



***SUMMER
KNOWLEDGE
ORGANISER***

YEAR 9

CONTENTS PAGE

Art & Design	1-2
Drama	3-4
Music	5-6
English	7
Geography	8-9
History	10-11
Maths	12-16
Religion and Ethics	17-18
Spanish	19-21
Science	22-40
Computer Science	41-42
Design Technology	43

Literacy / key words

Graffiti – A form of street art that involves writing or drawings made on walls or public surfaces, often created using spray paint or markers. It can be expressive, political, or simply decorative.

Mural – A large-scale artwork applied directly to a wall or ceiling, often commissioned or created legally to beautify urban spaces.

Stencil – A technique in which an artist cuts out a design on paper or cardboard and sprays or paints over it to create repeated, sharp-edged images on surfaces.

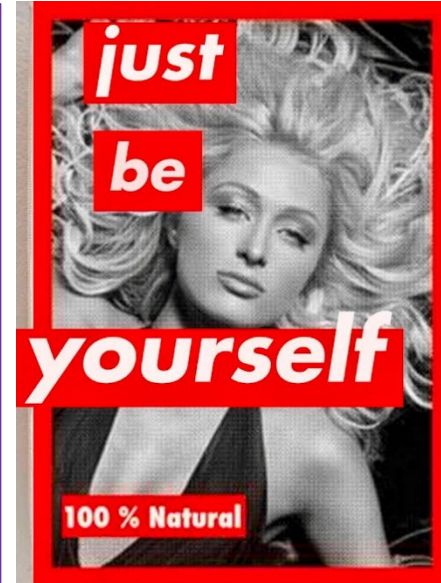
Tagging – A graffiti artist's personalised signature or symbol, usually written quickly as a form of self-

Pejac:

Pejac is a Spanish street artist known for his poetic and thought-provoking works that blend realism with surrealism. Using delicate brushwork, and stencils, he creates minimalist yet powerful pieces that address social, environmental, and political issues. His art often interacts with urban landscapes in unexpected ways, turning ordinary spaces into visual narratives. Pejac's work can be found on streets worldwide, as well as in gallery exhibitions.

Barbara Kruger:

Barbara Kruger is an American conceptual artist known for her bold, text-based works that combine black-and-white photography with provocative slogans in a signature red, black, and white colour scheme. Her art critiques power, consumerism, gender roles, and media influence, often using direct, confrontational phrases like "Your body is a battleground." Kruger's work is heavily influenced by advertising and propaganda, making strong political and social statements. Her work has been exhibited globally, influencing contemporary art and activism, and continues to challenge viewers to question authority, identity, and societal norms.



YEAR 9 Summer term- Street Art

Banksy:

Banksy is a British street artist known for his politically charged and often satirical works that critique society, capitalism, war, and authority. He primarily uses **stencilling**, a technique that allows for quick, repeatable, and highly detailed images on public surfaces. By layering pre-cut stencils and spray paint, Banksy creates striking, often monochrome pieces that blend humour with deep social commentary. His use of stencils helps maintain anonymity while ensuring a strong visual impact in urban environments.



Extra - Read/watch/do

- **Banksy-** <https://www.youtube.com/watch?v=8QS-HN1Wfyg>
- **Barbara Kruger-** <https://www.youtube.com/watch?v=8xi9qQb2SHU>
- **What is street Art?-** <https://www.bbc.co.uk/bitesize/articles/zdy9239>

Use this space to create your own street art 'tag'

Sticker bombing:

Sticker bombing is a form of street art that involves covering public spaces with a large number of stickers, often with unique, eye-catching designs or messages. Artists use stickers as a quick and easily reproducible medium to spread their artwork or statements across urban environments, including walls, street signs, lampposts, and even on other pieces of graffiti. This technique is often used by graffiti artists, urban explorers, and activists to create a visual presence, gain visibility, or challenge authority in an accessible way. While some view it as vandalism, others appreciate sticker bombing for its creativity, anonymity, and its ability to transform ordinary urban spaces into dynamic art galleries.



You will be assessed on

- Term 1 – Observational drawing (tonal shading)
- Term 2 – Biro pen drawing (Artist copy)
- Term 3 – Mixed media piece (Shepard Fairey inspired)

Collage:

Collage is an artistic technique that involves assembling different materials—such as photographs, newspaper clippings, fabric, or painted elements—onto a single surface to create a new composition. It allows artists to layer, juxtapose, and recontextualise images and text, often conveying bold messages or abstract ideas. Collage can also be used in street art, serving as a powerful tool for storytelling, critique, and visual experimentation.

Symbol:

Symbols in art are visual elements that represent deeper meanings or ideas beyond their literal appearance. Artists often use symbols to convey abstract concepts, emotions, or cultural messages, creating layers of meaning for the viewer to interpret. These symbols can be universal, like a dove representing peace, or highly personal, reflecting the artist's experiences or beliefs.

Stencilling:

Stencilling is a technique in which a design is cut out of a template, allowing paint or ink to be applied through the open spaces, creating sharp-edged images. In street art, stencilling is a powerful tool for quick, repeatable, and highly detailed works on urban surfaces. Artists like Banksy use stencils to produce striking, politically charged images in public spaces, often with bold messages that challenge authority, consumerism, and social issues. This method is favoured in street art for its efficiency and ability to create intricate, layered visuals while allowing for rapid execution and anonymity.

What techniques will I learn?

Mixed media:

Mixed media is an art technique that combines multiple materials and artistic methods in a single piece. It can include a mix of paint, ink, collage, fabric, sculpture, photography, or digital elements, allowing artists to experiment with texture, depth, and contrast. In street art, mixed media is often used to layer stencils, spray paint and posters to create dynamic urban artworks. This approach encourages creativity and innovation, blurring the boundaries between different art forms.

Wax resist:

Wax resist is a technique where a waxy substance repels water-based paint, creating contrast and texture in artwork. Using white oil pastel as the wax, you can draw patterns, lines, or shapes on paper before applying watercolour. Because oil pastels are non-water soluble, the watercolour will not adhere to the pastel marks, causing

Links to curriculum

English and History - In our lessons, we will look at political and global issues such as animal rights, human rights and activism.



Drama Knowledge Organiser



Plot

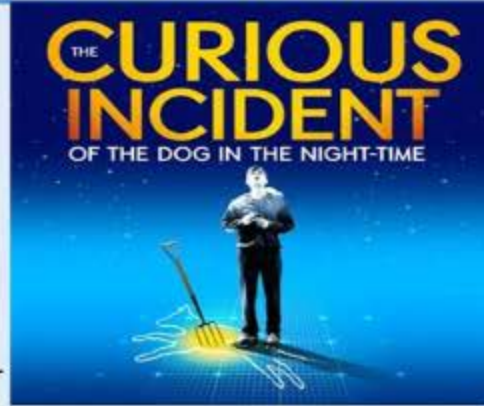
The Curious Incident of the Dog in the Night-Time is an adaptation by Simon Stephens of the original novel by Mark Haddon.

The Curious Incident of the Dog in the Night-Time follows the story of Christopher Boone, a 15 year old, who is exceptional at Maths but finds people confusing.

The play opens with Christopher discovering a dead dog in his neighbour, Mrs Shears', garden. Despite his father, Ed, warning Christopher not to get involved, Christopher decides to investigate the death of the dog. In doing so he discovers that his mother is not dead as his father had told him, but alive and well, living in London.

He also discovers that it was his father who killed the dog. Christopher feels that his father is a murderer, who he cannot trust. He can no longer live with him and so he bravely travels to London to find his mother. Christopher has difficulty settling into his new life in London and returns to Swindon to take his A-level Maths exam.

The play ends with him passing the exam and the realisation that he can do anything he puts his mind to.



CHARACTERS

Christopher Boone	The protagonist. A 15-year-old boy who is very good at maths but finds people confusing.
Ed Boone	Christopher's Dad. He cares about his son but is very hot-headed and stubborn.
Judy Boone	Christopher's Mum. Left due to not being able to handle his odd behaviour. Has a fun and romantic view of life.
Siobhan	Christopher's teacher. She is calm, patient and encouraging. She gives Christopher advice on what he should do.
Rodger Shears	Christopher's Mum's boyfriend. He is not understanding towards Christopher's needs and is often sarcastic
Mrs Shears	Rodger's wife. Helped Ed and Christopher. Wellington's owner.
Mrs Alexander	An elderly woman who lives on Christopher's street. She is kind and welcoming, but could also be seen as a gossip.

Vocal skills

Pitch
 Pace
 Pause
 Accent
 Emphasis
 Intonation
 Tone

Physical Skills

Posture
 Eye contact and its withdrawal
 Gesture
 Gait
 Interaction
 Body Language
 Mannerisms

Constantin Stanislavski
1863 - 1938



'The actor must use his imagination to be able to answer all questions (when, where, why, how).'

Believed that the audience should emotionally connect with the characters.

Actors should use their own experience to make their characters as believable as possible.

Terminology and techniques:

- The fourth wall
- Emotional memory
- The magic 'if'
- Sense memory
- Objectives
- Given circumstances
- Subtext
- Method of physical actions

Naturalism

Bertolt Brecht
1898 - 1956



'Art is not a mirror to reflect reality, but a hammer with which to shape it.'

Believed that theatre should be used to spread a message and comment on society.

The audience should always be aware they are watching a play and constantly questioning what they see.

Terminology and techniques:

- Breaking the fourth wall
- Alienation (Verfremdungseffekt)
- Gestus
- Use of placards
- Narration
- Multi-role
- Minimal set/costume/props
- Masks

Epic theatre

Frantic Assembly
1994 - Present

**FRANTIC
ASSEMBLY**

'We began with little more than a fierce work ethic and a desire to do something different and to do it differently.'

World-renowned theatre company who use physical theatre to devise performance.

Wanted to create non-realistic pieces of theatre through the use of movement and music.

Terminology and techniques:

- Chair duet
- Hymn hands
- Lifts
- Walk the grid
- Mirroring
- Round-By-Through

Physical theatre

To find out more about Naturalism, scan the QR code:



To find out more about Epic Theatre, scan the QR code:



To find out more about Physical Theatre, scan the QR code:





Music Knowledge Organiser



KEY WORDS – test yourself! (definitions on the next page)

INTERVAL	PEDAL NOTE	OMINOUS ENDING	FANFARE	TRIPLETS	LEITMOTIF
RITENUTO	STACCATO	DISSONANCE	PICCOLO	CONTRAST	OSTINATO

Year 9 Summer Term

The invention of the movie soundtrack changed the role of music in film. In the 1930s the role of the *film composer* began to emerge. Music was needed for the credits and for parts of the film with no dialogue, particularly the really dramatic sections. Many have REALLY good themes (leitmotifs) for their characters e.g. James Bond, Jaws, Superman.

Composers in big budget films use a full symphony orchestra. In modern times, films that do not have the large amounts of money can now employ one person using sampled sounds and a keyboard to re-create the sounds of a full orchestra.

Features of Movie Music:

- Lots of contrast to suit the drama – tempo changes, pitch changes, dynamics changes
- Syncopated rhythms
- Use of Symphony orchestra
- Leitmotifs (character themes)
- Cultural references in the music – choice of instruments and rhythms suitable to the location
- ‘Mickey Mousing’
- Interesting choice of tonality e.g. major = happy, minor = sad/mysterious, atonal = horror
- Diatonic music (can be heard by characters) and background music

What is Mickey Mousing?



A film technique that matches the music with the actions on screen. Walt Disney films often used this technique where the music almost completely works to mimic the animated motions of the characters.

John Williams is an American composer, conductor and pianist and has won 25 Grammy Awards! He is regarded as one of the most influential film composers. His work has influenced other film composers, as well as contemporary classical and popular music. Some of his most well-known films include: Star Wars, Jaws, Close Encounters of the Third Kind, Harry Potter, Jurassic Park and E.T.

Hans Florian Zimmer is a German film score composer and record producer. His works are notable for integrating electronic music sounds with traditional orchestral arrangements. Since the 1980s, Zimmer has composed music for over 150 films. His works include The Lion King, Dune, Pirates of the Caribbean, Gladiator. His films have grossed over 28 BILLION dollars at the box office world-wide!

Quincey Jones' legendary career spans over six decades in the entertainment industry. Jones's highlight-laden career includes producing everything from hits for Frank Sinatra and Count Basie to piloting *Off the Wall*, *Thriller*, and *Bad* for Michael Jackson. His work for *The Color Purple* was nominated for Best Original Score and Best Original Song in Steven Spielberg's first movie without composer John Williams.

