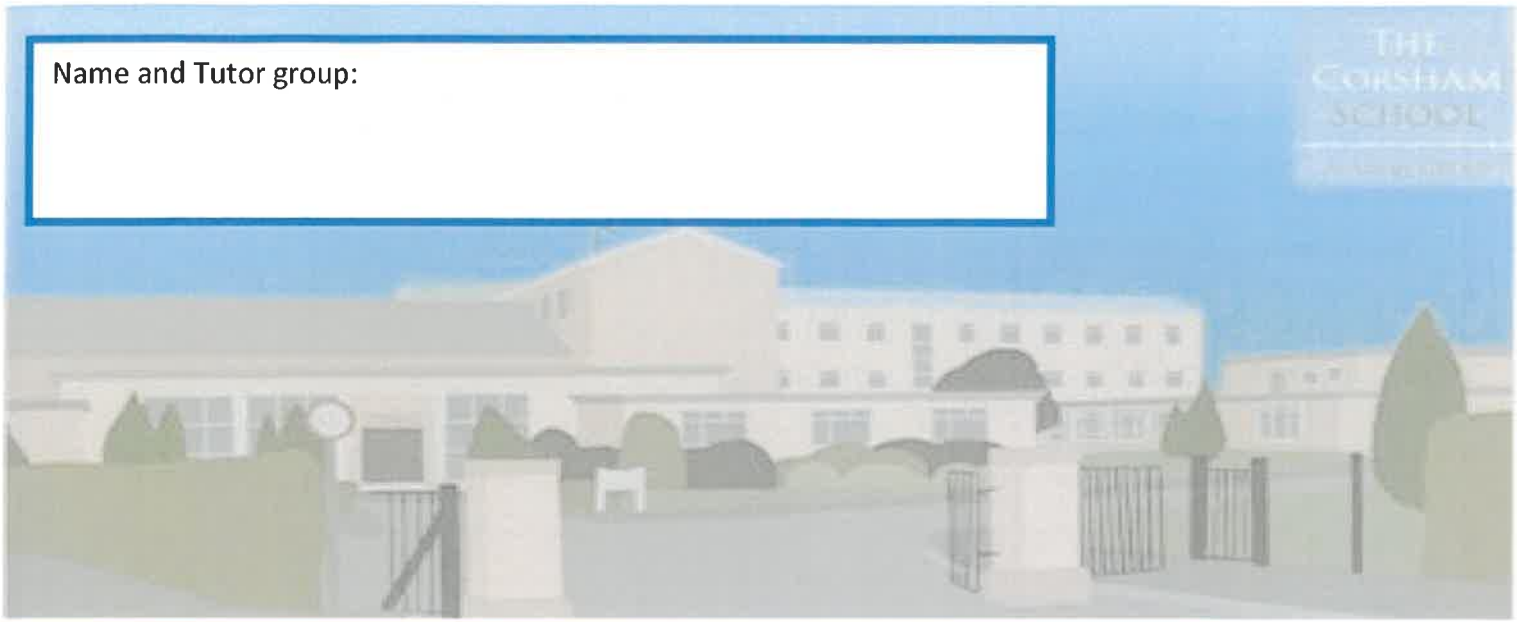
Name and Tutor group:



Year 9 Knowledge Organiser

Term 5

Contents

CORSHAM CHARACTER

INTELLECTUAL VALUES

The pursuit of truth, knowledge and understanding.

Be reflective. Be curious. Be open-minded. Be creative.

PERFORMANCE VALUES

Maximum effort, maximum focus.

Be resilient. Always Persevere. Contribute to Teamwork. Be ambitious.

DREAM BELIEVE ACHIEVE

Knowledge Organiser – Year 9 Art

"Transforming Reality" Surrealism Project

EXAMPLES OF FINAL OUTCOMES:

YOU WILL LEARN:

- What Surrealist Art is and its key concepts
- Famous Surrealist artists like Salvador Dal , Ren Magritte
- Concepts such as Metamorphosis, Distortion and Juxtaposition
- How to combine these new skills, more independently, to plan and create a personal response in a Surrealist portrait

Why am I learning this?

- To understand the principles of Surrealism and apply them to portraiture
- To explore techniques such as metamorphosis, symbolism and unexpected juxtapositions
- To encourage creativity and self-expression

Homework Tasks:

Tick when complete ✓

1. Surrealist Eyes
2. Animal metamorphosis
3. Photomontage Portraits
4. Plans for own surreal composition

HOW WELL AM I DOING?

CONTEXTUAL KNOWLEDGE:

Salvador Dali

Ana Maria

- Ana Maria is a street artist who uses the metamorphosis theme of animal/human faces to produce her large-scale pieces
- Dali uses Symbolism and distortion to represent hidden depths to his paintings
- Magritte explores unexpected juxtapositions in his compositions to play with reality

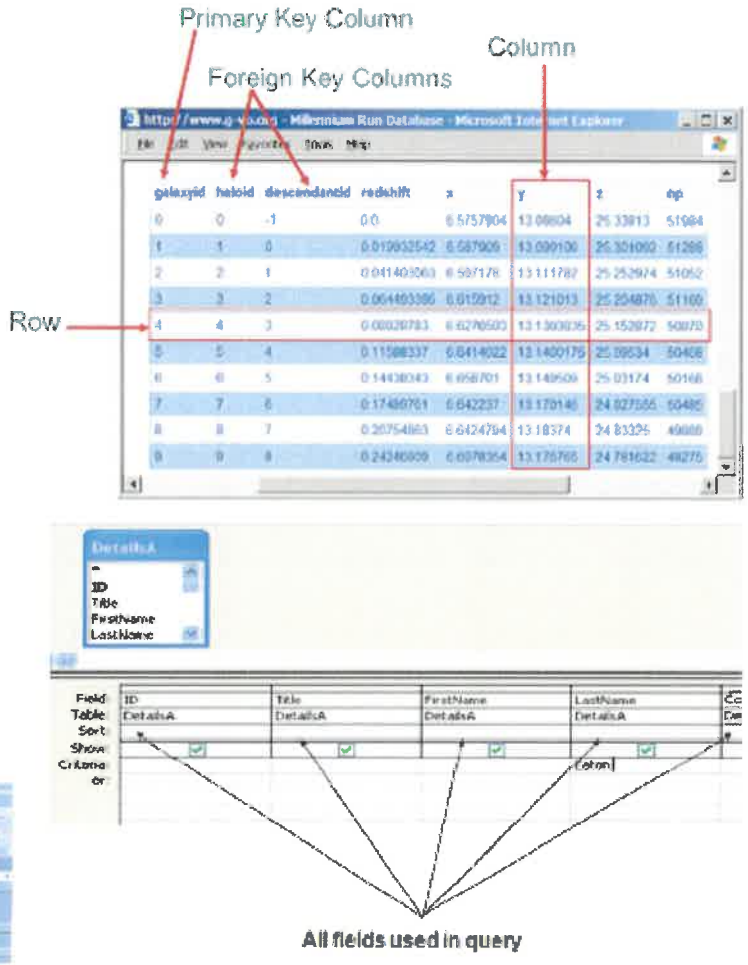
Keywords	
Surrealism	A style in art and literature in which ideas, images, and objects are combined in a strange way, like in a dream.
Portraits	A portrait is a painting, photograph, sculpture, or other artistic representation of a person
Metamorphosis	The transformation of something existing into something new
Distortion	A change, twist, or exaggeration that makes something appear different from the way it really is
Juxtaposition	The act or an instance of placing two or more things side by side often to compare or contrast or to create an interesting effect
Symbolism	The use of symbols or objects to represent deeper meanings or themes
Transform	To change completely the appearance or character of something or someone

Year 9 Database Knowledge Organiser

COMPUTING CORSHAM

Keywords

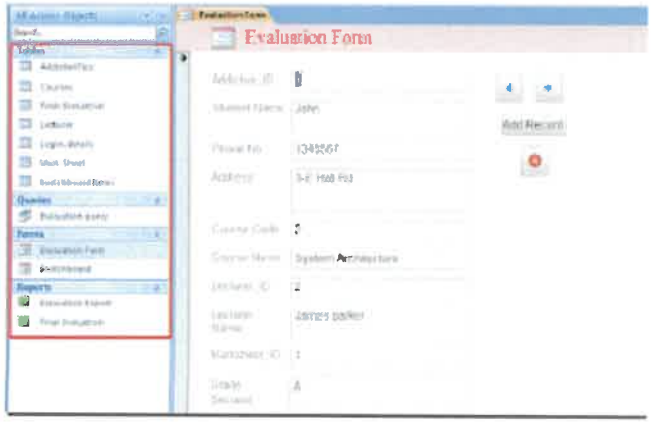
Word	Meaning/Description
Database	A **Database** is a collection of data.
Form	A **form** is used to make the database more user friendly.
Table	A **table** is a collection of rows.
Data Type	A **data type** is a data storage format that can contain a specific type or range of values.
Integers	**Integers** are whole numbers. For example: 4, 27, 65535.
Boolean	**Boolean** values are either 'True' or 'False' or 1 or 0.
Primary Key	A **primary key** is a unique number for an entity.
Row	A **row** is a collection of column values.
Field Size	The **field size** is the maximum size of characters allowed for each entry field.



