



KNOWLEDGE ORGANISER YEAR 9

2023 - 2024





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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.

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Introduction	2 - 5
Art	6-14
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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.

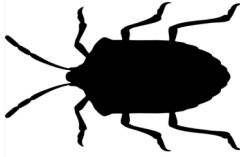
Command	How do I respond in my writing ?	Command	How do I respond in my writing ?	Command	How do I respond in my writing ?
Acknowledge	Music: To give credit for, recognise, and highlight something, such as a selected source or the work of others.	Explore	Music: To investigate, examine and look into with an open mind about what might be found and developed.	Produce	D&T: Draw or design an isometric or orthographic drawing
Apply	Music: To use knowledge, skills and understanding and to employ appropriate techniques when developing and progressing ideas.	Express	Maths: Re-write in another form, some working may be needed.	Prove	Maths: More formal than 'show', all steps must be present. In the case of a geometrical proof, reasons must be given.
Arrange	History: Put the factors in an order and then justify your choices	Factorise	Maths: Insert brackets by taking out common factors.	Prove algebraically	Maths: Use algebra in the proof.
Change	Maths: Usually convert from one unit to another, either using known metric unit conversions or the use of a conversion graph.	Factorise fully	Maths: Insert brackets by taking out all the common factors.	Realise	Music: To achieve, attain and/or accomplish your intentions.
Collate	Gather and organise your ideas logically	Find	Maths: Some working will be needed to get to the final answer.	Recommend	Put forward or suggest an answer that is suitable for the question
Comment	Write an informed opinion	Give	Typically a very short, undeveloped answer Synonyms: state, name and identify.	Record	Music: To document ideas, thoughts, insights and responses to starting points in visual and written annotated form.
Consider	To think through, review, reflect on, and respond to given information	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	Refine	Music: To improve, enhance and change elements of your work for the better.
Convert	Computing: change the form, character or function of something	How far do you agree...	History: Examine the evidence and form a detailed opinion	Research	Music: To study in detail, discover and find information about.
Demonstrate	Music: To show, exhibit, prove or express such things as subject specific knowledge, understanding and skills.	How important was...	History: Judge the importance of the factor and then compare relative to others	Respond	Music: To produce personal work generated by a subject, theme, starting point, or design brief.
Design	Computing: produce a plan, simulation or model	Identify	Provide an answer from a number of possibilities	Review	Review is to explain/evaluate e.g. write about and assess the importance, quality or value of the topic
Determine	Science: Use given data or information to obtain an answer	Interpret	Dance: Translate information into recognisable form. Other subjects: examine information for patterns and causation	Show	Show structured steps or evidence or all workings needed to get to a given answer
Develop	Music: To take forward, change, improve or build on an idea, theme or starting point.	List	Provide the information in a list rather than continuous writing	Simplify	Maths: Simplify the given expression
Draw	Produce a diagram or picture. Note: this command is often linked with 'label' or 'annotate'.	Match	Link or pair-up a definition to the a key term	Simplify fully	Maths: Simplify the given expression. Answer must be given in its simplest form
Estimate	Science: Assign an approximate value	Plan	Science: Write a method used extended bullet point method—unique to writing in Science!	Solve	Maths: Find the solution of an equation or inequality. Computing: Obtain the answer(s) using algebraic/numeric/graphical methods.
Evidence	To show, prove, support and make clear or verify something.	Predict	Science: Suggest the most likely outcome	State	Music: to express clearly and briefly your intentions.
Expand	Maths: Remove brackets	Present	Music: To give a response to an idea, theme or starting point that shows a personal, meaningful and organised fulfilment of intentions.	Tick	Put a mark to indicate that something is correct
Expand and simplify	Maths: Remove brackets and the collect like terms.	Produce	D&T: Draw or design an isometric or orthographic drawing	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.

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)

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 'Colour Code Complex' 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':



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. <i>Synonyms are: give/name or identify.</i>
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.
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 and 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.

THS Tier 2 Vocabulary - 100 Word List

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

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

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

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

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

- 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

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



4.

Alexander Calder

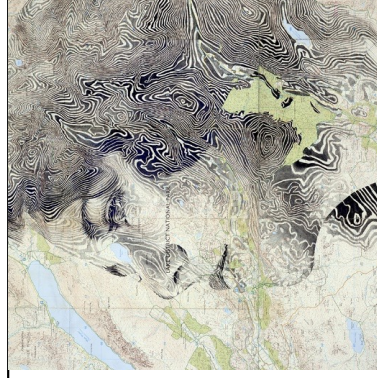
Prolific artist who made continuous line, wire sculptures of faces. These can lay flat or be made more 3D by using a stand.



5.

Ed Fairburn

Fairburn uses maps as backgrounds for his portraits. He thinks carefully about the contours and lines that already exist to work into the images.



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?

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

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.

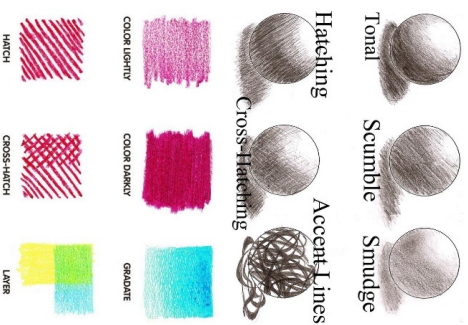
Dry media - Materials which are used dry include: pencil, charcoal, pen and pastels.

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.

Collage

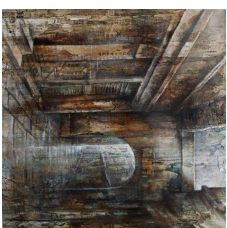
Gluing tissue, newspaper and other papers down onto your surface to create your artwork. Papers can be torn or cut and bring texture to your work.



11.

Ink

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..



13.

Mixed media

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.



12. Watercolour

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.



14.

Acrylic

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.



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.

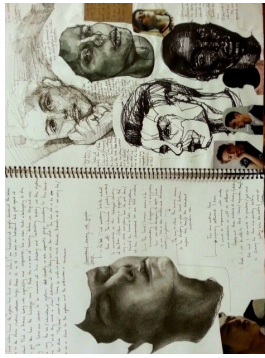
17.

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

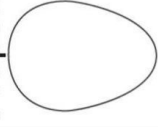
Detail - from observations you have included every aspect of the object.

Tone – It is important to use a large range of tone in your drawings, especially when drawing shiny objects such as bottles and glasses.

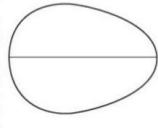


Proportions of the Face

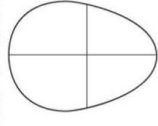
WRITE THESE RULES ON THE NEXT page in your sketchbook



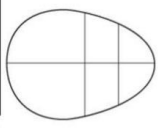
To begin drawing a portrait you should draw a simple oval shape. Remember that the eyes and nose are positioned at this level.



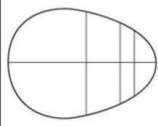
Draw a line vertically right through the nose. This line will be the mouth and eye centre line.



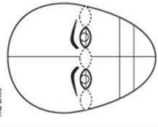
Draw a horizontal line half way between the eyes and the top of the nose and the eyes and top of the mouth will go.



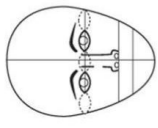
Half way between the eyes line and the top of the nose and the eyes and top of the mouth will go.



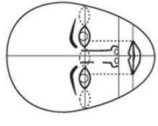
A third of the way down from the top of the nose and the eyes and top of the mouth will go.



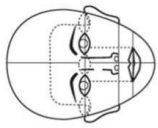
Draw in the eyes with the mouth. Remember that the eyes and nose are positioned at this level.



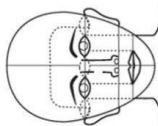
Draw in the mouth with the nose. Remember that the eyes and nose are positioned at this level.



Draw in the nose with the mouth. Remember that the eyes and nose are positioned at this level.



Draw in the eye and nose line. Remember that the eyes and nose are positioned at this level.



Draw the mouth by drawing a horizontal line. This is where the mouth will go.

19.

Facial Proportion

There are lots of rules when drawing the face that can help us be accurate in our representation.

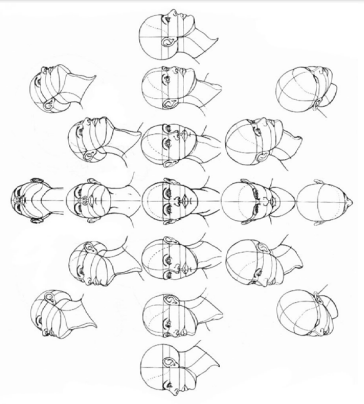
Faces are generally symmetrical.

Drawing out faint guide lines to

map out where the facial

features sit on the face is a great

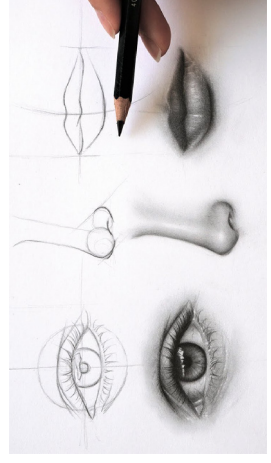
way to start a portrait.



20.

Drawing faces from different angles.

21. Drawing Facial features



Creativity

22.

AO4 – Final outcomes and bodies of work.

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

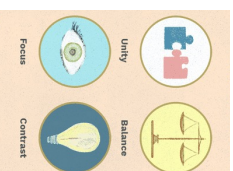
All of your preparatory work leads up to your personal response or final piece. To make a successful final piece, you must:

- 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

- 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.

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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.

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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.

Elements of composition in art

- 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.



Rule of thirds

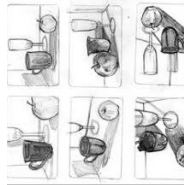
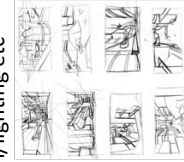
The rule of thirds is a composition guide that states that arranging the important features of an image on or near the horizontal and vertical lines that would divide the image into thirds horizontally and vertically is visually pleasing.

Photography skills

30.

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



31.

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?

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

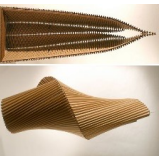
Different types of cardboard:

- 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 back to glue on.
- Bend – score lines down the cardboard to allow it to bend.

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 anything 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.



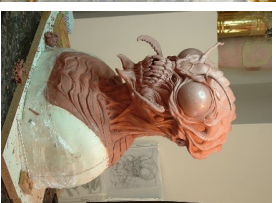
39.

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

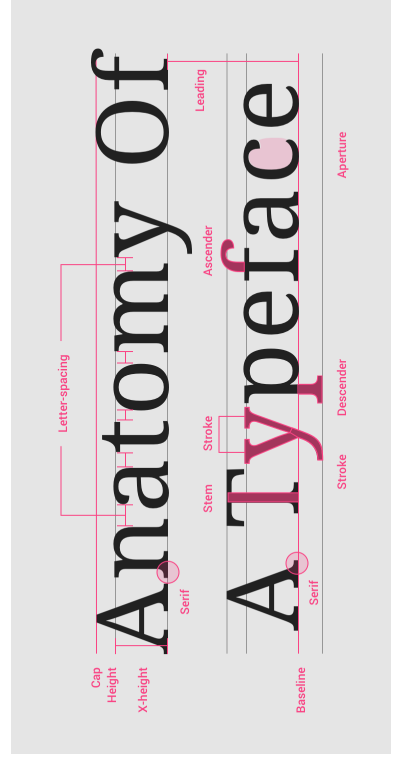
The term graphic design can refer to a number of artistic and professional disciplines which focus on visual communication and presentation. Various methods are used to create and combine symbols, images and/or words to create a visual representation of ideas and messages. A graphic designer may use 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

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)



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.



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.

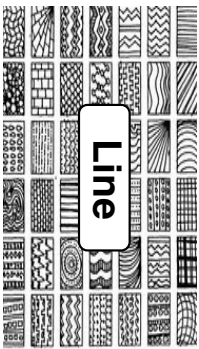
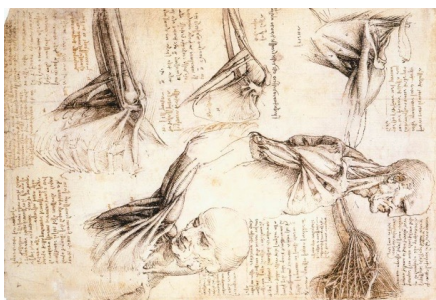
There are several reasons annotation may be used, for example to:

- 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

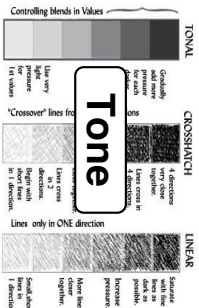
What to include in annotation

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



Line



Tone



Shape



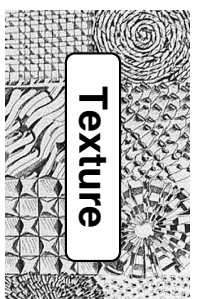
Colour



Pattern



Texture



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 **0000000** and **1111111**.

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

$(1 \times 64) + (1 \times 8) + (1 \times 2) = 74$ 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 use 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.
 $(2 \times 16) + (D \times 1)$
 $(2 \times 16) + (13 \times 1)$
 $32 + 13$
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... **1s** and **0s**.

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** together in varying amounts.

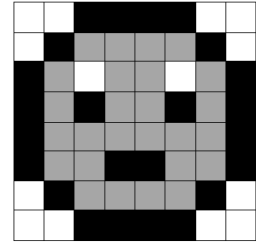
Many printers use the **CMYK model**. They combine the colours **Cyan**, **Magenta**, **Yellow** and **Black** in different amounts.

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).

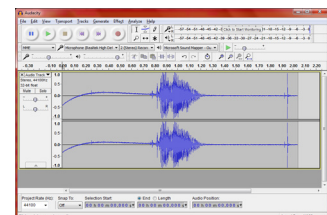
Sample-Rate (how many samples were used each second e.g. **8000 Hz**).

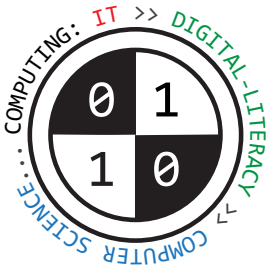
Sample-Size (how many bits each sample contains e.g. **32 bits**).

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.' )
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).

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**.

<p>Theatrical skills</p> <p>Freeze frame: A frozen moment in time expressing a character / scenario.</p> <p>Still image: frozen image that symbolises an idea or relationship</p> <p>Thought tracking: a character saying their thoughts aloud</p> <p>Hot seating: a character is asked questions and the actor responds in role</p> <p>Narration: telling the audience what is happening</p> <p>Mime: suggesting action, character, or emotion without words</p> <p>Improvisation: creating a scene without a script</p> <p>Proxemics: the use of space on stage to create meaning</p> <p>Levels: the use of height to show status</p> <p>Status: the power one character has over another</p> <p>Physical Theatre: creating objects, set or meaning through the use of the body</p> <p>Year 9 Drama specific vocabulary</p>	<p>2</p> <p>Vocal skills</p> <p>Pace: how fast or how slow the character speaks</p> <p>Power: how loud or how quiet a character speaks</p> <p>Pitch: how high or how low a character speaks</p> <p>Pause: moments where the character stops talking</p> <p>Tone: shows what the character thinking or how they are feeling</p> <p>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</p> <p>Accent: people from different countries or areas speak with different accents – this can help communicate the background of a character</p>	<p>3</p> <p>Physical skills</p> <p>Facial expression: showing emotion of the character through the face</p> <p>Body Language: using your body to show the characters emotion</p> <p>Physicality: using your body to show the character</p> <p>Gesture: a movement of part of the body to show meaning.</p> <p>Mannerisms: habitual gesture or way of speaking or behaving in role</p> <p>Gait: the way a character walks</p> <p>Posture: How straight or slouched a character stands</p> <p>Co-ordination:</p> <p>Stillness: lack of movement for a dramatic affect</p> <p>Timing: exactly when something is done of the stage</p> <p>Eye contact: looking directly at a character or choosing not to look at them</p> <p>Spatial Awareness: the ability to be aware of props and other actors around you</p> <p>Interaction with others: This could include touch or use of close proxemics to show the audience something</p> <p>Choral movement: where a group of actors move in the same way at the same time (synchronized)</p>	<p>4</p> <p>A sample of Rehearsal techniques:</p> <p>Thought tracking: stopping the action at any moment in rehearsal, then characters speak their thoughts</p> <p>Creating unseen scenes: improvise a scene to see how your character responds. The scene need not be part of the final performance.</p> <p>Research: you may look at videos, sound clips or other internet research, particularly if you are playing a real person.</p> <p>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.</p> <p>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</p> <p>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)</p> <p>5</p> <p>Command words:</p> <table border="1"> <tr> <td>IDENTIFY</td> <td>Can you find where in the performance they have used a particular skill?</td> </tr> <tr> <td>ANALYSE</td> <td>Why have they used this technique / skill, what was the effect?</td> </tr> <tr> <td>EVALUATE</td> <td>Were they successful when using this techniques / skill? If so why? If not why not?</td> </tr> </table>	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?	EVALUATE	Were they successful when using this techniques / skill? If so why? If not why not?
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EVALUATE	Were they successful when using this techniques / skill? If so why? If not why not?								

Year 9: Roles & Responsibilities:

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:

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:

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

Theatre Maker:

Playwright

What they do:

Writing the script of the play, including the dialogue and stage direction

2

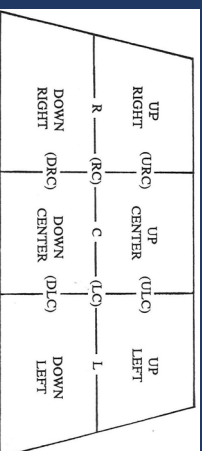
Theatre Maker:

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



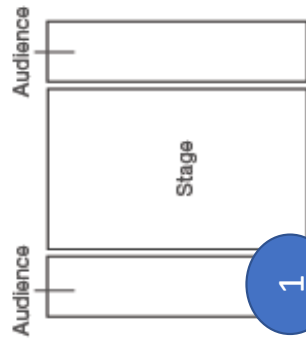
13

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



1

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:

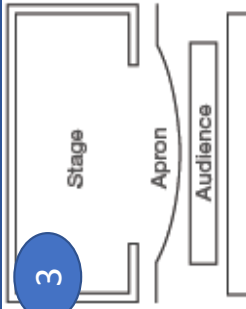
Big pieces of **scenery, backdrops or set** can block **sightlines**
Blocking can be challenging
Actors can struggle with making themselves visible to both side of the audience
Lighting needs to be carefully designed to avoid shining lights in the audience's eyes.

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.

3



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.

Theatre in the round:

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



2

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.

4



Advantages:

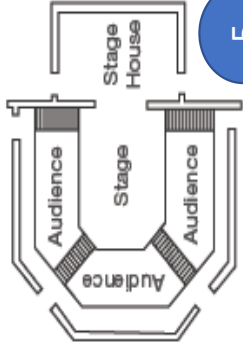
It is interactive and exciting – the audience may feel more involved.

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.



5

Thrust stage:

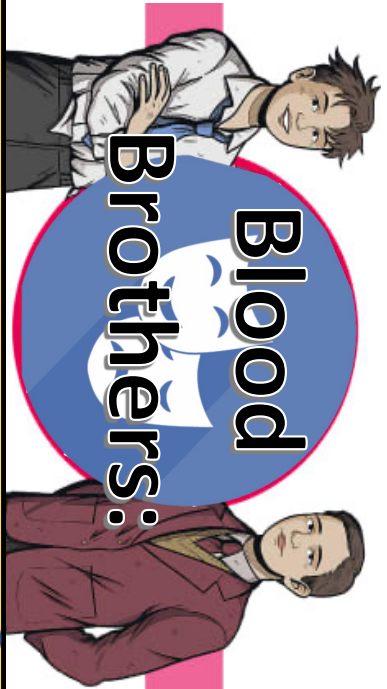
Protrudes into the auditorium with the audience on three sides.

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



Blood Brothers:

Brief plot Summary:

Blood Brothers, a musical by Liverpoolian 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:

- 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:

- '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'

Stylistic features and symbols:

- Reprise** – a song or part of a song that is repeated. Often it is intermingled with a new song. Eg. 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.
- Foreshadawning** – 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
- Antithero** – 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.

Key characters:

- 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: Book Musical. Links to Epic Theatre

Themes:

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



How to approach question:

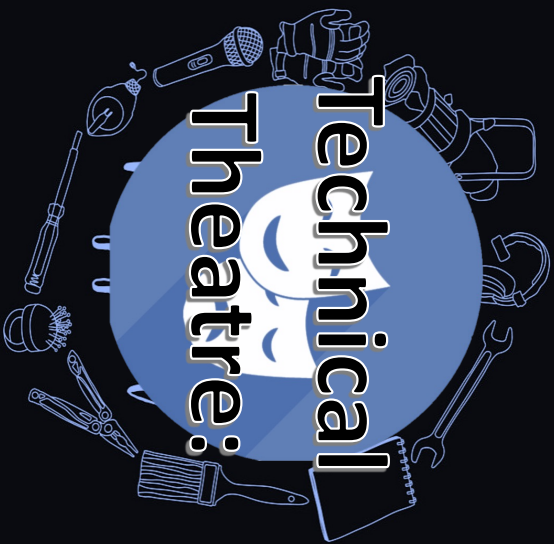
Technical language – use the accurate terminology to describe each aspect of a production, such as performance skills, design features and stage configurations

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.

<p>Year 9 Drama</p> 	<p>Structuring written responses: Live Theatre Review</p> <p style="text-align: right;">2</p>
<p>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)</p> <p>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?</p> <p>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?</p>	<p>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)</p> <p>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?</p> <p>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?</p>
<p>1</p> <p>4. Common feature of a play: 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 actors' 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.</p>	 <p>3</p> <p>Important things to think about when evaluating a moment:</p> <ul style="list-style-type: none"> • 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 THEATRICAL SKILLS USED THROUGHOUT! <p>4</p> <p>Important things to think about when analysing a moment:</p> <ul style="list-style-type: none"> • Explain in detail the meaning created by the moment, relating to the audience. <ul style="list-style-type: none"> • 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 placed on the set or at the front of the stage (not very strong)
- **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 backdrops 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.
 - **Minimalistic 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
- **Music:** style, atmosphere, effect, bass, treble, tempo
- **Effects:** echo, distortion, volume, amplification, pitch, reverb, fade, crossfade.
- **Microphones:** radio mics, microphones/stands, hanging mics.
- **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 of a scene. 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

1 Context: 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

2 Main Characters:
Ralph: one of the oldest boys; leader of the group, careful and mature. Represents law and 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.

3 Glossary:
Innate: ability you are born with
Hegemonic masculinity: an idea that promotes male aggression and dominance in society
Microcosm: a community or other unity that is an epitome of a larger unity
Totalitarianism: the political concept that the citizen should be totally subject to an absolute state authority
Democracy: a system where people can change their rulers in a peaceful manner
Savagery: an act of cruelty or violence
Civilisation: a society or place reaches an advanced stage of social and cultural development and organisation
Morality: the distinction between right and wrong or good and bad behaviour
Tribe: a group of people who live and work together in a shared geographical area
Instincts: an inborn impulse or motivation to action typically performed in response to specific external stimuli.

4 Themes:

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



5 Brief plot summary: 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.

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
Chair Duets: Physical movement based on and around chairs – includes touches, reaction, embraces, etc
levels with their partner.

Monologue

Round-By-Through: A string of movement that involves passing closely around the partner.

Aim: To create thrilling, energetic and unforgettable theatre.



Their physical style combines, movement, design, music and text.



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.

Stanislawski:

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 feelings 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

Practitioners:

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 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.

Year 9 Drama

8

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



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

1. Properties of Metals

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.

Metals

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.

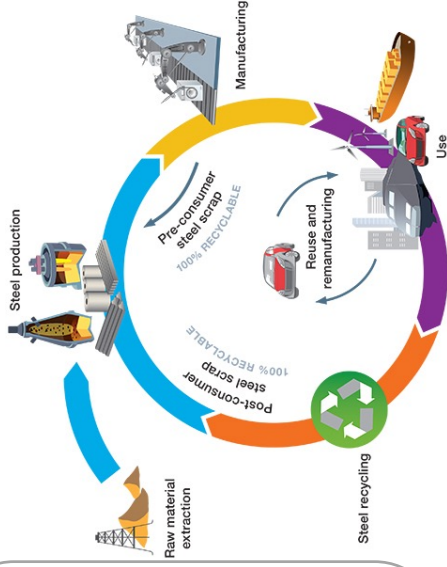
Ferrous Metals



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

Metal lifecycle



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.

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. 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.



NON FERROUS METALS



COPPER



BRASS



ALUMINIUM



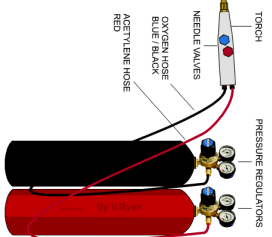
TUNGSTEN



LEAD

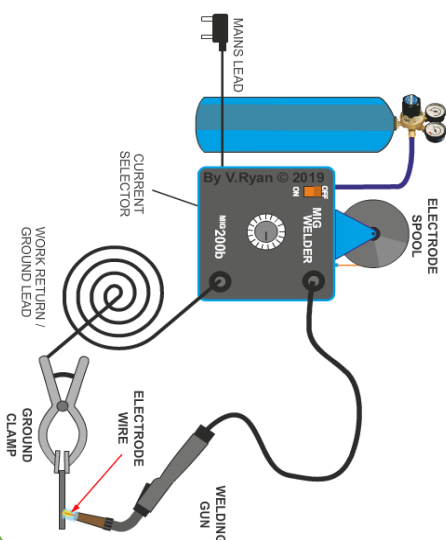
Oxyacetylene gas welding is commonly used to permanently join mild steel. A mixture of oxygen and acetylene, burns as an intense / focussed flame, at approximately 3,500 degrees centigrade. When the flame comes in contact with steel, it melts the surface forming a molten pool, allowing welding to take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

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



Processes

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.

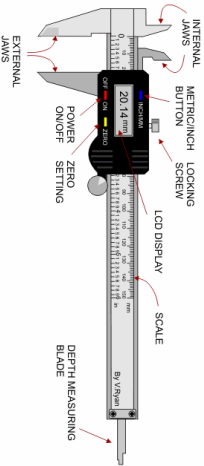


Metals

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**.



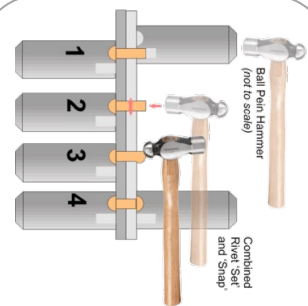
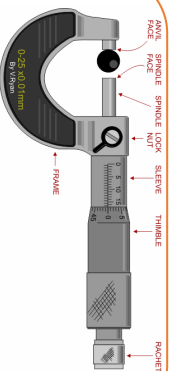
The **Digital Caliper** (sometimes incorrectly called the Digital Vernier Caliper) is a precision instrument that can be used to measure internal and external distances extremely accurately



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.

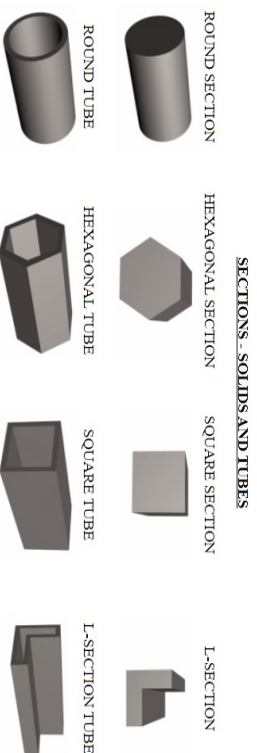


The **Micrometer** is a precision measuring instrument, used by engineers. Each revolution of the ratchet moves the spindle face 0.5mm towards the anvil face



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).

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.

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

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

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.

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

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?

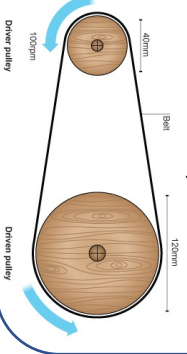
Pulley systems

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 Motions

Linear Motion	Rotational Motion	Oscillating Motion	Reciprocating Motion	Rotary Motion
Motion in a straight line, whether, vertically, horizontally or in a circle.	Motion in a circle.	Motion in a straight line, whether, vertically, horizontally or in a circle.	Motion in a straight line, whether, vertically, horizontally or in a circle.	Motion in a circle.
Examples: Piston, Train, Door, Sawing machine, Needle, Oscillating Motion	Examples: Fan, Metronome, Door, Oscillating Motion	Examples: Piston, Pedalling, Sawing	Examples: Opening & closing a drawer, Rotating	Examples: Door handle, Rotating

Types of motion

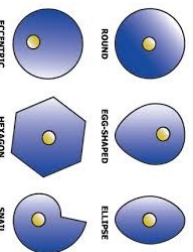
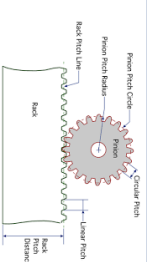
There are four basic types of motion in mechanical systems:

- 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.



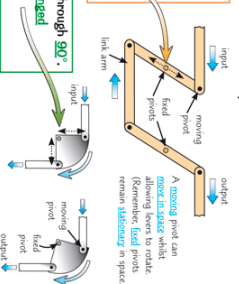
Microcontrollers are widely used in everyday items such as washing machines, remote controls, microwave ovens, mobile phones and vending machines. A modern car can contain around 40 of them. Several different types are commonly used in school electronics projects, including PICs, PICAXE and GENIE microcontrollers.

