

# Knowledge Organiser Booklet Year 11 Term 2 Core

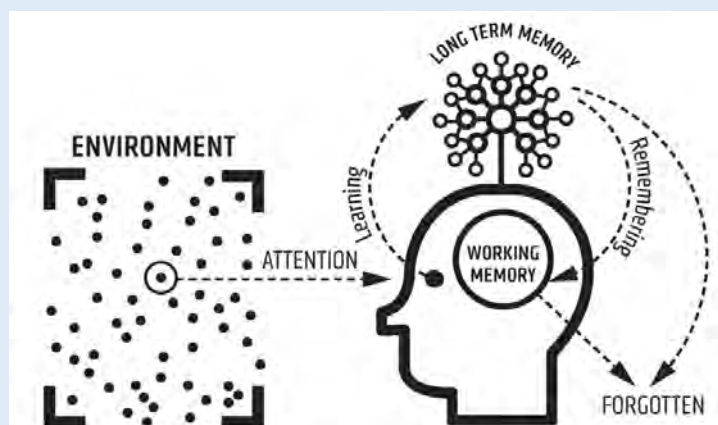


Our working memories can only store a limited amount of information, whereas our long term memories can store limitless information. To learn successfully, we need to store core knowledge into our long term memories, so we can retrieve it when we need it.

For instance, if you are at work or in the shops and need to work out a 25% discount, you can't memorise 25% of every number, so you need to be able to quickly recall the method for calculating a percentage. Committing core knowledge to our long-term memories is a life-hack. It makes thinking about difficult things easier.

Using a knowledge organiser with regular retrieval activities is a way for you to store core knowledge & subject specific words, into your long term memory so it is there when you need it.

Click here to be taken to the knowledge organiser part of the school website.



# Contents

Clicking on the subjects below will take you directly to the knowledge organisers for each subject. These are to support learning that has taken place this past term. Use these to help reinforce the key knowledge. Use some of the strategies explained in the introduction to help you retain this important information.

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# Blended Learning Expectations

Make sure you have access to a computer at home (If you don't please make pastoral staff aware or email [langley.homelearning@taw.org.uk](mailto:langley.homelearning@taw.org.uk))

**Download Microsoft Teams** on both your phone and computer. (If you don't know how to do this please ask a member of staff or do this in your next computing lesson)













**Spend at least 2 hours a week using teams EVERY WEEK.** (Engagement in teams can be tracked and monitored). You need to be accessing each of your class teams and recapping on the previous learning or completing additional tasks set by your class teacher.













If you have any issues with teams (e.g. login problems or missing classes etc then please email [langley.homelearning@taw.org.uk](mailto:langley.homelearning@taw.org.uk))

Teams is a tool to support ongoing learning and should **only be used for educational purposes.**



How to complete homework your teacher has set

	<b>LOOK, COVER, WRITE, CHECK</b>	<b>DEFINITIONS TO KEY WORDS</b>	<b>FLASHCARDS</b>	<b>DUAL CODING</b>
<b>STAGE 1</b>	<p>Look at &amp; study an area of your knowledge organiser</p> 	<p>Write down the key words &amp; definitions</p> 	<p>Write key words, dates/formulae, equations/quotes on one side &amp; answers on the other</p> 	<p>Draw pictures/diagrams/ cartoon strips</p> 
<b>STAGE 2</b>	<p>Cover up your knowledge organiser and write everything you remember</p> 	<p>Cover up the definitions. How many can you remember? Repeat.</p> 	<p>Include pictures or diagrams if it helps. Read through them.</p> 	<p>Label your pictures/diagrams/ cartoon strips</p> 
<b>STAGE 3</b>	<p>Check. Correct mistakes in green and add anything you missed. Repeat</p> 	<p>Check. Correct mistakes in green pen. Which ones do you find hard to remember?</p> 	<p>Test yourself and get someone to test you.</p> 	<p>Explain out loud to yourself or family/friend what your images show</p> 

	<b>SELF QUIZZING</b>	<b>MINDMAPS</b>	<b>PAIRED RETRIEVAL</b>	<b>SPEAK, COVER, WRITE, CHECK</b>
<b>STAGE 1</b>	<p>Use your knowledge organiser to create quiz questions.</p> 	<p>Create a mindmap of everything you can remember from your knowledge organiser</p> 	<p>Give a family member/friend the knowledge organiser to hold</p> 	<p>Read out loud the information from the knowledge organiser several times.</p> 
<b>STAGE 2</b>	<p>Write down the answers to your quiz</p> 	<p>Check your knowledge organiser &amp; use a green pen to make any corrections.</p> 	<p>Get them to test you using the knowledge organiser</p> 	<p>Cover up your knowledge organiser and write everything you remember</p> 
<b>STAGE 3</b>	<p>Keep self-quizzing until you get all the answers correct</p> 	<p>Add additional information to your mindmap or make connections to other knowledge</p> 	<p>Write down your answers to their questions</p> 	<p>Check. Correct mistakes in green and add anything you missed. Repeat.</p> 



# Retrieval Placemat

Look at your knowledge organiser. Now cover it up and write down  
Key vocabulary & definitions from memory:

First time: Look.  
Cover. State 3 facts

Second time: Look.  
Cover. State 3 facts

Third time: Look.  
Cover. State 3 facts

Check & green pen your answers

Look at the knowledge organiser again. Now cover it up and  
without looking, explain a concept or idea in your own words

Re-read your answer above. Look at the knowledge organiser  
again. Now cover it up and improve on your previous explanation in  
green pen.

# Retrieval Relay

Look at your knowledge organiser. Now cover it up.

First time: Write down everything you can remember

Second time: Look. Cover. Write down everything you can remember

Third time: Look. Cover. Write down everything you can remember

Write down everything here that you didn't remember:

# Vocabulary focus 1

Look at your knowledge organiser. Select a key word and write it here:

Write a definition of the key word in your own words - not the same as the one on the knowledge organiser:

Write a sentence with the key word in it:

Create a question where the key word is the answer:

What other words are connected to this key word?

Draw a picture or diagram to help you remember this key word:

# Vocabulary focus 2

Definition:

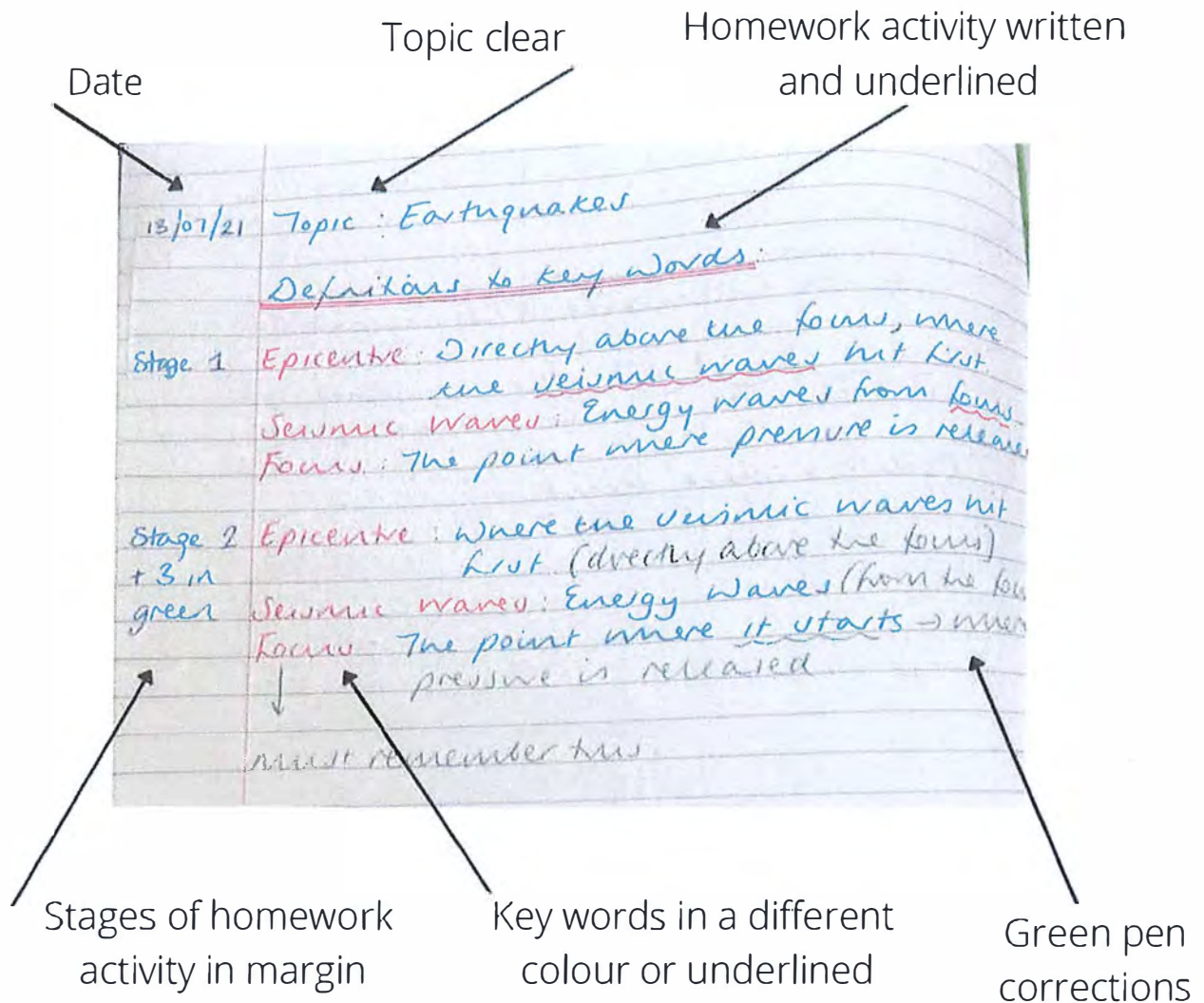
Characteristics:

Key word:

Examples:

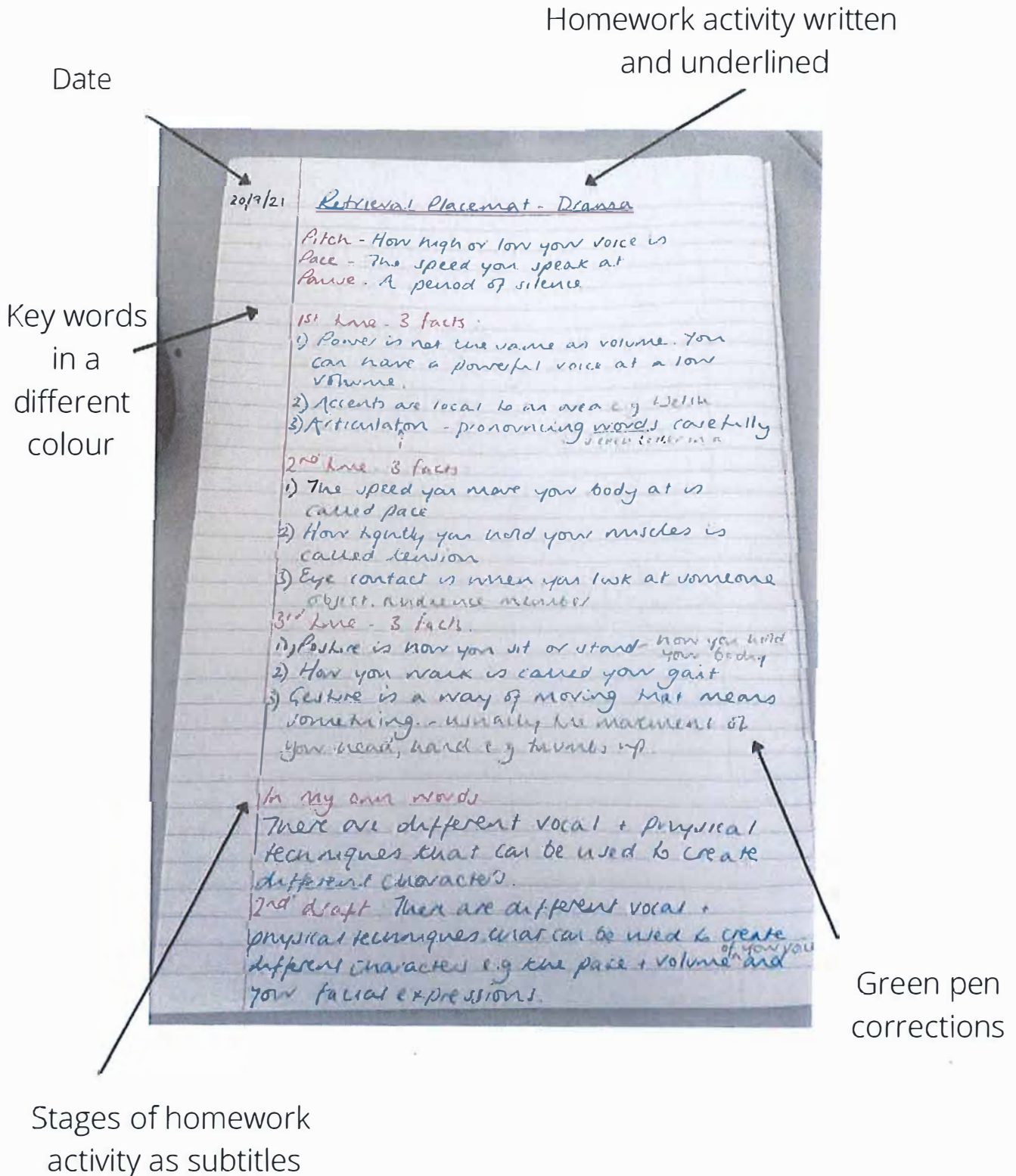
Non-examples:

# What should my knowledge organiser homework look like?





# What should my knowledge organiser homework look like?



**Biology**



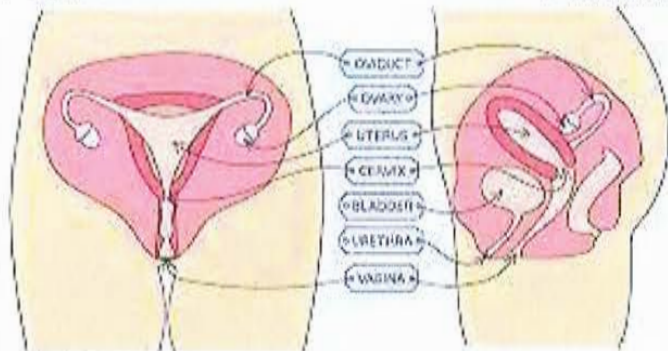
# Reproduction

## Threshold Concept

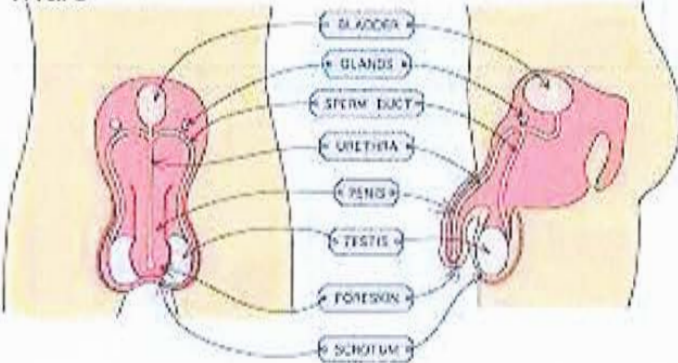
Reproduction can happen sexually and asexually

## Reproductive organs

Female



Male

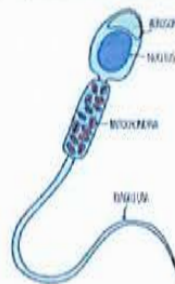


## Keywords

- **Sperm:** male reproductive cell that contains genetic material
- **Egg:** female reproductive cell that contains genetic material
- **Reproduction:** the joining of sex cells (a sperm and egg) to produce offspring
- **Fertilisation:** the joining of a male and female sex cell/genetic material
- **Develop:** build upon given information

## Sperm cell

### Adaptations

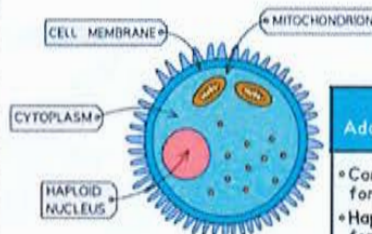


- The head contains the genetic material for fertilisation in a haploid nucleus (containing half the normal number of chromosomes)
- The acrosome in the head contains digestive enzymes so that a sperm can penetrate an egg
- The mid-piece is packed with mitochondria to release energy needed to swim and fertilise the egg
- The tail enables the sperm to swim



## Egg cell

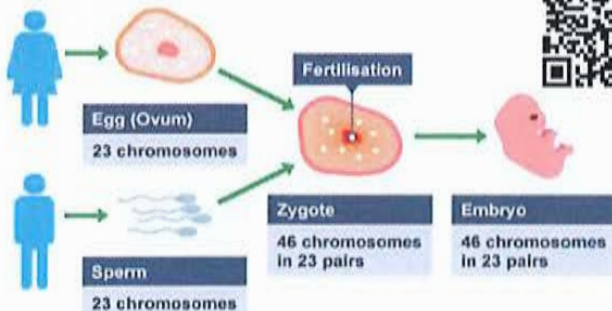
### Adaptations



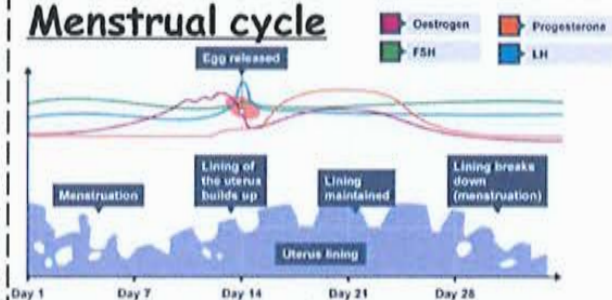
- Contains a lot of cytoplasm which has nutrients for the growth of the early embryo
- Haploid nucleus contains the genetic material for fertilisation
- Cell membrane changes after fertilisation by a single sperm so that no more sperm can enter

## Fertilisation

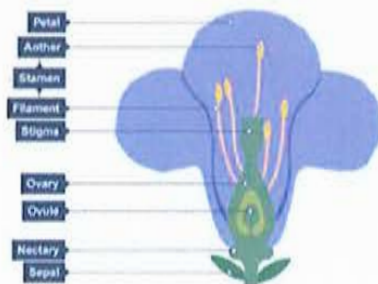
When the sperm and egg nuclei join, they form a ZYGOTE



## Menstrual cycle



## Plant structures

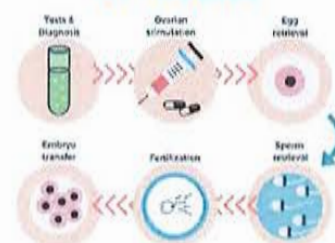


## Equations for this topic

## IVF

In Vitro Fertilisation is used to help people with fertility issues conceive

### IVF PROCESS





# Ecology

## Threshold Concept

Understand that living things interact with the world around them

Different Habitat- An area where an organism is at home



## Adaptations



## Abiotic and Biotic Factors

### Biotic factors

Living factors that affect another organism or shapes the environment.

- ✓ Predation
- ✓ Food availability
- ✓ Competition
- ✓ Disease

### Abiotic factors

Non-living factors that affect organisms.

- ✓ Temperature
- ✓ Light intensity
- ✓ Water
- ✓ Soil PH & mineral content
- ✓ Gases



## Producers and Consumers



## Keywords

- Living - Undertaking the seven processes of living things
- Changes - structural, physiological and behavioural changes that allow species to compete
- Animal - Living creature of one of seven domains
- Plant - Living tissue that is a producer
- Energy - The flow through all organisms and food chains

## Food Chains/Webs - show the flow of energy

### FOOD WEB

BYJU'S



## Required practical



### Quadrats

- 1 Measure area and form a grid
- 2 Take 2 random numbers and use these as coordinates on your grid
- 3 Lay your quadrat down
- 4 Count the number of a species and record results



- Must be random assignment of grids
- The bigger the sample the better (validity)

## Equations for this topic

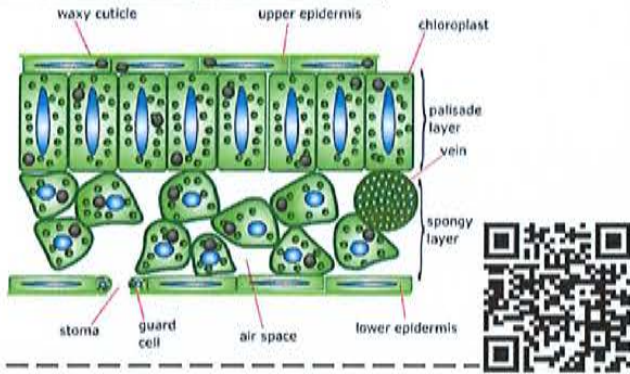


# Bioenergetics

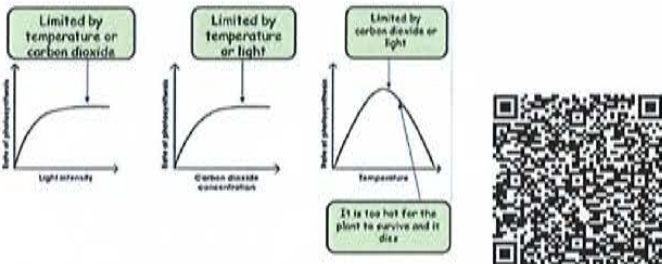
## Threshold Concept

Respiration and photosynthesis are chemical processes that provide plants and animals with energy.

