has)*	ist *(he/she/it is)*
wir *(we)*	haben *(we have)*	sind *(we are)*
ihr *(you plural)*	habt *(you have)*	seid *(you are)*
Sie/sie *(you polite/they)*	haben *(you polite/ they have)*	sind *(you polite/ they are)*

G2. How to form the perfect tense

The perfect tense needs 2 verbs. The 1st is a form of "haben", or "sein" and the 2nd is a past participle. Verbs of motion use sein. e.g. Ich bin ….gefahren.

Grammar.

G3. Common verbs & their past participles

Infinitive	Past Participle
spielen *(to play)*	gespielt *(played)*
machen *(to make/do)*	gemacht *(made/did)*
kaufen *(to buy)*	gekauft *(bought)*
besuchen *(to visit)*	besucht *(visited)*
benutzen *(to use)*	benutzt *(used)*
hören *(to listen)*	gehört *(listened)*
herunterladen *(to download)*	heruntergeladen *(downloaded)*
teilen *(to share)*	geteilt *(shared)*
*gehen *(to go)*	gegangen *(went)*
*fahren *(to go (by vehicle))*	gefahren *(went (by vehicle))*

Vocabulary.

V1. Useful past tense sentences.

Deutsch	Englisch
Ich habe am Computer gespielt.	*I have on the computer played./ I played on the computer.*
Ich habe Judo gemacht.	*I have Judo done. /I did Judo.*
Wir haben Schokolade gekauft.	*We have chocolate bought./We bought chocolate.*
Er hat seine Freunde besucht.	*He had his friends visited./ He visited his friends.*
Sie haben das Handy benutzt.	*They have the mobile phone used./They used the mobile phone.*
Ich habe Musik gehört.	*I have music listened/ I listened to music.*
Sie hat Filme heruntergeladen.	*She had films downloaded./ She downloaded films.*
Hast du die Fotos geteilt?	*Have you the photos shared?/Have you shared the photos?*
Ich bin in die Stadt gegangen/gefahren	*I am into town went/travelled/ I went/travelled into town.*

KO3. Neue Technologie (new technology)

Grammar.

G1. Common Verbs in this topic

Pronoun	sein to be	benutzen to use	herunterladen to download
ich *(I)*	bin *(I am)*	benutze *(I use)*	lade…herunter *(I download)*
du *(you informal)*	bist *(you are)*	benutzt *(you use)*	lädst…herunter *(you download)*
er/sie/es *(he/she/ it)*	ist *(he/she it is)*	benutzt *(he/she/it uses)*	lädt…herunter *(he/she it downloads)*
wir *(we)*	sind *(we are)*	benutzen *(we use)*	laden…herunter *(we download)*
ihr *(you plural)*	seid *(you are)*	benutzt *(you use)*	ladet…herunter *(you download)*
Sie/sie *(you polite/ they)*	sind *(you polite / they are)*	benutzen *(you polite they use)*	laden…herunter *(you polite/ they download)*

Vocabulary.

V1. Useful Phrases in this topic.

Deutsch	Englisch
Jeden Tag benutze ich mein Handy.	*I use my phone every day.*
Ich lade oft Musik unter.	*I often download music.*
der Vorteil/Nachteil	*the advantage/disadvantage*
Für mich ist die Technologie sehr nützlich.	*For me, technology is very useful.*
Man kann in Kontakt mit Freunden bleiben.	*You can stay in contact/touch with friends.*
Es gibt Probleme besonders mit Cybermobbing.	*There are problems, particularly with cyber bullying.*
Ich liebe mein Handy, weil es sehr nützlich ist.	*I love my phone because it is very useful.*
Meine Schwester spielt gern Computerspiele.	*My sister likes playing computer games.*
Das Internet ist besonders wichtig für mich aber es kann gefährlich sein.	*The internet is especially important for me, but it can be dangerous.*

Vocabulary.

V2. Adjectives

Deutsch	Englisch
praktisch/kreativ	*practical/creative*
nützlich/nutzlos	*useful/useless*
teuer/billig	*expensive/cheap*
schnell/langsam	*fast/slow*
modern/altmodisch	*modern/old fashioned*
neu/alt	*new/old*
sicher/gefährlich	*safe/dangerous*
innovativ/fade	*innovative/bland*
interessant/langweilig	*interesting/boring*

V3. Nouns

Deutsch	Englisch
das Handy	*mobile phone*
das Bildschirm	*screen*
die Spielkonsole	*games console*
der drahtloser Kopfhörer	*wireless headphones*

KO4. die Unterhaltung (entertainment)

Grammar.

G1. Common irregular & regular verbs.

Pronoun	*lesen to read	*sehen to watch	hören to listen
ich *(I)*	lese *(I read)*	sehe *(I watch)*	höre *(I listen)*
du *(you informal)*	liest *(you read)*	siehst *(you watch)*	hörst *(you listen)*
er/sie/es *(he/she/ it)*	liest *(he/she/ it reads)*	sieht *(he/she/ it watches)*	hört *(he/she/ it listens)*
wir *(we)*	lesen *(we read)*	sehen *(we watch)*	hören *(we listen)*
ihr *(you plural)*	lest *(you read)*	seht *(you watch)*	hört *(you listen)*
Sie/sie *(you polite/ they)*	lesen *(you polite/ they read)*	sehen *(you polite/ they watch)*	hören *(you polite/ they listen)*

Vocabulary.

V1. Nouns & adjectives.

Deutsch	Englisch
Romane/Comics	*Novels/Comics*
Zeitungen/Zeitschriften	*Newspapers/Magazines*
Biografien/Gedichte	*Biographies/Poems*
Abenteuerfilme	*Adventure films*
Zeichentrickfilme	*Cartoons*
Sendungen	*TV Programmes*
Komödien	*Comedies*
Seifernopern	*Soap Opera*
Fernsehserien	*TV Series*
unterhaltsam/langweilig	*entertaining/boring*
lustig/traurig	*funny/sad*
aufregend/entspannend	*exciting/relaxing*
gut/schlecht	*good/bad*

Pronunciation.

P1.You see, you say.

Deutsch	Englisch
Romane	row-marn-er
Biografien	bee-og-rar-fee-en
Abenteuerfilme	ar-ben-toy-er-film-er
Zeichentrickfilme	zye-kun-trick-film-er
Komödien	Kom-ur-dee-un
Seifernopern	zye-fun-oh-purn
Fernsehserien	furn-seh-sier-ee-un
aufregend	owf-ray-gund
gut	goot

P2. Opinions

Deutsch	Englisch
Ich sehe gern *(I like to watch)*	ich say-er gurn
Ich höre nicht gern *(I don't like listening)*	Ich hur-rer nicht gurn
Meine Lieblingssendungen sind Komödien *(my favourite programmes are comedies.)*	miner leeb-lings-sier-ee-un sind Kom-ur-dee-un

KO5. die Ferien (holidays)

Grammar.

G1. Common irregular & regular verbs.

Pronoun	*fahren to travel	reisen to travel	bleiben to stay
ich *(I)*	fahre *(I go)*	reise *(I travel)*	bleibe *(I stay)*
du *(you informal)*	fährst *(you go)*	reist *(you travel)*	bleibst *(you stay)*
er/sie/es *(he/she/ it)*	fährt *(he/she/ it goes)*	reist *(he/she/ it travels)*	bleibt *(he/she/ it stays)*
wir *(we)*	fahren *(we go)*	reisen *(we travel)*	bleiben *(we stay)*
ihr *(you plural)*	fahrt *(you go)*	reist *(you travel)*	bleibt *(you stay)*
Sie/sie *(you polite/ they)*	fahren *(you polite/ they go)*	reisen *(you polite/ they travel)*	bleiben *(you polite/ they stay)*

Vocabulary.

V1. Nouns (places & transport)

Deutsch	Englisch
nach Frankreich	*to France*
nach Spanien	*to Spain*
in die Türkei	*to Turkey*
in die Schweiz	*to Switzerland*
in die Vereingten Staaten	*to the USA*
mit dem Flugzeug	*with the/by plane*
mit dem Auto	*with the/by car*
mit der Fähre	*with the/ by ferry*
mit dem Zug	*with the/ by train*
in einem Hotel	*in a hotel*
auf einem Campingplatz	*on a camp site*
in einer Ferienwohnung	*in a holiday apartment*
in einer Villa	*in a villa*

Vocabulary

V2 Activities & tenses

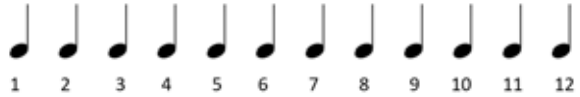
Past Tense	
Ich bin in einem Hotel geblieben	*I stayed in a hotel.*
Wir sind mit dem Flugzeug gefahren	*We flew/travelled by plane*
Er ist nach Frankreich gereist	*he travelled to France*
Wir haben im Meer geschwommen	*we swam in the sea*
Ich habe in einem Restaurant gegessen	*I ate in a restaurant*
Future Tense	
Ich werde in einem Hotel bleiben	*I will stay in a hotel*
Wir werden mit dem Flugzeug fahren	*we will travel by plane*
Er wird nach Frankreich fahren	*he will go to France*
Wir werden im Meer schwimmen	*we will swim in the sea*
Ich werde in einem Restaurant essen	*I will eat in a restaurant.*

Exploring Rhythm, Chords and Metre in Music for Dance

The **RHYTHMS** of dance music always match the **STEPS** of the dance: the two are inter-related. Dance music is based on **CHORD PATTERNS**: mainly **PRIMARY CHORDS (I, IV & V(7))** and has a clear **MELODY** with an **ACCOMPANIMENT (HOMOPHONIC TEXTURE)**. Different dances and their music use different **METRES/TIME SIGNATURES**.

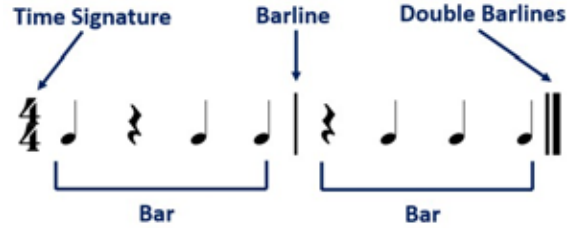
A. Pulse, Time and Metre in Dance Music

The **BEAT** or **PULSE** of dance music is always **REGULAR**. Here is a regular crotchet pulse of 12 beats:



A single **BEAT** is a basic unit of musical time. In dance music, beats are grouped together to make a repeating pattern – normally made up of either twos, threes or fours.

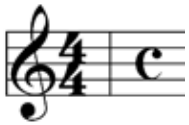
The repeating pattern of beats gives us the **METRE** or the **TIME** of the music, shown by the **TIME SIGNATURE** at the start of a piece of music. Each repetition of the beat-pattern is called a **BAR** and bars are separated by vertical lines called **BARLINES**. A **DOUBLE BARLINE** always comes at the end of a piece of music or section of music.



The **TOP NUMBER** of a time signature tells you how many beats there are in each bar. The **BOTTOM NUMBER** tells you what types or note values these beats are (as divisions of a semibreve = 1):

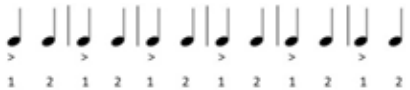
1 = Semibreve
2 = Minim
4 = Crotchet
8 = Quaver
16 = Semiquaver

4/4 can also be shown by a "C" meaning **COMMON TIME**



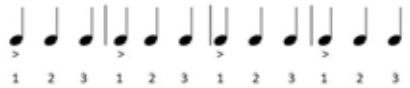
B. Simple Time in Dance Music

SIMPLE DUPLE METRE: Two beats to a bar



Dance music such as **MARCHES**, the **TANGO** and **IRISH REEL** often use simple duple metre.

SIMPLE TRIPLE METRE: Three beats to a bar

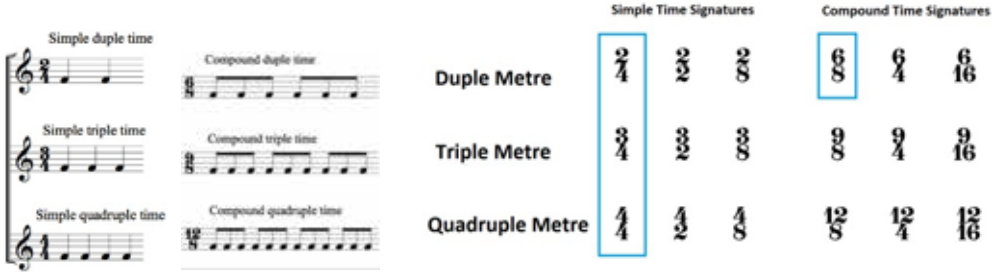


Dance music such as **WALTZES** and the **MINUET, COURANTE** and **SARABANDE** from the Baroque Dance Suite often use simple triple metre.

SIMPLE QUADRUPLE METRE: Four beats to a bar

Dance music such as the **TANGO**, the **IRISH REEL**, the **ALLEMANDE** from The Baroque Dance Suite, **AMERICAN LINE DANCE MUSIC** (Country and Western), **DISCO** and **CLUB DANCE** often use simple quadruple metre.

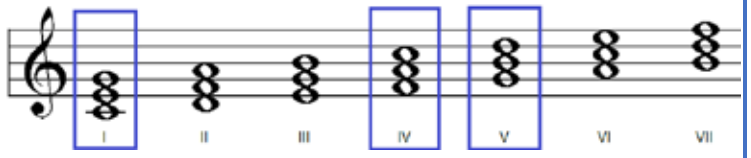
C. Simple and Compound Time

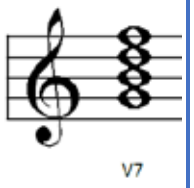


Dance music such as the **IRISH JIG** and the **GIGUE** from the Baroque Dance Suite often use compound duple metre (6/8) with a "**ONE** and a **TWO** and a" feel to the music.

D. Chords in Dance Music

Dance music is based on **CHORD PATTERNS**. **PRIMARY CHORDS**: **CHORD I**, **CHORD IV** and **CHORD V** are most commonly used in dance music with **SEVENTH CHORDS** featuring in popular dance music such as **DISCO** and **CLUB DANCE** (adding a note seven notes above the root of a chord, such as and **DOMINANT SEVENTH CHORD**). All seventh chords have 4 notes. Chords are often performed in different ways as an **ACCOMPANIMENT** in dance music.



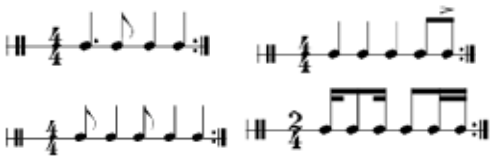


E. Characteristic Rhythms in Dance Music

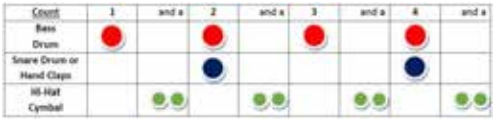
The **MARCH** has a strong **LEFT**, right, **LEFT**, right rhythm:

The **WALTZ** has a strong **OOM**-cha-cha, **OOM**-cha-cha rhythm:

The **TANGO** has several rhythms:



FOUR-ON-THE-FLOOR is a common rhythm in **DISCO** and more modern dance music:



SOUNDTRACKS

Exploring Film Music

A. The Purpose of Music in Film

Film Music is a type of **DESCRIPTIVE MUSIC** that represents a **MOOD, STORY, SCENE** or **CHARACTER** through music, it is designed to **SUPPORT THE ACTION AND EMOTIONS OF THE FILM ON SCREEN**. Film Music can be used to:

- Create or enhance a mood (though the **ELEMENTS OF MUSIC**) ->
- Function as a **LEITMOTIF** (see D)
- To emphasise a gesture (**MICKEY-MOUSING –** when the music fits precisely with a specific part of the action in a film e.g. cartoons)
- Provide unexpected juxtaposition/irony (using music the listener wouldn't expect to hear giving a sense of uneasiness or humour!)
- Link one scene to another providing continuity
- Influence the pacing of a scene making it appear faster/slower
- Give added commercial impetus (released as a **SOUNDTRACK**) – sometimes a song, usually a pop song is used as a **THEME SONG** for a film.
- Illustrate the geographic location (using instruments associated with a particular country) or historical period (using music 'of the time').

D. Leitmotifs

LEITMOTIF – A frequently recurring short melodic or harmonic idea which is associated with a character, event, concept, idea, object or situation which can be used directly or indirectly to remind us of one not actually present on screen

B. How the Elements of Music are used in Film Music

PITCH AND MELODY – **RISING MELODIES** are often used for increasing tension, **FALLING MELODIES** for defeat. Westerns often feature a **BIG THEME**. **Q&A PHRASES** can represent good versus evil. The **INTERVAL OF A FIFTH** is often used to represent outer space with its sparse sound.
DYNAMICS – **FORTE (LOUD)** dynamics to represent power; **PIANO (SOFT)** dynamics to represent weakness/calm/resolve. **CRESCENDOS** used for increasing threat, triumph or proximity and **DECRESCENDOS** or **DIMINUENDOS** used for things going away into the distance. Film soundtracks often use **EXTREME DYNAMICS** or **SUDDEN DYNAMIC CHANGES** to 'shock the listener'.
HARMONY – **MAJOR** – happy; **MINOR** – sad. **CONSONANT HARMONY OR CHORDS** for "good" and **DISSONANT HARMONY OR CHARDS** for "evil". **SEVENTH CHORDS** often used in Westerns soundtracks.
DURATION – **LONG** notes often used in Westerns to describe vast open spaces and in Sci-Fi soundtracks to depict outer space; **SHORT** notes often used to depict busy, chaotic or hectic scenes. **PEDAL NOTES** – long held notes in the **BASS LINE** used to create tension and suspense.
TEXTURE – **THIN/SPARE** textures used for bleak or lonely scenes; **THICK/FULL** textures used for active scenes or battles.
ARTICULATION – LEGATO for flowing or happy scenes, **STACCATO** for 'frozen' or 'icy' wintery scenes. **ACCENTS (>)** for violence or shock.
RHYTHM & METRE – 2/4 or 4/4 for Marches (battles), 3/4 for Waltzes, 4/4 for "Big Themes" in Westerns. **IRREGULAR TIME SIGNATURES** used for tension. **OSTINATO** rhythms for repeated sounds *e.g. horses.*

C. Film Music Key Words

SOUNDTRACK – The music and sound recorded on a motion-picture film. The word can also mean a commercial recording of a collection of music and songs from a film sold individually as a CD or collection for digital download.
MUSIC SPOTTING – A meeting/session where the composer meets with the director and decides when and where music and sound effects are to feature in the finished film.
STORYBOARD – A graphic organiser in the form of illustrations and images displayed in sequence to help the composer plan their soundtrack.
CUESHEET – A detailed listing of **MUSICAL CUES** matching the visual action of a film so that composers can time their music accurately. **CLICK TRACKS** – An electronic **METRONOME** which helps film composers accurately time their music to on-screen action through a series of 'clicks' (often heard through headphones). **DIEGETIC FILM MUSIC** – Music within the film for both the characters and audience to hear *e.g. a car radio, a band in a nightclub or sound effects.*
NON-DIEGETIC FILM MUSIC – Music which is put "over the top" of the action of a film for the audience's benefit and which the characters within a film can't hear – also known as **UNDERSCORE** or **INCIDENTAL MUSIC**.

E. History of Film Music

Early films had no soundtrack **("SILENT CINEMA")** and music was provided live, usually **IMPROVISED** by a pianist or organist. The first **SOUNDTRACKS** appeared in the 1920's and used existing music **(BORROWED MUSIC –** music composed for other (non-film) purposes) from composers such as Wagner and Verdi's operas and ballets. In the 1930's and 1940's Hollywood hired composers to write huge Romantic-style soundtracks. **JAZZ** and **EXPERIEMENTAL MUSIC** was sometimes used in the 1960's and 1970's. Today, film music often blends **POPULAR, ELECTRONIC** and **CLASSICAL** music together.

F. Film Music Composers and their Soundtracks

Jerry Goldsmith
Planet of the Apes
Star Trek: The Motion Picture
The Omen
Alien

John Williams
Star Wars
Jaws
Harry Potter
Indiana Jones
Superman, E.T.

James Horner
Titanic
Apollo 13
Braveheart
Star Trek II Aliens

Ennio Morricone
The Good, The Bad and The Ugly
For a Few Dollars More
The Mission

Danny Elfman
Mission Impossible
Batman Returns
Men in Black Spider Man

Hans Zimmer
The Lion King
Gladiator
Dunkirk
Blade Runner 2049 No Time to Die

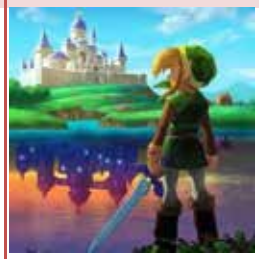
Bernard Hermann
Psycho
Vertigo
Taxi Driver

Computer and Video Game Music

Early Computer and Video Game Music

Early video game music consisted primarily of **SOUND EFFECTS** (an artificially created or enhanced sound used to emphasize certain actions within computer and video games), **CHIPTUNES** or **8-BIT MUSIC** (a style of electronic music which used simple melodies made for programmable sound generator (PSG) sound chips in vintage computers, consoles and arcade machines) and early sound **SYNTHESISER** technology (an electronic musical instrument that generates audio signals that may be converted to sound). **SAMPLING** (the technique of digitally encoding music or sound and reusing it as part of a composition or recording) began in the 1980's allowing sound to be played during the game, making it more realistic and less "synthetic-sounding".

How Computer and Video Game Music is used within a Game



Music within a computer or video game is often used for **CUES** (knowing when a significant event was about to occur).

Video game music is often heard over a game's title screen (called the **GROUND THEME**), options menu and bonus content as well as during the entire gameplay. Music can be used to **INCREASE TENSION AND SUSPENSE** *e.g. during battles and chases*, when the player must make a decision within the game (a **DECISION MOTIF**) and can change, depending on a player's actions or situation *e.g. indicating missing actions or "pick-ups"*.

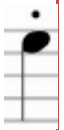
Musical Features of Computer and Video Game Music

JUMPING BASS LINE

Where the bass line often moves by **LEAP** (**DISJUNCT MOVEMENT**) leaving 'gaps' between notes

STACCATO ARTICULATION

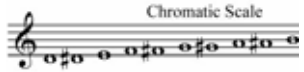
Performing each note sharply and detached from the others.



Shown by a dot.

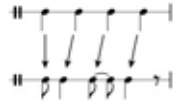
CHROMATIC MOVEMENT

Melodies and bass lines that ascend or descend by semitones.



SYNCOPATION

Accenting the weaker beats of the bar to give an "offbeat" jumpy feel to the music.



How Computer and Video Game Music is Produced

Fully-orchestrated **SOUNDTRACKS** (video game music scores) are now popular – technology is used in their creation but less in their performance. The composer uses **MUSIC TECHNOLOGY** to create the score, it is then played by an **ORCHESTRA** and then digitally converted and integrated into the game. Video game **SOUNDTRACKS** have become popular and are now commercially sold and performed in concerts

Character Themes in Computer and Video Game Music

Characters within a video game can also have their own **CHARACTER THEMES** or **CHARACTER MOTIFS** – like **LEITMOTIFS** within Film Music. These can be manipulated, altered and changed – adapting the elements of music – **ORCHESTRATION** (the act of arranging a piece of music for an orchestra and assigning parts to the different musical instruments)**, TIMBRE, SONORITY, TEXTURE, PITCH, TEMPO, DYNAMICS** – depending on the character's situation or different places they travel to within the game.

Famous Computer and Video Game Music Composers and their Soundtracks

Koji Kondo
Super Mario Bros. (1985)
The Legend of Zelda (1986)

Michael Giacchino
The Lost World: Jurassic Park (1997)
Medal of Honour (1999) Call of Duty (2003)

Mieko Ishikawa
Dragon Slayer (1993)

Martin O'Donnell and Michael Salvatori
Halo (2002)

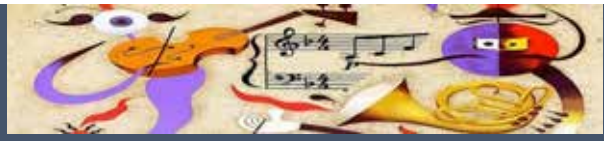
Daniel Rosenfield
Minecraft (2011)

Rom Di Prisco
Fortnite (2017)

New Directions

Exploring ways to develop music from small ideas in C20th Music

There were many different types, styles, genres and movements of music in the twentieth century. These include: Impressionism, 20th Century Nationalism, Jazz Influences, Polytonality, Atonality, ***Expressionism***, ***Serialism***, Microtonality, Electronic Music, Experimentalism, ***Minimalism***, Pointillism and Music Concrète.