Mechanical Systems

Linkages Connect Different Parts of a Mechanism

Links can be connected together to form linkages. Simple linkages can change the magnitude of the force and the direction of motion. Here are two examples:

- 1) Push/pull linkages use two fixed pivots. The input and output motions of the linkage are in the same direction. The motion of the link arm is in the opposite direction.
- 2) Here, each fixed pivot is in the centre of an arm. Changing the position of these pivots will change the magnitude of the output force — often the easiest way to see this is by making a model.



Push/Pull Linkages

1) A bell crank changes the direction of a force through 90°. 2) The magnitude of the output force can be changed by moving the fixed pivot so it's not an equal distance between the two moving pivots.



Bell Crank

Gear Trains Transmit or Change Rotary Motion

- 1) Gears are toothed wheels that interlock. They transfer motion from one part of a machine to another.
- 2) A gear train is where two or more gears are linked together. They can be used to change the direction of motion or change the magnitude of the input force (this is to do with the increase or decrease in the speed of rotation that can be generated by linking different-sized gears). Here are some examples:

The driver gear, turned by hand or a motor, turns the driven gear, and the driven gears will both turn in the same direction. The size of the driver gear, the size of the driven gear, and the number of teeth on the driver gear, will affect the speed of the other two gears.

If linked gears are different sizes, the smaller gear (i.e. the one with fewer teeth) will turn faster. The relationship between the driver and the driven gears can be described using a gear ratio. The size of this ratio describes how much the mechanism changes the speed of the gear from the input speed to the output speed. Here's an example of how gear ratios can be used in calculations:

EXAMPLE:

A gear train is made up of a driver gear with 10 teeth and a driven gear with 20 teeth. The driver gear is rotating at 500 rpm (revolutions per minute). Calculate the output speed of the gear train. $\text{Output speed} = 500 \times \frac{10}{20} = 250 \text{ rpm}$

MECHANISMS

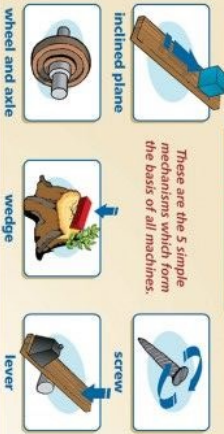
WHAT IS A MECHANISM?

A machine is made up of a number of working parts called mechanisms. A mechanism changes an input force + movement into a desired output force + movement.



SIMPLE MECHANISMS

These are the 5 simple mechanisms which form the basis of all machines:



EXAMPLES OF MECHANISMS



Types of Gears

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.

A gear is a wheel with teeth on the outer circumference connected to an axle. The teeth prevent slipping between meshing gears. The gear can be made to change direction, speed, and torque depending on how it's connected to the shaft.



Worm Drive Gear

Consists of a worm gear and a gear wheel. The worm gear is a gear with a long, thin, cylindrical shape. The gear wheel is a gear with many teeth. The worm gear is connected to the gear wheel. The worm gear is turned by hand or a motor. The gear wheel is turned by the worm gear. The worm gear is used to change the direction of rotation and to reduce the speed of rotation.



Spur Gear

The most common type of gear. The teeth are parallel to the axis of rotation. They are used to transmit motion between two shafts. They are used in many applications, including clocks, watches, and toys.



Bevel Gear

The teeth are cut at an angle to the axis of rotation. They are used to transmit motion between two shafts that are not parallel. They are used in many applications, including hand drills and power tools.



Helical Gear

The teeth are cut at an angle to the axis of rotation. They are used to transmit motion between two shafts. They are used in many applications, including cars and trucks.



Rack & Pinion Gear

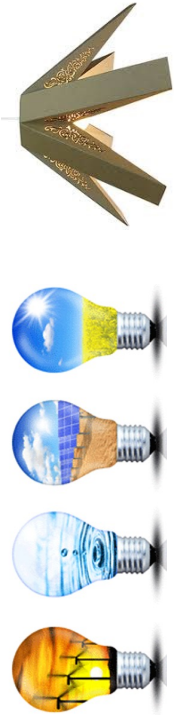
Consists of a rack and a pinion. The rack is a straight bar with teeth. The pinion is a gear with teeth. The rack and pinion are used to convert rotary motion into linear motion. They are used in many applications, including cars and trucks.



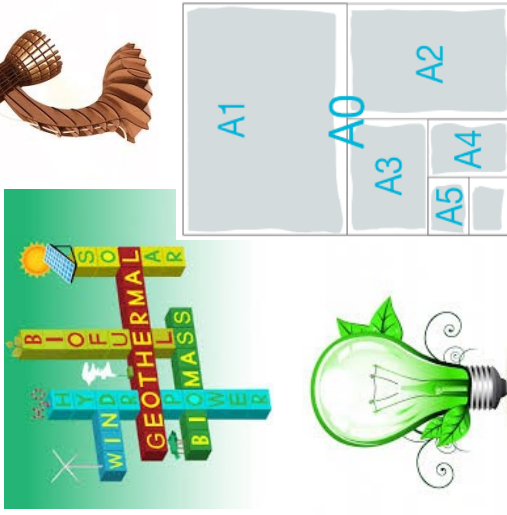
D Year 9 Design Technology.

Materials and Product Analysis, Paper and Card, CAD/CAM

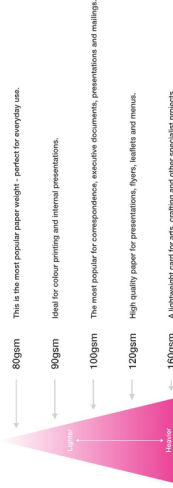
Type of paper and board.	Functional properties
Layout paper	Light weight, thin white paper. It is used for initial ideas. It also take colour media well and it is also cheap.
Tracing paper	This is thin translucent paper. Which is used to make copies of drawings. However it is also quite expensive. Its 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.



A GUIDE TO PAPER WEIGHTS - GSM



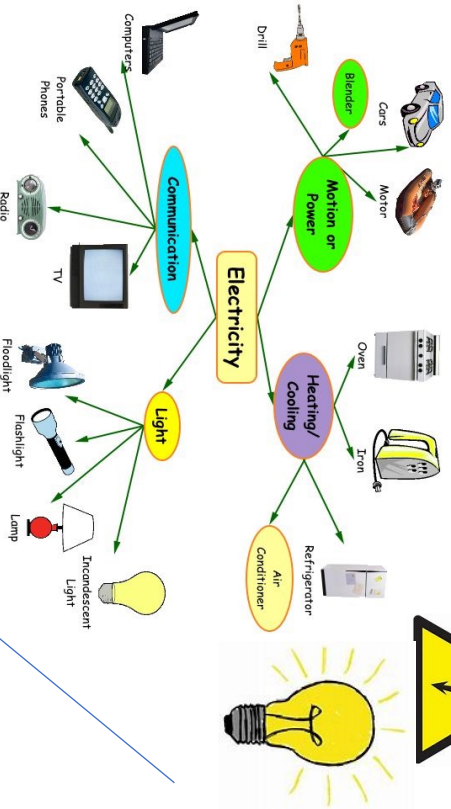
CAD/CAM (computer-aided design and computer-aided manufacturing) refers to computer software that is used to both design and manufacture products. **CAD** is the use of computer technology for design. We use 2D design. **CAD/CAM** applications are used to both design a product and program manufacturing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



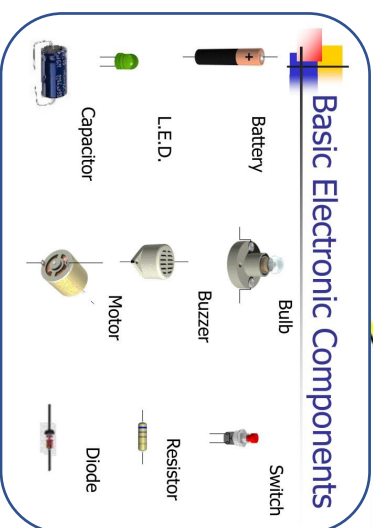
Computer Numerical Control
CNC means **Computer Numerical Control**. This means a computer converts the design produced by Computer Aided Design software (CAD), into numbers. The numbers can be considered to be the coordinates of a graph and they control the movement of the cutter.

Uses Of Electricity In Our Daily Life

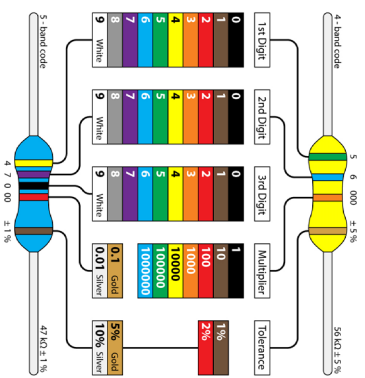


Electronics is the technology concerned with the design of circuits using transistors and microchips, and with the behaviour and movement of electrons.

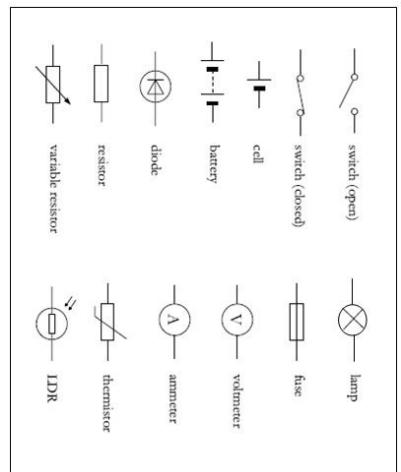
There are many different types of electrical and electronic components, including resistors, capacitors and diodes. Each of these has a specific use in a circuit.



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.

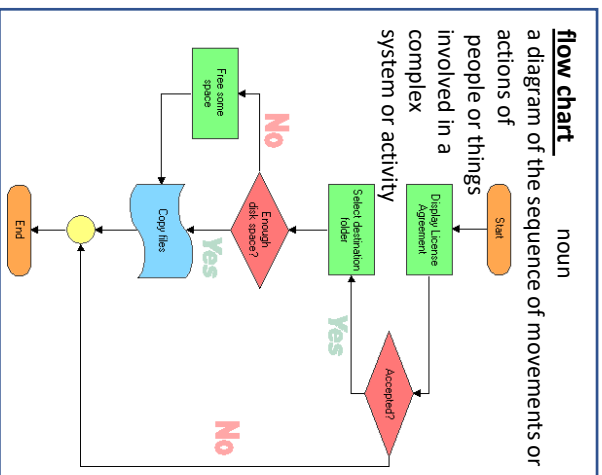


CAD is not only used to design and manufacture products. It is also used to create circuits for use in electronics.



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:

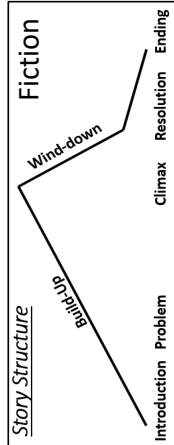
- which pins have to be connected
- the function of each pin
- how the IC is connected to the power supply

English Year 9 Writing

1. Key Terms

- Ethos:** to make yourself appear trustworthy, unbiased and credible, to your reader.
- Logic:** convince your audience through reason, facts and statistics.
- Pathos:** persuade your audience by appealing to their emotions
- Antithesis:** something that is the direct opposite of something else, eg. love is the antithesis of selfishness.
- Rhetoric:** effective use of persuasion
- Anaphora:** repetition of a word or phrase at the beginning of successive clauses.
- Anadiplosis:** repeating the final word or phrase from one clause at the beginning of the next, eg, when I give, I give myself.
- Nuance:** subtle or slight difference
- Perspective:** a way of looking at something, a viewpoint.
- Metaphor:** directly refers to one thing by describing something else
- Hyperbole:** extreme exaggeration to make a point

2. Planning writing



Purpose
Audience
Language
Layout

5. Super Spellings

- Abhorrent
- Anticipatory
- Vehement
- Serendipity
- Nonchalant
- Imperative
- Modicum
- Jubilant
- Reputate
- Myriad
- Salient
- Discombobulating
- Obsequious
- Plethora
- Panacea
- Taciturn
- Superfluous
- Umbrage
- Energetic
- Truculent

3. Ways to make your writing more persuasive and engaging



Anecdote

Alliteration

Pronouns

Facts

Opinions.

Rhetorical Questions

Repetition

Emotive Language

Exaggeration

Statistics.

Three's

Varied sentence lengths and structures such as multi-clausal sentences, fragment sentences.

Sensory language

Show don't tell

Figurative language: metaphor, simile, personification

Punctuation used to alter pace and tone

6. SPaG: complete these

Parentheses are....and can be used to...

Ellipsis is used to...

An **exclamation mark** shows ...

Commas are used to...

A **dash** is used to ...

Brackets can ...

4. Useful rhetorical structures

- Not only, but also** **E.g.** Not only are holidays too infrequent, but they are also too short.
- So, so** **E.g.** Holidays are so infrequent, so short, that they feel as if they are over before they begin
- Brackets although** **E.g.** School holidays are too infrequent (although some kiljoys will love to tell you otherwise) and the impact of this has been seen on students in the high anxiety rates among teenagers.
- Triple abstract noun colon** **E.g.** Fury, anger, dismay: the feelings felt by both staff and students at the end of the holidays are intense.
- Simile start** **E.g.** Like a child's first steps, holidays are something to be treasured.
- Verb beginnings** **E.g.** Considering the amount of time families spend apart, holidays are clearly too infrequent.
- More more** **E.g.** The more time children have to relax, the more energised and engaged they will be in their studies, and ultimately the more they will achieve.
- Less less** **E.g.** The less time spent with the family means the less time that is spent establishing family values, which means the less time a child is able to connect with their parents
- Fortunately/unfortunately** **E.g.** Fortunately, the holiday companies are aware of the holiday dates and can adjust the capacity for those dates; unfortunately, this comes at a significant financial premium.
- Adverb beginnings** **E.g.** Typically, no one consults children on how they feel about holiday dates and the frequency of their breaks.

1. Key Terms

- Rising action:** the part of the story where the plot becomes increasingly complicated.
- Climax:** the most dramatic, exciting part of a story.
- Falling action:** diminishing tension, leading towards a resolution.
- Foreshadowing:** hints at events to come.
- Allusion:** brief and indirect reference to a person, place, thing or idea of historical, cultural, literary or political significance. It does not describe in detail the person or thing to which it refers.
- Pun:** a play on words – a word has more than one possible meaning.
- Juxtaposition:** two contrasting ideas put next to each to make the difference clear.
- Alternative:** different without interruption.
- Sustained:** continues without interruption.
- Perceptive:** sensitive – noticing things that aren't obvious.
- Critical:** analyzing faults and issues.

English Year 9 Reading

2. Super Spellings

- Vapid
- Implications
- Predominantly
- Anticipate
- Integral
- Persistent
- Conversely
- Presumption
- Underlying
- Dominant
- Significant
- Adequate
- Imprudent
- Condescending
- Contentious
- Compassionate

3. Big questions

- What did the writer want us to think of the main character?
- What was the final message the writer wanted us to remember?
- Which of these characters would you want to have a coffee with? Can you see any moments where the context influences the text? Does the writer deliberately mislead us at any point? Why?
- If you were creating a film of a scene, what music would you use?
- If you had a problem, which character would you want to help you and why?
- Which character would make the best prime minister?

5. Contextual Information

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 what we believe 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 they 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?

4. Structuring your essay

Introduction

What is the novel about? '_____ by _____ is about...'
 What is the aim of the author? _____ wanted to highlight/explore/expose...

Developing an argument

What is the question asking you? What is your answer? Which moments of the text will support your argument?

At the start of the chapter/novel, the character/mood is...
 When we first meet _____, we are struck by.../Initially,

Initially,

In the middle of the chapter/novel, the character/mood changes...
 As the novel progresses, the character...
 However,

Furthermore,

By the end of the chapter/novel, the character/mood is...
 Finally,

Conclusion

What are your overall thoughts? How successful was the writer?
*Ultimately, I was left with a feeling of...
 _____ main message was....*

6. Ambiguity

Explore alternative interpretations

- Could
- May
- Might
- Perhaps
- Possibly
- Seems to
- Probably

7. Further reading

The Astonishing Colour of After - Emily X.R. Pan	The Big Lie - Julie Mayhew
After the Fire - Will Hill	The Hobbit and The Lord of the Rings - JRR Tolkien
George - Alex Gino	The Kite Runner - Khaled Housseini
Code Name Verity - E. Wein	Naughts and Crosses series - Malorie Blackman
THUG - Angie Thomas	Lies We Tell Ourselves - R. Talley
Gone Series - Michael Grant	Pride and Prejudice - Jane Austin
Orphan Monster Spay - Matt Killean	Oliver Twist - Charles Dickens
The Children of Blood and Bone - T Adeyemi	The Help - Kathryn Stockett
The Handmaid's Tale - Margaret Atwood	The Book Thief - Markus Zusak

English Year 9 Speaking and Listening

1. Key Terminology:

Sophisticated: having and expressed a developed knowledge on a particular topic.

Repertoire: a wide collection of items/terms/vocabulary.

Strategies: Methods and plan of action to achieve an overall aim.

Perceptive: Having or showing a sensitive insight into a key topic.

Elaborate: To develop further and in more detail.

Debate: A formal discussion on a particular matter or topic in which opposing arguments are put forward.

Biased: Unfairly prejudiced for or against someone/something.

Logical: Straight forward and making sense.

Reasoned: Based on logic or good sense.

4. PALL of Speaking and Listening Speech:

Purpose: To persuade and inform.

Audience: Year 9 students in your class.

Language: Formal but relevant to year 9s, engaging, persuasive and informative.

Layout: 6 paragraphs including an introduction, counter argument and conclusion.

3. Success Criteria

- You can express sophisticated ideas/information/feelings using a sophisticated repertoire of vocabulary.
- You organise and structure your presentation using an effective range of strategies to engage the audience.
- You achieve the purpose of your presentation.
- You listen to questions and feedback responding perceptively and if appropriate elaborate with further ideas and information.

2. Super Spellings

1. Dominant
2. Decline
Facilitate
3. Sustainable
4. Logic
5. Presumption
6. Enhanced
7. Explicit
8. Underlying
9. Implicit
10. Intervention
11. Hierarchical
12. Eliminate
13. Prohibited
14. Exploitation
15. Integrity

5. Key Topic Ideas

- Climate change and recycling
- Is Barbie a good role model?
- Is war ever justified?
- Should 16 year olds be allowed to vote?
- Video games cause violence
- Students from farming families should be given time off school to help with harvesting and silaging.
- Are beauty contests harmful?
- Is the death penalty ethical?
- Should we ban keeping animals in zoos?
- Should governments be allowed to sensor information on the internet?
- Mobile phones should be monitored and installed with tracking devices for under 16s.
- Police should be armed with guns.
- Should PE in school be compulsory?

6. Persuasive Techniques

Alliteration: starting 2 or more words with the same letter.

Anecdote: a short story to support your idea

Pronouns: I, you, he, she, we

Facts: something proven to be true

Opinion: a personal view.

Repetition: using the same word/phrase more than once.

Rhetorical Questions: a question that doesn't require an answer but encourages deeper thought.

Exaggeration: making an over the top statement.

Emotive Language: language that is designed to evoke an emotional response.

Statistics: numerical fractions and percentages.

Threes: using three words/phrases to support or describe.

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)

A

Fat
Vitamins (A, B, C, D, E, K)
Minerals (Iron, Sodium, Fluoride, 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

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

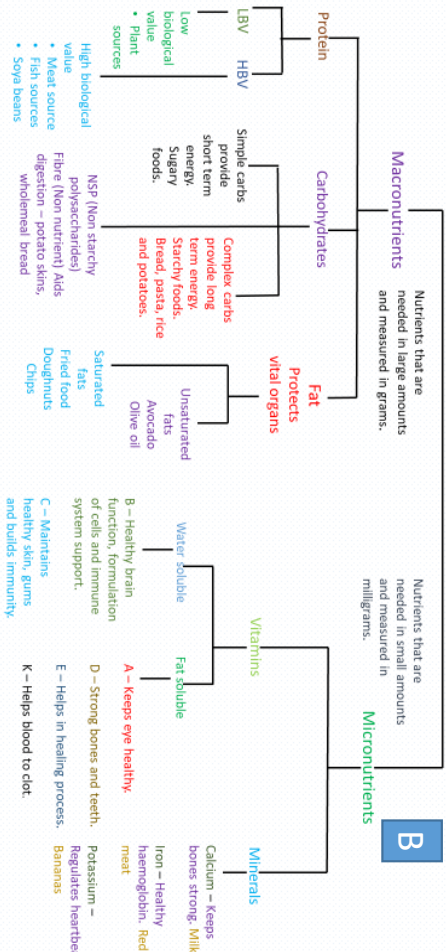
C

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 (CO2). 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

Nutrients



Food Poisoning

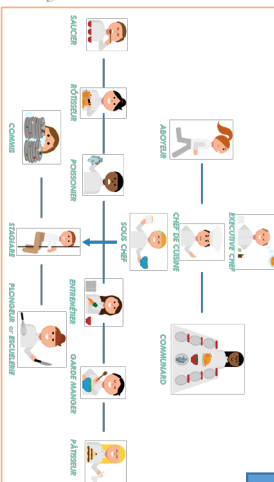
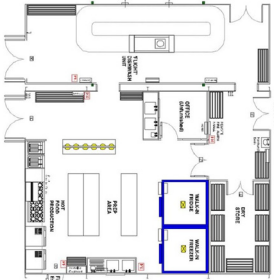
Pathogen	Symptoms	Source	Good Practice
STERIA	diarrhea, fever, muscle aches	unpasteurized milk, soft cheeses	cooking raw food thoroughly
CAMPYLOBACTER	nausea, fever, cramps, diarrhea	raw milk, raw meat	cooking raw food thoroughly
CLOSTRIDIUM PERFRINGENS	nausea, vomiting, cramps, diarrhea	stews, soups, gravies held at warm temperature	hold food at below 40°F (4°C) or above 140°F (60°C)
SALMONELLA	diarrhea, dizziness, 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

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 records
- Submitting reports

G

Hospitality & Catering – if you choose BTEC Hospitality and Catering you will need to learn all about the Catering industry. The Front of House system, kitchen layouts and the 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)



E

- Service Types**
- Table
 - Silver
 - Vending
 - Family
 - Counter
 - Buffet

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

H

Sauces classification
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, Velouté, Espagnole & Tomato sauce.
Warm Sauces: Hollandaise/ Béarnaise (Emulsion sauce)
Cold Sauces: Mayonnaise sauce (Emulsion sauce)

NUTRITION

There are many job roles available in the Hospitality & Catering industry. There are a number of training sectors available for different industry sectors. The WJEC vocational award helps you on your first step.

- 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.

FOOD SAFETY

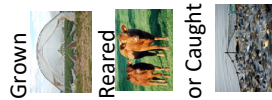
- Universities & Colleges Admissions service (UCAS)
- Examples of courses; Higher National Certificates & Diplomas & degrees
- Hospitality management
- Professional Cookery Management
- Culinary Industry Management
- Food & Culinary Arts

- Chartered Institute 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, willing 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

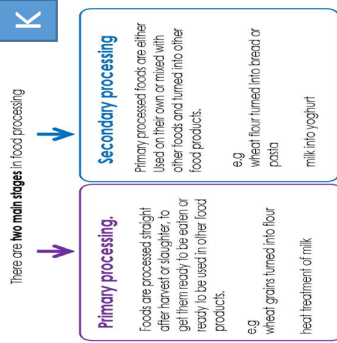
FOOD CHOICE

The food that we eat is either:



FOOD SCIENCE

Food Provenance – Processing and production
 Modern processing techniques have made it possible to produce a wide variety of food products to the same quality, standard, colour, flavour, shape and size every time.



FOOD IN INDUSTRY

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

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.

FOOD PROVENANCE

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	Celiac 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

Advantages and disadvantages of buying local and seasonal food
 Can you list which fruits and vegetables are in each season in the UK?

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	



Consider your options choices. Find out about the two courses available and how they are different. Ask your teachers about

Food Preparation & Nutrition GCSE Hospitality & Catering Level 1/2

Food packaging and labelling

Each burger contains:

ENERGY	924KJ 220Kcal	FAT	13g MED	SATURATES	5.9g HIGH	SUGARS	0.8g LOW	SALT	0.7g MED
	11%		19%		30%		<1%		12%

% of an adults reference intake.
 Typical values per 100g: Energy 966kJ/230kcal



Information required by law:

- 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

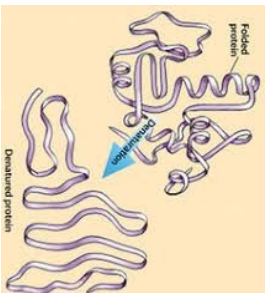
Types of pastry
 There are four main types of pastry that we use in school:



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.

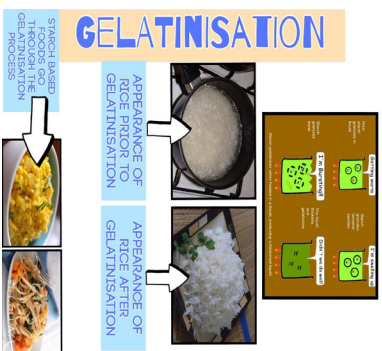


Denaturation



- Food Science:
- Gelatinisation
 - Denaturation
 - Shortening
 - Aeration
 - Layering
 - Elasticity
 - Glazing

GELATINISATION



GEOGRAPHY 9.1. Physical Earth

1. Geological Time Scales

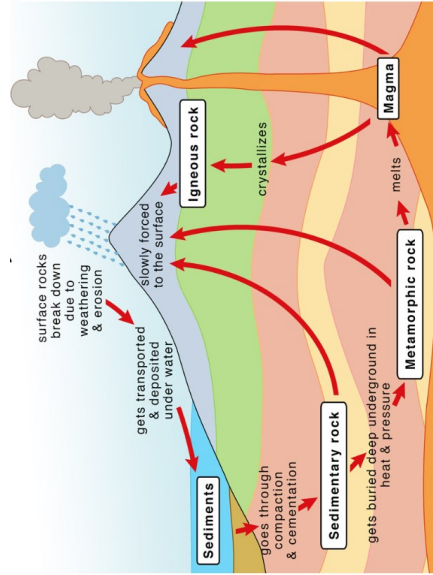
ERA	PERIOD	EPOCH
Cenozoic	Quaternary	Holocene
	Neogene	Pleistocene
		Pliocene
	Paleogene	Miocene
		Oligocene
Mesozoic	Eocene	66 million
	Paleocene	66 million
Paleozoic	Permian	299 million
		Carboniferous
	Devonian	Pennsylvanian
		Mississippian
	Silurian	
	Ordovician	
	Cambrian	541 million
4.5 billion		
Precambrian	Early Middle Late	

1. Geological time is like a calendar which starts back when Earth formed (around 4.6 billion years ago) right up to the present day. Each Era acts like a big book based on the four key time periods in the history of Earth. The change of geological era is based on a major past event, such as a mass extinction event, when Earth was struck by a huge meteorite—bringing about a significant shift in life or conditions on Earth.

Like all books, there are chapters (called Periods) which break up each Era into distinct blocks of time. The Jurassic period is well known for the evidence on dinosaurs found in the fossil record.

Finally, as the geological time scale nears the present day, epochs (pronounced: eh-pocks) are like scenes within a chapter. Currently, and as of the last 11,000 years, we are in the Holocene epoch, in the Quaternary period (last 2.5million years) of the Cenozoic era (last 66 million years).

2. The Rock Cycle



2. The surface layer of Earth, known as the crust, is made of one of three rock types. **Igneous rocks** are created by the inner heat of Earth, so are volcanic in nature. As they originate from magma. Sometimes, these rocks however don't burst out of the surface, but only get near it. Weathering and erosion break down and remove rocks exposed at the surface. The sediment get deposited, builds up in layers, gets compressed, and eventually forms **sedimentary rocks**. If sedimentary rocks are exposed to enough heat and pressure within the crust they change into **metamorphic rocks**.

Soil is our life support system. Soils anchor roots, hold water and store nutrients. Soils are home to earthworms, termites and a myriad of micro-organisms that fix nitrogen and decompose organic matter. We build on soil as well as with it.

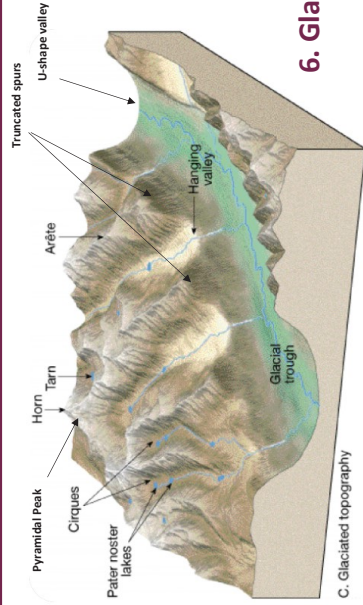


3. Soil = life



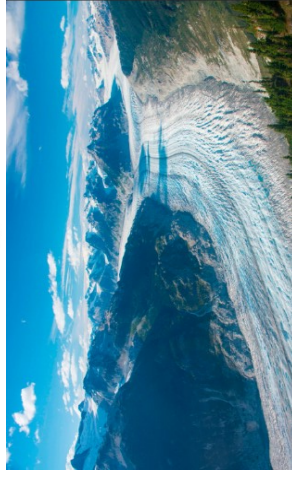
7. Post-Glacial landscapes

Mountainous areas at higher latitudes often show to signs that the environment was shaped by ice. The Brecon Beacons in South Wales show the best examples of some of these features in southern Britain, whilst the Lake District and Snowdonia National Parks are home to stunning examples further north in Great Britain. Glaciers are excellent at eroding the land creating iconic features such as U-shape valleys, arêtes and pyramidal peaks (horns). The Alps in Europe has glaciers and perfect examples of all of the features in the diagram below.