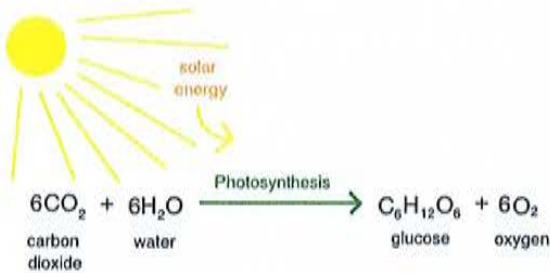
## Structure of the leaf



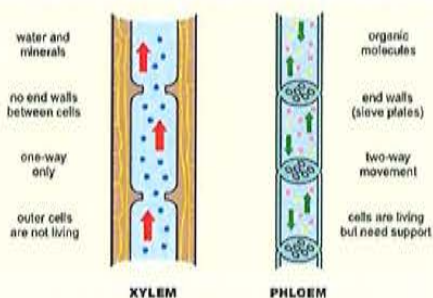
## Limiting factors of photosynthesis



## Photosynthesis



## Xylem and Phloem

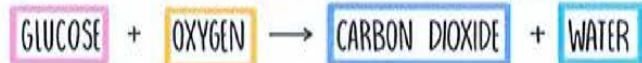


## Keywords

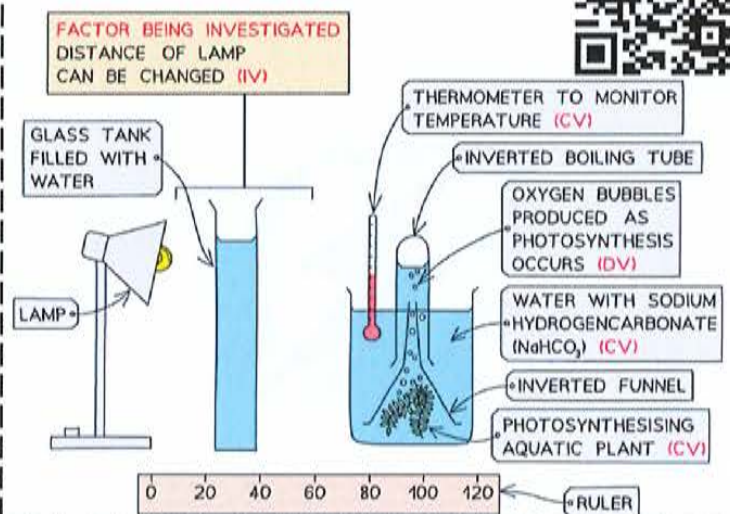
- **Respiration:** Respiration is the body's way of producing energy from the food we eat. It involves the breakdown of glucose in the presence of oxygen into carbon dioxide and water with the release of energy-generating molecules called ATP.
- **Photosynthesis:** is a chemical reaction that takes place in the chloroplasts of green plant cells, where light energy is used to convert carbon dioxide and water into glucose and oxygen.
- **Energy:** The ability to do work
- **Limiting factors:** Limiting factors affect the rate of a reaction. A limiting factor is a condition, that when in shortage, slows down the rate of a reaction.
- **Reaction:** A chemical reaction is when one or more substances change and produce one or more new chemical substances.



## Respiration



## Required practical



## Equations for this topic

$$\text{REACTION RATE} = \frac{\text{CHANGE IN MASS OF REACTANT OR PRODUCT}}{\text{TIME}}$$



# Infection and response

## Threshold Concept

Pathogens are microorganisms that cause disease

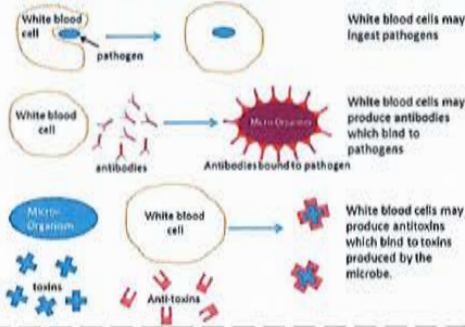
## Communicable and non-communicable disease:

- Communicable, which can be transferred from one person to another, or from one organism to another, eg in humans, these include measles, food poisoning and malaria
- Non-communicable, which are not transferred between people or other organisms



## Fighting against disease

How white blood cells protect us from disease



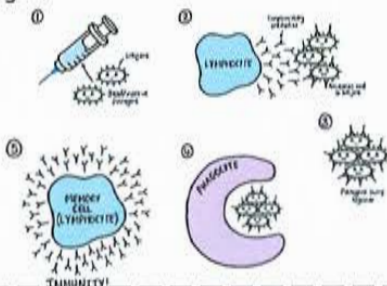
## Antibiotics vs painkillers

- Antibiotics are substances that slow down or stop the growth of bacteria.
- Painkillers are chemicals that relieve the symptoms but do not kill the pathogens.



## Vaccinations

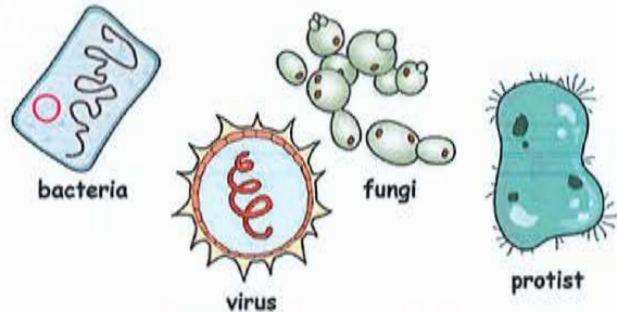
Vaccines allow a dead or altered form of the disease causing pathogen to be introduced into the body, which contain a specific antigen.



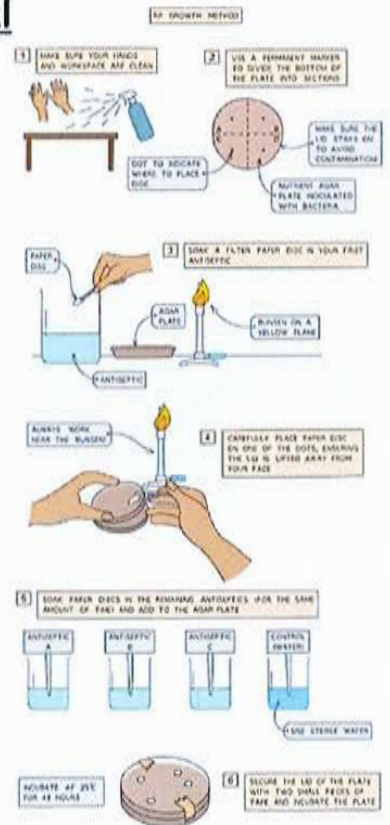
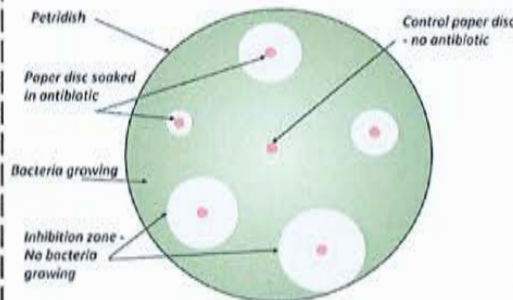
## Keywords

- **Pathogens:** A microorganism that causes disease e.g. bacteria, virus, protist, fungus.
- **Microorganism:** Are so small they can only be seen using a microscope.
- **Virus:** A disease causing agent about 1/100<sup>th</sup> of the size of a bacterial cell. Can only replicate within host body cell/
- **Bacteria:** A single celled microorganism without a true nucleus, some cause disease.
- **Fungi:** A microorganism that can cause disease, and that produces spores that can spread to other organisms.