A. Features of Music in the Twentieth Century (How Composers used the Elements of Music)

A1. Melody & Dynamics

CONJUNCT - wide leaps, angular and spiky.
CHROMATIC -uses all 12 notes (black and white) of the **CHROMATIC SCALE**.
DISSONANCE - harsh sounds.
EXTREMES OF DYNAMICS - *(pppp-ffff)* No clear melody/"tune".

A2. Harmony

ATONALITY – no (sense of) key.
POLYTONALITY – two or more keys played at once.
DISCORDS – dissonant, clashing chords.

A3. Rhythm

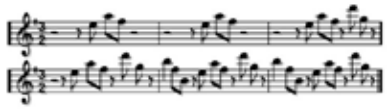
SYNCOPATION – half beat followed by full beat emphasising weaker beats of the bar.
IRREGULAR ACCENTS (>) – *e.g. The Rite of Spring*
IRREGULAR TIME SIGNATURES – 5 or 7 beats per bar.

A4. Timbres and Sonorities

Strange, intriguing, and exotic sounds; striking, sometimes explosive, contrasts.
PERCUSSION – expanded in orchestra and more emphasis on percussion timbre and sonorities.
Unfamiliar sounds from strange instruments such as **EXTREME PITCH RANGES** and playing instruments in different and unusual ways.
TOTALLY NEW SOUNDS often involving **ELECTRONIC EQUIPMENT** and **MAGNETIC TAPE**.

B. Minimalism

Based on **CELLS** or **MOTIFS** – short simple ideas.
Use of **REPETITION** – also called **LOOPING**.
LAYERED TEXTURES
NO CLEAR MELODY
GRADUAL CHANGES OVER TIME



PHASE SHIFT (PHASE IN/OUT) – when two or more motifs or cells begin in **UNISON** and gradually become "out of sync" with each other through displacement, either forwards or backwards. **METAMORPHOSIS** – tiny changes are made over time to one note or to one part of the rhythm. This can go a "full circle" and end up exactly the same at the end.

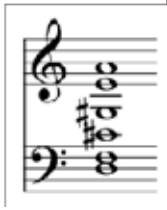
ADDITIVE MELODY – adding notes to an original melodic cell gradually.
ISORHYTHMIC OVERLAP – combining different length motifs or ostinato patterns
AUGMENTATION – doubling the note values of a motif or cell.
DIMINUTION – halving the note values of a motif or cell.

RETROGRADE/INVERSION/RETROGRADE INVERSION (see D. Serialism)
Famous Minimalist Composers include: *Terry Riley, Steve Reich, Philip Glass, Michael Nyman.*

C. Expressionism

"Expressionism" is borrowed from painting and is concerned with dark, secret terrors, mental breakdowns, and fantastic visions.
ATONAL, DISSONANCE, DISJUNCT, LARGE ORCHESTRAS, UNUSUAL AND STRANGE TIMBRES AND SONORITIES.

Expressionist composers often use **HEXACHORDS** as a form of **ACCOMPANIMENT**.



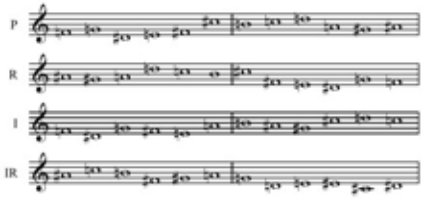
Hexachords are chords formed of **SIX NOTES**. A hexachord can be formed on any note of the **CHROMATIC SCALE**, but must follow a strict pattern of **TONES** and **SEMITONES**:

Semitone – Tone – Semitone – Tone+Semitone - Semitone The notes can then be arranged in any order in different (and often extreme!) pitch ranges.

Famous Expressionist Composers include: Arnold Schoenberg, Alban Berg, Anton Webern

D. Serialism

TONE/NOTE ROWS – use the 12 notes of the **CHROMATIC SCALE** into an order (the **PRIME/ORIGINAL**) on which the entire composition is based. All 12 notes are of equal importance and none should appear out of turn.



As well as being used in its **PRIME/ORIGINAL**, the tone/note row could also be used in:
INVERSION (intervals upside down)
RETROGRADE (backwards)
RETROGRADE INVERSION (the inversion row backwards)

These 4 rows would then become the bases of the composition, used either vertically (as chords) or horizontally (as melody).
Famous Serialist Composers include: Arnold Schoenberg, Alban Berg, Anton Webern, Igor Stravinsky

SAMBA

Samba is a musical genre and dance style with its roots in Africa via the West African slave trade and African religious traditions. Samba is an expression of Brazilian cultural expression and is a symbol of carnival. Samba schools form and compete bringing people together.

A. Key Words and Terms in Samba Music

CALL AND RESPONSE – one person plays or sings a musical phrase, then another person/group responds with a different phrase or copies the first one.
CYCLIC RHYTHM – a rhythm that is repeated over and over again.
IMPROVISATION – making up music as you go along, without preparation.
OSTINATO – a repeated pattern. Can be rhythmic or melodic; usually short.
PERCUSSION – Instruments that are mostly hit, scraped or shaken to produce sound. Samba uses many percussion instruments which together are called a **BATERIA**.
POLYRHYTHM – the use of several rhythms performed simultaneously, often overlapping each other to create a thick texture.
PULSE – a regular beat that is felt throughout music
RHYTHM – a series of notes of different lengths that create a pattern. Usually fits with a regular beat or pulse.
SYNCOPATION – accenting or emphasising the weaker beats of the bar (often a half beat (quaver) followed by a full beat (crotchet)) giving the rhythm an **OFFBEAT** feel.
SAMBISTA – the leader of a Samba band or ensemble, often signalling cues to the rest of the band of when to change sections within the music with an **APITO** (Samba whistle)

B. Form and Structure of Samba

Samba music often starts with an **INTRODUCTION** often featuring **CALL AND RESPONSE RHYTHMS** between the Samba Leader and ensemble. The main Ostinato rhythm of Samba is called the **GROOVE** when all the instruments of the Samba Band play their respective rhythms over and over again **(CYCLIC RHYTHMS)** forming the main body of the piece. The **GROOVE** is broken up by **BREAKS** - 4 or 8 beat rhythms providing contrast and **MID SECTIONS** – one or two instruments change the rhythm of their ostinato and the others stay the same or stop. Sometimes **BREAKS** and **MID SECTIONS** feature a **SOLOIST** who "shows off" their rhythms. The **SAMBISTA** must signal to the group when to change to a different section which is normally done with an **APITO** (Samba Whistle – loud!). A piece of Samba can end (this section is called the **CODA**) with either a **CALL AND RESPONSE** pattern or a pre-rehearsed ending phrase of rhythm. The **FORM AND STRUCTURE** of a piece of Samba may look like the following:

Intro	Groove	Break	Groove	Mid-Section	Groove	Mid-Section	Groove	Break	Groove	Coda

C. Texture of Samba Music

Texture varies in Samba music, often **MONOPHONIC** where a single rhythm is heard as in **CALL AND RESPONSE** sections, sometimes **POLYPHONIC** where sections of the Samba band play different rhythms **(OSTINATOS)** creating **CROSS-RHYTHMS** (when two rhythmic patterns that "conflict" with each other occur simultaneously) creating a thick texture of interweaving and interlocking rhythms – a **POLYRHYHM** or a **POLYRHYTHMIC TEXTURE**.

D. Dynamics of Samba Music

The dynamics of Samba music are normally **VERY LOUD** – it is music designed to be performed outdoors at carnivals and is played by large numbers of instrumentalists and to accompany dancers and processions with large audiences watching and listening. Sometimes, a **CRESCENDO** is used at the end of a piece of Samba music for dramatic effect.

E. Tempo of Samba Music

Samba music is generally **FAST** at around 104 bpm and keeps a constant tempo to assist the dancers or processional nature of the music. Sometimes the **SAMBISTA** (Samba leader) uses **(TEMPO) RUBATO** – tiny fluctuations in tempo for expressive effect.

F. Instruments, Timbres and Sonorities of Samba

SURDO

REPINIQUE

TAMBORIM

CHOCOLO

RECO-RECO

APITO

AGOGO BELLS

CAIXA DE GUERRO

What Makes a Good Song?

Exploring Popular Songs and Musical Arrangements

A. Popular Song Structure

SONG STRUCTURE – How a song is made up of or divided into different sections (see below) and the order in which these sections occur. To work out the structure of a song, it's helpful to analyse the **LYRICS** **and** listen to a recording for the song (for instrumental sections). **INTRO** – often shortened to 'intro', the first section of a song which sets the mood of the song and is sometimes, but not always, an instrumental section using the song's chord pattern.

VERSES – songs normally have several verses. Verses introduce the song's theme and have the same melody but different lyrics for each verse which helps develop the song's narrative and story. Songs made up entirely of verses are called **STROPHIC**.

LINK – a optional short section often used to join different parts of a song together, often instrumental, and sometimes joins verses together or appears at other points within a song.

PRE-CHORUS – an optional section of music that occurs before the **CHORUS** which helps the music move forward and "prepare" for what is to come.

CHORUS – occurs several times within a song and contains the most memorable **HOOK/RIFF**. The chorus relays the message of the song and is repeated with the same melody and lyrics each time it is heard. In popular songs, the chorus is often repeated several times towards the end of the song.

MIDDLE 8/BRIDGE – a section (often 8 bars in length) that provides contrasting musical material often featuring an instrumental or vocal solo using new musical material allowing the performer to display their technical skill on their instrument or voice.

CODA/OUTRO – The final section of a popular song which brings it to an end (Coda is Italian for "tail"!)

B. Key Words

LYRICS – The words of a song, usually consisting of **VERSES** and a **CHORUS**.

HOOK – A 'musical hook' is usually the 'catchy bit' of the song that you will remember. It is often short and used and repeated in different places throughout the piece. Hooks can be either **MELODIC, RHYTHMIC** or **VERBAL/LYRICAL**.

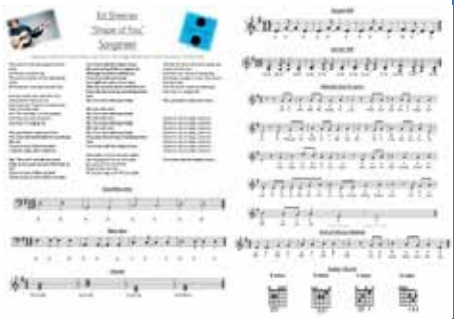
RIFF – A repeated musical pattern often used in the introduction and instrumental breaks in a song or piece of music. Riffs can be rhythmic, melodic or lyrical, short and repeated.

MELODY – The main tune of the song often sung by the **LEAD SINGER**.

COUNTER-MELODY – An 'extra' melody often performed 'on top of' the main melody that 'fits' with it a **DESCANT** or **INSTRUMENTAL SOLO**.

TEXTURE – The layers that make up a song *e.g., Melody, Counter-Melody, Hooks/Riffs, Chords, Accompaniment, Bass Line*.

C. Lead Sheet Notation and Arrangements



A **LEAD SHEET** is a form of musical **NOTATION** that contains only the essential elements of a popular song such as the **MELODY, LYRICS, RIFFS, CHORDS** (often as guitar chord symbols) and **BASS LINE**; it is not as developed as a ***FULL SCORE ARRANGEMENT*** and is open to interpretation by performers who need to use and adapt the given elements to create their own musical **ARRANGEMENT:** their "version" of an existing song.

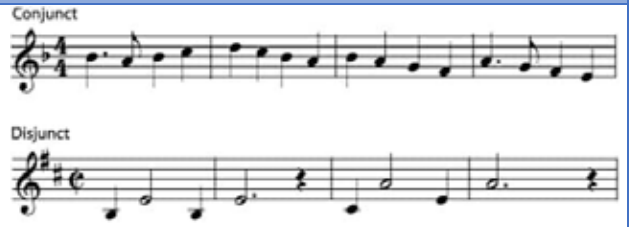
COVER (VERSION) – A new performance, remake or recording by someone other than the original artist or composer of the song.

D. Conjunct and Disjunct Melodic Motion

CONJUNCT MELODIC MOTION – Melodies which move mainly by step or use notes which are next to or close to one another.

DISJUNCT MELODIC MOTION – Melodies which move mainly by leap or use notes which are not next to or close to one another.

MELODIC RANGE – The distance between the lowest and highest pitched notes in a melody.



E. Song Timbre and Sonority (Instruments that are used to Accompany Songs)

Pop Bands often feature a **DRUM KIT** and **PERCUSSION** to provide the rhythm along with **ELECTRIC GUITARS** (**LEAD GUITAR, RHYTHM GUITAR** and **BASS GUITAR)** and **KEYBOARDS**. Sometimes **ACOUSTIC INSTRUMENTS** are used such as the **PIANO** or **ACOUSTIC GUITAR**. **ORCHESTRAL INSTRUMENTS** are often found in pop songs such as the **STRINGS**, **SAXOPHONE, TROMBONE** and **TRUMPET.** Singers are essential to a pop song - **LEAD SINGER** – Often the "frontline" member of the band (most famous) who sings most of the melody line to the song. **BACKING SINGERS** support the lead singer providing **HARMONY** or a **COUNTER-MELODY** (a melody that is often higher in pitch and different, but still 'fits with' the main melody) and do not sing all the time but just at certain points within a pop song e.g. in the chorus.

FOOTBALL

Knowledge Organiser

Tackling:

1. Get close but not too close to your opponent – about two to three feet is ideal.
2. Keep your eye on the ball. Lock the ankle of your kicking foot (the foot you're going to tackle with).
3. Bend your knees slightly now get close to your opponent and strike the ball firmly

Passing:

1. Place your non-kicking foot to the side of the ball. Hold your arms up and wide to support your balance.
2. Swing your kicking foot through and strike the ball with the inside of your foot. Aim to hit the middle of the ball to ensure it stays close to the ground.
3. Follow your kicking leg through towards the intended target. The speed of the kicking leg will direct how hard you kick the ball.

Shooting:

1. Plant your supporting foot beside the ball to gain stability. Pointing your planted foot in the direction that you want the ball to go will help guide your aim.
2. Hit the ball with the top of your foot, also known as your laces. As you kick, lock your ankle to create power through your striking foot
3. After kicking the ball, follow through with your shooting leg in the direction that you aimed the ball.

Dribbling:

1. Keep the ball close at all times using gentle touches with both the inside and outside of your foot, changing direction to outwit your opponent.
2. Keep your head up, eyes scanning the field, and be aware of surroundings.
3. Establish a low center of gravity keeping your arms out for balance.

Heading:

1. Back slightly arched as ball approaches, slightly leaning forward after striking the ball
2. Contact with the ball should be made on the forehead between the eyebrows and the hairline.
3. Head moves toward the ball. Ball must be struck and not bounce off the head

Rugby

Knowledge Organiser

Handling:

1. Signal for the ball and make a 'W' with your hands
2. Maintain eye contact
3. Tuck or place the ball on your hip

Tackling:

1. Eyes to thighs
2. Ring of steel
3. Squeeze the knees and then drive for five

Ruck:

1. Hinge at the hips and target the ball
2. Get underneath the jackle
3. Wide legs and sink at the hips

Maul:

1. Hinge at the hips
2. Keep your spine in line
3. Keep chasing your feet

Kicking:

1. Eyes on the ball
2. Drop ball onto your foot
3. Follow your foot through in the direction you want the ball to go

HOCKEY

Knowledge Organiser

Passing:

1. Eye on the ball, feet apart, knees bent
2. Stick in contact with ball as weight shifts from back to front foot
3. Push ball towards target

Receiving:

1. Stick down low, flat on floor
2. Rotate stick toward floor 45°
3. Absorb impact

Shooting:

1. One foot in front the other
2. Hands together, raise stick to hip level
3. Looking at the ball, rotate and contact the ball

Dribbling:

1. Hands apart, wide stance
2. Looking up and down
3. Gentle touches using the flat side of the stick

Marking:

1. Get between player with the ball and receiver
2. Close down the space
3. Stick down to apply pressure

Basketball

Knowledge Organiser

Passing:

1. Make a W shape with fingers on the ball
2. Step into pass
3. Follow through

Dribbling:

1. Look up
2. Using your fingers not your palm
3. Bouncing ball to waist height

Shooting:

1. Balanced looking at the hoop
2. Elbow bent
3. Follow through

Footwork/ Marking:

1. Anchor one of your feet
2. Pivot on that anchor foot
3. Bounce of pass before you pick up your anchor foot

Receiving/ Interceptions:

1. Make yourself big to catch and intercept
2. Place the ball in your 'pocket'
3. Now it is in the triple threat position

Badminton

Knowledge Organiser

Forehand Serve:

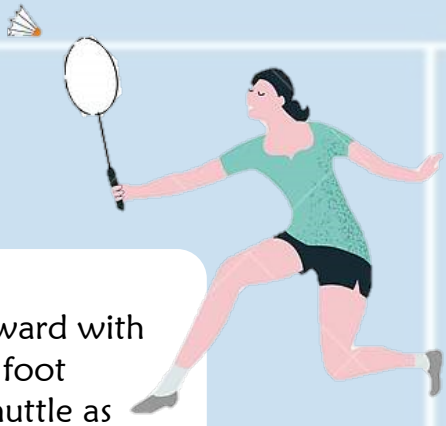
1. Hold shuttle at waist
2. Stand side on, feet shoulder width apart
3. Full swing of racket to make contact at hip height

Overhead Clear:

1. Contact shuttle at highest point
2. Body side on
3. Full swing and follow through

Backhand Serve:

1. Hold shuttle at waist
2. Stood facing the net with feet shoulder width apart
3. Push motion with the racket to make contact around hip height



Net Play:

1. Lunge forward with dominant foot
2. Contact shuttle as close to net height as possible
3. Push forwards with racket facing up

Smash:

1. Contact shuttle at highest point
2. Body side on
3. 'Whip' action when making contact with shuttle.

Netball

Knowledge Organiser

Passing and Receiving:

1. Quick, short passes
2. Receive ball on the move- throw ahead of receiver
3. Get in front of the defender

Dodging:

1. Eyes on the ball
2. Accelerate away from the defender
3. Extend arms to receive ball

Footwork/ Movement:

1. Bend knees on landing
2. Bring weight over grounded food
3. Non grounded foot is reground to maintain balance

Marking:

1. Must be 3ft away from attacker
2. Weight balanced on two feet
3. Arms up and in position over the ball

Shooting:

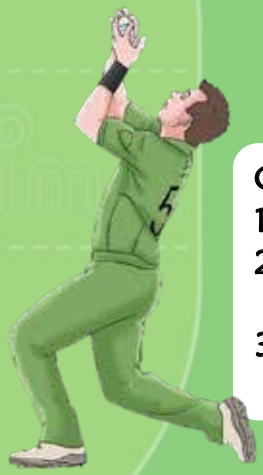
1. Arms extended above head with ball in hand
2. Push through the hoop
3. Flick your wrist

Cricket

Knowledge Organiser

Batting:
1. Left hand above right hand (Opposite for left handers)
2. Loose, bent elbows
3. Strike the ball from under your nose

Bowling:
1. Straight arm at the elbow
2. Hold the ball with two split fingers
3. Release the ball at 12pm



Catching:
1. Little fingers together
2. Hands spread into wide surface area
3. Cushion the ball into the body

Throwing:
1. Stand side on to your target
2. Throwing hand back behind
3. Rotate shoulders with speed to generate power.

Ground Fielding (Long Barrier):
1. Move into line of ball
2. Place knee on the ground with leg to the side of the body
3. Cup hands, fingers pointing down, collect ball in front of body

Rounders

Knowledge Organiser

Batting:
1. Stand side on
2. Bat up in line with shoulder
3. Watch ball, rotate hips & shoulders to hit ball
4. Follow through

Bowling:
1. Step forward with opposite leg to throwing arm
2. Aim with non-throwing arm to target
3. Throwing arm draws back
4. Throwing arm forward till in line with aim arm & release

(Step, aim, tick, tock)

Underarm Throw: Step, aim, tick, tock
1. Step forward with opposite leg to throwing arm
2. Aim with non-throwing arm to target
3. Throwing arm draws back
4. Throwing arm forward till in line with aim arm & release

(Step, aim, tick, tock)

Overarm throw:
1. Stand side on
2. Arm in Nike tick position with your non-throwing arm aiming at target
3. Rotate hips & shoulders forward
4. Release ball and follow through

Underarm Catching:
1. Little fingers/pinkies together
2. Bucket hands
3. Close hands & bring arms into body

Overarm Catching
1. Thumbs together
2. Bucket hands
3. Close hands & bring into body

Ground Fielding - Long barrier:
1. Body side on, heel and knee touching
2. Hands in front of body, little fingers together
3. Track ball & close hands when ball is in hands

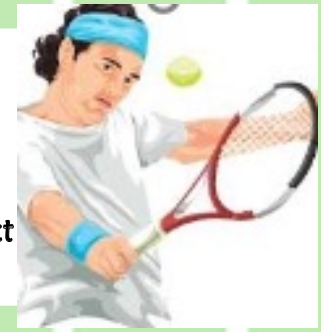
Tennis

Knowledge Organiser

Service:
Point toe to target
Ball Hand and Racquet together in front
Ball toss in front / above head
Bring racket back to tick position
Follow through

Groundstrokes:
Ready Postiion
V Grip
Turn sideways on
Low to high
Finish over your shoulder

Volley:
Ready position
Feet Front Facing
Step into Volley
Strong grip on contact



Smash:
Move feet to position of strike
Ball above head
Tick Position
Follow through to contact in front of head position

Lob:
Move feet to position of ball
Contact with open racket face
Low to high
Follow through to strike above opponents' head

9.1 A Study of Islam

KEY CONSTRUCT

2. Beliefs and teachings form the basis of organised religions.

3.10 What is good and what is challenging about being Muslim in the UK today?

Section A: Key Vocabulary

1. **Salah** — the second pillar, which is the five daily prayers Muslims perform.
2. **Zakah** — the fourth pillar, which refers to giving to 2.5% of income to charity.
3. **Sawm** — the third pillar, which is fasting for the month of Ramadan.
4. **Hajj** — the fifth pillar; the annual pilgrimage to the holy city of Makkah.
5. **Islamophobia** — fear or hatred of Islam based on a prejudice.

Section B: Component Knowledge

1. The Muslim community make up 6.5% of the UK population.
2. Muslims believe in one god who they refer to as Allah.
3. Muhammad is the most important person in the religion as he received the Qur'an from Allah.
4. The Five Pillars and 10 Obligatory Acts allow Muslims to put these beliefs into action.
5. Islamophobia is a problem in British society and is illegal under the Equality Act.

Section C: Core Content

A) Allah & Muhammad

⇒ **Tawhid** - means 'one God'. Muslims believe strongly that there is only one God, referred to as **Allah**. Allah has **no equals and no partners**. Allah has **no physical form** and therefore has no image. Muslims use **99 names** to describe the key characteristics of Allah (**merciful, powerful, all-knowing, creator** etc).

⇒ **Muhammad** is the most important **prophet** in Islam. His early life prepared him to be Allah's final, most trusted, messenger; his later life was spent either **teaching others what Allah wanted them to know** or **defending the faith from persecution**.

B) The Five Pillars

⇒ Islam is split into **two main groups** (denominations) called **Sunni and Shi'a**.

⇒ **Shahadah** is the **declaration of faith** which should ideally be the first and last thing a Muslim says/hears. It states **''There is no god but Allah, and Muhammad is his messenger''**.

⇒ **Salah** means **'prayer'**. Sunni Muslims are instructed to **pray 5 times a day**; Shi'a Muslims **pray 3 times a day**. Key features of Islamic prayer are; **a prayer mat, facing the direction of Makkah, placing forehead to the ground, washing before prayer.**

⇒ **Zakah** is the act giving money away for the benefit of others and reminds Muslims to put others before themselves.

⇒ **Sawm** is the act of **fasting for the month of Ramadan**; this is done to remember the struggle of others and to show spiritual discipline.

⇒ **Hajj** is the **annual pilgrimage to the holy city (Makkah)**. When there, Muslims spend a week **performing sacred tasks and rituals designed to remember their past and to test their faith.**

C) Being Muslim in Britain

⇒ There are approximately **1.8billion** (<24%) Muslims in the worldwide population and **3.9million** (6.5%) live in the UK.

⇒ Britain has around **1750 mosques** and nearly half of all British Muslims were **born in the UK**. In WW2 **500 000 Muslim soldiers fought for the British** and after the war were invited to Britain to help make up the workforce to **rebuild the country**.

⇒ In recent years countries such as **Iraq, Afghanistan and Syria** have suffered **war** and great **poverty** which has led to many having to flee and **seek refuge** in other countries.

⇒ Today, Muslims represent Britain in; **sport, entertainment and politics**. As well as contributing to society in the fields of **medicine, science, food, retail and construction**.

⇒ **Islamophobia** translates to 'fear of Islam'. In the UK there is strong evidence of Islamophobia with reports of **hate crimes, abuse and damage to Islamic buildings** increasing in recent years.