Key Score: *In the Heat of the Night*, *The Italian Job*, *The Colour Purple*

KEY WORDS AND MEANINGS: Tier two words in BLUE, Tier three words in ORANGE

Interval	The distance between two notes e.g. a 4 th , 5 th , 7 th
Pedal (note)	A long, sustained note OR a repeated note in the bass line
Ominous ending	A tense and worrying ending to the piece created by using a long, low pitched note on cello
Fanfare	A fancy, brass 'announcement' that something or someone important has arrived e.g. The Queen
Triplets	Three notes that can be played in the space of two. Sounds like 'sau-sa-ges'
Contrast	Opposites e.g. Fast and Slow, Loud and Quiet, High and Low
Leitmotif	A theme for a character, place or item e.g. Luke Skywalker or the Death Star
Ritenuato	To gradually slow down
Staccato	To play the notes in a short and detached way
Dissonance	Clashing harmonies
Piccolo	A small flute – very high in pitch
Ostinato	Repetition – this could be a rhythm or a melody

Y9 Summer 2 KO: Friendship and Identity Poetry

Techniques:

- Metaphor - A comparison in which one thing is said to be another.
- Extended metaphor - A metaphor which is developed through the text.
- Semantic field - A semantic field is a group of words which are associated in some way to one another.
- Caesura - Caesura (pronounced see-ZOO-ra) refers to a break or pause in the middle of a line of verse indicated by a piece of punctuation.
- Free verse - Refers to the form of a poem that does not have a regular pattern of rhyme or rhythm.
- Sonnet - A sonnet is a one stanza, 14 line poem.
- Elegy - A poem or song that is written in dedication to someone who has died.

Key ideas/themes:

- **Oppression** - Based on or relating to a particular set of ideas of beliefs.
- **Revolution** - Unwillingness to accept views, beliefs, or behaviour that differ from one's own.
- **Self-love** - an appreciation of one's own worth or value.
- **Mother tongue** - The first language that you learn when you are a baby/growing up.
- **Unconventional** - not conforming to what is done or believed in society.
- **Bereavement** - The death of a close relative or friend.
- **Futility** - Useless or pointless
- **Materialism** - The attitude of someone who attaches a lot of importance to money and wants to possess a lot of material things.
- **Immortalise** - To give everlasting fame and life to someone or something.
- **Agency** - In this context agency means the capacity of individuals to act independently and make their own choices.

Sentence Starters

The writer creates the idea/ theme/ character to...

This is shown in the quote "..."

The word/ techniques suggests...

Also, the (word) emphasises...

Alternatively, it could also imply...

The audience will think/feel... because...

This links to the context of ... because...

The writer intended to...

Extra - Read/watch

King of Nothing – Nathanael Lessore

Noughts & Crosses – Malorie Blackman

Margot and Me – Juno Dawson

Inside Out (film)

Billy Elliot (film)

The Perks of Being a Wallflower – Stephen

Chbosky

The Hate U Give – Angie Thomas



Key terms / Literacy:

Erosion – the wearing away of the land or rocks due to a moving force e.g. wave action.

Hydraulic action – a type of erosion whereby the force of waves pushes water and air into cracks, forcing them open.

Weathering – the breakdown or disintegration of rock in situ (in its place).

Concordant – a type of coastline where the arrangement of hard and soft rocks sits behind one another parallel to the coastline.

Discordant – a type of coastline where the arrangement of hard and soft rocks sits next to each other, perpendicular to the coastline.

Saltation – a type of saltation where small stones hop along the seabed.

Longshore drift – the movement of beach material along a coastline due to the swash moving up the beach at an oblique angle.

Deposition – the laying down or dumping of material e.g. sand being deposited on a beach.

Engineering – ways of preventing erosion at the coast, either by preventing the natural processes of erosion (hard engineering), or working with nature to reduce the impacts (soft engineering).

How do weathering and erosion affect the coast?

- **Weathering** – Freeze-thaw weathering. This occurs in coastal areas with fluctuating temperatures above and below freezing. Water enters cracks in the rocks, freezes (expands), and then thaws (contracts). This continual freeze-thaw cycle widens the cracks, causing rock fragments to break off over time.
- **Erosion** – Hydraulic action – The power of waves crashing against a cliff or other rocky coastline compresses air in cracks and crevices, this breaks apart the rocks. Abrasion - when waves carrying sand, pebbles, and other sediment, strike the shoreline or cliffs. The friction from these materials hitting the land is similar to the action of sandpaper, which gradually wears away the rock.
- **Wave types** – Constructive waves are low energy waves that add material to the coastline (construct the coastline), low in height, long wave length, carry material on to the beach. Destructive waves are erosional waves, high in height, crash on to the beach which erodes/removes material from the beach.

What landforms are created from erosion?

Formation of a cave, arch, stack and stump.

1. A joint or fault is formed in a resistant (hard) rock.
2. Over time, erosion (hydraulic action and abrasion) widens the joint into a cave.
3. Wave action and erosional processes make the cave bigger until it cuts through the headland to make an arch.
4. The arch is eroded on the roof by weathering and erosion until it becomes too heavy and collapses.
5. This leaves a tall stack.
6. Over time, the stack is eroded from the top which leaves a stump.

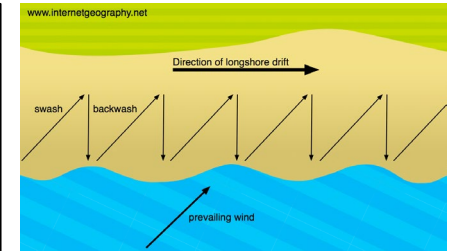
How does transportation affect the coast?

- **Traction** – sediment is transported along the seabed.
- **Saltation** – pieces of sediment are bounced along the seabed.
- **Suspension** – sediment is carried/suspended in the flow of the water.
- **Solution** – when sediment has been dissolved in the water and is carried in solution (not visible).

GEOGRAPHY: Year 9 – Coasts

What is longshore drift?

The prevailing wind causes the waves to approach the beach at an angle. The swash carries sediment up the beach at the same angle as the prevailing wind. The backwash carries the material back down the beach, but perpendicular to the beach at a right angle (90°). This carries sediment along the beach in a 'zig-zag' motion. Sediment is subsequently transported along the beach and deposited when the waves lose energy.



What is a spit?

A spit is a depositional landform formed when a 'finger' of sediment extends from the shore out to sea, often at a river mouth. When there is a change in the shape of the coastline, longshore drift continues to deposit material in the sea. This eventually breaks through the surface of the water so the long narrow spit can be seen. It usually has a curved end because of opposing winds and currents. Waves can't get past the spit, which creates a sheltered and low energy environment behind the spit. Silt is deposited here to create salt marshes or mud flats.

How can we protect the coastline?

Hard engineering e.g. Sea walls: a concrete or rock wall placed at the foot of a cliff or at the top of a beach. Often has a recurved face that reflects waves back to sea. These are highly effective at preventing erosion of the coast. Acts as a barrier to prevent flooding. Usually have promenades so people can walk along them. However, they create a strong backwash that erodes under the wall. Can look obtrusive and unnatural. Expensive to build and maintain – approx. £5,000-10,000/metre.

Soft engineering: e.g. beach nourishment - Pumping sand and shingle from elsewhere (e.g. from the seabed) or from lower down the beach to an existing beach to make it higher or wider. It creates wider beaches which slows down waves – also attracts tourists. Cheap and simple. Blends in with the existing beach. However, sand needs to be constantly replaced. Sand may be brought in from elsewhere, which might not blend in with geology. £5,000/metre

Extra: Read / Watch / Do:

Read: Where the World Ends by Geraldine McCaughrean.

Watch: Coast on BBC iPlayer.

Do: Visit the coast! Consider the processes that affected the features – is there a beach? Why?

Curriculum Links:

The content from this unit ties in with work in Y7 on Rivers and Y8 on Flooding considering how hydrology affects our landscapes and lives.

Assessment Skill - Writing to explain:

K: Show **knowledge** of the geographical issue in question e.g. hard engineering is more expensive than soft engineering to put in place.

PLC: Try to include some **place located content** i.e. a specific fact e.g. they cost between £5,000 - £10,000 per metre.

U: show your **understanding** by explaining why this feature is significant. You may use terms such as 'because', 'therefore', and 'as a result' e.g. paying for hard engineering strategies may mean less money available for other sort of infrastructure in the local area.

Literacy / key words

•**Emancipation** -the process of giving people social or political freedom and rights •**Jim Crow Laws**–Racial segregation laws in the Southern US. •**Segregation**–Separation of people based on race. •**Plessy v. Ferguson (1896)**–Supreme Court case that upheld "separate but equal." •**Brown v. Board of Education (1954)**– Supreme Court case that ruled segregation in schools unconstitutional. •**Civil Rights Act (1964)**–Banned discrimination based on race, colour, religion, sex, or national origin. •**Martin Luther King Jr.**–Civil rights leader advocating nonviolent protest. •**Malcolm X**–Civil rights leader advocating Black empowerment and self-defence. •**Constitutional** –legal in the eyes of the America constitution or government. •**Ku Klux Klan (KKK)**–White supremacist group opposing civil rights. •**Affirmative Action**–Policies to improve opportunities for historically marginalized groups.



Slavery in the USA was officially abolished in 1863 with the **Emancipation Proclamation** issued by Abraham Lincoln, although many historians recognise the end of slavery in America to be in 1865 when the American Civil War ended. This meant that American society now needed to find a jobs, housing and care for **over 3 million people** that had been forced into slavery through the triangular trade.



In many cases, people that had previously been enslaved remained on plantations and continued to do the same work as they had done before, but now with a small wage. In 1896 the US supreme court ruled that it was constitutional to have '**separate but equal**' facilities for black and white people. This legislation made it legal for America to segregate services like **schools, hospitals, restaurants and even busses**. This segregation was supported by laws that were known as **Jim Crow Laws**.

Emmett Till

- **14 year old African American boy from the Northern states of America.**
 - **In 1955 he was murdered by two white men for allegedly flirting with a white woman in a southern state of America where segregation was still practiced alongside Jim Crow laws.**
 - He had been beaten and shot
 - His mother requested an open casket as his funeral to show the barbarity and severity of his murder.
- The American people were horrified by this case and Emmett Till's murder is seen as the catalyst for the Civil Rights Movement**



Scan the QR code to learn more.



Resistance to segregation –case studies



Montgomery bus boycott

Buses in Montgomery Alabama were segregated in 1955. On December 5th 1955 Rosa Parks refused to give up her seat to a white person on a full bus which led to her arrest. This led to a group of African American protestors, supported by white Americans refusing to use the bus service until they integrated them



Greensboro sit ins

In the 1960s lunch counters were segregated. Young African American students staged a sit in Greensboro, North Carolina. They sat at the counter for white customers and requested to be served. This turned into a worldwide movement that was met with aggression but the sit in protestors remained non-violent.



Little Rock Nine

The Supreme Court ruled in 1954 that segregation in schools was unconstitutional. One of the first to attempt integration was Little Rock Central High School, Arkansas in 1957. 9 black students were enrolled, but on their first day met with abuse and prevented from entering the school. The national guard was called in by the president to protect the students to be able to get into school

Extra - Read/watch/do



Holt, Thomas C. *The movement: The African American struggle for civil rights*. Oxford University Press, 2021.
History of Civil Rights in the UK on blackhistorymonth.org.uk



Selma (film) 2014. Martin Luther King Jr's I have a dream speech.

You will be assessed on

Causes and consequences of the civil rights movement in the USA and the UK. Key figures involved in the movement and key events.

Links to curriculum

Geography
English
PSHE

Literacy / key words

- **Race Relations Act (1965, 1968, 1976, 2000)**—Laws against racial discrimination.
- **Commonwealth Immigration Acts (1962, 1968, 1971)**—Restricted immigration from former colonies.
- **Brixton Riots (1981)**—Protests against racial discrimination and police brutality.
- **Stephen Lawrence Case (1993)**—Racially motivated murder that led to police reform.
- **Windrush Generation**—Caribbean migrants who faced discrimination in the UK.
- **Macpherson Report (1999)**—Found institutional racism in UK policing.
- **Equality Act (2010)**—Protects against discrimination based on race, gender, disability, etc.
- **Notting Hill Riots (1958)**—Clashes between white nationalists and Black communities.
- **National Front**—Far-right group opposing immigration and multiculturalism.

Martin Luther King

- **Dignified, intelligent, peaceful:** helped win support not only of black Americans but also many white Americans
Made it clear that the protestors were the victims of police brutality
- **Outrage at the use of Water Cannons on protestors during the Birmingham Campaign in 1963**
- **Peaceful protests** -without this message, the protests could have spilled into violence, which some white Americans could have twisted to support their views that African-Americans were brutal thugs who did not deserve the same rights as they did not follow the law
- **1964 The Civil Rights Act desegregated many states and improved the lives of millions of black Americans. MLK played a key role in getting this act passed.**



Scan the QR code to learn more



Malcolm X

- **Believed peaceful protest was not bringing change fast enough and violence was needed in some cases**
 - **Used his speeches to inspire people, more to remind people that they have a voice and should use it.**
 - **Inspired young African Americans who were unhappy with their treatment and felt that the civil rights movement was not improving their lives**
- Key role in the development of the Black Power Movement and the idea that being black was something to be proud of rather than to be made to feel ashamed of**
Gained publicity for black civil rights campaigns

Civil Rights in the UK



The roots of the Notting Hill Riots are found in the migration of people from the Caribbean to London right after World War II. With the population influx, Notting Hill became a more international district. Claudia Jones was a key figure.