## Pathogens



## Required practical



## Equations for this topic

# Chemistry



# Foundations of chemistry

## Threshold Concept

All matter is made of particles

## States of matter:



State	Solid	Liquid	Gas
Closeness of particles	Very close	Close	Far apart
Arrangement of particles	Regular pattern	Randomly arranged	Randomly arranged
Movement of particles	Vibrate around a fixed position	Move around each other	Move quickly in all directions
Energy of particles	Low energy	Greater energy	Highest energy
2D diagram			

## Atoms and compounds:

**Elements**  
contain just one type of atom.

Oxygen ( $O_2$ )



**Compounds**  
contain different types of atom bonded together.

Carbon dioxide ( $CO_2$ )



## Pure substances:

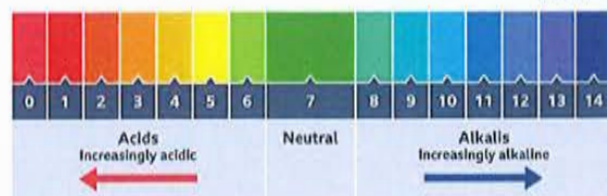
Pure substances are made from only one chemical element or one compound.

For example, salt is a pure substance made only of sodium chloride.



## The pH scale:

0-1 Hydrochloric acid (HCl)	1 Stomach acid	2 Lemon juice	3 Vinegar
4 Tomato	5 Banana	6 Milk	7 Pure water
8-10 Soaps	11 Ammonia solution	12 Bleach	13 Drain cleaner
13-14 Sodium hydroxide (NaOH)			

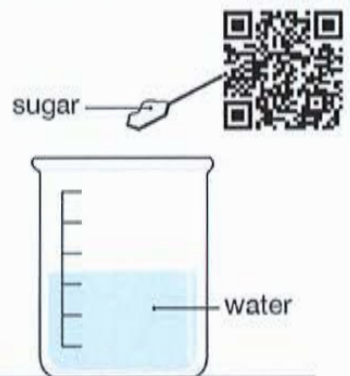


## Keywords

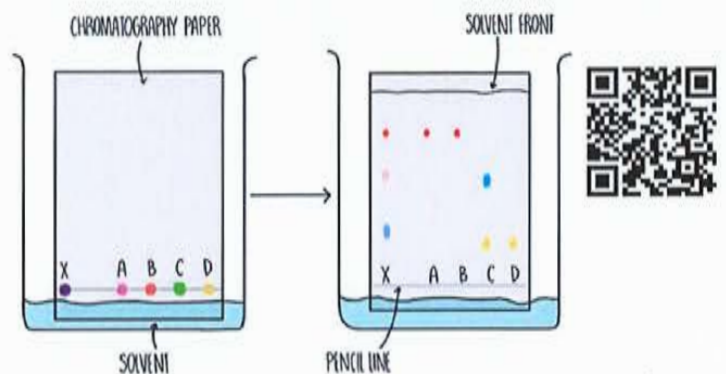
- **Particles:** The tiny things that all materials are made from. The smallest unit of matter.
- **Atom:** Atoms are the building blocks of all matter. Everything is made of atoms - even yourself. They are the smallest particle of an element, which are far too small to see.
- **Solid:** Have a fixed shape and cannot flow, because their particles cannot move from place to place, cannot be compressed (squashed), because their particles are close together and have no space to move into.
- **Liquid:** Flow and take the shape of their container, because their particles can move around each other, cannot be compressed, because their particles are close together and have no space to move into
- **Gas:** Flow and completely fill their container, because their particles can move quickly in all directions, can be compressed, because their particles are far apart and have space to move into

## Solubility:

- Some solids dissolve in water to make a solution.
- These solids are soluble.
- A solution is made from a solute (usually a solid) and a solvent (liquid).
- Some gases, such as oxygen and carbon dioxide, can also dissolve in water.



## Required practical: Chromatography



## Equations for this topic:

$$R_f \text{ value} = \frac{\text{distance travelled by substance (B)}}{\text{distance travelled by solvent (A)}}$$



# Periodic Table

## Threshold Concept

All elements fit within the Periodic Table



Link to information on most of the topic, consisting of slides, videos, and quizzes

## Keywords

**Elements** - a substance that cannot be broken down into any other substance.

**Periodic Table** - a table showing every element that is known to exist.

**Symbol** - a sign/letter/character that is used to represent something

## Periodic Table & Developing the Periodic Table

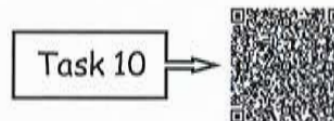
Mendeleev redesigned Newlands periodic table by organising the periodic table by atomic weights and the properties of the elements. Some gaps were left based on his predictions of other elements that hadn't been discovered yet. As more elements were found, the modern periodic table took form from organised by atomic number.

Task 1 & 2 →

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

Period numbers

## RAM & Isotopes



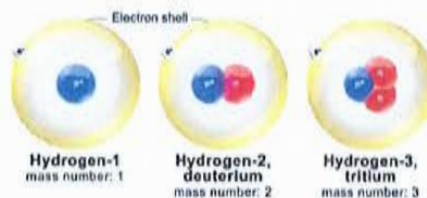
### RAM



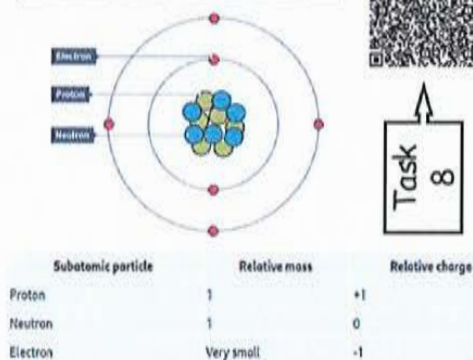
### Isotopes

Atoms of the same element must have the same number of protons, but they can have different numbers of neutrons. Atoms of the same element with different numbers of neutrons are called **isotopes**. Isotopes of an element have:

- the same atomic number
- different mass numbers



## Atomic Structure



## Electronic Configuration

Task 9 →

Example, using an atom of sodium

No. of electrons per shell

- 1st shell: up to 2
- 2nd shell: up to 8
- 3rd shell: up to 8
- etc

## Group 1 - Alkali Metals



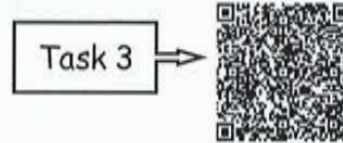
- 1
- All share similar properties:
- Are soft (can be cut)
  - Have relatively low MP
  - Have low densities
- The further down the group you go, the more reactive the elements become.
- They will react with air and tarnish quite quickly.
  - They will react with water to produce an alkaline solution (hence the name) and turn universal indicator blue/purple
- Li  
Na  
K  
Rb  
Cs  
Fr