⇒ The **Declaration of Human Rights**, and the **UK Equality Act**, make it **illegal** to discriminate against Muslims.

9.2 Philosophical Worldviews

KEY CONSTRUCT

1. Diverse worldviews influence and impact how we experience the world.

3.17 Does happiness give life meaning or is it something different?

Section A: Key Vocabulary

1. **Philosophy** — the pursuit of knowledge about life and the world.
2. **Science** — the pursuit of facts and evidence to explain things.
3. **Truth** — that which is accepted as infallible, undeniable and accurate by all.
4. **Trust** — believing something to be reliable, true or accurate.
5. **Happiness** — feeling contentment or pleasure.

Section B: Component Knowledge

1. There are six main worldviews; nihilist, spiritual postmodernist, humanist optimist, theistic believer, eastern worldview and rational agnostic.
2. There are four main forms of knowledge; scientific, historical, spiritual and moral.
3. The meaning of life refers to things that give a person a sense of identity, belonging, success or happiness.
4. Religious scripture is viewed as either God-breathed or God-inspired which gives it authority.
5. Philosophy seeks to answer big questions such as 'what is the meaning of life?'.

Section C: Core Content

A) Worldviews

Six Worldviews (how people make sense of the world around them)

⇒ **Rational agnostic**—willing to say they don't know what gives life meaning.

⇒ **Nihilist**—believes in nothing and sees no purpose or meaning to life.

⇒ **Theistic believer**—sees God and/or religion as a source of meaning in life.

⇒ **Humanist Optimist**—takes life as it comes and hopes for a meaning to life.

⇒ **Spiritual post-modernist**— relies on personal experiences to give life meaning.

⇒ **Eastern worldview**—sees life as part of a great mysterious, but purposeful cycle.

Plato's Cave Allegory

⇒ This story is a **metaphor** for life. A group of **prisoners** are chained in a **cave** their whole life only ever seeing **shadows** on a wall which are created by other people holding up statues of living things. One day one of the prisoners leaves the cave and sees the **real world**—all the creatures he saw as shadows are now in front of him. The prisoner realises that the life he knew was a lie and goes back to the cave to tell the others; some are too **scared** of reality and choose to stay in the cave; others want to **experience** the real world for themselves and venture out; and some try to attack him because they think he is mad/dishonest.

B) Knowledge

⇒ **Four types of knowledge**: **Scientific** (what science tells us), **Historical** (what history tells us), **Spiritual/Religious** (what religions tell us) and **Moral** (what our instincts tell us).

⇒ **Science and religion are both sources of wisdom and authority** and because of this there is a long history of **conflict** between the two communities.

⇒ **Scientific knowledge relies on experiments** (where you try something out to see the effect it has) and **observations** (looking for patterns which make things occur a certain way) to gain knowledge.

⇒ **Religious knowledge relies on information passed onto humans through divine intervention**; this could be through studying a **holy text, angels/divine beings, visions or religious experiences** (seeing God/enlightenment).

C) Truth

Scripture

⇒ Holy texts—referred to as ***scripture***—contain the truth about life and the universe.

⇒ Some believers say **''all scripture is God-breathed''** meaning the information in their holy texts comes directly from God. Others believe it is **'God-inspired'** - meaning the people who wrote it were inspired by God but wrote in their own words and context.

Philosophers (truth seekers)

⇒ Some key philosophers are **Socrates, Plato, Simone De Beauvoir, Ludwig Wittgenstein**. Philosophers can be **religious or non-religious**.

⇒ Philosophers repeatedly question the **nature of truth** and **whether truth actually exists**.

9.3 A Study of Christianity

KEY CONSTRUCT

2. Beliefs and teachings form the basis of organised religions.

3.6 Why and how should Christians accept Jesus as their saviour?

Section A: Key Vocabulary

1. **Salvation** — to be saved from hell and/or sin.
2. **Incarnation** — to be born in flesh form
3. **Parable** — a story told by Jesus to teach a lesson or deliver a message.
4. **Crucifixion** — to die on the cross; the image of Jesus dying for humanity.
5. **Sacrament**—an outward display of God's blessing.

Section B: Component Knowledge

1. Jesus was God incarnate (flesh) sent to experience and guide humanity onto the right path.
2. Jesus believed it is important to put others first and so sacrificed himself so others can know God.
3. 'I am the way the truth and the life. No-one comes to the Father except through me'.
4. Religious rituals and ceremonies such as sacraments enable Christians to become closer to God.
5. Christians believe that if they earn it God will save them from Hell, this is called salvation.

Section C: Core Content

A) The way (salvation)

⇒ Christianity is represented by the **symbol** of the cross and Christians today wear **crucifix'** to remember the **sacrifice** Jesus made and to **inspire them to sacrifice for others** too.

⇒ The crucifixion is important because **Jesus took with him the sins humans have committed**, which gives anyone who **believes in Jesus/God a fresh start and a chance at getting to Heaven**.

⇒ Jesus is called a **martyr** because he died for the benefit of others.

⇒ Jesus told his followers that **''I am the way, the truth and the life. No-one comes to the Father except through me''.**

⇒ If Christians follow the 'way' of Jesus they can **reach Heaven and be with God the Father for eternity.** Jesus is a **bridge between earthly life and heavenly life.**

⇒ The Bible says **'For God so loved the world that he gave his only Son, so that those who believe in him will not perish but have eternal life' John 3:16.**

B) The truth (incarnation)

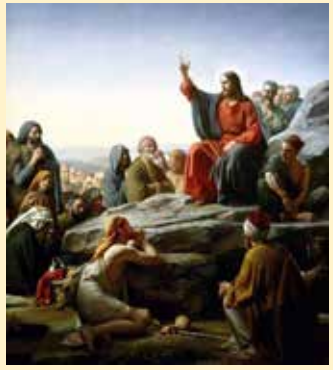
⇒ Jesus us referred to as **'God incarnate' = God in flesh.** Therefore he is both **human <u>and</u> God.**

⇒ Accounts of Jesus birth (nativity) are found in **Matthew and Luke's Gospels** in the New Testament in the Bible.

⇒ Key features are: **Mary (virgin mother), Joseph (carpenter father), Bethlehem, important visitors (shepherds/wise men), Angel Gabriel).**

⇒ From the start of his life Jesus had a **mission**—to **gather followers and guide them back onto the right path.**

C) The life (how to live)



⇒ The are **seven significant rituals** a Christian may perform during their life to **celebrate and strengthen their connection with God**. Catholics call them **SACRAMENTS**.

⇒ **The 7 sacraments are: Baptism, Confirmation, Eucharist, Marriage, Holy Orders, Confession, Anointing the sick.**

⇒ **Baptism begins a person's journey to salvation**; it can be done at any time in a persons life; many Christian parents baptise their children—this is called **Christening**.

⇒ **Marriage** is a ceremony which joins two people together in a romantic way for their rest of their lives; Christians believe that **God witnesses the promises** they make to each other during the ceremony; **'what God has brought together let no-one tear apart'.**

⇒ Christians are expected to follow the **teachings and example of Jesus**. Among others they must 'Treat others as you wish to be treated'.

⇒ Jesus was a **pacifist**, which means he did not believe in using violence and would avoid conflict. Christians should therefore do the same.

9.4 Evil and Suffering

KEY CONSTRUCT

4. Sources of authority are interpreted for wisdom and guidance.

To what extent does religion impact a person's perspective?

Section A: Key Vocabulary

1. **Evil** — that which causes suffering, harm or disorder.
2. **Suffering** — distress or pain; can be physical, emotional or psychological.
3. **Aid** — help which is sent when others need it, particularly after a disaster.
4. **Justice** — creating a balance between right and wrong to create a fair society.
5. **Forgiveness** —to pardon someone who causes evil or suffering.

Section B: Component Knowledge

1. Evil can be moral (caused by humans) or natural (caused by nature).
2. Some people believe evil exists to test the faith and character of humans.
3. Religions encourage followers to help people who are suffering.
4. Justice means that people who do wrong must be punished to maintain a fair society.
5. Some people believe that forgiveness is better than punishment.

Section C: Core Content

A) Evil

⇒ **MORAL EVIL** - caused by human; could be directly or indirectly. Examples of moral evil are **violence, war, crime, prejudice/discrimination, abuse and murder**.

⇒ **NATURAL EVIL** - caused by natural forces. Examples of natural evil are **illness, diseases and natural disasters.**

⇒ Christianity teaches that **evil and suffering can make their faith stronger** and give them a better understanding of God. They often refer to the **Story of Job** who's life was destroyed by God to prove that faith is the most important thing in life.

⇒ In the 3rd Century a philosopher called **Epicurus** said **the fact evil and suffering exists proves that either; God must not exist; or is not as 'good' (omnibenevolent) and powerful (omnipotent) as people think He is.**

B) Suffering & Aid

⇒ Suffering can occur in many ways; **physical, emotional and psychological (mentally).** Examples include **physical pain, sadness, loneliness, loss, sickness and poverty.**

⇒ **Short-term aid** is when you send emergency supplies like **medical goods, temporary shelters, food and water).**

⇒ **Long-term aid** is when a country, region or community are assisted in rebuilding infrastructure like **roads, hospitals, schools, waterways, sanitation and housing**.

⇒ Aid is usually provided through **charities such as UNICEF, Oxfam, The Red Cross, Salvation Army, Islamic Relief and Khalsa Aid.**

C) Punishment v Forgiveness

⇒ Society says that when a person commits a crime they should be punished. This is known as **justice**.

⇒ There are different forms of punishment, some are more widely supported than others. Some **forms of punishment include fines, community service, prison and in some countries death penalty.**

⇒ Many people believe in **forgiveness as the most important part of justice**.

⇒ Christians are told to forgive people **''70x7''** - this is a metaphor for an infinite number of times.

⇒ **Nelson Mandela** (a famous African human rights campaigner who was wrongfully imprisoned for 27 years) once wrote **'Resentment is like drinking poison and then hoping it will kill your enemies'.**

⇒ **Mohandas K. Gandhi** (an Indian campaigner for equality) said **'an eye for an eye makes the whole world blind'.**

9.5 21st Century Ethics

KEY CONSTRUCT

5. Moral and ethical issues are influenced by religious and non-religious beliefs.

To what extent does religion impact a person's perspective?

Section A: Key Vocabulary

1. **Rights** — basic human entitlements outlined in the Declaration of Human Rights.
2. **Equality** — all people having the same rights, opportunities and status.
3. **Prejudice** — pre-judging a person or group of people.
4. **Discrimination** — treating a person or group of people negatively due to a prejudice.
5. **Liberation** — to release from oppression or confinement.

Section B: Component Knowledge

1. Human Rights states that everyone is entitled to a life of good quality, free from oppression and mistreatment.
2. A person's identity relates to their name, age, gender, sexuality, religion and worldview.
3. Forms of prejudice include racism, sexism, ageism, ableism and stereotyping.
4. Liberation Theology is using Christian teachings to improve the lives of minority groups.
5. Religious practices and beliefs impact a person's identity.

Section C: Core Content

A) Identity

⇒ Identity refers to what you believe about yourself—aspects of a persons identity include **name, age, gender, ethnicity, genetics, relationships, physical image, personality traits, sexuality, morality and worldview.**

⇒ Religion impacts identity by giving them a **community to belong to**; a **set of rules to follow**; **rituals and acts to perform**; **clothing and food rules**; **morals and values to live up to**.

⇒ Hindus and Buddhists believe that your identity is only temporary because your soul goes to another person after you die, therefore everything that made you you is left behind.

B) Quality and Value of Life

⇒ The **Declaration of Human Rights** is a list of **30 articles/statements** about how people should be treated. Some of the most significant are: **The right to freedom, equality, quality of life (food, water, shelter), education, heath-care and religion.**

⇒ The **Quality of Life** argument states that all people should be **entitled** to a life which is of good quality. This affects how people feel about their **health, wealth and general happiness**.

⇒ The **Value of Life** argument states that **all lives are valuable**.

⇒ Many **religious teachings** reflect Human Rights; **''treat others are you want to be treated'' ''do not steal'' ''do not kill''** (Christianity) **''if you save one person it is as if you save the whole world''** (Islam) **''the greatest good for the greatest number''** (Humanism)

C) Prejudice & Discrimination

⇒ Prejudice and discrimination can be based on a person's: **race, ethnicity, religion, gender, sexuality, age, ability/disability, wealth, job, lifestyle, political/social affiliations, education or looks**.

Racial Prejudice and Discrimination (Racism)

⇒ A **race** can be defined as a group of people who share a certain **distinctive physical attribute**; this could be **skin colour or other physical appearances**.

⇒ People like **Martin Luther King Jnr, Desmond Tutu** and **Malala** have fought against racism. Campaigns such as **Black Lives Matter** and **Show Racism the Red Card** aim to raise awareness of how to stop racism. High-profile incidents such as the murders of **George Floyd** and **Steven Lawrence** push for social and political reform.

Liberation Theology

⇒ **Liberation Theology** started in **South America** where there were/are high levels of **poverty**. The cause states that the Bible **'should be read and experienced from the perspective of the poor and marginalised'**.

⇒ Liberation Theologians believe that Jesus came to earth to **''preach good news to the poor...proclaim freedom for the prisoners...release the oppressed...''.**

⇒ Liberation Theology campaign for churches to change their views on minority groups—**today this could include women and members of the LGBTQIA+ community**.

Knowledge Organiser – 4.1.1 Cell Biology

4.1.1 Cell Structure

4.1.1.1. Eukaryotes & Prokaryotes:

Eukaryotic (plant, animal & fungal cells).

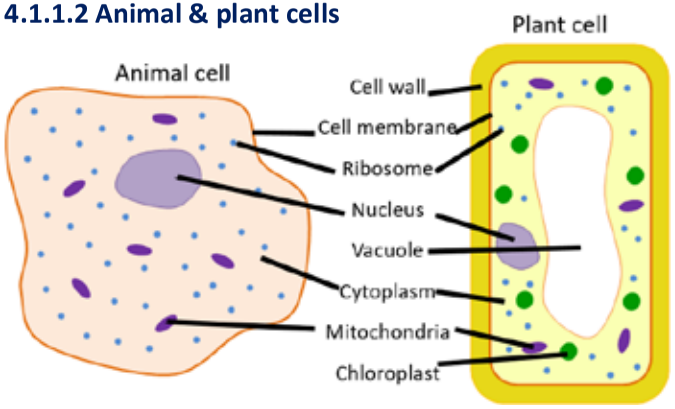
- Cell membrane
- Cytoplasm
- Genetic material enclosed in membrane

Prokaryotic (bacteria and archaea)

- smaller with no true nucleus.
- No mitochondria or chloroplasts.
- DNA loops called plasmids
- Bacteria are prokaryotes.

4.1.1.2	Definitions
eukaryotic	A type of cell that has a nucleus.
prokaryotic cell	A simple cell that does not have a nucleus – the DNA is free in the cytoplasm.
mitochondria	Structures in the cytoplasm of all cells where aerobic respiration takes place
ribosome	The site of protein synthesis.
sub-cellular	Structures smaller than a cell that are found within it.
tissue	A group of similar cells that carry out the same function, eg muscle tissue.
Nucleus	Contains the cell's genetic materials
Cell membrane	Controls the movement of substances in and out of the cell
Cytoplasm	where many chemical reactions take place
Chloroplasts	where photosynthesis occurs
Vacuole	Filled with cell sap to help support the plant
Cell wall	made of cellulose to strengthen the cell.

4.1.1.2 Animal & plant cells



You must be able to label the animal and plant cells

Sub-cellular structures:

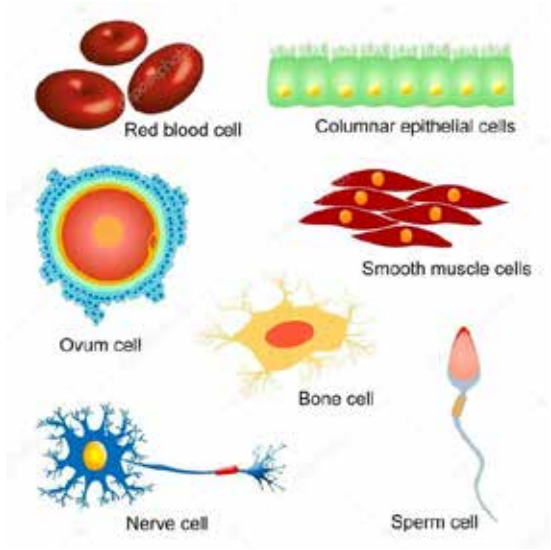
Most animal cells have the following

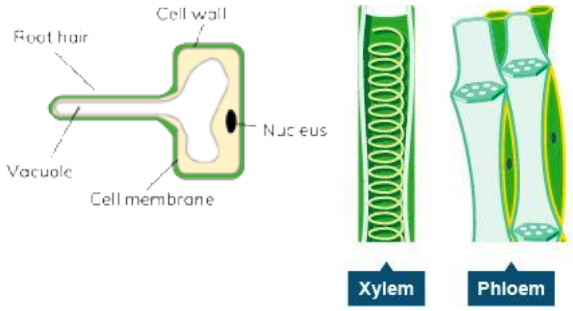
- **nucleus**
- **cytoplasm**
- **a cell membrane**
- **mitochondria**
- **ribosomes.**

In addition to the parts found in animal cells, plant cells often have:

- **chloroplasts**
- a permanent **vacuole** filled with cell sap.
- Plant and algal cells also have a **cell wall made of cellulose**, which strengthens the cell

4.1.1.3. Cell specialisation:

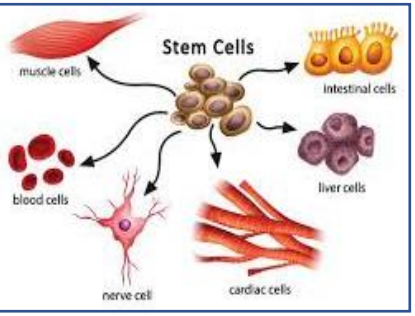




4.1.1.4 Cell differentiation

As an organism develops, cells differentiate to form different types of cells.

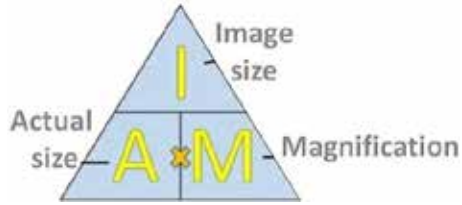
- Most types of animal cell differentiate at an early stage.
- Many types of plant cells retain the ability to differentiate throughout life.



4.1.1.5 Microscopy

Electron microscope

- has much **higher magnification** and **resolving power** than a light microscope.
- Can be used to **study cells in much finer detail.**
- Enabled biologists to see and **understand many more sub-cellular structures**.



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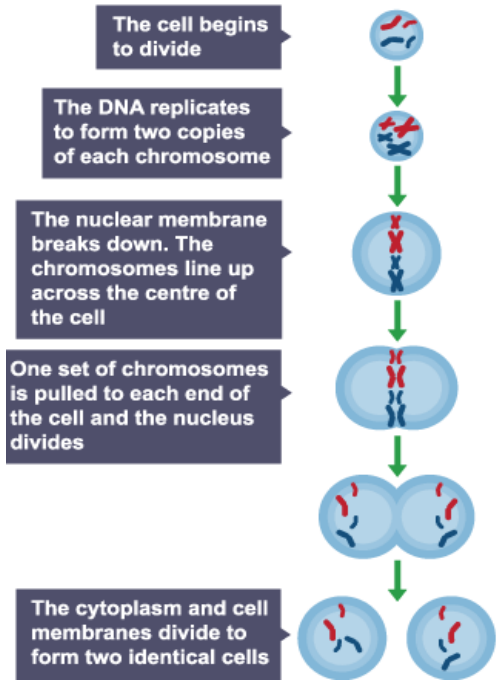
Knowledge Organiser – 4.1.2 Cell Biology

4.1.2 Cell Division : MITOSIS

- The nucleus of a cell contains **chromosomes** made of **DNA** molecules.
- Each chromosome carries a large number of **genes**.
- In body cells the chromosomes are **normally found in pairs**.
- **Mitosis** is **cell division for growth & repair**.
- 2 genetically identical daughter cells are formed.

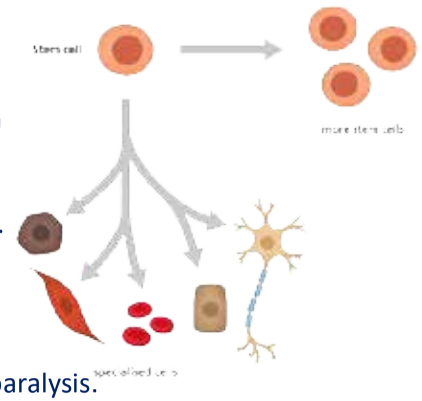


4.1.2.3 Stem cells - Plants

- **Meristem tissue** in plants can **differentiate into any type of plant cell**, throughout the life of the plant.
- can be used to **produce clones** of plants quickly and economically and to prevent extinction.
- **Crop plants** with special features such as disease resistance can be cloned to produce large numbers of identical plants for farmers.

4.1.2.3 Stem cells - animals

- A **stem cell is an undifferentiated cell of an organism** which is capable of giving rise to cells of any type.
- **Stem cells from human embryos can be cloned** and made to **differentiate into most** types of human cells.
- **Stem cells from adult bone marrow** can form many types of cells including **blood cells.**

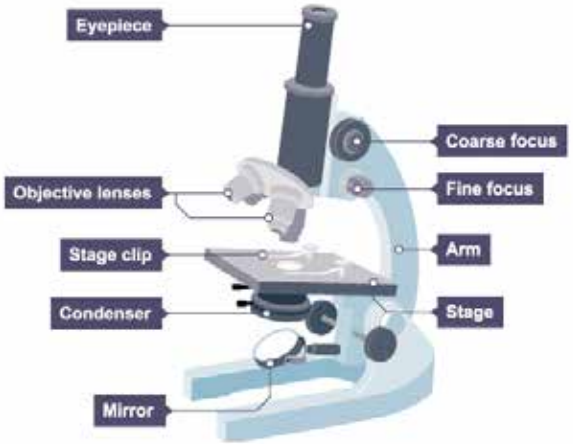


Treatment with stem cells

- may be able to help conditions such as diabetes and paralysis.
- In **therapeutic cloning** an embryo is produced with the same genes as the patient. Stem cells from the embryo are not rejected by the patient's body so they may be used for medical treatment.
- The use of stem cells has potential risks such as transfer of viral infection, and some people have ethical or religious objections.

RPA: Microscopy	Definitions
calibrate	To set an instrument or scale against a standard.
field of view	The area seen when looking through a microscope.
graticule	The graticule has a scale ruled on it and is used to estimate the size of a specimen when viewed with a microscope.
magnification	The amount that an image of something is scaled up when viewed through a microscope.
order of magnitude	For each order of magnitude, a number is ten times the previous one.
resolution	The fineness of detail that can be seen in an image - the higher the resolution of an image, the more detail it holds.
significant figure	Giving a number to a specified number of significant figures is a method of rounding. E.g., in the number 7483, the most significant, or important, figure is 7, as its value is 7000. To give 7483 correct to one significant figure (1 sf), would be 7000. To 2 sf, it would be 7500.
stage micrometer	A glass slide with a scale etched on it. It is used to calibrate the eyepiece graticule of a microscope.
standard form	A system in which numbers are written as a number greater than 1 and less than 10 multiplied by a power of 10 (either positive or negative.)

Required practical activity: use a light microscope to observe, draw and label a selection of plant and animal cells.
A magnification scale must be included



Knowledge Organiser – 4.1.3 Transport in Cells

4.1.3.1 Diffusion

Substances may move into and out of cells across the cell membranes via diffusion.

- Diffusion is the spreading out of the particles of any substance in solution, or particles of a gas, resulting in **a net movement from an area of higher concentration to an area of lower concentration**.

Some of the substances transported in and out of cells by diffusion are:

- **oxygen** and **carbon dioxide** in gas exchange,
- waste product **urea** from cells into the blood plasma for excretion in the kidney.

Factors which affect the rate of diffusion are:

- the difference in concentrations (**concentration gradient)**
- the **temperature**
- the **surface area** of the membrane.

The effectiveness of an exchange surface is increased by:

- having a **large surface area**
- a membrane that is **thin** to provide a short diffusion path
- (in animals) having an **efficient blood supply**
- (in animals, for gaseous exchange) being **ventilated**.