Scan the QR code to watch a clip



The Bristol Bus Boycott of 1963 came from the refusal of the Bristol Omnibus Company to employ black or Asian bus crews in the city of Bristol, England.

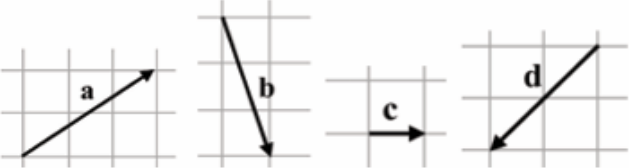
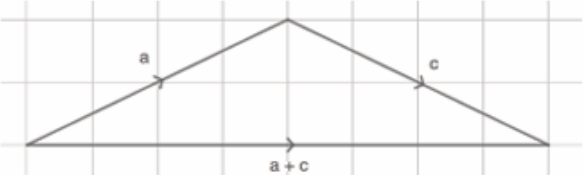
In British cities, there was widespread racial discrimination in housing and employment at that time. The boycott was led by Paul Stephenson. The boycott of the company's buses by Bristolians lasted for four months until the company backed down and overturned the colour rule.



KPI 9.17 Interior and Exterior Angles

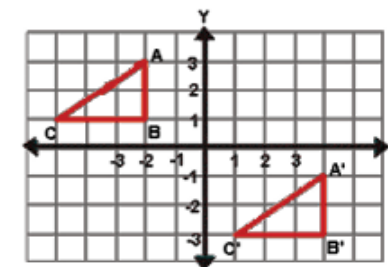
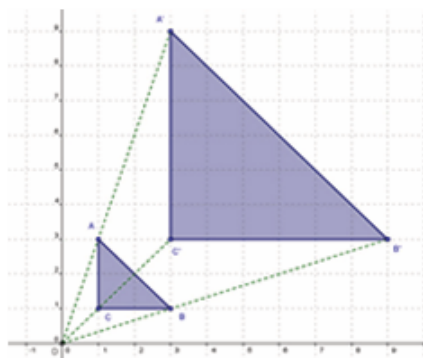
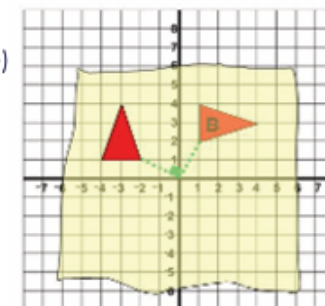
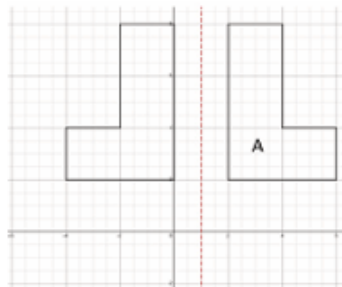
1) Polygon	A polygon is a two-dimensional shape with 3 or more straight sides. A polygon is either regular or irregular: Regular – side lengths are equal, and all angles are equal. Irregular – side lengths are unequal, and angles are unequal.		
2) 3 sides	Triangle	3) 4 sides	Quadrilateral
4) 5 sides	Pentagon	5) 6 sides	Hexagon
6) 7 sides	Heptagon	7) 8 sides	Octagon
8) 9 sides	Nonagon	9) 10 sides	Decagon
10) 11 sides	Hendecagon	11) 12 sides	Dodecagon
12) Exterior Angles	Exterior angles of polygons sum to 360° . An exterior angle of a <u>regular</u> polygon is found by calculating $\frac{360}{n}$ n is the number of sides.	13) Interior Angles	In a regular polygon. Interior Angle + Exterior Angle = 180°
14) Tessellation	A pattern created with identical shapes that fit together with no gaps.		

KPI 9.18 Vectors 1

1) Vector	Vectors represent movement of a certain size in a certain direction, they are represented on a diagram with an arrow.		
2) Magnitude	Magnitude is defined as the length of a vector.	3) Scalar	A scalar is the number we multiply a vector by.
4) Column vector	$\begin{pmatrix} a \\ b \end{pmatrix}$ a: movement along the x-axis (left/right) b: movement along the y-axis (up/down)		
5) Adding and subtracting column vectors	$\begin{pmatrix} a \\ b \end{pmatrix} + \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} a + c \\ b + d \end{pmatrix}$	6) Multiplying vectors	To multiply a column vector by a number, we multiply both values in the vector by that number.
7) Resultant vectors	The resultant vector is the vector that results from adding two or more vectors together.		
8) Parallel vectors	Travel in the same or opposite direction. Can be of varying lengths. Must be scalar multiples of one another.	The vectors $\begin{pmatrix} 8 \\ 12 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ are parallel because $\begin{pmatrix} 8 \\ 12 \end{pmatrix} = 4 \begin{pmatrix} 2 \\ 3 \end{pmatrix}$	

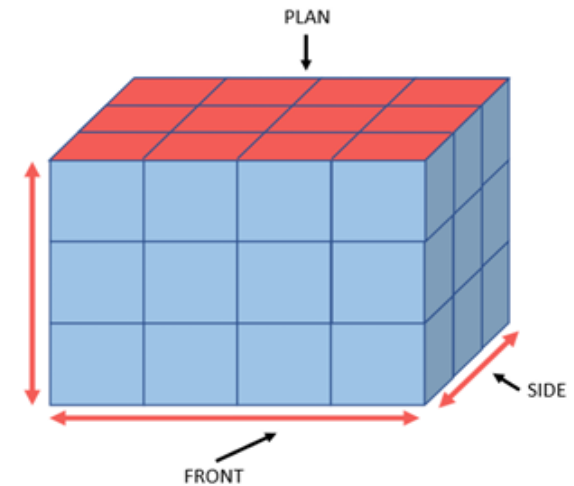
KPI 9.19 Transformations 1

1) Transformations	There are four types of transformations: Reflection Rotation Enlargement Translation	2) Object	This is the original shape used to perform the transformation on
3) Image	This is the new shape created as the result of the transformation.	4) Congruent	Two (or more) shapes that are the same size and the same shape.
5) Reflection	A shape is reflected in a line of symmetry. When a shape is reflected the image is always congruent to the object. The line of symmetry used must be given or found using an equation. An object and its image are always the same perpendicular distance from the line of symmetry. E.g. Reflect shape A in the line $x=1$	6) Rotation	When rotating a shape we must have 3 pieces of information. Centre of rotation given as a coordinate (x,y) Angle of rotation (usually $90^\circ, 180^\circ, 270^\circ$) Direction (clockwise or anticlockwise)
7) Enlargement	When enlarging a shape we must have two pieces of information. Centre of enlargement given as a coordinate (x,y) Scale factor	8) Translation	A translation is a movement of an object When a shape is translated the image is congruent to the object. Translations are described using column vectors $\begin{pmatrix} a \\ b \end{pmatrix}$ a: movement along the x-axis (left or right) b: movement along the y-axis (up or down) E.g. Translate the original triangle ABC by the vector $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$



KPI 9.20 Plans and Elevations

1) Plan	View looking vertically downwards.
2) Side elevation	View looking horizontally from the side.
3) Front elevation	View looking horizontally from the front.



KPI 9.21 Arcs and Sectors

1) Circumference	The perimeter of the circle. $C = \pi d$	5) Area of a circle	$A = \pi r^2$
2) Perimeter of a semi-circle	$P = \frac{\pi d}{2} + d$	6) Area of a semi-circle	$A = \frac{\pi r^2}{2}$
3) Perimeter of a quarter-circle	$P = \frac{\pi d}{4} + 2r$	7) Area of a quarter-circle	$A = \frac{\pi r^2}{4}$
4) Perimeter of a three-quarter circle	$P = \frac{3}{4} \pi d + 2r$	8) Area of a three-quarter circle	$A = \frac{3\pi r^2}{4}$

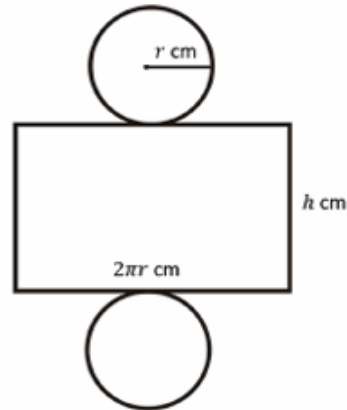
KPI 9.22 Surface Area

1) Surface Area

The total area of the surface of a three-dimensional object. For example, the surface area of a cube is the area of all 6 faces added together. It is measured in square units. E.g. square centimetres (cm²), square metres (m²).

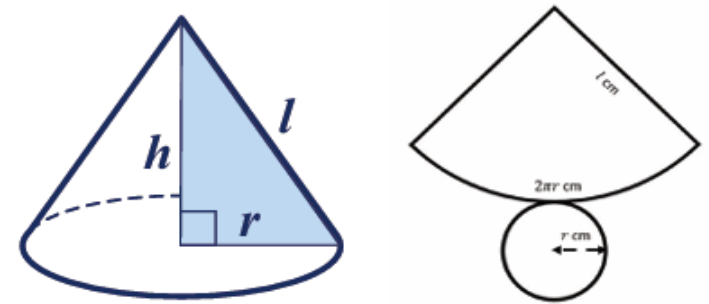
2) Cylinder

$$\text{Surface Area} = 2\pi r^2 + 2\pi rh$$



3) Cone

$$\text{Surface Area} = \pi r^2 + \pi rl$$



4) Sphere

$$\text{Surface Area} = 4\pi r^2$$

5) Hemi-sphere

$$\text{Surface Area of a Hemi-sphere} = 3\pi r^2$$

Literacy / key words

Ritual: Planned actions or ceremonies done for religious or cultural reasons.

Community: A group of people living together and sharing common interests, values, and goals.

Sacred: Holy, blessed, or set apart for worship or reverence.

Numinous: The presence of a divine or spiritual quality that evokes awe and reverence.

Identity: The unique traits and features that make someone who they are.

Shared identity: Common characteristics, experiences, or values that bind a community together.

Diversity: Having different people in a group or community.

Charity: Providing help, support, or resources to those in need, often through acts of kindness and generosity.

Extra - Read/watch/do

Gurdwara - <https://www.truetube.co.uk/resource/holy-cribs-the-gurdwara/>

Mosque - <https://www.truetube.co.uk/resource/holy-cribs-the-mosque/>

Church - <https://www.truetube.co.uk/resource/holy-cribs-the-anglican-church/>

What is the importance of Sacred Spaces?

Sacred spaces are important for both religious and non-religious people. For religious people, these places are where they go to **worship, connect with their faith, and be part of a community**. The art and symbols in these spaces help them understand their religion better. Non-religious people can appreciate sacred spaces for their **cultural and historical value, beautiful architecture**, and as **quiet places for reflection**. These spaces also host events support their local community and bring **people together, fostering understanding and shared values**.

YEAR 9 Why are sacred spaces important?

Notre Dame – Why does it matter?

Notre Dame Cathedral in Paris which was erected in the 1345. It's a symbol of **France's history, art, and shared identity**. The cathedral's stunning architecture showcases the incredible skills of French craftsmen and contains important **religious relics** making it a **proud landmark that people around the world recognize**. When Notre Dame faced a **fire in 2019**, people from around the world **raised money to save the building**. Many people supported the effort, however some **people criticised the fund raising effort** stating that the money would be better spent looking after **people who are struggle or homeless**.

Why are Churches important?

Churches are important for various reasons. They are places where people come together to **worship, find moral guidance**, and build a **supportive community**. Churches often organise charitable activities such as **food banks**, contributing to the well-being of the local community. Additionally, they mark important **life events** and serve as cultural and architectural landmarks, **preserving history** and providing **educational programs**. Churches play a role in shaping individuals' **spiritual journeys**, fostering a **sense of belonging**, and making positive contributions to society through acts of charity.



Why are Gurdwaras important?

A Gurdwara serves as a central place for **worship and community activities**. It embodies the Sikh principles of **equality, selfless service (sewa), and community fellowship**. Sikhs gather at the Gurdwara to engage in **congregational prayers, listen to the Guru Granth Sahib**, and participate in the **langar**, a community kitchen that offers free meals to all, regardless of background. The concept of **sewa**, or selfless service, is integral to Gurdwaras, where volunteers work together to ensure the well-being of the community and extend assistance to those in need.



Why are Mosques important?



Mosques are crucial for Muslims as places of **worship and community gathering**. They provide spaces for **daily prayers, Friday congregations**, and educational programs, promoting spiritual growth and unity. Beyond religious duties, mosques engage in charitable activities, actively promoting the **principle of zakat**, where they **organise aid distributions, food drives, and community outreach**. They also offer a sense of **belonging among diverse Muslim communities**, encouraging shared values and collective well-being.

Religion and Ethics

Literacy / key words

Human Rights: The basic rights and freedoms that every person is entitled to, such as the right to life, freedom, and equality. **Social Justice:** The idea of creating a society where everyone is treated fairly. **Discrimination:** Treating someone unfairly because of characteristics (age, gender, sex, race, etc.) **Prejudice:** Holding unfair and biased opinions based on appearance, background or belief. **Poverty:** The state of having little or no money/resources, making it difficult to meet basic needs. **Activism:** Taking action and campaigning to make a positive change in society, especially for human rights or social justice.