## Group 7 - Halogens



- 7
- All have 7 electrons in outer shell.
- All diatomic (made up of two atoms bonded together).
- The further down the group you go, the less reactive the elements become.
- The further down the group you go, the higher its MP and BP, because:
- Molecules become larger
  - Intermolecular forces become stronger
  - More energy is needed to overcome these forces
- F  
Cl  
Br  
I  
At  
Ts

## Group 0 - Noble Gases



- 0
- All have full outer shells. All unreactive (inert).
- All have low boiling points. Lower down the group, the higher it gets.
- This is because, going down the group:
- Atoms become larger
  - Intermolecular forces between atoms become stronger
  - More energy is needed to overcome these forces
- He  
Ne  
Ar  
Kr  
Xe  
Rn  
Og



# Metals

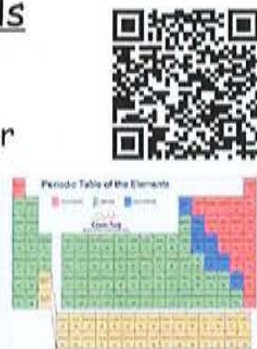
## Threshold Concept

Identify most metals have similar properties

## Metals and non metals

Most elements on the periodic table are metals. They are grouped together in the middle to the left-hand side of the periodic table.

Non metals are on the right-hand side.



## Keywords

**Metal**..... DEFINITION

**Non metal** ..... DEFINITION

**Property** ..... a characteristic of a particular substance

**Reaction** ..... a process that leads to the change of one set of chemical substances into another

**Alloy** ..... a mixture of two or more metals, or a metal and a non-metal

**Displacement** ..... A more reactive metal will displace a less reactive metal from its compound.

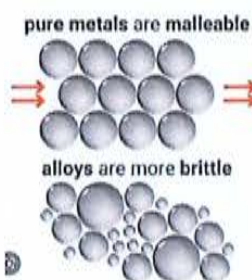
## Physical properties of metals

Properties	Metals	Non-metals
Appearance	Shiny	Dull
Hardness	Very hard or hard	Brittle
Malleability	Malleable	Non-malleable
Ductility	Ductile	Non-ductile
Heat conduction	Good conductor	Bad conductor
Conduction of electricity	Good conductor	Bad conductor
State	Solid	Solids, liquid, gases
Density	Higher	Lower



## Metals and alloys

Making alloys changes the metals properties by changing its structure. Alloying is done for many reasons, typically to increase strength, increase corrosion resistance, or reduce costs



## Chemical properties of metals

Burnt in air

Water

Acids

Metal salts

## Practical - Displacement reactions

**1**

Metal

**2**

Sulfate

**3**

What did you see?

	Magnesium	Zinc	Copper
Magnesium sulfate	X	O	O
Zinc sulfate	O	X	O
Copper sulfate	O	O	X



## The reactivity series

potassium most reactive  
sodium  
calcium  
magnesium  
aluminium  
carbon  
zinc  
iron  
tin  
lead  
hydrogen  
copper  
silver  
gold  
platinum least reactive



The Reactivity Series lists metals in order how easily they react with other substances



## Equations for this topic

Metal + acid → salt + hydrogen

Metal + oxygen → Metal oxide

Metal + water → Metal hydroxide + hydrogen



# Rock Cycle

## Threshold Concept

Understand that rocks change within 3 types over time.

## Types of rocks

### Sedimentary rocks

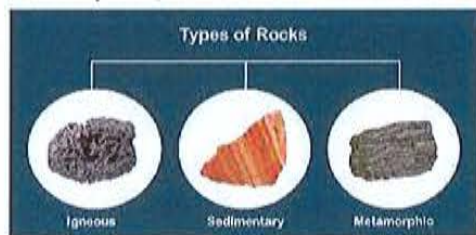
Sedimentary rocks are formed from sediments that have settled at the bottom of a lake, sea or ocean, and have been compressed over millions of years.

### Metamorphic rocks

Metamorphic rocks are formed from other rocks which change due to heat or pressure.

### Igneous rocks

Igneous rocks are formed from molten (liquid) rock that has cooled and solidified.

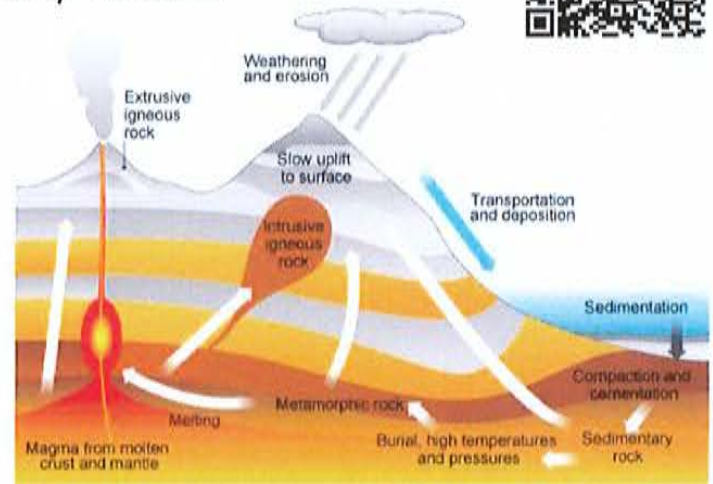


## Keywords

- **Rock:** The solid mineral material forming part of the surface of the earth and other similar planets, exposed on the surface or underlying the soil.
- **Earth:** The planet on which we live; the world.
- **Cycle:** Move in or follow a regularly repeated sequence of events.
- **Temperature:** The degree or intensity of heat present in a substance or object.
- **Pressure:** Continuous physical force exerted on or against an object by something in contact with it.

## The rock cycle

Rocks on earth do not always stay the same.



Rocks are continually changing due to processes such as, weathering, erosion and large earth movements. The rocks are gradually recycled over millions of years, changing between the different rock types.

## Types of weathering

### 1. Biological weathering

This describes rocks being broken up by the roots of plants, or animals burrowing into them.

### 2. Chemical weathering

This describes rocks being broken up because substances in rainwater, rivers and seawater or the air, react with the in the rocks.

### 3. Physical weathering

This describes rocks being broken up by changes in temperature, freezing and thawing of trapped water or the action of waves and rivers.



## Required practical

## Equations for this topic

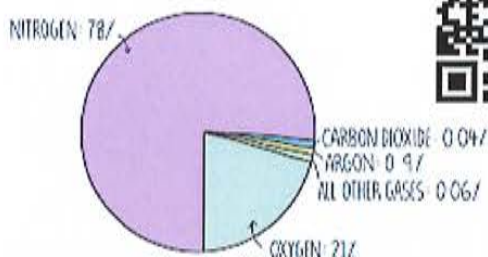


# Chemistry of the atmosphere

## Threshold Concept

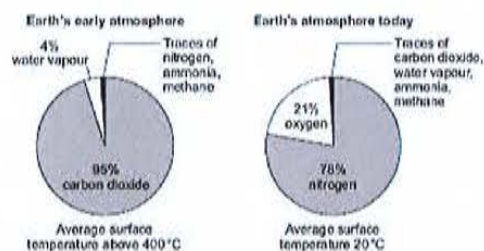
The Earth's atmosphere is made of different gases.