C. Glaciated topography

6. Glaciers

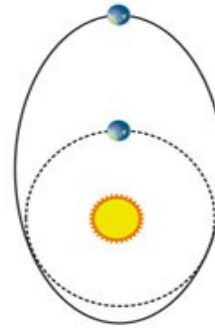


6. A glacier is essentially a frozen river slowly flowing downhill under the force of gravity. They form in high altitude mountainous areas that receive snow that remains on the ground even through Summer. The snow gets compressed into ice by the weight of more snow accumulating. Despite now being ice, their ice-crystal structure means they bend and 'flow' as they move; eroding the ground brilliantly.

4. & 5. Past Global Climates and Glaciations

The climate on Earth has been slowly but constantly changing forever. Looking back over geological time (millions or even billions of years), Earth has been both warmer and colder than it is at the present.

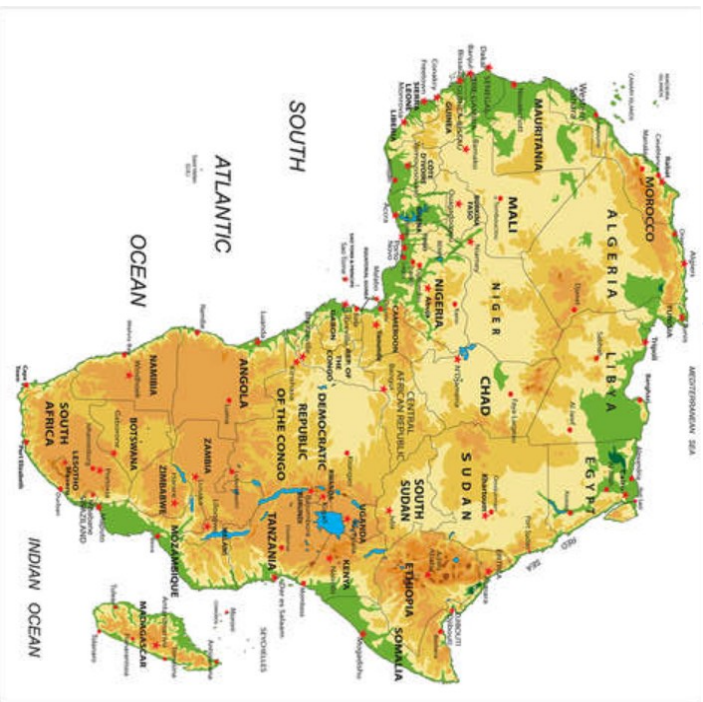
Earth is currently in a **warm climate phase** called an **interglacial**. This is because the planet is doing a near circular orbit of the sun (see dotted line on the diagram to the left) so it is **evenly heated throughout a year**. However, when the orbit of Earth around the sun isn't a perfect circle shape—but an **elliptical shape**—with the sun off-centre (see solid line on the diagram). This means Earth spends more time of a year **further away from the sun** as it completes an orbit. This means Earth's climate **cools** and **more ice forms** on Earth; these periods in geological time are called **glaciations**. It takes about 100,000 years to go from a circular orbit to an elliptical orbit and back again, so glaciations last for thousands of years! The current warm phase (**interglacial**) started about 11,000 years ago. In very recent geological time, there is much talk about 'climate change'. This is referring to the action and activities of humankind warming Earth's climate by changing the concentration of some of the gases in the



GEOGRAPHY

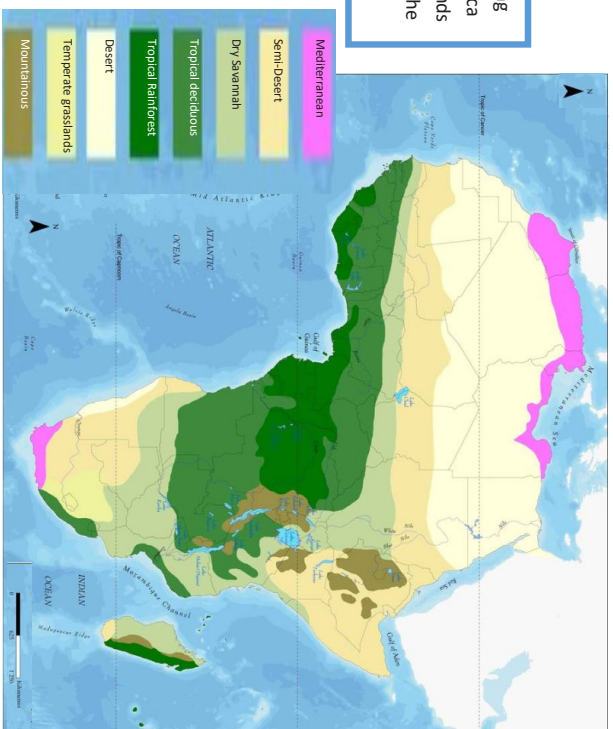
9.2. Africa

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.



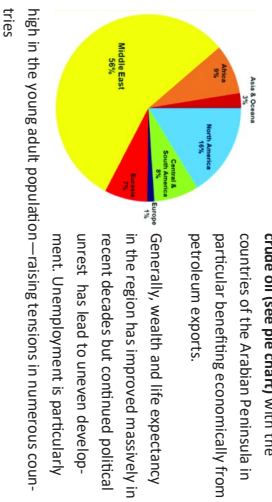
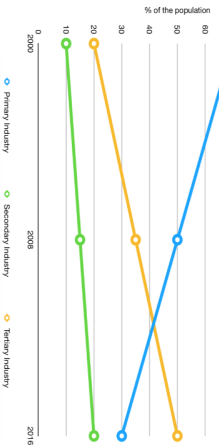
The Middle East generally has a hot, dry climate, with several major rivers providing irrigation to support agriculture in limited areas such as the Nile Delta in Egypt, the Tigris and Euphrates watersheds of Iraq, Kuwait and eastern Syria.

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.

Lagos City is Nigeria's largest city and its economic capital.

6. Changing Economic Structures in Nigeria



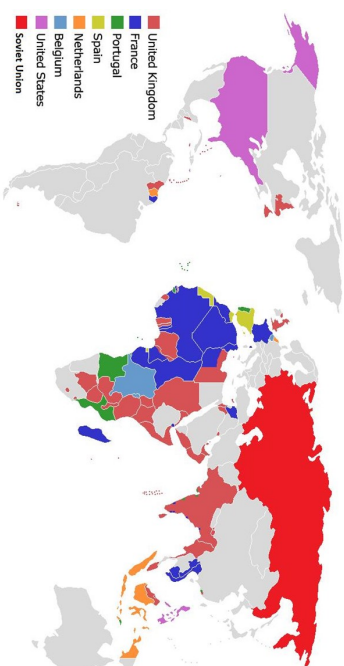
Most of the countries that border the Persian Gulf have vast reserves of crude oil (see pie chart) with the countries of the Arabian Peninsula in particular benefiting economically from petroleum exports.

4. The Akie people: Hunter-gatherers

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

The Akie are one of the last actual hunter-gatherer 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.

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

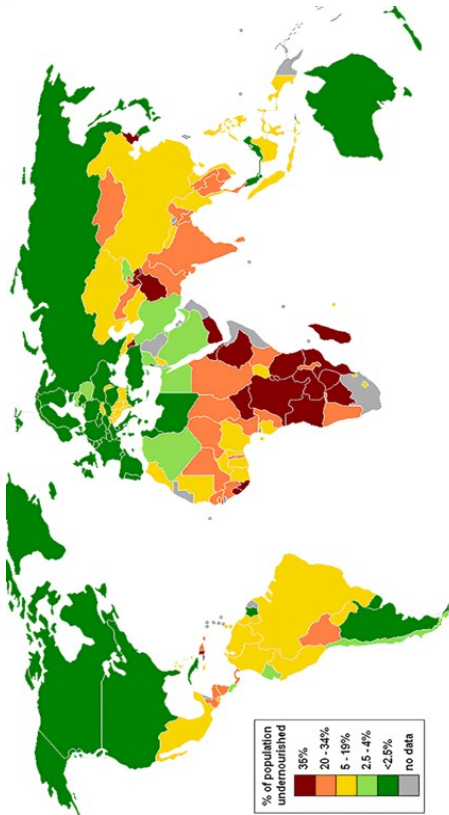
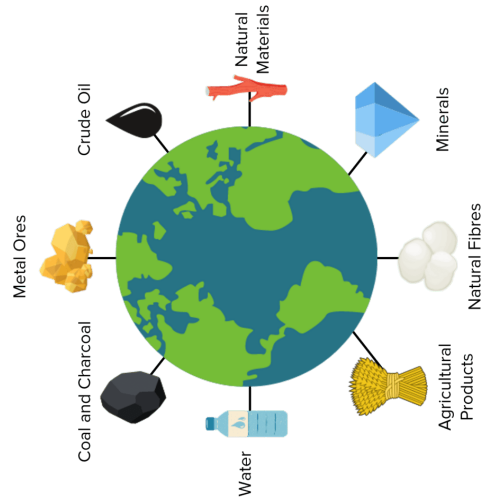


GEOGRAPHY 9.3 Resources & Issues

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 shows 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 (DESERTIFICATION)

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.

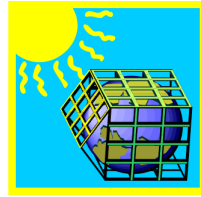


8. Mitigation or Adaptation?

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.

6. Human Activity is creating climate change



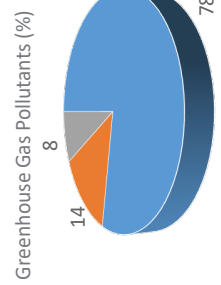
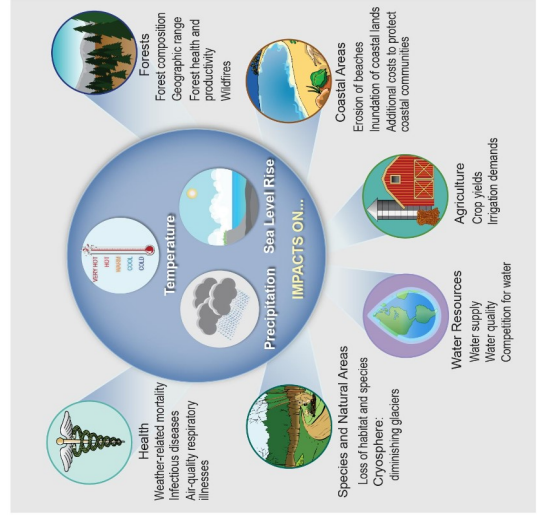
The thin atmosphere around Earth acts like the glass on a greenhouse. Incoming UV radiation passes through the glass and outgoing IR radiation (heat) does not. The outcome is heat gets trapped inside the greenhouse. This process happens naturally thanks to the greenhouse gases such as CO₂ (Carbon Dioxide) and CH₄ (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 NO_x 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 CH₄—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.

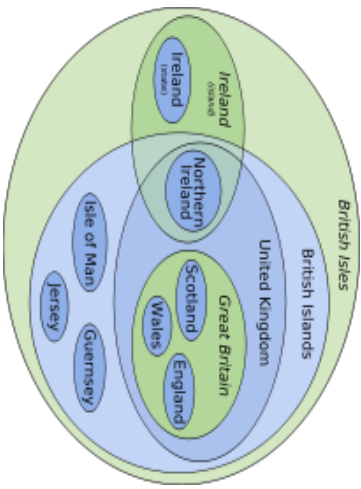
7. Impacts of climate change



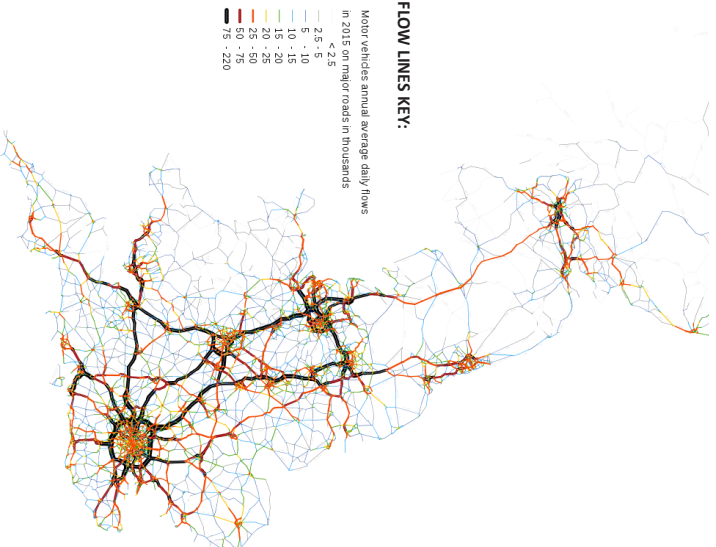
GEOGRAPHY 9.4 UK Case Study

1. & 2. The British Isles and the United Kingdom of Great Britain and Northern Ireland

The **British Isles** is a group of islands off the northwestern coast of Europe. The group consists of two main islands, **Great Britain** and **Ireland**, and numerous smaller islands and island groups, including: the Hebrides, the Shetland Islands, the Orkney Islands, the Isles of Scilly, and the Isle of Man. Some also include the Channel Islands in this grouping.



UK Traffic flow lines

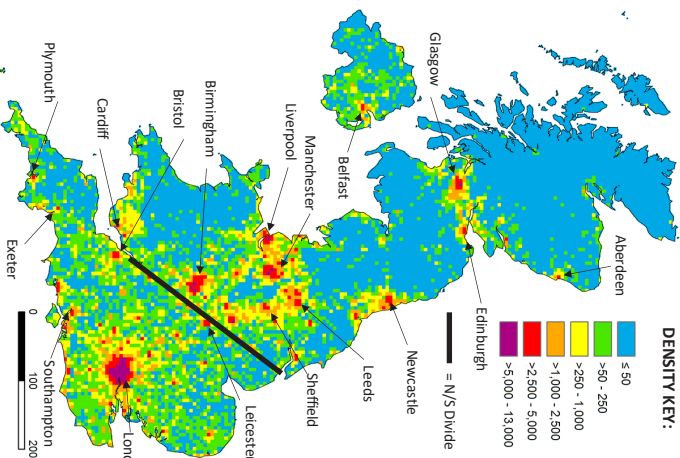


Proportional flow lines show values of data between locations with wider arrows or lines. The above map shows a pattern whereby the lines (along major roads) are a different colour and wider to show a greater value. For example, the M25 circular motorway around London is clearly very heavily used and has the greatest flow of traffic. You'll notice how badly connected the south-west is however (with the exception of the M5), as the traffic-flow values are low as a result of smaller roads

3. UK Population Distribution

The United Kingdom of Great Britain and Northern Ireland is a union, or 'country of countries', made of three countries and a province. The three countries are **England**, **Scotland**, **Wales** from the island of Great Britain, and the province of **Northern Ireland** being the fourth member—located on the island of Ireland.

4. UK Population Distribution

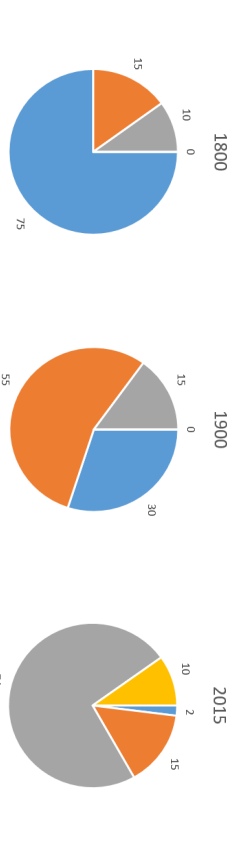


The UK has an uneven population distribution. There is a clear correlation where dense population centres are located (as shown as orange up to purple on the Density map - left) and flatter, low-lying relief (as shown by the relief map - right). At the same time, low density of population occurs in the upland areas of inland Wales, northern Scotland, and inland south-west England.

So, why is the population concentrated into lowland areas and coastal locations? Think: water, building, resources, accessibility and trade links!

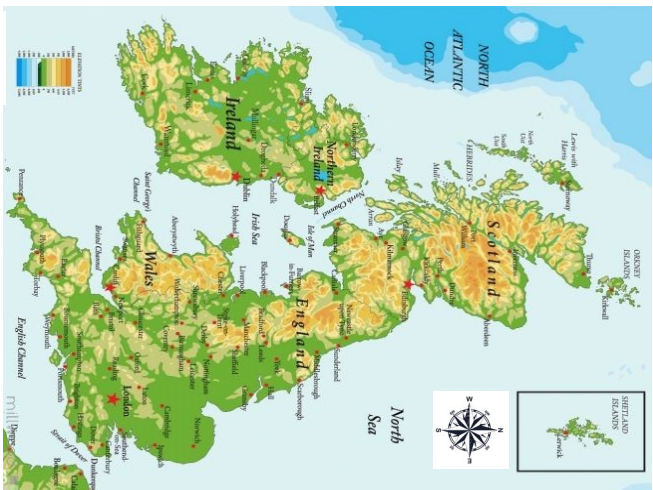
Situated between 50-59° North, the UK has a mild and wet (maritime) climate overall. The prevailing wind (dominant wind direction) comes from over a relatively mild southern North Atlantic Ocean. As such, the UK experiences plenty of rainfall the year round—especially in the west. The relief of the land here, encourages the moisture-rich tropical maritime air to cool, condense and produce rainfall as it is forced to rise over the hills and mountains as it blows over the country from west to east. At the same time, the temperatures are moderated and therefore rarely extreme: staying mild during winter as the North Atlantic still contains warmth from the previous summer, and yet kept relatively cool during summer as the North Atlantic has yet to fully warm during these months, so any wind coming in off the sea brings with it a classic, cool sea breeze.

7. Changing UK economic structures over time

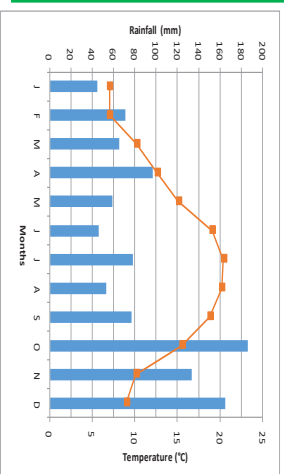


The United Kingdom has experienced a significant change in economic structure from pre-industrial revolution (1800), through the industrial revolution era (1900) and now into a post-industrial era (2015).

3. UK Relief (topographical) map (showing height)



5. UK Climate (SW Example)



GEOGRAPHY COMMAND WORDS

ADDITIONAL

EXAM SKILLS

'Study figure X...'

The majority of questions in geography GCSE exam papers have a linked resource for you to include in your answer - such as photo, graph, map, diagram of set of data. Before you even get to the question, you are commanded to 'study' the resource; they've essentially given you something to use in your answer—so study it well to find the best bits to include!

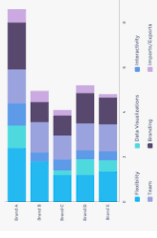
Examples of 'figures' in exams:



Maps

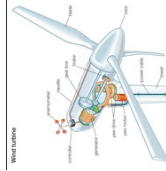


Photos



Diagrams

Graphs



Justify	Write a convincing argument to reach a conclusion supported by evidence.
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.
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.

GEOGRAPHY ASSESSMENT OBJECTIVES

AO1	Demonstrate knowledge of location, places, processes, patterns, environments at different scales
AO2	Demonstrate geographical understanding of concepts and how they are used in relation to places, environments and processes; interrelationships between places, environments and processes.
AO3	Application of knowledge and understanding to interpret, analyse and evaluate information and issues to make judgements.
AO4	Select, adapt and use a variety of skills and techniques to investigate questions and issues and communicate finding.

Assessment Objectives are the ways that your knowledge of the subject could be assessed using the command words. For example, the command word 'explain' would be AO2, and 'evaluate' would be AO3.

Command	How do I respond in my writing ?
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 and 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.
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.
Draw	Using a pencil, produce a simple diagram (plan view/cross-section/ field sketch or box style) of the theme within the question. Quite often, you will be asked to label or annotate your drawing too
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 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.
Identify	Identify the name of a feature or item referenced in the question. Synonyms are: give/name or state.
Label	Labelling is simply naming features or parts of something; these are not sentences

History Year 9 Knowledge Organiser Autumn Term: Rise of the Nazis and WWII

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

1933	Hitler takes power
1935	Hitler announces rearmament
1936	Invasion of the Rhineland
1938	Anschluss with Austria
Sep 1938	Invasion of Sudetenland
Mar 1939	Invasion of Czechoslovakia
Sep 1939	Invasion of Poland

4) What was the key turning point of WWII?

Key Terms

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 Stalingrad .	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.

A War of Two Halves: The first half is a disaster for the Allies

3rd September
1939. Britain
declares war

May 1940.
Dunkirk

Summer of
1940. Battle
of Britain

1941. Invasion
of the USSR
(Operation
Barbarossa)

A 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 commits
suicide

DEFEAT AND PARTITION



Intro: After World War II Germany is divided

Split of interests
Soviets want revenge. Allies want to rebuild.



1) Key events after World War II

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

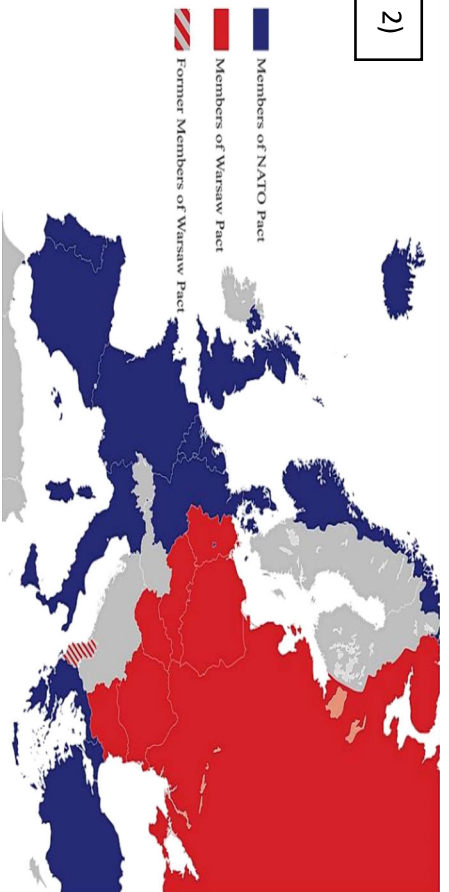
24th June 1948: Stalin blockades Berlin which causes the Berlin Airlift.

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

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

1961: Berlin Wall is put up to prevent East Germans leaving.

2)



3)

- **Capitalism: USA**
 - **Individuals** own business
 - **Opportunity** for all
 - Democracy: Different parties compete for political office
 - Higher standard of living = **Wealth, health, goods** and services
- **Communism: USSR**
 - **Government** owns business
 - **Equality** for all
 - Only 1 **Political** party
 - No need for any more
 - Lower **standard of living** but all are equal



4) 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

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 form
- 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

$$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^9$$

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 $\rightarrow A \times 10^n$ ← Any integer

Example

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

Non-example

$$0.8 \times 10^4 \\ 5.3 \times 10^{07}$$

Negative powers of 10

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

$$6.4 \times 10^{-2} \quad 2.4 \times 10^{-2} \quad 3.3 \times 10^0 \quad 1.3 \times 10^{-1}$$

$$0.064 \quad 240 \quad 1 \quad 0.13$$

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

$$6.4 \times 10^2 \times 1000 \quad \text{Not in Standard Form} \\ = 6.4 \times 10^2 \times 10^3 \\ = 6.4 \times 10^5$$

Use addition for indices rule

$$8 \times 10^5 \times 3 \\ = 24 \times 10^5 \quad \text{Not in Standard Form} \\ = 2.4 \times 10^1 \times 10^5 \quad \text{Use addition for indices rule} \\ = 2.4 \times 10^6$$

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

Remember the layout for standard form

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

Addition and Subtraction

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

Method 1

$$6 \times 10^5 + 8 \times 10^5 \\ = 600000 + 800000 \\ = 1400000 \\ = 1.4 \times 10^6$$

Method 2

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

This is not the final answer

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

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

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

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

$$(1.5 \div 0.3) \times 10^5 \div 10^3 \\ = 5 \times 10^2$$

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

$$14 \times 10^5 \times 3.9 \times 10^3$$

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

Input 14 and press $\times 10^x$ Then press 5 (for the power)
Press \times
Input 3.9 and press $\times 10^x$ 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

Directed number R

Addition

$2 + -4 = -2$

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

Two -1 's left $= -2$

Generalisation: $+ - = -$

Subtraction

$2 - -1 = 3$

Representation for calculation

Generalisation: $- - = +$

"Subtract" – means take away or remove

Start with the representation of 2

Take away one

$2 - -1 = 3$

Multiplication

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

$-2 \times -3 = 6$

Divisions are the inverse operations



$a = 5$

$b = -4$

Brackets around negative substitutions helps remove calculation errors

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

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 $\rightarrow A \times 10^n$ \leftarrow Any integer

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

$= 600000 + 800000$
 $= 1400000$
 $= 1.4 \times 10^6$

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

$15 \div 0.3 \times 10^5 \div 10^3$
 $= 5 \times 10^2$

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

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

Shade in 3 parts

Repeat it on this many rows

Modelled:

This many columns

This many rows

Parts shaded

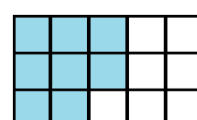
Total number of parts in the diagram

Remember to use reciprocals

$2 \div \frac{3}{4} = 2 \times \frac{4}{3} = \frac{8}{3}$

Multiplying by a reciprocal gives the same outcome

Represented



$= \frac{8}{3}$

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%

One hundredth
(one whole split into 100 equal parts)

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

ones	tenths	hundredths
	•	•

Converting FDP R

70/100 → This also means 70 out of 100 squares → 70 hundredths = 70%

Using a calculator → 70 ÷ 100 = 0.7 → 70 "hundredths" = 7 "tenths" = 0.7

Convert to a decimal → × 100 converts to a percentage

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

Percentage Increase/ Decrease R

Decrease
 100% → 42% → Decrease by 58%

Increase
 100% → Increase by 12%

Multiplier Less than 1: $100 - 0.58 = 0.42$

Multiplier More than 1: $100\% + 12\% = 112\%$
 $100 + 0.12 = 112$

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

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%

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

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
19 th Sept	Salary	£1500		£1500
19 th Sept	Mortgage		£600	£900
25 th Sept	Bday Money	£15		£915

Simple Interest

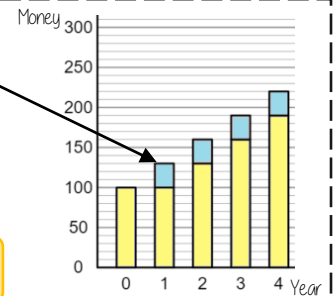
For each year of investment the interest remains the same

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

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

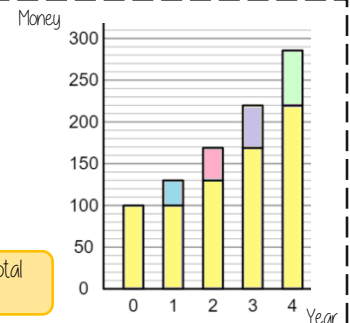
Interest is added to the current value of investment at the end of each year so the next year's interest is greater.

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

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

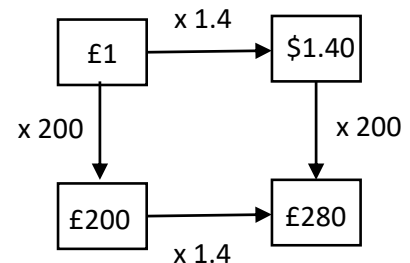
Salaries fall into tax brackets – which means they pay this much each month from their salary.

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 £1	5 cupcakes £1.20
-----------------	---------------------

$$4 = £1.00 \div 2 \quad 5 = £1.20 \div 5$$

$$2 = £0.50 \quad 1 = £0.20$$

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

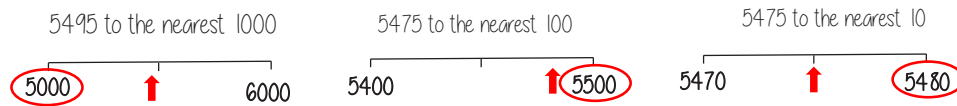
Keywords

- 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"

- 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

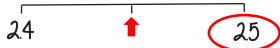
Round to the first non-zero number



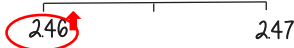
Round to decimal places R Focus on the numbers after the decimal point

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

2.46192 (to 1dp) - Is this closer to 2.4 or 2.5



2.46192 (to 2dp) - Is this closer to 2.46 or 2.47



2.46192 This shows the number is closer to 2.5

2.46192 This shows the number is closer to 2.46

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 R

Debit - You have £0 or more in an account

Credit - You have less than £0 in an account



Using a calculator – ensure you are working in the correct units.

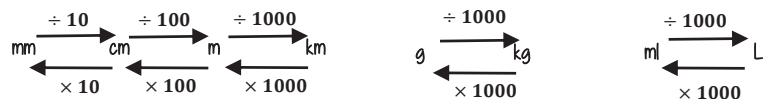
$$\begin{aligned} \text{£}130 + 50\text{p} &= 130 + 50 \text{ (in pence)} \\ &= 130 + 0.50 \text{ (in pounds)} \end{aligned}$$

Money calculations are to 2dp

$$\text{£}1 = 100\text{p}$$



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

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

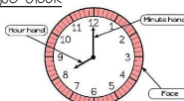
Use a number line for time calculations!

Units of weight/ capacity

Weight = g, kg, t

Capacity (volume of liquid) = ml, L

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.