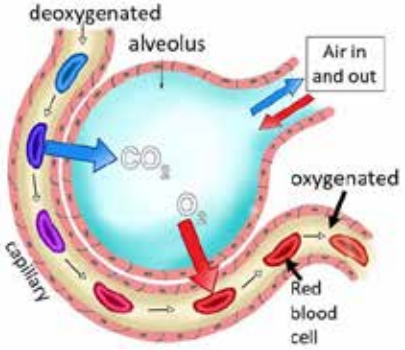
4.1.3.1 Diffusion - examples

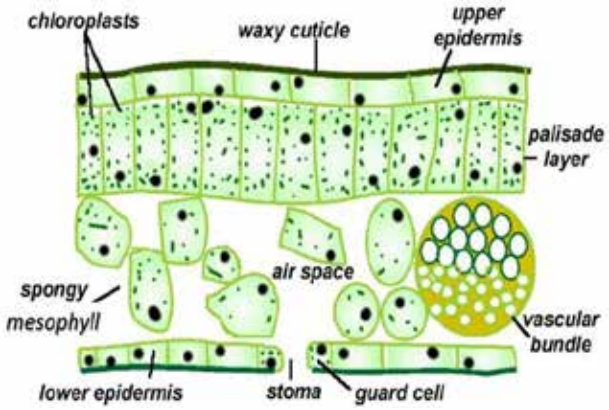
Single-celled organisms have a **large surface area to volume ratio**, allowing sufficient transport of molecules in and out of the cell.

Multicellular organisms have a **relatively small surface area to volume ratio** so they **need specialised exchange surfaces** and a transport system:

- Large surface area
- Thin membranes for a short diffusion path
- Efficient blood supply (animals)
- Being ventilated (animals)

Gas exchange in the alveoli

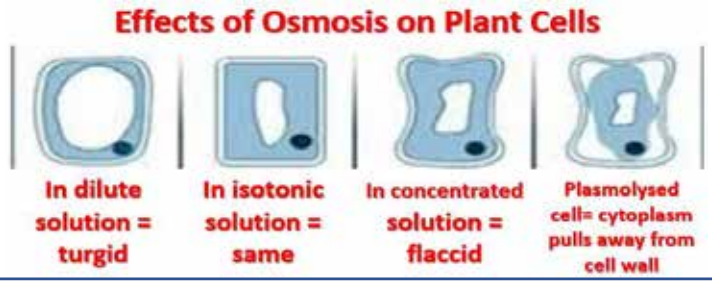




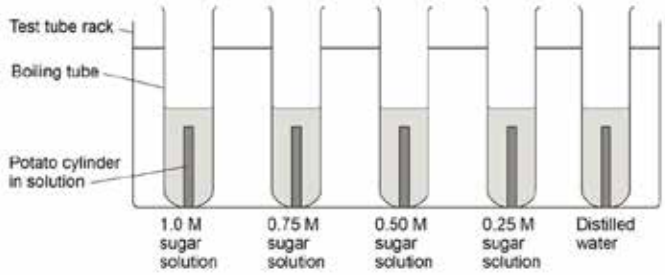
CO_2 diffuses from high concentration in the air space to a low concentration inside the mesophyll cells

4.1.3.2 Osmosis

Osmosis is the **diffusion of water from a dilute solution** to a **concentrated solution** through a partially permeable membrane.



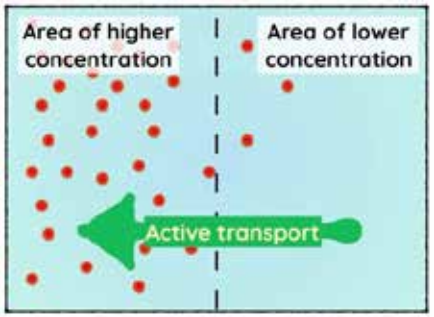
RPA: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue



4.1.3.3 Active Transport

Is the movement of substances from a more dilute to a more concentrated solution (against the concentration gradient).
It needs ENERGY from respiration.
for respiration.

Eg 1- **Mineral ions** absorbed **into root hair cells** from very dilute solutions in the soil.
Eg 2- **Sugar molecules** absorbed **from the gut** (lower concentration) into the blood for respiration.



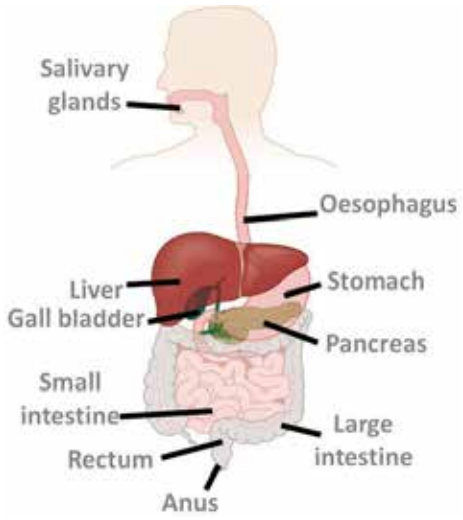
Knowledge Organiser – 4.2 Organisation

4.2.1 Principles of organisation

4.2.1	Definitions
Cells	The basic building blocks of all living organisms. Eg. Muscle, skin, nerve, root hair and palisade leaf cells
Tissue	A group of cells with a similar structure and function (job). Eg. Muscle, heart, xylem and epidermal tissue
Organs	A group of tissues performing a specific function. Eg. Heart, liver, brain, roots, stem, leaf & flower
Organ systems	Groups of organs working together to form an organism. Eg. circulatory, nervous & transpiration systems
Digestive system	Organ system in which several organs work together to digest & absorb food.

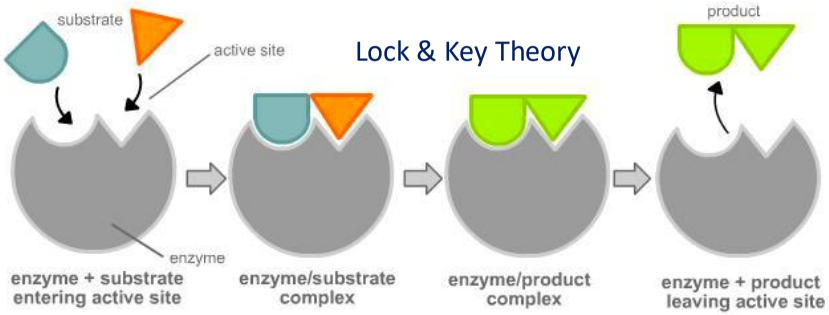
4.2.2 Animal tissues, organs and organ systems

4.2.2.1 The human digestive system



Enzyme	Produced	Nutrients acted upon	Products (smaller molecules)	Optimum pH & temperature
Carbohydrase Eg. Amylase	Salivary glands	Carbohydrate Eg. starch	Simple sugars Eg. glucose	pH7 37°C
Protease	Stomach, pancreas	Protein	Amino acids	pH2 37°C
Lipase	Pancreas, small intestine	Lipid (fats & oils)	Glycerol & fatty acids	pH8 37°C

Enzymes are **biological catalysts** that breakdown food into small, soluble molecules that can be absorbed into the bloodstream from the digestive system.



Denature. If the optimum conditions are not correct for an enzyme, it loses it's shape and cannot attach to the substrate (nutrient molecule). It is "denatured".

bile	Made in the liver, stored in gall bladder. Emulsifies fats to for digestion and neutralises stomach acid.
carbohydrate	Food consisting of sugars, starch and cellulose. Carbohydrates are vital for energy in humans and are stored as fat if eaten in excess.
digestion	The breakdown of large insoluble food molecules to smaller soluble ones.
digestive system	Organ system involved in breaking food down so that it can be absorbed into the bloodstream.
egestion	The process of passing out the remains of food that has not been digested, as faeces, through the anus.
emulsify	To mix water with lipids to produce a cloudy mixture called an emulsion.
fats	Naturally occurring compounds of carbon, hydrogen and oxygen. They are esters made from fatty acids and glycerol.
fatty acids	Carboxylic acids with a long chain of carbon atoms. Fatty acids react with glycerol to produce lipids (fats and oils).
gall bladder	Stores bile before releasing it into the duodenum.
glucose	A simple sugar used by cells for respiration.
glycogen	Animals store glucose as glycogen in their liver and muscle tissues.
gut	The digestive system.
lipid	Fat or oils, composed of fatty acids and glycerol.
liver	The large organ, beside the stomach, which has many functions, including processing substances absorbed by the digestive system and a role in the storage of the body's carbohydrate.
metabolism	All the chemical reactions in the cells of an organism, including respiration.
microvilli	Projections from the surface of an epithelial cell of the small intestine wall.
pancreas	Large gland located in the abdomen near the stomach which produces digestive enzymes and the hormone insulin.
protein	Organic compound made up of amino acid molecules. Proteins are needed by the body for cell growth and repair.
starch	A type of carbohydrate. Plants can turn the glucose produced in photosynthesis into starch for storage
sugar	A simple carbohydrate that is sweet to the taste.
villi	Finger-like projections in the small intestine that provide a large surface area for the absorption of food.

Knowledge Organiser – 4.2 Organisation

RPA: investigate the effect of pH on the rate of reaction of amylase on starch

Amylase breaks down starch. Starch turns blue/black when iodine (an orange solution) is added.

- Starch solution (CV)
- Amylase solution (CV)
- Buffer solutions of different pH (**IV**)
- Spotting tiles
- Test tubes
- Water bath (temp CV)
- Iodine solution
- Stop clock

DV is the time at which the starch/ amylase solution no longer turns blue/black.

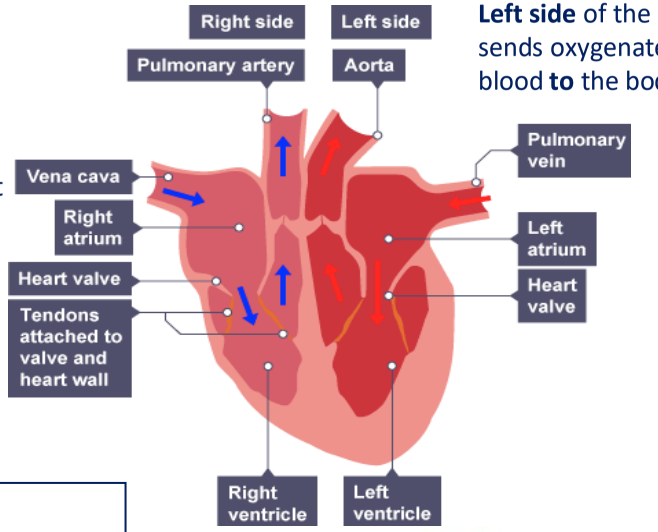
RPA: use qualitative reagents to test for carbohydrates (starch and glucose), proteins and lipids

Food group	Reagent	Positive result
Glucose	Benedict's solution (heated) 	Bright blue to orange/ brick red 
Protein	Biuret's solution 	Bright blue to lilac 
Starch	Iodine solution 	Orange to blue/ black 
Lipid (Fat/oil)	Ethanol & water 	Clear to Milky/ cloudy 

4.2.2.2 The heart and blood vessels

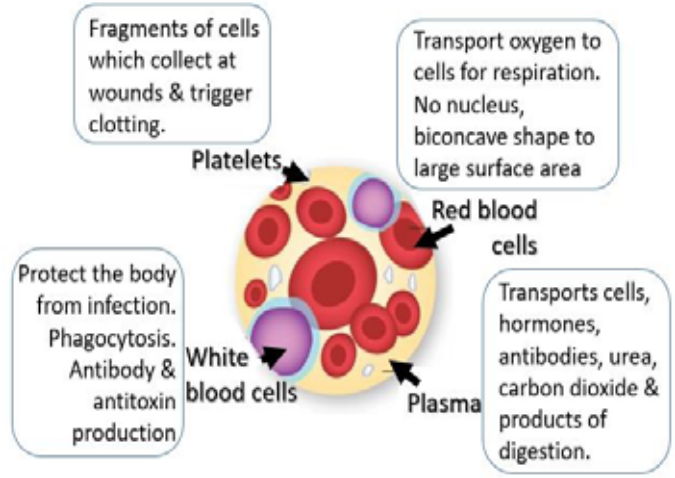
Right side of the heart receives deoxygenated blood **from** the body and pumps it to the lungs.

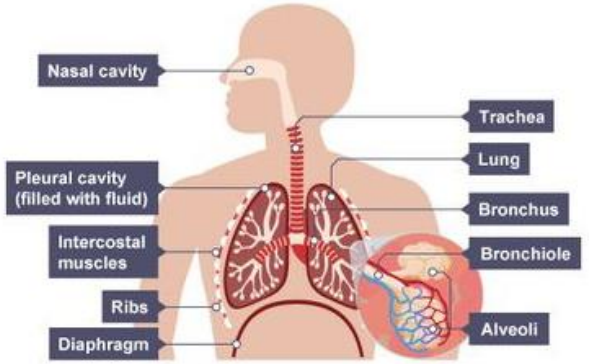
Pacemaker
Group of cells in the right atrium that control resting heart rate.



Left side of the heart sends oxygenated blood **to** the body.

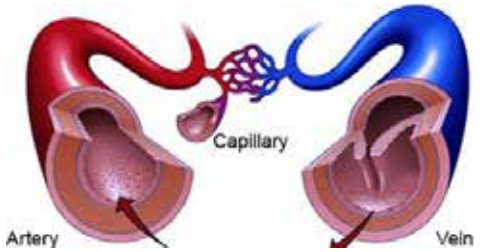
4.2.2.2 The heart and blood vessels





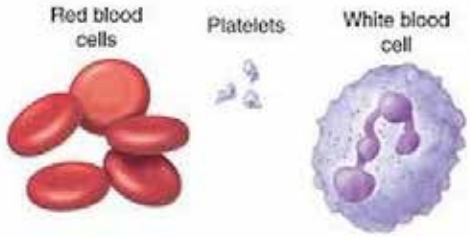
4.2.2.3 Blood

- Blood away from heart
- Thick muscular wall
- Small lumen
- Under high pressure



- Blood towards from heart
- Thinner wall
- Large lumen
- Under low pressure

4.2.2.3 Blood



Blood is a tissue consisting of plasma containing red blood cells, white blood cells and platelets

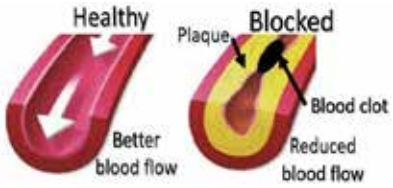
Knowledge Organiser – 4.2 Organisation

4.2.2.4 Coronary heart disease: a non-communicable disease

- **Coronary heart disease** layers of fatty material build up inside the coronary arteries, narrowing them.
- Reduces the flow of blood through the coronary arteries, resulting in a lack of oxygen for the heart muscle.
- Stents are used to keep the coronary arteries open.
- Statins are widely used to reduce blood cholesterol levels which slows down the rate of fatty material deposit.

- **Heart valves may become faulty**, preventing the valve from opening fully, or the heart valve might develop a leak.
- Faulty heart valves can be replaced using biological or mechanical valves.

- **Heart Transplants**: the case of heart failure a donor heart, or heart and lungs can be transplanted.
- Artificial hearts are occasionally used to keep patients alive whilst waiting for a heart transplant, or the heart to rest as an aid to recovery.



4.2.2.5 Health issues & types of disease

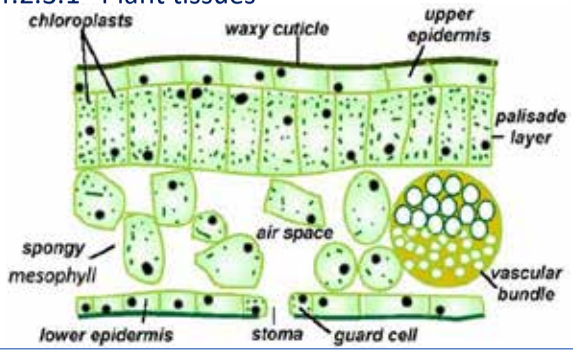
communicable, can be transferred from one organism to another, e.g. measles, food poisoning and malaria
non-communicable, which are not transferred between people or other organisms, e.g.

- **cancer**
- **diabetes**
- **genetic diseases** and conditions
- heart disease
- neurological disorders

Other factors that can effect physical and mental health include:

- **diet**
- **lifestyle factors** such as alcohol and other drugs
- **stress**
- situations that may occur in a person's life

4.2.3.1 Plant tissues



Epidermis	Covers outer leaf surface for protection
Palisade mesophyll	Main site for photosynthesis. Many chloroplasts
Spongy mesophyll	Air spaces between cells allow gases to diffuse

4.2.2.6 lifestyle on non-communicable disease

Risk factors are linked to increased rate of a disease.
aspects of a person's lifestyle

- substances in the body or environment.
- The effects of diet, smoking and exercise on cardiovascular disease.
- Obesity as a risk factor for Type 2 diabetes.
- The effect of alcohol on liver & brain function.
- Effect of smoking on lung disease & lung cancer.
- Effects of smoking & alcohol on unborn babies.
- Carcinogens, including ionising radiation, as risk factors in cancer.

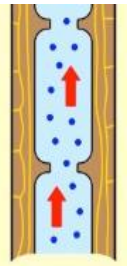
4.2.2.7 Cancer

Benign tumours are abnormal cell growths contained in one area, **usually within a membrane**. They do not invade other parts of the body.
Malignant tumour cells are cancers. Invade neighbouring tissues and **spread to different parts of the body** where they form secondary tumours.

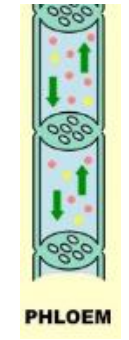
4.2.3.2 Plant organ system

Roots, stem, leaves form plant transport organ system.

- **Root hair cells** are adapted for the efficient uptake of water by osmosis, and mineral ions by active transport.

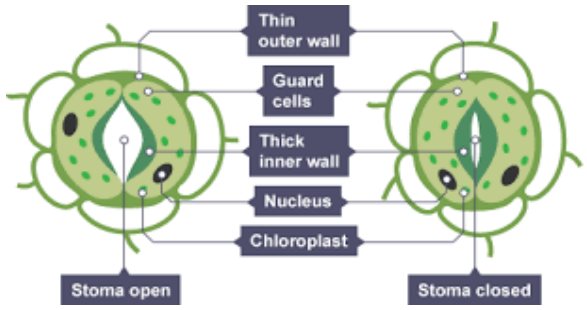


- **Xylem tissue** transports water and mineral ions from the roots to the stems and leaves.
- Made of hollow tubes strengthened by **lignin** adapted for the transport of water in the **transpiration** stream.



- **Phloem tissue** transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage. This transport is called **translocation**.
- **Phloem** is composed of tubes of elongated cells. **Cell sap can move from one phloem cell to the next through pores in the end walls**.

- **Stomata** and **guard cells** control gas exchange and water loss.



Knowledge Organiser – 4.3 Infection and response

4.3.1.1 Communicable (infectious) diseases

Pathogens are microorganisms that cause infectious disease.

Pathogens may be **viruses**, **bacteria**, **protists** or **fungi**.

- They may infect plants or animals and can be spread by direct contact, by water or by air.
- Bacteria and viruses may reproduce rapidly inside the body.
- Bacteria may produce poisons (toxins) that damage tissues and make us feel ill.
- Viruses live and reproduce inside cells, causing cell damage. Viruses are not considered to be living organisms.

Pathogen	Example in animals	Example in plants	Treatment
Viruses	Measles, HIV potentially leading to AIDS	Tobacco mosaic virus	Vaccination
Bacteria	Salmonella Gonorrhoea	Agrobacterium	Antibiotics
Fungi	Athlete's foot	Rose black spot	Anti fungal medication & Fungicides.
Protists	Malaria (Spread by mosquitos)	Downy mildew	Anti malarial drugs, prevention from vector contact eg mosquito nets

Tobacco mosaic virus

Rose Black Spot

Downy mildew

4.3.1.2 Viral diseases

Measles is a **viral disease**

- Symptoms: fever and a red skin rash.
- Measles can be fatal if complications arise.
- Most young children are vaccinated against measles.
- The measles virus is spread by inhalation of droplets from sneezes and coughs.

HIV initially causes a flu-like illness.

- Unless successfully controlled with antiretroviral drugs the virus attacks the body's immune cells.
- Late stage HIV infection, or AIDS, occurs when the body's immune system becomes so badly damaged it can no longer deal with other infections or cancers.
- HIV is spread by sexual contact or exchange of body fluids such as blood which occurs when drug users share needles.

Tobacco mosaic virus (TMV) is a widespread plant pathogen

- Affecting many species of plants including tomatoes.
- Symptoms: Gives a distinctive 'mosaic' pattern of discolouration on the leaves which affects the growth of the plant due to lack of photosynthesis.

4.3.1.3 Bacterial diseases

Salmonella food poisoning

- Spread by bacteria ingested in food, or on food prepared in unhygienic conditions.
- In the UK, poultry are vaccinated against salmonella to control the spread.
- Symptoms: Fever, abdominal cramps, vomiting and diarrhoea are caused by the bacteria and the toxins they secrete.

Gonorrhoea is a sexually transmitted disease (STD)

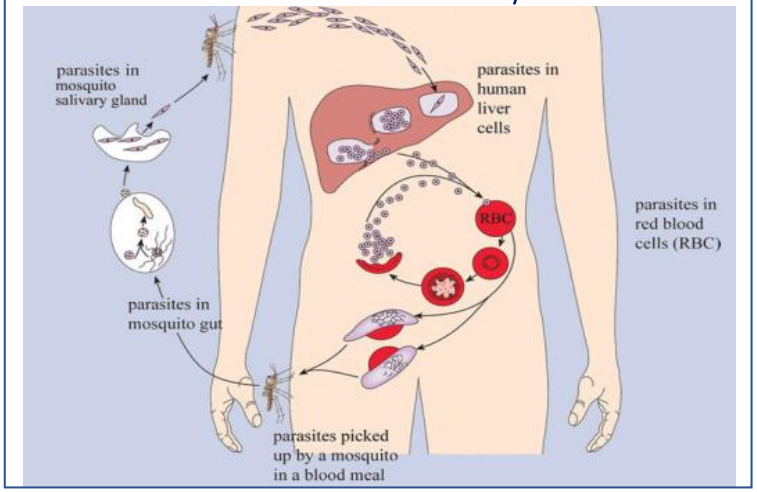
- Symptoms: thick yellow or green discharge from the vagina or penis and pain on urinating.
- Was easily treated with the antibiotic penicillin until many **resistant strains appeared**.
- Spread by sexual contact.
- The spread can be controlled by treatment with antibiotics or the use of a barrier method of contraception such as a condom.

4.3.1.4 Fungal diseases

Rose black spot is a fungal disease

- Symptoms: purple or black spots develop on leaves, which often turn yellow and drop early.
- It affects the growth of the plant as photosynthesis is reduced.
- It is spread in the environment by water or wind. Rose black spot can be treated by using fungicides and/or removing and destroying the affected leaves.

4.3.1.5 Protist diseases : Malaria Life Cycle



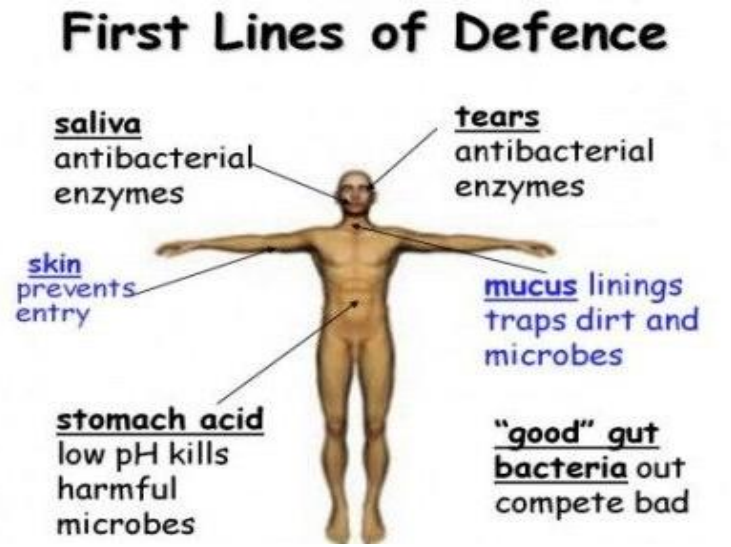
Knowledge Organiser – 4.3.1.6 Human defence systems

4.3.1.6 Human defence systems

Humans have a variety of **specific** and **non specific** Human defences against invading pathogens.

