CHRIST THE KING

KNOWLEDGE ORGANISER

Year 9 ADVENT

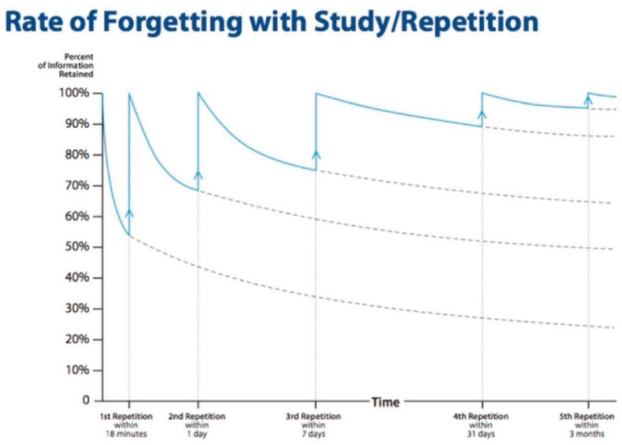
(Term 1)

#CTKCares

Knowledge Organisers

We use knowledge Organisers at Christ the King to help all students achieve. Knowledge Organisers improve your confidence by helping you to understand how to learn and revise. We are building a seven-year revision strategy that supports you to remember the core and powerful knowledge that is required to be successful in each subject.

The Ebbinghaus Forgetting Curve demonstrates that knowledge is lost over time if it is not revisited. A simple model for memory involves working memory and long term memory; working memory is limited, and can very easily become overloaded, whereas long-term memory is effectively limitless. You can support your limited working memory by storing key facts and processes in your long-term memory. Research evidence indicates that regular recall activities, known as retrieval practice, are an effective way of ensuring that knowledge is committed to long-term memory



At the start of each term, you will receive a knowledge organiser booklet that contains content for all subject areas. You will use your knowledge organiser in your lessons, in tutor time, and during homework tasks. An important aspect of your revision for assessments and end-of-year examinations will be to use the knowledge organisers for self-quizzing. If this core knowledge is secured, you will be in a strong position to use and apply this knowledge in a range of contexts. You will be given your knowledge organiser in a plastic wallet along with a homework booklet – the expectation is that you bring this to school every day – **it should be placed on your desk in every lesson**, ready to use. Geography and History highlight the essential 'golden knowledge' in yellow to support your learning.

How to use your Knowledge Organiser

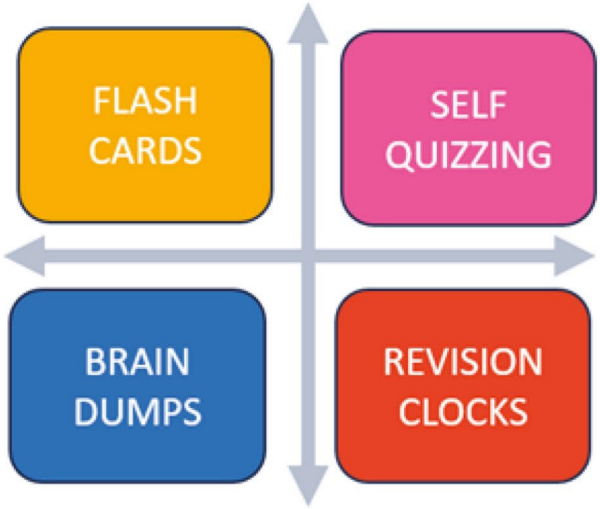
The best way to use your knowledge organisers is to regularly use one of our Core 4 Revision strategies as part of your home learning. These strategies will be explained to you in more detail in tutor time, by your class teachers and as part of your Personal Development lessons.

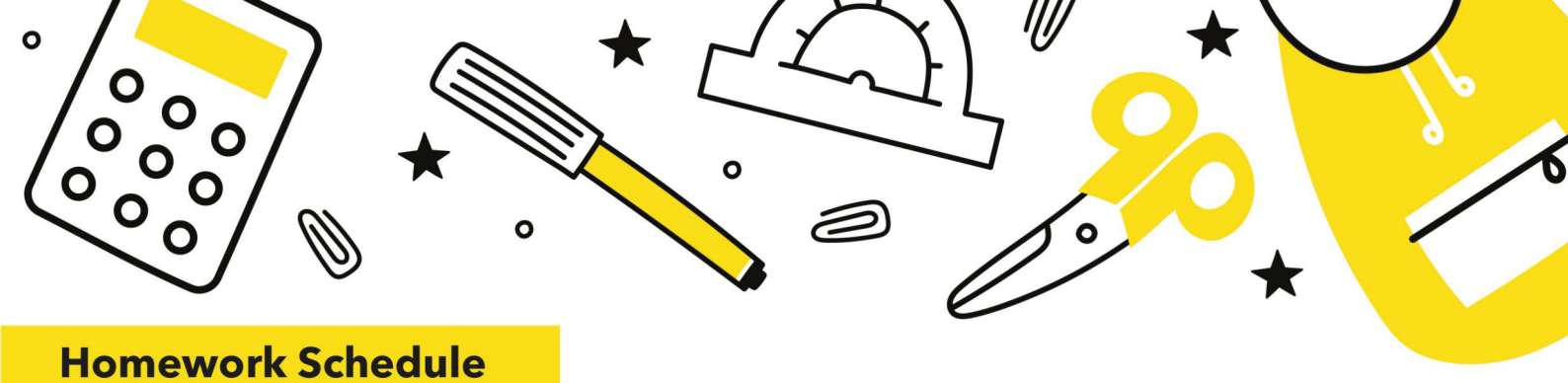
- **Flash Cards:** Use the information from your knowledge organiser to create flashcards – these could be double sided, with a question on one side and the answer on another, or a keyword on one side and the definition on the other.

- **Self Quizzing:** There are different ways you can self-quiz:
  - Look, cover, write, (say), check
  - Create gaps fills
  - Create questions for the information you want to learn and then answer them from memory

- **Brain dumps:** These are a small but powerful revision strategy which help makes the information 'sticky' so that it goes into your long-term memory, ready for you to recall it into your working memory. They are good to use at the end of topics. An effective brain dump involves you writing down everything you can about a topic you want to revise from your memory. You then check the information against the information on your Knowledge Organiser – you then mark your work and add any missing information onto your brain dump in a different colour pen, so that you know which information you need to revisit, either through using flash cards or self-quizzing.

- **Revision Clocks:** Revision Clocks are a blank clock shape – divided into 12 segments. In each segment put a sub-heading and then include the information linked to that. They are effective as they allow you to 'chunk' up the core knowledge from the topic into the segments. You can use colours and pictures to make the information more 'sticky'.





Homework Schedule

You should complete at least one hour of Home Learning per school day.

This will consist of:

- Knowledge Organiser and Online Learning as directed by your teachers.
- If you have no tasks set, carry out Knowledge Organiser activities as per the Knowledge Organiser timetable below.
- Two periods of 20 minute reading each week.

Week 1					
20 Minutes Per Subject	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Subject 1	English	Science	Maths (Sparx)	Maths	English
Subject 2	RE	PE	RE	Science	Geography
Subject 3	Music	History	Technology / IT	MFL	Art

Week 2					
20 Minutes Per Subject	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Subject 1	Science	English	English	Maths (Sparx)	Science
Subject 2	RE	Maths	RE	Drama	Geography
Subject 3	Music (Practical)	History	Technology / IT	MFL	Art (Practical)

Read 20 minutes a day and you'll read 1,800,000 words per year.

Reading for 6 minutes a day reduces stress by 68%.

Children learn 4,000 to 12,000 words per year through reading,

What are the homework expectations?

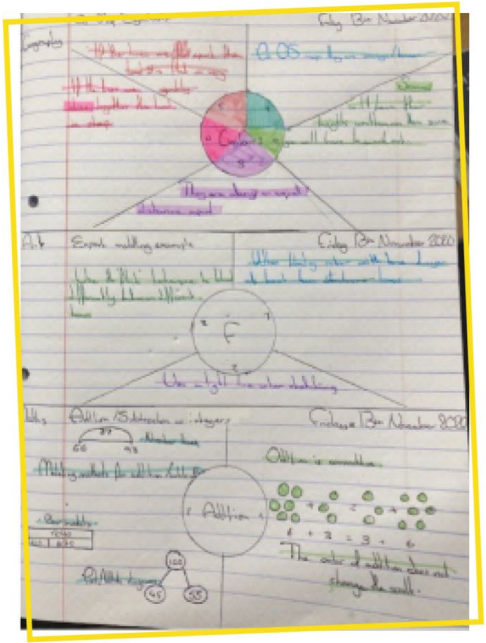
Each homework must meet the following 5 requirements:

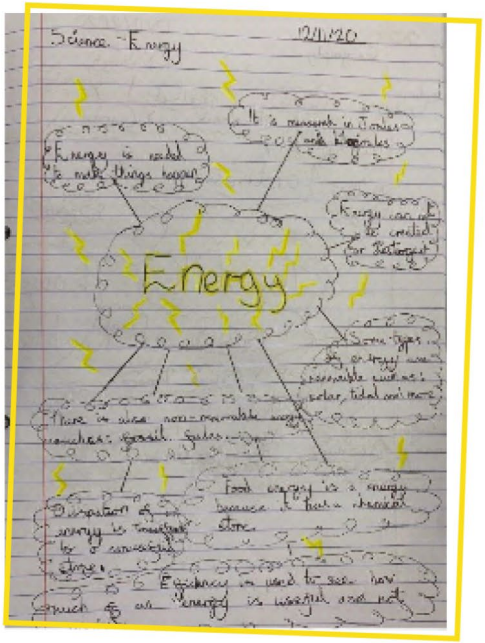
- Write the complete title and date in full *e.g Wednesday 7th June 2023* on each page and underline.
- You should include minimum of words to summarise the topic. Do not copy the words from the text.
- Make full use of the page for each topic by scaling your notes and images appropriately to use all the space.
- You must include diagrams, sketches, or cartoon doodles to visually represent the topic, try to use humour.
- Highlight key words and phrases, using underlines and highlighter pens, and explain technical terms.

How should I present my work?

Please remember that the same rules apply to the presentation of your homework as applies for your class work: **dates and titles** (which should be the name of the subject) **need to be underlined with a ruler** and you should **present your work as neatly as you are able to.**

If you are self-quizzing correctly, there should be **evidence of green pen on your page**. Here are some examples of how to set out your work:





DON'T FORGET!

Always record the date, topic, and page number in your Home Learning Book!

1. Keywords	Definition
Composition	Means 'putting together' and can apply to any work of art or photography that is arranged or put together using conscious thought.
Contrast	Is the representation of two elements of design in opposite ways. For example, areas of bright light in comparison to areas of dark.
Proportion	Refers to the dimensions of an object and relationships between height, width and depth.
Mark-making	Describes the different lines, dots, marks. Patterns, and textures we create in an artwork. It can be loose and gestural or controlled and neat.
Medium/ media	The materials used to create a piece of artwork.
Realism	An accurate and detailed depiction of nature or of contemporary life.
Observe	To draw or paint an object as accurately as possible.

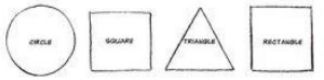
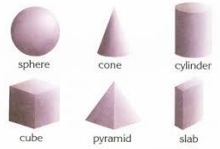
3.

NATURAL FORMS

WHAT?
Natural forms are objects in nature in their original form. Examples: leaves, flowers, pinecones, fossils, shells, plants, stones, feathers, fruit, vegetables

WHY?
Artists use natural forms as part of still life compositions to observe and record the object.

HOW?
Using the natural form itself or a photograph, artists observe the shape, texture and colour to inspire their work to create both realistic and abstract artwork.

2.Formal Elements	Definition	Visual
Tone	Is the lightness or darkness of something. This could be a shade or how dark or light a colour appears. Tones are created by the way light falls on a 3D object. The parts of the object on which the light is strongest are called highlights and the darker areas are called shadows.	
Colour	Colour theory includes the colour wheel, colour value, and colour schemes. The colour wheel shows **primary**, **secondary** and **tertiary** colours. Red, yellow and blue are primary colours and in theory all colours can be mixed from these 3 colours.	
Shape	Is an area enclosed by a line. It could be just an outline or it could be shaded in. Shapes can be geometric or irregular.	
Form	Is something that is three-dimensional and encloses volume, having length, width, and height it can be geometric or organic.	