R



4 cans of pop = £2.40

4 cans of pop = £2.40
 $\times 0.5$ → 2 cans of pop = £1.20
 $\times 50$ → 200 cans of pop = £120

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
 $\times 3$ → 12 cans of pop = £7.20

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

R



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

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

$\div 2$ (from 1 to 2)
 $\times 4$ (from 2 to 8)
 $\times 2$ (from 40 to 20)
 $\div 4$ (from 20 to 5)

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

4 cans for £1.20

↓ $\pounds 1.20 \div 4$

Cost per item

1 can is £0.30
Or 30p

Shop B

3 cans for 93p

↓ $\pounds 0.93 \div 3$

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

↓ $4 \div \pounds 1.20$

Cost per pound

£1 buys 3.333 cans of pop

3 cans for 93p

↓ $3 \div \pounds 0.93$

£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

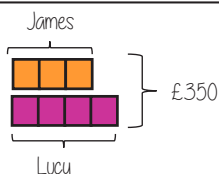
R

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

Model the Question

James: Lucy

3 : 4



£350 ÷ 7 = £50

□ = one part = £50

Find the value of one part

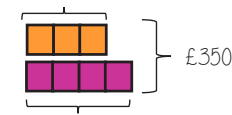
Whole: £350
7 parts to share between (3 James, 4 Lucy)

Put back into the question

James: Lucy

$\left(\begin{matrix} \times 50 \\ \times 50 \end{matrix} \right) 3 : 4$
 → £150 : £200

James = 3 × £50 = £150



Lucy = 4 × £50 = £200

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

R

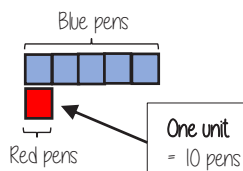
Inside a box are blue and red pens in the ratio 5:1. If there are 10 red pens how many blue pens are there?

Model the Question

Blue : Red

5 : 1

□ = one part = 10 pens



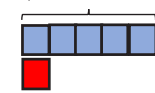
One unit = 10 pens

Put back into the question

Blue : Red

$\left(\begin{matrix} \times 10 \\ \times 10 \end{matrix} \right) 5 : 1$
 → 50 : 10

Blue pens = 5 × 10 = 50 pens



Red pens = 1 × 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

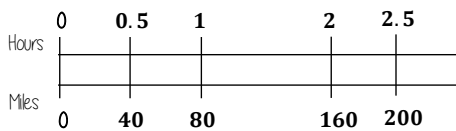
Speed, Distance, Time

'per' for every

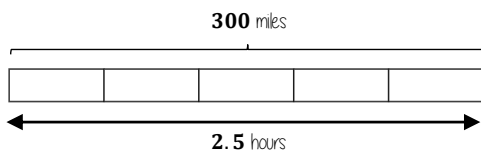
e.g. 80 miles per hour (mph)
Travel 80 miles every hour

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

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



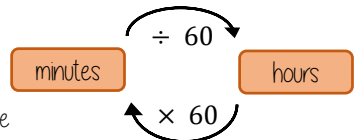
e.g. A boat travels at a constant speed for 2.5 hours
It travels 300 miles.



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 formula for speed, distance and time

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

Substitute in the variables given

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

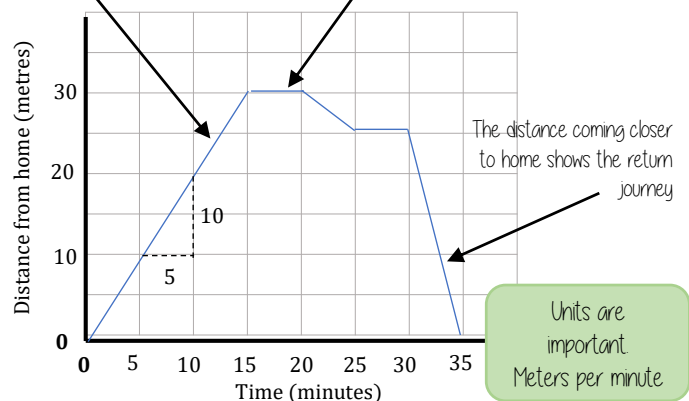
Distance – Time graphs

The steeper a gradient the faster the speed

Gradient = speed

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

Horizontal lines represent staying still



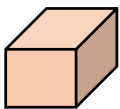
Units are important
Meters per minute

Density, Mass, Volume

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

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

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



$$\text{volume of prism} = \text{Area of cross section} \times \text{Depth}$$

R

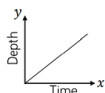
Flow problems & graphs



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

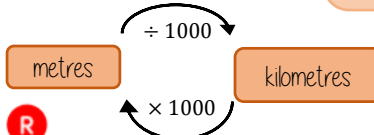
Common rates of change relationships

Revisit your conversions between units of length and capacity

Speed: miles per hour

Exchange rates: euros per pounds

Density: mass per volume



R

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 two 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

$3(2x + 4) = 30$

Expand the brackets

$$6x + 12 = 30$$

$$-12 \quad -12$$

$$6x = 18$$

$$-6 \quad -6 \quad x = 3$$

Form and solve inequalities

Two more than treble my number is greater than 11

Find the possible range of values

$$3x + 2 > 11$$

Solve

$$x < -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3$$

$$x > 3$$

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

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

Smaller ← | → Bigger

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

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

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...

Change the subject

Make XXX 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

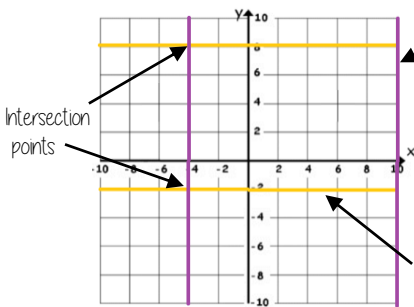
Perpendicular: two lines that meet at a right angle.

Lines parallel to the axes

R

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

'a' can be ONLY 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

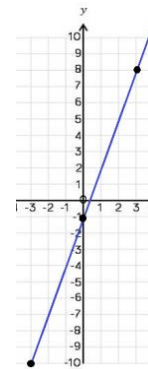
R

$y = 3x - 1$ → 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

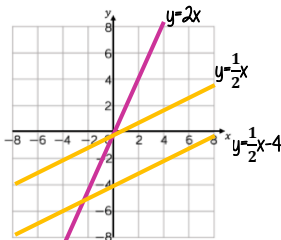
Plotting more points helps you decide if your calculations are correct (if they do make a straight line)

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

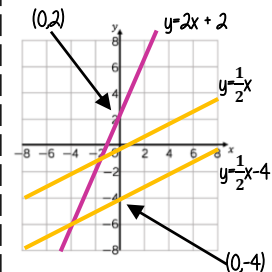
Positive gradients

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

$$y = mx + c$$

y and x are coordinates

The value of c is the point at which the line crosses the y-axis Y intercept

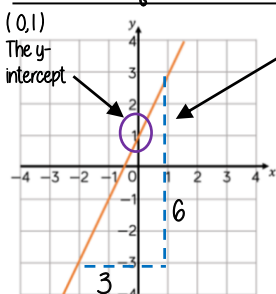
The equation of a line can be rearranged: Eg

$$y = c + mx$$

$$c = y - mx$$

Identify which coefficient you are identifying or comparing

Find the equation from a graph



The Gradient $\frac{6}{3} = 2$

$$y = 2x + 1$$

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

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

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			

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

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

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)

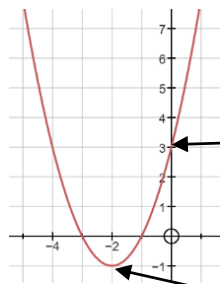
Parabola: a 'u' shaped curve that has mirror symmetry

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



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)

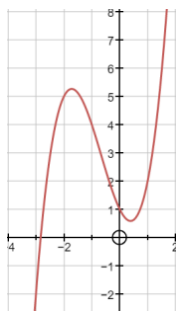
Quadratic graphs are always symmetrical with the turning point in the middle

Interpret other graphs

Cubic Graphs

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

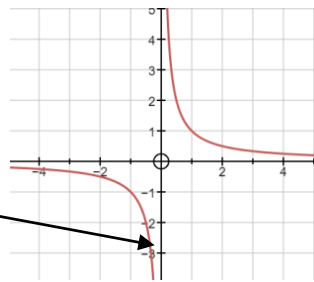
If x^3 is the highest power in your equation then you have a cubic graph



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

Reciprocal Graphs

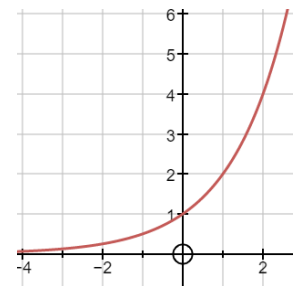
$$y = \frac{1}{x}$$



Exponential Graphs

$$y = 2^x$$

Exponential graphs have a power of x

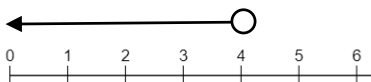


Represent Inequalities

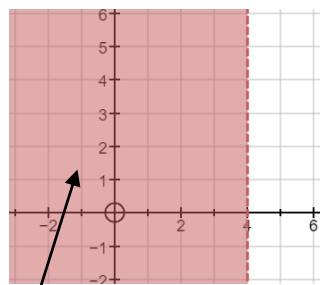
Multiple methods of representing inequalities

$$x < 4$$

All values are less than 4



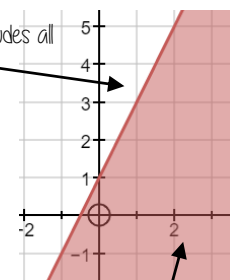
The shaded area indicates all possible values of x



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

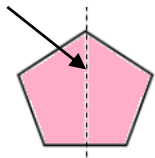
Perpendicular: lines that cross at 90°

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)



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



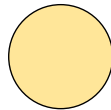
Rhombus
two lines of symmetry

Parallelogram

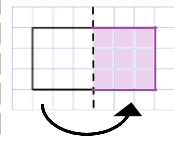
No lines of symmetry



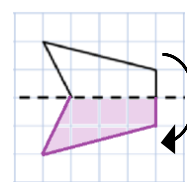
A circle has an infinite amount of lines of symmetry



Reflect horizontally/ vertically (1)



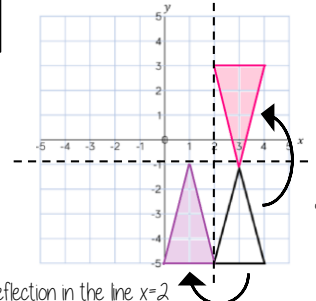
Reflection in a vertical line



Reflection in a horizontal line

Note: a reflection doubles the area of the original shape

Reflection on an axis grid

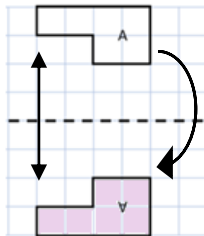


Reflection in the line $y=2$

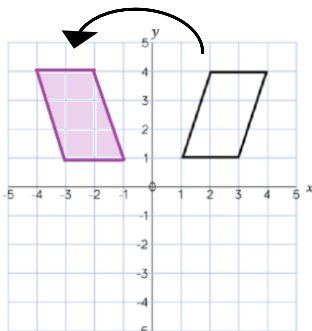
Reflection in the line $x=2$

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

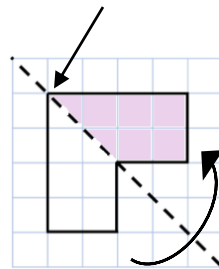
REMEMBER

Lines parallel to the x-axis are $y = \dots$

Lines parallel to the y-axis are $x = \dots$

Reflect Diagonally (1)

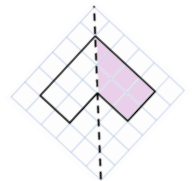
Points on the mirror line don't change position



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

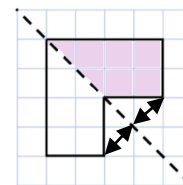
Turn your image

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



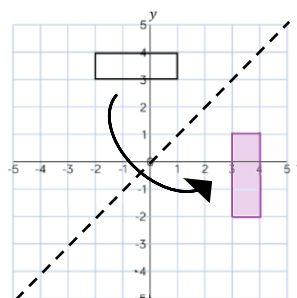
Drawing perpendicular lines

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

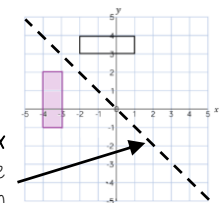


Reflect Diagonally (2)

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

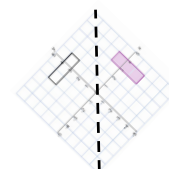


This is the line $y = -x$
The x and y coordinate have the same value but opposite sign



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.

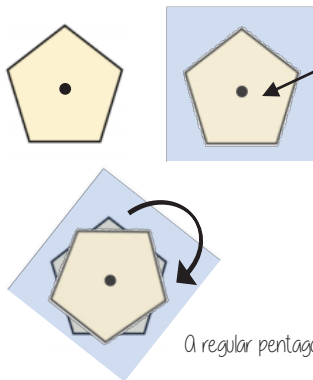
Vertex: a point two edges meet.

Horizontal: from side to side

Vertical: from up to down

Rotational Symmetry

Tracing paper helps check rotational symmetry.



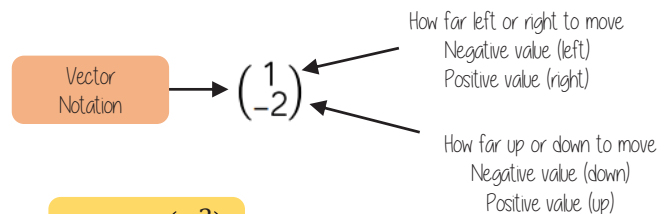
1 Trace your shape (mark the centre point)

2 Rotate your tracing paper on top of the original through 360°

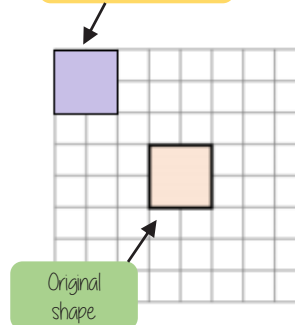
3 Count the times it fits back into itself

A regular pentagon has rotational symmetry of order 5

Translation and vector notation

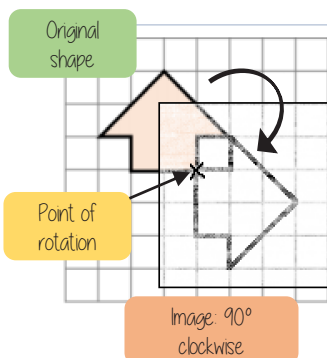


Translation $\begin{pmatrix} -3 \\ 3 \end{pmatrix}$



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)

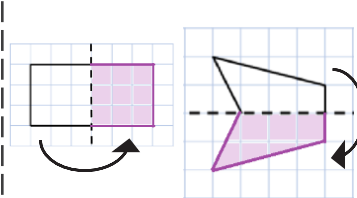
2 Keep the point in the same place and turn the tracing paper

3 Draw the new shape



Image: 90° clockwise

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)

Rotate from a point (outside a shape)

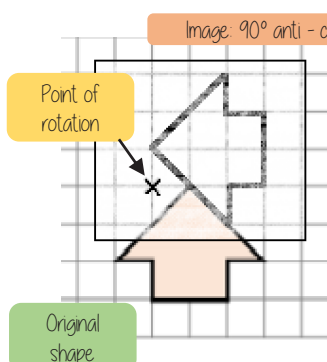


Image: 90° anti-clockwise

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

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)

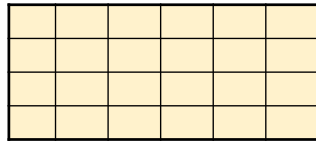
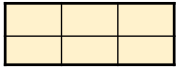
Corresponding: objects (or sides) that appear in the same place in two similar situations.

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

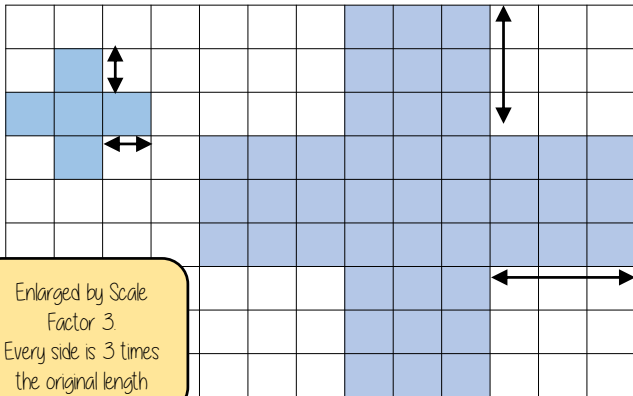
These shapes are similar because all sides are increased by the same ratio



Enlargements are similar shapes with a ratio other than 1

Enlarge by a positive scale factor

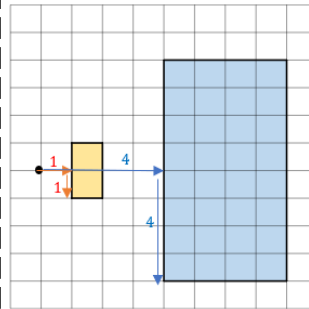
With a scale factor larger than 1 it makes the shape **bigger**



Enlarged by Scale Factor 3
Every side is 3 times the original length

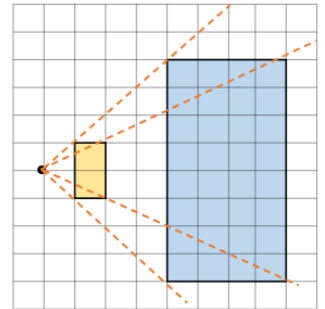
Enlarge a shape from a point

Scaled distances method



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

Rays method

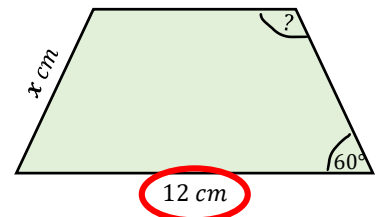
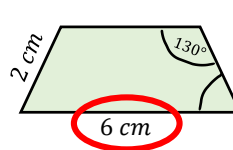


Multiply the distance from the centre of corresponding vertices by the scale factor along the ray

Calculations in similar shapes

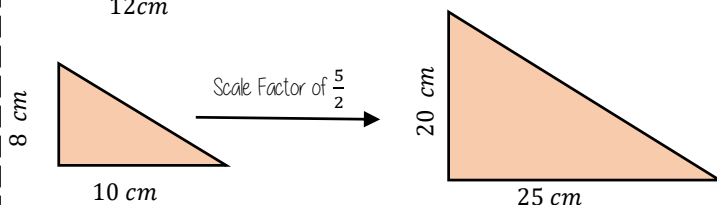
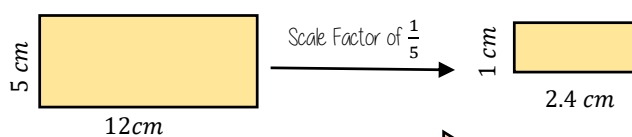
Don't forget that properties of shapes don't change with enlargements or in similar shapes

The two trapezium are similar find the missing side and angle



Positive fractional scale factor

With a scale factor between 0 and 1 it makes the shape **smaller**



Corresponding sides identify the scale factor

$$\frac{12}{6} = 2$$

Scale Factor = 2

Calculate the missing side

Length (corresponding side) \times scale factor

$$2\text{ cm} \times 2$$

$$x = 4\text{ cm}$$

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

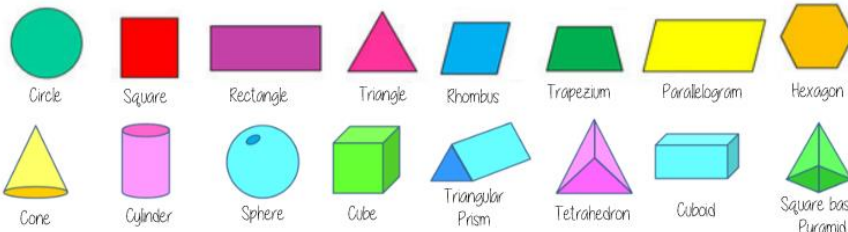
Face: a flat surface on a solid object

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)

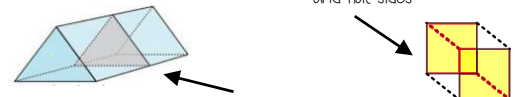
Perspective: a way to give illustration of a 3D shape when drawn on a flat surface.

Name 2D & 3D shapes



Recognise prisms

A solid object with two identical ends and flat sides

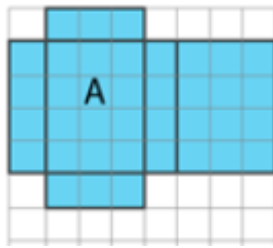
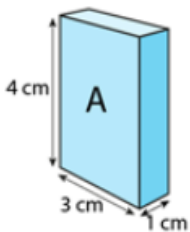


The cross section will also be identical to the end faces



A cylinder although with very similar properties does not have flat faces so is not categorised as a prism

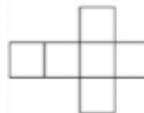
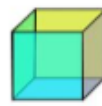
Nets of cuboids



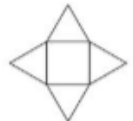
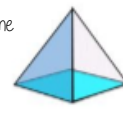
1cm grids help to draw accurately

Visualise the folding of the net. Will it make the cuboid with all sides touching

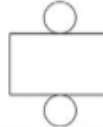
Sketch and recognise nets



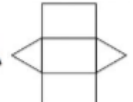
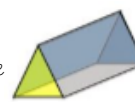
Do they have the same number of faces?



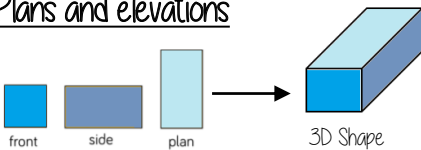
Where do the edges join?



Are the shapes of the faces correct?



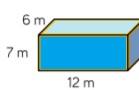
Plans and elevations



The direction you are considering the shape from determines the front and side views

Surface area

Sketching nets first helps you visualise all the sides that will form the overall surface area



Sides 6×7
 6×7

Front and back 12×7
 12×7

Top and Bottom 12×6
 12×6

Sum of all sides is surface area

For cubes and cuboids you can also find one of each face and double it



For other shapes - not all the sides are the same, so calculate the individually

Area of 2D shapes

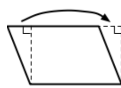
Rectangle
Base x Height



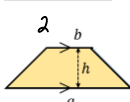
Triangle
 $\frac{1}{2} \times \text{Base} \times \text{Perpendicular height}$



Parallelogram/ Rhombus
Base x Perpendicular height



Area of a trapezium
 $(a + b) \times h$



Area of a circle
 $\pi \times \text{radius}^2$



Surface area - cylinders

The area of the circle
 $\pi \times \text{radius}^2$



Circumference

The width of this face is the same as the circumference
 $\pi \times \text{diameter} \times \text{height}$

$$2 \times \pi \times \text{radius}^2 + \pi \times \text{diameter} \times \text{height}$$

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.

$$\text{Cubes/ Cuboids} = \text{base} \times \text{width} \times \text{height}$$

Remember multiplication is commutative



Cross section



Cross section

$$\text{Prisms and cylinders} = \text{area cross section} \times \text{height}$$

Height can also be described as depth

Areas - square units
Volumes - cube units

Areas and volumes can be left in terms of 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

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

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
 $\times 10$ \rightarrow 10cm : 300cm $\times 10$

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

Equipment needed
The line is straight so a ruler is used for the straight lines parallel to your original line

The ends of the line are fixed points

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

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 intersecting 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

$\triangle ABC = \triangle KLM$

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

Side, Angle, Angle

Side, Angle, Side

Side, Side, Side

Link to steps **R**

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.

$$\sin \theta = x, \text{ so } \theta = \sin^{-1} x$$

Worked example

Use the sine ratio to find the missing angle in this right-angled triangle.



Using the sine ratio

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\sin \theta = \frac{5}{13}$$

$$\theta = 22.6^\circ$$

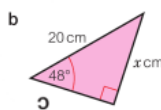
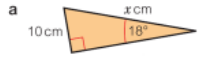
You need to find $\sin^{-1} \frac{5}{13}$

Use these buttons on your calculator:

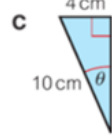


Questions

Work out the value of x , correct to 1 d.p.



Work out the missing angle



Corbett Maths
Videos 329, 330 and 331

Answers: a 32.4 b 14.9
c 23.6

S O A O
H H T 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

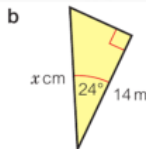
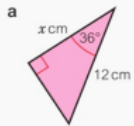
You can use **inverse** trigonometric functions to work out unknown angles.

$$\cos \theta = x, \text{ so } \theta = \cos^{-1} x$$

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.



Work out the missing angle



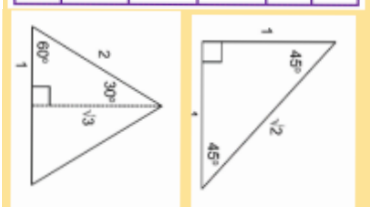
Answers:

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 $\theta = \tan^{-1} x$**

For a worked example to find a missing angle in a right-angle triangle, look at 9.2 'using sine'

Hint for Qb:

$$\tan 53 = \frac{5}{x}$$

Rearranges to

$$x = \frac{5}{\tan 53}$$

Worked example

Use the **tangent** ratio to work out the value of x , correct to 1 d.p.



$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

$$\text{opposite} = x$$

$$\text{adjacent} = 8$$

$$\theta = 34^\circ$$

$$\tan 34^\circ = \frac{x}{8}$$

$$8 \times \tan 34^\circ = x$$

$$x = 5.4 \text{ cm (to 1 d.p.)}$$

Write the tangent ratio.

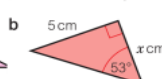
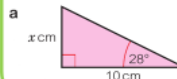
Identify the opposite and adjacent sides.

Substitute the sides and angle into the equation.

Rearrange to make x the subject. Use your calculator to work out $8 \times \tan 34^\circ$.

Questions

Work out the value of x , correct to 1 d.p.



Work out the missing angle



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

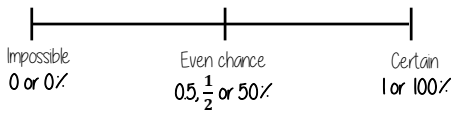
Independent: an event that is not effected by any other events.

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



The more likely an event the further up the probability it will be in comparison to another event (it will have a probability closer to 1)



There are 2 pink and 2 yellow balls, so they have the same probability

There are 5 possible outcomes So 5 intervals on this scale, each interval value is $\frac{1}{5}$

Single event probability



Probability is always a value between 0 and 1



The probability of getting a blue ball is $\frac{1}{5}$
 \therefore 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	

$$P(\text{white chocolate}) = 1 - 0.15 - 0.35 = 0.5$$



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.

$$\text{Relative frequency} \times \text{Number of times} \\ 0.3 \times 100 = 30$$

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 \times Probability of event 2



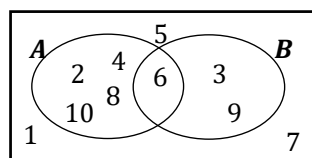
$$P(5) = \frac{1}{6} \quad P(R) = \frac{1}{4}$$

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	Wak	Total
Boys	15	24	14	53
Girls	6	20	21	47
Total	21	44	35	100

The possible outcomes from tossing a coin

The possible outcomes from rolling a dice

	1	2	3	4	5	6
H	1H	2H	3H	4H	5H	6H
T	1T	2T	3T	4T	5T	6T



Grammar

G1: Infinitive verbs

<u>Regular verbs</u> (follow patterns)	to listen
Écouter	to watch
Regarder	to chat
Bavarder	to visit
Visiter	to study
Étudier	to swim
Nager	to eat
Manger	to start
Commencer	to teach
Enseigner	to wear
Porter	to finish
Finir	to learn
Apprendre	

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)

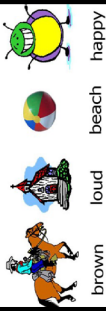
Pouvoir	to be able to
Devoir	to have to

Vocabulary

G2: Articles and genders

M	F	Pl	meaning
Le	La	Les	The
Un	Une	A	A
Du	De la	des	some

An adjective modifies a noun.



G3: Adjectives

	F	Fpl	Meaning
bavard	bavarde	bavarde	chatty
sympa	sympa	sympa	Nice
créatif	créative	créatives	Creative
ennuyeux	ennuyeuse	ennuyeuses	Boring
gentil	gentille	gentille	Kind
ancien	ancienne	anciennes	old

Pronunciation

Pronunciation (you see/say) P1

you see	you say
a	"ah"
à	"ah"
y	"ee"
r	"ruh"
rr	"rrrr"
ç	"ss"
th	"tuh"
gn	"nuh"
ien	"eeahn"

V1: Connectives

et and	car because
mais but	ou or
parce que	because
pendant	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



Grammar

Vocabulary



- jouer
- bavarder
- manger
- visiter
- regarder
- vendre
- écouter
- finir

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)
Je <u> </u> e	Je <u> </u> is	Je <u> </u> s
Tu <u> </u> es	Tu <u> </u> is	Tu <u> </u> s
Il/elle/on <u> </u> e	Il/elle/on <u> </u> it	Il/elle/on <u> </u>
Nous <u> </u> ons	Nous <u> </u> issions	Nous <u> </u> ons
Vous <u> </u> ez	Vous <u> </u> issez	Vous <u> </u> ez
Ils/elles <u> </u> ent	Ils/elles <u> </u> issent	Ils/elles <u> </u> ent

Remove last 2 letters from each infinitive to make the verb stem and then add the following endings.