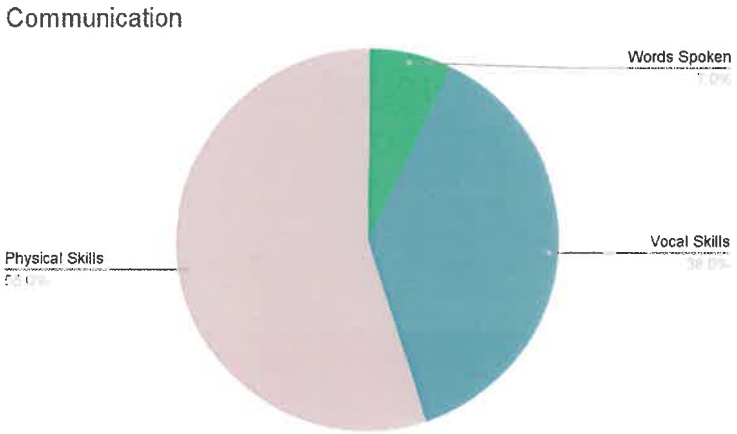
Data types

Projects

Field Name	Data Type
ID	AutoNumber
projectTitle	Long Text
partyID	Number
receiveDate	Date/Time
dueDate	Date/Time
deliveryDate	Date/Time
prepay	Currency
cost	Currency
projectTypeID	Number
lines	Number
pages	Number
words	Short Text
settled	Yes/No
projectComment	Long Text



Technique	Definition
Seven Levels of Tension	Different levels of physical or emotional tension an actor can use, from relaxed to very intense, to show different feelings or actions
Clocking the Audience	Paying attention to how the audience is reacting or where they are looking during a performance.
Major Focus	The main thing the actor focuses on while performing in a mask, which drives the character's actions
Minor Focus	Smaller details or secondary things the actor focuses on that support the main focus and add depth to the performance.
Suspension of Disbelief	The audience choosing to believe in the fictional world of a performance, even if it's unrealistic or fantastical.
Hot-seating	When an actor stays in character and answers questions from others to learn more about their character.



Year 9 – Term 5 - Mask

Rules of wearing mask

- Never speak through a full face Mask
- Always turn away from the audience when putting a mask on
- Always aim to face the audience when wearing a Mask
- Don't wear the Mask on your head like a hat
- Don't leave a Mask on the floor to be trod on.
- Only place the mask down face up.
- Do not touch the mask when wearing it

Identify which rules are about creating an illusion and which are health and safety?

14

Performance Skills		Techniques	Production Elements	Other
Vocal Skills	Physical Skills			
Tone Pitch Pace Projection Volume Emphasis Pause Accent Articulation/Diction	Body Language Gesture Facial Expressions Eye Contact Movement Posture	Major Focus Minor Focus Mime Freeze Frame Hot Seating	Staging	Rehearsal Performance Blocking Directing Devising Audience Awareness

Year 9 Food and Nutrition- Knowledge Organiser

Nutritional needs of people at different life stages	
Babies 0-1 year - Fast body growth and development. Energy needs increase with activity 	All nutrients, especially protein, vitamins and minerals Avoid adding sugar and salt to foods
Pre-school children 1-4 years - Fast body growth and development. A lot of energy is used in play.	All nutrients, especially protein, vitamins and minerals but Limit sugar & salt.
Children 5-12 years - Growth continues in spurts. Physical activity most of the time to prevent becoming overweight.	All nutrients, especially protein, vitamins and minerals Limit the number of free sugars and salt in foods and drinks
Teenagers - Fast body growth and development from child to adult. Minerals are put into the bones and teeth; Females start to have periods. Lack of sleep and pressures of school may lead to lack of energy and poor concentration	All nutrients, especially protein, vitamins and minerals Limit the number of free sugars and salt in foods and drinks 
Adults - Body stops growing at 21 years of age and needs to looked after to maintain health, prevent disease and be active Weight gain if the diet is unbalanced and not active	All nutrients, especially protein, vitamins and minerals 
Older adults The body needs to be looked after. Memory may become poor. Bones & teeth gradually start to lose minerals, and osteoporosis may develop.	All nutrients, especially protein, vitamins and minerals. Limit fatty and sugary foods to prevent weight gain.

Sustainable food – Sustainable food is food that is produced, processed, distributed, and disposed of in ways that are environmentally friendly and contribute to a healthy and nutritious food system. These food are unlikely to run out.




Nutrient	Functions - Why do we need it?	Sources
Carbs	Carbohydrates give us energy. Sugary ones give us quick release energy. Starchy ones give us slow release.	Bread, rice, pasta, potatoes
Protein	Needed for the growth and repair of our bodies and can also be used for energy.	Meat, fish, dairy products, tofu, soya, Quorn, nuts, sees, lentils
Fat	These keep us warm, protect us and provides our bodies with energy	Butter, oil, processed foods e.g. crisps, chips, chocolate, cake.
Water	Keeps us hydrated and keeps our body's working properly.	Fruit and vegetables, water, fruit juices, milk.
Vitamins	These are needed generally to keep us healthy. The allow all the chemical reactions in our body and protect us from diseases.	Fruit, vegetables, cereals, dairy products
Minerals	Helps build bones and teeth and allow muscles to work properly.	Green vegetables, dairy products and red meat
Fibre	These are needed to keep our digestive system working (help us go to the toilet) and helps to fill us up.	Wholegrain cereals, brown rice, pasta, bread, fruit, vegetables

Food Miles is the distance food travels from where it is grown to where it is purchased by the customer. The closer it is, the less damage to our environment.

Seasonality refers to the time of year when the food is at its peak, either in terms of harvest or flavour. This is usually when the product is cheapest and freshest.

Overfishing occurs when too many fish are caught at once, so the breeding population becomes too depleted to recover. It endangers ocean ecosystems and the billions of people who rely on seafood as a key source of protein. Buying fish with the blue **Marine Stewardship Council (MSC)** label, means the fish has been caught sustainably.

Fairtrade is a way of buying and selling products that ensure that the people who produce the goods receive a fair price. Fair trade brings a better standard of living for poor farmers in developing countries.

Keywords
Micronutrient, macro nutrient, sustainable food, seasonal food, food miles, fairtrade, overfishing, special diet.

Year 9 Electronics

DESIGN AND TECHNOLOGY

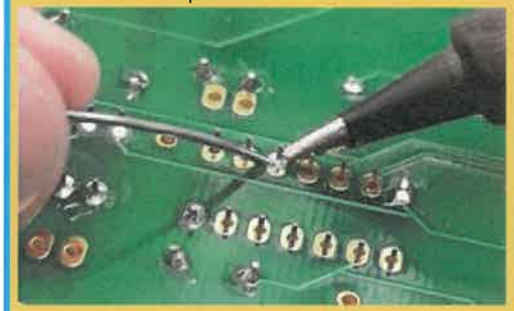
Tools and Equipment

Tools used for Soldering

Soldering iron, stand, sponge and heat mat		Electrically heated tip used to melt solder onto joint or PCB. Damp sponge used to clean the tip.
Side cutters		Cuts components or wire.
Helping hands tool		Holds wire, components or board whilst soldering.
Solder		Solder helps to connect components.
Wire Strippers		Used to remove the outer plastic layer of wires.

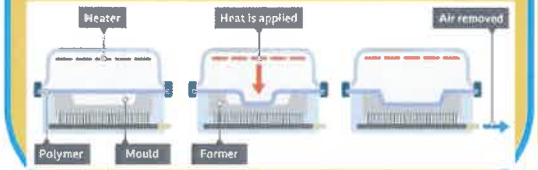
Soldering

Soldering is used to connect two or more contacts so that electricity can flow between components.



Vacuum Forming

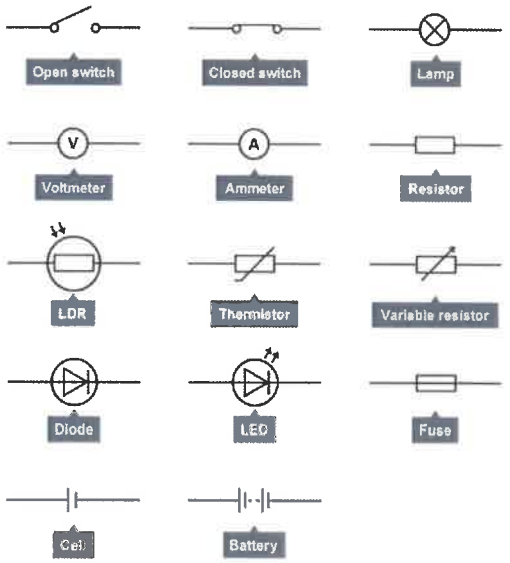
Vacuum forming is a polymer process. A sheet of thermoplastic is heated and pressed onto the former (mould) to create a shape.