Human Rights and Social Justice

Human rights and social justice focus on ensuring **dignity, equality, and freedom** for all individuals, with key principles outlined in the **Universal Declaration of Human Rights (UDHR)**, adopted by the United Nations in 1948. The UDHR advocates for rights such as the right to life, liberty, education, and non-discrimination.

YEAR 9 Social Justice & Human Rights

Religious Freedom

Religious freedom is the right to practice, change, or express one's religion **without persecution**. However, in many parts of the world, people face restrictions or discrimination due to their beliefs. The UDHR upholds this freedom, but individuals in some countries experience severe limitations.

Christian Responses to Human Rights

Christian responses to human rights emphasise **compassion, justice, and human dignity**, based on the belief that all are made in the image of God (Imago Dei). The **parable of the Sheep and Goats** (Matthew 25:31-46) teaches that helping the marginalised is a way to serve Christ. Similarly, the story of the **Rich Man and Lazarus** (Luke 16:19-31) highlights the moral responsibility of the wealthy to care for the poor.

Muslim Responses to Human Rights

Muslim responses to human rights are rooted in the principles of **justice, equality, and compassion**, as outlined in the Qur'an and Hadith. **Zakat**, one of the Five Pillars of Islam, emphasises the duty of Muslims to give to those in need, **promoting social welfare and reducing inequality**. The concept of **khalifah** (stewardship) outlines the responsibility of humans to care for others and the world, ensuring justice and the protection of rights, as Islam teaches that all people are equal in the eyes of God.

Sikh Responses to Human Rights

Sikh responses to human rights are grounded in the principles of equality, justice, and selfless service. The concept of **sewa** (selfless service) encourages Sikhs to support others without expectation of reward. **Langar**, the free community kitchen, embodies this commitment by offering meals to all, regardless of background or status, reinforcing the belief in equality. The **Khalsa**, established by **Guru Gobind Singh**, are called to protect human rights and fight against injustice.

Religious Charities



Extra - Read/watch/do

What is Equality & Social Justice: <https://www.bbc.co.uk/bitesize/articles/z42khbk>

Human Rights and Responsibilities: <https://www.bbc.co.uk/bitesize/articles/zdv646f#zt83239>



Tenses

PRESENT	-ar verbs	-er verbs	-ir verbs
I	-o	-o	-o
you	-as	-es	-es
he/she/it	-a	-e	-e
we	-amos	-emos	-imos
you (pl)	-áis	-éis	-ís
they	-an	-en	-en

Opinions & Pronouns

Lo que más me gusta es... =the thing I most like is
 Creo que../pienso que= I think that

Me chifla

Me enfada

Me alegra



(angers)

(it makes me happy)

Me duele(n)

Indirect object pronouns

Me te le nos os les

Connectives



SEQUENCING

En primero	firstly
En Segundo	secondly
Finalmente	finally
Luego	then
Después	after that
Más tarde	later

Complexity

Quiero – I want	suelo + inf = I tend to
Quise – I wanted	solía + inf – I used to tend to
Tengo que – I have to	acabo de – I have just
Tuve que – I had to	
Puedo – I can	
Se puede you can	
Pude – I could	

Adjectives

Doloroso(a)	painful
Cansado(a)	tiring
Peligroso(a)	dangerous
(Mal)sano(a)	(un)healthy
saludable	healthy
Intenso(a)	intense
Emocionante	exciting
Relajante	relaxing

Cansado(a)	tiring
Peligroso(a)	dangerous
saludable	healthy
Sanamente	healthily
Estresante	stressful
Agotador(a)	exhausting
Estimulante	exhilarating

FUTURE Saying what you are going to do		
Voy	a	INFINITIVE Ir
vas		
va		Tocar jugar nadar
vamos		
vais		leer Ver
van		

PAST preterit	AR	ER/ IR	IR-to go
I (yo)	é	í	Fui I went
You (tú)	aste	iste	Fuiste
He/she (él /ella)	ó	ió	Fue
We (nosotros)	amos	imos	Fuimos
You (pl) vosotros	asteis	isteis	Fuisteis
They (ellos/ellas)	aron	ieron	fueron

Hacer – to do/make
Hice – I did
Hiciste
Hizo
Hicimos
Hicisteis
Hicieron

TOPIC VOCABULARY TRANSLATED

A

Daily routine words

1. Me levanto - I get up
2. Me despierto – I wake up
3. Me lavo los dientes – I brush my teeth
4. Desayuno – I have breakfast
5. Me ducho - I shower
6. me baño -I bathe/have a bath
7. Me visto – I get dressed
8. Me arreglo – I get ready
9. Me voy al instituto – I go to school
10. Salgo – I go out
11. Vuelvo a casa – I return home
12. Ceno – I have dinner
13. Me relajo – I relax
14. Me acuesto – I go to bed

B



C

After school activities

	El tiempo libre	Free time
6	Jugar	To play
	Tocar	To play (<u>an instrument</u>)
	cantar	To sing
	practicar	To practice
	comprar	To buy
	hablar	To talk
	Montar en bicicleta	To ride a bike
	Bailar	To dance
	cocinar	To cook
	Navegar	To search
	comer	To eat
	Leer	To read
	Ver la tele	To watch TV
	Hacer	To do
	dormir	To sleep
	salir	To go out
	ir	To go

¿Qué cambiarías?

What would you change?



Cambiaría mucho/poco...

I would change a lot/ little

Me gustaría...

I would like...

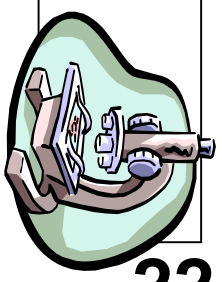
Me gustaría poder...

I would like to be able

- levantarme to get up
- acostarme to go to bed
- comer to eat
- ir al instituto to go to school
- volver a casa to return home
- tener más tiempo en la cama to have more time in bed
- tener más tiempo en casa to have more time at home
- tener más tiempo en el instituto to have more time at school

Key Words - GCSE Biology unit 1

Cells



Active Transport The movement of particles against a concentration gradient, using energy from respiration

Chloroplasts Where photosynthesis takes place in plant cells

Cytoplasm Where the chemical reactions that keep the cell alive take place

Diffusion The movement of particles from a high concentration to a low concentration across the cell membrane.

Nucleus The control centre of the cell, where the genes are found

Membrane Controls what passes in and out of a cell

Meristem Source of stem cells in plants found in the growing parts of the plant.

Mitochondria Where energy is released during respiration

Osmosis The movement of water from a dilute solution to a less dilute solution (e.g. from a high water concentration to a low one)

Respiration Chemical reaction that takes place in living cells, releasing energy for the cell

Ribosomes Where proteins are made in a cell

Stem cell Unspecialised cells that can develop into any other type of cell

Vacuole Where the cell sap is found in plant cells

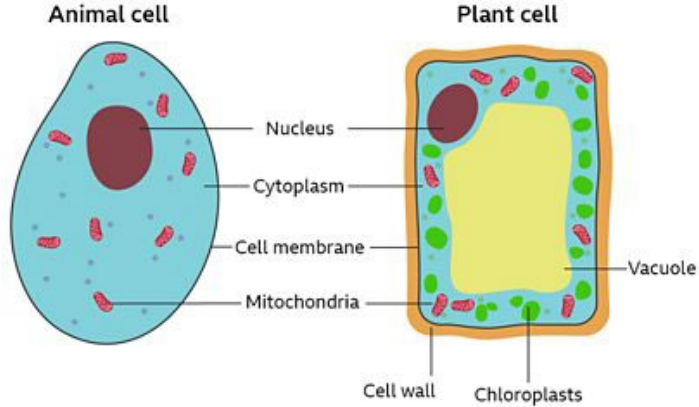
Numeracy:

Total Microscope magnification = eyepiece lens x objective lens

B1 – Cell Biology

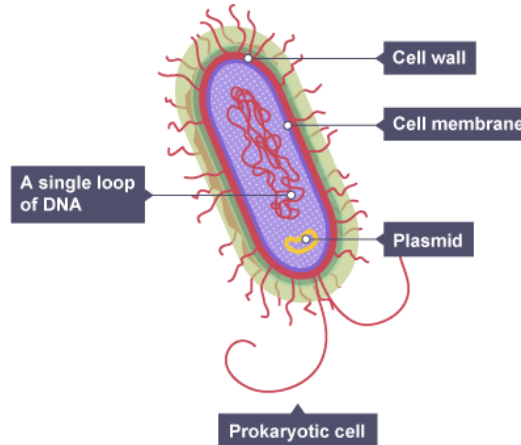
Eukaryotic Cells

They have a nucleus to contain the chromosomes. These can be animal, plant or fungus or protist cells. Animal and plant cells are shown below.



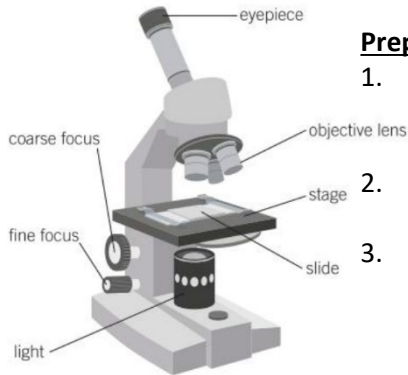
Prokaryotic Cells

They do not have a nucleus, they are usually a lot smaller and may contain plasmids.



Cell		Features
Animal	Sperm	High number of mitochondria Ribosomes that make enzymes in the head
	Nerve	Long Lots of branches (dendrites)
	Muscle	High number of mitochondria High Number of ribosomes Store glycogen
Plant	Xylem	Walls thickened with lignin to strength the cells into a tube
	Phloem	Sections between cells called sieves to help transport substances like dissolved sugars
	Root hair	Large surface area Lack of chloroplasts Large vacuole

RP1 – Microscopy; Observing Plant Cells



Preparing the slide:

1. Place a thin layer of onion membrane on a glass slide with forceps.
2. Use a drop of iodine to stain the cells.
3. Gently place a glass cover slip over the same and tap carefully to remove air bubbles.

Viewing the slide:

1. Place the slide on the stage and turn on the light.
2. Select the lowest magnification objective lens.
3. Look through the eyepiece and turn the coarse focus until the image can be seen.
4. Turn the fine focus until a clear image is formed.
5. Change the objective lens to another with a higher magnification and turn the fine focus re-focus the image.

Microscopes

The development of microscopes of the last 200 years has allowed us to study cells and the structures inside them in more and more detail.

Light Microscope	Electron Microscope
Low resolution Low magnification Cheap	High resolution High magnification Expensive

Calculating Magnification

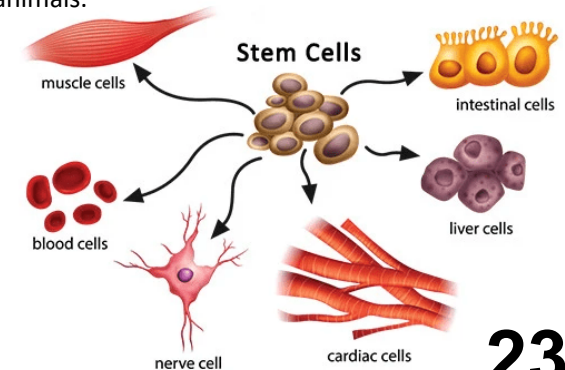
Units for image and actual size may need to be converted before using the equation below.

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

$$\begin{array}{l} \text{mm} \rightarrow \mu\text{m} \\ \mu\text{m} \rightarrow \text{mm} \end{array} \quad \begin{array}{l} \times 1000 \\ \div 1000 \end{array}$$

Cell Differentiation

As an organism develops, cells differentiate to form different types of cells. This is an example in animals.



B1 – Cell Biology

1. Name the three cell parts (organelles) found in a plant cell but not in an animal cell.
2. How can you identify an eukaryotic cells from its structure?
3. What is the role of a ribosome?
4. Which organelle releases energy through respiration?
5. What is the role of the cell wall?

1. What structures are only found in prokaryotic cells?
2. Which are larger; prokaryotic or eukaryotic cells?
3. What feature do some bacterial (and some animal) cells have that enable it to move?

1. How is a root hair cell specialised?
2. Why would a cell contain more mitochondria than usual?
3. Describe the structure of phloem cells.
4. How are nerve cells specialised?
5. Why does a sperm cell require a lot of mitochondria?
6. How are xylem cells specialised?

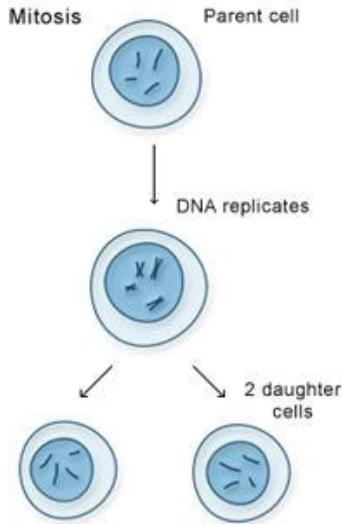
1. Which part of a light microscope is the glass slide placed on?
2. Which objective lens is selected first to produce a magnified image of a sample?
3. What is used to stain plant cells?
4. What is place on top of the slide, sample and stain?
5. What part of the microscope is used to focus the image and make it clear?