V1: adverbs of time

Aujourd'hui	Today
Normalement	Normally
D'habitude	Typically

G2: The present tense of irregular verbs
These are verbs that **DO NOT** follow a pattern

avoir	être	faire	aller
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

G3: The present tense of modal verbs

Pouvoir To be able to	Devoir To have to
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

These verbs are **always** followed by an infinitive verb.

Example sentence
Normalement **je joue** au tennis.
Normally I play tennis.

Example sentence
J'ai une soeur elle **est** grande.
I have a sister and she is tall

Example sentence
Normalement on peut aller en ville
Normally we can go into town

Y9 French KO2: The essentials: 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	Take a bit of être	Add a past participle
J'ai	joué (played)	Je suis	Allé (e) (s) (went)
Tu as	Visité (visited)	Tu es	Sorti (e) (s) (went out)
Il/elle/on a	Bavardé (chatted)	Il/elle/on est	These past participles need agreements
Nous avons	Regardé (watched)	Nous sommes	
Vous avez	Écouté (listened)	Vous êtes	
Il/elles ont	Mangé (ate)	Il/elles sont	
	Fait (did/made)		
	Lu (read)		
	Vu (saw)		
	Bu (drank)		

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)
Tu vas	Visiter (to visit)
Il/elle/on va	Bavarder (to chat)
Nous allons	Regarder (to watch)
Vous allez	Écouter (to listen)
Il/elles vont	Manger (to eat)
	Faire (to do/make)
	Lire (to read)
	Voir (to see)
	Boire (to drink)
	Aller (to go)
	Sortir (to go out)

Example sentence

Demain **je vais regarder** un film.
Tomorrow I am going to watch a film.

G6: The conditional tense

Describes an action that **would happen in an ideal situation**

Add the infinitive to the pronoun E.g: jouer	Add an these conditional tense endings
Je jouer	Je.....ais
Tu jouer	Tu.....ais
Il/elle/on jouer	Il/elle/on.....ait
Nous jouer	Nous.....ions
Vous jouer	Vous.....iez
Il/elles jouer	Il/elles.....aient
	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 it were possible, I would play tennis..

Y9 French KO3: 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 + <u>ball sport</u>	Faire du + sport
Jouer au rugby	Faire du canoe-Kayak
<u>Jouer</u> + à la + ball sport	<u>Faire de</u> la + sport
Jouer à la pétanque	Faire de la natation
<u>Jouer</u> + aux	<u>Faire de l'</u> + sport
Jouer aux boules	Faire de l'équitation
	Faire des + sport
	Faire des randonnées

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 feuilletons	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	Passionnant	Génial	Ennuyeux
<i>funny</i>	<i>exciting</i>	<i>great</i>	<i>boring</i>
			Nul
			<i>rubbish</i>

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

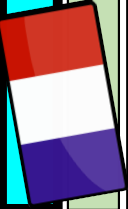
Pronunciation

G2 Places (at the / in/ on/ at the house of)	
Au terrain de foot	<u>À</u> la piscine
Au centre sportif	<u>À</u> la bibliothèque
<u>En</u> ville	<u>Sur</u>
<u>En</u> ligne	Sur l'internet
	Sur mon portable
	Sur WhatsApp
<u>Dans</u> ma chambre	<u>Chez</u>
Dans un café	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 KO4: Comment est la vie au collège? (what is school life like?)



Grammar

V1: school subjects

Les matières	School subjects
L'anglais	English
L'espagnol	Spanish
L'allemande	German
La technologie	DT
L'informatique	ICT
Les sciences	science
Le français	French
Le dessin	art
Les arts plastiques	art
L'emploi du temps	timetable
La récréation	breaktime



Vocabulary

V4 : Opinions

Je pense que

Je trouve que

J'ai horreur de

Je crois que

A mon avis

Je le/la/les trouve...

Ma matière préférée

I think that

I find that

I cannot stand

I believe that

In my opinion

I find it/them

My favourite subject

G3: Key verbs

étudier *to study*

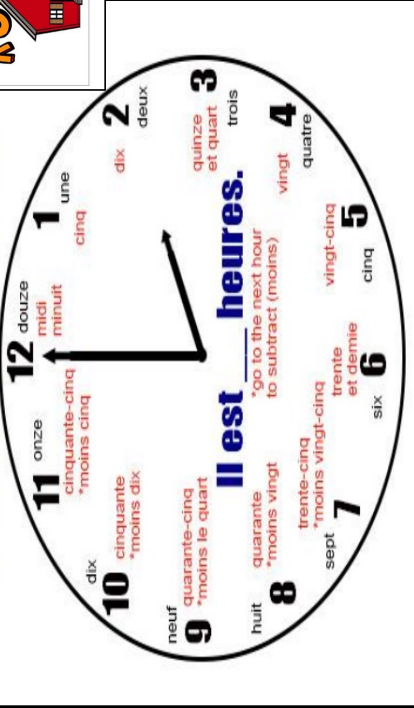
apprendre *to learn*

enseigner *to teach*



V3: telling the time

Mon horloge française



V2: numbers

10	Dix
20	Vingt
30	Trente
40	Quarante
50	cinquante

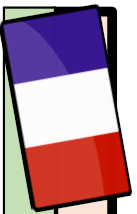
Pronunciation

Pronunciation P1	
th	"tuh"
gn	"nuh"
r	"ruh"
Silent final s, t, x	
Nothing	

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)	<i>understanding</i>
Rigolo	<i>funny</i>
Sympa	<i>nice</i>
Utile	<i>useful</i>
Facile	<i>easy</i>
Stimulant (e)	<i>stimulating</i>
Pratique	<i>practical</i>
Barbant	<i>boring</i>
Sévère	<i>strict</i>
Stressé (e)	<i>stressed</i>
Agaçant (e)	<i>annoying</i>
Inutile	<i>useless</i>
Compiqué(e)	<i>complicated</i>

Y9 French KO 5: Comment est ta ville? (what is your town like?)



Grammar

V1: places in town	
Un château	<i>a castle</i>
Un musée	<i>a museum</i>
Un théâtre	<i>a theatre</i>
Un jardin publique	<i>a public garden</i>
Un collège	<i>a high school</i>
Une église	<i>a church</i>
Une stade	<i>a stadium</i>
Une cathédrale	<i>a cathedral</i>
Une centre commerciale	<i>a business centre</i>
Une grande surface	<i>a shopping mall</i>
Une piscine	<i>a swimming pool</i>
Des magasins	<i>some shops</i>
Des bâtiments	<i>some buildings</i>
Des installations sportives	<i>some sports facilities</i>

V2: Connectives	
Pourtant	<i>yet</i>
Ou	<i>or</i>
Où	<i>where</i>
Quand	<i>when</i>
Si/ s'	<i>if</i>

Vocabulary

G1: Key verbs	
Il y a	<i>there is/are</i>
avoir	<i>to have</i>
être	<i>to be</i>
voir	<i>to see</i>
visiter	<i>to visit</i>
pouvoir	<i>to be able to</i>
se relaxer	<i>to relax</i>
se promener	<i>to walk</i>

V2 Opinions	
Je pense que	<i>I think that</i>
Je trouve que	<i>I find that</i>
J'ai horreur de	<i>I cannot stand</i>
Je crois que	<i>I believe that</i>
A mon avis	<i>In my opinion</i>
Je le/la/les trouve...	<i>I find it/ them</i>

Pronunciation

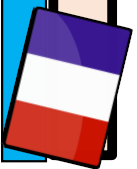
G2: Adjectives			
animé(e)	<i>lively</i>	bruyant(e)	<i>noisy</i>
agréable	<i>pleasant</i>	désagréable	<i>unpleasant</i>
divertissant(e)	<i>entertaining</i>	déprimant(e)	<i>depressing</i>
tranquille	<i>peaceful</i>	affreux (euse)	<i>awful</i>
passionnant(e)	<i>exciting</i>	laid(e)	<i>ugly</i>
pittoresque	<i>picturesque</i>	ancien(ne)	<i>old</i>
beau (belle)	<i>beautiful</i>		

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

G3 Comparative adjectives	
Plus...que	<i>More...than</i>
Moins...que	<i>Less...than</i>
Aussi ...que	<i>as...as</i>
Meilleur(e) que	<i>better than</i>
Pire que	<i>worse than</i>

G4: Negatives	
Ne...pas	<i>Not</i>
Ne...rien	<i>nothing</i>
Ne...ni	<i>neither, nor</i>
Ne...jamais	<i>never</i>
Ne...plus	<i>no longer</i>
Ne...aucun(e)	<i>not a single</i>
Ne...que	<i>only</i>



Y9 French KO6: Quel film as-tu vu récemment? (what film have you seen recently?)

Grammar

V1: Film genres

Un film policier	<i>a thriller</i>
Un film comique	<i>a comedy</i>
Un film d'horreur	<i>a horror film</i>
Un film d'action	<i>an action film</i>
Un film de science-fiction	<i>a sci-fi film</i>
Un film de guerre	<i>a war film</i>
Un film d'animation	<i>an animated film</i>
Un film d'amour	<i>a romantic film</i>
Un film fantastique	<i>a fantasy film</i>
Un film d'aventure	<i>an adventure film</i>

G1: Adjectives

<i>divertissant(e)</i>	<i>entertaining</i>	<i>effrayant(e)</i>	<i>scary</i>
<i>exceptionnel (le)</i>	<i>exceptional</i>	<i>Choquant (e)</i>	<i>shocking</i>
<i>passionnant(e)</i>	<i>exciting</i>	<i>Terrible</i>	<i>terrible</i>
<i>Incroyable</i>	<i>incredible</i>	<i>Imprévisible</i>	<i>unpredictable</i>
<i>prenant(e)</i>	<i>gripping</i>	<i>agaçant(e)</i>	<i>annoying</i>
<i>fascinant(e)</i>	<i>fascinating</i>	<i>peu convaincant(e)</i>	<i>unconvincing</i>
<i>prévisible</i>	<i>predictable</i>	<i>ennuyeux (euse)</i>	<i>boring</i>
<i>Sensationnel (le)</i>	<i>sensational</i>		
<i>drôle</i>	<i>funny</i>		

V2: The specifics of a film

Le conflit	<i>conflict</i>	la violence	<i>the violence</i>
L'amour	<i>love</i>	la politique	<i>the politics</i>
Le début	<i>the start</i>	la romance	<i>the romance</i>
L'histoire	<i>the story</i>	La bande sonore	<i>the sound track</i>
La lutte	<i>the fight</i>	les effets spéciaux	<i>the special effects</i>
L'amitié	<i>friendship</i>	les blagues	<i>the jokes</i>
L'histoire	<i>the story</i>	les vedettes	<i>the stars</i>
La suspense	<i>the suspense</i>	les acteurs	<i>the actors</i>
La fin	<i>the ending</i>	les extras	<i>the extras</i>



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

Pronunciation

P1 Pronunciation	
a	"ah"
rr	"rrr"
ç	"ss"
y	"ee"
Silent final s, t, x	
nothing	

G2: Key verbs

voir	<i>to see</i>
regarder	<i>to watch</i>
jouer	<i>to play</i>
se dérouler	<i>to take place</i>
conseiller	<i>to advise</i>
recommander	<i>to recommend</i>

Grammar.

KO1. Grammar Focus. Das Perfect. (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)

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.

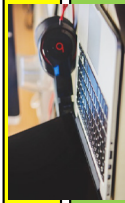
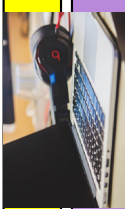
V1. Useful past tense sentences.

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.

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.

KO2. Neue Technologie (new technology)



Grammar.

<u>G1. Common Verbs in this topic</u>			
Pronoun	sein to be	benutzen to use	herunterladen to download
ich (I)	bin (I am)	benutzt (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.

<u>V1. Useful Phrases in this topic.</u>	
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.

<u>V2. Adjectives</u>	
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

<u>V3. Nouns</u>	
Deutsch	Englisch
das Handy	mobile phone
das Bildschirm	screen
die Spielkonsole	games console
der drahtloser Kopfhörer	wireless headphones



Grammar.

<u>G1. Common irregular & regular verbs.</u>			
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)

K03. die Unterhaltung (entertainment)

Vocabulary.

<u>V1. Nouns & adjectives.</u>	
Deutsch	Englisch
Romane/Comics	Novels/Comics
Zeitungen/Zeitschriften	Newspapers/Magazines
Biografien/Gedichte	Biographies/Poems
Abenteuerfilme	Adventure films
Zeichentrickfilme	Cartoons
Sendungen	TV Programmes
Komödien	Comedies
Seifenoperen	Soap Opera
Fernsehserien	TV Series
unterhaltsam/langweilig	entertaining/boring
lustig/traurig	funny/sad
aufregend/entspannend	exciting/relaxing
gut/schlecht	good/bad

Pronunciation.

<u>P1. You see, you say.</u>	
Deutsch	Englisch
Romane	row-marr-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
Seifenoperen	zye-fun-oh-purn
Fernsehserien	furn-seh-sier-ee-un
aufregend	owf-ray-gund
gut	goot

<u>P2. Opinions</u>	
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.)	min-er leeb-ling-s-ier-ee-un sind Kom-ur-dee-un

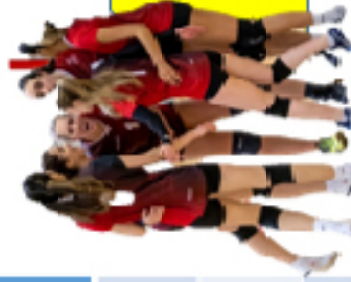


Year 9 Physical Education

1. How to improve your Components of Fitness

Component of Fitness	Definition	Methods of Training
Agility	The ability to move and change direction quickly, at speed, while maintaining control	Interval Training Circuit Training
Balance	Maintaining the centre of the mass over the base of support	Circuit Training Static Stretching
Cardiovascular Endurance	The ability of the heart and lungs to supply oxygen to the working muscles	Continuous Training Circuit Training High Altitude Training Parkleak Training
Coordination	The ability to use two or more different parts of the body together, smoothly and efficiently	Circuit Training
Flexibility	The range of movement possible at a joint	Static Stretching Circuit Training
Muscular Endurance	The ability of a muscle or a muscle group to undergo repeated contractions, avoiding fatigue	Weight Training Circuit Training
Power	The product of speed and strength. $\text{Power} = \text{strength} \times \text{speed}$	Plyometric Training Weight Training
Reactor Time	The time taken to initiate a response to a stimulus	Circuit Training
Strength	The ability to overcome resistance	Weight Training Circuit Training
Speed	The maximum rate at which an individual is able to perform a movement or cover a distance in a period of time.	HIIT Interval Training

2. Sports and Physical Activity improves your Social Health



Enables you to cooperate with other people

Provides Opportunities to socialise and make friends



Work collaboratively, in a team



Improves communication

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

B. Simple Time in Dance Music

SIMPLE DUPLÉ 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:

Count	1	and a	2	and a	3	and a	4	and a
Drum	●		●		●		●	
Snare/Drum or Hi-hat		●		●		●		●
Cymbal			●		●		●	

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 (through 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 – **RIISING 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 **CHORDS** 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 **EXPERIMENTAL 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

 <p>John Goldsmith Planet of the Apes Star Trek: The Motion Picture The Open Alien</p>	 <p>John Williams Jaws Harry Potter Indiana Jones Superman, E.T.</p>	 <p>James Horner Titanic Apollo 13 Braveheart Star Trek II: The Wrath of Khan</p>	 <p>Ennio Morricone The Good, The Bad and The Ugly For a Few Dollars More The Mission</p>	 <p>Danny Elfman Mission: Impossible Batman Returns Men in Black: Spider-Man</p>	 <p>Hans Zimmer The Lion King Gladiator Dunkirk Blade Runner 2049 No Time to Die</p>	 <p>Bernard Herrmann Psycho Vertigo Taxi Driver</p>
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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

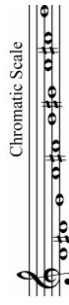
JUMPING BASS LINE
Where the bass line often moves by **LEAP (DISJUNCT MOVEMENT)** leaving 'gaps' between notes



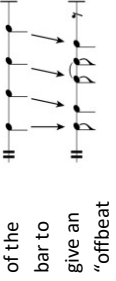
STACCATO ARTICULATION
Performing each note sharply and detached from the others.
Shown by a dot.



CHROMATIC MOVEMENT
Melodies and bass lines that ascend or descend by semitones.



SYNCOPIATION
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)



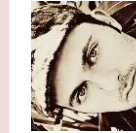
Mieko Ishikawa
Dragon Slayer (1993)



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	A2. Harmony	A3. Rhythm	A4. Timbres and Sonorities
<p>CONJUNCT - wide leaps, angular and spiky.</p> <p>CHROMATIC - uses all 12 notes (black and white) of the CHROMATIC SCALE.</p> <p>DISSONANCE - harsh sounds.</p> <p>EXTREMES OF DYNAMICS - (pppp-ffff) No clear melody/"tune".</p>	<p>ATONALITY – no (sense of) key.</p> <p>POLYTONALITY – two or more keys played at once.</p> <p>DISCORDS – dissonant, clashing chords.</p>	<p>SYNCOPE – half beat followed by full beat emphasising weaker beats of the bar.</p> <p>IRREGULAR ACCENTS (>) – e.g. <i>The Rite of Spring</i></p> <p>IRREGULAR TIME SIGNATURES – 5 or 7 beats per bar.</p>	<p>Strange, intriguing, and exotic sounds; striking, sometimes explosive, contrasts.</p> <p>PERCUSSION – expanded in orchestra and more emphasis on percussion timbre and sonorities.</p> <p>Unfamiliar sounds from strange instruments such as EXTREME PITCH RANGES and playing instruments in different and unusual ways.</p> <p>TOTALLY NEW SOUNDS often involving ELECTRONIC EQUIPMENT and MAGNETIC TAPE.</p>

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)

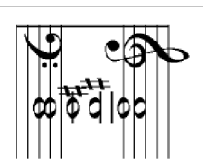
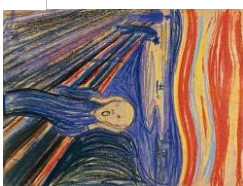


Famous Minimalist Composers include: Terry Riley, Steve Reich, Philip Glass, Michael Nyman.

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**.

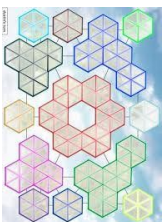


Hexachords are chords formed of **SIX** notes. A hexachord can be formed on the **CHROMATIC SCALE**, but must follow a strict pattern of **TONES** and **SEMITONES**:

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

NOTE/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 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:



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 **POLYRHYTHM** 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.

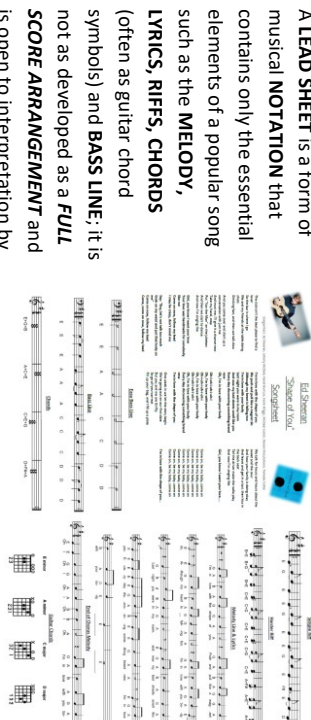
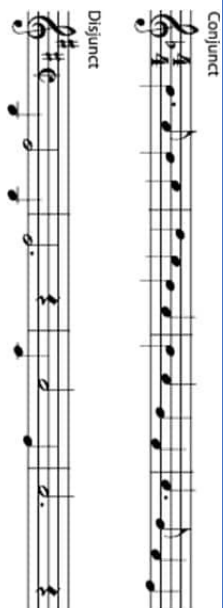
F. Instruments, Timbres and Sonorities of Samba

SURDO		REPINIQUE		TAMBORIM		CHOCOLO		RECO-RECO		APITO		AGOGO BELLS		CAIXA DE GUERRO	
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What Makes a Good Song?

Exploring Popular Songs and Musical Arrangements







A. Popular Song Structure	B. Key Words	C. Lead Sheet Notation and Arrangements
<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>CODA/OUTRO – The final section of a popular song which brings it to an end (Coda is Italian for "tail"!)</p>	<p>LYRICS – The words of a song, usually consisting of VERSES and a CHORUS.</p> <p>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.</p> <p>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.</p> <p>MELODY – The main tune of the song often sung by the LEAD SINGER.</p> <p>COUNTER-MELODY – An 'extra' melody often performed 'on top of' the main melody that 'fits' with it. DISCANT or INSTRUMENTAL SOLO.</p> <p>TEXTURE – The layers that make up a song e.g., <i>Melody, Counter-Melody, Hooks/Riffs, Chords, Accompaniment, Bass Line</i>.</p>	<p>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.</p> <p>COVER (VERSION) – A new performance, remake or recording by someone other than the original artist or composer of the song.</p> 
<p>CONJUNCT MELODIC MOTION – Melodies which move mainly by step or use notes which are next to or close to one another.</p> <p>DISJUNCT MELODIC MOTION – Melodies which move mainly by leap or use notes which are not next to or close to one another.</p> <p>MELODIC RANGE – The distance between the lowest and highest pitched notes in a melody.</p>	<p>D. Conjunct and Disjunct Melodic Motion</p> 	<p>E. Song Timbre and Sonority (Instruments that are used to Accompany Songs)</p> <p>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.</p>

9.1 Evil and Suffering

Key Constructs: P2. Moral and ethical issues are influenced by religious and non-religious beliefs.
 P3. Religious and non-religious philosophy aims to answer unanswerable questions about the world.

Enquiry Questions:

- 3.5 What do people do when life gets hard?
 3.16 Why is there suffering? Are there any good solutions?

Section A: Key Vocabulary	Section C: Core Content
<ol style="list-style-type: none"> Evil — that which causes suffering, harm or disorder. Suffering — distress or pain; can be physical, emotional or psychological. Aid — help which is sent when others need it, particularly after a disaster. Justice — creating a balance between right and wrong to create a fair society. Restoration — repairing what is wrong, damaging or harmful. 	<p>⇒ Evil is what causes suffering; evil can be moral (caused by humans) or natural (caused by nature) or a combination of both.</p> <p>⇒ Examples of moral evil are violence, war, crime, prejudice/discrimination, abuse (4types) and murder.</p> <p>⇒ Examples of natural evil are death, illness and natural disasters.</p> <p>⇒ Suffering can occur in many ways; physical, emotional and psychological (mentally). Examples include physical pain, sadness, loneliness, loss, sickness and poverty.</p> <p>⇒ Religious and non-religious people often believe that evil comes from humans and human actions.</p> <p>⇒ Some theists believe evil comes from a devil-type figure which is described in some holy texts.</p> <p>⇒ 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 a man names Job who's life was destroyed by God to prove that faith is the most important thing in life.</p> <p>⇒ 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.</p>
<ol style="list-style-type: none"> The two forms of evil are moral (caused by humans) and natural (caused by nature). Theists believe evil exists to test the faith and character of humans. Charities send short-term and long-term aid to help when others are suffering from a disaster. Justice means that people who do wrong must be punished to maintain a fair society. Some people believe that restoration and forgiveness are better than punishment. 	<p>⇒ Natural disasters include earthquakes, land slides, tsunamis, hurricanes, floods and volcanic eruptions.</p> <p>⇒ Short-term aid is when you send emergency supplies like medical goods, temporary shelters, food and water).</p> <p>⇒ Long-term aid is when a country, region or community are assisted in rebuilding infrastructure like roads, hospitals, schools, waterways, sanitation and housing.</p> <p>⇒ Aid is usually provided through charities such as UNICEF, Oxfam, The Red Cross, Salvation Army, Islamic Relief and Khalsa Aid.</p> <p>⇒ Society says that when a person commits a crime they should be punished. This is known as justice.</p> <p>⇒ 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.</p> <p>⇒ Many religious people believe in forgiveness as the most important part of justice and believe the in the power of forgiveness.</p> <p>⇒ Prison reformers are people who advocate and campaign for the conditions within prisons to be improved so that prisoners stand a better chance of rehabilitation and are therefore less likely to re-offend.</p> <p>⇒ Chaplains are people appointed by the Church to work in all kinds of places like prisons, hospitals, the armed forces, universities and schools to show God's love through offering care and support, and by representing Christian values and beliefs.</p>
<p>Section B: Component Knowledge</p>	<p>A) Types of evil and suffering</p>  <p>B) Moral evil and suffering</p>  <p>C) Natural evil and suffering</p>  <p>D) Justice and Restoration</p> 

Learning Milestone Tasks

Can you describe where evil might come from according to different people?	Can you explain which is worse: moral or natural evil and suffering?	Can you explain why evil and suffering might make it impossible to believe in God?	Can you create a poster to raise awareness of the work charities do for others?	Can you explain why prison reformers and chaplains believe in helping criminals?
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9.2 Philosophy, Truth and Meaning

Key Construct: P3. Religious and non-religious philosophy aims to answer unanswerable questions about the world.

Enquiry Question:
3.17 Is happiness the true meaning of life?

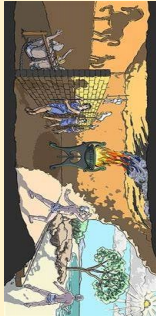


Section A: Key Vocabulary
1. Philosophy — the pursuit of knowledge about life and the world.
2. Trust — believing something to be reliable, true or accurate.
3. Ignorance — lacking correct knowledge or understanding of something.
4. Science — the pursuit of facts and evidence to explain things.
5. Happiness — feeling contentment or pleasure.

Section B: Component Knowledge
1. Happiness comes from knowing what's true and what we can or can't trust.
2. Science and religion both claim to have the truth about the world and life.
3. Happiness depends on our perception and situation, if we are being deluded or ignorant we cannot be truly happy.
4. Religions claim to give meaning to peoples lives and to make them happy.
5. Science lacks information about how to be happy or

Learning Milestone Tasks

Can you describe what a philosopher is, with examples?

Section C: Core Content

A) Philosophy	B) Truth	C) Meaning
 <p>⇒ 'Philosophy' comes from the Greek words for 'knowledge' and is thought of as the study of the nature of knowledge, wisdom, reality, truth and existence.</p> <p>⇒ Some key philosophers are Socrates, Plato, John Stuart Mill, William Paley, Richard Dawkins.</p> <p>⇒ Philosophers can be religious or non-religious.</p> <p>⇒ Plato developed a famous philosophical story known as 'The Allegory of the Cave'. This story is a metaphor for life. The story consists of a group of prisoners who 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 or dishonest.</p> <p>⇒ John Stuart Mill once questioned 'Is it better to be a human (intelligent being) dissatisfied or a pig (ignorant/unintelligent being) satisfied?'. He believed that it is better to question everything (like the philosophers do) than to question nothing at all.</p> <p>⇒ The Truman Show is a modern representation of the Allegory of the Cave, where Truman escapes the world which is created for him and finds the real world. Truman is therefore the enlightened prisoner.</p>	 <p>⇒ Epistemology is the study of knowledge. There are 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).</p> <p>⇒ 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.</p> <p>⇒ 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.</p> <p>⇒ 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).</p> <p>⇒ Some scientists are atheist and believe that science has or will prove that God does not exist—they have supporters like Richard Dawkins, Stephen Fry and Ricky Gervais.</p> <p>⇒ Some scientists are agnostic or theist and believe science could eventually find evidence that God does exist—they have supporters like Einstein, William Paley, Charles Darwin and Brian Cox.</p>	 <p>⇒ Science and religion have two different accounts of creation (how the world came to exist). Science have developed the theory of The Big Bang; religions accounts vary according to the religious system but the most famous is the Judeo-Christian account of the Six Days of Creation.</p> <p>⇒ Many people, both scientists and religious believers, say that both could be correct to some extent as they have a similar sequence (light—>atmosphere—>earth—>water—>animals—>humans) and only differ in the time scale (6 "days" v 12million years).</p> <p>⇒ A common idea is that 'science tells us how we were created, but religion tells us why'. Science doesn't have opinions about how we should act and why we should value but religion does. For this reason you are more likely to find meaning and happiness through religion.</p> <p>⇒ Thought experiments & optical illusions are designed to make us question our senses to remind us that</p>

Can you describe the four types of knowledge and say why some people need knowledge to be happy?

Can you explain why science and religion have conflict?

Can you explain why Truman wasn't happy in the world that was created for him?

Can you explain why people think religion brings more happiness than science?

9.3 Christian Beliefs and Teachings

Key Construct: R2. Beliefs and teachings are what form the basis of a religion.

Enquiry Questions:

3.6 Why do Christians believe Jesus was God on Earth?

3.7 What is so radical about Jesus?

Section A: Key Vocabulary	
1.	Incarnation — to be born in flesh form
2.	Miracle — an extraordinary event which cannot be explained.
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.	Resurrection — coming back to life after death.

Section C: Core Content

A) Incarnation



⇒ Incarnation means 'born in flesh'. Jesus is referred to as '**God incarnate**' = **God in flesh**.

⇒ Accounts of Jesus birth (The Incarnation) are found in **Matthew and Luke's Gospels** in the New Testament in the Bible.

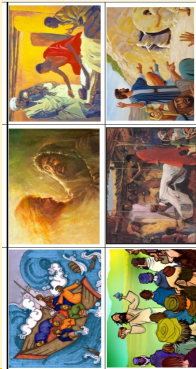
⇒ **Matthew** writes to **Jewish converts** to Christianity, he **links Jesus to Jewish prophecies** (predictions) in the Hebrew Bible and **refers to Jewish history**.

⇒ **Luke** writes to **Greek converts** to Christianity, he doesn't refer to unfamiliar Jewish history, instead he **shows Jesus being accepted by common people** (shepherds).