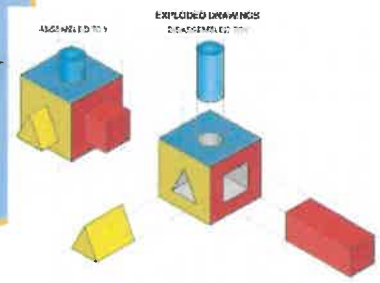


Keywords

- Cell
- Battery
- Resistor
- Lamp
- Circuit
- Buzzer
- Systems
- Input
- Output
- Switch
- Solder
- Wire Strippers
- Side Cutters
- Vacuum Former
- Mould
- Draft Angle
- HIPs

Circuit diagrams use simplified universal symbols to represent the electronic circuit and its components. These are some of the symbols used.





Memphis design movement

Established in the 1980s. Composed of designers based in Italy. Memphis designers, regarded aesthetics as the most important aspect of a product, not its function. Memphis designs/products can be regarded as pieces of art or exhibition pieces, not useable, practical items.

Maths in DT:

- Multiplication
- Divide
- Add / Subtract
- Measurement conversion
- Ratios
- Percentages
- Surface area

What is good design?

- Clear ideas
- Annotations
- Measurements
- Content
- Presentation
- Balance

Health and Safety in DT:

- Listen to your teacher's instructions
- Always wear an apron
- Long hair should be tied back
- Don't use equipment you are not trained on
- Always stand up during practical lessons
- When using machines, always wear safety glasses
- Only use the stop button in an emergency
- Work quietly and be sensible and careful at all times

Ettore Sotsass

KS3 Year 8/9 Design and Technology CAD CAM: Board Games

CAD: Computer Aided Design
CAM: Computer Aided Manufacture

Adobe Illustrator

Adobe Illustrator is the industry-leading graphic design tool that is a professional vector-based design and drawing program. Used as part of a larger design workflow, Illustrator allows for the creation of everything from single design elements to entire compositions.

TinkerCAD

Is a 3D modelling platform that has been launched by AutoDesk – a industry leading program. It allows you to create 3D models on the computer.

Key words

Vector	CAD/CAM	Automation
3D printing	Illustrator	Additive
Graphics	TinkerCAD	ACCESSFM

3D printing

3D printing is an additive technology used to manufacture parts. It is 'additive' in that it doesn't require a block of material or a mold to manufacture physical objects, it simply stacks and fuses layers of material. It's typically fast, with low fixed setup costs, and can create more complex geometries than 'traditional' technologies, with an ever-expanding list of materials. It is used extensively in the engineering industry, particularly for prototyping and creating lightweight geometries.

Tools and Equipment

CAD CAM

3D printer		3D printing or additive manufacturing is the construction of a three-dimensional object from a CAD model or a digital 3D model.
Template		A template is a tool used to mark out shapes repeatedly

Maths in DT:
Multiplication
Divide
Add / Subtract
Measurement conversion
Ratios
Percentages
Surface area

What is good design?
Clear ideas
Annotations
Measurements
Content
Presentation
Balance

Year 7 / 9 D&T RESISTANT MATERIALS

UCD &Modelling: Playgrounds

Tools and Equipment

Measuring and marking

Steel rule		An accurate tool for measuring and marking out.
Set square		A ruler to ensure you measure and mark accurate 45 / 90 degree angles.
Template		A template is a tool used to mark out shapes repeatedly

Card shaping and adhesives

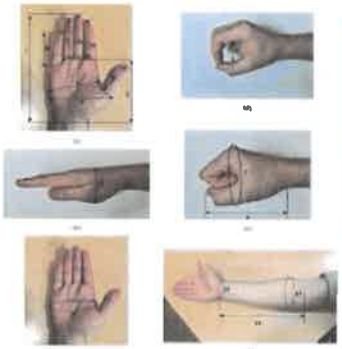
Slot		A joining technique to join card.
Curve cut		Kerf cutting (partial cuts) will ensure a smoother curve in the card.
Tabs		Tabs help to join the card components together.
Hot glue gun		An adhesive which joins card.
Masking tape		A temporary adhesive which joins card / paper.

Anthropometrics

Anthropometrics is the collection of maximum and minimum measurements of a target market. The data can be used to work out the dimensions of a product.

Ergonomics

Ergonomics Testing and analysing how a person interacts with the product can improve its ***functionality*** and how it fits into its surroundings.



Maths in DT:

Multiplication / Divide
Add / Subtract
Measurement conversion
Ratios /Percentages

Keywords

Modelling Iterative designs UCD
User needs Reformulate Creativity
Functional Innovative Anthropometrics
Ergonomics Social Client Testing
Evaluation

We use **ACCESS FM** to help us write a **specification** - a list of requirements for a design - and to help us **analyse and describe** an already existing product.

ACCESS FM - Helpsh

- **A** is for **Aesthetics**
- **C** is for **Cost**
- **C** is for **Customer**
- **E** is for **Environment**
- **S** is for **Size**
- **S** is for **Safety**
- **F** is for **Function**
- **M** is for **Material**

Cutting

Craft knife		A tool for precision cutting. This tool is used for accurate cutting of paper and card. Can cut in a straight or curved line.
Paper scissors		A tool for cutting paper or board.

Materials

Single corrugated card		Corrugations make the card strong.
Card		A compliant material which comes in a variety of colours .

Health and Safety in DT:

- Listen to your teacher's instructions
- Always wear an apron
- Long hair should be tied back
- Don't use equipment you are not trained on
- Always stand up during practical lessons
- When using machines, always wear safety glasses
- Only use the stop button in an emergency
- Work quietly and be sensible and careful at all times

Using quotations and useful phrases

When quoting, remember to:

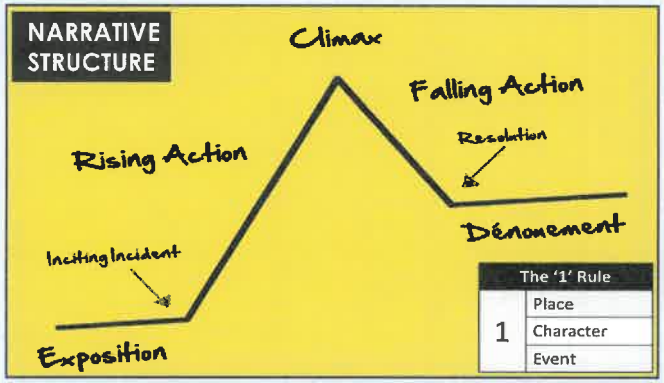
- use quotation marks
- quote accurately
- quotes of three words or fewer can be used in the sentence you are writing - for example, when the writer talks about the 'futility of life' he means...
- short, well-chosen quotations are better than long ones , so that you can give more precise analysis

If you are commenting on implicit meaning use some of these phrase to introduce analysis:

- this implies
- this suggests
- which gives the impression that
- possibly
- perhaps
- this indicates that
- this shows
- obviously

Use **connectives** to build your analysis:

- however
- therefore
- in contrast
- because
- but
- and
- furthermore
- also
- then
- at first



NARRATIVE VOICE

A story has to be 'told' to the reader and a 'narrator' is needed to do this. A narrator's voice can be first, second or third person.

First person: 'I' or 'we' to tell the story. In this case, the narrator is a character and you will read about events from their point of view. You are more likely to be able to relate to and sympathise with their feelings because of this.

Second person: 'you'. It is not often used in fiction texts and it's rare to find a story written entirely from this perspective (*try writing a piece in the second person to see how difficult it is*). However, some fiction texts, such as gamebooks (choose your own adventure) use this perspective.

Third person: 'he', 'she', 'it' or 'they'. The narrator of the story will usually be the writer. Some texts will give many different characters' viewpoints, but others will focus on one character, the hero or heroine, and the reader will usually relate to and sympathise with them more than others.

EXPLICIT V's IMPLICIT

Explicit meaning describes something that is very clear and without vagueness or ambiguity.

Implicit meaning often functions as the opposite, referring to something that is understood, but not described clearly or directly, and often using implication or assumption.

METHODS	DEFINITION
Allegory	Extended metaphor in which a symbolic story is told
Hyperbole	An exaggeration.
Imagery	Visually descriptive language
Motif	A recurring set of words/phrases or imagery for effect
Metaphor	a figure of speech that describes an object or action in a way that isn't literally true.
Onomatopoeia	A word that imitate the sound it represents.
Personification	A figure of speech in which an object is given human feelings, thoughts or attitudes.
Simile	A comparison that uses 'like' or 'as'.
Symbolism	Use of symbols to represent ideas or qualities

Enquiry: How similar are 20th century assassinations?

Outline: Assassinations have been used for centuries as a tactic by political groups to undermine their enemies through the murder of their leaders. The 20th century saw a spate of high profile murders which caused fundamental changes to politics and society, especially in the USA.

Date	Event	Summary
1962	Cuban Missile Crisis	When the USA and USSR almost began a nuclear war over Soviet missiles stored on Cuba.
1963	Assassination of John F. Kennedy	Assassinated in Texas whilst visiting the state to support the civil rights movement there.
1965	Assassination of Malcolm X	Assassinated in New York whilst giving a speech to a civil rights group.
1968	Assassination of Martin Luther King	Assassinated in Tennessee whilst on a tour for his work in the civil rights movement.
1968	Assassination of Robert Kennedy	Assassinated in California whilst campaigning to become the Democrat nominee for the 1968 election.
2011	Assassination of Osama bin Laden	Targeted in Pakistan by US special forces. He was on a most wanted list as he was held responsible for the terrorist attack, 9/11.
2017	Assassination of Kim Jong-nam	Targeted at an airport and killed by a nerve agent. His half-brother, Kim Jong-un, the leader of North Korea is suspected of ordering this.