1. What are the advantages of using a electron microscope for viewing cells?
2. Convert 2.3mm into μm .
3. How would we calculate the actual size of a cell using the image size and magnification?
4. Convert 570 μm into mm.

1. What does cell differentiation mean?
2. How is plant cell differentiation different to animal cells differentiation?

B1 – Cell Biology

Mitosis

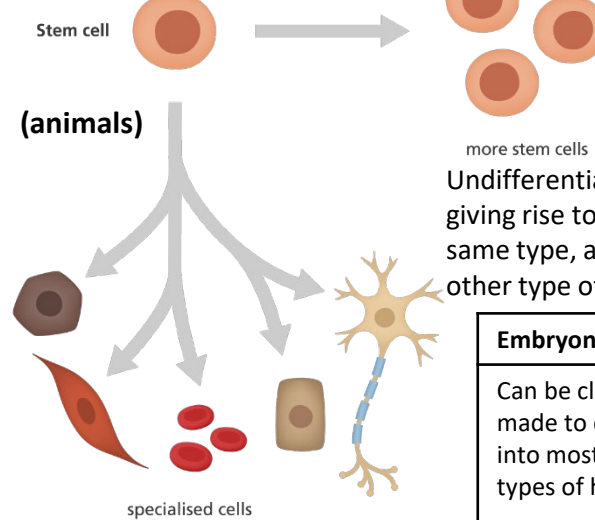


Before a cell can divide it needs to grow and increase the number of sub-cellular structures such as ribosomes and mitochondria. **The DNA replicates** to form two copies of each chromosome.

In mitosis one set of chromosomes is pulled to each end of the cell and the **nucleus divides**.

Finally the **cytoplasm and cell membranes divide** to form two identical cells.

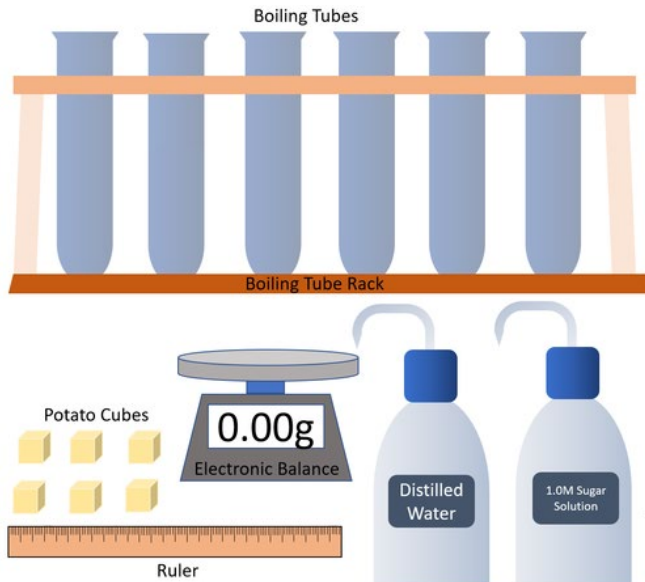
Stem Cells



Undifferentiated cells are capable of giving rise to many more cells of the same type, and can differentiate into other type of cells.

Embryonic	Adult	Meristems
Can be cloned and made to differentiate into most different types of human cells	Bone marrow stem cells can form many types of cells including blood cells.	Can differentiate into any type of plant cell, throughout the life of the plant.

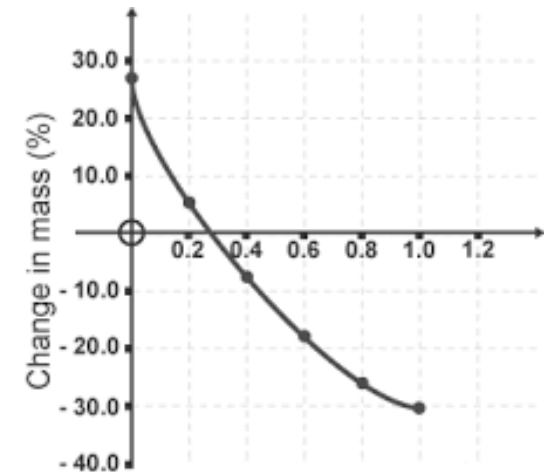
RP2 – Osmosis: The concentration of surrounding solution affects mass of plant tissue



1. Use a cork borer to create 5 cylinders of plant tissue (usually potato) and cut them all to the same length.
2. Measure the mass of each piece using a top pan balance and the length of each piece with a ruler. Record in a table.
3. Measure out 100cm³ of each concentration of salt/sugar solution into labelled boiling tubes.
4. Place each piece of potato into a boiling tube for 24 hours.
5. Remove the pieces and blot with a paper towel.
6. Measure the mass of each piece using a top pan balance and the length of each piece with a ruler. Record in a table.
7. Calculate the percentage change in mass.

$$\% \text{ change in mass} = \frac{\text{change in mass (g)}}{\text{initial mass of potato (g)}}$$

Results Graph



B1 – Cell Biology

1. What has to be replicated (copied) before the cell can divide?
2. What happens in the third stage of mitosis?
3. What word is used to describe the similarity of the two cells formed?

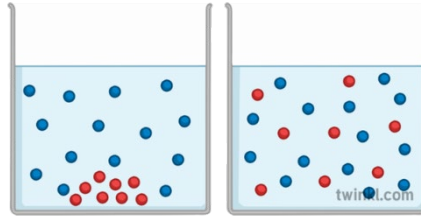
1. Where type of organism contains meristems?
2. What is a stem cell?
3. Which type of animal stem cell can only become a small number of different cells rather than any type of cell?

1. What piece of equipment is used to ensure the surface area of each piece of potato is the same?
2. What piece of equipment is used to measure the mass before and after the experiment?
3. What happens to pieces of potato in dilute (high water concentration) solutions?
4. What should be done with the pieces of potato after then have been removed from the solution but before their mass is measured?

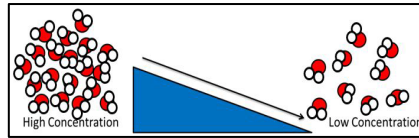
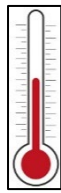
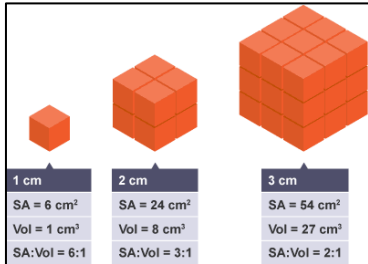
B1 – Cell Biology

Diffusion

- Substances move a higher concentration of that substance (red particles pictured) to where there is a lower concentration of that substance. (High → Low)
- This happens because of the random movement of the particles in a fluid (liquid or gas).



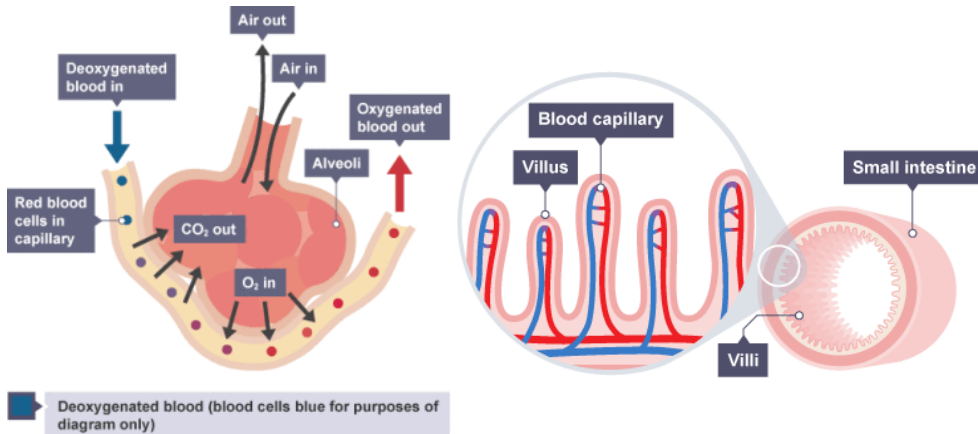
- There are ways the rate of diffusion can be changed:
 - the difference in concentrations (concentration gradient)
 - the temperature
 - the surface area of the membrane



Examples

Alveoli in the lungs and villi in the small intestine are both structured in similar ways so diffusion can happen at a high rate (fast).

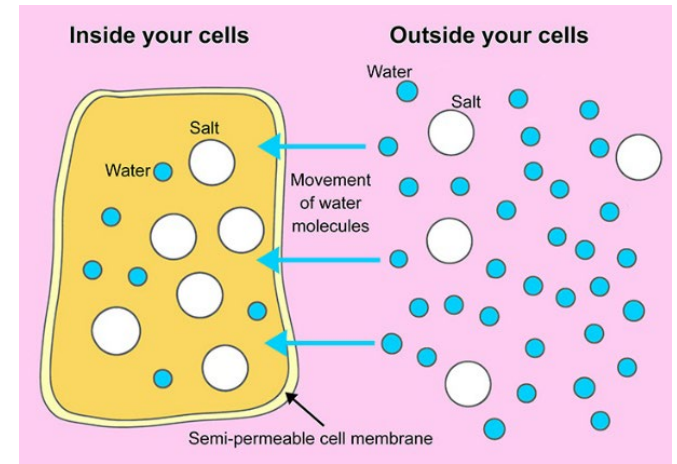
- having a large surface area
- a membrane that is thin, to provide a short diffusion path
- (in animals) having an efficient blood supply



Osmosis

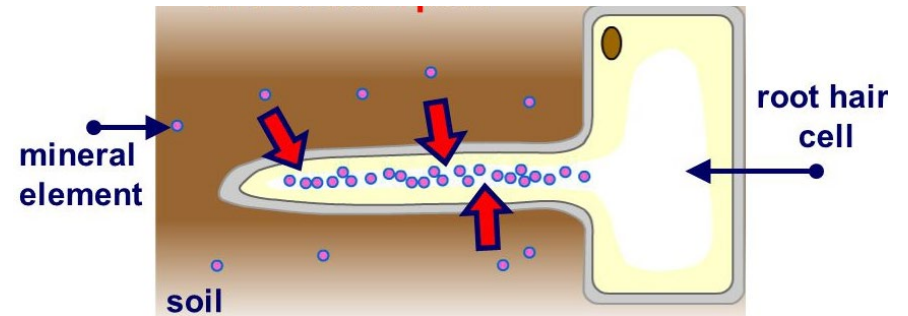
Water may move across cell membranes via osmosis.

Osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane (H → L).



Partially permeable means small molecules can move through but large molecules cannot.

Active Transport



- Active transport is moving substances against the concentration gradient (L → H) so requires energy. This energy comes from respiration.
- This means that cells that carry out a lot of active transport (root hair cells, epithelial cells on villi in the small intestine) contain a lot of mitochondria.

B1 – Cell Biology

1. What factors affect the rate of diffusion?
 -
 -
 -
2. Give an example in animals where diffusion would take place?
3. How are structures in organisms adapted for efficient diffusion?
 -
 -
 -
4. Do substances move from a low concentration to a high concentration

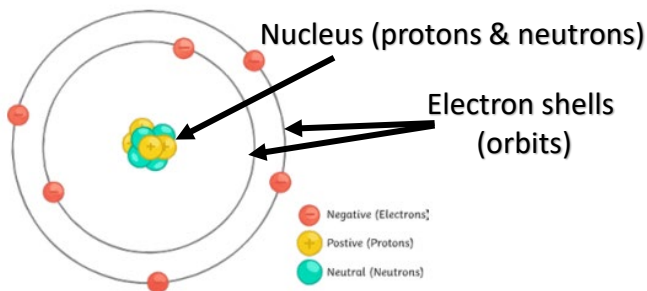
1. What substance is being transported by osmosis?
2. What does partially permeable mean?

1. How is active transport different to diffusion?
2. Give an example of where active transport happens often in organisms.
3. Why do cells that carry out active transport often have a lot of mitochondria?