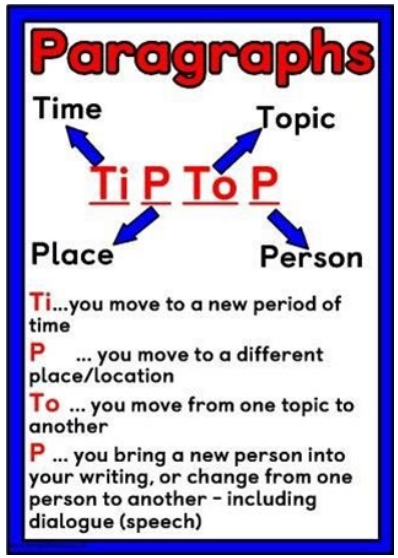
4. Processes	Definition
Collage	Art in which various materials or objects, for example paper, cloth, or photographs, are stuck onto a larger surface to create an image.
Stipple	A drawing technique in which areas of light and shadow are created using nothing but dots.

English – Speaking & Writing from a Viewpoint

Persuasive Devices	Definition/example
Direct address	Personal pronouns 'you, we,' used to speak directly to the audience/reader
Alliteration	Series of words beginning with the same consonant sound
Facts	Real information used as evidence in a letter or speech
Opinion	The personal and biased viewpoint of the writer/speaker
Repetition	Repeating the same words or phrases
Rhetorical questions	a question asked for dramatic effect or to make a point, rather than to get an answer
Emotive Language	Words which evoke some emotional response from the listener/reader
Statistics	numerical evidence used to support an idea e.g %
Triplets	Using the same language technique, three times, in a sentence

Text-type	Features
Persuasive letter	• Recipient's address (top-right) • Sender's address (top-left) • Title (beginning) – Dear Sir, • Direct address • Salutation (ending) – Yours sincerely,
Persuasive speech	• Greeting (Good morning/evening/ ladies and gentlemen) • Direct address • Salutation (ending) – Thank you for listening.

Connectives	Use to open paragraphs and link them together
Furthermore	To develop a point further
Therefore	To explain an idea
On the other hand	To introduce a counterargument
Firstly	To introduce your first paragraph



Punctuation	When to use
.	Mark end of a sentence
?	Mark end of a question
!	Mark end of an emotive sentence
" "	Start and end of speech
' (apostrophe)	Indicate possession or omission
,	Separate lists, subordinate clauses
:	Start of a list
;	Separate two independent clauses
( )	Enclose extra information

1 Charge of the Light Brigade	The Crimean War was between the Russian and the British in 1854. The Russians were armed with canons and the British had swords. The Russians had the advantage of surrounding the higher land around the valley. **'Into the jaws of Death,** **Into the mouth of Hell'**		**Alfred Tennyson** Poem was based on a newspaper report that the poet saw in a newspaper. The order to charge was a mistake and it cost the British in terms of casualties. He was not directly involved in the war but wanted everyone to recognise how brave the soldiers had been.
2 Remains	The poem is an account from Guardsman Tromans about being one of a group of soldiers that kill a looter that is robbing a bank in Basra, Iraq. **'probably armed, possibly not'** **'his bloody life in my bloody hands'**		**Simon Armitage** Wrote the poem to show the aftereffects of war on a real soldier, who was interviewed for a documentary and collection of poems called 'The Not Dead'. Armitage wanted to raise awareness of PTSD being experienced after war.
3 Poppies	The poem is from the perspective of a mother who sends her son off to fight. **'the world overflowing/ like a treasure chest'** **'hoping to hear your playground voice catching on the wind'**		**Jane Weir** Commissioned to write Poppies by Carol Ann Duffy as a contemporary war poem. Written from the perspective of a mother letting her child go.
4 Bayonet Charge	The soldier in this poem is scared and worried. He is not ready to go to run and attack the enemy. **'Suddenly'** **'A rifle as numb as a smashed arm'** **Sweating 'like molten iron'**		**Ted Hughes** Too young to have fought in the first world war but his father did. It's only about a single soldier and suggests that war is a terrifying experience.
5 War Photographer	The poem is not about a soldier but a civilian: whose job is to take photos of war situations without participating, or being able to help. **'In his dark room he is finally alone'** **'Beneath his hands which did not tremble then / Though seem to now'**		**Carol Ann Duffy** Knew a real war photographer (Don McCullin) and is interested in whether it is right to take pictures of suffering like this.

Dans ma ville il y a beaucoup de magasins	1	In my town there are a lot of shops
Mon magasin préféré s'appelle printemps	2	My favourite shop is called 'printemps'
car il y a beaucoup de choix.	3	Because there is lots of choice
J'adore acheter les vêtements à la mode en ligne,	4	I love to buy fashionable clothes online
cependant, hier je suis allé chez galeries Lafayette à Paris	5	however, yesterday I went to 'Galeries Lafayette' in Paris
où j'ai acheté une belle chemise à rayures.	6	Where I bought a beautiful, stripy shirt.
Il y a beaucoup de créateurs de mode célèbres de Paris	7	There are lots of famous fashion designers from Paris
par exemple Coco Chanel et Yves Saint Laurent.	8.	For example, Coco Chanel and Yves Saint Laurent.

A l'âge de seize ans, je veux continuer mes études au lycée.	1	At age 16, I want to continue my studies at sixth form
J'ai l'intention d'étudier le français, le théâtre et le dessin car c'est ma passion	2	I intend to study French, Drama and Art because it's my passion.
Au collège j'apprends le français, c'est important car c'est bien pour trouver un bon emploi.	3	At school, I study French, it is important because I want a good job
Quand j'ai dix-huit ans j'espère faire un apprentissage ou	4	When I am 18, I hope to do an apprenticeship or
peut-être Je vais aller a l'université pour étudier les langues.		Maybe i am going to go to university to study languages.
Après ca je voudrais voyager le monde et puis Je veux être avocat.	5	After that, I am going to travel the world and then I want to be a lawyer.
Je vais travailler dans un bureau avec une grande équipe,	6	I am going to work in an office with a big team

GIS helps geographers collect, display and analyse spatial data to identify patterns, relationships and change.

1. Key Terms	
GIS (Geographic Information System)	Software that is used to capture, store, manage and analyse spatial data.
Spatial data	Information linked to a specific location on Earth.
Layer	A set of data displayed on a map, which can be added or removed to reveal patterns.
Layering	Combining different layers of data to identify patterns and relationships.
Storymap	Combine maps, text and media to tell stories about places using GIS.
Timelapse	Using GIS to visualise change over time.

2. Map projections	
Map Projection	The method used to transform a 3D globe to a flat 2D plane.
Mercator	Preserves direction and shape but distorts size near the poles.
Robinson	Attempts to balance size and shape distortions.
Gall-Peters	Shows land area more accurately but distorts shape.
AuthaGraph	Minimises overall distortion and shows continents more accurately.

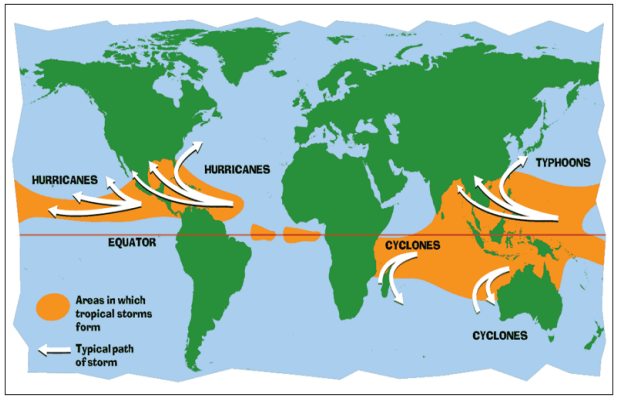
3. Google Earth Functions	
Placemark	A visual marker used to pinpoint and label a location.
Path	Used to draw a route on your map which can be saved.
Polygon	Used to draw an area on your map which can be saved.
Data layer	Source of data which can be added to a map.
Measure	Instantly identify the distance and bearing between places.
Project	The interactive map which you create.
Streetview	Ground-level panoramic images.

4. ArcGIS Functions	
Basemap	The foundation map layers will be presented on.
Open Map	Maps containing pre-defined layers.
Map layers	The layers which have been added to your map.
Add layers	Data which can be added to your map
Legend	Explains the colours, symbols and proportions used to present the data in each layer of your map.
Measure	Can be used to measure distance and area.
Elevation Profile	A cross-section showing the topography of an area.
Bookmark	A saved location you can jump to instantly.

Google Earth

ArcGIS Visualiser

Geography – Extreme Weather



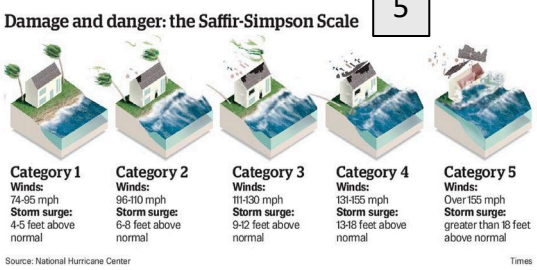
Distribution

1. Tropical Storms key words	
Tropical Storm	Intense low pressure weather system formed over tropical oceans with winds over 74 mph
Hurricane	Tropical Storm in the Atlantic/East Pacific
Cyclone	Tropical Storm in the Indian Ocean
Typhoon	Tropical Storm in the Western Pacific
Coriolis effect	The effect of the earth's rotation, deflecting storms which makes the storm spin
Trade wind	Wind blowing towards the equator from a high-pressure belt to a low-pressure belt
Vortex	A whirling mass of air
Eye	Calmer centre of the storm
Eye wall	Most intense winds and rainfall surrounding the eye
Track	The path a tropical storm follows
Storm Surge	Rising sea caused by high winds

2. Tropical Storms Facts
Ocean temperature of 27 degrees required
Ocean depth of 60m required
Last 6-14 days
Intensity changes during their duration
Spiralling trade winds cause the storm to spin
Form between 5 and 15degrees north and south of the equator

3. Formation of tropical storms
1. Moist air rises and cools over oceans forming thunderstorms. Condensing water releases heat which leads to more evaporation.
2. Thunderstorms gather to create a tropical storm. Trade winds blowing in opposite directions cause the storm to spin.
3. Rising air leads to falling pressure drawing in more moist air.
4. As the storm sucks in more air the wind speeds increase.
5. The storm continues this process as it moves over the ocean

4. Reasons tropical storms lose energy	
Cool water	Not enough evaporation occurs to provide energy to the storm
Shallow water	Not enough convection in the water to provide warm water for evaporation
Move on to land	Friction with the land slows wind speeds



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6. Impact of climate change on tropical storms	
Distribution	More areas will be susceptible north and south of current belts as sea temperatures rise
Intensity	Tropical storms which do form are becoming more intense with more severe wind, rain and storm surges
Frequency	Tropical storms are becoming less frequent as winds in the upper atmosphere prevent their formation

7. Immediate Effects
People are killed and injured
Homes are destroyed
Flooding
Infrastructure destroyed e.g., roads
Services are destroyed e.g., hospitals

8. Long-Term Effects
Homelessness
Landslides
Food shortages
Lack of sanitation and clean water
Loss of power supplies

9. Immediate Responses
Search and rescue
Evacuation centres
Armed forces deployed
Food, water and shelter provided

10. Long-term responses
Restore water supplies and sanitation
Rebuilding homes
Rebuild infrastructure e.g., roads
Rebuild services e.g., schools
Construct new buildings away from storm-prone areas to withstand strong winds and heavy rain
Improve monitoring and early-warning systems

11. Managing Tropical Storms	
Planning	Build new homes away from areas at risk. Prepare populations on how to respond e.g. evacuation, prepare emergency supplies, train emergency services, plan evacuation routes
Monitoring and Prediction	Data from satellites and radars, tracks predicted, sea temperatures observed
Protection	Secure roofs, concrete buildings, concrete pillars, metal shutters, raise buildings on stilts, build levees, build sea walls

History - Causes of WW1

1. Europe before WW1	
Europe	Europe dominated by Great Powers: Britain, France, Germany, Austria-Hungary, Russia.
Imperialism	Competition for colonies and overseas empires.
Germany	Germany unified in 1871 → rapidly industrialised and powerful.
France	France angry about loss of Alsace-Lorraine (1871) to Germany.
Austria-Hungary	Austria-Hungary ruled over many different ethnic groups → instability.
Why this mattered?	Europe was already tense and divided. Rivalries and nationalist movements made conflict more likely

2. Arms Race	
Arms Race	Competition to build armies and Dreadnoughts
Germany	Germany increased army size after 1890 (Kaiser Wilhelm II).
Britain	Britain had strongest navy → Germany challenged this. 1906: HMS Dreadnought launched → new powerful battleship.
Weapons	By 1914 Britain had 29 Dreadnoughts, Germany had 17.
Conscription	Most powers introduced conscription (forced military service).
Why this mattered?	Countries were prepared for war and felt pressure to use their armies before falling behind.

3. Alliances	
The Alliance system	Countries formed defensive agreements for protection.
Triple Alliance	Germany, Italy and Austria-Hungary
Triple Entente	England, France and Russia

4. Nationalism	
Nationalism	pride in country; desire for independence (e.g. Serbia).
Why this mattered?	Many people believed war would bring glory to their country and show their nation's strength.
Balkans	Serbia wanted Slavic people to unite and become independent from Austria-Hungary. This made Austria-Hungary feel threatened.
Propaganda	Propaganda posters used patriotic messages to persuade men that fighting for their country was brave and honourable.