Furthering learning

Want to find out more about Kennedy and Cuba?

History – Year 9
Knowledge Organiser
Topic 4

Key individuals

Jackie Kennedy. First lady to President Kennedy. After his assassination she helped to create the ideal image of his presidency as a "Camelot"

Robert Kennedy. Younger brother of JFK, he worked in the president's government and then ran for president on a platform to end poverty.

Coretta Scott King. Wife to Dr King, she tirelessly supported his work in the Civil rights movement and continued this after King's murder.

Malcolm X. A human rights activist who was a controversial in the Civil rights movement Born with the surname Little. he changed this to an X to remember those who lost their names when they were enslaved.

Key vocabulary:

Assassin: someone who carries out an assassination.
Assassination: a murder of someone who is important in politics.
Civil rights movement: a campaign to achieve equal rights for people of colour and to address the disadvantages suffered due to the legacy of slavery in the USA.
Camelot: an ideal society. The original Camelot was the legend of King Arthur and the so-called ideal country that he ruled.
Cold War: when the USA and the USSR competed to be the top superpower in the world.
Communism: an ideology which concerns sharing wealth and property in a society. The USSR claimed to follow these ideas.
Conspiracy theory: a belief that there has been a cover-up over an extremely shocking or unexplained event.
Democrat: a political party in the USA. They favour a big government which raises taxes to pay for more support for the vulnerable.
Politics: how a country is ruled and organised. This often concerns who has the power in a country.
Republican: a political party in the USA. They favour a small government which lowers taxes so that people rely on themselves.
Segregation: Black Americans living in the south of the USA were kept separately from white Americans in areas like education, transport....
Terrorism: violent actions which hurt and scare People to achieve political goals.

Prior learning:

Slavery
Assassination
Ideology

Enquiry: How similar are 20th century assassinations?

History – Year 9
Knowledge Organiser
Topic 4

Historical skill focus: similarity & difference

- How is the past similar to life now?
- How does the past differ to life now?

Remember to mention:	Areas you could mention include:	Starting sentences...
Similarities AND differences	Reasons for assassinations Key events during assassinations The assassins The consequences of the assassination	The key similarities between assassinations are... However, the main differences include...

Point = A key similarity was...
Evidence = This is shown by...
Explain = This is similar because...

Section B: Using similarity and difference: Write at least two paragraphs to answer this question:

How similar were the key assassinations in the 20th and 21st centuries?

Developing	Secure	Exceeding
I can explain key similarities and key differences between people's lives during two periods of time using PEE paragraphs.	I can explain key similarities and key differences between people's lives during two periods of time using PEEL paragraphs I can begin to judge the extent of the similarity or difference	I can explain key similarities and key differences between people's lives during two or more periods of time using PEEL paragraphs and detailed evidence. I can judge the extent of the similarity or difference and give reasons for these.

YEAR 9 – REASONING WITH GEOMETRY...

Enlargement & Similarity

@whisto_maths

What do I need to be able to do?

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

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

Keywords

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

Recognise enlargement & similarity

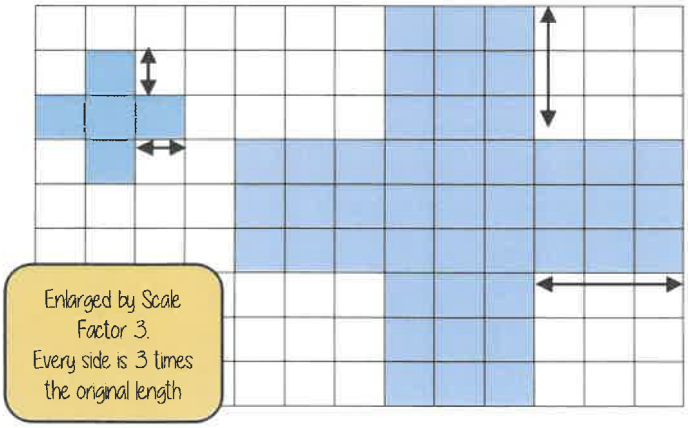
Shapes are similar if all pairs of corresponding sides are in the same ratio

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

Enlargements are similar shapes with a ratio other than 1

Enlarge by a positive scale factor

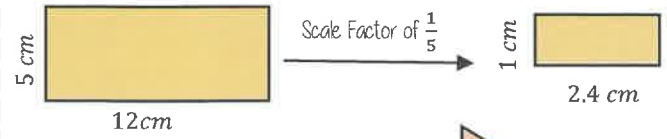
With a scale factor larger than 1 it makes the shape **bigger**

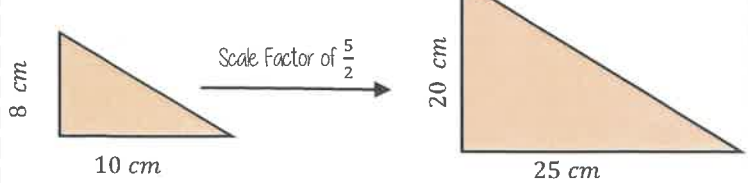


Enlarged by Scale Factor 3.
Every side is 3 times the original length

Positive fractional scale factor

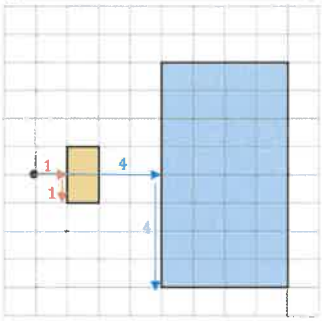
With a scale factor between 0 and 1 it makes the shape **smaller**





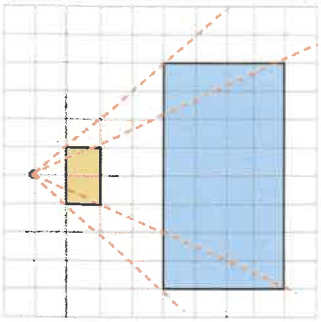
Enlarge a shape from a point

Scaled distances method



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

Rays method

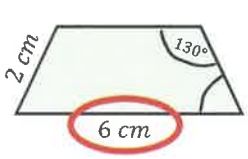


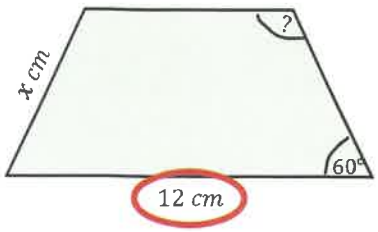
Multiply the distance from the centre of corresponding vertices by the scale factor along the ray

Calculations in similar shapes

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

The two trapezium are similar find the missing side and angle





Corresponding sides identify the scale factor $\frac{12}{6} = 2$ Scale Factor = **2**

Calculate the missing side Length (corresponding side) x scale factor

$2cm \times 2$

$x = 4cm$

Enlargement does not change angle size

Calculate the missing angle Corresponding angles remain the same

$130°$

YEAR 9 — REASONING WITH GEOMETRY...

Solving ratio & proportion problems

@whisto_maths

What do I need to be able to do?

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

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

Keywords

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

Direct Proportion

As one variable changes the other changes at the same rate

4 cans of pop = £2.40

This is a multiplicative change

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

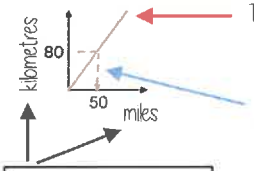
4 cans of pop = £2.40 → (×3) → 12 cans of pop = £7.20

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

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

Conversion Graphs

Compare two variables



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

Labelling of both axes is vital

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

Inverse Proportion

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

Examples of inversely proportional relationships

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

Time taken to paint a room and the number of workers

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

T	1	2	8
G	40	20	5

(÷2, ×4 above; ×2, ÷4 below)

Best Buys

Have a directly proportional relationship

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

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

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

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

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

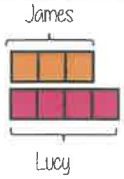
Best value is the most product for the lowest price per unit

Sharing a whole into a given ratio

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

Model the Question

James: Lucy
3 : 4



Find the value of one part

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

£350 ÷ 7 = £50

□ = one part = £50

Put back into the question

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

James = 3 × £50 = £150

Lucy = 4 × £50 = £200

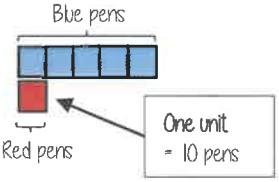
Finding a value given 1:n (or n:1)

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

Model the Question

Blue : Red
5 : 1

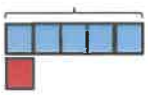
□ = one part = 10 pens



Put back into the question

Blue : Red
(×10) 5 : 1 (×10)
50 : 10

Blue pens = 5 × 10 = 50 pens



Red pens = 1 × 10 = 10 pens

There are 50 Blue Pens

YEAR 9 – REASONING WITH GEOMETRY...