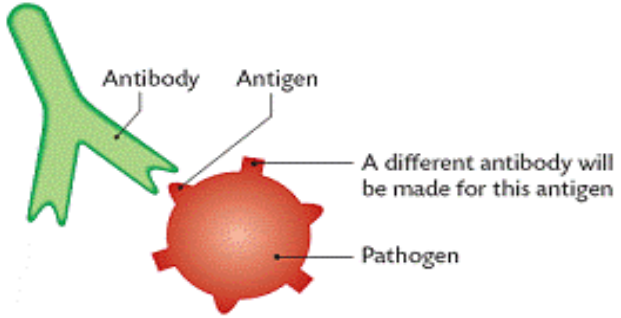
Non-specific:
Skin (physical barrier)
Nose (mucus)
Trachea and bronchi (cilia)
Stomach (acid)

Specific via white blood cells
Phagocytosis
Antibodies
Antitoxins



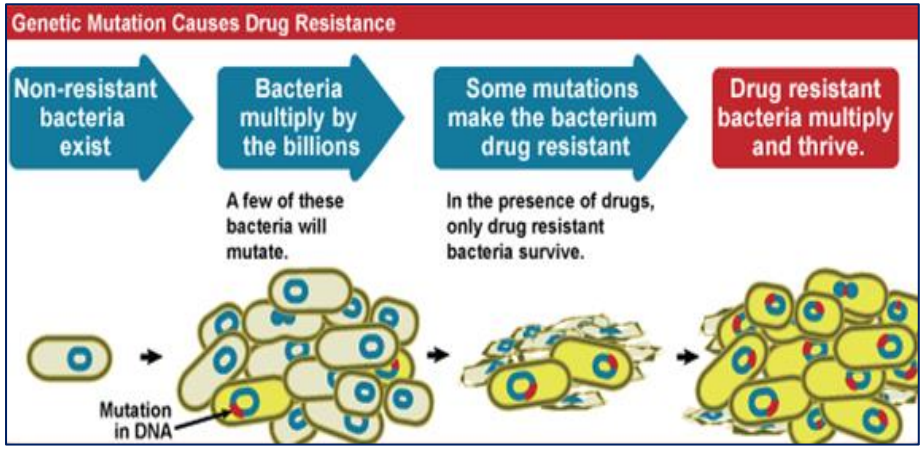
4.3.1.7 Vaccination

- Introducing small **quantities of dead or inactive pathogens** to **stimulate antibody production**.
- This leads to a quicker response in future infections.



4.3.1.8 Antibiotics and pain killers

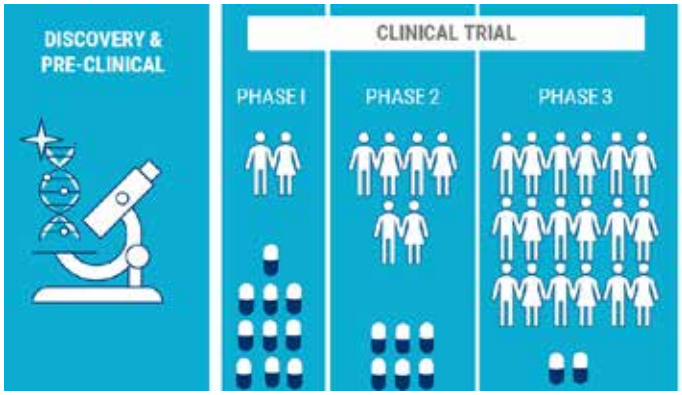
- **Antibiotics**, such as **penicillin**, are medicines that help to cure bacterial disease by killing infective bacteria inside the body.
- Specific bacteria should be treated by specific antibiotics
- **Emergence of antibiotic resistant bacteria** is of great concern.
- **Antibiotics CANNOT kill viral pathogens**
- Painkillers and other drugs are used to treat the symptoms of disease, but do not kill pathogens.



4.3.1.9 Discovery and development of drugs

Have traditionally been extracted from Plants and microorganisms.
Digitalis – Foxgloves
Aspirin – Willow
Penicillin – Penicillium mould

- Most new drugs are **synthesised by chemists** in pharmaceutical industry
- New drugs have to be **tested** and **trialled** before use to check they are **safe and effective**.
- New drugs tested for **toxicity, efficacy and dose**



Clinical trials use healthy volunteers and patients.

- Very low doses of the drug are given at the start of the clinical trial.
- If the drug is found to be safe, further clinical trials are carried out to find the optimum dose for the drug.
- In double blind trials, some patients are given a placebo

Knowledge Organiser – 4.4 Bioenergetics

4.4.1 Photosynthetic reaction

- Captures light energy from the sun and uses it to produce chemical potential energy
- transfer of light energy to chemical potential energy in cells
- **endothermic** reaction.
- Trapped by chlorophyll in chloroplasts

The reaction can be shown in these equations:

carbon dioxide + water $\xrightarrow{\text{light}}$ glucose + oxygen

$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

Key Terms	Photosynthesis Definitions
Photosynthesis	The endothermic reaction that transfers light energy to chemical potential energy. In it, simple molecules (CO2 and H2O) are converted into more complex molecules (glucose) that can be used for food.
Nitrates	Ions containing nitrogen and oxygen. These are found in the soil; plants need nitrates to produce amino acids.
Rate	As always, rate means how quickly something happens.
Light intensity	The amount/strength of light. Use this term instead of 'amount of light'.
Chlorophyll	The green pigment in leaves that absorbs light for photosynthesis. Chlorophyll is found in chloroplasts.

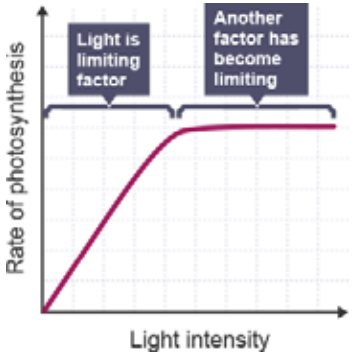
4.4.1.3 Uses of glucose from photosynthesis

- Used in <u>respiration</u> in the cells of the plant/algae
- Converted into insoluble **starch** for <u>storage</u>.
- Produces **fats or oils (lipids)** for <u>storage</u>. Eg Nuts & seeds
- Used to produce **cellulose**, which strengthens the cell wall.
- Used to produce **amino acids**, to <u>synthesise proteins</u>. To produce amino acids, plants also require **nitrates** from the soil.

4.4.1.2 Rate of Photosynthesis

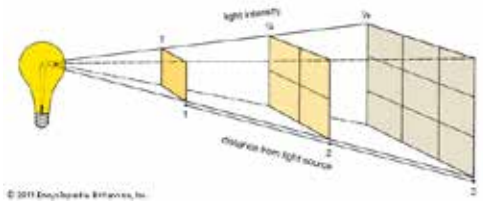
The following factors affect the rate of photosynthesis:

- **Temperature**: because all chemical reactions speed up as the temperature increases. As photosynthesis is controlled by enzymes which are affected by temperature



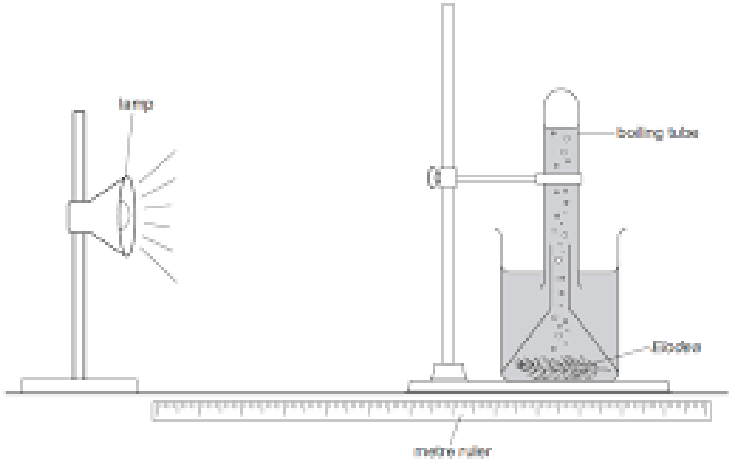
- **Carbon dioxide concentration**: the higher the concentration of CO2 in the air, the more is available for photosynthesis, so the rate increases as concentration increases.
- **Light intensity**: as the equation shows, photosynthesis requires light energy. So, the higher the light intensity, the higher the rate of photosynthesis.

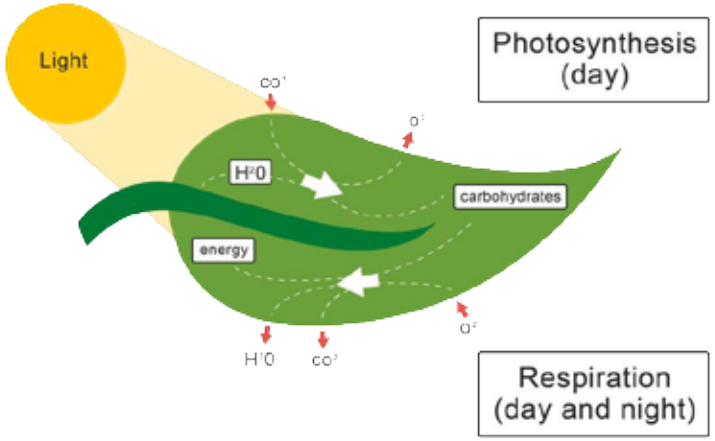
$$\text{light intensity} = \frac{}{distance\ from\ source2}$$



- **Amount of chlorophyll**: more chlorophyll means more light can be absorbed.

RPA: investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.





Knowledge Organiser – 4.4 Bioenergetics

4.4.2 Respiration

- the chemical potential energy stored in food molecules is released through **oxidation** reactions
- The energy released allows living cells to do **work including:**.
  - Chemical reactions to build larger molecules from smaller ones
  - Movement.
  - Keeping warm.
- There are two types of respiration: **aerobic** and **anaerobic**.

4.4.2.1 Aerobic and anaerobic respiration

Aerobic respiration occurs when oxygen is used in the reaction

glucose + oxygen → carbon dioxide + water

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

aerobic respiration releases much more energy than anaerobic respiration.

Anaerobic respiration occurs when there is insufficient oxygen available for complete oxidation of the glucose.

The reaction differs depending on the organism

In *animals:* glucose → lactic acid

In *plants* and *yeast*: glucose → ethanol and carbon dioxide

$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

In yeast, anaerobic respiration is called fermentation. Used for:

- making bread (the CO2 makes it rise)
- making alcoholic drinks (since ethanol is a type of alcohol).

4.4.2.2 Response to exercise

During exercise, more energy is required by the body than when resting, due to increased muscle contractions.

The body reacts to this increased **demand** for energy:

- **heart rate**, **breathing rate**, and **volume of each breath** all **increase**.
- these **increase the amount of oxygenated blood** reaching the muscles.
- oxygenated blood provides the **extra oxygen and glucose** needed for **respiration in muscle cells**, to transfer more energy to meet demand.

If insufficient oxygen reaches muscles but exercise continues, the muscle cells use **anaerobic respiration** to transfer energy.

- incomplete oxidation of glucose takes place
- **lactic acid** is produced which is a poison
- lactic acid builds up and causes an **oxygen debt** causing **fatigue**.
- breathing deeply after exercise repays the oxygen debt.

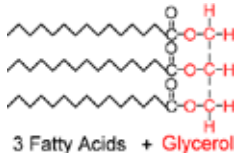
4.4.2.3 Metabolism

Metabolism is the sum of ALL the chemical reactions happening in a cell or in the whole body.

- Metabolism relies on energy transferred by respiration.
- chemical reactions in cells are controlled by enzymes.
- Reactants are used to make products: new molecules are synthesised.

metabolism includes these reactions:

- Conversion of glucose to glycogen (animals), or to starch or cellulose (plants).
- Formation of lipid (fat) molecules from one molecule of glycerol and three molecules of fatty acids
- In plants, the use of glucose and nitrate ions to make amino acids. These amino acids are then used to synthesise proteins.
- Respiration, both aerobic and anaerobic.
- Breaking down excess proteins into urea for excretion



4.4.2.2 Response to exercise (HT)

HT: oxygen debt is the amount of extra oxygen needed to react with lactic acid in muscles and remove it from cells.

- The blood flow through muscles removes lactic acid and transports it to the liver to be converted back into glucose.

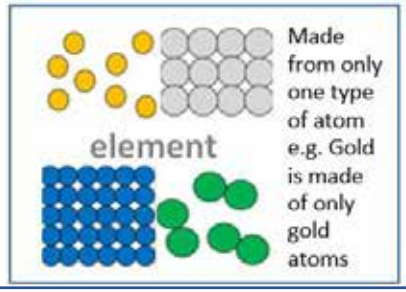
Key Terms	Respiration Definitions
Aerobic	Using oxygen
Anaerobic	Not using oxygen
Oxidation	A reaction with oxygen. In this case, food molecules like glucose reacting with oxygen.
Fatigue	Tiredness. Fatigue in muscles is caused by a build-up of lactic acid, which is produced during anaerobic respiration (when there is insufficient oxygen).
Oxygen debt	After exercise, the lactic acid has built up and caused an extra need for oxygen – called the oxygen debt.
Lactic acid	Chemical produced by the incomplete oxidation of glucose (anaerobic respiration).

Key Terms	Metabolism Definitions
Metabolism	The sum of all the chemical reactions in a cell or in the body of an organism.
Enzyme	Large protein molecule that acts as a biological catalyst, dramatically speeding up chemical reactions in organisms.

Knowledge Organiser – 5.1 Atomic structure & the periodic table

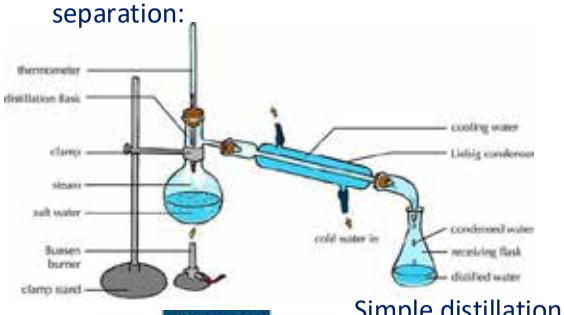
5.1.1.1 Atoms, elements & compounds

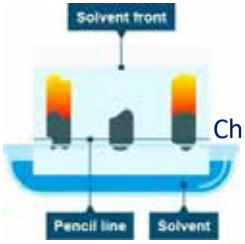
An **Atom** is the **smallest part of an element that can exist.**

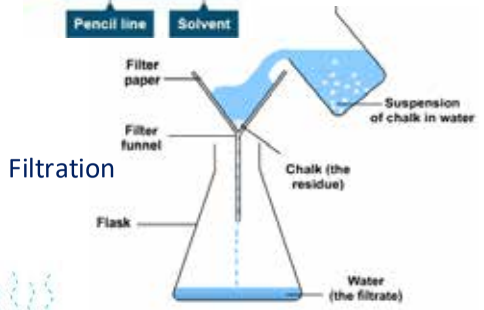


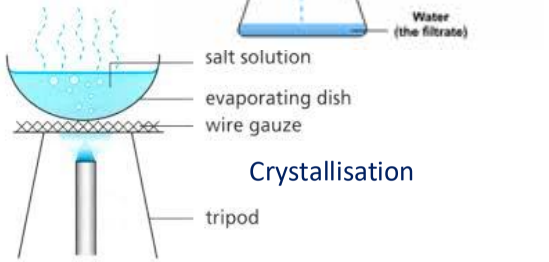
5.1.1.2 Mixtures

- Mixtures can be **separated by physical processes** such as **filtration, crystallisation, simple distillation, fractional distillation & chromatography.**
- These physical processes **do not involve chemical reactions** and **no new substances are made.**
- Examples of the specified processes of separation:



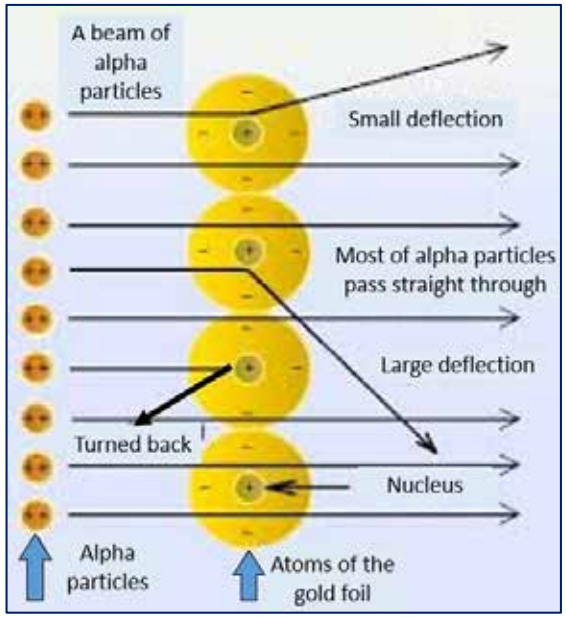






5.1.1.3 The development of the model of the atom

Ideas about atoms have changed over time. Scientists developed new atomic **models** as they gathered new experimental evidence.

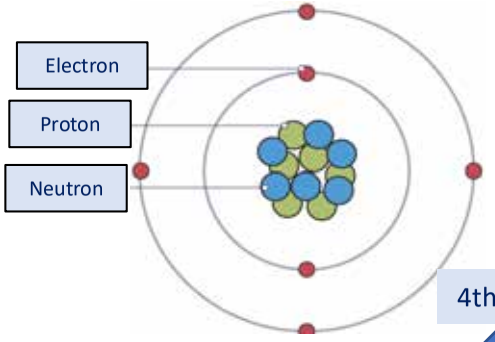


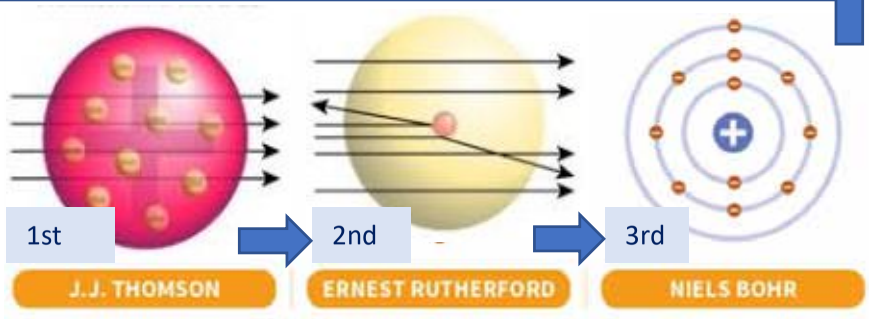
Ernest Rutherford's Gold scattering experiment

- **Positive alpha particles** fired at gold leaf
- **Most passed straight through** suggesting the atom was mainly empty space
- **Some deflected at angles** suggesting the presence of electrons
- **Some bounced straight back** suggesting a positive nucleus repelled the alpha particles.

The Nuclear Model

In 1932 James Chadwick found evidence for the existence of particles in the nucleus with mass but no charge.
These particles are called **neutrons.**
This atomic model is still used today.





1904- **electron** discovered, placed in a sphere of positive charge (the **plum pudding model**)

1911 - gold scattering experiment discovered mass was concentrated in a central positive **nucleus** (the nuclear model)- further experiments led to discovery of **protons**

1913 - Suggested electrons orbit the nucleus in **shells.** The shells are at certain distances from the nucleus.

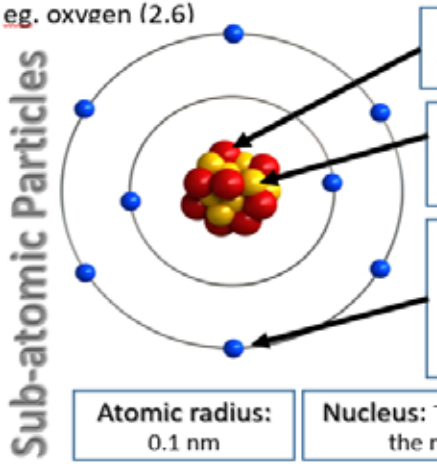
4th

Knowledge Organiser – 5.1 Atomic structure & the periodic table

5.1.1.4 Relative electrical charges of subatomic particles & 5.1.1.7 Electron structure

Innermost, lowest energy level, **shell** has **2 electrons**.
Next shell 8, next shell 8. (2,8,8)

Electronic structure an be shown as a diagram or a number
eg. oxygen (2.6)



Proton: Positive subatomic particle in the nucleus. Relative mass 1, charge +1

Neutron: Neutral subatomic particle in the nucleus. Relative mass 1, Charge 0 (no charge)

Electron: Negative subatomic particle orbiting the nucleus. Very small relative mass. Charge -1. Can be represented by dots or crosses

Atomic radius: 0.1 nm

Nucleus: The centre of an atom in which most of the mass of the atom is concentrated

5.1.1.5 Size and mass of atoms

- Atoms are **very small**, having a radius of about 0.1 nm (1 x 10-10 m).
- Atomic mass number: The sum (total) of the protons and neutrons in the nucleus of an atom of an element.
- Atomic (Proton) number: The number of protons in an atom of an element. Balanced by number of electrons in an atom of that element. (so atoms have no overall charge).

Name of particle	Relative mass
Proton	1
Neutron	1
Electron	Very small

12
C
carbon
6

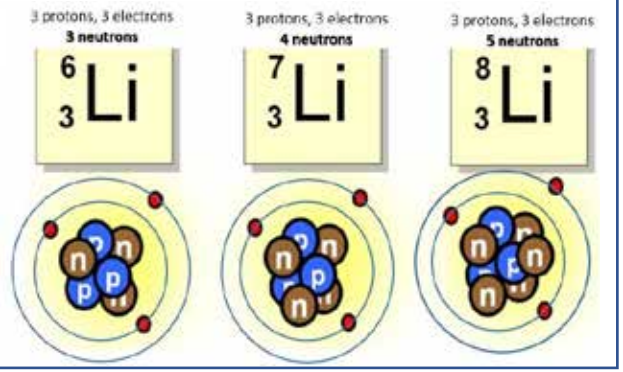
5.1.2.2 Development of the periodic table

- Early versions organized by atomic mass
- Didn't take account of isotopes
- Many elements missing
- Mendeleev ordered elements by atomic (proton) number
- Left gaps for undiscovered elements. Later discoveries proved him right.

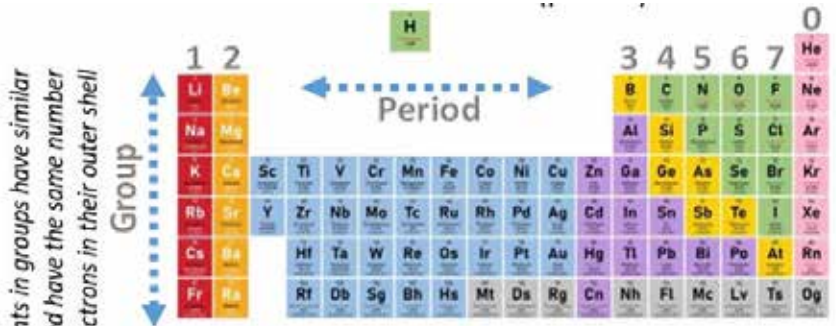
5.1.1.6 Relative atomic mass

Isotopes are atoms of the same element with **different numbers of neutrons** in the nucleus.

Relative atomic mass: Average value that takes account of the **abundance** of the different isotopes of that element.



5.1.2 Periodic Table **Shows the ~100 known elements in order of atomic (proton) number**



Group 1: Alkali Metals 1 electron on the outer shell. Reactivity INCREASES going down the group. Vigorous reactions with oxygen, chlorine and water.

Group 7: Halogens 7 electrons on the outer shell. Non-metals. Exist as diatomic (2 atoms) molecules. Reactivity decreases going down the group.

Group 0: Noble Gases Have full outer shells so stable and unreactive. Boiling points increase going down the group.

5.1.2.3 Metals & Non-metals

Elements that react to form positive ions are **metals**.

VS

Elements that do NOT form positive ions are **non-metals.**

Metals	Non-metals
Good conductors of heat and electricity	Bad conductors of heat and electricity
Malleable: can be beaten into thin sheets, hammered into shape	Brittle: breaks easily if solid
Ductile: can be stretched into wires	Non-ductile: snap easily
Shiny (lustre)	Dull

Knowledge Organiser – 5.2 Structure & bonding

5.2.1.1 Chemical bonds

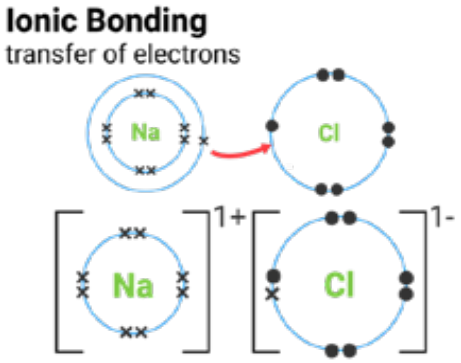
There are three types of strong chemical bonds: ionic, covalent and metallic.

Ionic bonding: particles are oppositely charged ions. Ionic bonding occurs in compounds formed from metals combined with non-metals

Covalent bonding the particles are atoms which share pairs of electrons. Covalent bonding occurs in most non-metallic elements and in compounds of non-metals

Metallic bonding the particles are atoms which share delocalised electrons. Metallic bonding occurs in metallic elements and alloys.