C1 – Atomic Structure and The Periodic Table

Atoms

- Made up of **protons, electrons and neutrons.**



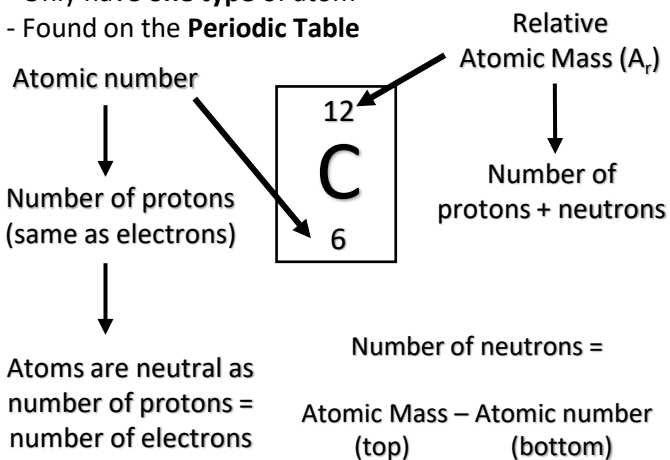
Subatomic particle	Relative Mass	Charge
Proton	1	Positive
Neutron	1	Neutral
Electron	Very small	Negative

Atoms have a radius of about 0.1nm (1×10^{-10} m)

Radius of nucleus = about 1×10^{-14} m

Elements

- Only have **one type** of atom
- Found on the **Periodic Table**



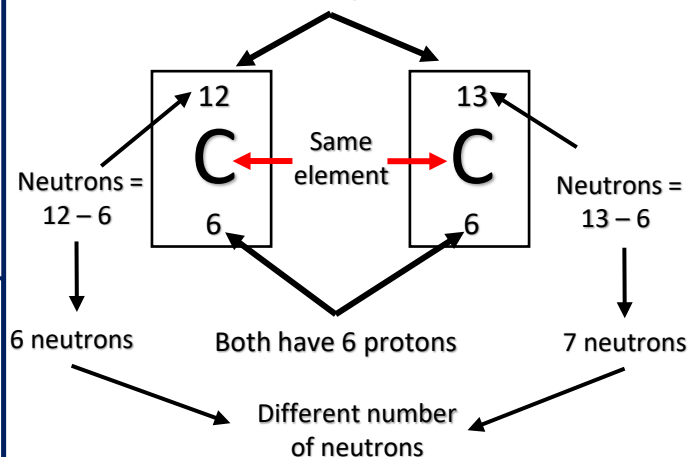
Compounds

- Two or more elements **chemically combined.**
- Formed by chemical reactions
- For example: CO_2 H_2O CH_4 HCl NaCl

Isotopes

Isotope = atoms of the **same element** which have the **same number of protons**, but a **different number of neutrons.**

These are isotopes because..



Chemical Equations

- Shown by using a **word equation.**
- e.g. magnesium + oxygen \rightarrow magnesium oxide

Left of the arrow = **reactants**
Right of the arrow = **products.**

- Also can be shown by a **symbol equation**
- e.g. $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

Mixtures and Separation

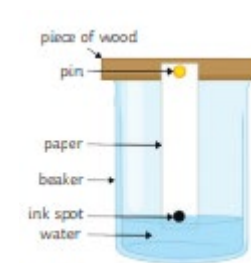
Mixtures – two or more elements or compounds **not** chemically joined.

This means the different components of the mixture can be separated by physical methods (below)

E.g. air is a mixture mainly made of nitrogen, oxygen and carbon dioxide.

Chromatography

to separate out mixtures (usually liquids) (e.g. colours in ink)



Filtration

To separate insoluble solids from liquids (e.g. sand and water)



Evaporation

To quickly separate soluble solids from a solution. (e.g. salt and water)



Crystallisation

To slowly separate a soluble salt from a solution. (e.g. copper sulfate crystals)



C1 – Atomic Structure and The Periodic Table

1. Name the three subatomic particles.

2. Which two subatomic particles are found in the nucleus of an atom?

3. What is the mass of a proton?

4. What is the radius of an atom?

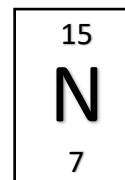
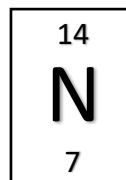
5. What is the radius of the nucleus of an atom?

1. Define the word compound.

2. Give three examples of compounds.

1. What is an isotope?

2. Why are the two elements below isotopes? (use the numbers of **subatomic particles**)



1. Is air an element, compound or mixture? Why?

2. What is chromatography used to separate?

3. What can be separated using filtration?

4. Give an example of a mixture that can be separated using filtration.

5. What is evaporation used to separate?

6. Give an example of a mixture that can be separated using evaporation.

1. Where are elements found?

2. What does the relative atomic mass of an element show?

3. What does the atomic number show?

4. How do you calculate the amount of neutrons?

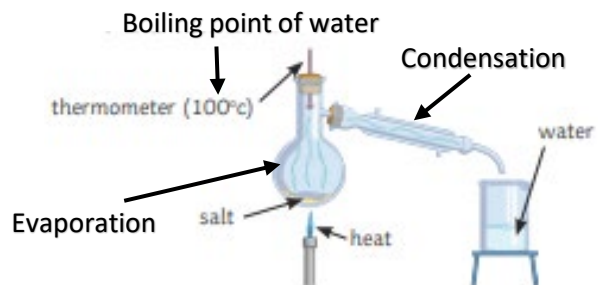
1. Where do you find the reactants in a chemical reaction?

2. Where do you find the products in a chemical reaction?

C1 – Atomic Structure and The Periodic Table

Distillation

Simple distillation – separating a liquid from a solution.



- Liquid is heated to boiling point and evaporates
- Vapours travel up into the condenser
- Condenser has cold water around it.
- Vapours cool and condense (turn back into a liquid).

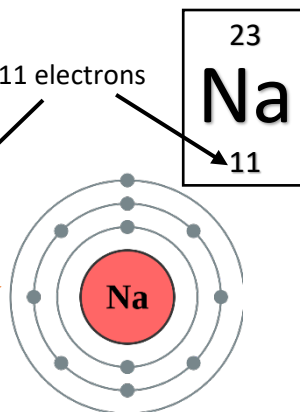
Electronic Structure

- Electrons are found on shells (orbits) orbiting the nucleus.
- There is a maximum number of electrons allowed on each shell:

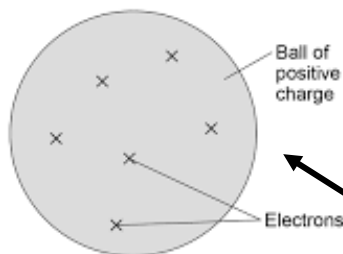
First shell = 2 electrons
Second shell = 8 electrons
Third shell = 8 electrons.

1st shell = 2
2nd shell = 8
3rd shell = 1

Total = 11 electrons



Plum pudding model



Differences to nuclear model

- Ball of positive charge (no protons)
- No nucleus
- No neutrons
- Evenly distributed mass

Rutherford tested the plum pudding model

History of the atom

Scientist	Time	Discovery
John Dalton	Start of the 19 th century	Atoms were first described as solid spheres.
JJ Thomson	1897	Plum pudding model – atom is a ball of + charge with electrons scattered
Ernest Rutherford	1909	Alpha scattering experiment - mass concentrated at the centre, only the nucleus is + charged. Most of the atoms is empty space.
Niels Bohr	Around 1911	Electrons are in shells orbiting the nucleus
James Chadwick	Around 1940	Discovered that there are neutrons in the nucleus.

What happened?

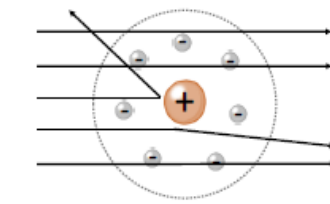
Rutherford's scattering experiment

alpha particles are positively charged

Fired at gold foil

some alpha particles are deflected/ repelled

most alpha particles passed straight through



Conclusions made

Observation	Conclusion
Most of the particles passed straight through	Most of the atom is empty space
Some were deflected to the sides	The particles had passed close by a positive charge
A very small number were repelled straight back	The alpha particles had approached the nucleus straight on. the tiny number told him that the positive charge is in a very small dense core

C1 – Atomic Structure and The Periodic Table

1. What two changes of state occur in distillation?
2. What temperature would the thermometer show when distilling salt and water?
3. Why does the water vapour condense in the condenser?

1. Who suggested the plum pudding model?
2. State three differences between the nuclear model and the plum pudding model.
3. What did Niels Bohr discover?
4. What did James Chadwick discover?
5. Put the particles into order of discovery:
proton electron neutron

1. Where are electrons found?
2. How many electrons can be placed in the first, second and third shells?
3. Which number on the element shows the number of electrons?

1. Who conducted the scattering experiment?
2. What was fired at gold leaf during the scattering experiment?
3. Only a tiny number of the alpha particles were deflected, what did this show about the atom?
4. Some particles went straight through, what did this show about the atom?

C1 – Atomic Structure and The Periodic Table

Development of the Periodic Table

John Newlands – Law of Octaves

- Elements ordered by **atomic weight**.
- Noticed a pattern with every eighth element.
- Some elements placed inappropriately – metals and non-metals grouped together.
- Rejected by other scientists.

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co, Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zr	Di, Mo	Ro, Ru

John Newlands' Law of Octaves

Dimitri Mendeleev

- Still ordered by atomic weight
- Left gaps for **undiscovered elements**
- Could predict properties of undiscovered elements.
- Some elements didn't fit pattern – switched them to keep pattern of **similar properties**.

H 1.01	II	III	IV	V	VI	VII				
Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0				
Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5	VIII			
K 39.1	Ca 40.1		Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7	
Cu 63.5	Zn 65.4			As 74.9	Se 79.0	Br 79.9				
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9		Ru 101	Rh 103	Pd 106	
Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127				
Au 197	Ba 137	La 139	Pb 207	Tl 204	Pb 207	Bi 209		Os 194	Ir 192	Pt 195
	Hg 201	Ti 204								
			Th 232			U 238				

Dimitri Mendeleev left gaps for undiscovered elements

Eventually, knowledge of isotopes explained why elements could not be ordered by atomic weight.

The Modern Periodic Table

- Ordered by **atomic (proton) number**.

Columns = groups

Group number = number of electrons in outer shell.

Elements in each group have similar properties.

non-metals

metals

1	2		3	4	5	6	7	8	9	10									
1	Li	Be	B	C	N	O	F	Ne											
2	Li	Be	B	C	N	O	F	Ne											
3	Na	Mg	Al	Si	P	S	Cl	Ar											
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	Ac																

Rows = periods

Period number = number of electron shells the atom has.

Group 0 (Noble Gases)

- Full outer shell – unreactive as they don't need to lose or gain any electrons

- As you go down...
- Boiling point increases
 - More electron shells
 - Bigger atoms
 - More intermolecular forces
 - More energy needed to break forces.

Group 1 (alkali metals)

- Similar properties as all have 1 electron in outer shell.
- All lose one electron in reactions to form 1+ ions
- Soft, grey, shiny metals
- Stored in oil as would react with oxygen in air.
- When placed in water they produce an alkali (hence alkali metals) and hydrogen gas

E.g. Lithium + water → lithium hydroxide + hydrogen

Reactivity of Group 1

- As you go down the group...
- Elements are more reactive because:
 - More electron shells
 - Outer electron = further from nucleus and more shielded by the other shells
 - The electrostatic force of attraction between outer electron and nucleus is weaker
 - Easier for outer electron to be lost

Group 7 (Halogens)

- 7 electrons in outer shell – all react similarly
- All gain one electron when they react to form 1- ions
- Form molecules (e.g. Cl₂, F₂)
- Non-metals.
- A more reactive halogen can replace a less reactive halogen in a reaction (**displacement**)

Reactivity of Group 7

- As you go down the group...
- Elements are **less** reactive because:
 - More electron shells
 - Outer shell is further from nucleus and is **more shielded** by the other shells
 - The electrostatic force of attraction between free electron and nucleus is **weaker**
 - Harder to attract an electron into the outer shell.

C1 – Atomic Structure and The Periodic Table

1. Who created the 'Law of Octaves'?
2. How were the elements ordered in old versions of the periodic table?
3. How did Dimitri Mendeleev order his elements?
4. Why did Mendeleev leave gaps in his periodic table?
5. The knowledge of what eventually explained why elements could not be ordered by atomic weight?

1. State 2 properties of Group 1 metals.
2. Why are they known as the alkali metals?
3. Are they reactive or unreactive?
4. As you go down the group, what happens to the reactivity of elements?
5. Explain your answer to Q4.

1. How are elements ordered in the modern periodic table?
2. Groups are rows or columns?
3. What does group number show?
4. What does period number show?

1. What are elements in group 0 known as?
2. Why are these elements unreactive?
3. What happens to boiling point as you go down group 0?

1. How many electrons do the halogens have in the outer shell?
2. What type of element are they?
3. State the trend in reactivity as you go down group 7.
4. Explain your answer to Q4.