5. Assassination	
Assassination	The action of killing someone for political or religious reasons.
Archduke Franz Ferdinand	Heir to the Austro-Hungarian empire was assassinated on 28th June 1914
Who by?	Killed by Gavrilo Princip, member of Serbian group Black Hand.
Events	•Germany gave Austria the "Blank Cheque" (full support). •Austria issued an ultimatum to Serbia (23 July 1914). •Russia supported Serbia → mobilisation. •Germany declared war on Russia (1 Aug) and France (3 Aug). •Germany invaded Belgium → Britain declared war (4 Aug 1914).
Why this mattered?	The alliance system turned a regional dispute into a European war within weeks.

1. Imperial Soldiers	
Propaganda	False or misleading information used to spread a certain point of view.
Conscription	A compulsory law introduced in Britain in 1916 making military service mandatory for all men aged 19 to 41
Sepoy Khudadad Khan:	The first Indian soldier to be awarded the **Victoria Cross** (Britain's highest bravery medal).
India's Contribution	Over 1 million solders fought and 600,000 served as crucial labourers and porters.
Imperial army	Around **2.5 million men** from Britain's colonies fought during the war.
Institutional Barriers	Despite the immediate willingness of black communities in Cardiff, Liverpool, and London to fight, the British War Office actively discouraged black men from entering the regular army.

2. The Battle of the Somme 1st July 1916	
The Somme	River in France
Lord Kitchener	British Field Marshall and war hero; Minster for War from August 1914 to June 1916 and drove early recruitment campaigns in Britain
Pals Battalions	A groups of friends or co workers who enlisted to fight in the First World War together.
Purpose	Reduce pressure on French forces
Length	5 months (1st July 1916 – November 1916)
Losses	420,000 casualties (killed, wounded and missing) across the British and Empire forces.
The Debut of the Tank (15 September 1916)	50 Mark I tanks were used to cross No Mans Land and crush barbed wire. First time used in Warfare!

3. Women during WW1	
Female employment	3,224,600 July 1914 4,814,600 by January 1918
Munitions Industry	Over 700, 000 worked in munitions and engineering – creating the ammunition for frontline. 'Canaries' – skin turned yellow (poison)
Women's Land Army (WLA)	Established in 1915 to solve agricultural labour shortages. By 1918 there were 20,000 volunteers.
Voluntary Aid Detachments (VAD)	These were volunteers, often from wealthy backgrounds, who had minimal formal nursing experience but provided essential medical support.
Sex Disqualification (Removal) Act (1919)	Officially made it illegal to bar women from jobs or professional fields based solely on gender

4. Conscientious objectors	
Cowardice	A trait where excessive fear prevents an individual from facing danger. Under British military law, it was a capital offence punishable by death
Shell Shock	A physical and psychological condition caused by the trauma of combat. (PTSD)
Shot at Dawn	**306 British Soldiers** were executed ("Shot at Dawn") by their own men for cowardice and desertion during WWI.
Harry Farr	charged with *"Misbehaving before the enemy in such a manner as to show cowardice"* on 17 September 1916

5. Treaty of Versailles	
Armistice	An agreement to end war
28th June 1919	Treaty of Versailles is signed
Key People	Georges Clemenceau (France), David Lloyd George (UK) and Woodrow Wilson (USA)
War Guilt Clause	Article 231 – Germany forced to accept responsibility for starting WW1
Reparations	Germany had to pay for the damage caused by the War. £6600 million.
Land changes	Alsace and Lorraine returned to France. Germany was forbidden to unite with Austria.
Military Restrictions	Army limited to 100,000 men. Conscription banned, Germany not allowed tanks, submarines or military aircraft and only 6 battleships.

6. Timeline of key dates	
1914	The start of World War One
Jan. 1916	The British government introduces conscription
July 1st 1916	The Battle of the Somme
1918	The Armistice 11am 11th November (end WW2)
1919	Treaty of Versailles

History – Rise of Dictators

1. Key words	
Ideology	A system of ideas and ideals, especially one which forms the basis of economic or political theory.
Communism	A left-wing political system where all property is owned by the community and each person contributes and receives according to their ability and needs. (USSR)
Fascism	An extreme right-wing, highly nationalistic system of government led by an absolute dictator. (Nazi Germany)
Totalitarian	A government that seeks total control over the lives of its citizens through terror, censorship, and propaganda.
Indoctrination	Teaching people to accept a set of beliefs without questioning them
Censorship	Suppressing or banning books, films, news, or art that are considered politically unacceptable.
Purge	The violent removal of political enemies or "disloyal" people from an organisation or country.

2. Key individuals	
Adolf Hitler	Leader of Nazi Party (*Führer*). Dictator of Germany 1933–1945.
Joseph Stalin	General Secretary of the Communist Party. Dictator of the USSR 1924–1953
Joseph Goebbels	Hitler's Minister of Propaganda; masterminded Nazi control of media, culture, and youth.

3. Ruling using Terror (Fear)	
Secret Police	Hitler used the **Gestapo** and the **SS** to spy on citizens. Stalin used the **NKVD** (later KGB) to do the same
Prisons and Camps	Hitler sent political rivals to early concentration camps like **Dachau** (1933). Stalin sent millions of "enemies of the state" to forced labor camps in Siberia called the **Gulags**.
Removing Rivals	Hitler murdered his internal rivals during the **Night of the Long Knives (1934)**. Stalin held public **Show Trials** during the **Great Purges (1936–38)** to execute anyone who might challenge him.

4. Ruling using manufactured Consent (Popularity)	
Cult of personality	Both leaders used propaganda to make themselves look like superhuman, god-like "fathers" of their nations.
Youth Groups	Children were targeted early. Nazi children joined the **Hitler Youth**; Soviet children joined the **Young Pioneers**. Both were taught that loyalty to the dictator came before loyalty to their own families.
Censorship	Radios, newspapers, and art were strictly controlled. History books were rewritten, and Stalin even had executed rivals airbrushed out of official photographs

5. Timeline	
1924	Stalin's rise begins
1929	Wall Street Crash and the Great Depression sparks a global economic meltdown. Mass unemployment
1933	Hitler becomes Chancellor of Germany
1934	The Night of the Long Knives – Hitler purges his own paramilitary force (SA) and assassinates political rivals.
1936-38	Staline's Great Purge – arresting and executing millions of Communist Pary members, military officers and ordinary citizens.
1939	The Nazi Soviet Pact – Stalin and Hitler sign a non-aggression pact. They secretly agree to invade and split Poland between them, triggering WWII.

Straight Line Graphs Sparx Codes M797 M932 M544

1 Key Words

Gradient: The steepness of a line.
Intercept: Where two lines cross.
Y-intercept: Where the line meets the y-axis.
Parallel: Two lines that will 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 or 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.

2

$y = mx + c$

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

$y = mx + c$

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

y and x are coordinates

The equation of a line can be rearranged: Eg

$y = c + mx$

$c = y - mx$

Identify which coefficient you are identifying or comparing

3

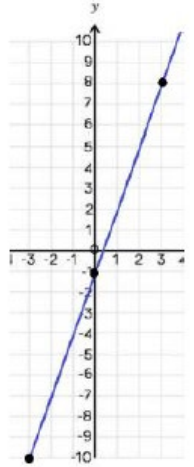
Plotting y = mx + c graphs R

$y = 3x - 1$ → 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)



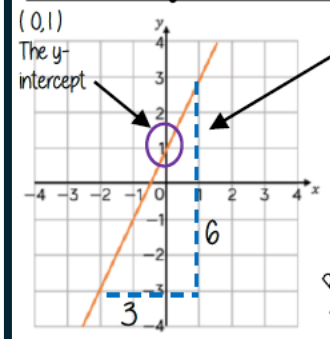
You only need two points to form a straight line

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

4

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

Forming and Solving Equations Sparx Codes M509 M957 M118 M554

Key Words 1

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

2 Equations with unknown on both sides

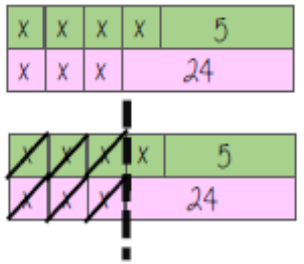
$4x + 5 = 3x + 24$

$-3x \quad -3x$

$x + 5 = 24$

$-5 \quad -5$

$x = 19$



3 Form and solve inequalities R

Two more than treble my number is greater than 11

Find the possible range of values

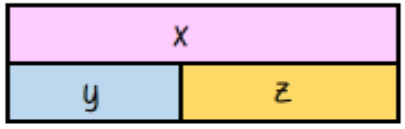
$3x + 2 > 11$

Solve

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

$x > 3$

4 Rearranging Formulae (one step)



$x = y + z$

Rearrange to make y the subject

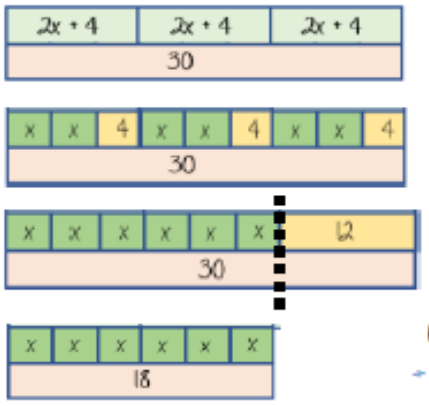
$y = x - z$

$y \rightarrow +z \rightarrow x$

$y \leftarrow -z \leftarrow x$

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

5 Solve equations with brackets R



$3(2x + 4) = 30$

Expand the brackets

$6x + 12 = 30$

$-12 \quad -12$

$6x = 18$

$\div 6 \quad \div 6$

$x = 3$

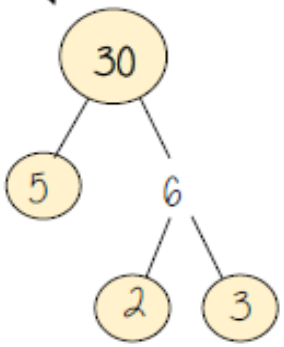
Testing conjectures Sparx Codes M108 M227 M698

Key Words (1)

Multiples: found by multiplying any number by positive integers.
Factor: Integers that multiply together to get another number.
Prime: An integer with only 2 factors.
HCF: Highest common factor (biggest factor two or more numbers share)
LCM: Lowest common multiple (the first time the times table of two or more numbers match)
Verify: The process of making sure a solution is correct.
Proof: Logical mathematical arguments used to show the truth of a statement.
Binomial: A polynomial with two terms.
Quadratic: A polynomial with four terms (often simplified to three terms)

Factors, Multiples and Primes (2) R

Multiplication part-whole models



All three prime factor trees represent the same decomposition

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

Common factors are factors two or more numbers share

LCM – Lowest common multiple

LCM of 9 and 12

9: 9, 18, 27, 36, 45, 54

12: 12, 24, 36, 48, 60

Common multiples are multiples two or more numbers share

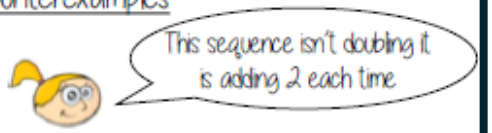
True or False? (3)

Conjecture

A pattern that is noticed for many cases

1, 2, 4....
The numbers in the sequence are doubling each time.

Counterexamples



Only one counterexample is needed to disprove a conjecture

Always, Sometimes, Never true. (4)

Always Every value always supports the statement

Sometimes Examples show the statement being true and counter examples to show when it is false.