Rates

@whisto_maths

What do I need to be able to do?

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

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

Keywords

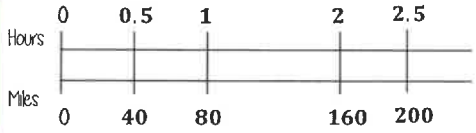
Convert: change
Mass: a measure of how much matter is in an object. Commonly measured by weight
Origin: the coordinate (0, 0)
Volume: the amount of 3D space a shape takes up
Substitute: putting numbers where letters are – replacing numbers into a formula

Speed, Distance, Time

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

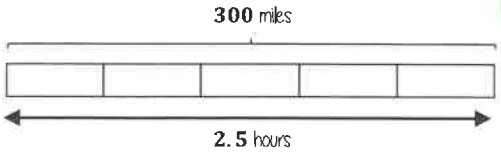
$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

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



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

Bar models can help to calculate mph



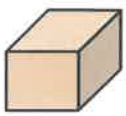
Each part is half an hour
Each part is 60 miles

Density, Mass, Volume

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

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

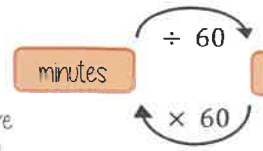
$$\text{mass} = \text{volume} \times \text{density}$$



volume of prism = Area of cross section × Depth

R

Speed, Distance, Time



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

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

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

Substitute in the variables given

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

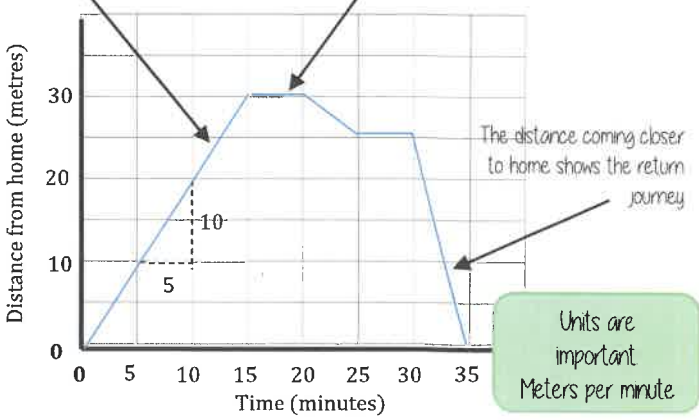
Distance – Time graphs

Gradient = speed

The steeper a gradient the faster the speed

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

Horizontal lines represent staying still



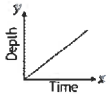
The distance coming closer to home shows the return journey

Units are important
Meters per minute

Flow problems & graphs

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

The cylinder will fill at a constant speed



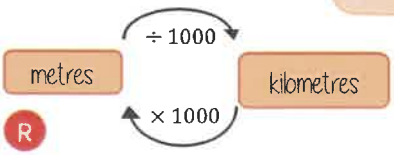
Units are important
Ensure any volume calculations are the same unit as the rate of flow

Rates of change & units

Common rates of change relationships

Revisit your conversions between units of length and capacity

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



R

What Makes a Good Song?

Exploring Popular Songs and Musical Arrangements

A. Popular Song Structure

SONG STRUCTURE – How a song is made up of or divided into different sections (see below) and the order in which these sections occur. To work out the structure of a song, it's helpful to analyse the **LYRICS and** listen to a recording for the song (for instrumental sections).

INTRO – often shortened to 'intro', the first section of a song which sets the mood of the song and is sometimes, but not always, an instrumental section using the song's chord pattern.

VERSES – songs normally have several verses. Verses introduce the song's theme and have the same melody but different lyrics for each verse which helps develop the song's narrative and story. Songs made up entirely of verses are called **STROPHIC**.

LINK – a optional short section often used to join different parts of a song together, often instrumental, and sometimes joins verses together or appears at other points within a song.

PRE-CHORUS – an optional section of music that occurs before the **CHORUS** which helps the music move forward and "prepare" for what is to come.

CHORUS – occurs several times within a song and contains the most memorable **HOOK/RIFF**. The chorus relays the message of the song and is repeated with the same melody and lyrics each time it is heard. In popular songs, the chorus is often repeated several times towards the end of the song.

MIDDLE 8/BRIDGE – a section (often 8 bars in length) that provides contrasting musical material often featuring an instrumental or vocal solo using new musical material allowing the performer to display their technical skill on their instrument or voice.

CODA/OUTRO – The final section of a popular song which brings it to an end (Coda is Italian for "tail"!)

B. Key Words

LYRICS – The words of a song, usually consisting of **VERSES** and a **CHORUS**.

HOOK – A 'musical hook' is usually the 'catchy bit' of the song that you will remember. It is often short and used and repeated in different places throughout the piece. Hooks can be either **MELODIC, RHYTHMIC** or **VERBAL/LYRICAL**.

RIFF – A repeated musical pattern often used in the introduction and instrumental breaks in a song or piece of music. Riffs can be rhythmic, melodic or lyrical, short and repeated.

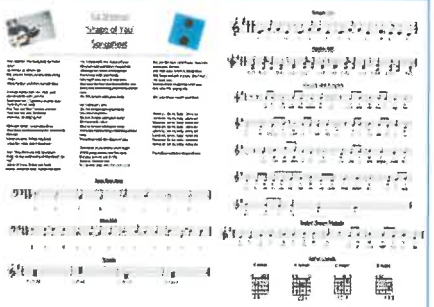
MELODY – The main tune of the song often sung by the **LEAD SINGER**.

COUNTER-MELODY – An 'extra' melody often performed 'on top of' the main melody that 'fits' with it a **DESCANT** or **INSTRUMENTAL SOLO**.

TEXTURE – The layers that make up a song *e.g., Melody, Counter-Melody, Hooks/Riffs, Chords, Accompaniment, Bass Line*.

C. Lead Sheet Notation and Arrangements

A **LEAD SHEET** is a form of musical **NOTATION** that contains only the essential elements of a popular song such as the **MELODY, LYRICS, RIFFS, CHORDS** (often as guitar chord symbols) and **BASS LINE**; it is not as developed as a ***FULL SCORE ARRANGEMENT*** and is open to interpretation by performers who need to use and adapt the given elements to create their own musical **ARRANGEMENT**: their "version" of an existing song.



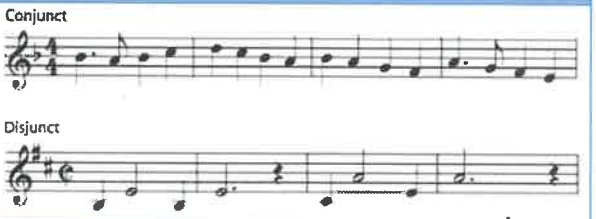
COVER (VERSION) – A new performance, remake or recording by someone other than the original artist or composer of the song.

D. Conjunct and Disjunct Melodic Motion

CONJUNCT MELODIC MOTION – Melodies which move mainly by step or use notes which are next to or close to one another.

DISJUNCT MELODIC MOTION – Melodies which move mainly by leap or use notes which are not next to or close to one another.

MELODIC RANGE – The distance between the lowest and highest pitched notes in a melody.



E. Song Timbre and Sonority (Instruments that are used to Accompany Songs)

Pop Bands often feature a **DRUM KIT** and **PERCUSSION** to provide the rhythm along with **ELECTRIC GUITARS (LEAD GUITAR, RHYTHM GUITAR** and **BASS GUITAR)** and **KEYBOARDS**. Sometimes **ACOUSTIC INSTRUMENTS** are used such as the **PIANO** or **ACOUSTIC GUITAR**. **ORCHESTRAL INSTRUMENTS** are often found in pop songs such as the **STRINGS, SAXOPHONE, TROMBONE** and **TRUMPET.**

Singers are essential to a pop song - **LEAD SINGER** – Often the "frontline" member of the band (most famous) who sings most of the melody line to the song. **BACKING SINGERS** support the lead singer providing **HARMONY** or a **COUNTER-MELODY** (a melody that is often higher in pitch and different, but still 'fits with' the main melody) and do not sing all the time but just at certain points within a pop song e.g. in the chorus.

Year 9 Terms 5 and 6: What does it mean to be human?

Building on the previous two Y9 modules as well as prior learning in other years on religious attitudes, this module looks to lead you into what will be the culmination of your KS3 Philosophy and Beliefs education. It specifically focuses on humanity both from the position of both an individual and a collective, comparing and contrasting different philosophical and religious views in order to explore the value and nature life, contrasting the prior module which viewed life from view of death. This will be done by exploring notions of 'free will', understanding differing religious views to the meaning for life while also analysing the uniqueness of humanity amongst other things. As with all modules, the aim is not only to ensure learners have a strong theoretical understanding of the different views, but are able to explore and rationalise their own views in an articulate and academic manner.

Personal Learning checklist:

○ What makes you, you? ○ How much is a human worth? ○ Are humans special? ○ What is the meaning of life?	○ How free are we really? ○ What does the future hold for humanity?