## The Proportion of gases in the earth's atmosphere



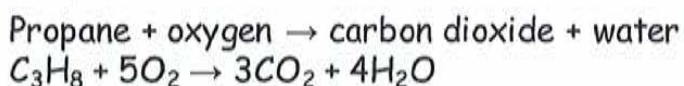
## History of the earth's atmosphere

- The proportion of oxygen increased because of **photosynthesis** by plants and algae.
- The proportion of ammonia decreased as it reacted with the newly formed oxygen in the atmosphere to form nitrogen and water vapour.
- The proportion of methane decreased as it reacted with the newly formed oxygen to form carbon dioxide and water.

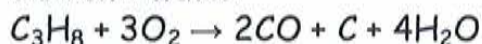
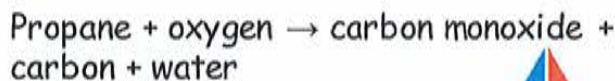


## Combustion

Complete combustion:



Incomplete combustion:



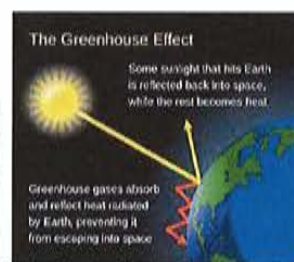
## Keywords

- **Atmosphere:** An atmosphere is the layers of gases surrounding a planet.
- **Pollutants:** A pollutant is a chemical or biological substance which harms water, air, or land quality.
- **Climate change:** Climate change refers to long-term shifts in temperatures and weather patterns.
- **Combustion:** Combustion is another name for burning. In a combustion reaction, fuel is burned and reacts with oxygen to release energy.
- **Global Warming:** Global warming is the long-term warming of the planet's overall temperature.

## Greenhouse gases

Greenhouse gases present in the atmosphere include:

- water vapour
- carbon dioxide
- methane



## Required practical Testing for gases

<b>Test for Carbon dioxide, CO<sub>2</sub></b> Carbon dioxide gas Limewater (clear/colourless) → Limewater (cloudy/milky)	<b>Test for Chlorine, Cl<sub>2</sub></b> Chlorine bleaches damp blue litmus paper Chlorine gas: Blue → Red → White	<b>Test for Hydrogen, H<sub>2</sub></b> Hydrogen makes a squeaky pop with a lighted splint POP!
<b>Test for Water, H<sub>2</sub>O</b> Water turns cobalt chloride paper from blue to pink	<b>Test for Oxygen, O<sub>2</sub></b> Oxygen relights a glowing splint Glowing splint → Relights	<b>Cl Gas Tests</b> Cl, CO <sub>2</sub> , O <sub>2</sub> , H <sub>2</sub> , H <sub>2</sub> O These gas tests appear regularly on the final exam. Try to learn them.



## Equations for this topic



# Bonding Part 1

## Threshold Concept

How do 100 elements make up everything in the universe?

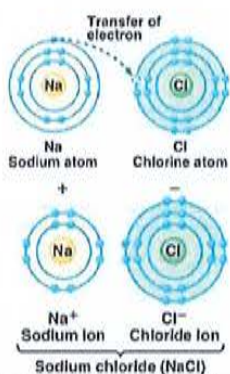
## Forming ions

An ion is a charged particle.

Atoms will lose or gain electrons to get a full outer shell.

The **metal** atom **loses electrons** to become a **positive** ion

The **non-metal** atom **gains electrons** to become a **negative** ion.



Use task 3-5

## Keywords

**Electron** - a subatomic particle with a negative charge

**Electrostatic attraction** - strong attraction between oppositely charged ions

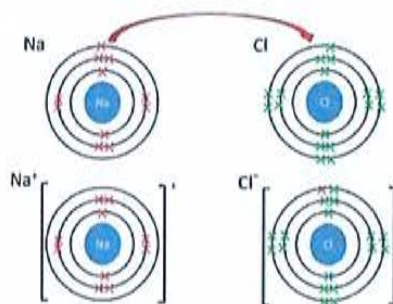
**Weak intermolecular forces** - force of attraction between atoms, elements and molecules

**Delocalised electron** - free moving electron that isn't a part of any atom

**Ion** - a charged particle

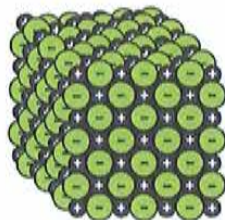
## Ionic bonds

Ionic bonds are formed between metals and non-metals. Metals **lose** electrons and **non-metals** gain electrons. The oppositely charged ions attract one another forming an ionic bond.



## Ionic compounds and properties

Positive and negative ions join together to form a giant ionic lattice



electrostatic attraction is strong

Ionic compounds have a high M.P

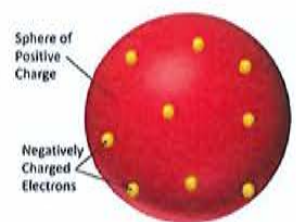
Lots of energy needed to overcome attraction



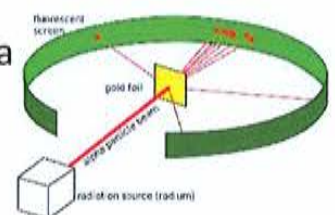
Ionic compounds don't conduct when solid because the ions are locked in position. When molten or dissolved the ions are free to move and can conduct

## History of the atom

JJ Thomson – Suggested the plum pudding model. Atoms were a ball of positive charge with negative particles scattered within.



Ernest Rutherford – Alpha scattering experiment. Found that atoms has a very small, positive nucleus and the majority of atoms are empty space.





# Bonding Part 2

## Threshold Concept

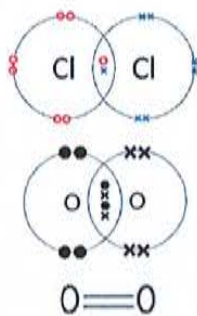
How do 100 elements make up everything in the universe?

## Covalent bonds

Two non-metals will form a covalent bond. The atoms share electrons to make themselves stable.



- 1 shared pair = a single bond
- 2 shared pairs = a double bond
- 3 shared pairs = a triple bond



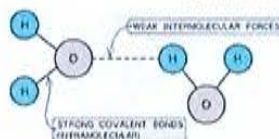
## Keywords

- Electron** - a subatomic particle with a negative charge
- Electrostatic attraction** - strong attraction between oppositely charged ions
- Weak intermolecular forces** - force of attraction between atoms, elements and molecules
- Delocalised electron** - free moving electron that isn't a part of any atom
- Ion** - a charged particle

## Simple Covalent compounds

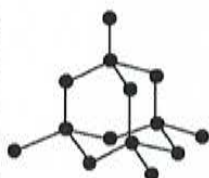
Simple covalent compounds have strong covalent bonds between atoms and weak intermolecular forces between molecules.

- Properties - low m.p and b.p
- cannot conduct electricity

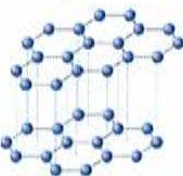


## Giant Covalent Structures

Diamond



Graphite



Silicon dioxide



Graphene



Fullerenes



## Metallic bonding

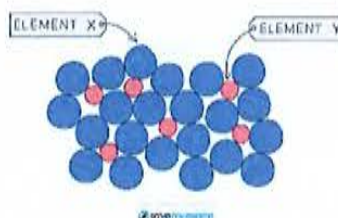
Metals consist of a giant metallic structure. They are positive metal ions surrounded by a sea of delocalised electrons.