⇒ Key features of the incarnation story (nativity) are: **Mary (virgin mother), Joseph (carpenter father), Bethlehem, visitors (shepherds/wise men), Angel Gabriel**.

⇒ 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) Mission



⇒ When Jesus was on earth his purpose was to **inspire** the faithful, **convert** others and **restore** the bond between humans and God.

⇒ He taught through telling stories; called **parables**. Some of his most famous parables are **The Lost Son, The Lost Sheep, The Good Samaritan**.

⇒ He demonstrated his **power** as God incarnate by performing **miracles**, such as; walking on water, calming the seas, feeding 5000 from 5 loaves and fish, healing the sick, raising people from the dead.

⇒ He established the new Christian church by passing down his power and knowledge to his disciples; **Peter, James, John, Andrew, Bartholomew, James, Judas, Jude, Matthew, Philip, Simon and Thomas**. Some of them took new names or were **baptised** to show their new life and purpose.

⇒ Jesus was a **pacifist**, which means he did not believe in using violence and would avoid conflict.

⇒ His most famous teachings are: '**Treat others as you wish to be treated**' (The Golden Rule); '**Love thy neighbour**' (The Great Commandment); '**I am the way, the truth and the life. No-one comes to the Father except through me**' John 14:6.

C) Crucifixion and Resurrection



⇒ Jesus was crucified by the **Romans**, at behest of **Jewish** elders. He was found guilty of **blasphemy** (speaking against God) because he was telling people he was God incarnate and **forgiving sins**.

⇒ Key features of the crucifixion are: Jesus was **tortured** before crucified, **carried** his own cross, **crown of thorns** around his head, a sign hung saying '**King of the Jews**' above his head to **mock** him.

⇒ Despite this before he died Jesus said '**Forgive them Father for they know not what they do**'.

⇒ After he died the **sky went dark**, later he was buried in a **tomb** behind an immovable rock.

⇒ **Three days** later the tomb was **empty** and Jesus appeared to his disciples—this is the **resurrection**.

⇒ **40 days later**, Jesus told his disciples that they must stay in Jerusalem and that they would receive the **Holy Spirit**. Then, Jesus was taken up into the sky and the disciples understood that he had gone to Heaven—this is called the **Ascension**.

⇒ 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**.

⇒ Christianity is represented by the **symbol** of the cross and Christians today wear **crucifix** to remember the **sacrifice** Jesus made.

⇒ Jesus is called a **martyr** because he died for the sins committed by others, not his own.

Section B: Component Knowledge

- Jesus was God born in human flesh to experience and guide humanity.
- Jesus used miracles and parables to teach others how to better serve and please God.
- Jesus believed it is important to put others first and so sacrificed himself so others can know God.
- When Jesus died on the cross it made up for the sins committed by humans so it gave humans a fresh start with God.
- When Jesus resurrected it proved that resurrection is possible and it gives Christians hope they can be resurrected

Learning Milestone Tasks

Can you describe how and why Jesus was born?

Can you explain why Jesus performed miracles and told stories?

Can you describe the crucifixion and say why Jesus didn't fight back?

Can you summarise three of Jesus' most important teachings and what they mean?

Can you describe what the disciples learnt from Jesus and what he instructed them to do?

9.4 Islamic Beliefs and Teachings

Key Constructs: R2. Beliefs and teachings are what form the basis of a religion.

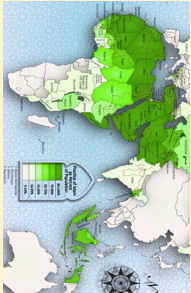

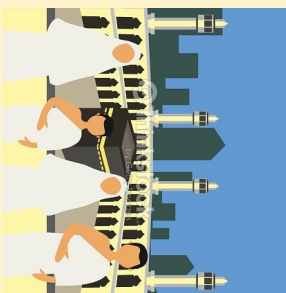

Enquiry Questions:
3.10 What is good and what is challenging about being a Muslim teenager in Britain today?

Section A: Key Vocabulary
1. Tawhid — the belief that Allah is the one and only God.
2. Risalah — communication from Allah, angels, prophets and holy texts.
3. Akhirah — eternal afterlife spent in either Paradise or hell
4. Ibadah — worshipping Allah in different ways.
5. Islamophobia —fear or hatred of Islam.

Section B: Component Knowledge
1. Muslims make up part of British society in multiple ways.
2. Muslims believe in one god who they refer to as Allah.
3. Islam teaches that there is an afterlife which will be spent in Paradise or hell.
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.

Learning Milestone Tasks

Can you describe the ways Muslims have contributed to UK society?

Section C: Core Content	
<p>A) Islam</p> 	<p>⇒ There are approximately 1.8billion (<24%) Muslims in the worldwide population and 3.3million (5.2%) live in the UK.</p> <p>⇒ Britain has around 1750 mosques and nearly half of all British Muslims were born in the UK.</p> <p>⇒ The first English-language Qur'an was published in 1649 and the first Indian restaurant in Britain was opened by an Indian-Muslim family in 1810.</p> <p>⇒ 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.</p> <p>⇒ 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.</p> <p>⇒ Today, the Muslim community represents Britain in areas such as; sport, entertainment and politics. As well as contributing to society in the fields of medicine, science, food production and construction.</p>
<p>B) Key Beliefs</p> 	<p>⇒ 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).</p> <p>⇒ Risalah is the channel of communication from Allah through the angels (divine messengers), the prophets (human messengers) and the holy texts (Qur'an).</p> <p>⇒ Akhirah is the belief in the afterlife. Muslims believe that after we die our soul leaves our body and goes to a waiting place, then one day in the future all will be judged and sent to either Paradise or Hell.</p> <p>⇒ Muhammad is the most important prophet in Islam. His early life prepared him to be Allah's final, and most trusted, messenger; his later life was spent either teaching others what Allah wanted them to know (through his example) or defending the faith from persecution.</p>
<p>C) Ibadah (worship)</p> 	<p>⇒ Islam is split into two main groups (denominations) called Sunni and Shi'a. Sunni Muslims follow the Five Pillars and Shi'a Muslims follow the 10 Obligatory Acts.</p> <p>⇒ 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'. Shi'a Muslims add the phrase 'and Ali is his friend' on the end.</p> <p>⇒ 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 Mecca, placing forehead to the ground, washing before prayer.</p> <p>⇒ Zakah is the act giving money away for the benefit of others and reminds Muslims to put others before themselves.</p> <p>⇒ 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.</p> <p>⇒ Hajj is the annual pilgrimage to the holy city (Mecca). When there, Muslims spend a week performing sacred tasks and rituals designed to remember their past and to test their faith.</p>
<p>D) Islamophobia</p> 	<p>⇒ 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.</p> <p>⇒ The Declaration of Human Rights, and the UK Equality Act, make it illegal to discriminate against Muslims.</p>

Can you create a list of things Muslims believe about Allah?

Can you describe some differences between Sunni and Shi'a Muslims?

Can you explain why Zakah and Sawm may be the most important things to a Muslim?


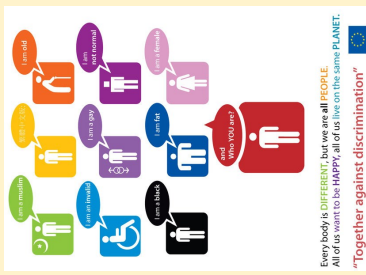

Can you explain what Islamophobia is and why it is important to stop it?

9.5 21st Century Ethics

Key Constructs: P2. Moral and ethical issues are influenced by religious and non-religious beliefs.

Enquiry Questions:

3.14 Good, bad; right, wrong: how do I decide?

Section A: Key Vocabulary	Section C: Core Content	
<ol style="list-style-type: none"> Rights — basic human entitlements outlined in the Declaration of Human Rights. Equality — all people having the same rights, opportunities and status. Prejudice — pre-judging a person or group of people. Discrimination — treating a person or group of people negatively due to a prejudice. Liberation — to release from oppression or confinement. 	<p>A) Human Rights</p>  <p>B) Prejudice & Discrimination</p>  <p>C) Liberation Theology</p> 	<p>⇒ The United Nations was founded shortly after World War 2. It is made up of 193 countries/nations which work together to resolve global issues.</p> <p>⇒ 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, health-care and religion.</p> <p>⇒ There is a difference between equality (everyone having the same) and equity (people having what they need).</p> <p>⇒ 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.</p> <p>⇒ Morality can affect a persons quality of life because; they may have to put their happiness aside to ensure others are happy, they may be treated badly because of another persons lack of care/understanding.</p> <p>⇒ 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) “an eye for an eye leaves the whole world blind” (Gandhi—Hindu/Jain) “the greatest good for the greatest number”. (Humanism)</p> <p>⇒ Prejudice is to pre-judge a person or group of people, however discrimination is how you treat them as a result of the prejudice. Stereotyping is when a person or group’s identity is oversimplified or assumed.</p> <p>⇒ Prejudice can be based on a persons’: race, geographical origins/ethnicity, religion, gender, sexuality, age, ability/disability, wealth, job, lifestyle, political/social affiliations, education or looks.</p> <p>Racial Prejudice and Discrimination (Racism)</p> <p>⇒ 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.</p> <p>⇒ People such as 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.</p> <p>Religious Prejudice and Discrimination</p> <p>⇒ Religious prejudice can take the form of: stereotyping religious people/groups; derogatory language (slurs); limiting religious practices; burning/defacing/banning holy texts; damaging places of worship or holy sites.</p> <p>⇒ The effects of religious prejudice and discrimination can be; conflict (potentially leading to violence), isolation, inequality in the work force, migration.</p> <p>⇒ The United Nations has it’s own armed force tasked with bringing corrupt governments to justice.</p> <p>⇒ 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”.</p> <p>⇒ Liberation Theologians believe that Jesus came to earth to “preach good news to the poor...proclaim freedom for the prisoners...release the oppressed...” from Luke 4 v 18-19.</p> <p>⇒ Because of this, followers of Liberation Theology campaign for churches to change their views on minority groups — today this could include women and members of the LGBTQIA+ community.</p> <p>⇒ Many religions allow women and/or LGBTQIA+ members to be part of their congregation but rarely as leaders — Liberation Theology would seek to change this.</p>
<h3>Section B: Component Knowledge</h3> <ol style="list-style-type: none"> Every human is entitled to a life of good quality, free from oppression and mistreatment. There are 30 Human Rights which are established and enforced by the United Nations. Prejudice and discrimination have a negative effect on the individual and the community. Modern ethical issues mainly focus on the oppression of minority groups. Liberation Theology is using Christian teachings to improve the lives of minority groups. 		
<h3>Learning Milestone Tasks</h3>		

Can you describe what human rights are, with examples?	Can you explain what a good quality of life might involve?	Can you describe, with examples, the difference between prejudice and discrimination?	Can you describe what Liberation Theology is? Can you explain what is meant by a minority group and how they should be treated?
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Knowledge Organiser – 4.1.1 Cell Biology

4.1.1.1 Cell Structure

4.1.1.1.1. Eukaryotes & Prokaryotes:

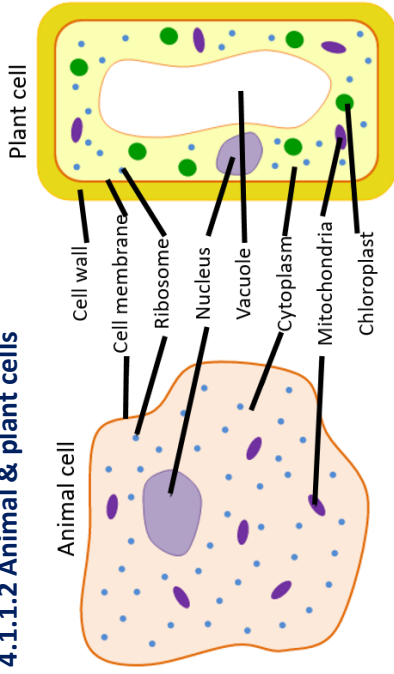
Eukaryotic (plant, animal & fungal cells).

- 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:

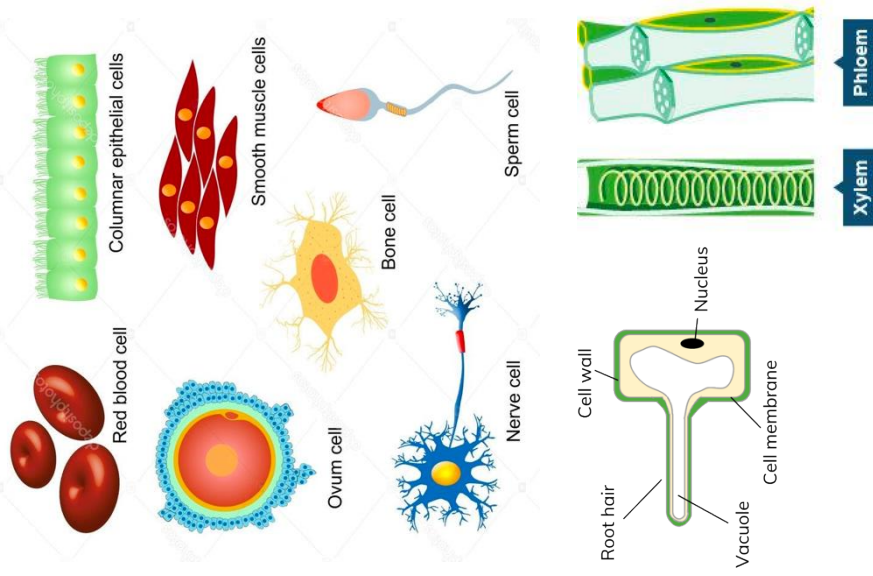
Most animal cells have the following

- **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

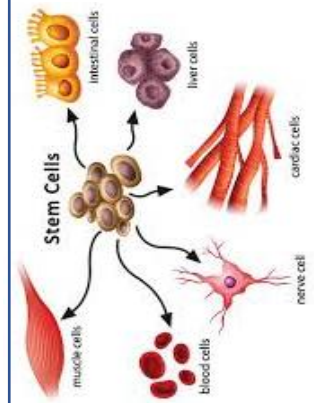
4.1.1.3. Cell specialisation:



4.1.1.4 Cell differentiation

As an organism develops, cells differentiate to form different types of cells.

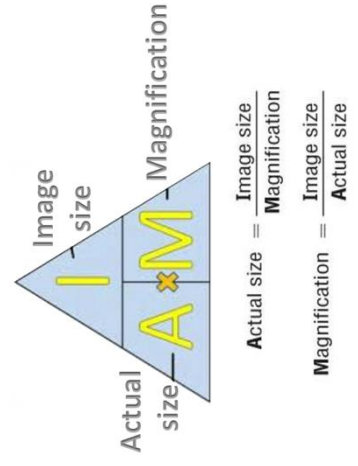
- Most types of animal cell differentiate at an early stage.
- Many types of plant cells retain the ability to differentiate throughout life.



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.**



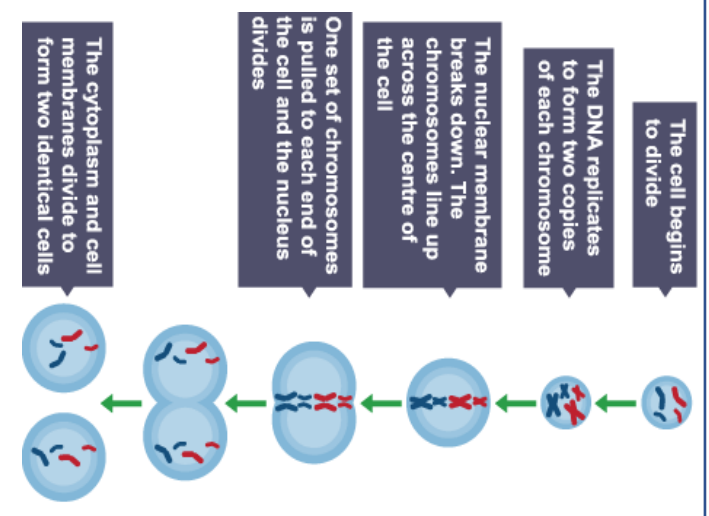
Knowledge Organiser – 4.1.2 Cell Biology

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.

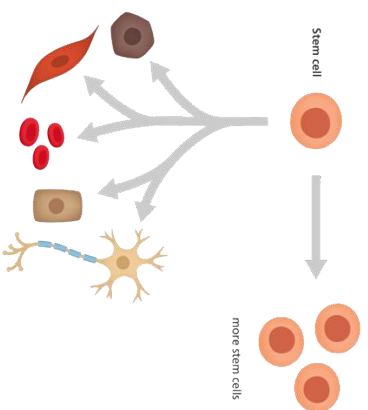
4.1.2.3 Stem cells - Plants

- **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**.



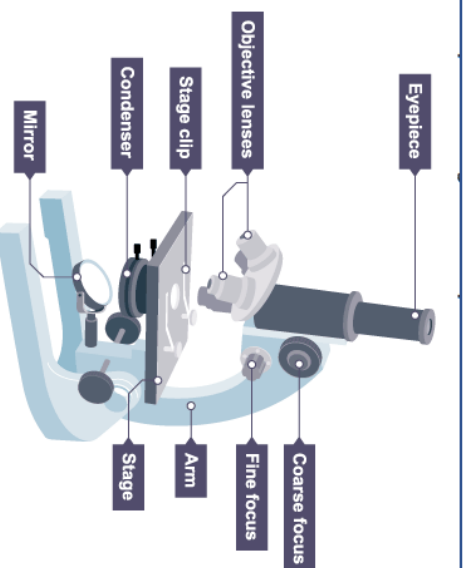
Treatment with stem cells

- 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
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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	A glass slide with a scale etched on it. It is used to calibrate the eyepiece graticule of a microscope.
micrometer	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.)
standard form	

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:

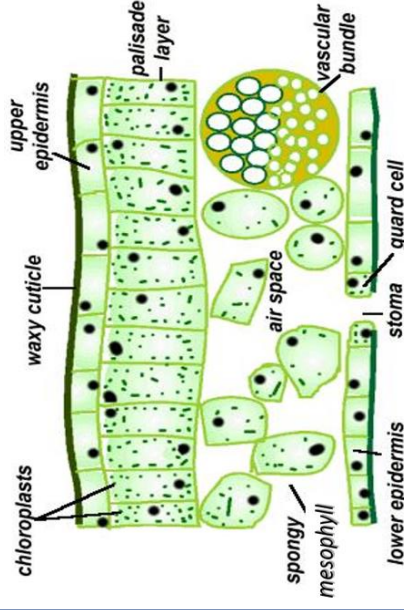
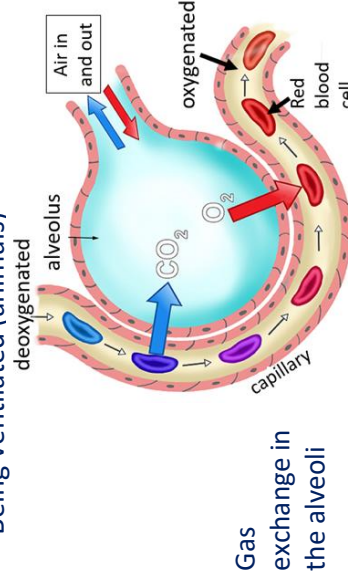
- having a **large surface area**
- a membrane that is **thin** to provide a short diffusion path
- (in animals) having an **efficient blood supply**
- (in animals, for gaseous exchange) being **ventilated**.

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)

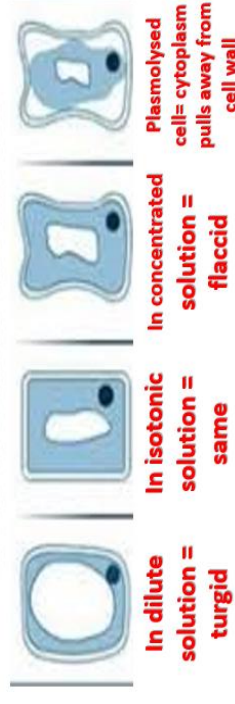


CO₂ diffuses from high concentration in the air space to a low concentration inside the mesophyll cells

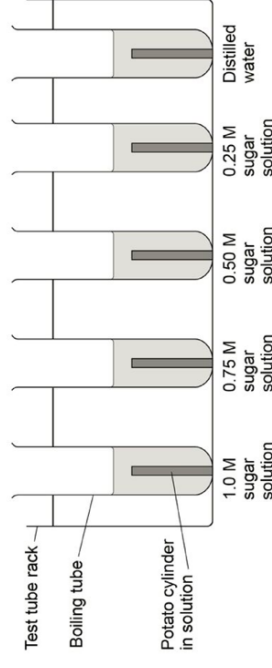
4.1.3.2 Osmosis

Osmosis is the **diffusion of water from a dilute solution to a concentrated solution** through a partially permeable membrane.

Effects of Osmosis on Plant Cells



RPA: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue

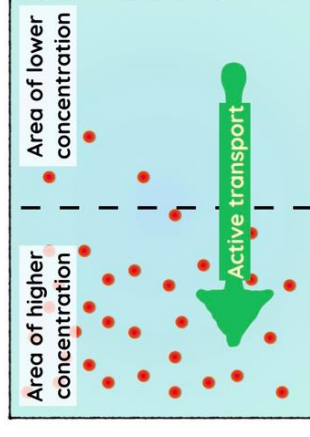


4.1.3.3 Active Transport

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.



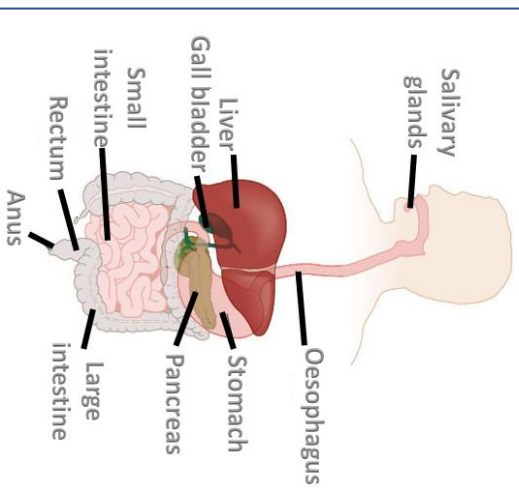
Knowledge Organiser – 4.2 Organisation

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.

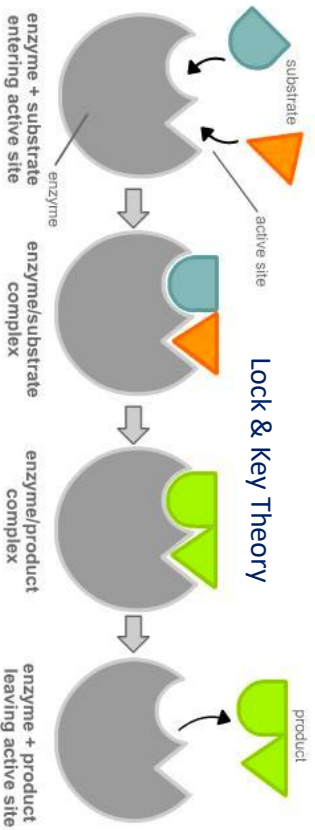
4.2.2 Animal tissues, organs and organ systems

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.



Lock & Key Theory

Denature: If the optimum conditions are not correct for an enzyme, it loses its 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.

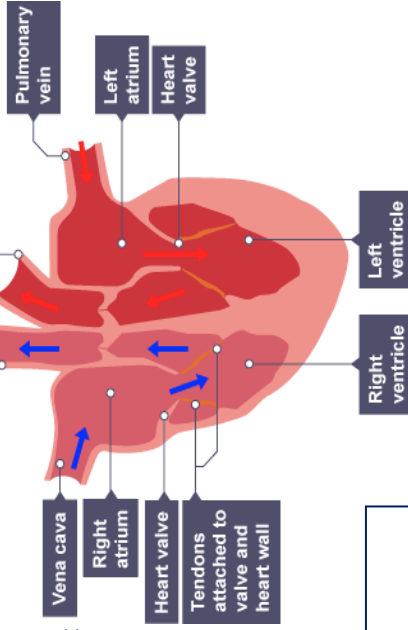
4.2.2.2 The heart and blood vessels

Right side of the heart receives deoxygenated blood from the body and pumps it to the lungs.

Pacemaker

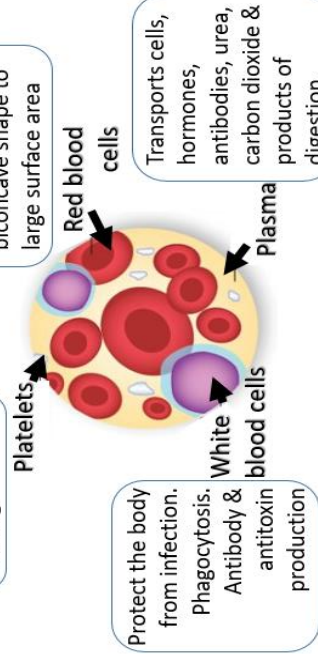
Group of cells in the right atrium that control resting heart rate.

Left side of the heart sends oxygenated blood to the body.



4.2.2.2 The heart and blood vessels

Fragments of cells which collect at wounds & trigger clotting.



Transport oxygen to cells for respiration. No nucleus, biconcave shape to large surface area

Red blood cells

Transports cells, hormones, antibodies, urea, carbon dioxide & products of digestion.

Plasma

Protect the body from infection. Phagocytosis. Antibody & antitoxin production

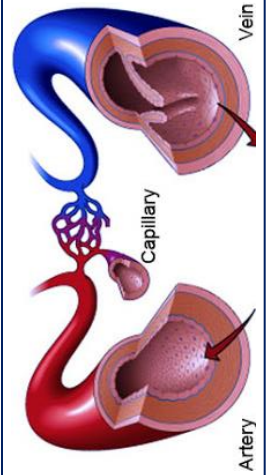
White blood cells

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

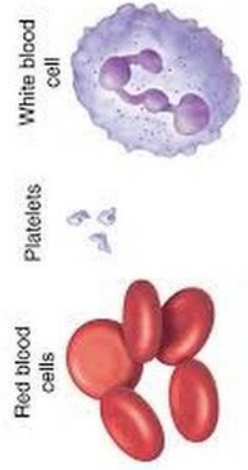
4.2.2.3 Blood

- 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

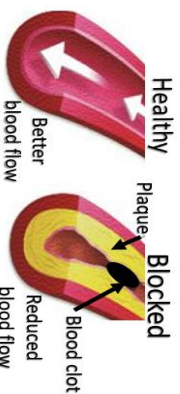


Blood is a tissue consisting of plasma containing red blood cells, white blood cells and platelets

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.



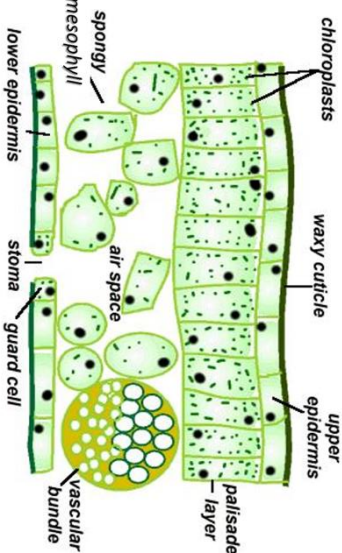
4.2.2.5 Health issues & types of disease

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

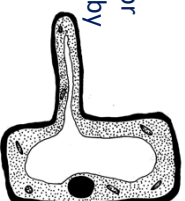
Benign tumours are abnormal cell growths contained in one area, **usually within a membrane**. They do not invade other parts of the body.

Malignant tumour cells are cancers. Invade neighbouring tissues and **spread to different parts of the body** where they form secondary tumours.

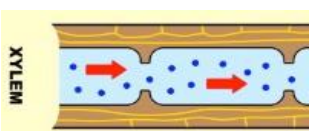
4.2.3.2 Plant organ system

Roots, stem, leaves form plant transport organ system.

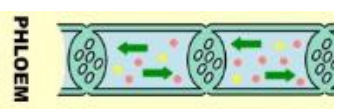
- **Root hair cells** are adapted for the efficient uptake of water by osmosis, and mineral ions by active transport.



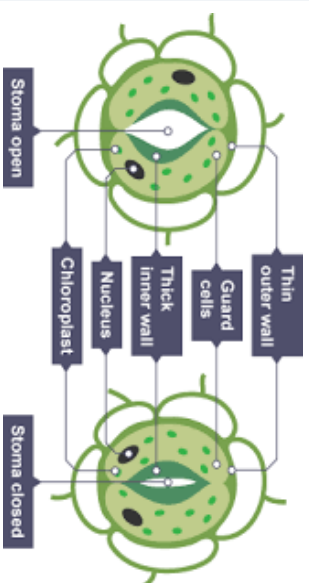
- **Xylem tissue** transports water and mineral ions from the roots to the stems and leaves.
- Made of hollow tubes strengthened by **lignin** adapted for the transport of water in the **transpiration stream**.



- **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.

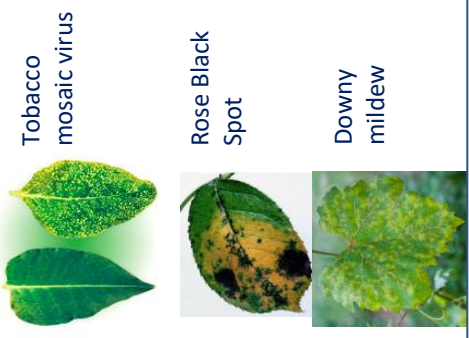


- **Stomata and guard cells** control gas exchange and water loss.



Knowledge Organiser – 4.3 Infection and response

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



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.

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.