Assessment: To create a piece of art entitled 'Person' based on everything you have learnt in this topic and from previous topics i.e. Buddhism, Christianity, worship, belief and actions, suffering, evil, existence of God, morality and life after death

Keywords for this unit:

Materialist View*	The only things that exists in the world is the physical stuff	*Utopia/Dystopia*	An imagined place or state of things in which everything is perfect or far from perfect.
Personhood	What makes a person, a person?	*Existentialism**	The philosophical belief we are each responsible for creating purpose or meaning in our own lives (not God)
Uniqueness of Humanity	A socially learned and culturally-specific sense of humanness involving qualities that distinguish humans from other animals	*Absurdism*	e belief that the universe is irrational and meaningless and that the search for order brings the individual into
Purpose of Life	The central motivating aims of your life	*Utilitarianism**	An action is right in so far as it promotes happiness, and that the greatest happiness of the greatest number should be the guiding principle.
*Determinism**	The thesis that all events in the universe, including human decisions and actions, are causally inevitable.	Eudamonia*	Human Flourishing. he highest good humans could strive toward – or a life 'well lived
*Free Will**	voluntary choice or decision	*Evolution**	differential survival of organisms following their naturally occurring variation—a process Darwin termed "natural selection"
*Sanctity of Life**	Human life is sacred and is a gift from God	*Ātman**	The personal soul or self (Hinduism)

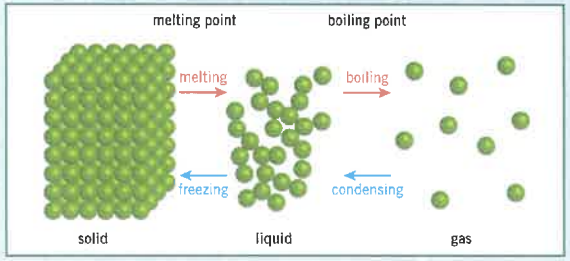
*Asterixed words are word that you have already encountered in K33

Chapter 3: Bonding 1

Knowledge organiser

Particle model

The three states of matter can be represented in the particle model.



(HT only) This model assumes that:

- there are no forces between the particles
- that all particles in a substance are spherical
- that the spheres are solid.

The amount of energy needed to change the state of a substance depends on the forces between the particles. The stronger the forces between the particles, the higher the melting or boiling point of the substance.

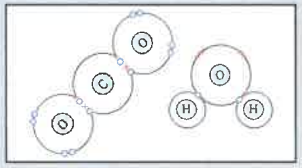
Covalent bonding

Atoms can share or transfer electrons to form strong chemical bonds.

A **covalent bond** is when electrons are *shared* between **non-metal** atoms.

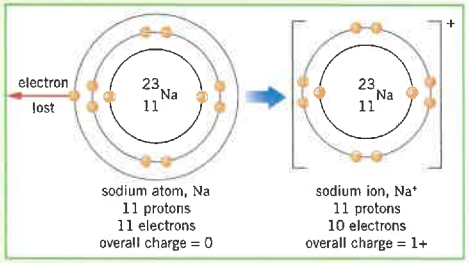
The number of electrons shared depends on how many extra electrons an atom needs to make a full outer shell.

If you include electrons that are shared between atoms, each atom has a full outer shell.
Single bond = each atom shares one pair of electrons.
Double bond = each atom shares two pairs of electrons.



Ions

Atoms can gain or lose electrons to give them a full outer shell. The number of protons is then different from the number of electrons. The resulting particle has a charge and is called an **ion**.



Conductivity

Solid ionic substances do not conduct electricity because the ions are fixed in position and not free to carry charge.

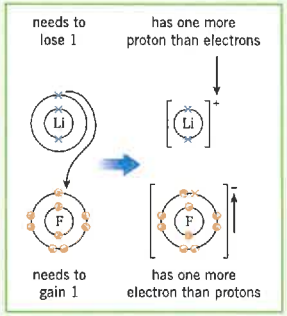
When melted or dissolved in water, ionic substances do conduct electricity because the ions are free to move and carry charge.

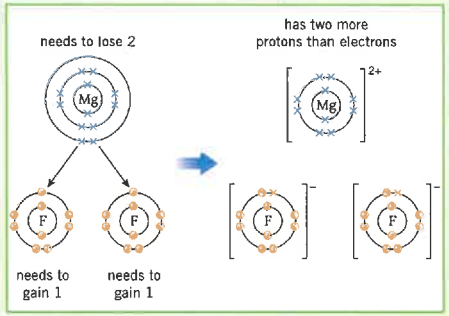
Melting points

Ionic substances have high melting points because the electrostatic force of attraction between oppositely charged ions is strong and so requires lots of energy to break.

Ionic bonding

When metal atoms react with non-metal atoms they **transfer** electrons to the non-metal atom.

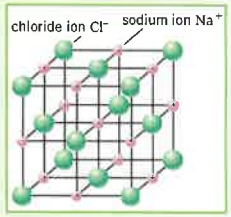




Metal atoms lose electrons to become positive ions. Non-metal atoms gain electrons to become negative ions.

Giant ionic lattice

When metal atoms transfer electrons to non-metal atoms you end up with positive and negative ions. These are attracted to each other by the strong **electrostatic force of attraction**. This is called ionic bonding.

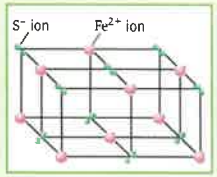


The electrostatic force of attraction works in all directions, so many billions of ions can be bonded together in a 3D structure.

Formulae

The formula of an ionic substance can be worked out

1. from its bonding diagram:
   for every one magnesium ion there are two fluoride ions – so the formula for magnesium fluoride is MgF_2
2. from a lattice diagram:
   there are nine Fe^{2+} ions and 18 S^- ions – simplifying this ratio gives a formula of FeS_2



Covalent structures

There are three main types of covalent structure:

Structure and bonding

Giant covalent

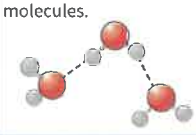
Many billions of atoms, each one with a strong covalent bond to a number of others.

An example of a giant covalent structure is diamond.

Small molecules

Each molecule contains only a few atoms with strong covalent bonds between these atoms. Different molecules are held together by weak **intermolecular forces**.

For example, water is made of small molecules.



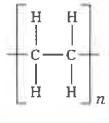
Large molecules

Many repeating units joined by covalent bonds to form a chain.

The small section is bonded to many identical sections to the left and right. The 'n' represents a large number.

Separate chains are held together by intermolecular forces that are stronger than in small molecules.

Polymers are examples of long molecules.



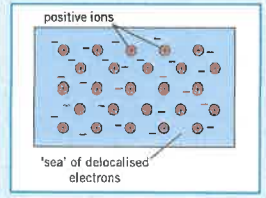
Metals: structure and properties

The atoms that make up metals form layers. The electrons in the outer shells of the atoms are **delocalised** – this means they are free to move through the whole structure.

The positive metal ions are then attracted to these delocalised electrons by the electrostatic force of attraction.

Some important properties of metals are:

- pure metals are **malleable** because the layers can slide over each other
- they are good **conductors** of electricity and of thermal energy because delocalised electrons are free to move through the whole structure
- they have high melting and boiling points because the electrostatic force of attraction between metal ions and delocalised electrons is strong so lots of energy is needed to break it.



Chapter 3: Bonding 2

Knowledge organiser

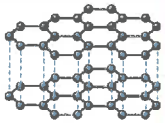
Properties			
	High melting and boiling points because the strong covalent bonds between the atoms must be broken to melt or boil the substances. This requires a lot of energy. Solid at room temperature.	Low melting and boiling points because only the intermolecular forces need to be overcome to melt or boil the substances, not the bonds between the atoms. This does not require a lot of energy as the intermolecular forces are weak. Normally gaseous or liquid at room temperature.	Melting and boiling points are low compared to giant covalent substances but higher than for small molecules. Large molecules have stronger intermolecular forces than small molecules, which require more energy to overcome. Normally solid at room temperature.

Most covalent structures do not conduct electricity because they do not have **delocalised electrons** or ions that are free to move to carry charge.

Graphite

Graphite is a giant covalent structure, but is different to other giant covalent substances.

Structure



Made only of carbon – each carbon atom bonds to three others, and forms hexagonal rings in layers. Each carbon atom has one spare electron, which is delocalised and therefore free to move around the structure.

Hardness

The layers can slide over each other because they are not covalently bonded. Graphite is therefore softer than diamond, even though both are made only of carbon, as each atom in diamond has four strong covalent bonds.

Conductivity

The delocalised electrons are free to move through graphite, so can carry charges and allow an electrical current to flow. Graphite is therefore a conductor of electricity.

Graphene

Graphene consists of only a single layer of graphite. Its strong covalent bonds make it a strong material that can also conduct electricity. It could be used in composites and high-tech electronics.

Fullerenes

- hollow cages of carbon atoms bonded together in one molecule
- can be arranged as a sphere or a tube (called a **nanotube**)
- molecules held together by weak intermolecular forces, so can slide over each other
- conduct electricity

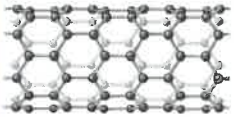
Spheres

Buckminsterfullerene was the first fullerene to be discovered, and has 60 carbon atoms.