Never No example supports the statement

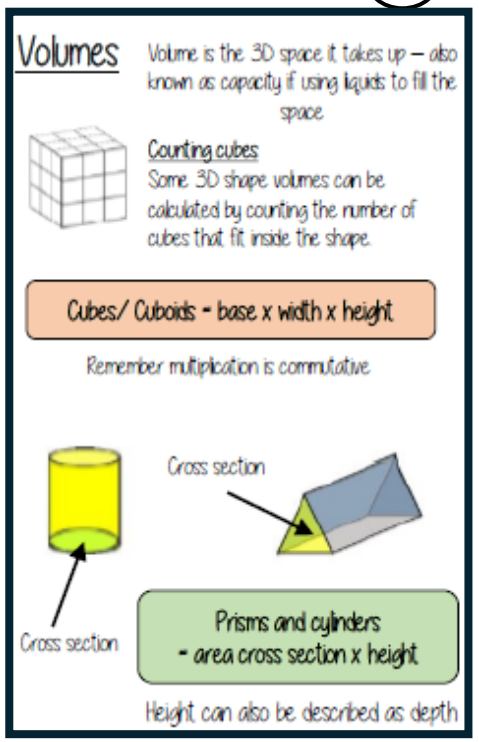
Examples to try
- 0 and 1
- Fractions
- Negative numbers

3D Shapes Sparx Codes Q675 M534 M765

Key Words 1

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
Plan: a drawing of something when drawn from above (birds eye view)
Surface Area: Total area of all faces om a 3D shape
Volume: The amount of space taken up by a 3D shape

2



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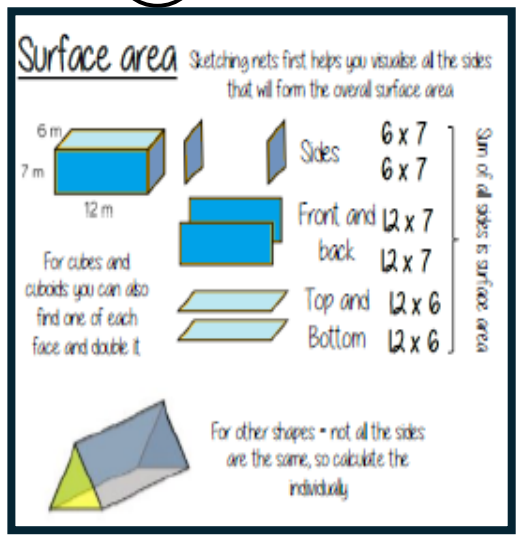

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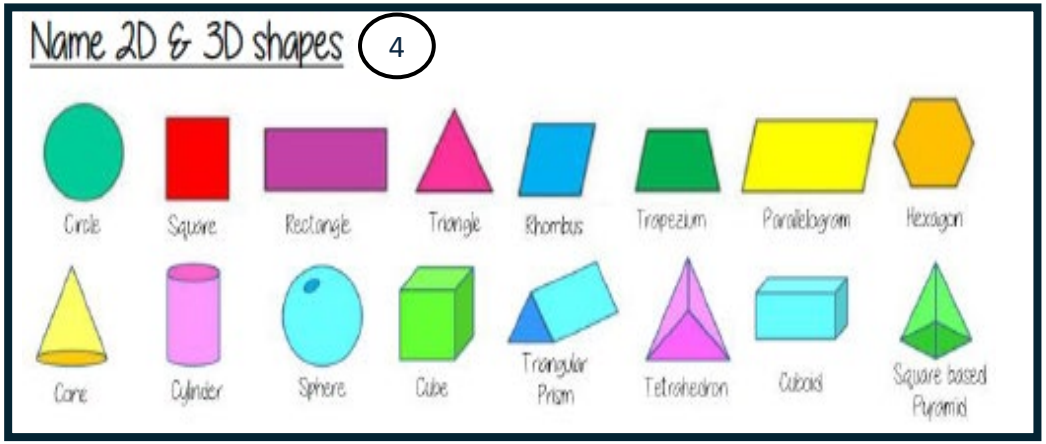

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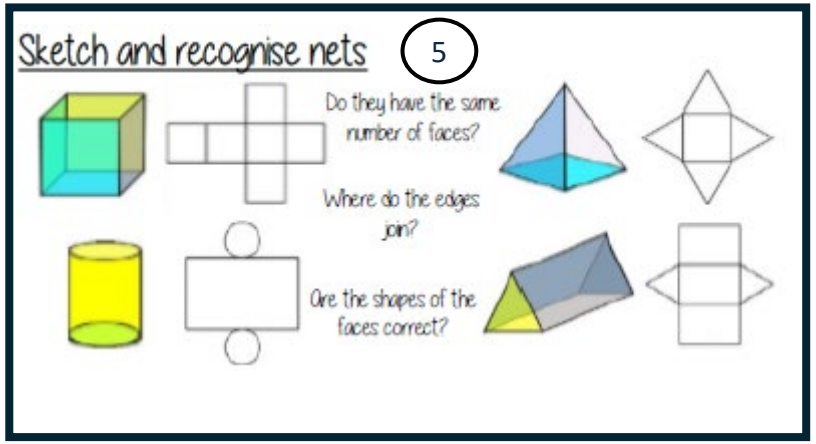


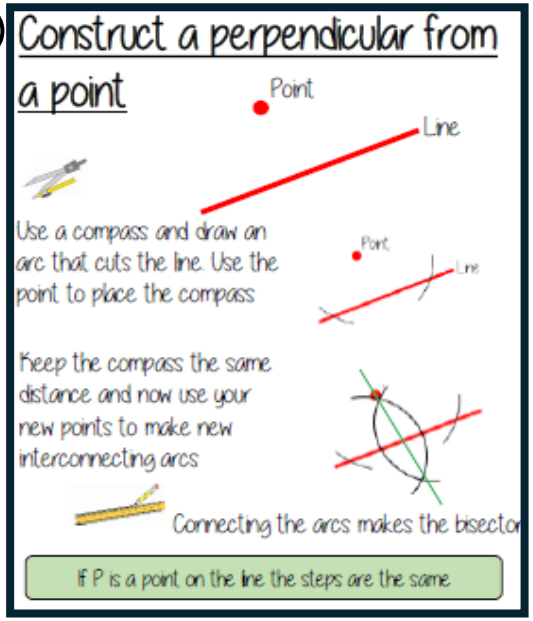
Constructions

Sparx Codes M565 M239 M253

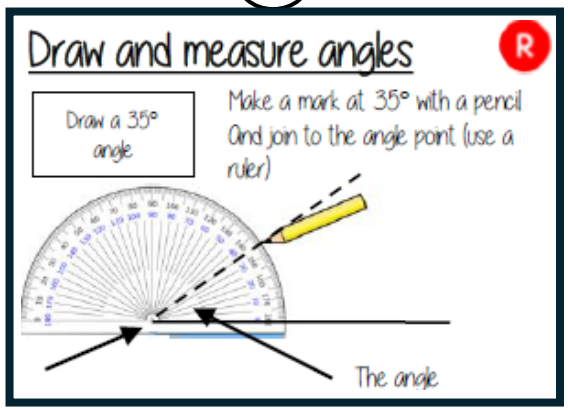
Key Words 1

Protractor: Piece of equipment used to measure and draws angles
Locus: Set of points with a common property
Equidistant: The same distance.
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.

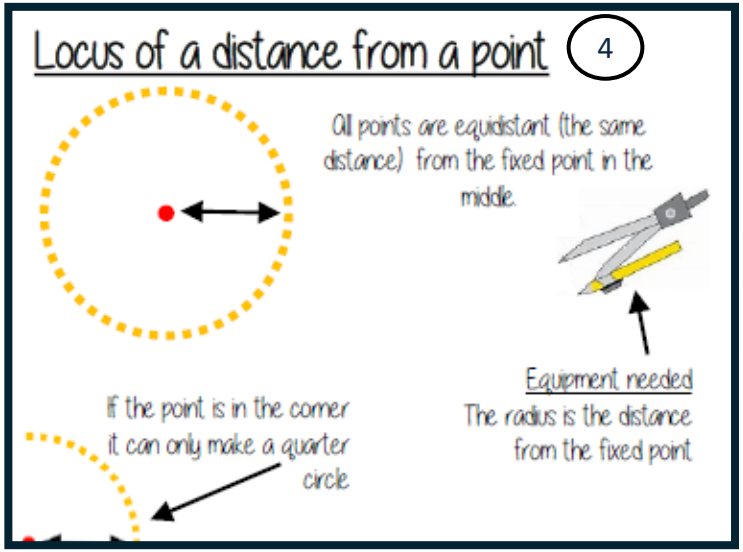
2 Construct a perpendicular from a point



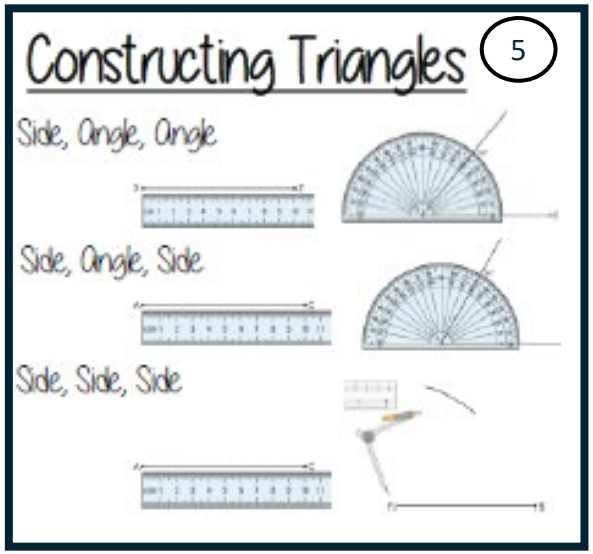
3 Draw and measure angles



4 Locus of a distance from a point



5 Constructing Triangles



6 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

A. How did Reggae develop?

REGGAE is one of the traditional musical styles from **JAMAICA**. It developed from :

REGGAE

MENTO	SKA	ROCK STEADY
A form of Jamaican **FOLK MUSIC** like **CALYPSO** popular in the 1950's.	Fast dance music that emerged in the 1950's fusing American R&B with **MENTO** rhythms and featuring **ELECTRIC GUITARS, JAZZY HORN SECTIONS** and characteristic **OFFBEAT RHYTHMS.**	A more vocal style of dance music which used **RIFFS, SIMPLE HARMONIES, OFFBEAT RHYTHMS** and a strong **BASS LINE**.

Reggae was first heard in the UK in the 1950's when immigrants began to settle. During the 1960's, people began importing singles from Jamaica to sell in UK shops. Now, Reggae is known as the national music of Jamaica.

B. Where is Jamaica?

C. What are Reggae Songs About?

Reggae is closely associated with **RASTAFARIANISM** (a religious movement worshipping Haile Selassie as the Messiah and that black people are the chosen people and will eventually return to their African homeland). The **LYRICS** of Reggae songs are strongly influenced by Rastafarianism and are often political including themes such as **LOVE, BROTHERHOOD, PEACE, POVERTY, ANTI-RACISM, OPTIMISM** and **FREEDOM**.

D. Offbeat Rhythms & Syncopation

OFFBEAT RHYTHMS – Rhythms that emphasise or stress the **WEAK BEATS OF A BAR**. In music that is in 4/4 time, the first beat of the bar is the strongest, the third the next strongest and the second and fourth are weaker. Emphasising the second and fourth beats of the bar gives a "missing beat feel" to the rhythm and makes the music sound **OFFBEAT,** often emphasised by the **BASS DRUM** or a **RIM SHOT** (hitting the edge of a **SNARE DRUM**) in much Reggae music.

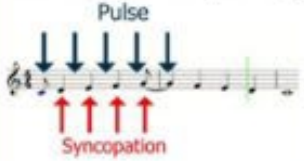
ONBEAT RHYTHM GRID

Pulse/Beat	1	2	3	4	1	2	3	4
"Onbeat" rhythms (strong beats)	♩	𝄽	♩	𝄽	♩	𝄽	♩	𝄽

OFFBEAT RHYTHM GRID

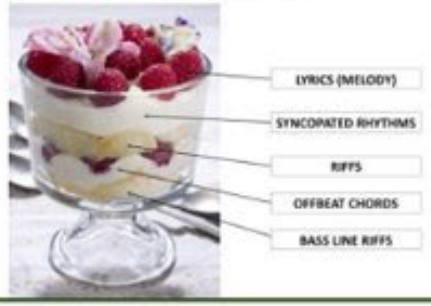
Pulse/Beat	1	2	3	4	1	2	3	4
"Offbeat" rhythms (weak beats)	𝄽	♩	𝄽	♩	𝄽	♩	𝄽	♩

SYNCOPATION – A way of changing a rhythm by making some notes a bit early, often so they cross over the main beat of the music giving the music a further **OFFBEAT** feel – another common feature of Reggae music.



E. Musical Features of Reggae

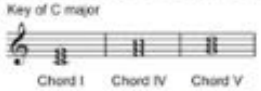
OFFBEAT RHYTHMS AND CHORDS (see D)
SYNCOPATED RHYTHMS AND MELODIES (see D)
SUNG LYRICS (see C)
LEAD SINGER often with **BACKING SINGERS** sometimes singing in **CALL AND RESPONSE** (see F3) accompanied by a Reggae band which often features: **BRASS INSTRUMENTS** and **SAXOPHONES, ELECTRIC GUITARS, BASS GUITAR, KEYBOARDS, DRUMS AND PERCUSSION INSTRUMENTS.**
VOCAL AND INSTRUMENTAL IMPROVISATIONS (see F2)
MELODIC RIFFS (see F5)
SLOW, RELAXED ('chilled!') **TEMPO**
4/4 METRE/TIME SIGNATURE
Most Reggae songs are structured in **VERSE AND CHORUS/POPULAR SONG FORM.**
SIMPLE HARMONIES (see F4)



THICK TEXTURAL LAYERS (see F9) "The Reggae Trifle" is an example of how many Reggae songs are 'layered'.