P1 Energy

Energy Stores

There are 8 energy stores:

Store	Stored in...
Kinetic	moving objects
Gravitational potential	objects raised above ground
Elastic potential	Stretched or compressed objects
Thermal	All objects due to particle movement
Chemical	Substances (foods, fuels) that can release energy in a chemical reaction
Nuclear	The nucleus of atoms
Magnetic	Magnets attracting or repelling
Electrostatic	Separation of charges

Conservation of energy law:

Energy is **NEVER** created or destroyed

Energy is transferred by different pathways – by heating or when work is done

When energy is transferred, some is often transferred to the environment – this is wasted or dissipated energy

Efficiency

Tells us how much of the energy is transferred usefully.

$$\text{Efficiency} = \frac{\text{Useful output energy transferred by the device}}{\text{Total input energy supplied to the device}}$$

$$\text{Efficiency} = \frac{\text{Useful power out}}{\text{Total power in}}$$

Wasted energy always ends up in the **thermal store** of the surroundings

Calculating energy stores

The energy stored in a raised object can be calculated using:

$$\text{GPE} = \text{mass} \times \text{height} \times \text{gravitational field strength}$$

$$\text{GPE} = mgh$$

The energy stored in a moving object can be calculated using:

$$\text{KE} = \frac{1}{2} \text{mass} \times \text{velocity}^2$$

$$\text{KE} = \frac{1}{2} m v^2$$

Energy stored in a stretched or compressed object can be calculated using :

$$E = \frac{1}{2} \text{spring constant} \times \text{extension}^2$$

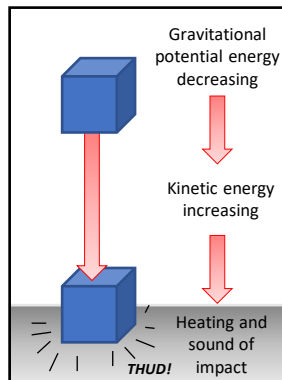
$$E = \frac{1}{2} k e^2$$

Transfers of energy:

E.g. An object above ground has GPE.

If that object falls:

1. Decreases its GPE store
2. Increases its KE store as it falls
3. Waste energy transferred to the environment by heating and sound



Specific heat capacity

The amount of energy needed to change the temperature of 1Kg of a substance by 1°C

It is calculated by:

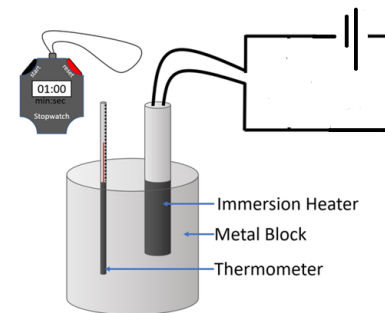
$$E = \text{specific heat capacity} \times \text{mass} \times \text{temp change}$$

$$E = \text{SHC} \times m \times \theta$$

Units for SHC are J/Kg/°C

Different materials have different specific heat capacity values.

This can be investigated using the equipment below:



- Energy is supplied to the block by the immersion heater over a fixed time period (e.g 5 mins)
- The thermometer measures the temperature of the block at the start and the end of the experiment
- The stopwatch measures the time
- If the power of the heater is known (e.g 50W) the energy transferred to the block can be found using the equation:

$$\text{Energy (J)} = \text{Power (W)} \times \text{time (s)}$$

The specific heat capacity of different materials can be investigated by:

- changing the metal (**independent variable**)
- measuring the temperature increase (**dependent variable**)
- Keeping the energy supplied, mass and insulation the same (**control variables**)

Insulating the block reduces energy transferred to the thermal store of the environment, improving accuracy

Energy Stores

Complete the table:

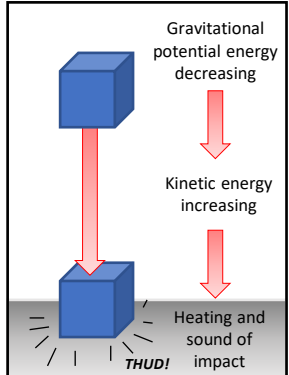
Store	Stored in...
kinetic	
	objects raised above ground
Elastic potential	
	All objects due to particle movement
Chemical	
	The nucleus of atoms
Magnetic	
	Separation of charges

1. What is the conservation of energy law?
2. In what two general ways is energy transferred?
3. What is wasted energy?

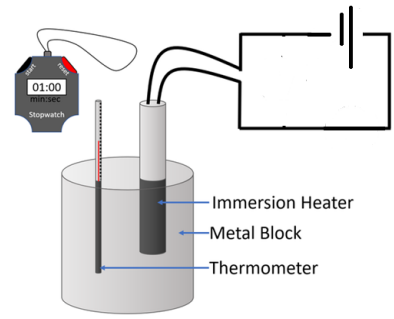
Efficiency

1. What is the equation to calculate efficiency?
2. Where does wasted energy end up?

1. What is the equation linking gravitational field strength, GPE, height and mass?
2. What is the equation linking kinetic energy, mass and velocity?
3. What quantity is found in both equations?
4. What happens to the GPE store when a raised object falls?
5. What happens to the KE store of a raised object when it begins to fall?
6. By which two pathways is energy transferred to the environment when an object falls?



1. What is the specific heat capacity of a substance?
2. In the hypothesis 'different metals have different specific heat capacity values' what is the independent variable?



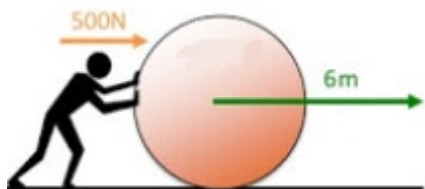
3. What does the immersion heater do?
4. What two readings are taken using the thermometer?
5. What is a sensible time period to use for transferring energy to the block?
6. What should be put round the block?

Power and work done

Work done = energy transferred

Energy transferred mechanically is calculated:

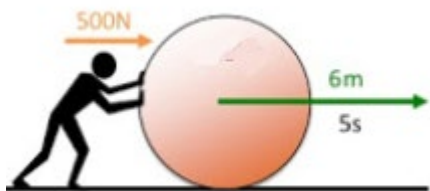
Work done = force x distance
 $W (J) = F (N) \times s (m)$



Work done = 500N x 6m
= 3000 J

Power = energy transferred per second
1 Watt = 1 Joule per second

Power = energy transferred ÷ time
 $P (W) = e (J) \div t (s)$



Power = Energy ÷ time
= 3000 J ÷ 5 s
= 600W

A more powerful appliance transfers more energy per second, eg:



Reducing unwanted energy transfers

Reducing wasted energy means lower costs

Materials that conduct heat well have a high **thermal conductivity**.

WHERE DOES THE HEAT GO?



Reducing energy transfers in homes

- Double glazing
- Thick walls
- Walls made of materials with low thermal conductivity
- Insulation – wall and loft

Reducing energy transfers in appliances:

- Lubrication – reduces friction



- Streamlining – reduces air resistance



Energy resources

We use energy resources for electricity generation, transport and heating

Non-renewable – ones that are being used faster than they can be replaced and will run out.

Example	+	-
Coal, oil, natural gas	Reliable method of generating electricity	Release CO ₂ which contributes to global warming
nuclear	No CO ₂ released	Produces radioactive nuclear waste

Renewable resources:

Ones that will not run out , they are being replenished as they are used

Example	+	-
Solar	No CO ₂ released	Don't work at night or well on cloudy days
wind	No CO ₂ released	Doesn't work if it isn't windy
Hydro	No CO ₂ released	Damage to habitats
Geothermal	No CO ₂ released	Only found in specific places
waves	No CO ₂ released	Damage to habitats
Biofuel	Carbon neutral	Uses crop land to grow new forests

1. What are the units for work done?
2. What are the units for force?
3. What is the equation to calculate work done during mechanical work?
4. What is the equation to calculate power?
5. What is the unit for power?
6. What is the unit for time in the power equation?
7. What is 1 Watt equivalent to?
8. How would you recognise a more powerful lightbulb?
9. What is meant by a more powerful appliance?

1. Why is reducing unwanted energy transfers from the home important?
2. What is meant by 'high thermal conductivity'?

WHERE DOES THE HEAT GO?



3. Where is most of the heat lost through in a house?
4. Give two ways to reduce the heat lost through the walls of a house.

5. What does lubrication reduce?






6. What does streamlining reduce?



1. Give the three main uses for energy resources
2. What is a non-renewable energy resource?
3. Give 2 examples of non-renewable energy resources
4. Give two disadvantages of using coal and oil
5. Give one advantage to using nuclear resources to generate electricity.
6. What is a renewable energy resource?
7. Give 4 examples of renewable resources
8. Give 2 advantages of using renewable resources to generate electricity
9. Give two disadvantages of using renewable resources to generate electricity

Particle model of matter

State	Pattern	Energy and movement	Forces between particles
Solid 	Ordered and all touching	Vibrate around fixed positions	Strong forces between particles
Liquid 	Random and touching	Move around randomly	Weaker than in a solid
Gas 	Random and far apart	Move around randomly	Weak forces of attraction

Models	+	-
Particle diagrams	Easy to see/draw arrangement	<ul style="list-style-type: none"> Can't see the forces between particles Particles look like flat circles rather than 3D spheres Movement isn't shown
Kinetic models (eg marbles or animations)	Easy to see particle arrangement Can see the movement of particles	Can't see forces between particles

Density

Density is mass per cm^3
It can be calculated using:

$$\text{Density} = \text{mass} \div \text{volume}$$

$$\rho = m \div V$$

Required practical – measuring the density of different materials.

For regular solids :

Mass measured by **top pan balance**

Volume measured by measuring **length x breadth x height**

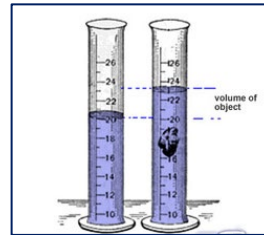
For irregular solids:

Mass measured by **top pan balance**

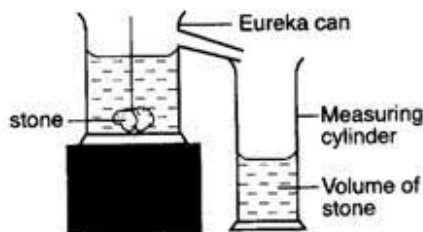
Volume measured by **displacement of water**

This means putting the object into water and measuring the volume of water 'pushed out'

Measure the volume of small objects by putting them into a measuring cylinder with 100cm^3 water in



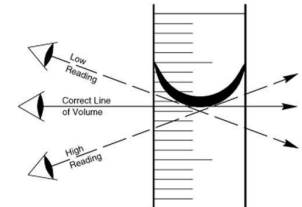
Measure the volume of larger objects by putting them into a full eureka can and catching and measuring the water that is displaced



Zero error



Read the meniscus!



Required practical continued : Density of liquids

- Find the mass of an empty measuring cylinder using a top pan balance.
- Pour a known volume (100ml) of liquid into the measuring cylinder.
- Use the meniscus to measure the volume of the liquid accurately. This is the volume.
- Now measure the mass of the measuring cylinder + the liquid combined.
- Subtract the mass of the empty measuring cylinder and this is the mass of the liquid.

Density = mass \div volume.

Particle model

1. Describe the arrangement of the particles in a solid, a liquid and a gas
2. Describe the movement of the particles in a solid, a liquid and a gas
3. In which state of matter are the forces between the particles the weakest?
4. In which state of matter are the forces between the particles the strongest?
5. Give one advantage of using particle diagrams to show the different states of matter
6. Give three disadvantages of using particle diagrams to show the different states of matter
7. Give two advantages of using kinetic models to show the different states of matter
8. Give one disadvantages of using kinetic models to show the different states of matter

Density

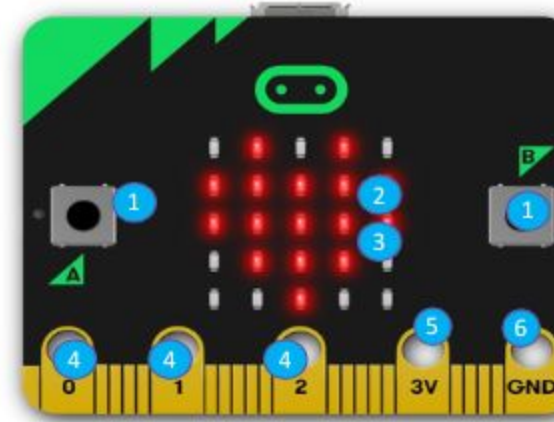
1. Give the formula that links density, mass and volume?
2. Give a unit for density
3. Which piece of equipment is used to measure mass of an object?
4. What type of error is it if a balance reads 0.03g when nothing is resting on it?
5. What term is used to describe when water is pushed out of the way by a solid object?
6. Name two pieces of equipment that could be used to measure the volume of an irregular object
7. What three measurements do you need to calculate the volume of a regular object?

COMPUTER SCIENCE

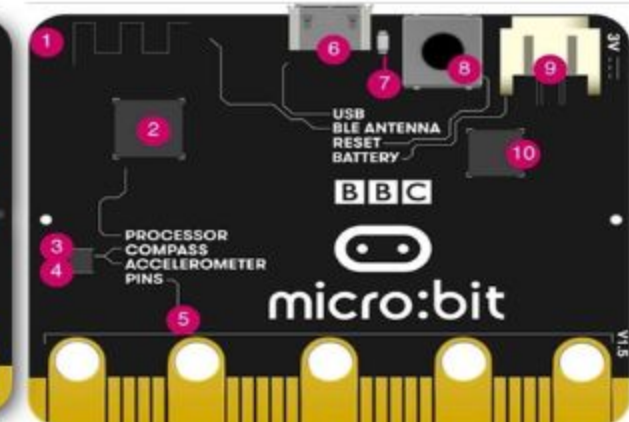
MICRO-BITS

The **micro: bit** is a pocket-sized computer that introduces you to how software and hardware work together. It has an LED light display, buttons, sensors and many input/output features that you can program and physically interact with.