Other fullerenes exist with different numbers of carbon atoms arranged in rings that form hollow shapes.

Fullerenes like this can be used as lubricants and in drug delivery.

Nanotubes

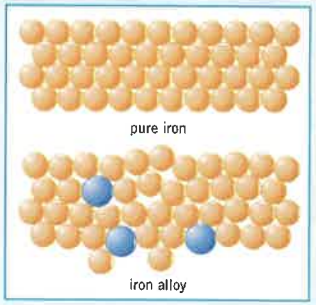


The carbon atoms in nanotubes are arranged in cylindrical tubes.
Their high **tensile strength** (they are difficult to break when pulled) makes them useful in electronics.

Alloys

Pure metals are often too soft to use as they are. Adding atoms of a different element can make the resulting mixture harder because the new atoms will be a different size to the pure metal's atoms. This will disturb the regular arrangement of the layers, preventing them from sliding over each other.

The harder mixture is called an **alloy**.



Measuring particles

We use different units and scales to measure the size of particles.

Particle	Particulate matter	Size	Standard form	Full form
grain of sand	N/A	0.1 mm	1×10^{-4} m	0.0001 m
coarse particles (e.g., dust)	PM_{10}	10 µm	1×10^{-5} m	0.00001 m
fine particles	PM_{25}	100 nm	1×10^{-7} m	0.0000001 m
nanoparticles	< PM_{25}	1 to 100 nm	1×10^{-9} to 1×10^{-7} m	0.000000001 m to 0.0000001 m

PM stands for **particulate matter** and is another way of measuring very small particles.

Uses of nanoparticles

Nanoparticles often have very different properties to bulk materials of the same substance, caused by their high surface area-to-volume-ratio.

Nanoparticles have many uses and are an important area of research. They are used in healthcare, electronics, cosmetics, and as catalysts.

However, nanoparticles have the potential to be hazardous to health and to ecosystems, so it is important that they are researched further.

Key terms

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

conductivity, conductor, delocalised electron, electrostatic force of attraction, ion, lattice, layer, malleable, nanoparticle, particulate matter, surface area to volume ratio, transfer

Chapter 3: Bonding

Retrieval questions

Learn the answers to the questions below then cover the answers column with a piece of paper and write as many as you can. Check and repeat.

C3 questions	Answers
1 How are covalent bonds formed?	by atoms sharing electrons
2 Which type of atoms form covalent bonds between them?	non-metals
3 Describe the structure and bonding of a giant covalent substance.	billions of atoms bonded together by strong covalent bonds
4 Describe the structure and bonding of small molecules.	small numbers of atoms group together into molecules with strong covalent bonds between the atoms and weak intermolecular forces between the molecules
5 Describe the structure and bonding of polymers.	many identical molecules joined together by strong covalent bonds in a long chain, with weak intermolecular forces between the chains
6 Why do giant covalent substances have high melting points?	it takes a lot of energy to break the strong covalent bonds between the atoms
7 Why do small molecules have low melting points?	only a small amount of energy is needed to break the weak intermolecular forces
8 Why do large molecules have higher melting and boiling points than small molecules?	the intermolecular forces are stronger in large molecules
9 Why do most covalent substances not conduct electricity?	do not have delocalised electrons or ions
10 Describe the structure and bonding in graphite.	each carbon atom is bonded to three others in hexagonal rings arranged in layers – it has delocalised electrons and weak forces between the layers
11 Why can graphite conduct electricity?	the delocalised electrons can move through the graphite
12 Explain why graphite is soft.	layers are not bonded so can slide over each other
13 What is graphene?	one layer of graphite
14 Give two properties of graphene.	strong, conducts electricity
15 What is a fullerene?	hollow cage of carbon atoms arranged as a sphere or a tube
16 What is a nanotube?	hollow cylinder of carbon atoms
17 Give two properties of nanotubes.	high tensile strength, conduct electricity
18 Give three uses of fullerenes.	lubricants, drug delivery (spheres), high-tech electronics
19 What is an ion?	atom that has lost or gained electrons
20 Which kinds of elements form ionic bonds?	metals and non-metals
21 What charges do ions from Groups 1 and 2 form?	Group 1 forms 1+, Group 2 forms 2+
22 What charges do ions from Groups 6 and 7 form?	Group 6 forms 2−, Group 7 forms 1−
23 Name the force that holds oppositely charged ions together.	electrostatic force of attraction
24 Describe the structure of a giant ionic lattice.	regular structure of alternating positive and negative ions, held together by the electrostatic force of attraction
25 Why do ionic substances have high melting points?	electrostatic force of attraction between positive and negative ions is strong and requires lots of energy to break
26 Why don't ionic substances conduct electricity when solid?	ions are fixed in position so cannot move, and there are no delocalised electrons
27 When can ionic substances conduct electricity?	when melted or dissolved
28 Why do ionic substances conduct electricity when melted or dissolved?	ions are free to move and carry charge
29 Describe the structure of a pure metal.	layers of positive metal ions surrounded by delocalised electrons
30 Describe the bonding in a pure metal.	strong electrostatic forces of attraction between metal ions and delocalised electrons
31 What are four properties of pure metals?	malleable, high melting/boiling points, good conductors of electricity, good conductors of thermal energy
32 Explain why pure metals are malleable.	layers can slide over each other easily
33 Explain why metals have high melting and boiling points.	electrostatic force of attraction between positive metal ions and delocalised electrons is strong and requires a lot of energy to break
34 Why are metals good conductors of electricity and of thermal energy?	delocalised electrons are free to move through the metal
35 What is an alloy?	mixture of a metal with atoms of another element
36 Explain why alloys are harder than pure metals.	different sized atoms disturb the layers, preventing them from sliding over each other
37 How big are nanoparticles?	1–100 nm
38 How are nanomaterials different from bulk materials?	nanomaterials have a much higher surface area-to-volume ratio
39 What is the relationship between side length and surface area-to-volume ratio?	as side length decreases by a factor of ten, the surface-area-to-volume ratio increases by a factor of ten
40 What are nanoparticles used for?	used in healthcare, electronics, cosmetics, and catalysts

Chapter 12: Wave properties

Knowledge organiser

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.

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

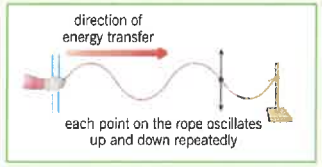
Examples of mechanical waves include sound waves, water waves, waves on springs and ropes, and seismic waves produced by earthquakes.

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

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.

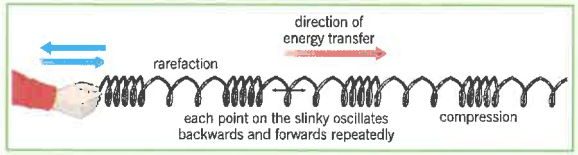


Longitudinal waves

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.



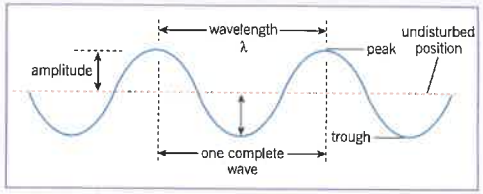
Wave motion is described by a number of properties.

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)

Properties of waves

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:

$$\text{wave speed (m/s)} = \text{frequency (Hz)} \times \text{wavelength (m)}$$

L $\quad v = f\lambda$

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:

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

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.

Reflection of waves

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

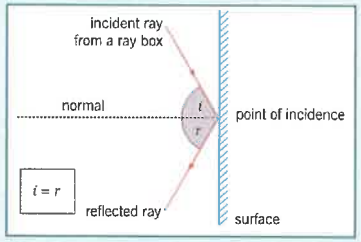
Ray diagrams can be used to show what happens when a wave is reflected at a surface.

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:

$$i = r$$



Key terms

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 · wave speed

Chapter 12: Wave properties

Retrieval questions

Learn the answers to the questions below then cover the answers column with a piece of paper and write as many as you can. Check and repeat.

	P12 questions	Answers
1	What is a transverse wave?	oscillations/vibrations are perpendicular (at right angles) to the direction of energy transfer
2	What is a longitudinal wave?	oscillations/vibrations are parallel to the direction of energy transfer
3	Give an example of a transverse wave.	electromagnetic waves
4	Give an example of a longitudinal wave.	sound waves
5	What is a compression?	area in longitudinal waves where the particles are squashed closer together
6	What is a rarefaction?	area in longitudinal waves where the particles are pulled further apart
7	What is the amplitude of a wave?	maximum displacement of a point on the wave from its undisturbed position
8	What is the wavelength of a wave?	distance from a point on one wave to the equivalent point on the adjacent wave
9	What is the frequency of a wave?	number of waves passing a fixed point per second
10	What unit is frequency measured in?	hertz (Hz)
11	What property of a wave always stays the same when it travels from one medium to another?	frequency
12	What rule do waves follow when they reflect off a surface?	angle of incidence = angle of reflection
13	What happens when waves are transmitted at a boundary between two substances?	they carry on moving at a different speed
14	What happens when waves are absorbed by a substance?	energy of the wave is transferred to energy stores of the substance

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Chapter 13: Electromagnetic waves

Knowledge organiser

The electromagnetic spectrum

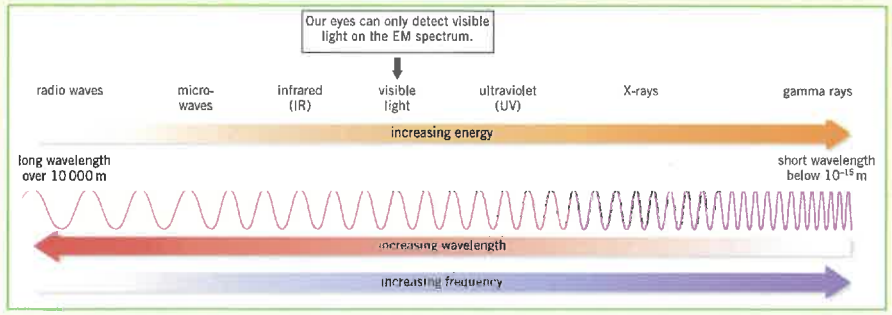
Electromagnetic (EM) waves are **transverse** waves that transfer energy from their source to an absorber. For example, infrared waves emitted from a hot object transfer thermal energy.