5.2.1.2 Ionic Bonding



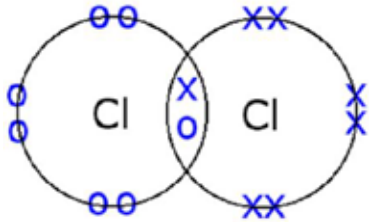
- Between a metal atom and a non-metal atom
- Metals lose electrons to form positive ions
- Non-metals gain electrons & form negative ions
- Electrons **transferred** (**ions** formed)
- Strong **electrostatic** forces
- Giant **lattice** structures
- High melting/boiling points
- If **molten** or in **solution** ions will conduct electricity

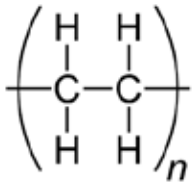
5.2.1.3 Ionic compounds

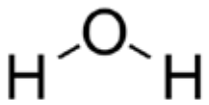
- An ionic compound is a **giant structure of ions**.
- Ionic compounds are held together by **strong electrostatic forces of attraction** between oppositely charged ions.

5.2.1.4 Covalent Bonding

Sharing electrons







- Between two non-metal atoms
- Electrons are **shared**
- A **covalent** bond is one pair of shared electrons
- Covalent bonds are ALWAYS STRONG

5.2.2.1. The three states of matter

- **Freezing** take place at the **melting point**
- **Boiling** and **condensing** take place at the **boiling point**.
- **Particle theory** can help to explain melting, boiling, freezing and condensing.
- The **amount of energy needed to change state** from solid to liquid and from liquid to gas **depends on the strength of the forces** between the particles of the substance.
- **The stronger the forces between the particles the higher the melting point and boiling point of the substance**.

5.2.2.4 Properties of Small molecules

- Usually **gases or liquids** with **low melting point & low boiling point.**
- Weak **intermolecular** forces (because they are small molecules) which are overcome when substance melts or boils.
- e.g. gases, water
- Do not conduct electricity as no overall electric charge.

5.2.2.5 Polymers

- **Long** molecules with atoms linked by **strong covalent bonds**.
- Solid at room temperature as **relatively strong intermolecular forces.**
- **Repeating** units
  e.g. plastics

5.2.2.6 Giant covalent structures

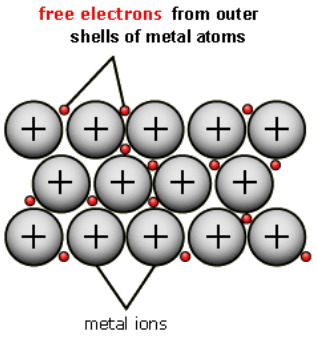
Giant lattices

- High melting point and boiling point
- Strong covalent bonds which must be overcome to melt or boil.
- e.g. silicon dioxide, diamond, graphite

Knowledge Organiser – 5.2 Structure & bonding

5.2.1.5 Metallic Bonding

- Bonding between atoms of a metal
- **Delocalised** electrons (negative) & metal ions (positive)
- Shared delocalised electrons form strong metallic bonds
- Delocalised electrons **conduct** heat and electricity



- Pure metals are soft: layers of atoms can slide over each other

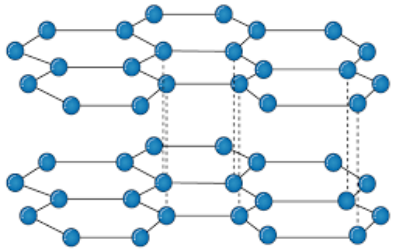
5.2.2.7 Properties of metals and alloys

- Metals have **giant structures of atoms** with **strong metallic bonding**. Therefore most metals have **high melting and boiling points.**
- In **pure metals, atoms are arranged in layers**, which allows metals to be **bent and shaped**. (malleable)
- **Pure metals** are too soft for many uses and so **are mixed with other metals to make alloys which are harder**.
- In **alloys**, different atoms **disrupt** the layers
- Alloys are **harder** than pure metals

5.2.2.8 Metals as conductors

- Metals are **good conductors of electricity** because the **delocalised electrons** in the metal **carry electrical charge** through the metal.

5.2.3 Structure & bonding of carbon

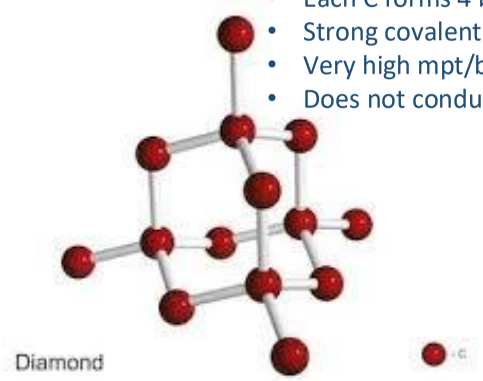


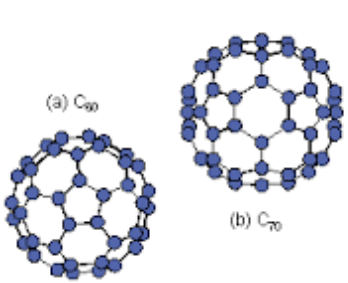
Graphite

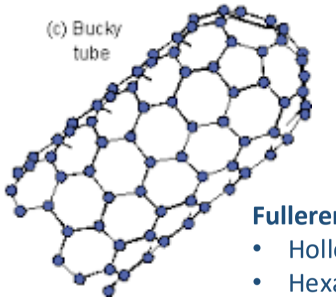
- Giant lattice (in layers)
- Each C forms 3 bonds
- Layers of hexagonal rings with no bonds between layers
- Giving 1 delocalised electron
- Good conductor

Diamond: Giant lattice

- Each C forms 4 bonds
- Strong covalent bonds
- Very high mpt/bpt
- Does not conduct electricity

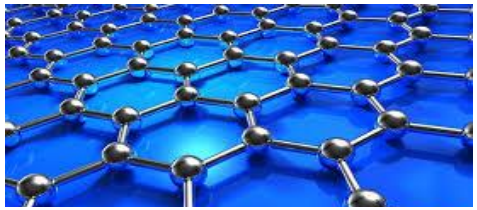






Fullerenes

- Hollow shapes
- Hexagonal rings, but may also contain rings of 5 or 7 Cs
- Buckminsterfullerene (C_{60}) spherical.
- Carbon nanotubes are cylindrical. Very useful for nanotechnology, electronics



Graphene

- A single layer of graphite

Knowledge Organiser – 5.3 Quantitative Chemistry

5.3.1.1 Conservation of mass and balanced chemical equations

Reacting masses

In all chemical reactions the **total mass of reactants used is equal to the total mass of the product**s made: Reactants ⟶ Products

5.3.1.2 Relative Formula Mass (M_r)

Relative atomic mass

Different atoms have different masses.

Atoms have such a small mass it is more convenient to know their masses compared to each other.

Carbon is taken as the standard atom and has a relative atomic mass (A_r) of 12.

Relative formula mass

To find the relative formula mass (M_r) of a compound, you just add together the A_r values for all the atoms in its formula.

Example 1:

Find the M_r of carbon monoxide (CO).

The A_r of carbon is 12 and the A_r of oxygen is 16

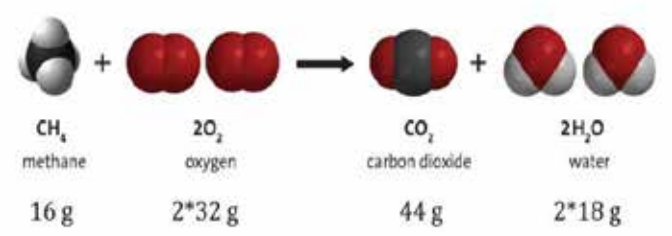
So the M_r of carbon monoxide is 12 + 16 = 28.

Example 2:

Find the M_r of carbon dioxide (CO2)

The A_r of carbon is 12 and the A_r of oxygen is 16, but there are 2 atoms of oxygen in the formula.

So the M_r of Carbon dioxide is 12 + 16 + 16 = 44



Mass of reactants (80g) Mass of products (80g)

5.3.1.3 Mass change when a reactant or product is a gas

Apparent loss of gain in mass when a **gas** is a product or reactant and is **gained** or **released** to the atmosphere in an **non-enclosed system**.

5.3.1.4 Chemical Measurements

Measurements have uncertainty.

You need to be able to look at the range of measurements about the mean (average) as a measure of uncertainty.

5.3.2.5 Limiting reactants (HT only)

- In a chemical reaction involving two reactants, it is common to use an excess of one of the reactants to ensure that all of the other reactant is used.
- The **reactant that is completely used up** is called the **limiting reactant** because it limits the amount of products.

5.3.2 Amounts of substances in relation to masses of pure substances (HT only)

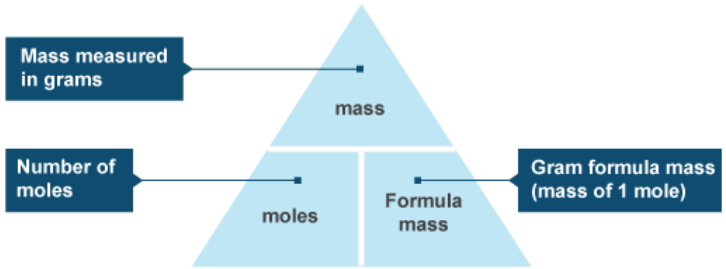
The Mole:

- The unit for amount of substance is called the **mole**, shown as **mol**. One mole of atoms, *ions* or *molecules* is around 6×10^{23} (6 followed by 23 zeroes). This is called Avogadro constant.
- This is the same number as the number of carbon atoms in 12 g of carbon.

This equation shows how **molar mass**, **number of moles** and **mass** are related:

number of moles = mass ÷ molar mass

This can be rearranged to find the mass if the number of moles and molar mass are known, or to find the molar mass if the mass and number of moles are known.



Finding the number of moles

Example

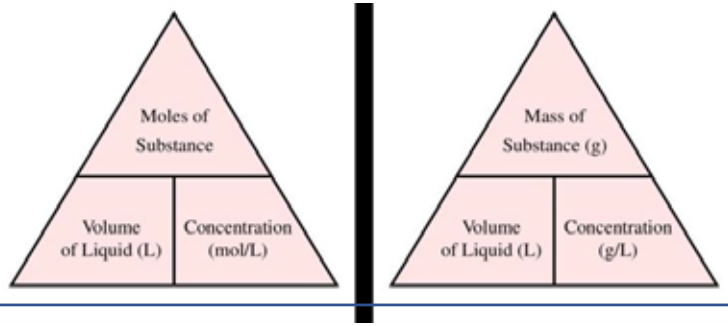
What is the number of moles of carbon dioxide molecules in 22 g of CO2?

A_r of C = 12, A_r of O = 16

The relative formula mass M_r of carbon dioxide = 12 + 16 + 16 = 44

This means that the molar mass of carbon dioxide = 44 g/mol

number of moles = 22 ÷ 44 = 0.5 mol



Knowledge Organiser – 5.3 Quantitative Chemistry

Spec	Question	Answer
5.3.1.1	What is the law of conservation of mass?	The law of conservation of mass states that no atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants.
5.3.1.1	What does the conservation of mass mean in terms of chemical reactions?	This means that chemical reactions can be represented by symbol equations which are balanced in terms of the numbers of atoms of each element involved on both sides of the equation.
5.3.1.2	What is the relative formula mass (Mr) of a compound?	The relative formula mass (Mr) of a compound is the sum of the relative atomic masses of the atoms in the numbers shown in the formula
5.3.1.2	What happens to the sum of the relative formula masses of the reactants & products?	The sum of the relative formula masses of the reactants in the quantities shown equals the sum of the relative formula masses of the products in the quantities shown.
5.3.1.3	How can we explain a change in mass?	This can usually be explained because a reactant or product is a gas and its mass has not been taken into account.
5.3.1.3	Give 2 examples of reactions where there appears to be a change in mass	• when a metal reacts with oxygen the mass of the oxide produced is greater than the mass of the metal • thermal decompositions of metal carbonates carbon dioxide is produced and escapes into the atmosphere leaving the metal oxide as the only solid product.
5.3.1.4	When there is uncertainty about a result, what 2 things should you do?	• represent the distribution of results and make estimations of uncertainty • use the range of a set of measurements about the mean as a measure of uncertainty.
5.3.2.1	What are chemical amounts measured in and what is its unit?	Chemical amounts are measured in moles. The symbol for the unit mole is mol.

Spec	Question	Answer
5.3.2.1 HT	What is the mass of one mole equal to?	The mass of one mole of a substance in grams is numerically equal to its relative formula mass. One mole of a substance contains the same number of the stated particles, atoms, molecules or ions as one mole of any other substance.
5.3.2.1 HT	What is Avogadros number, including its value?	The number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is 6.02×10^{23} per mole
5.3.2.2 HT	How many moles of reactants and products in: Mg + 2HCl MgCl2 + H2	one mole of magnesium reacts with two moles of hydrochloric acid to produce one mole of magnesium chloride and one mole of hydrogen gas.
5.3.2.3 HT	How are the balancing numbers in a symbol equation calculated?	The balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses in grams to amounts in moles and converting the numbers of moles to simple whole number ratios.
5.3.2.4 HT	What is a limiting reactant and how does the limiting reactant affect the amount of products produced?	The reactant that is completely used up is called the limiting reactant because it limits the amount of products. The effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams.
5.3.2.5 HT	How is the concentration of a solution measured?	The concentration of a solution can be measured in mass per given volume of solution, eg grams per dm3 (g/dm3).
5.3.3.1 HT	Why is it not always possible to obtain the calculated amount of product?	• the reaction may not go to completion because it is reversible • some of the product may be lost when it is separated • some of the reactants may react in ways different to the expected reaction.
5.3.3.1 HT	How do you calculate percentage yield?	$\% \text{ Yield} = \frac{\text{Mass of product actually made}}{\text{Maximum theoretical mass of product}} \times 100$
5.3.3.2 HT	How is percentage atom economy calculated?	The percentage atom economy of a reaction is calculated using the balanced equation for the reaction as follows: $= \frac{\text{Relative formula mass of desired product from equation}}{\text{Sum of relative formula masses of all reactants from equation}} \times 100$
5.3.4 HT	What information do you need to calculate the concentration of a soln?	If the volumes of two solutions that react completely are known and the concentration of one solution is known, the concentration of the other solution can be calculated.
5.3.5 HT	What is the volume of one mole of any gas at room temp and pressure?	. The volume of one mole of any gas at room temperature and pressure (20oC and 1 atmosphere pressure) is 24 dm3

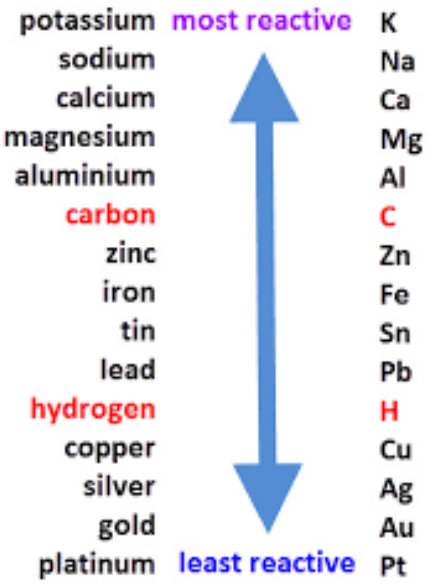
Knowledge Organiser – 5.4 Chemical Changes

5.4.1 Reactivity of metals

Metals react with oxygen to produce **metal oxides**.
The reactions are **oxidation reactions because the metals gain oxygen**.

5.4.1.2 The reactivity series

- When metals react with other substances the metal atoms form positive ions.
- The reactivity of a metal is related to its tendency to form positive ions.
- Metals can be arranged in order of their reactivity in a reactivity series.
- The metals potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper can be put in order of their reactivity from their reactions with water and dilute acids.
- A more reactive metal can displace a less reactive metal from a compound.

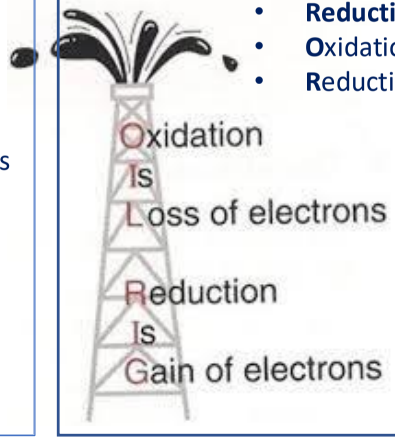


5.4.1.3 Extraction of metals and reduction

- **Unreactive** metals are found as pure elements (eg gold) but most are compounds.
- Those below carbon can be **extracted** from oxides using carbon.
- Those above carbon need to be extracted using **electrolysis**.

5.4.1.4 Oxidation and reduction in terms of electrons (HT only)

- **Oxidation** involves gain of oxygen
- **Reduction** involves loss of oxygen
- **O**xidation **I**s **L**oss of electrons
- **R**eduction **I**s **G**ain of electrons



5.4.2.1 Reactions of acids with metals

Acids react with some metals to produce salts and hydrogen.

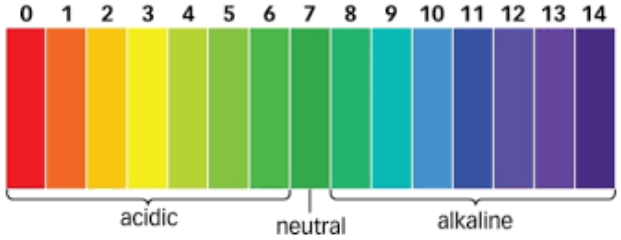
acid + metal ⟶ salt + hydrogen
acid + alkali ⟶ salt + water
acid + carbonate ⟶ salt + water + carbon dioxide

HCl - hydrochloric acid produces chlorides
HNO_3 - nitric acid produces nitrates
H_2SO_4 - sulfuric acid produces sulfates

(HT only)
- explain in terms of gain or loss of electrons, these are redox reactions
- identify which species are oxidised and which are reduced in given chemical equations.

5.4.2.2 Neutralisation of acids and salt production

- Acids are neutralised by alkalis (eg soluble metal hydroxides) and bases (eg insoluble metal hydroxides and metal oxides)



5.4.2.4. The pH scale and neutralisation

- **Acids produce hydrogen ions (H+)** in aqueous solutions.
- Aqueous **solutions of alkalis contain hydroxide ions (OH–).**
- The **pH scale**, from 0 to 14, is a measure of the **acidity** or **alkalinity** of a solution, and can be measured using **universal indicator** or a **pH probe**.
- A solution with pH 7 is neutral.
- In **neutralisation reactions** between an acid and an alkali, **hydrogen ions react with hydroxide ions to produce water.**

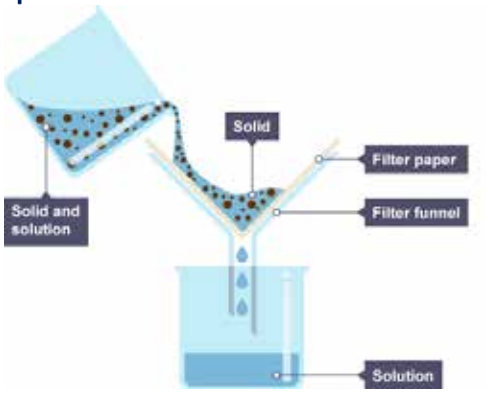
HIGHER TIER
Strong acids (HCl, HNO_3, H_2SO_4) fully **ionise**
Weak acids (ethanoic, citric, carbonic) partially ionise

Knowledge Organiser – 5.4 Chemical Changes

5.4.2.3 Soluble salts

- Soluble salts can be made from acids by reacting them with solid insoluble substances, such as metals, metal oxides, hydroxides or carbonates.
- The solid is added to the acid until no more reacts and the excess solid is filtered off to produce a solution of the salt.
- Salt solutions can be crystallised to produce solid salts.

RPA Preparation of a soluble salt



1. Add excess solid to acid
2. React
3. Filter off unreacted solid

4. Warm over water bath then leave to evaporate
5. Allow to crystallise. Dry the pure crystals

5.4.3. Electrolysis

5.4.3.1 The process of electrolysis

- Ionic compounds can be electrolysed when liquid or molten, as the ions are then free to move
- An electric current is passed through the electrolyte
- Positive ions move to the negative electrode (cathode)
- Negative ions move to the positive electrode (anode)
- Aluminium is extracted by electrolysis from a mixture of aluminium oxide and cryolite

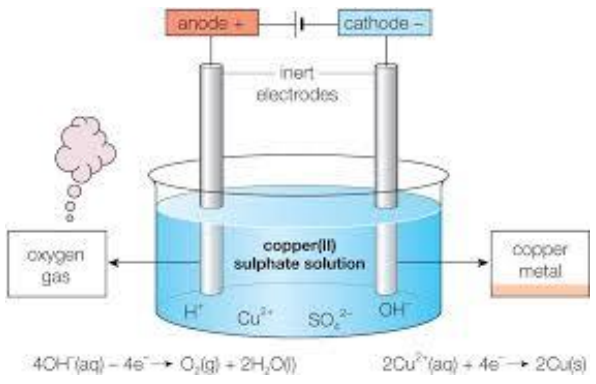
5.4.3.2 Electrolysis of molten ionic compounds

- When a simple ionic compound (eg lead bromide) is electrolysed in the molten state using inert electrodes
- the metal (lead) is produced at the cathode
- the non-metal (bromine) is produced at the anode.

5.4.3.3 Using electrolysis to extract metals

- **Metals** can be **extracted** from molten compounds using **electrolysis**.
- Electrolysis is used **if the metal is too reactive to be extracted by reduction** with carbon or if the metal reacts with carbon.
- **Large amounts of energy** are used in the extraction process to melt the compounds and to produce the electrical current.
- **Aluminium** is manufactured by the **electrolysis** of a **molten mixture of aluminium oxide and cryolite using carbon** as the **positive** electrode (**anode**).

RPA Electrolysis of aqueous solution



5.4.3.4. Electrolysis of aqueous solutions

- The ions discharged when an aqueous solution is electrolysed using inert electrodes depend on the relative reactivity of the elements involved.
- At the negative electrode (cathode), hydrogen is produced if the metal is more reactive than hydrogen.
- At the positive electrode (anode), oxygen is produced unless the solution contains halide ions when the halogen is produced.
- This happens because in the aqueous solution water molecules break down producing hydrogen ions and hydroxide ions that are discharged.

5.4.3.5 Representation of reactions at electrodes as half equations (HT only)

During **electrolysis**, at the **cathode** (negative electrode), **positively charged ions gain electrons**. Ie **reductions reactions** At the **anode** (positive electrode), **negatively charged ions lose electrons**. Ie **oxidations**. Reactions at electrodes can be represented by half equations, for example:

$2H^+ + 2e^- \rightarrow H_2$

and

$4OH^- \rightarrow O_2 + 2H_2O + 4e^-$ or

$4OH^- - 4e^- \rightarrow O_2 + 2H_2O$

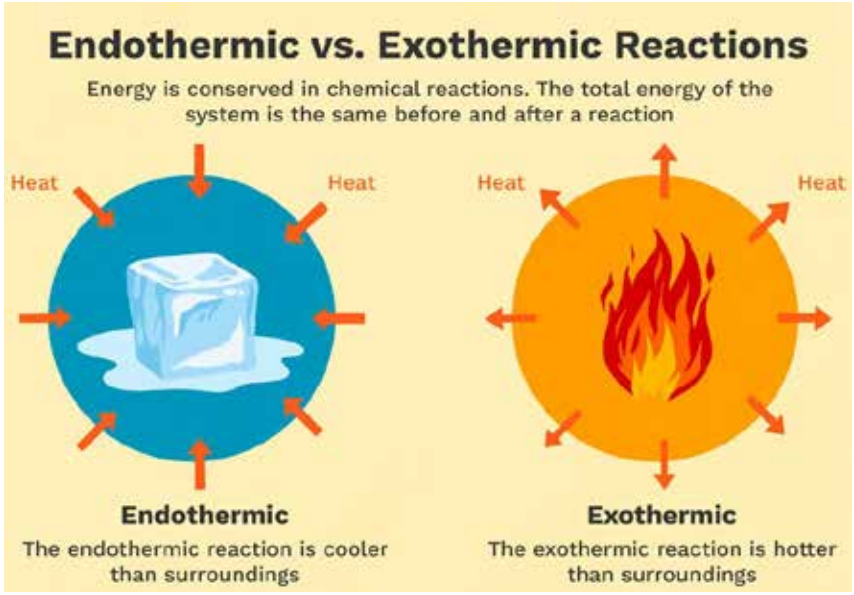
Knowledge Organiser – 5.5 Energy Changes

5.5.1 Exothermic and endothermic reactions

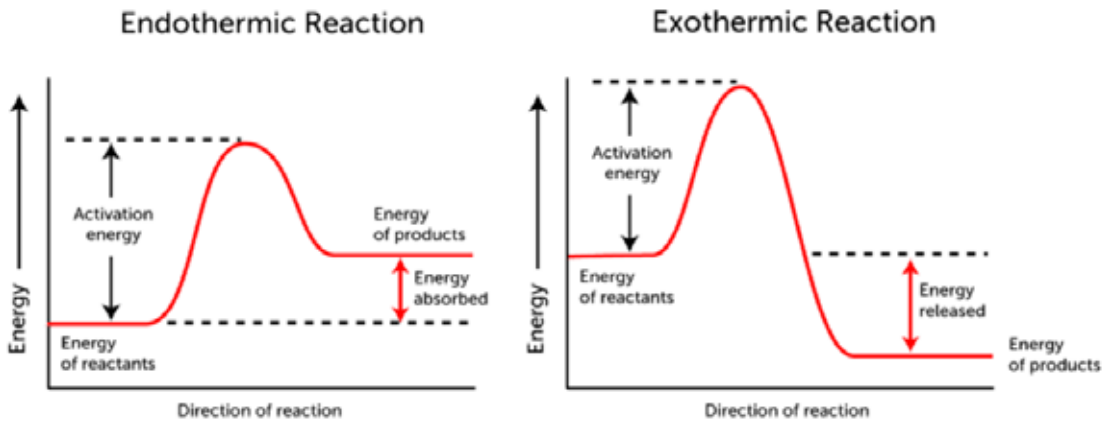
5.5.1.1 Energy transfer during Exothermic and endothermic reactions

- **Energy is conserved** in chemical reactions.
- The amount of energy in the universe at the end of a chemical reaction is the same as before the reaction takes place.
- If a **reaction transfers energy to the surroundings** the **product** molecules must have **less energy than the reactants, by the amount transferred.**

- **Exothermic reactions give out energy to the surroundings. Exo = exit.**
  - Examples: combustion, neutralisation, hand warmers.
- **Endothermic reactions take in energy from the surroundings. Endo = enter.**
  - Examples: thermal decomposition, reaction of citric acid and sodium hydrogencarbonate and sports injury packs.