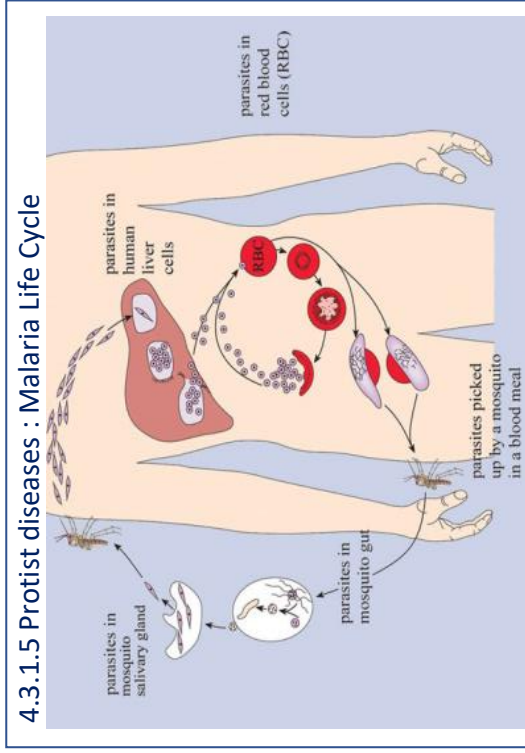
Gonorrhoea is a sexually transmitted disease (STD)

- 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.



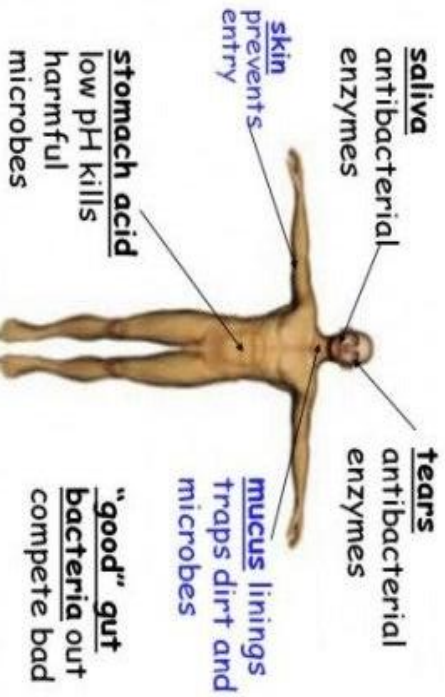
Knowledge Organiser – 4.3.1.6 Human defence systems

4.3.1.6 Human defence systems

Humans have a variety of **specific and non specific** Human defences against invading pathogens.

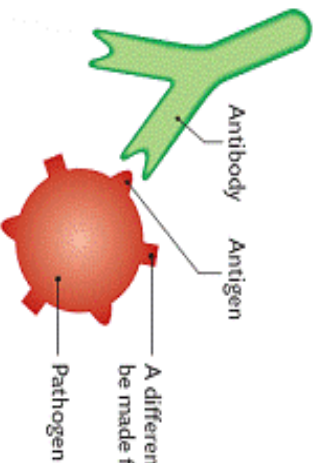
- | | |
|-----------------------------|---------------------------------------|
| Non-specific: | Specific via white blood cells |
| Skin (physical barrier) | Phagocytosis |
| Nose (mucus) | Antibodies |
| Trachea and bronchi (cilia) | Antitoxins |
| Stomach (acid) | |

First Lines of Defence



4.3.1.7 Vaccination

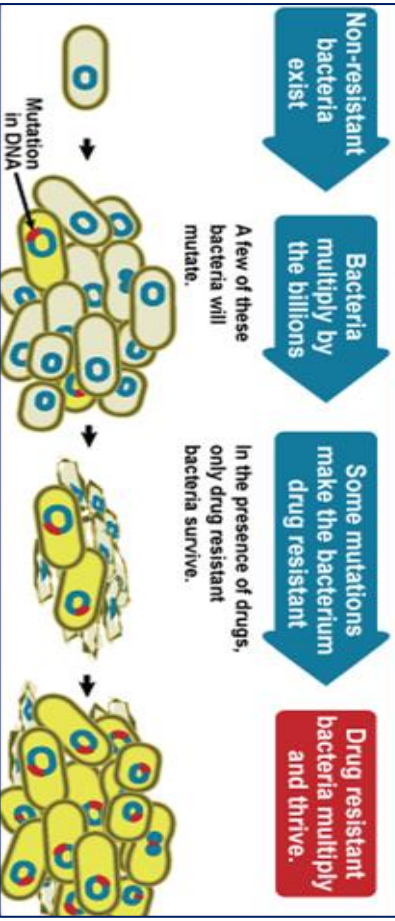
- Introducing small quantities of **dead or inactive pathogens to stimulate antibody production.**
- This leads to a quicker response in future infections.



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.

Genetic Mutation Causes Drug Resistance



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**

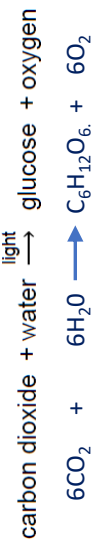
DISCOVERY & PRE-CLINICAL	CLINICAL TRIAL		
PHASE 1	PHASE 2	PHASE 3	
<p>Clinical trials use healthy volunteers and patients.</p> <ul style="list-style-type: none"> Very low doses of the drug are given at the start of the clinical trial. If the drug is found to be safe, further clinical trials are carried 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:



Key Terms

Photosynthesis Definitions

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.

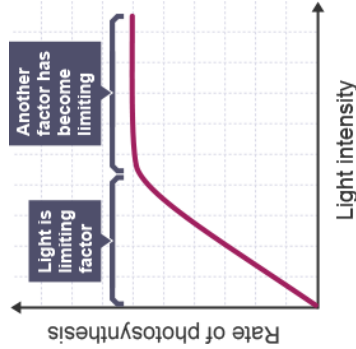
4.4.1.3 Uses of glucose from photosynthesis

- Used in respiration in the cells of the plant/algae
- Converted into insoluble **starch** for storage.
- Produces **fats or oils (lipids)** for storage. Eg Nuts & seeds
- Used to produce **cellulose**, which strengthens the cell wall.
- Used to produce **amino acids**, to synthesise proteins. To produce amino acids, plants also require **nitrates** from the soil.

4.4.1.2 Rate of Photosynthesis

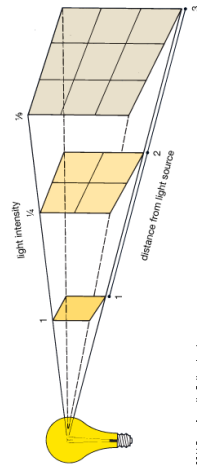
The following factors affect the rate of photosynthesis:

- **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.

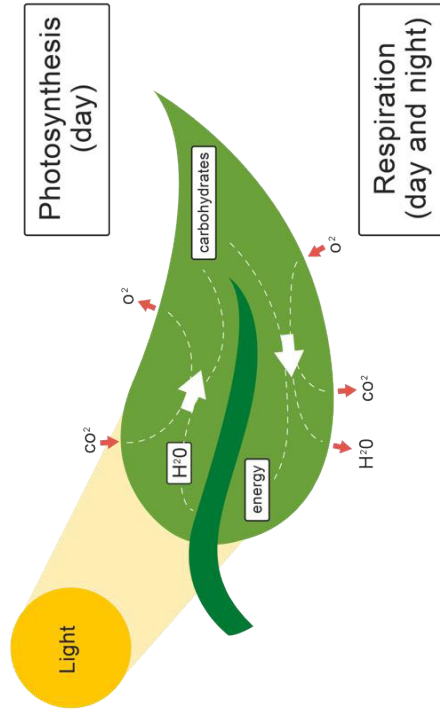
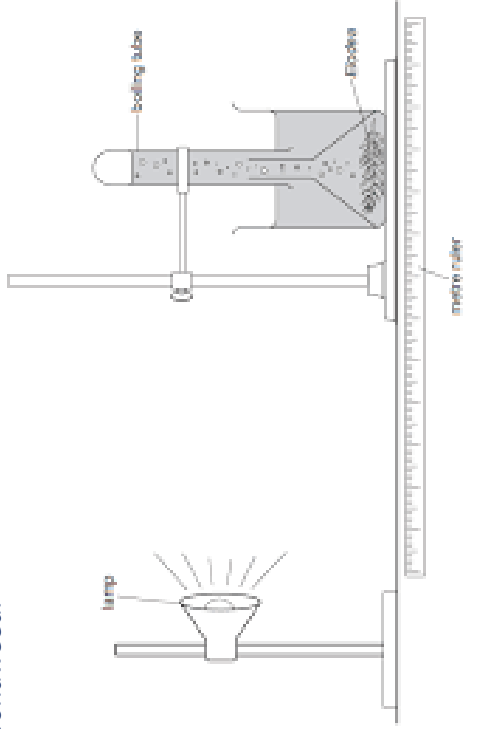
$$\text{light intensity} = \frac{\text{distance from source}^2}{\text{light intensity}}$$



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- **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 \rightarrow 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 \rightarrow lactic acid

In *plants* and *yeast*: glucose \rightarrow 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:

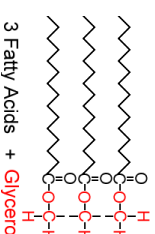
- Conversion of glucose to glycogen (animals), or to starch or cellulose (plants).

- 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

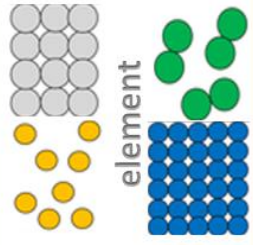
Chemical produced by the incomplete oxidation of glucose (anaerobic respiration).

Knowledge Organiser – 5.1 Atomic structure & the periodic table

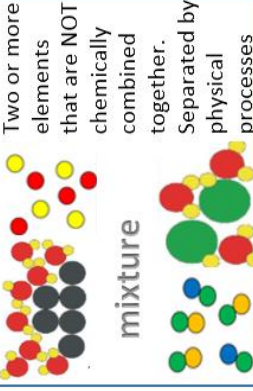
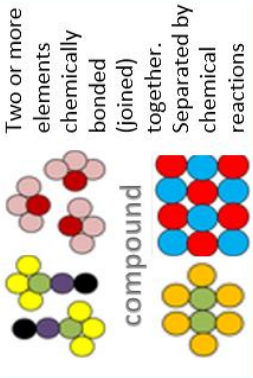
5.1.1.1

Atoms, elements & compounds

An **Atom** is the **smallest part of an element that can exist.**



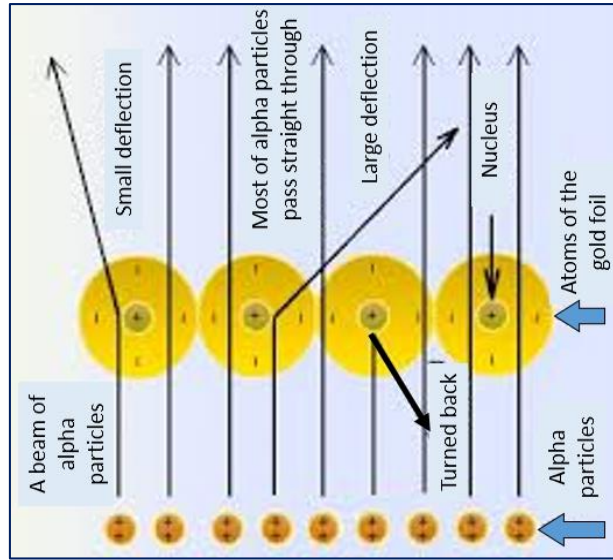
Made from only one type of atom
e.g. Gold is made of only gold atoms



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:



Ernest Rutherford's Gold scattering experiment

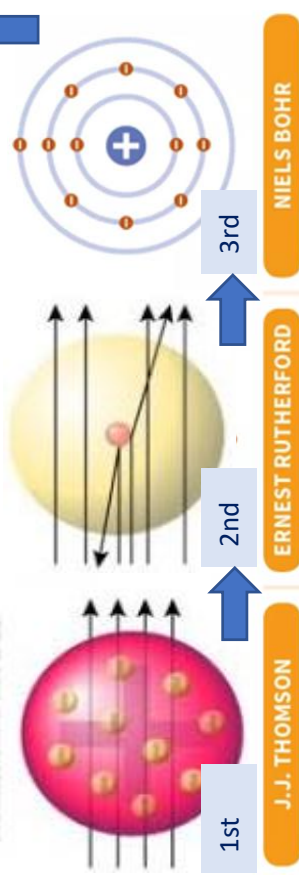
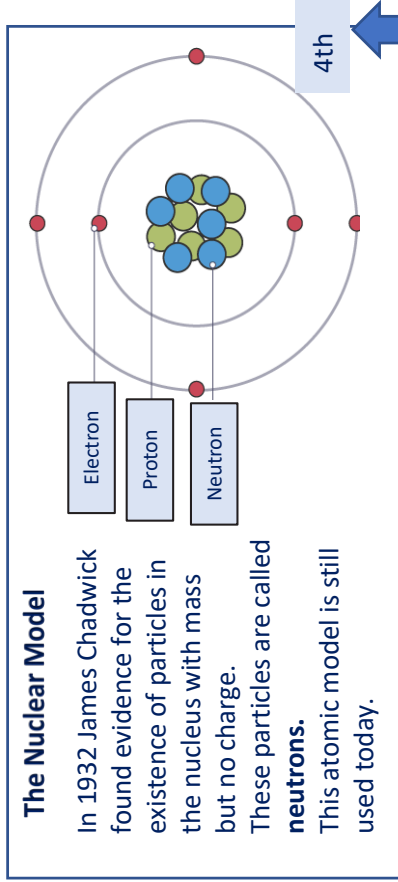
- Positive alpha particles** fired at gold leaf
- Most passed straight through** suggesting the atom was mainly empty space
- Some deflected at angles** suggesting the presence of electrons
- Some bounced straight back** suggesting a positive nucleus repelled the alpha particles.

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.

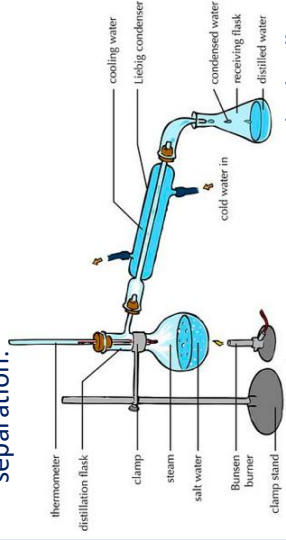
The Nuclear Model

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.

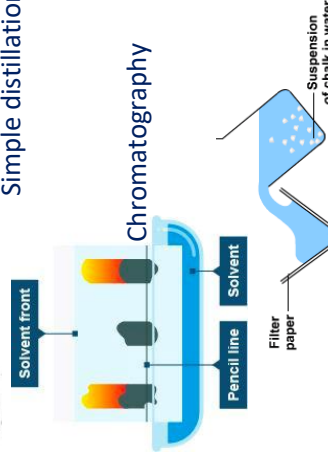


- 1904- electron discovered**, placed in a sphere of positive charge (the **plum pudding model**) - further experiments led to discovery of **protons**
- 1911 - gold scattering experiment** discovered mass was concentrated in a central positive **nucleus** (the nuclear model)- further experiments led to discovery of **protons** from the nucleus.
- 1913 - Suggested** electrons orbit the nucleus in **shells**. The shells are at certain distances from the nucleus.

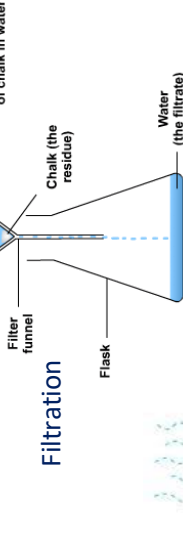
Simple distillation



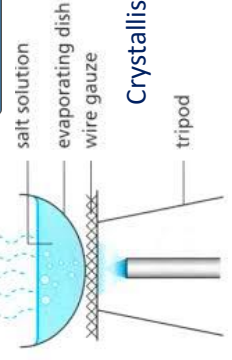
Chromatography



Filtration



Crystallisation



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

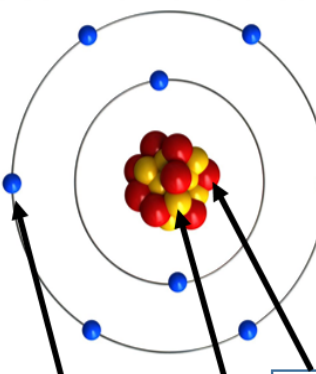
Innermost, lowest energy level, shell has **2 electrons**.

Next shell **8, next shell 8.** (2,8,8)

Electronic structure can be shown as a diagram or a number

eg. oxygen (2,6)

Sub-atomic Particles



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

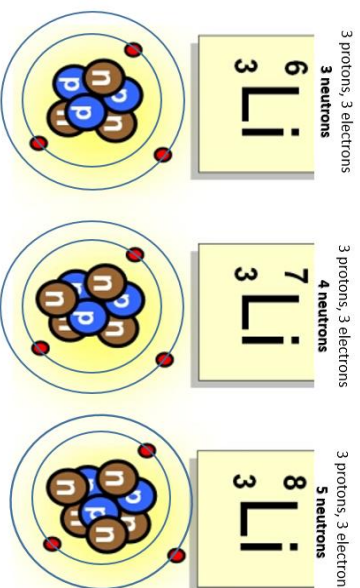
5.1.2.2 Development of the periodic table

- 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

Elements in groups have similar properties and have the same number of electrons in their outer shell

Group	1	2											3	4	5	6	7	0										
	Li	Be											B	C	N	O	F	Ne										
	Na	Mg											Al	Si	P	S	Cl	Ar										
	K	Ca											Sc	Ti	V	Cr	Mn	Fe	Cu	Zn	Ga	Ge	As	Se	Br	Kr		
	Rb	Sr											Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
	Cs	Ba											Hf	Ta	W	Re	Os	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn		
	Fr	Ra											Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Lv	Ts	Og			

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



vs



Elements that react to form positive ions are **metals**.

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

5.2.1.1.1 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

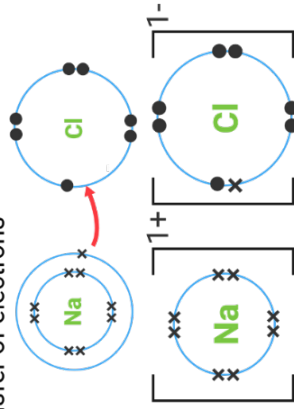
Covalent bonding the particles are atoms which share pairs of electrons. Covalent bonding occurs in most non-metallic elements and in compounds of non-metals

Metallic bonding the particles are atoms which share delocalised electrons. Metallic bonding occurs in metallic elements and alloys.

5.2.1.2 Ionic Bonding

Ionic Bonding

transfer of electrons



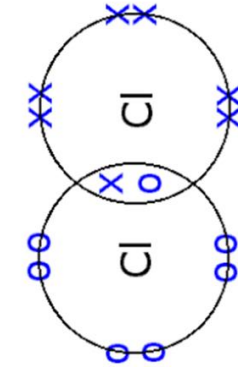
- Between a metal atom and a non-metal atom
- Metals lose electrons to form positive ions
- Non-metals gain electrons & form negative ions
- Electrons **transferred** (ions formed)
- Strong **electrostatic** forces
- Giant **lattice** structures
- High melting/boiling points
- If **molten** or in **solution** ions will conduct electricity

5.2.1.3 Ionic compounds

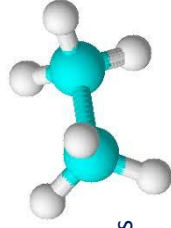
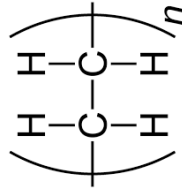
- An ionic compound is a **giant structure of ions**.
- Ionic compounds are held together by **strong electrostatic forces of attraction** between oppositely charged ions.

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

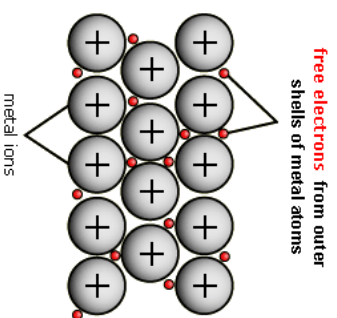
Giant lattices

- 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

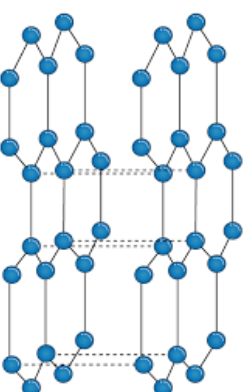
5.2.2.7 Properties of metals and alloys

- 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

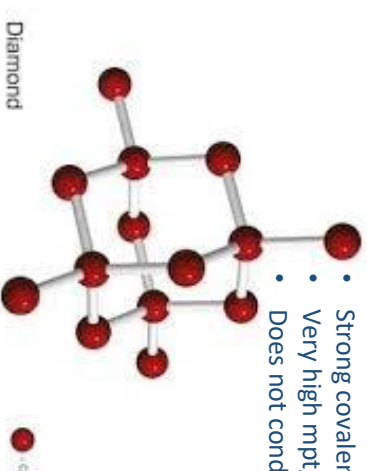
- Metals are **good conductors of electricity** because the **delocalised electrons** in the metal **carry electrical charge** through the metal.

5.2.3 Structure & bonding of carbon



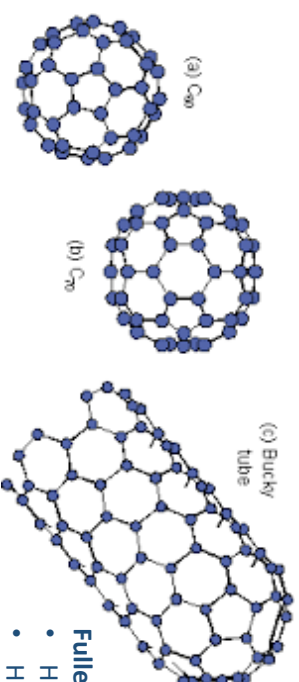
Graphite

- Giant lattice (in layers)
- Each C forms 3 bonds
- Layers of hexagonal rings with no bonds between layers
- Giving 1 delocalised electron
- Good conductor



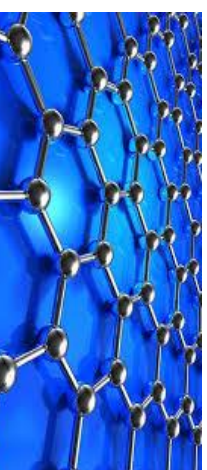
Diamond: Giant lattice

- Each C forms 4 bonds
- Strong covalent bonds
- Very high mp/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 products 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).

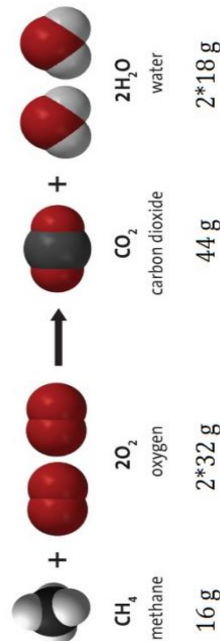
The A_r of carbon is 12 and the A_r of oxygen is 16
So the M_r of carbon monoxide is $12 + 16 = 28$.

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)

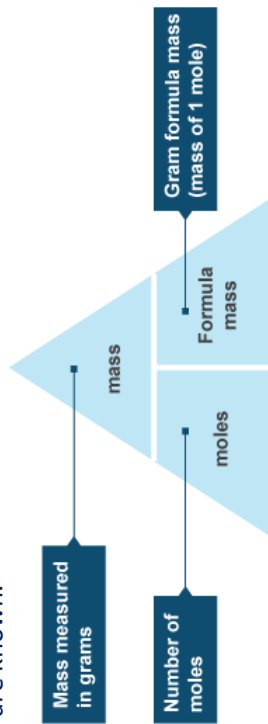
The Mole:

- 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.



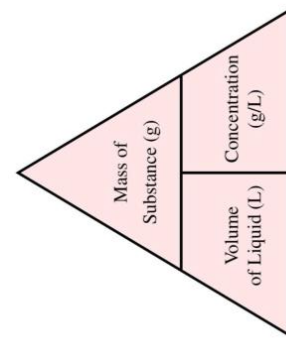
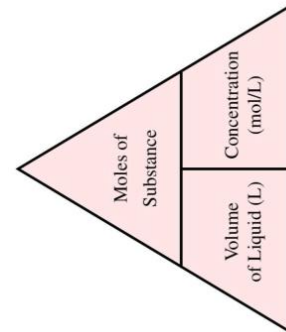
Finding the number of moles

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 = $22 \div 44 = 0.5$ 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	<ul style="list-style-type: none"> • 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?	<ul style="list-style-type: none"> • 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	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	What is Avogadro's 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	How many moles of reactants and products in: $Mg + 2HCl \rightarrow MgCl_2 + H_2$	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	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	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	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 dm ³ (g/dm ³).
5.3.3.1	Why is it not always possible to obtain the calculated amount of product?	<ul style="list-style-type: none"> • 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	How do you calculate percentage yield?	% Yield = $\frac{\text{Mass of product actually made}}{\text{Maximum theoretical mass of product}} \times 100$
5.3.3.2	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	What information do you need to calculate the concentration of a solution?	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	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 (20°C and 1 atmosphere pressure) is 24 dm ³

Knowledge Organiser – 5.4 Chemical Changes

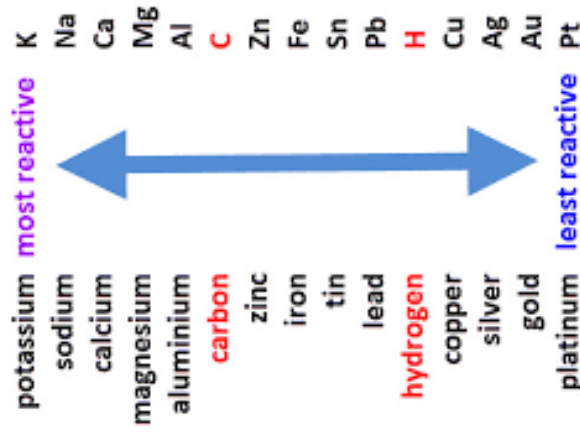
5.4.1 Reactivity of metals

Metals react with oxygen to produce **metal oxides**.

The reactions are **oxidation reactions** because the metals gain oxygen.

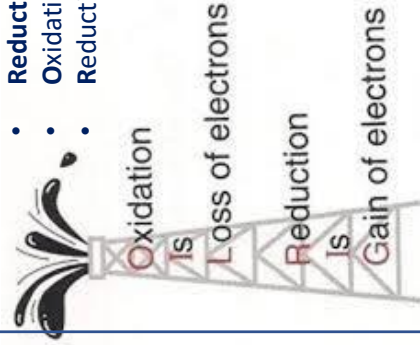
5.4.1.2 The reactivity series

- 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**.

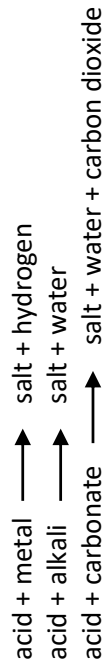


5.4.1.4 Oxidation and reduction in terms of electrons (HT only)

- **Oxidation** involves gain of oxygen
- **Reduction** involves loss of oxygen
- Oxidation Is Loss of electrons
- Reduction Is Gain of electrons

5.4.2.1 Reactions of acids with metals

Acids react with some metals to produce salts and hydrogen.



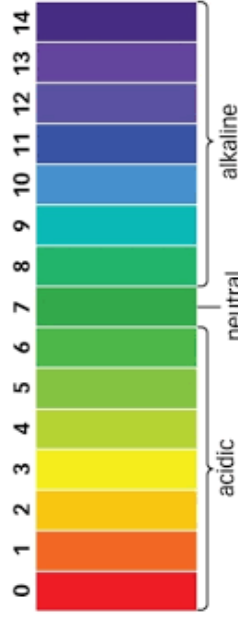
HCl - hydrochloric acid produces chlorides
 HNO₃ - nitric acid produces nitrates
 H₂SO₄ - sulfuric acid produces sulfates

(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

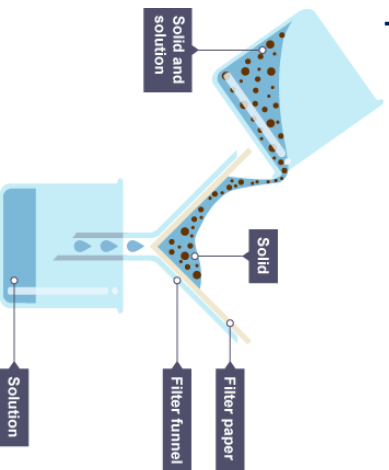
Strong acids (HCl, HNO₃, H₂SO₄) **fully ionise**

Weak acids (ethanoic, citric, carbonic) **partially ionise**

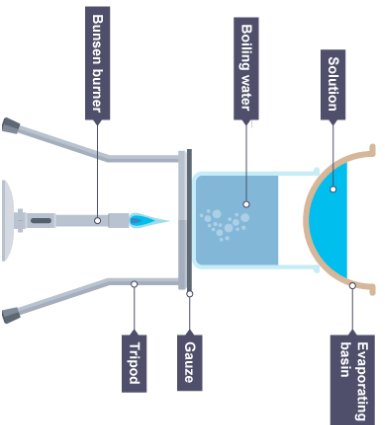
Knowledge Organiser – 5.4 Chemical Changes

- 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

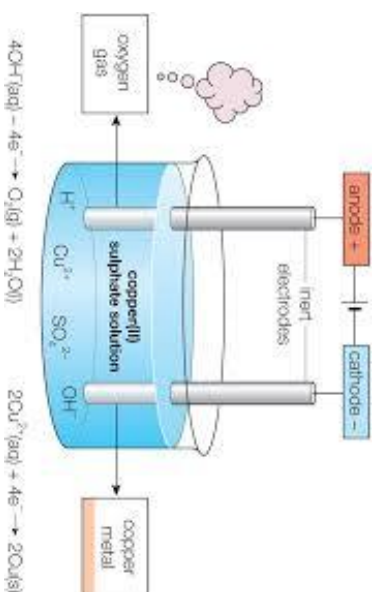
5.4.3.2 Electrolysis of molten ionic compounds

- 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**. I.e **reductions reactions** At the **anode** (positive electrode), **negatively charged ions lose electrons**. I.e **oxidations**. Reactions at electrodes can be represented by half equations, for example:



and



Knowledge Organiser – 5.5 Energy Changes

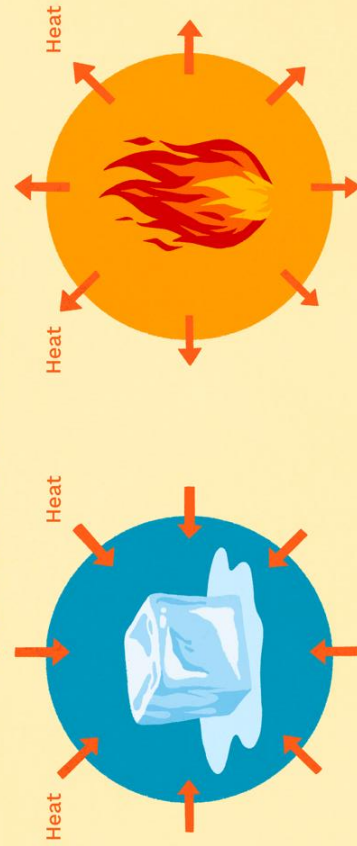
5.5.1 Exothermic and endothermic reactions

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.