F. Reggae Key Words

1. **MELODY** – The main 'tune' of a piece of music, often sung by the **LEAD SINGER**.
2. **IMPROVISATION** – Previously unprepared performance.
3. **CALL AND RESPONSE** – Similar to a "Question and Answer" often the call sung by the lead singer and answered by the backing singers or instruments (the response) – musical dialogue.
4. **SIMPLE HARMONIES** – using a limited number of **CHORDS,** mainly **PRIMARY TRIADS** such as the **TONIC, DOMINANT** and **SUBDOMINANT** chords.



5. **RIFF** – A repeated musical pattern. Often the **BASS GUITAR** played repeated **MELODIC BASS RIFFS** in Reggae songs.
6. **BASS/BASS LINE** – The lowest pitched part of a piece of music often played by the **BASS GUITAR** in Reggae which plays an important role.
7. **CHORD** – 2 or more notes played together in **HARMONY**.
8. **RHYTHM** – A series of long and short sounds.
9. **TEXTURE** – Layers of sound combined to make music.

G. Who was Bob Marley?

BOB MARLEY was a famous reggae singer, **SONGWRITER,** and musician who first became famous in his band The Wailers, and later as a **SOLO ARTIST**. He was born Nesta Robert Marley on February 6th, 1945 in Nine Mile, Saint Ann, Jamaica. Although he grew up in poverty, he surrounded himself with music and met some of the future members of The Wailers. Bob Marley became involved in the Rastafarian movement and this influenced his music style greatly. Bob Marley and The Wailers worked with several famous musicians before becoming famous on their own. His career flourished and he became a cultural icon. He was the first international superstar to have been born in poverty in a Third-World country.

Computer and Video Game Music

Early Computer and Video Game Music

Early video game music consisted primarily of **SOUND EFFECTS** (an artificially created or enhanced sound used to emphasize certain actions within computer and video games), **CHIPTUNES** or **8-BIT MUSIC** (a style of electronic music which used simple melodies made for programmable sound generator (PSG) sound chips in vintage computers, consoles and arcade machines) and early sound **SYNTHESISER** technology (an electronic musical instrument that generates audio signals that may be converted to sound). **SAMPLING** (the technique of digitally encoding music or sound and reusing it as part of a composition or recording) began in the 1980's allowing sound to be played during the game, making it more realistic and less "synthetic-sounding".

How Computer and Video Game Music is used within a Game

Music within a computer or video game is often used for **CUES** (knowing when a significant event was about to occur).

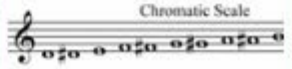
Video game music is often heard over a game's title screen (called the **GROUND THEME**), options menu and bonus content as well as during the entire gameplay. Music can be used to **INCREASE TENSION AND SUSPENSE** *e.g. during battles and chases*, when the player must make a decision within the game (a **DECISION MOTIF**) and can change, depending on a player's actions or situation *e.g. indicating missing actions or "pick-ups".*

Musical Features of Computer and Video Game Music

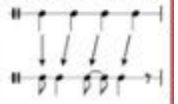
JUMPING BASS LINE
Where the bass line often moves by **LEAP** (**DISJUNCT MOVEMENT**) leaving 'gaps' between notes

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

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



SYNCOPATION
Accenting the weaker beats of the bar to give an "offbeat" jumpy feel to the music.



How Computer and Video Game Music is Produced

Fully-orchestrated **SOUNDTRACKS** (video game music scores) are now popular – technology is used in their creation but less in their performance. The composer uses **MUSIC TECHNOLOGY** to create the score, it is then played by an **ORCHESTRA** and then digitally converted and integrated into the game. Video game **SOUNDTRACKS** have become popular and are now commercially sold and performed in concert with some radio stations featuring entire shows dedicated to video game music.

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)

Component 1 Aerobic & Anaerobic Exercise

Aerobic exercise:

- Uses oxygen for energy production
- Includes activities that are of a long duration
- Includes activities that are of a moderate intensity

Sports and activities:

Long distance cycling

Marathon running

Triathlon

Long distance rowing

Aerobic equation:

$$Glucose + O_2 \rightarrow CO_2 + H_2O + Heat + Energy$$

Glucose and oxygen are used to release energy aerobically. This process produces carbon dioxide, water and heat (and energy)

Anaerobic exercise:

- Does not use oxygen for energy production
- Include activities that are of a short duration
- Includes activities that are of a high intensity

Sports and activities:

Shot put

Sprinting

Long jump

Weight lifting

Anaerobic equation:

$$Glucose \rightarrow lactic\ Acid + Energy$$

Lactic acid is produced as a waste product when carbohydrates are broken down without oxygen during anaerobic respiration

Energy Sources

Carbohydrates

- They are an energy source for both aerobic & anaerobic activities
- Doesn't need oxygen to break down into glucose
- Doesn't give as much energy as fats
- Quicker to break down and release more energy than fats

Fats

- They are an energy source for aerobic activities
- They require oxygen to break down the fat into energy (a type of glucose)
- They are slow to break down
- Once broken down they give large quantities of energy

Component 1 Short Term Effects of Exercise

Short term effects of exercise are the ways your body responds as it starts to exercise. These changes happen so that the body can meet the increased demands to the exercise undertaken

Muscular System:

- Muscle fatigue
- Lactate accumulation
- Oxygen deficit

When we start to exercise there is a demand for energy.
When we work anaerobically, we get muscle fatigue and a build-up of lactic acid. This will create an oxygen deficit

Cardiovascular System:

- Increase in heart rate
- Increase stroke volume
- Increase blood pressure
- Increase cardiac output
- Vascular shunting occurs

Respiratory system:

- Increase depth of breathing
- Increase rate of breathing
- Increase gas exchange
- Increase in tidal volume
- Oxygen deficit

The cardiovascular system & respiratory system work together

When we exercise the demand for oxygen and the removal of carbon dioxide increases. This will increase breathing rate and depth and the rate of gas exchange

Because oxygen is needed for the working muscles, vascular shunting occurs

Heart rate is increased as the blood transports the oxygen and carbon dioxide. This increases blood pressure, stroke volume and heart rate

Cardiac output = Stroke Volume x Heart Rate

Stroke volume = Amount of blood pumped from the heart in 1 beat

Heart rate = Amount of time the heart beats per minute

Cardiac output = Amount of blood pumped from the heart in 1 minute

Component 1 The Cardiovascular System

Functions of the cardiovascular system:

The cardiovascular system consists of the:

- **The heart** pumps blood around the body
- **Blood** transports gasses, blood cells and nutrients
- **Blood vessels** carry the blood

Function	Explanation
Transport of nutrients	Nutrients we eat are broken down from the food we eat and transported to the body in the blood
Transport of oxygen	The cardiovascular system transports oxygen around the body in the blood Oxygen is needed to provide energy to the working muscles during aerobic exercise
Transport of carbon dioxide	Carbon dioxide is produced as a by-product during aerobic energy production. The cardiovascular system takes carbon dioxide away from the muscles to the lungs and exhaled.
Clotting of open wounds	Blood contains blood cells called platelets. They are transported in the blood. They help to clot wounds by performing a plug to prevent blood loss
Regulation of body temperature	Blood vessels can help regulate body temperature. When we get hot blood vessels near the skin will get bigger (**vasodilation**) this will increase blood flow so heat can radiate from the skin When we get cold the blood vessels near the skin will get smaller (**vasoconstriction**) this will decrease blood flow so less heat is lost through radiation

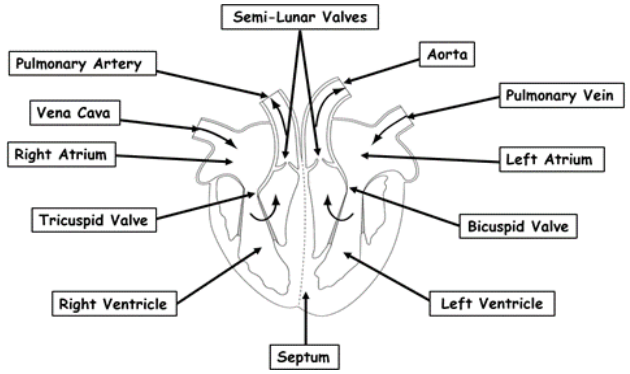
Redistribution of blood flow:

Vascular Shunting: When we exercise blood is redistributed. The working muscles need more oxygen than other inactive areas of the body such as the stomach. Blood is diverted away from inactive areas to the working muscles.

Vasoconstriction means that the blood vessels constrict to make them smaller. Chemical changes signal the nervous system to **constrict** blood vessels to **inactive** areas.

Vasodilation means that the blood vessels dilate to make them bigger. Chemical changes signal the nervous system to dilate blood vessels that supply active areas.

Structure of the heart:



Septum separates the right and left sides of the heart

Valves prevent the backflow of blood

Arteries take blood away from the heart

Veins take blood towards the heart

Pulmonary artery take blood to the lungs

Pulmonary vein takes blood from the lungs back to the heart

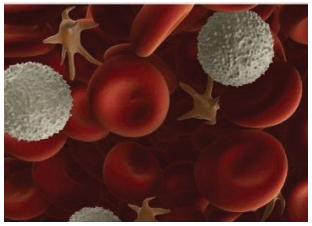
Aorta delivers oxygenated blood to the body

Structure of blood vessels:

Blood Vessel	Structure	Importance During Physical Activity
Artery 	• Thick muscular walls • Thick elastic walls • Small lumen (internal diameter) • Carry blood at high pressure • Cary blood away from the heart • Usually carry oxygenated blood (except the pulmonary artery)	When we exercise, blood pressure increases due to the demand for oxygen from the working muscles. Arteries take the blood to the working muscles. They dilate to allow more blood through
Vein 	• Thin walls • Large lumen (internal diameter) • Carry blood at low pressure • Contain valves • Mainly carry deoxygenated blood (except the pulmonary vein)	When we exercise aerobically the body produces waste products such as carbon dioxide. The blood in the veins take this to the lungs to be exhaled. The valves in the veins prevent the back flow of blood at low pressure
Capillary 	• Very thin walls (one cell thick) • Small lumen (internal diameter) • Link smaller arteries with small veins • Allow gaseous exchange	When we exercise, we need to deliver oxygen to the working muscles and remove the waste product, carbon dioxide. Capillaries allow the gaseous exchange at the lungs and the muscles

Function of blood:

Blood has four components that each play a role in physical activity:



Red blood cells

Red blood cells carry oxygen and carbon dioxide.

The oxygen binds with haemoglobin in the blood. It is then transported to the working muscles by the plasma

The waste product carbon dioxide is also transported by the red blood cells, it is also carried by the plasma

White blood cells

White blood cells fight infection and disease. When playing sport, they prevent infection if we get cut or scratched. They also keep us healthy so we are fit to train and take part in physical activity

Platelets

Platelets help prevent bleeding by clotting (sticking together) and forming a plug. This is important to allow performers such as boxers to stop the bleeding if they get a cut, allowing them to continue performing

Plasma

Plasma is the liquid part of the blood it acts as a transport system that transports the blood cells, platelets and nutrients to different parts of the body

Component 1 Lever Systems

Lever Systems:

Lever systems help you to move. They can increase the amount you can lift or the speed in which you can move something. You need to be able to:

- Draw the three classes of lever
- Describe the lever
- Give examples in sport

Key Words

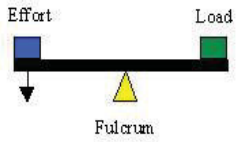
Lever: Is a bone and is shown as a straight line

Fulcrum: Is a pivot or joint and is shown as a triangle

Effort: Is a force provided by muscles and is shown by an arrow

Load: Is the weight of the body/object being moved, it is shown as a square

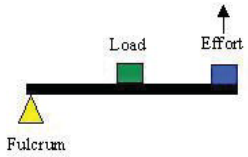
Levers:



1st Class Lever
The fulcrum is surrounded by the effort and the load

Sporting Example

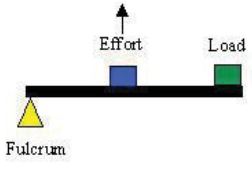
Header in football



2nd Class Lever
The load is surrounded by the fulcrum and the effort

Sporting Example

Calf raises



3rd Class Lever
The load is surrounded by the fulcrum and the effort

Sporting Example

Bicep curl

Mechanical advantages and disadvantages

Lever	Advantage	Disadvantage
2nd class	Provides force to lift heavy loads	Small range of movement and cannot move a load quickly
This is due to the load being closer to the fulcrum than the effort		
3rd class	Provides speed and a wide range of movement	A greater force is needed to move the load
This is due to the effort closer to the fulcrum than the load		

Each lever system can be identified by the component in the middle:

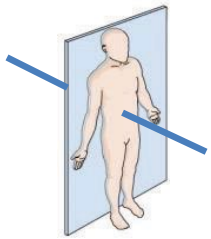
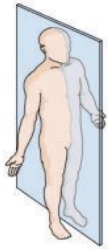
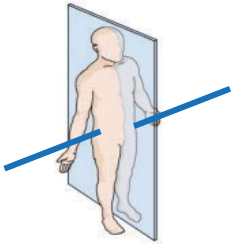
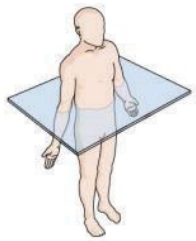
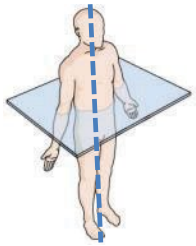
One	Two	Three
F	L	E
(fulcrum)	(load)	(effort)

Component 1 Planes & Axes of Movement

Planes and axes of movement

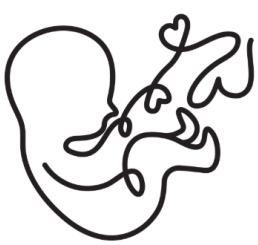
We move in planes around axes. You need to be able to identify and describe the three different body planes and axes

- A plane is an imaginary line that movement direction occurs in
- An axis is a line about which the body or body part can turn

Plane of movement	Axes of movement	Sporting example
		
Frontal plane Separates the front and the back of the body	**Sagittal axis** Goes from the front to the back of the body	**Cartwheel** The only movements are abduction and adduction
		
Sagittal plane Separates the left and the right side of the body	**Frontal axis** Does from one side to the other side of the body	**Somersault** The only movements are flexion and extension
		
Transverse plane Separates the top and the bottom of the body	**Vertical axis** Goes from the top of the body to the bottom of the body	**Full twist (diving)** The only movements are rotating and twisting

RE – Creation and Covenant

	Key Quotes
1	'Therefore, a man shall leave his father and mother and hold fast to his wife, and the two shall become one flesh.'
2	'Then the Lord God formed the man of dust from the ground and breathed into his nostrils the breath of life, and the man became a living creature.'



	Key Words	
1	Imago Dei	A Latin phrase meaning 'in the image of God', the idea that humans reflect God's nature
2	Inalienable dignity	A state of value attached to human life that cannot be challenged or removed.
3	Human person	For Catholics, a living being possessing both a physical body and a spiritual soul.
4	Relational	Concerning the way in which two or more people are connected; in Catholicism this is the relationship between humans, and between humans and God.
5	Rational	Based on reason or logic.
6	Volitional	Based on free choice or free will.
7	Sanctity of Life	The idea that human life is a holy gift from God.
8	Marriage	In Catholicism, a binding lifelong relationship in which a man and a woman live by promises made to each other and God.
9	Sacrament of Matrimony	The Sacrament at the Service of Communion in which a man and woman make the lasting commitment of marriage.

	Key Facts
1	The stories of the Old Testament were repeated and retold between communities and passed down through generations. This is called Oral Tradition.
2	God has made human beings ***imago Dei***. This means that they are **relational** (able to connect with other and with God), **volitional** (able to make free choices) and **rational** (able to make logical decisions)
	Catholics believe that life is precious and holy. Therefore they believe that only God gives life and only God can take it away. If a human takes the decision to end a life, they are undermining the belief in the **sanctity of life.**
3	The Valladolid Debate discussed how the Spanish Empire should treat the indigenous people of the Americas. The case was made that all people should be treated with respect, regardless of who they are. Because all people have been made in the image of God.
4	Malala Yousafzai is a good example of a someone who stands up for the **dignity** of others in the 21st century. She fights for girl's rights to education against the Taliban. She continues to do this despite being shot in the face for her activism.
5	The Church believes that life begins at conception. This means that abortion is wrong because it is taking away life. The UK allows abortion up to 24 weeks in certain circumstances and up to birth in rarer cases.
6	**Marriage** is one of the two sacraments of service. The Catholic Church believes that it is exclusive, life-giving, permanent and a sacrament.
7	During the rite of **marriage**, a couple make vows to love and cherish each other and exchange rings as a sign of their commitment to one another.

RE – Prophecy and Promise

	Key Quotes
1	'Such holy women as Sarah, Rebecca, Rachel, Miriam, Deborah, Hannah, Judith and Esther kept alive the hope of Israel's salvation' (CCC 64)
2	'My soul magnifies the Lord, and my spirit rejoices in God my saviour for he has looked on the humble estate of his servant.' Luke 1:46

	Key Words	
1	Typology	In Christianity, the study of the Old Testament figures, objects, places or events which predict or hint at who or what is to come in the New Testament.
2	Protoevangelium	The 'first gospel'; this refers to Genesis 3:15 because it is the first messianic prophecy in the Bible.
3	Mary	The Mother of Jesus
4	Mother of God	A title given to Mary, because Jesus is God and she is Jesus' mother.
5	Immaculate Conception	A dogma (teaching) of the Catholic Church that states that Mary, the mother of Jesus, did not inherit the stain of Original Sin when she was conceived by her own mother.
6	Our Lady	A title of respect for Mary, reflecting her high status within the Church.
7	New Eve	Eve is the mother of all humans as the first woman; Mary, as the Mother of Jesus, who offers redemption and new life to humanity, becomes the New Eve, or mother, for baptised Catholics.
8	Magnificat	Mary's prayer of praise in Luke 1:45-56.
9	The Rosary	A set of prayers said in honour of Mary during which Catholics will meditate on particular events in the life of Mary and Jesus.

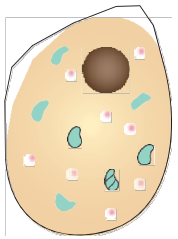
	Key Facts
1	Typology is when Christians read stories in the Old Testament as signs that point to something in the New Testament. For example, Adam is a symbol of Jesus, and Eve is a symbol of Mary.
2	Eve made a mistake disobeying God, which brought sin into the world. Mary did the opposite – she obeyed God and gave birth to Jesus, who saves people from sin. That's why Catholics call her the 'New Eve'.
3	The Catholic Church has four important beliefs about Mary: She is the Mother of God, she was born without Original Sin (Immaculate Conception), she stayed a virgin all her life and she was assumed to heaven.
4	Genesis 3:15 in the Bible is called the 'first gospel' because it hints that a saviour will come. Catholics believe this is the first sign that Jesus and Mary would defeat sin and evil.
5	Mary's Prayer in Luke 1 is called the Magnificat. It's very similar to Hannah's prayer in the Old Testament. Both women thank God for helping the poor and lifting up the humble.
6	Josephine Bakhita was taken as a slave when she was young. Later, she became a Catholic nun and chose to forgive the people who hurt her. She lived a life full of faith, kindness and trust in God.
7	Women like Sarah, Rebecca, Rachel and Hannah all trusted God when life was hard. They were blessed with children who helped prepare the way for Jesus. Mary is the final and most important part of that story.
8	Catholics around the world show love and respect for Mary. They say special prayers like the Rosary, celebrate feast remember her appearances – like Our Lady of Lourdes in France.

Biology – Cell Biology and Transport

1. Eukaryotic cells

Animal and plant cells are eukaryotic. They have genetic material (DNA) that forms **chromosomes** and is contained in a **nucleus**.

Animal cell



cell membrane: controls the movement of substances in and out of a cell

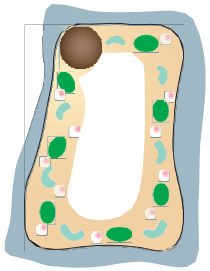
nucleus: contains DNA

mitochondria: where energy is released through respiration

ribosomes: site of protein synthesis

cytoplasm: jelly-like substance, where chemical reactions happen

Plant cell



permanent vacuole: contains cell sap

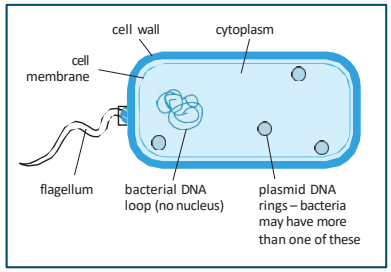
chloroplasts: contain chlorophyll to absorb light energy for photosynthesis

cell wall: made of cellulose, which strengthens the cell

2. Prokaryotic cells

Bacteria have the following characteristics:

- single-celled
- no nucleus – have a single loop of DNA
- have small rings of DNA called **plasmids**
- smaller than eukaryotic cells.



3. Microscopes

Light microscope	Electron microscope
uses light to form images	uses a beamof electrons to formimages
living samples can be viewed	samples cannot be living
relatively cheap	expensive
lowmagnification	high magnification
lowresolution	high resolution

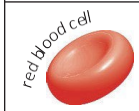
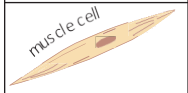
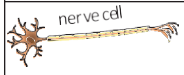
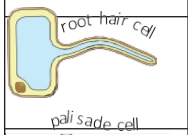
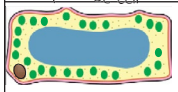
Electron microscopes allow you to see sub-cellular structures, such as ribosomes, that are too small to be seen with a light microscope.

To calculate the **magnification** of an image:

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}}$$

4. Specialised cells

Cells in animals and plants differentiate to form different types of cells. Most animal cells differentiate at an early stage of development, whereas a plant's cells differentiate throughout its lifetime.

Specialised cell	Function	Adaptations
	fertilise an ovum(egg)	• tail to swimto the ovumand fertilise it • lots of mitochondria to release energyfrom respiration, enabling the sperm to swimto the ovum
	transport oxygen around the body	• nonucleus so moreroomto carry oxygen • contains a redpigment called haemoglobin that binds to oxygen molecules • flat bi-concave disc shape to increase surface area-to- volumeratio
	contract and relax to allow movement	• contains protein fibres, whichcan contract to make the cells shorter • contains lots of mitochondria to release energy from respiration, allowing the muscles to contract
	carry electrical impulses around the body	• branched endings, called dendrites, to make connections withotherneuronesoreffectors • myelin sheath insulates the axon to increase the transmission speed of the electrical impulses
	absorb mineral ions and water from the soil	• long projectionspeeds upthe absorption of waterand mineralions by increasing the surface area of the cell • lots of mitochondria to release energyfor the active transport of mineralions from the soil
	enable photosynthesis in the leaf	• lots of chloroplasts containing chlorophyll to absorb light energy • located at the top surface of the leaf whereit can absorb the most light energy

5.

	Diffusion	Osmosis	Active Transport
Definition	The spreading out of particles, resulting in a net movement from an area of higher concentration to an area of lower concentration. Factors which affect the rate of diffusion: difference in concentration, temperature, and surface area of the membrane.	The diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.	The movement of particles from a more dilute solution to a more concentrated solution using energy from respiration.
Movement of Particles	Particles move down the concentration gradient – from an area of high concentration to an area of low concentration.	Water moves from an area of lower solute concentration to an area of higher solute concentration.	Particles move against the concentration gradient – from an area of low concentration to an area of high concentration.
Energy Required?	No – passive process	No – passive process	Yes – energy released by respiration
Examples	**Humans** • Nutrients in the small intestine diffuse into the capillaries through the villi. • Oxygen diffuses from the air in the alveoli into the blood in the capillaries. Carbon dioxide diffuses from the blood in the capillaries into the air in the alveoli. • Urea diffuses from cells into the blood for excretion in the kidney. **Fish** • Oxygen from water passing over the gills diffuses into the blood in the gill filaments. • Carbon dioxide diffuses from the blood in the gill filaments into the water. **Plants** • Carbon dioxide used for photosynthesis diffuses into leaves through the stomata. • Oxygen produced during photosynthesis diffuses out of the leaves through the stomata.	**Plants** • Water moves by osmosis from a dilute solution in the soil to a concentrated solution in the root hair cell.	**Humans** • Active transport allows sugar molecules to be absorbed from the small intestine when the sugar concentration is higher in the blood than in the small intestine. **Plants** • Active transport is used to absorb mineral ions into the root hair cells from more dilute solutions in the soil.

Key terms

Make sure you can write a definition for these key terms.