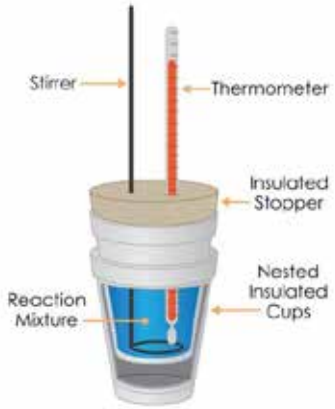


5.5.1.2 Reaction Profiles



- In an **endothermic** reaction profile the **products finish higher in energy** than the reactants.
- In an **exothermic reaction** profile the **products finish lower in energy** than the reactants.
- **Activation energy** is the **minimum** energy required for a reaction to happen when particles **collide.**
- The **overall energy change** is the difference between the relative energy of the reactants and the products.

RPA Investigate the variables that affect temperature in reacting solutions



The variables you could change are:
- Type of reactant (metal, carbonate, alkali)
- Type of acid used.
- Concentration of acid.
- Size of reactant pieces (if solid).
- Concentration of alkali.

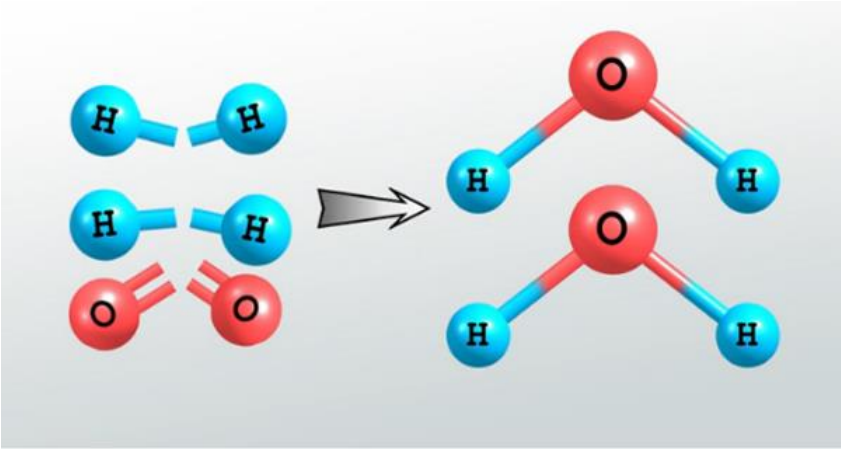
If one of these variables is changing, then all others stay the same.

Knowledge Organiser – 5.5 Energy Changes

5.5.1.3 Energy change of reactions (HT only)

During a chemical reaction:

- **Energy must be put in** to **break bonds** in the **reactants**.
- **Energy is given** out when **bonds in the products are formed**.



- If **overall energy change is negative** = **exothermic** reaction.
- If **overall energy change is positive** = **endothermic** reaction.

- In **exothermic** reactions, the **energy released from forming new bonds** is **greater** than the energy needed to break existing bonds.
- In **endothermic** reactions, the **energy needed to break existing bonds** is **greater** than the energy released from forming new bonds.

- The **difference between the sum of the energy needed to break bonds** in the reactants and the **sum of the energy released when bonds in the products are formed** is the **overall energy change of the reaction**.

Example:

Bond	Average bond energy (kJ mol^{-1})
H — H	436
O — H	463
O = O	498

Bonds broken:

- 2 x **H-H** = 2 x 436 = 872 kJ/mol
- **O=O** = 498 kJ/mol
- Total = 872 + 498 = 1370 kJ/mol

Bonds formed:

- 4 x **H-O** = 4 x 463 = 1852 kJ/mol
- Total = 1852 kJ/mol

Total energy change = reactants - products:

1370 kJ/mol – 1852 kJ/mol = - 482 kJ/mol

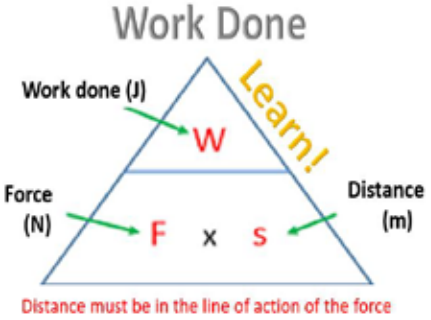
Knowledge Organiser – 6.1 Energy

joule (J) = unit of energy

6.1.1.1 Energy stores and systems

Energy store	Description	Examples
Magnetic	The energy stored when **repelling poles have been pushed closer** together or when **attracting poles have been pulled further apart.**	Fridge magnets, compasses, maglev trains which use magnetic levitation.
Internal (thermal)	Total kinetic and potential energy of the particles in an object, eg **the vibrations - also known as the kinetic energy - of particles**. In **hotter objects, the particles have more internal energy** & vibrate faster.	Human bodies, hot coffees, stoves or hobs. Ice particles vibrate slower, but still have energy.
Chemical	The energy **stored in chemical bonds**, such as those between molecules.	Foods, muscles, electrical cells.
Kinetic	Energy of a **moving object**.	Runners, buses, comets.
Electrostatic	The energy stored when **repelling charges have been moved closer together** or when attracting charges have been pulled further apart.	Thunderclouds, Van De Graaff generators.
Elastic potential	The energy stored when an **object is stretched or squashed**.	Drawn catapults, compressed springs, inflated balloons.
Gravitational potential	The energy of an **object at height**.	Aeroplanes, kites, mugs on a table.
Nuclear	The energy stored in the **nucleus of an atom.**	Uranium nuclear power, nuclear reactors.

- When a **force** causes a body to move, work is being done on the object by the force.
- Work is the measure of energy transfer when a force (*F*) moves an object through a distance (*d*).
- When work is done, **energy** has been transferred from one energy store to another.
- Therefore Energy transferred = work done



Quantity	Unit
Current	A
Energy	J
Mass	kg
Power	W
Time	s
Temp	°c
Height	m
Velocity	m/s
Extension	m
Spring constant	N/m
Force	N
Gravitational field strength	N/kg
Specific heat capacity	J/kg°C

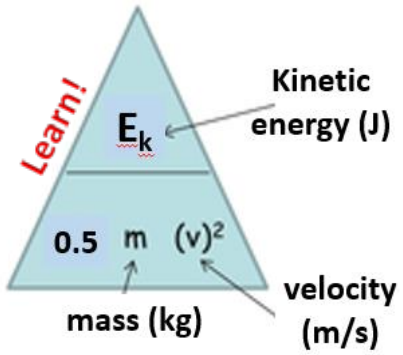
6.1.1.2 Changes in energy

Kinetic energy of a moving object can be calculated using the equation:

kinetic energy = 0.5 × mass × speed²

$E_k = \frac{1}{2} m (v)^2$

- kinetic energy, *E*k, in joules, J
- mass, *m*, in kilograms, kg
- speed, *v*, in metres per second, m/s

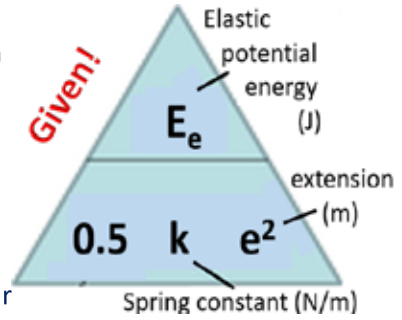


Elastic potential energy stored in a stretched spring can be calculated using the equation (assuming the limit of proportionality has not been exceeded:

elastic potential energy = 0.5 × spring constant × extension²

$E_e = \frac{1}{2} k e^2$

- elastic potential energy, *E*e, in joules, J
- spring constant, *k*, in newtons per metre, N/m
- extension, *e*, in metres, m

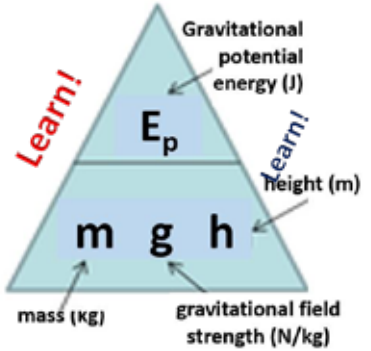


Gravitational potential energy gained by an object raised above ground level can be calculated using the equation:

g.p.e. = mass × gravitational field strength × height

Ep = mgh

- gravitational potential energy, *E*p, in joules, J
- mass, *m*, in kilograms, kg
- gravitational field strength, *g*, in newtons per kilogram, N/kg
- height, *h*, in metres, m



Gravitational field strength is 9.8N/kg on Earth.

(g will be given in the exam).

Knowledge Organiser – 6.1 Energy

6.1.1.3 Energy changes in systems

The amount of energy stored in or released from a system as its temperature changes can be calculated using the equation:

change in thermal energy = mass × specific heat capacity × temperature change

$$\Delta E = m\, c\, \Delta\theta$$ **Given!**

- change in thermal energy, Δ*E*, in joules, J
- mass, *m*, in kilograms, kg
- specific heat capacity, *c*, in joules per kilogram per degree Celsius, J/kg °C
- temperature change, Δ*ϑ*, in degrees Celsius, °C

Specific heat capacity

- This is the amount of energy needed to raise the temperature of 1kg of a material by 1°C

$E = m \times c \times \theta$

Energy (J) | Mass (kg) | Specific heat Capacity (J / kg °C) | Change in temperature (°C)

6.1.1.4 Power

Power is defined as the rate at which energy is transferred or the rate at which work is done.

- power, *P*, in watts, W
- energy transferred, *E*, in joules, J
- time, *t*, in seconds, s
- work done, *W*, in joules, J

An energy transfer of 1 joule per second is equal to a power of 1 watt

$$\text{power (W)} = \frac{\text{work done (J)}}{\text{time taken (s)}}$$

$$\text{power (W)} = \frac{\text{energy transferred (J)}}{\text{time taken (s)}}$$ **Learn!**

Example

Two electric motors are used to lift a 5 N weight through a vertical height of 6 m.
Motor A does this in 5 seconds.
Motor B does this in 10 seconds.

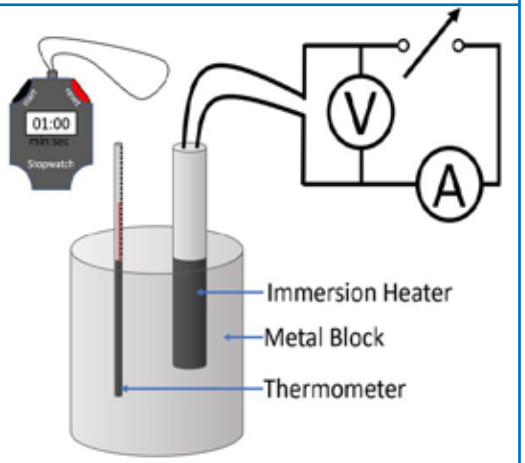
For both motors the work done is:
W = F x d = 5N x 6m = **30J**

For motor A: $P = \frac{W}{t} = \frac{30J}{5s} = 6W$

For motor B: $P = \frac{W}{t} = \frac{30J}{10s} = 3W$

Motor B is twice as powerful as motor A.

RPA: an investigation to determine the specific heat capacity of one or more materials. The investigation involve linking the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored



Method:

1. Place the immersion heater into central hole at top of block.
2. Place the thermometer into smaller hole and add drops of oil into the hole to ensure thermometer is surrounded by hot material.
3. Fully insulate the block by wrapping it loosely with cotton wool.
4. Record the temperature of the block.
5. Connect the heater to the power supply and turn it off after ten minutes. After ten minutes the temperature will still rise even though the heater has been turned off and then it will begin to cool.
6. Record the highest temperature that it reaches and calculate the temperature rise during the experiment.

Improving accuracy:

- Place the metal block on a heatproof mat to reduce the thermal energy lost to the table surface by conduction.
- Wrap the metal block in a thermal insulator to reduce the thermal energy lost to the air.
- Place the electronic balance on a flat, level surface to get an accurate reading of the mass.

Improving precision:

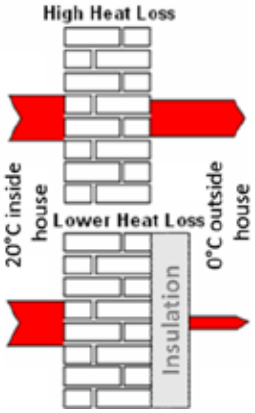
- Use a data logger rather than a thermometer to reduce the random error & add more decimal places.
- Ensure the immersion heater and block begin at room temperature to reduce the error in repeat readings.
- Ensure the same thickness and type of insulator is used for every repeat measurement reduce anomalies.

Knowledge Organiser – 6.1 Energy

6.1.2.1 Energy transfers in a system

Energy cannot be created or destroyed, only transformed from one form to another (**Law of conservation of energy**).
"**Work done**" is another way of describing energy transfer.

- where there are energy transfers in a **closed system**, there is **no net change to the total energy.**
- In all system changes energy is dissipated, so that it is stored in less useful ways. This energy is often described as being 'wasted'.
- Unwanted energy transfers can be reduced, eg. through lubrication and the use of thermal insulation.
- The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material.



The rate of cooling of a building is affected by the **thickness** and **thermal conductivity of its walls**.
Higher thermal conductivity = higher rate of energy transfer = house cools down quicker.

6.1.2.2 Efficiency

$$\frac{\text{Useful energy output}}{\text{total energy input}} \times 100\%$$

Learn!

OR

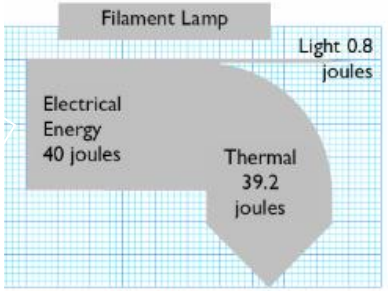
$$\frac{\text{Useful power output}}{\text{total power input}} \times 100\%$$

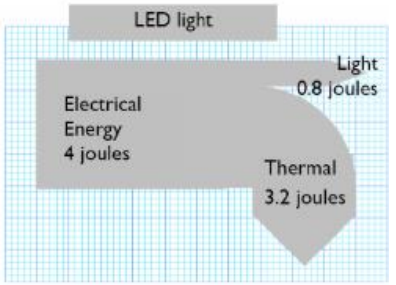
Efficiency can be represented as a decimal or percentage. It has to be <100% (or <1.0) as all energy transfers involve wasted energy.

In a closed system there is no net change to the total energy

Total IN = total OUT

Increase efficiency by insulating or streamlining/ lubricating to reduce friction.





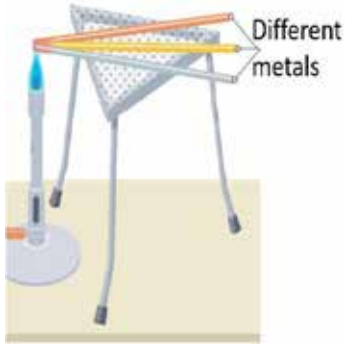
$\frac{0.8}{40} \times 100 = 2\%$

$\frac{0.8}{4} \times 100 = 20\%$

The LED is 10 x more efficient than the filament lamp

Investigate thermal conductivity using rods of different materials (NOT RPA)

Whichever rod gets hottest first at the other end is the best conductor. The material that **heats the quickest** is said to have a higher thermal conductivity



6.1.3 National and Global energy resources

- Main energy resources available for use on Earth include: fossil fuels (coal, oil and gas), nuclear fuel, biofuel, wind, hydro-electricity, geothermal, the tides, the Sun and water waves.
- A **renewable energy** resource is one that is **being** (or can be) **replenished** as it is used.
- A **Non-renewable energy** source **cannot be replaced** after it has been used. It is **finite**
- The uses of energy resources include: transport, electricity generation and heating.

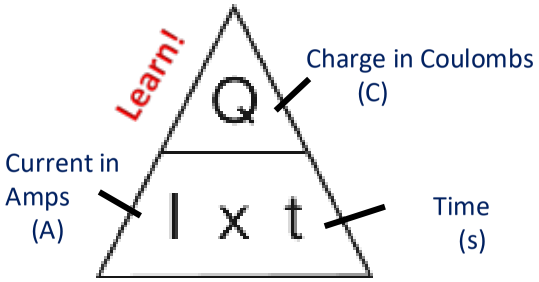
	Positives	Negatives
Fossil fuel (coal/oil/gas)	Reliable, cheap to run and mine	Finite, atmospheric pollution (CO_2, SO_2, NO_x)
Nuclear	Reliable, No CO_2, lots energy released	Long-lasting toxic waste, finite
Wind	Infinite, free, no atmospheric pollution	Unreliable (not always windy), visual pollution, costly to build, sometime noisy
Sun	Infinite, free, put on buildings/ in fields	Costly to set up, pollution from batteries
Geothermal	Infinite, free, no atmospheric pollution	Products from ground may contain toxic elements
Tidal	Barrages reduce flooding eg Thames, free, no pollution, reliable(2 tides/day)	Disturb ecology and shipping lanes, costly to build
Biofuel	Can be regrown, cheap, carbon neutral	Use up land that could grow food/ livestock
Hydroelectricity	No atmospheric pollution, free	High rainfall needed, floods valleys therefore habitats/ villages destroyed
Water Waves	No atmospheric pollution, free	Disturb ecology and shipping lanes, costly to build, unreliable (sea does not always have waves)

Knowledge Organiser – 6.2 Electricity

6.2.1.2 Electrical charge and current

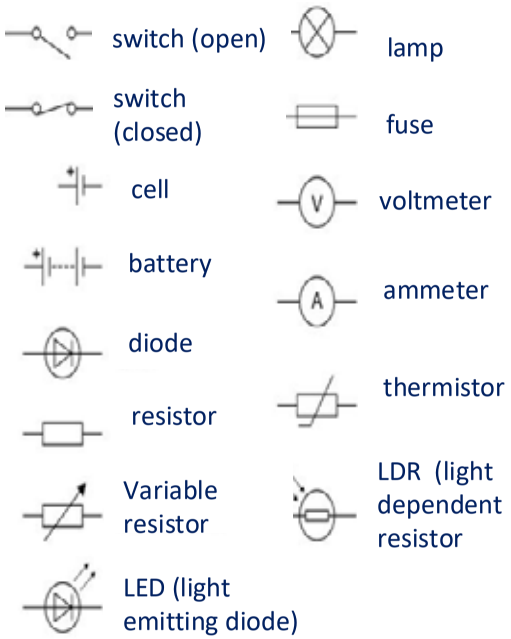
Electric current is a flow of electrical charge.
Size of current is **rate of flow of electrical charge**.

Charge flow, current and time are linked by the equation:
charge flow = current × time



- Current has **same value at any point in a single closed loop**.
- Measured with **Ammeter**

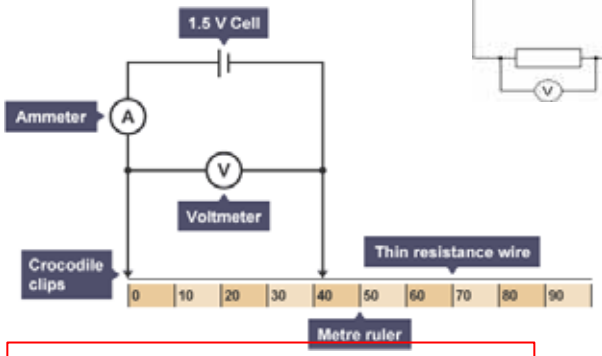
6.2.1.1 Standard circuit diagram symbols



RPA: use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits.

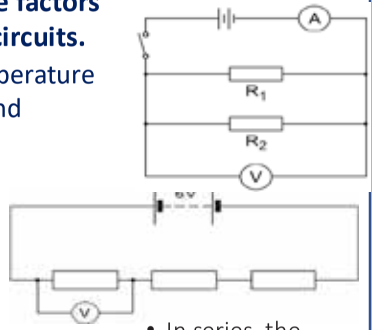
- the length of a wire at constant temperature
- combinations of resistors in series and parallel.

IV: Length of a wire



Hazard	Consequences	Control measures
Heating of wires	Minor burns	Set up circuit before closing the switch

IV: resistors in series or parallel



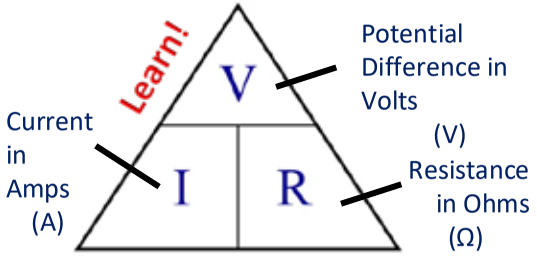
- In series, the resistance of the network is equal to the sum of the other resistances.
- In parallel, the resistance of the network is less than either of the other resistances.

6.2.1.3 Current, resistance and potential difference

- **Potential difference** is the amount of work energy required to move an electric charge (Coulomb) from one point to another
- Current (*I*) through a component depends on the **resistance** (*R*) of the component and the **potential difference** (*V*) **across the component**.
- The **greater the resistance** of the component the **smaller the current for a given potential difference (pd) across the component**.
- Measured with **Voltmeter**
- **Voltmeter must be connected in parallel**

Current, **potential difference** and **resistance** can be calculated using the equation:

potential difference = current × resistance



Resistance

- **Metal atoms** (**ions**) in a **wire have delocalised electrons** which are free to move and **carry the charge**.
- **Electrons moving** around the circuit **collide with the ions**.
- This is called **resistance**.

Units of resistance = ohms, Ω

Components with high resistance often **get hot** (e.g. filament lamp).

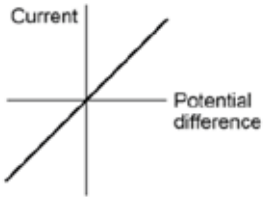
- **Electrons colliding** with the ions **transfer energy** as **heat** and **light**.
- **Causes the ions to vibrate more**, **increasing** the **resistance** even more.
- This makes it harder for the electrons to pass through without collisions.

E.g. What is the resistance of a component if 12 V causes a current of 2 A through it?
R = V / I = 12V / 2A = 6Ω

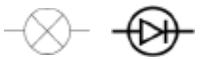
Knowledge Organiser – 6.2 Electricity

6.2.1.4 Resistors

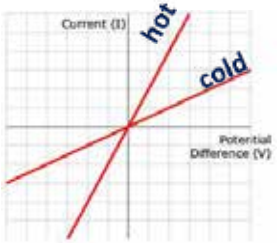
- **Current through an ohmic conductor** (at a constant temperature) is **directly proportional to the potential difference** across the resistor.
- **Resistance remains constant as the current changes**.



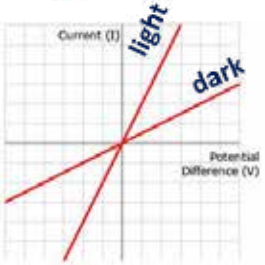
- **Resistance of components such as lamps, diodes, thermistors** and **LDRs** is **not** constant; it **changes with the current through the component**.
- SEE RPA



- **Resistance of a thermistor decreases as the temperature** increases.
- Low temperature = High resistance
- Used in heat activate fire alarms and thermostats



- **Resistance of an LDR decreases** as **light intensity increases**
  Low light levels = high resistance.
- An **LDR** can be used in lights that come on when it's dark.