Endothermic vs. Exothermic Reactions

Energy is conserved in chemical reactions. The total energy of the system is the same before and after a reaction



Endothermic

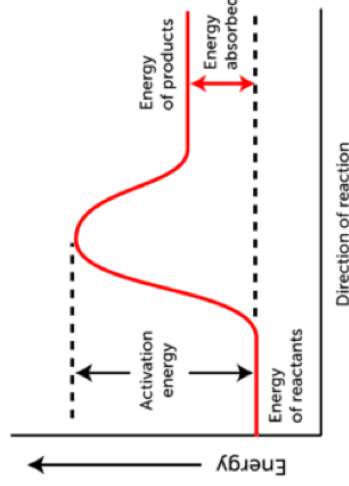
The endothermic reaction is cooler than surroundings

Exothermic

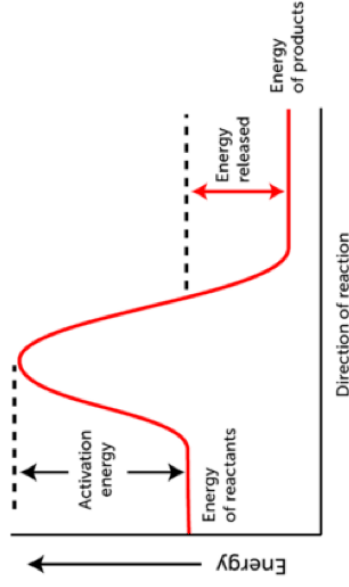
The exothermic reaction is hotter than surroundings

5.5.1.2 Reaction Profiles

Endothermic Reaction

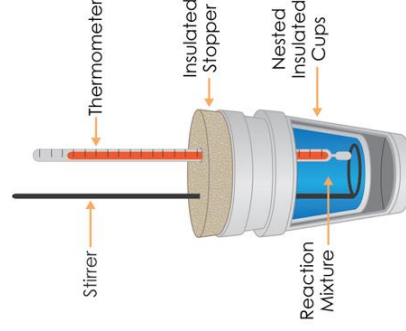


Exothermic Reaction



- 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.

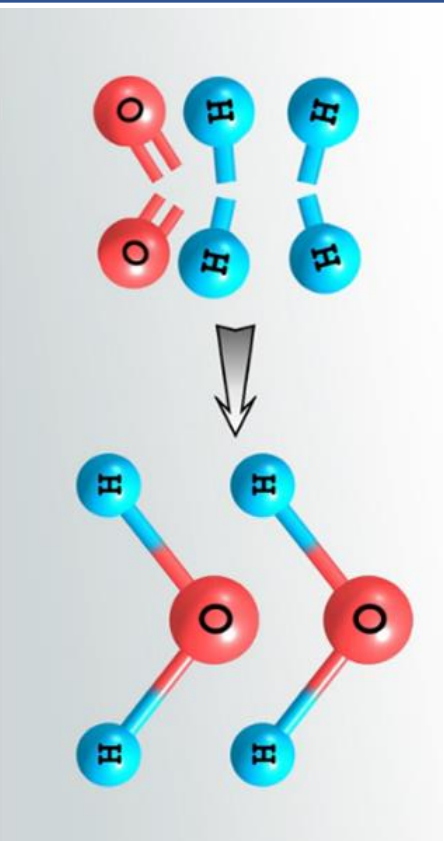
If one of these variables is changing, then all others stay the same.

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:

$$1370 \text{ kJ/mol} - 1852 \text{ kJ/mol} = -482 \text{ kJ/mol}$$

Knowledge Organiser – 6.1 Energy

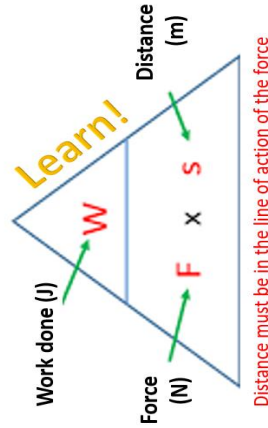
joule (J) = unit of energy

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

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:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times \text{speed}^2$$

$$E_k = \frac{1}{2} m (v)^2$$

- 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):

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times \text{extension}^2$$

$$E_e = \frac{1}{2} k e^2$$

- elastic potential energy, E_e , in joules, J
- spring constant, k , in newtons per metre, N/m
- extension, e , in metres, m

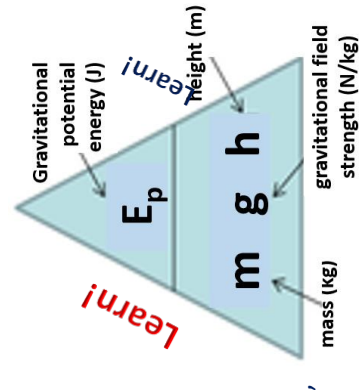
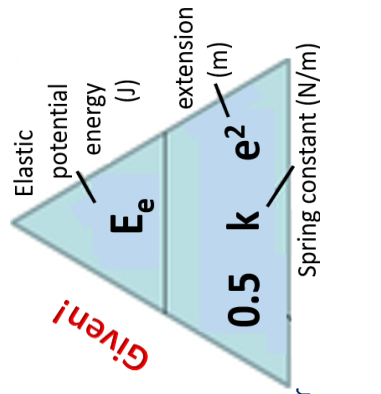
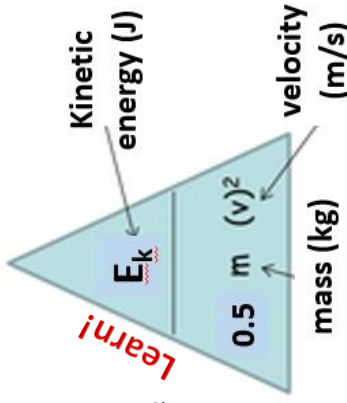
Gravitational potential energy

gained by an object raised above ground level can be calculated using the equation:

$$\text{g.p.e.} = \text{mass} \times \text{gravitational field strength} \times \text{height}$$

$$E_p = mgh$$

- 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:

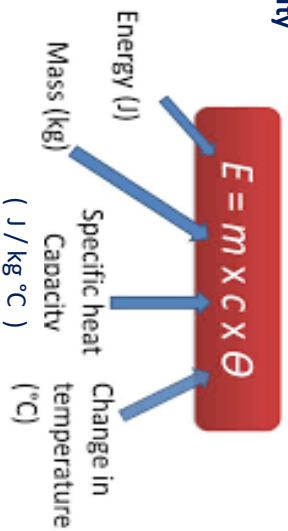
change in thermal energy = mass x specific heat capacity x temperature change

$$\Delta E = m c \Delta \theta \quad \text{Given!}$$

- 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

Specific heat capacity

- This is the amount of energy needed to raise the temperature of 1kg of a material by 1°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:

$$W = F \times d = 5\text{ N} \times 6\text{ m} = 30\text{ J}$$

For motor A:

$$P = \frac{W}{t} = \frac{30\text{ J}}{5\text{ s}} = 6\text{ W}$$

For motor B:

$$P = \frac{W}{t} = \frac{30\text{ J}}{10\text{ s}} = 3\text{ W}$$

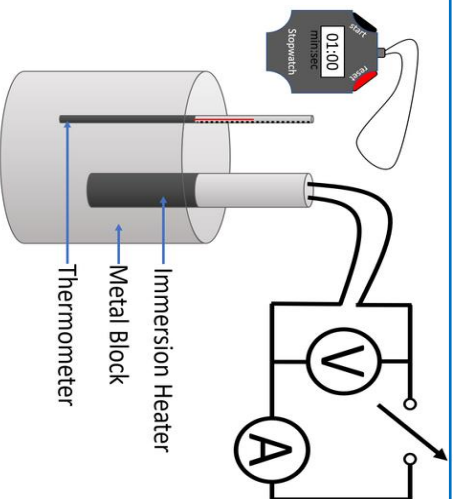
Motor B is twice as powerful as motor A.

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:

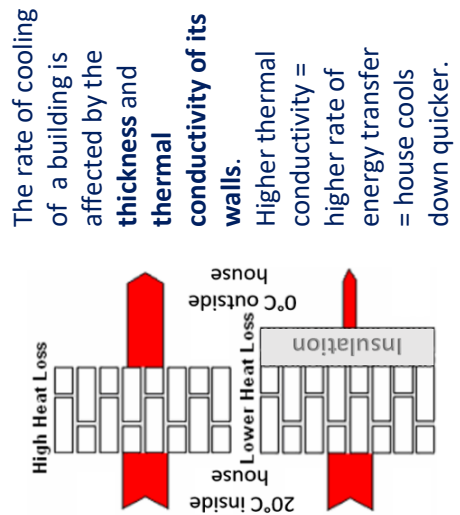
- Use a data logger rather than a thermometer to reduce the random error & add more decimal places.
- Ensure the immersion heater and block begin at room temperature to reduce the error in repeat readings.
- Ensure the same thickness and type of insulator is used for every repeat measurement reduce anomalies.

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.



6.1.2.2 Efficiency

Useful **energy** output
 $\frac{\text{total energy input}}{\text{total power output}} \times 100\%$ **Learn!**

OR

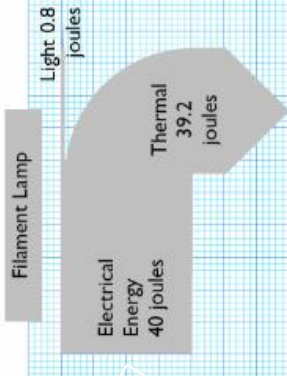
Useful **power** output
 $\frac{\text{total power input}}{\text{total energy output}} \times 100\%$

Efficiency can be represented as a decimal or percentage. It has to be <100% (or <1.0) as all energy transfers involve wasted energy.

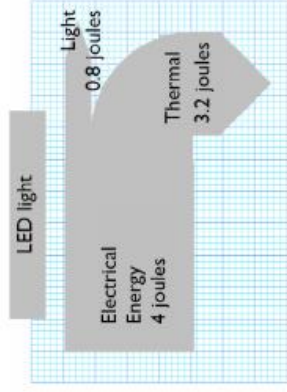
In a **closed system** there is no net change to the total energy

$$\text{Total IN} = \text{total OUT}$$

Increase efficiency by insulating or streamlining/lubricating to reduce friction.



$$\frac{0.8}{40} \times 100 = 2\%$$

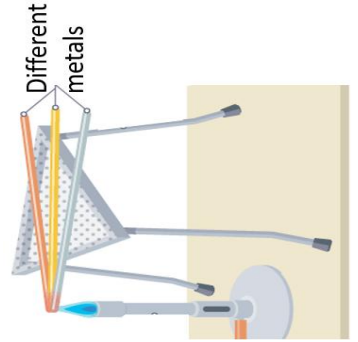


$$\frac{0.8}{4} \times 100 = 20\%$$

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)

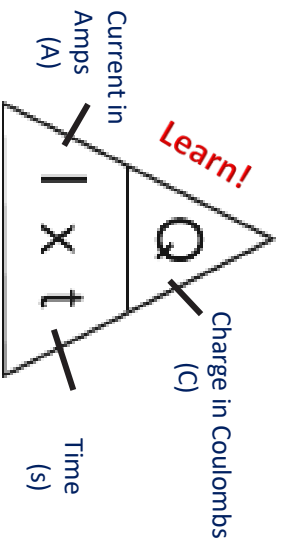
Knowledge Organiser – 6.2 Electricity

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:

$$\text{charge flow} = \text{current} \times \text{time}$$

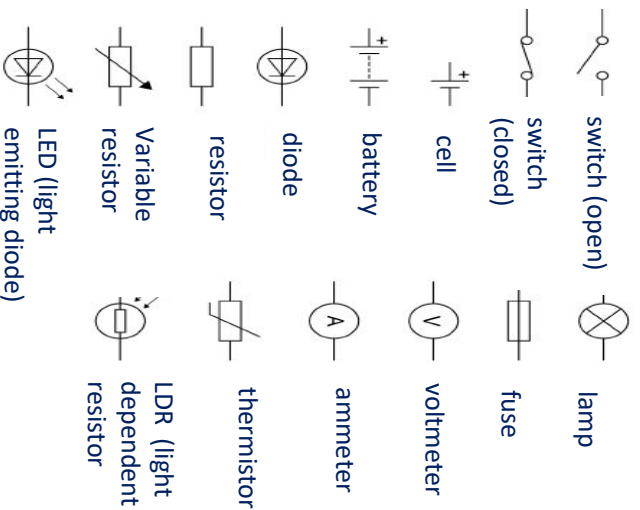


- Current has same value at any point in a single closed loop.
- Measured with **Ammeter**

6.2.1.3 Current, resistance and potential difference

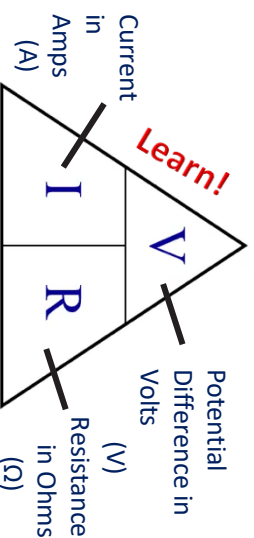
- **Potential difference** is the amount of work energy required to move an electric charge (Coulomb) from one point to another
- Current (I) through a component depends on the **resistance (R)** of the component and the **potential difference (V) across the component.**
- The **greater the resistance** 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**

6.2.1.1 Standard circuit diagram symbols



Current, potential difference and resistance can be calculated using the equation:

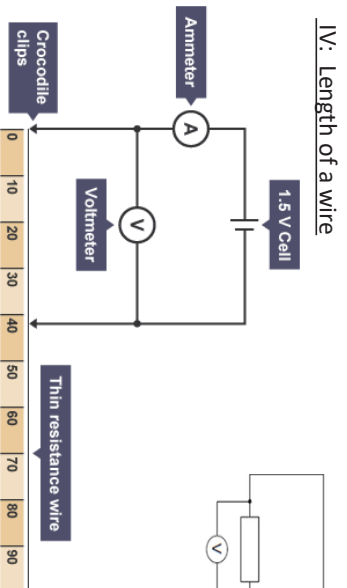
$$\text{potential difference} = \text{current} \times \text{resistance}$$



E.g. What is the resistance of a component if 12 V causes a current of 2 A through it?
 $R = V / I = 12V / 2A = 6\Omega$

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.

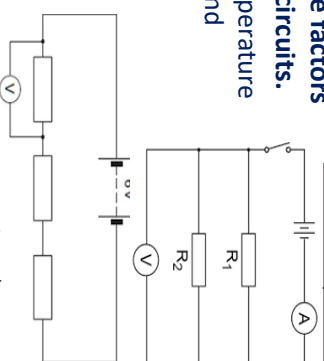


Hazard Heating
Consequences Minor burns
Control measures Set up circuit before closing the switch

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.

IV: resistors in series or parallel

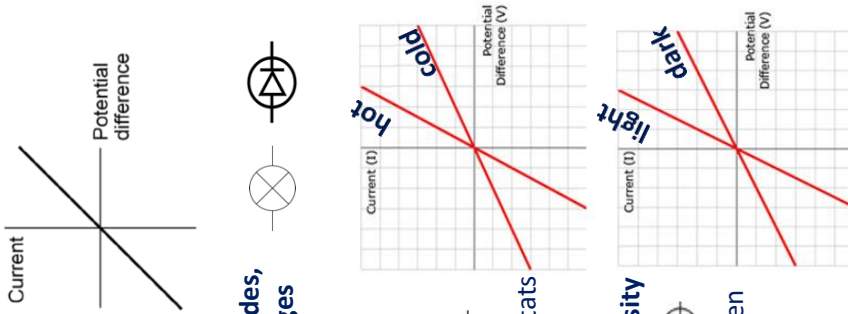


- In series, the resistance of the network is equal to the **sum of the other resistances.**
- In parallel, the resistance of the network is **less than either** of the other resistances.

Knowledge Organiser – 6.2 Electricity

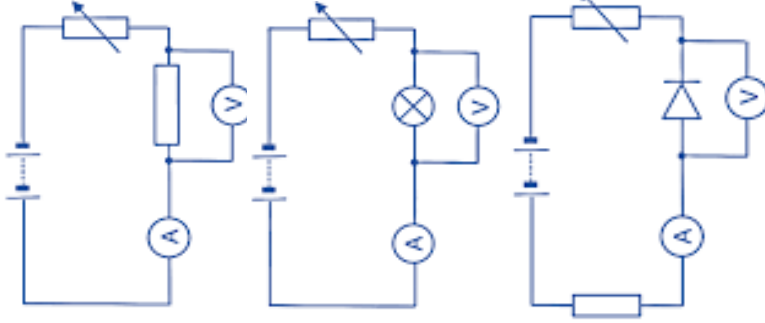
6.2.1.4 Resistors

- **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.



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 temperature is **directly proportional** to the potential difference across the resistor.

The resistance of a **bulb** **increases** as the temperature of the filament increases.

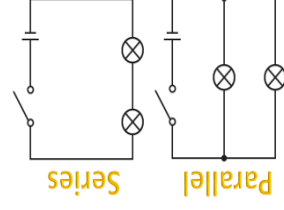
The current through a **diode** flows in **one direction**. It has very **high resistance** in the opposite direction.



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.
 $R_{\text{total}} = R_1 + R_2$ resistance, R , in ohms, Ω



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.**

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.

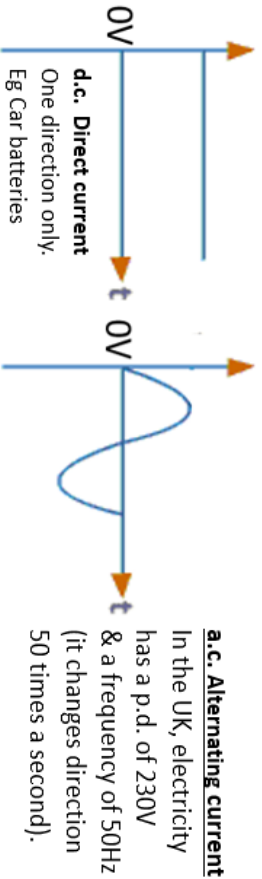
One coulomb of charge is a package equivalent to 6,250,000,000,000,000 electrons.

One **volt** is the **potential difference** when one coulomb of charge transfers one **joule** of energy.

Unit	symbol
Potential difference	V
Current	A
Energy	J
Work done	J
Charge	C
Time	s
Power	W
Resistance	Ω

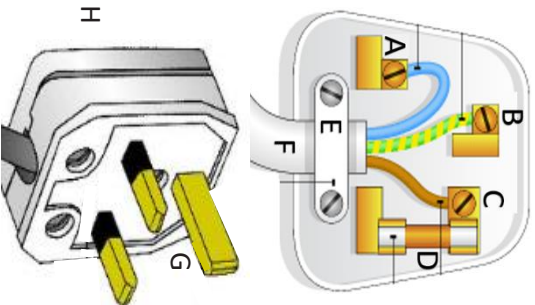
Knowledge Organiser – 6.2 Electricity

6.2.3.1 Direct and alternating potential difference



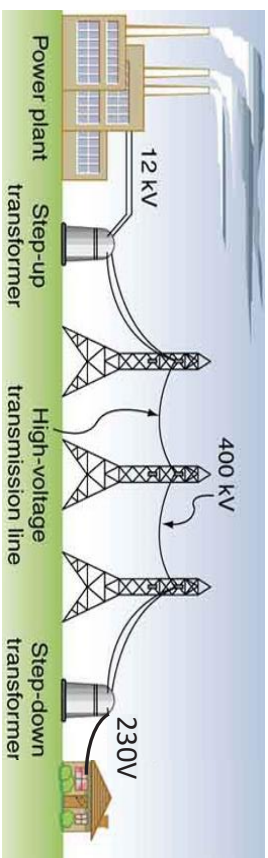
6.2.3.2 Mains electricity

- 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

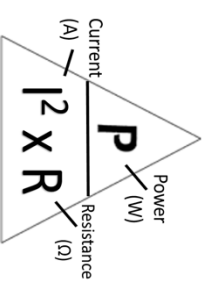
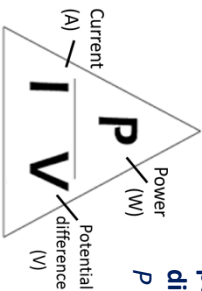


- Network of cables and transformers linking power stations to consumers
- Step-up transformers = higher potential difference
- Reduced energy loss because resistance is lower in cables (high volts = fewer amps for same power)
- Step-down transformers = decrease potential difference to safe level for 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?
 $V = E/Q$
 $= 10J / 5C$
 $= \underline{2 \text{ volts}}$

6.2.4.1 Power

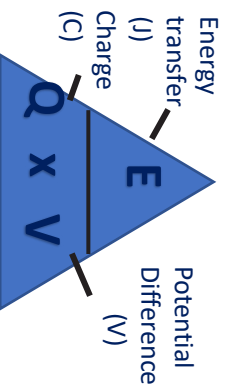
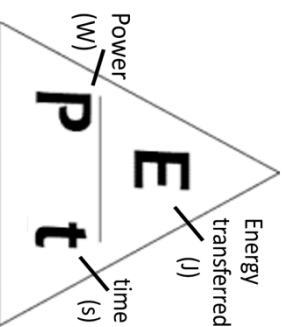
power = potential difference x current
 $P = V I$



- power, P , in watts, W
 - potential difference, V , in volts, V
 - current, I , in amps, A
 - resistance, R , in ohms, Ω
- power = current² x resistance**
 $P = I^2 R$

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: $4\pi(\frac{d}{2})^3$

Method 2: Stone or other irregular shaped object volume
Displacement can or measuring cylinder

Read from bottom of meniscus

Measure mass of object and then use density equation.

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.**

Solid	Liquid	Gas
Particles closely packed - vibrate - Little 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.

6.3.2 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 x specific heat capacity x temperature change

$$\Delta E = mc\Delta\theta$$

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	

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.

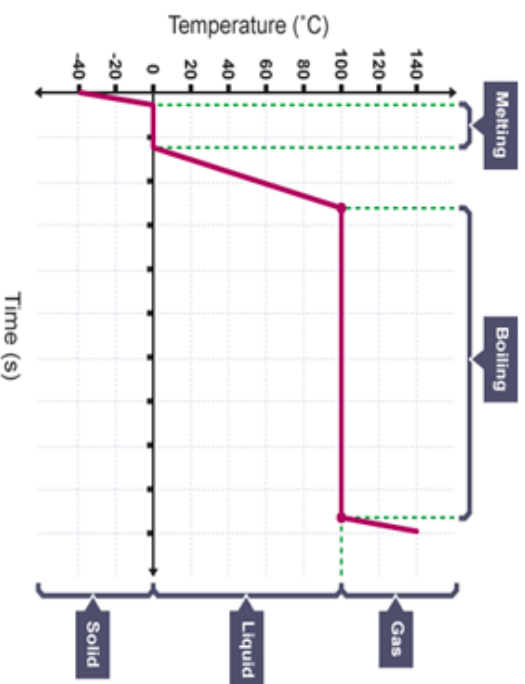
energy for a change of state = mass x specific latent heat

$$E = mL$$

- 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



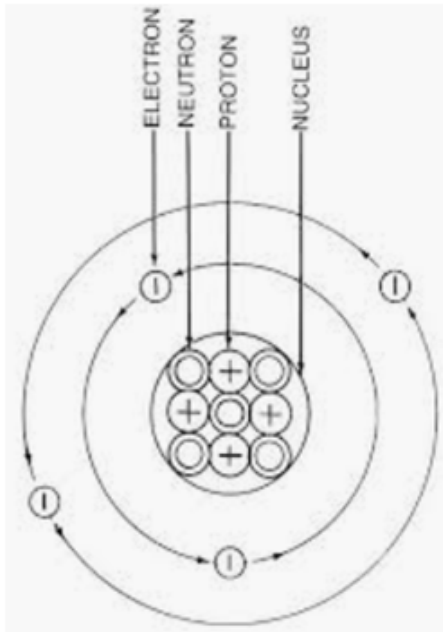
6.3.3.1 Particle motion in gases

- 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 1×10^{-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.

SOLID SPHERE MODEL



JOHN DALTON



1803

PLUM PUDDING MODEL



J.J. THOMSON



1904

NUCLEAR MODEL



ERNEST RUTHERFORD



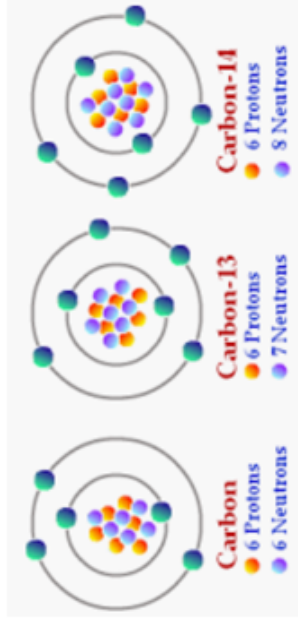
1911

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**.

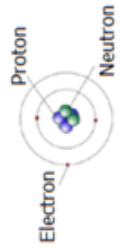


- Niels Bohr adapted the nuclear model by suggesting that **electrons orbit the nucleus at specific distances**.

- 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**.

- This **nuclear model replaced** the previous one.



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

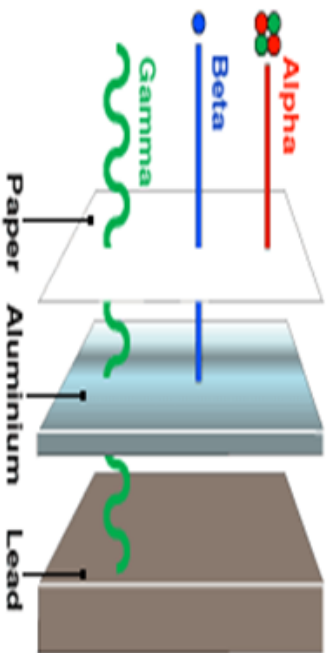
6.4.2.1 Radioactive decay and nuclear radiation

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 from 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-Müller tube).

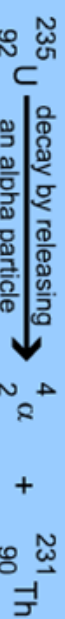
6.4.2.2 Nuclear equations

Are used to represent radioactive decay.

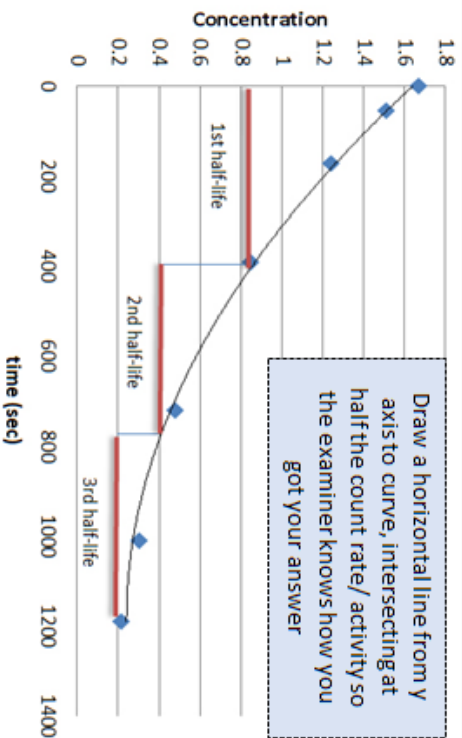
Alpha decay causes both the mass and charge of a nucleus to decrease.

Beta decay causes the charge to increase ${}^0_{-1}e$ 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.



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 $(\frac{1}{2})^3 = \frac{1}{8} = 12.5\text{g}$

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 it takes for the count rate from that sample to fall to half of its initial level.

6.4.2.4 Radioactive contamination

Irradiation:	Irradiation	Contamination	Radioactive Contamination:
Exposing an object to nuclear radiation, the object does not become radioactive but it can still damage cells.	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	Unwanted presence of materials containing radioactive atoms on other materials.
	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	