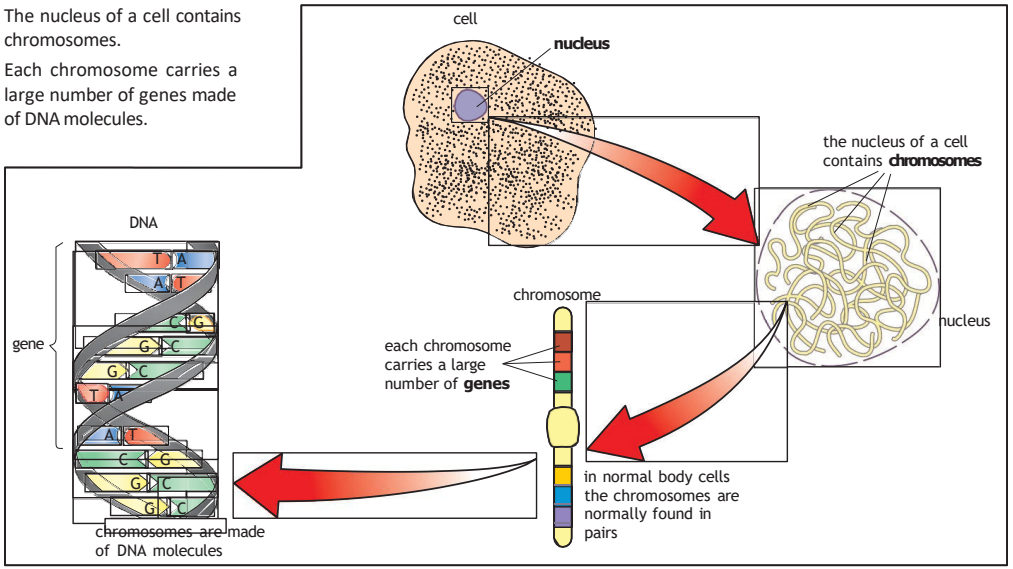
cell membrane cell wall chloroplast chromosome concentration cytoplasm dilute DNA eukaryotic gill filaments gradient magnification mitochondria nucleus partially permeable membrane passive process permanent vacuole plasmid prokaryotic resolution ribosome root hair cell stomata

Biology – Cell Division

1. Chromosomes

The nucleus of a cell contains chromosomes.

Each chromosome carries a large number of genes made of DNA molecules.

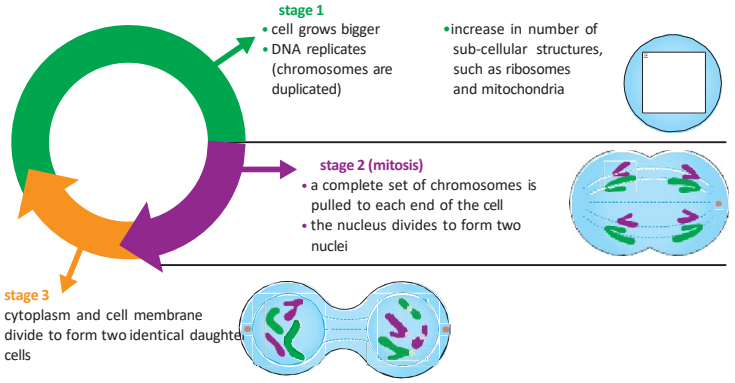


2. The cell cycle

Body cells divide to form two identical **daughter cells** by going through a series of stages known as the **cell cycle**.

Cell division by **mitosis** is important for the growth and repair of cells, for example, the replacement of skin cells. Mitosis is also used for asexual reproduction.

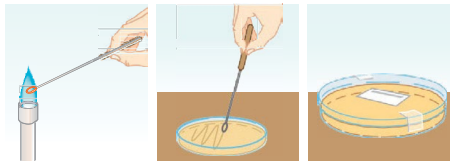
There are *three* main stages in the cell cycle:



3. Binary fission

Cell division in bacteria is called binary fission. In optimum temperature and nutrients, bacteria can multiply as often as every 20 minutes. In a lab, bacteria can be grown in sterile conditions on an agar gel plate or in a nutrient broth.

The lid of the petri dish must be sealed but not all the way so that oxygen can still get in. This is so that harmful bacteria that do not need oxygen aren't able to grow.



4. Stem cells in medicine

A stem cell is an undifferentiated cell that can develop into one or more types of specialised cell.

There are two types of stem cell in mammals: **adult stem cells** and **embryonic stem cells**.

Stem cells can be **cloned** to produce large numbers of identical cells.

Type of stem cell	Where are they found?	What can they differentiate into?	Advantages	Disadvantages
adult stem cells	specific parts of the bodyin adults and children– for example, bone marrow	can only differentiate to formcertain types of cells – for example, stem cells in bone marrowcan only differentiate into types of blood cell	• fewerethical issues – adults can consent to have their stem cells removedand used • an already established technique for treating diseases such as leukaemia • relatively safe to use as a treatment and donors recover quickly	• requires a donor, potentially meaning a long wait time to find someone suitable • can only differentiate into certain types of specialised cells, so can beused to treat fewer diseases
embryonic stem cells	early human embryos (often taken from spare embryos from fertility clinics)	can differentiate into any type of specialised cell in the body– for example, a nerve cell ora muscle cell	• can treat a wide range of diseases as can form any specialised cell • may bepossible to growwhole replacementorgans • usually nodonorneeded as they are obtained fromspare embryos from fertility clinics	• ethical issues as the embryois destroyed and each embryois a potential human life • risk of transferring viral infections to the patient • newer treatment so relatively under-researched – not yet clear if they can cure as many diseases as thought
plant meristem	meristem regions in the roots and shoots of plants	can differentiate into all cell types – they can be used to create clones of wholeplants	• rare species of plants can be clonedto prevent extinction • plants with desirable traits, such as disease resistance, can beclonedto produce large numbersof identical plants • fast and low-cost production of large numbers of plants	• cloned plants are genetically identical, so a wholecropis at risk of beingdestroyed by a single disease orgenetic defect

5. Therapeutic cloning

In **therapeutic cloning**

- cells from a patient's own body are used to create a cloned early embryo of themselves
- stem cells from this embryo can be used for medical treatments and growing new organs
- these stem cells have the same genes as the patient, so are less likely to be rejected when transplanted.

Key terms

Make sure you can write a definition for these key terms.

adult stem cell | binaryfission | cell cycle | chromosome | clone | daughter cells | embryonicstem cell | gene | meristem | mitosis | nucleus | therapeutic cloning

Chemistry – Atomic Structure

1. Development of the model of the atom

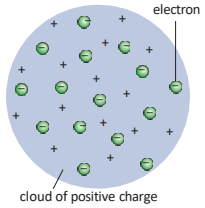
Dalton's model

John Dalton thought of the **atom** as a solid sphere that could not be divided into smaller parts. His model did not include **protons**, **neutrons**, or **electrons**.

The plum pudding model

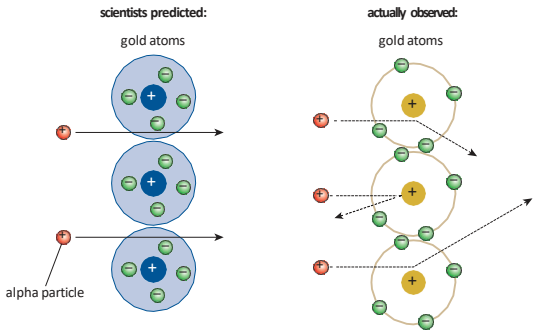
Scientists' experiments resulted in the discovery of sub-atomic charged particles. The first to be discovered were electrons – tiny, negatively charged particles.

The discovery of electrons led to the plum pudding model of the atom – a sphere of positive charge, with negative electrons embedded in it. Protons and neutrons had not yet been discovered.



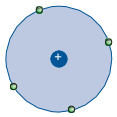
Alpha scattering experiment

1. Scientists fired small, positively charged particles (called alpha particles) at a piece of gold foil only a few atoms thick.
2. They expected the alpha particles to travel straight through the gold.
3. They were surprised that some of the alpha particles bounced back and many were deflected (alpha scattering).
4. To explain why the alpha particles were repelled the scientists suggested that the positive charge and mass of an atom must be concentrated in a small space at its centre. They called this space the **nucleus**.



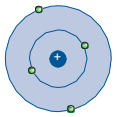
Nuclear model

Scientists replaced the plum pudding model with the nuclear model and suggested that the electrons **orbit** the nucleus, but not at set distances.



Electron shell (Bohr) model

Niels Bohr calculated that electrons must orbit the nucleus at fixed distances. These orbits are called **shells** or **energy levels**.



The proton

Further experiments provided evidence that the nucleus contained smaller particles called protons. A proton has an opposite charge to an electron.

The neutron

James Chadwick carried out experiments that gave evidence for a particle with no charge. Scientists called this the neutron and concluded that the protons and neutrons are in the nucleus, and the electrons orbit the nucleus in shells.

Relative mass

One property of protons, neutrons, and electrons is **relative mass** – their masses compared to each other. Protons and neutrons have the same mass, so are given a relative mass of 1. It takes almost 2000 electrons to equal the mass of a single proton – their relative mass is so small that we can consider it as 0.

Size

The atom has a radius of 1×10^{-10} m. Nuclei (plural of nucleus) are around 10000 times smaller than atoms and have a radius of around 1×10^{-14} m.

2. Elements and compounds

Elements are substances made of one type of atom. Each atom of an element will have the same number of protons.

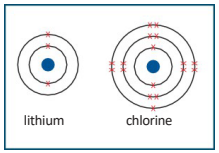
Compounds are made of different types of atoms chemically bonded together. The atoms in a compound have different numbers of protons.

3. Drawing atoms

Electrons in an atom are placed in fixed shells. You can put

- up to two electrons in the first shell
- eight electrons each in the second and third shells.

You must fill up a shell before moving on to the next one.



4. Mixtures

- A mixture consists of two or more elements or compounds that are not chemically combined together.
- The substances in a mixture can be separated using physical processes.
- These processes do not use chemical reactions.

Separating mixtures

- filtration – insoluble solids and a liquid
- crystallisation – soluble solid from a solution
- simple distillation – solvent from a solution
- fractional distillation – two liquids with similar boiling points
- paper chromatography – identify substances from a mixture in solution

5. Atoms and particles

	Relative charge	Relative mass	
Proton	+1	1	= atomic number
Neutron	0	1	= mass number – atomic number
Electron	−1	0 (very small)	= same as the number of protons

All atoms have equal numbers of protons and electrons, meaning they have no overall charge:

total negative charge from electrons = total positive charge from protons

6. Isotopes

Atoms of the same element can have a different number of neutrons, giving them a different overall mass number. Atoms of the same element with different numbers of neutrons are called **isotopes**.

The **relative atomic mass** is the average mass of all the atoms of an element:

$$\text{relative atomic mass} = \frac{(\text{abundance of isotope 1} \times \text{mass of isotope 1}) + (\text{abundance of isotope 2} \times \text{mass of isotope 2}) \ldots}{100}$$

Key terms

Make sure you can write a definition for these key terms.

abundance, atom, atomic number, aqueous, compound, electron, element, energy level, isotope, neutron, nucleus, orbit, product, proton, reactant, relative atomic mass, relative charge, relative mass, shell

Chemistry – The Periodic Table

1. Development of the Periodic Table

The Periodic Table has changed over time as scientists haveorganised it differently. Mendeleev was able to accurately predict the properties of undiscoveredelements based on the gapsin the table.

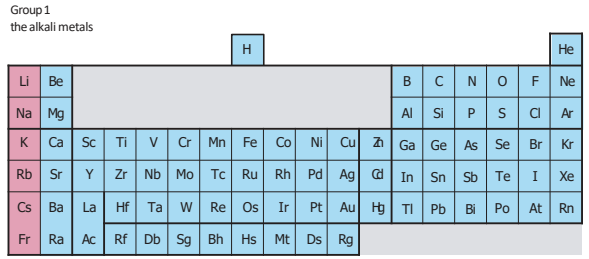
	First lists of elements	Mendeleev's Periodic Table	Modern Periodic Table
How are elements ordered?	byatomic mass	normallybyatomic mass but some elements were swappedaround	byatomic number
Are there gaps?	nogaps	gaps left for undiscovered elements	nogaps – allelements upto a certain atomic numberhavebeendiscovered
How are elements grouped?	not grouped	grouped bychemical properties	groupedby the numberof electrons in the outer shells
Metals and non-metals	nocleardistinction	nocleardistinction	metals to the left, non-metals to the right
Problems	some elements grouped inappropriately	incomplete, with noexplanationfor why some elements had to beswappedto fit in the appropriate groups	—

2. Group 1 elements

Group 1 elementsreact with oxygen,chlorine, and water,for example:

lithium + oxygen → lithiumoxide
lithium + chlorine → lithiumchloride
lithium + water → lithium hydroxide + hydrogen

Group 1 elements are called **alkali metals** because they react with water to formanalkali (asolution of their metal hydroxide).

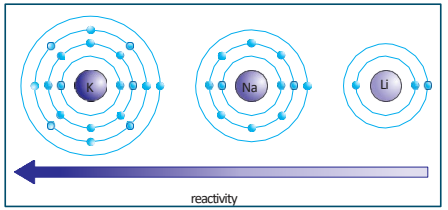


3. Group 1 properties

Group1elementsall haveoneelectronin theiroutershell.