Keywords	
Micro:bit	A small computer with a microprocessor that can execute a single program at a time.
Buttons	Capture user input and makes things happen
LED display (Light Emitting Diodes)	5x5 LED matrix output used to display information.
Light Sensor	Input, measures how much light is falling on the micro:bit.
GPIO (General-Purpose Input Output) pins	Input and output connects headphones, sensor touch and other electronics.
Temperature sensor	Input measures how warm the environment is.
Compass	Input, finds magnetic north or measures magnetic field strength
Accelerometer	Input detects gestures and measures movement in 3 dimensions.
Radio	Communication input and output allows communication with other devices
Algorithm	A set of instructions to be followed to complete a given task or solve a problem.
Program	A sequence of instructions used by a computer.
Sequence	The order which the computer will run code in, one line at a time.
Selection	A decision made by a computer, choosing what code should be run only when certain conditions are met.
Condition	Checking to see whether a statement or sum is true or false.
Iteration	When a section of code is repeated several times – also known as looping.
Variable	Something which can be changed in a computer. Made up of a name and some data to be saved.



1. Buttons: input
2. LED display: output
3. Light sensor: input
4. Pins –GPIO: input/output
5. Pin -3 volt power
6. Pin -Ground



1. Radio & Bluetooth antenna
2. Processor & temperature sensor
3. Compass
4. Accelerometer
5. Pins
6. Micro USB socket
7. Single LED
8. Reset button
9. Battery socket
10. USB interface chip

Python is a **text based programming language**. That can be used to create programs, games, applications and much more!

A **program** is a set of precise instructions, expressed in a **programming language**. **Translating** the programming language is necessary for a machine to be able to **execute** the instructions.

To execute a Python program, you need a **Python interpreter**. This is a program that translates and executes your Python program.

Python with data



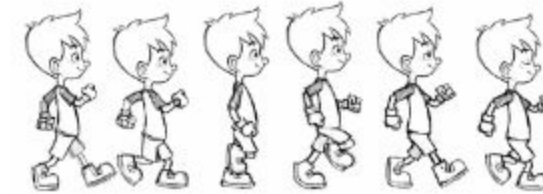
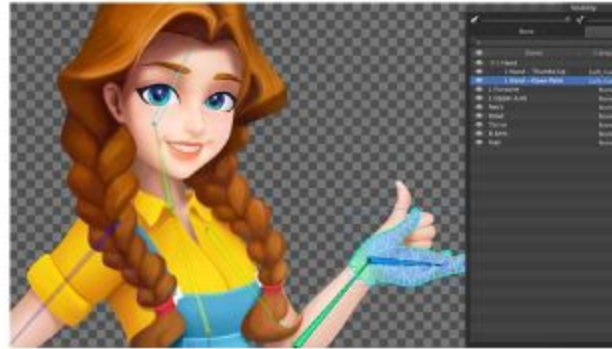
BLENDER - MEDIA ANIMATIONS

Stop motion-manually animate every frame of the animation e.g. Shaun the Sheep

- slower to make animations
- More difficult to edit

Keyframe animation-pick the important locations, the keyframes and the computer works out the rest (called tweening) e.g. Pixar films

- Faster to make animations
- Easier to edit
- Smoother animations
- Repeatable



Key words		
add	colour	cut
edge	knife tool	extrude
face	keyframe	focus
edit	vertex	location
loop	tweening	object
organic	proportional	rotate
render	ray tracing	scale
timeline	subdivision	mode



STOP MOTION ANIMATION

Definitions	
Face:	A surface made up of three or more sides. Faces are often referred to as polygons .
Vertex:	A point where one or more edges meet
Edge:	A line connecting two vertices
Objects:	Scenes are made up of geometric, control, lamp and camera objects
Keyframes:	Used for tracking change, a key is a marker in time
Ray tracing:	Rendering that involves tracing the path of a ray of light through the scene
Rendering:	The process of computationally generating a 2D image from 3D geometry
Subdivision:	Creating smooth higher poly surfaces which can take a low polygon mesh as input.
Proportional editing:	Transforming selected elements
Extrude:	Extend an object

Literacy / key words

CAD and CAM

Computer Aided Design (CAD) drawing allows products to be manufactured using Computer Aided Manufacture (CAM) Computer aided manufacture is very fast and accurate and requires less human intervention

Renewable

energy comes from natural resources that are constantly replenished and never run out. These sources can be used repeatedly without depleting the Earth's supply.

Non-renewable energy comes from sources that will eventually run out because they are not replenished at the rate they are consumed

CAD Computer Aided Design

This is using computer software to draw and model a product.

Examples:

2D Design, Photoshop, Macromedia Fireworks and Sketch Up

Advantages:

- Designs can be shared electronically
- Accurate
- Designs can be easily edited

Disadvantages:

- Software and training can be expensive
- Security issues

CAD Computer Aided Manufacture

This is using computer software to control machine tools to make products.

Examples:

Laser Cutter, 3D printer

Advantages:

- Faster
- Complicated shapes are easily produced
- Exact copied are easily made
- Machines can run 24/7

Disadvantages:

- High initial set up costs as CAM machines are expensive

Non renewable energy	Advantages	Disadvantages
Coal	Produces high amounts of energy	Carbon dioxide produced when burned and mining damages the environment.
Gas	It emits less Co2 than coal . The UK has shale gas reserves .	Can cause water pollution,
Oil	A small amount of oil can produce a lot of energy.	Creates significant air pollution when burned.

renewable energy	Advantages	Disadvantages
Wind turbines	Clean and cheap to run	Expensive to set up and wind does not always blow. Can be an eye sore
Hydroelectric power stations	Clean and cheap to run	Expensive to set up and output could be affected by drought
Solar cells	Clean and cheap to run	Not always sunny

Extra - Read/watch/do

Watch and read

Who was ZahaHadid



<https://www.bbc.co.uk/bitesize/articles/zd48239#zqtsg2p>

You will be assessed on

- Your knowledge of CAD CAM
- Your ability to write a specification
- Your completed product (cad and physical prototypes)

Make

select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture

Linkstocurriculum

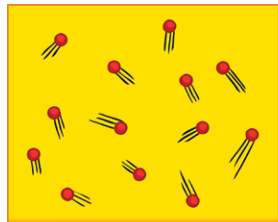
Internal energy

The temperature of any substance is related to the average speed of its particles.

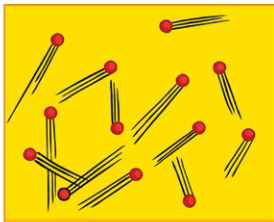
The internal energy of a system is the total kinetic energy and the potential energy of the particles

The particles in a system **vibrate** or **move around** because they have energy in their **kinetic energy stores**

The faster a particle moves, the greater its **kinetic energy store**



Low Temperature



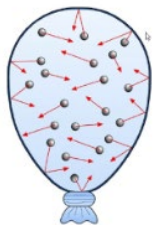
High Temperature

The particles also have energy in their **potential energy stores** due to their position.

As particles **move further apart**, their potential energy stores **increase**

Gas pressure

The particles in a gas are in constant random motion
They collide with the walls of their container
This exerts a force **on the container**.



The more energy the particles have, the higher the temperature.

An increase in temperature of a gas causes the particles to move further apart.

If this is not possible, because of the container, then there is an increase in pressure.

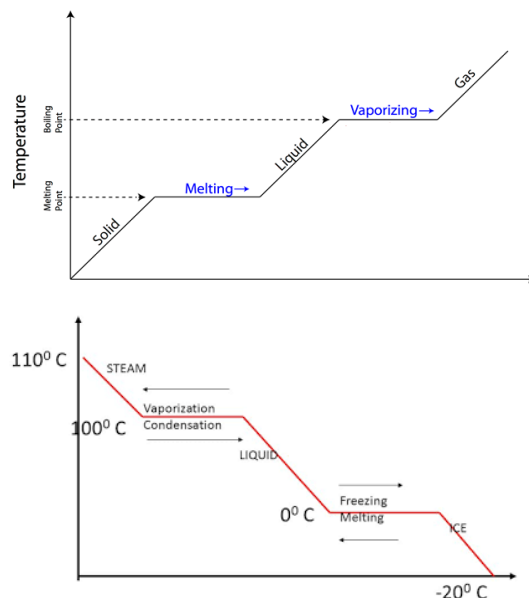
Heating and cooling

When the internal energy of a substance changes, then either :

- The **temperature** of the substance changes
- The **state** of the substance changes

This can be seen by plotting the temperature change during **heating** or **cooling**.

Heating a solid would give us a graph that looks like this:



- The **temperature stays the same**.
- This is when a change of state is happening – for example melting.
- The energy transferred is not increasing the mean particle speed – it is increasing the potential energy of the particles.

When the line is increasing (heating) or decreasing (cooling)

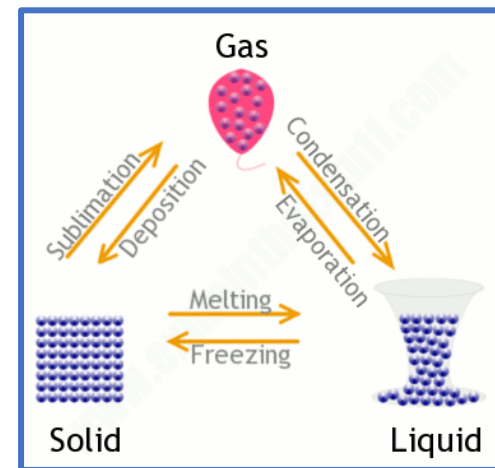
- The temperature is increasing / decreasing
- The kinetic energy store is increasing /decreasing
- Average particle speed is increasing /decreasing

Specific latent heat

Specific latent heat is the amount of energy needed to **change 1kg of a substance from one state to another** without changing the temperature.

Specific latent heat will be different for different materials.

- Energy needed to change 1kg of Solid → liquid - **specific latent heat of fusion**
- Energy needed to change 1kg of Liquid → gas - **specific latent heat of vaporisation**



The amount of energy needed to change 1Kg of a material is found by the equation:

$$\text{Energy} = \text{mass (kg)} \times \text{specific latent heat (L)}$$
$$E = m L$$

Specific heat capacity

This is the amount of energy needed to change the temperature of 1Kg of a substance by 1°C

It is calculated by:

$$E = \text{specific heat capacity} \times \text{mass} \times \text{temp change}$$

$$E = \text{SHC} \times m \times \theta$$

Internal energy

1. What two stores of energy make up internal energy?
2. Which energy store is linked with particle movement?
3. Which energy store increases if the particles in a substance move further apart?
4. What happens to the temperature when the kinetic store of the particles increases?

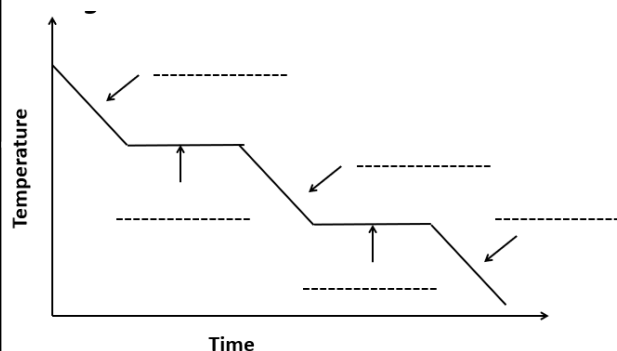
Gas pressure

1. What causes gas pressure?
2. What happens to the temperature of a gas if the kinetic energy store of the particles increases?
3. What happens to the space between particles in a gas as it heats up?
4. If the volume of the gas is kept constant, what happens to the pressure?

Heating and cooling

1. What two things can happen to a substance when the internal energy changes?
2. Label the graph below using the words given:

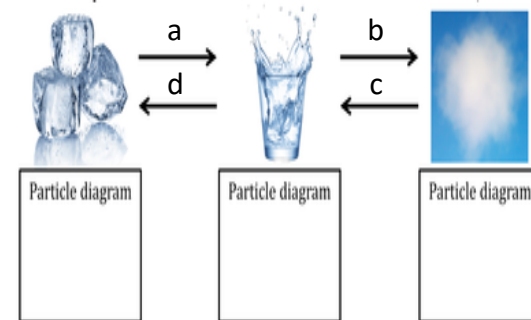
liquid, gas, solid, condensing, freezing



3. What is happening to temperature when the line is flat on a heating or cooling curve?
4. What is happening to the substance when the line is flat?

Specific latent heat

1. What is specific latent heat?
2. What is the term given to the amount of energy needed to change 1kg of a liquid into a solid?
3. What is the specific latent heat of vapourisation?
4. Label the changes of state below
 - a.
 - b.
 - c.
 - d.



5. Draw the particle diagrams in the boxes