Unit	symbol
Potential difference	V
Current	A
Energy	J
Work done	J
Charge	C
Time	s
Power	W
Resistance	Ω

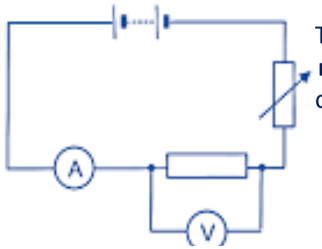
Charge is a property of a body which experiences a force in an electric field. **Charge** is measured in **coulombs** (C).

Since electrons are so small and one electron will not have much of an effect anywhere, it is more useful to refer to packages of electrons.

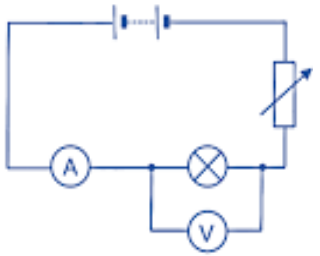
One coulomb of charge is a package equivalent to 6,250,000,000,000,000,000 electrons.

One volt is the **potential difference when one coulomb** of **charge** transfers one **joule** of energy.

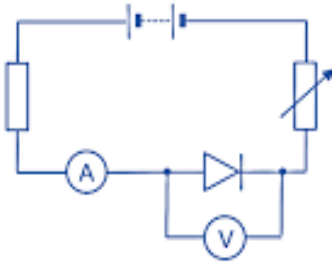
RPA: use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a filament lamp, a diode and a resistor at constant temperature



The current through a **resistor** at constant a constant temperature is directly proportional to the potential difference across the resistor.



The resistance of a **bulb** increases as the temperature of the filament increases.



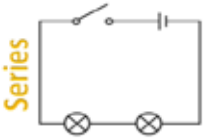
The current through a **diode** flows in one direction. It has very high resistance in the opposite direction.

6.2.2 Series and Parallel circuits

For components connected in series:

- same **current (A)** through each component
- total **potential difference (V)** of the power supply is **shared between components**
- total resistance of two components is the sum of the resistance of each component.

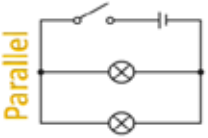
$R_{total} = R1 + R2$ resistance, R, in ohms, Ω



A Same V Shared

For components connected in parallel:

- **potential difference** across each component is the **same**
- **total current** through the whole circuit is **sum of the currents** through the separate components
- **total resistance** of **two resistors is less** than the **resistance** of the **smallest individual resistor.**

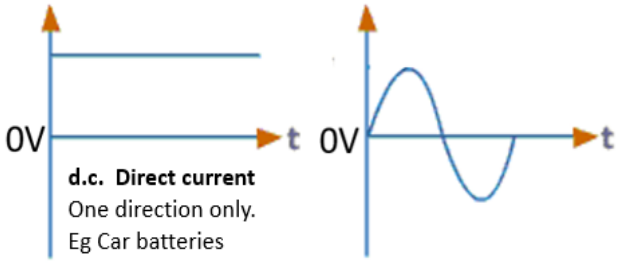


A Shared V Same

Knowledge Organiser – 6.2 Electricity

6.2.3 Domestic uses and safety

6.2.3.1 Direct and alternating potential difference



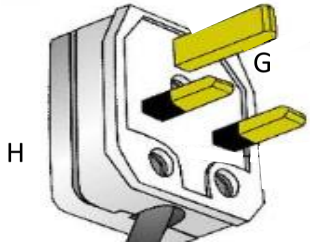
d.c. Direct current
One direction only.
Eg Car batteries

a.c. Alternating current
In the UK, electricity has a p.d. of 230V & a frequency of 50Hz (it changes direction 50 times a second).

6.2.3.2 Mains electricity

A= neutral wire, close to 0V.
B= earth wire, 0V, only carries current if there's a fault, stops appliance becoming live.
C= live wire, 230V between earth and live.
D= Fuse, internal wire melts when current is too big so breaks the circuit.

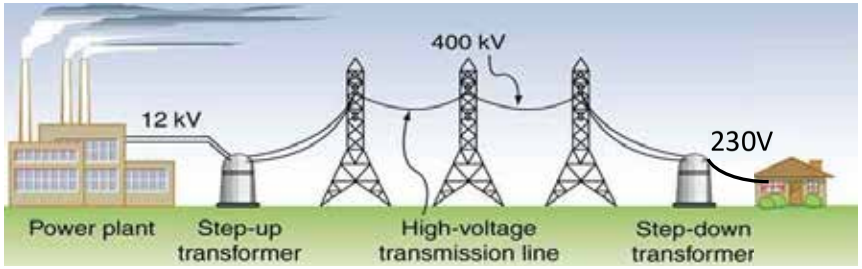
E= cable grip
F= three-core cable, copper wire = flexible and good conductor, plastic coating.
G= brass pins, hard wearing, good conductor
H= plastic casing is an insulator



- a live wire may be dangerous even when a switch in the mains circuit is open
- It is dangerous to provide any connection between the live wire and earth.

6.2.4 Energy Transfers

6.2.4.3 The National Grid

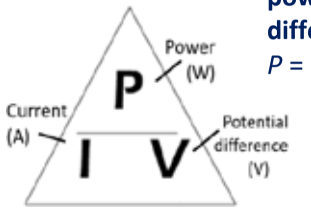


- Network of cables and transformers linking power stations to consumers
- Step-up transformers = higher potential difference
- Reduced energy loss because resistance is lower in cables (high volts = fewer amps for same power)
- Step-down transformers = decrease potential difference to safe level for domestic use (about 230V in UK)
- Underground cables protected from bad weather but get damaged by diggers in building projects

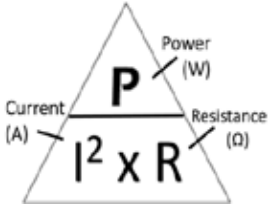
E.g. What is the potential difference between two points if 5 C of charge shifts 10 J?
V= E/Q
= 10J / 5C
= **2 volts**

6.2.4.1 Power

power = potential difference × current
$P = V I$



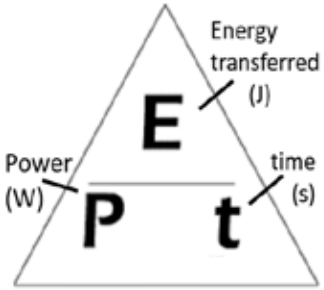
power = current² × resistance
$P = I^2 R$

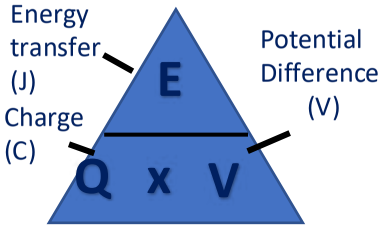


- power, *P*, in watts, W
- potential difference, *V*, in volts, V
- current, *I*, in amps, A
- resistance, *R*, in ohms, Ω

6.2.4.2 Energy transfers in everyday appliances

- The rate at which energy is transferred by an appliance is called the **power**.
- Also known as "**work done**" by the components in the circuit when charge flows.
- The energy transferred by an appliance depends on how long it is switched on for and the power of the appliance.





- energy transferred, *E*, in joules, J
- power, *P*, in watts, W
- time, *t*, in seconds, s
- charge flow, *Q*, in coulombs, C
- potential difference, *V*, in volts, V

Knowledge Organiser – 6.3 Particle model of matter

6.3.1.1 Density of materials

The particle model can be used to explain the different states of matter differences in density.

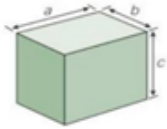
Calculation	Equation	Symbol equation	Units
Density	Density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{v}$	Density = kg/m^3 Mass = kg Volume = m^3

RPA: Measuring volume of irregular objects and calculating density

Method 1: Regular solid volume

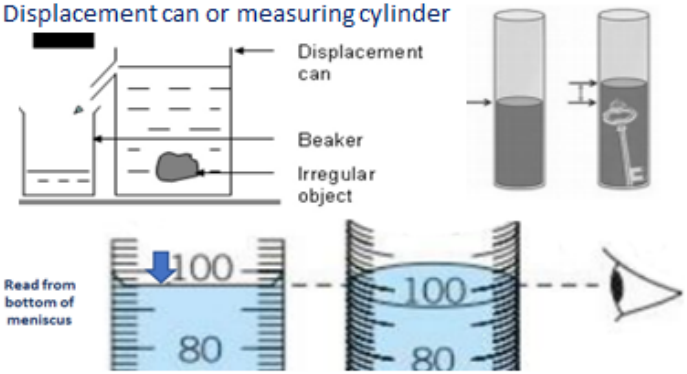
Length x width x height

Sphere: $\frac{4}{3}\pi(\frac{d}{2})^3$

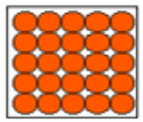
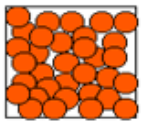
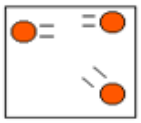


Method 2: Stone or other irregular shaped object volume

Displacement can or measuring cylinder



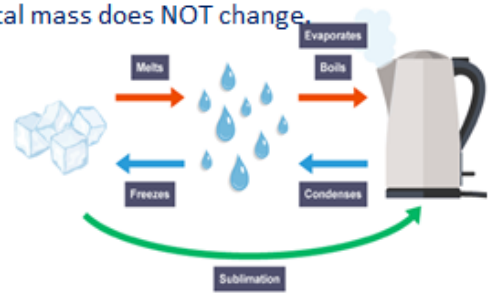
Measure mass of object and then use density equation.

Solid	Liquid	Gas
Particles closely packed - vibrate - Little energy - Very strong forces of attraction	Particles touching, - Move past each other - Some energy - Relatively strong forces of attraction	Particles very far apart - Move very fast - Lots of energy - Weak forces of attraction
		

6.3.1.2 Changes of State

Conservation of mass

- The number of particles does not change during a change of state, only their spacing and arrangement.
- Total mass does NOT change.



- Change of state is **physical**.
- The material **recovers its original properties** if the change is reversed.

Key Terms	Particle Model of Matter Definitions
condensation	A change of state in which gas becomes liquid by cooling.
energy	The capacity for doing work
evaporation	The process in which a liquid changes state and turns into a gas.
freeze	A change of state in which liquid becomes solid by cooling.
Internal energy	The total kinetic energy and potential energy of the particles in an object. Heating changes the energy stored within the object by increasing the energy of the particles that make up the system.
Kinetic energy	Energy which an object possesses by being in motion
Melting	The process that occurs when a solid turns into a liquid when it is heated
Specific heat capacity	The amount of energy needed to raise the temperature of 1 kg of substance by 1°C
Specific latent heat	The amount of energy needed to melt or vaporise 1 kg at its melting or boiling point
Sublimation	When a solid turns straight into a gas on heating, without becoming a liquid first, or when a gas turns straight into a solid, without becoming a liquid.
Temperature	How warm or cold something is
Thermal energy	Scientific term for heat energy

6.3.1.3 Internal Energy

- **Internal Energy:** Energy is stored inside a system by the particles that make up the system. Internal energy is the **total kinetic energy** and **potential energy** of **all the particles** that make up a system.
- Heating **increases** the energy of the particles
- Either **raises the temperature** of the system **or produces a change of state.**

6.3.2.2 Temperature changes in a system and specific heat capacity

The change in temperature of a system depends on:

- the amount of **thermal energy** transferred to the system
- the mass of the substance
- the nature of the substance itself

change in thermal energy = mass × specific heat capacity x temperature change

$$\Delta E = mc\Delta\theta$$

Units Used:-

- change in thermal energy, ΔE, in joules, J
- mass, m, in kilograms, kg
- specific heat capacity, c,
- in joules per kilogram per degree Celsius, J/kg °C
- temperature change, $\Delta\theta$, in degrees Celsius, °C.

Knowledge Organiser – 6.3 Particle model of matter

6.3.2.3 Changes of heat and specific latent heat

If a change of state happens:

- The energy needed for a substance to change state is called **latent heat**.
- When a change of state occurs, the energy supplied **changes the energy stored** (internal energy) but **does not change the temperature.**
- **specific latent heat** of a substance is the **amount of energy required to change the state of one kilogram of the substance** with no change in temperature.

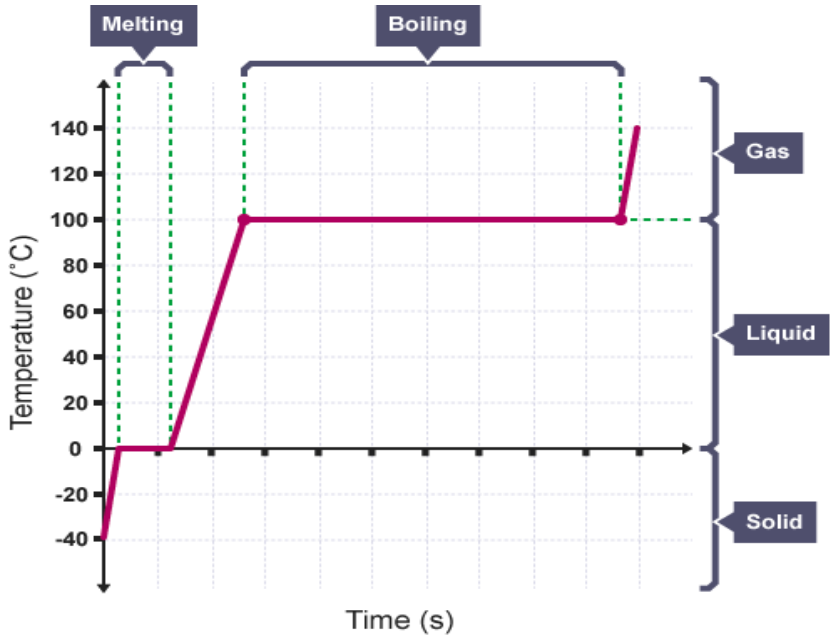
energy for a change of state = mass × specific latent heat

$$E = mL$$

- energy, E, in joules, J
- mass, m, in kilograms, kg
- specific latent heat, L, in joules per kilogram, J/kg
- **specific latent heat**, L, in joules per kilogram, J/kg

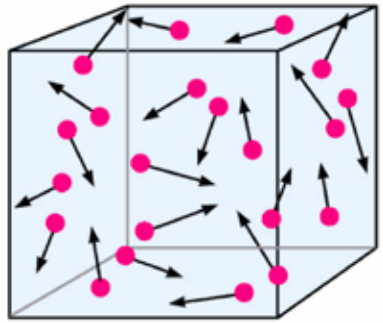
Specific latent heat of fusion – change of state from solid to liquid

Specific latent heat of vaporisation – change of state from liquid to vapour



6.3.3.1 Particle motion in gases

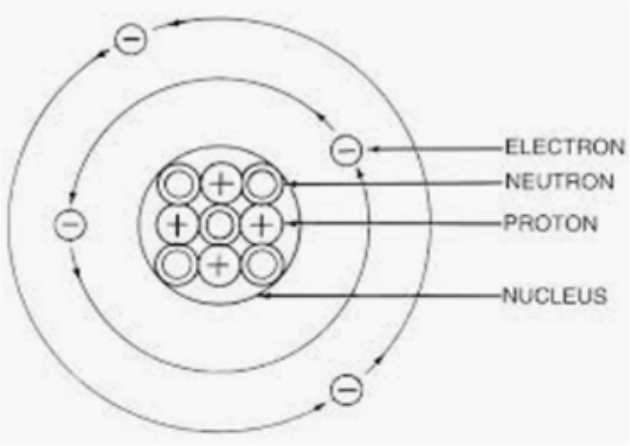
- Molecules of gas in **constant random motion**
- **Temperature** of gas **related to average kinetic energy of the molecules**
- **Changing the temperature** of a gas, held at constant volume, **changes the pressure** exerted by the gas



Knowledge Organiser – 6.4 Atomic Structure

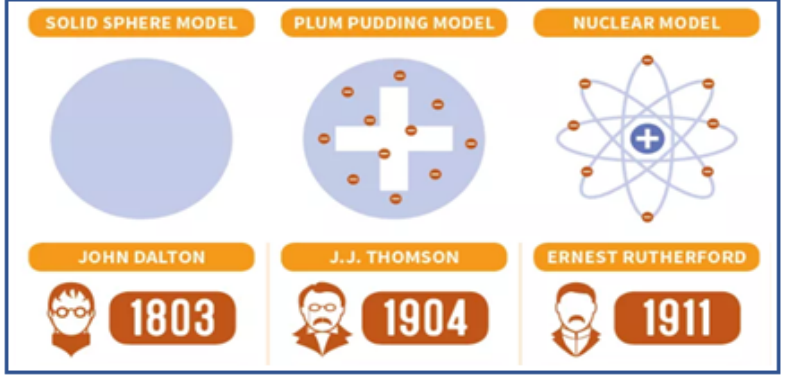
6.4.1.1 The structure of an atom

Atoms are very small, having a radius of about **1 x 10^{-10} metres**. They make up all of the matter around us. The basic structure of an atom consists of a **positively charged nucleus** composed of **protons** and **neutrons** surrounded by **negatively charged electrons**.



The electrons are arranged at different distances from the nucleus known both as **shells** and **energy levels**. They are the represented by the circles around the nucleus on the diagram.

Electron arrangements can change with **absorption** of electromagnetic radiation or **emission** of electromagnetic radiation.

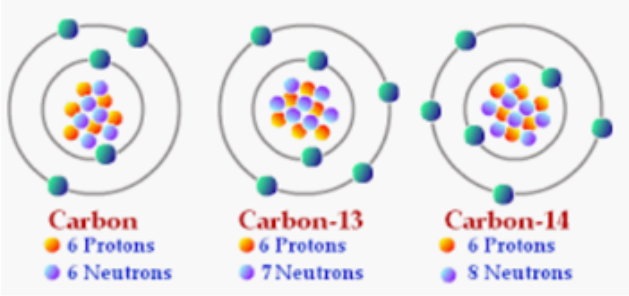


6.4.1.2 Mass number, atomic number and isotopes

The numbers on the periodic table are called the **mass number** and the **atomic number**.
The atomic number (proton number): Smaller number, tells you the number of protons are in an atom of that element. There will be the same number of electrons as protons.
Mass number: larger number, tells you how many neutrons and protons combined are in that atom.
Calculate neutrons by taking away the atomic number from the mass number.

Key

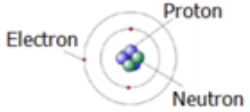
relative atomic mass
atomic symbol
name
atomic (proton) number



Isotopes: Versions of same element (same number of protons) with **different numbers** of **neutrons** in their nuclei.
Atoms turn into **positive ions**, if they lose one or more outer electron(s)

6.4.1.3 The development of the model of the atom

- **Experimental evidence** may lead to a scientific model changing over time. Atoms were originally thought to have been **solid spheres of matter**.
- The **discovery** of the **electron** led to the **plum pudding model** which suggested a **positive ball of charge** containing negative particles.
- Rutherford's **alpha particle scattering** experiment (using gold leaf) led to the conclusion that the **mass of an atom** was **concentrated** with **a positively** charged **nucleus**.
- This **nuclear model replaced**
- the previous one.



- Niels Bohr adapted the nuclear model by suggesting that **electrons orbit the nucleus at specific distances.**
- Later experiments identified positive particles which were called **protons.**
- The experimental work of James **Chadwick** provided the evidence to show the existence of **neutrons within the nucleus.**

Sub-atomic particle	Mass	Charge	Position in Atom
Proton	1	+1	Nucleus
Neutron	1	0	Nucleus
Electron	$\frac{1}{2000}$	-1	Orbiting in shells

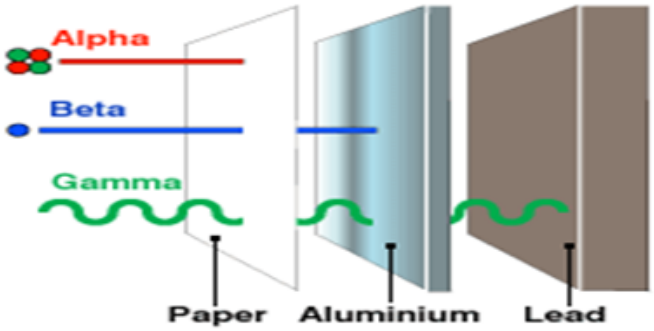
Knowledge Organiser – 6.4 Atomic Structure

6.4.2.1 Radioactive decay and nuclear radiation

Some atomic **nuclei** are **unstable**, radiation is given out and the nucleus becomes more stable. This is a **random process** called **radioactive decay**.

- **Alpha particles** consist of two neutrons and two protons (same as a helium nucleus)
- **Beta particles** consist of a high speed electron ejected from the nucleus as a neutron turned into a proton.
- **Gamma rays** are electromagnetic radiation form the nucleus.
- **Neutron** emission is a decay process where one or more neutrons are ejected from a nucleus. It can occur in nuclei that are neutron rich/proton poor. As only one or more neutrons are lost, the atom becomes a different isotope of the original element.

Each type of radiation has **a different range** and **penetration power;** Alpha has the **highest ionising power** although having the shortest range and is least penetrating.



- **Activity** is the rate at which a source of unstable nuclei decays.
- Activity is measured in **becquerel** (Bq)
- **Count-rate** is the number of decays recorded each second by a detector (e.g. Geiger-Muller tube).

6.4.2.2 Nuclear equations

Are used to represent radioactive decay.
Alpha decay causes both the mass and charge of a nucleus to decrease.

Beta decay causes the charge to increase But does not change the mass of the nucleus

Gamma ray emission does not cause a change in the mass or charge of a nucleus.

$^{4}_{2}He$

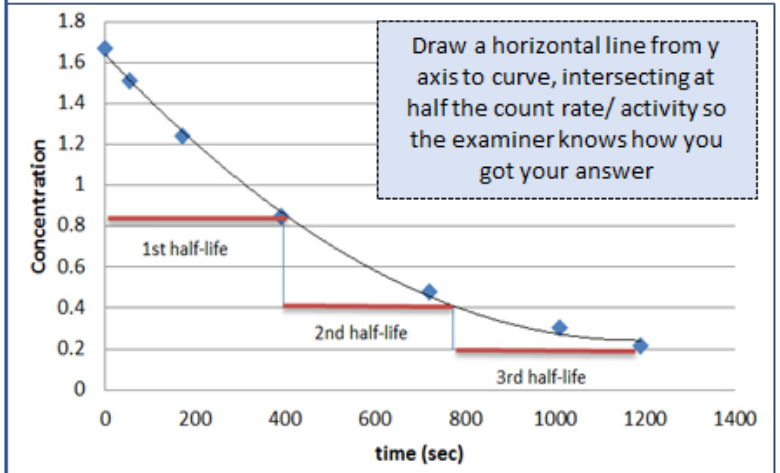
$^{0}_{-1}e$

$^{235}_{92}U \xrightarrow{\text{decay by releasing an alpha particle}} {}^{4}_{2}\alpha + {}^{231}_{90}Th$

$^{14}_{6}C \xrightarrow{\text{decay by releasing an beta particle}} {}^{0}_{-1}\beta + {}^{14}_{7}N$

$^{235}_{92}U \xrightarrow{\text{decay by releasing a gamma wave}} {}^{0}_{0}\gamma + {}^{235}_{92}U$

6.4.2.3 Half-lives and the random nature of radioactive decay



(HT Only) Calculating half life.
Question:
The half-life of cobalt-60 is 5 years. If there are 100 g of cobalt-60 in a sample, how much will be left after 15 years?
15 years is three half-lives so the fraction remaining will be $(\frac{1}{2})^3 = \frac{1}{8} = 12.5g$
As a ratio of what was present originally compared to what was left, this would be 100:12.5 or 1:0.125

A **half-life** is either:-
- the time it takes for the number of nuclei of a radioactive isotope in a sample to halve

or
- the time is takes for the count rate from that sample to fall to half of its initial level.

6.4.2.4 Radioactive contamination

Irradiation: Exposing an object to **nuclear radiation**, the object **does not** become **radioactive** but it can still **damage cells.**

Irradiation	Contamination
Occurs when an object is exposed to a source of radiation outside the object	Occurs if the radioactive source is on or in the object
Doesn't cause the object to become radioactive	A contaminated object will be radioactive for as long as the source is on or in it
Can be blocked from the object with suitable shielding	Once an object is contaminated, the radiation cannot be blocked from the object
Stops as soon as the source is removed	It can be very difficult to remove all of the contamination

Radioactive Contamination: Unwanted presence of **materials** containing **radioactive atoms** on other materials.