Reactivity increases down Group 1 because as youmovedown the group:

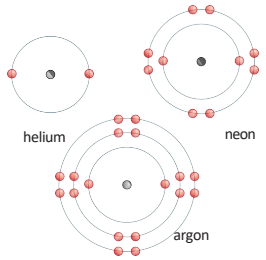
- the atoms increase in size
- the outer electron is further awayfrom the nucleus, and there are moreshells shielding the outer electronfrom the nucleus
- the electrostatic attraction between the nucleus and the outer electronis weakerso it is easier to lose the one outer electron
- the melting point and boiling point decreasesdown Group 1.



4. Group 0

Elements in **Group 0** are called the **noble gases**. Noble gases have the following properties:

- full outer shells with eight electrons, so donot need to lose or gain electrons
- are very unreactive (**inert**) so exist as single atoms as they do not bond to form molecules
- boiling points that increase down the group.



5. Group 7 elements

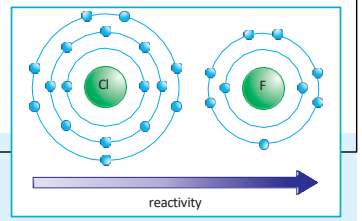
Group 7 elements are called the **halogens**. They are non-metals that exist as molecules made up of pairs of atoms.

Name	Formula	State at room temperature	Melting point and boiling point	Reactivity
fluorine	F_2	gas	increasesdownthe group	decreases downthe group
chlorine	Cl_2	gas		
bromine	Br_2	liquid		
iodine	I_2	solid		

6. Group 7 reactivity

Reactivitydecreasesdown Group7 because as youmovedownthe group:

- the atoms increase in size
- the outer shell is further awayfrom the nucleus, and there aremore shells between the nucleus and the outer shell
- theelectrostatic attraction fromthenucleus to theoutershell is weakerso it is harder to gainone electron to fill theoutershell.



7. Group 7 displacement

MorereactiveGroup7 elementscantake the place oflessreactiveones in a compound. Thisis called **displacement**.

Forexample,fluorine displaces chlorine asit is morereactive:

fluorine + potassium chloride → potassium fluoride + chlorine

Keyterms

Make sure you can write a definition for these key terms.

alkali metals chemical properties displacement groups halogens inert isotopes noble gas organised Periodic Table reactivity undiscovered unreactive

Physics – Wave Properties

1. Waves in air, fluids, and solids

Waves transfer energy from one place to another without transferring matter. Waves may be **transverse** or **longitudinal**.

For waves in water and air, it is the wave and not the substance that moves.

- When a light object is dropped into still water, it produces ripples (waves) on the water which spread out, but neither the object nor the water moves with the ripples.
- When you speak, your voice box vibrates, making sound waves travel through the air. The air itself does not travel away from your throat, otherwise a vacuum would be created.

2. Mechanical waves require a substance (a medium) to travel through.

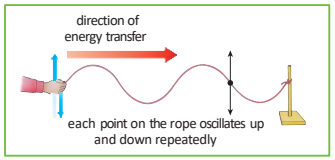
Examples of mechanical waves include sound waves, water waves, waves on springs and ropes, and seismic waves produced by earthquakes.

When waves travel through a substance, the particles in the substance **oscillate** (vibrate) and pass energy on to neighbouring particles.

3. Transverse waves

The oscillations of a transverse wave are *perpendicular* (at right angles) to the direction in which the waves transfer energy.

Ripples on the surface of water are an example of transverse waves.

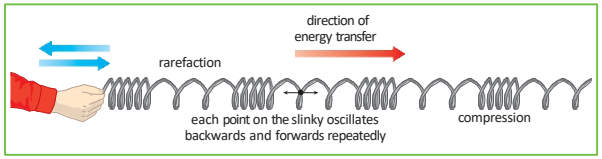


4. Longitudinal waves

The oscillations of a longitudinal wave are *parallel* to the direction in which the waves transfer energy.

Longitudinal waves cause particles in a substance to be squashed closer together and pulled further apart, producing areas of **compression** and **rarefaction** in the substance.

Sound waves in air are an example of longitudinal waves.

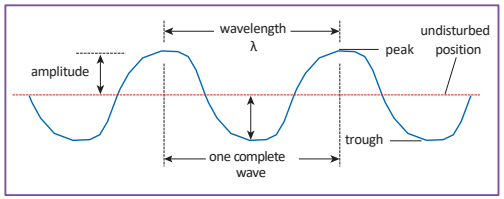


9. Wave motion is described by a number of properties.

Property	Description	Unit
amplitude A	maximum displacement of a point on a wave from its undisturbed position	metre (m)
frequency f	number of waves passing a fixed point per second	hertz (Hz)
period T	time taken for one complete wave to pass a fixed point	second (s)
wavelength λ	distance from one point on a wave to the equivalent point on the next wave	metre (m)
wave speed v	distance travelled by each wave per second, and the speed at which energy is transferred by the wave	metres per second (m/s)

Frequency and period are related by the equation:

$$\text{period (s)} = \frac{1}{\text{frequency (Hz)}} \qquad T = \frac{1}{f}$$



All waves obey the wave equation:

wave speed (m/s) = frequency (Hz) × wavelength (m)

$v = f\lambda$

6. When waves travel from one medium to another, their speed and wavelength may change but the frequency always stays the same.

The speed of ripples on water can be slow enough to measure using a stopwatch and ruler, and applying the equation:

$$\text{speed (m/s)} = \frac{\text{distance (m)}}{\text{time (s)}}$$

The speed of sound in air can be measured by using a stopwatch to measure the time taken for a sound to travel a known distance, and applying the same equation.

7. Reflection of waves (HT only)

When waves arrive at the boundary between two different substances, one or more of the following things can happen:

Absorption – the energy of the waves is transferred to the energy stores of the substance they travel into (for example, when food is heated in a microwave)

Reflection – the waves bounce back

Refraction – the waves change speed and direction as they cross the boundary

Transmission – the waves carry on moving once they've crossed the boundary, but may be refracted

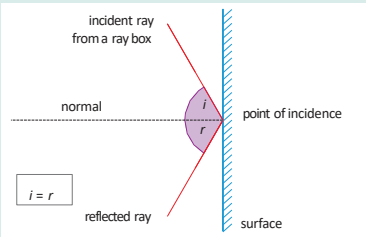
8. Ray diagrams can be used to show what happens when a wave is reflected at a surface.

To correctly draw a ray diagram for reflection:

1. use a ruler to draw all lines for the rays
2. draw a single arrow on the rays to show the direction the wave is travelling
3. draw a dotted line at right angles to the surface at the point of **incidence** (this line is normal to the surface)
4. label the normal, angle of incidence (i), and angle of reflection (r).

When reflection happens at a surface, the angle of incidence is always equal to the angle of reflection:

$i = r$



Keyterms

9. Make sure you can write a definition for these key terms.

absorption amplitude compression frequency incidence longitudinal mechanical wave oscillate period ray diagram reflection rarefaction transmission transverse wavelength wavespeed

Physics – Electromagnetic Waves

1. The electromagnetic spectrum

Electromagnetic (EM) waves are **transverse** waves that transfer energy from their source to an absorber. For example, infrared waves emitted from a hot object transfer thermal energy.

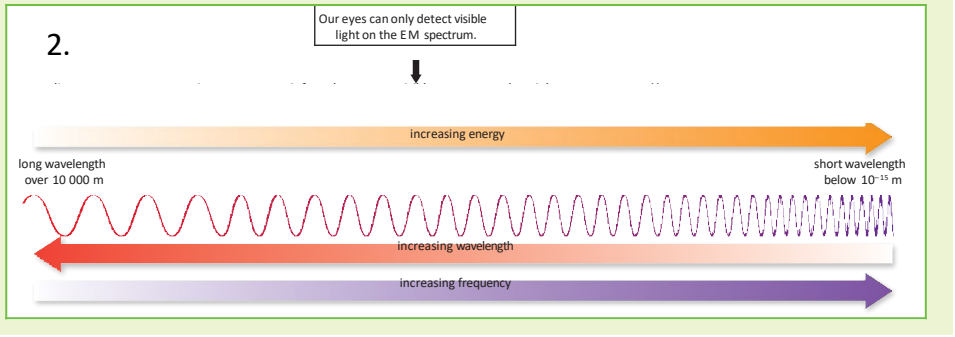
EM waves form a continuous **spectrum**, and are grouped by their wavelengths and frequencies.

EM waves all travel at the same velocity through air or a vacuum. They travel all at a speed of 3×10^8 m/s through a vacuum.

(HT only) Different substances may absorb, transmit, **refract**, or **reflect** EM waves in ways that vary with their wavelength.

Refraction occurs when there is a difference in the velocity of an EM wave in different substances.

2.



3. Infrared radiation (required practical)

This practical investigates the rates of absorption and radiation of infrared radiation from different surfaces.

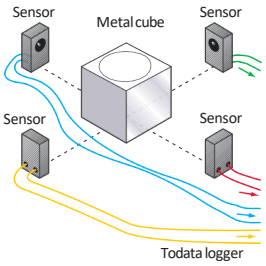
You should be able to plan a method to determine the rate of cooling due to emission of infrared radiation and evaluate your method.

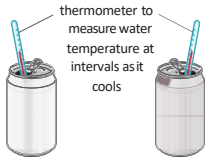
Using infrared detectors to measure the radiation emitted by different surfaces

Monitoring the rate of cooling in cans with different surfaces

To be accurate and precise in your investigation you need to:

- use an infrared detector with a suitable meter, where possible
- ensure that you always put the detector the same distance from the surface
- repeat measurements and calculate an average.





4. Properties of EM waves

EM waves of a wide range of frequencies can be absorbed or produced by changes inside an atom or nucleus. For example, gamma rays are produced by changes in the nucleus of an atom.

When electrons in an atom move down between energy levels, they emit EM waves.

5. Properties of radio waves (HT only)

Radio waves can be produced by **oscillations** in an electrical circuit.

When radio waves are absorbed by a receiver aerial, they may create an **alternating current** with the same frequency as the radio waves.

6. Uses of EM waves

EM waves have many practical applications, but exposure to some EM waves (such as those that are forms of ionising radiation) can have hazardous effects.

Radiation dose (in sieverts) is the risk of harm from exposure of the body to a particular radiation.

Type of EM wave	Use	Why is it suitable for this use? (HT only)	Hazards
radio waves	television and radio signals	• can travel long distances through air • longer wavelengths can bend around obstructions to allow detection of signals when not in line of sight	can penetrate the body and cause internal heating
microwaves	satellite communications and cooking food	• can pass through Earth's atmosphere to reach satellites • can penetrate into food and are absorbed by water molecules in food, heating it	
infrared	electrical heaters, cooking food, and infrared cameras	• all hot objects emit infrared waves – sensors can detect these to turn them into an image • can transfer energy quickly to heat rooms and food	can damage or kill skin cells due to heating
visible light	fibre optic communications	• short wavelength means visible light carries more information	can damage the retina
ultraviolet (UV)	energy efficient lights and artificial sun tanning	• carries more energy than visible light • some chemicals used inside light bulbs can absorb UV and emit visible light	can damage skin cells, causing skin to age prematurely and increasing the risk of skin cancer, and can cause blindness
X-rays	medical imaging and treatments	• pass easily through flesh, but not denser materials like bone • high doses kill living cells, so can be used to kill cancer cells – gamma rays can also be used to kill harmful bacteria	form of ionising radiation – can damage or kill cells, cause mutation of genes, and lead to cancers
gamma rays			

Key terms

8. Make sure you can write a definition for these key terms.

alternating current, electromagnetic wave, electromagnetic spectrum, oscillation, radiation dose, reflection, refraction, transverse

Normalmente voy de vacaciones en España porque hablo Español.	1	Normally I go on holiday in Spain because I speak Spanish.
Vamos en primavera cuando hace sol. En verano hace mucho calor.	2	We go in spring when it is sunny. In summer it is very hot.
Mi padre le gusta ir en coche porque es fácil pero a mi, me gusta ir en avion porque es rápido.	3	My dad likes to travel by car because it's easy, but I like to go by plane because it's fast
Durante las vacaciones voy a la playa y nado con mi hermano menor.	4	On holiday, we go to the beach and I swim with my younger brother.
Pero mis padres van al centro de la ciudad y compran recurdos ¡es aburrido!	5	But my parents go to the city centre and they buy souvenirs, it's boring!
Ayer tomé el sol y comí en un restaurante mexicano.	6	Yesterday I sunbathed and I ate at a Mexican restaurant.
El año pasado, fui a Mexico con mi familia y fue fantastico. Hizo buen tiempo.	7	Last year, I went to Mexico with my family and it was fantastic. It was good weather.
En el futuro, voy a visitar Cuba porque la cultura es muy interesante.	8	In the future, I am going to visit Cuba because the culture is very interesting
Me gustaría ver los coches antiguos, sería una experiencia muy divertido.	9	I would like to see the old cars, it would be very fun experience.