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.



Infrared radiation (required practical)

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

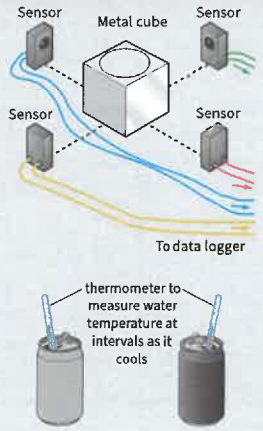
You should be able to plan a method to determine the rate of cooling due to emission of infrared radiation and evaluate your method.

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.



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.

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.

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

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

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

Chapter 13: Electromagnetic waves

Retrieval questions

Learn the answers to the questions below then cover the answers column with a piece of paper and write as many as you can. Check and repeat.

	P13 questions	Answers
1	Are electromagnetic (EM) waves longitudinal or transverse waves?	transverse
2	Explain why EM waves are not mechanical waves.	they can travel through a vacuum (don't need a substance to travel through)
3	What do EM waves transfer from their source to an absorber?	energy
4	List the different types of waves in the EM spectrum in order of decreasing wavelength (increasing frequency).	radio, microwave, infrared, visible, ultraviolet, X-rays, gamma
5	Which part of the EM spectrum can humans see?	visible light
6	How can electromagnetic waves be produced?	changes inside an atom/atomic nucleus
7	How are gamma rays produced?	changes in the nucleus of an atom, for example during radioactive decay
8	How can radio waves be produced?	oscillations in an electrical circuit
9	How can we detect radio waves?	waves are absorbed and create an alternating current with the same frequency as the radio wave
10	What are radio waves used for?	transmitting television, mobile phone, and Bluetooth signals
11	What are microwaves used for?	satellite communications, cooking food
12	What is infrared radiation used for?	heating, remote controls, infrared cameras, cooking food
13	Which types of EM waves are harmful to the human body?	ultraviolet, X-rays, gamma rays
14	What are the hazards of being exposed to ultraviolet radiation?	damage skin cells, sunburn, increase risk of skin cancer, age skin prematurely, blindness
15	Why are X-rays used for medical imaging?	they pass through flesh but not bone
16	Why are gamma rays used for treating cancer and sterilising medical equipment?	high doses kill cells and bacteria

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Chapter 16: Adaptations and interdependence

Knowledge organiser

Ecosystem organisation

Individual organisms

↓

Population
the total number of organisms of the same species that live in one specific geographical area

↓

Community
group of two or more populations of different species living in one specific geographical area

↓

Ecosystem
the interaction of a community of living organisms with the non-living parts of their environment

A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant.

An example of this is the interaction between predator and prey species, which rise and fall in a constant cycle so that each remains within a stable range.

Competition

To survive and reproduce, organisms require a supply of resources from their surroundings and from the other living organisms there.

This can create competition, where organisms within a community compete for resources.

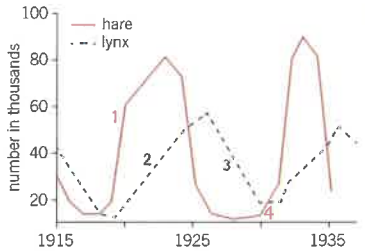
There are two types of competition – **interspecific competition** is between organisms of different species and **intraspecific competition** is between organisms of the same species.

Animals often compete for:	Plants often compete for:
• food	• light
• mates	• space
• territory.	• water and mineral ions from the soil.

Interdependence

Within a community each species **interacts** with many others and may depend on other species for things like food, shelter, pollination, and seed dispersal.

If one species is removed it can affect the whole community – this is called **interdependence**.



1 If the population of hares increases there is a larger food supply for the lynx.

2 This can therefore support more lynx, so more offspring survive.

3 The growing numbers of lynx eventually reduce the food supply. The number of predators starts to decrease.

4 The prey population starts to increase once more – the cycle then begins again.

Abiotic factors

Abiotic factors are non-living factors in the ecosystem that can affect a community.

Too much or too little of the following abiotic factors can negatively affect the community in an ecosystem:

- carbon dioxide levels for plants
- light intensity
- moisture levels
- oxygen levels for animals that live in water
- soil pH and mineral content
- temperature
- wind intensity and direction.

Biotic factors

Biotic factors are living factors in the ecosystem that can affect a community.

For example, the following biotic factors would all negatively affect populations in a community:

- decreased availability of food
- new predators arriving
- new pathogens
- competition between species, for example, one species outcompeting another for food or shelter, causing a decline in the other species' population.

Adaptations of organisms

Organisms have features – **adaptations** – that enable them to survive in the conditions in which they live. The adaptations of an organism may allow it to outcompete others, and provide it with an evolutionary advantage.

Structural adaptations

The physical features that allow an organism to successfully compete:

- sharp teeth to hunt prey
- colouring that may provide camouflage to hide from predators or hunt prey
- a large or small body-surface-area-to-volume ratio.

Behavioural adaptations

The behaviour of an organism that gives it an advantage:

- making nests to attract a mate
- courtship dances to attract a mate
- use of tools to obtain food
- working together in packs.

Functional adaptations

Adaptations related to processes that allow an organism to survive:

- photosynthesis in plants
- production of poisons or venom to deter predators and kill prey
- changes in reproduction timings.

You can work out how an organism is adapted to where it lives when given information on its environment and what it looks like.

For example, without the following adaptations the organisms below would be at a disadvantage in their environment.

Organism	Example adaptations
	• white fur for camouflage when hunting prey • feet with large surface area to distribute weight on snow • small ears to reduce heat loss • thick fur for insulation
	• feet with large surface area to distribute weight on sand • hump stores fat to provide energy when food is scarce • tough mouth and tongue to allow camel to eat cacti • long eyelashes to keep sand out of eyes
	• spines instead of leaves to reduce surface area and therefore water loss, and to deter predators • long roots to reach water underground • large, fleshy stem to store water

Some organisms are **extremophiles**, which means they live in environments that are very extreme where most other organisms could not survive. For example, areas with:

- very high or low temperatures
- extreme pressures
- high salt concentrations
- highly acidic or alkaline conditions
- low levels of oxygen or water.

Bacteria that live in deep sea vents are extremophiles.

Deep sea vents are formed when seawater circulates through hot volcanic rocks on the seafloor. These environments have very high pressures and temperatures, no sunlight, and are strongly acidic.

Key terms

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

abiotic factor · adaptation · biotic factor · community · ecosystem · extremophile · interaction · interdependence · interspecific competition · intraspecific competition · population

Chapter 16: Adaptations and interdependence

Retrieval questions

Learn the answers to the questions below then cover the answers column with a piece of paper and write as many as you can. Check and repeat.

	B16 questions	Answers
1	What is a population?	total number of organisms of the same species that live in a specific geographical area
2	What is a community?	group of two or more populations of different species living in a specific geographical area
3	What is an ecosystem?	the interaction of a community of living organisms with the non-living parts of their environment
4	What is competition?	contest between organisms within a community for resources
5	What is interdependence?	when species in a community depend on others for resources and shelter
6	What do animals often compete for?	food, mates, and territory
7	What do plants often compete for?	light, space, water, and mineral ions
8	What is an abiotic factor?	non-living factor that can affect a community
9	List the abiotic factors that can affect a community.	• carbon dioxide levels for plants • light intensity • moisture levels • oxygen levels for animals that live in water • soil pH and mineral content • temperature • wind intensity and direction
10	What is a biotic factor?	living factor that can affect a community
11	List the biotic factors that can affect a community.	• availability of food • new predators • new pathogens • competition between species
12	What is a stable community?	when all species and environmental factors are in balance, so population sizes remain fairly constant
13	How do adaptations help an organism?	they enable the organism to survive in the conditions in which it lives
14	What are the three types of adaptations?	structural, behavioural, and functional
15	What is an extremophile?	an organism that lives in a very extreme environment
16	What makes an environment extreme?	• very high or low temperatures • extreme pressures • high salt concentrations • highly acidic or alkaline conditions • lack of oxygen or water

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