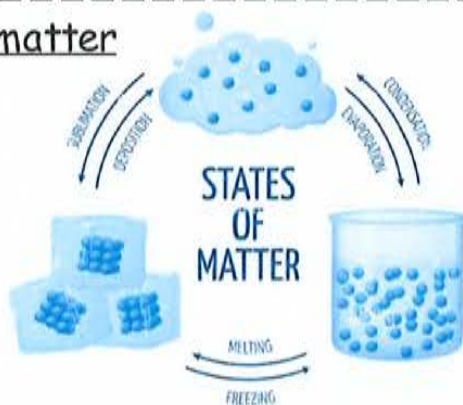
## Alloys

Alloys are a mixture of metals and another element.

Alloys are stronger than metals as the different sized atoms distort the layers.



## States of matter



## States of matter



# Quantitative chemistry

## Threshold Concept

To understand that total mass of reactants equals total mass of products

## RFM

molybdenum	← element name
42	← atomic number number of protons (Z)
Mo	← atomic symbol
95.94	← atomic mass A this is an average mass

RAM is a tomic mass of an element

RFM is the combination of all elements Ar in a compound or Molecule

### Work example

Helium (He) Ar = 4

Carbon dioxide = CO<sub>2</sub>

Carbon (C) = 12 Oxygen (O) = 16

Mr of CO<sub>2</sub> = 12 + (16 x 2) = 44

4 He helium	12 C carbon
16 O oxygen	



## Keywords

Conservation - the mass of the reactants must equal the mass of the products in a chemical reaction

Formula mass - the combined mass numbers of an element or compound

Concentration - the amount of substance dissolved in a solution

Equation - symbol representation of a chemical reaction

Loss - the process of losing something

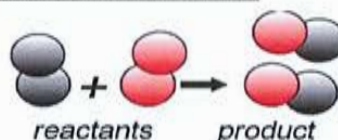
Gain - the process of gaining something

## Balancing Equations

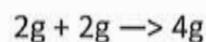
As the same number of elements are at the start and the end of reactions. The Equation needs to be balanced.



## Conservation of Mass



The reactants mass must always equal the mass of the products



We can not destroy atoms.



## Moles

Chemical amounts are measured in moles. One mole of a substance contains  $6.02 \times 10^{23}$  particles (Avagadro's number)



## Concentration

Concentration is the amount of substance in a certain volume of solution (g/dm<sup>3</sup>)



## Percentage by mass

The amount of an element in a compound is called its percentage composition. It can be calculated using the mass of the given element in the compound and the RFM of the Compound.

$$\text{Mass \%} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100\%$$



## Limiting reactions

The reactant that gets used up first in a reaction is called the limiting reactant. This reactant is not in EXCESS



## Reacting masses

The mass of a product or reactant can be determined from having a balanced symbol equation. Once balanced, the equation tells you how many moles of each substance react with each other :  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$  (Balanced)

This equation states that: 1 : Mg 2 : HCl to form 1 : MgCl<sub>2</sub> 1 : H<sub>2</sub>

Using the formula and moles you can use this information to work out how much product you will make





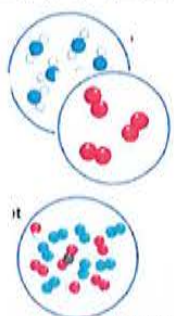
# Chemical analysis

## Threshold Concept

How do we identify a substance?

## Pure and impure

Pure substances are made up of just one type of element or compound. They will have one set melting or boiling point.



Impure substances are a mixture of elements or compounds and have a range of melting/boiling points.



## Formulations

A formulation is a mixture which has been designed as a useful product.

- Fuels
- Cleaning products
- Paints

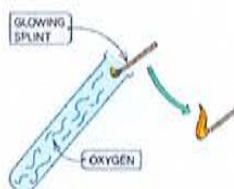


## Test for gases

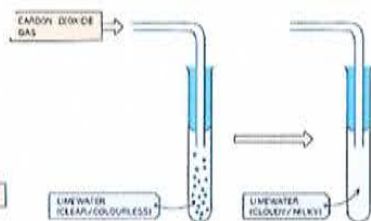
### Test for Hydrogen



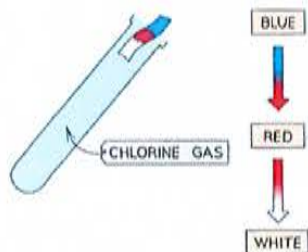
### Test for Oxygen



### Test for Carbon Dioxide



### Test for Chlorine



## Keywords

**Pure** – a substance made from just one element or compound

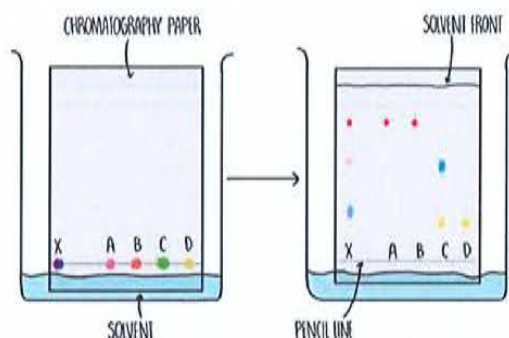
**Impure** – a substance made from more than one element or compound

**Analyse** – to find the chemical composition of a substance

**Sample** – a portion of a substance taken from a larger amount

## Chromatography required practical

Chromatography is a method used to separate the substances in a mixtures.



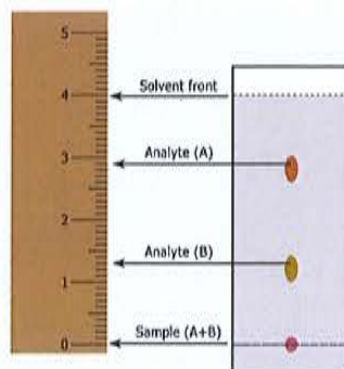
**Stationary phase** – where the molecules can't move (chromatography paper)

**Mobile phase** – where the molecules can move (the solvent)



## R<sub>f</sub> Value

$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$





# Chemical analysis Triple

## Threshold Concept

How do we identify a substance?

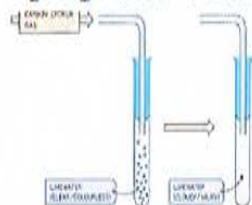
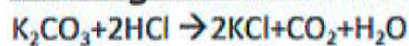
## Testing for metal ions

Metal ions will form coloured precipitates when they react with sodium hydroxide.

Metal Cation	Effect of adding NaOH
Aluminium ( $Al^{3+}$ )	White precipitate, dissolves in excess NaOH to form a colourless solution
Magnesium ( $Mg^{2+}$ )	White precipitate, insoluble so remains in excess NaOH
Calcium ( $Ca^{2+}$ )	White precipitate, insoluble so remains in excess NaOH
Copper (II) ( $Cu^{2+}$ )	Light blue precipitate, insoluble in excess
Iron (II) ( $Fe^{2+}$ )	Green precipitate, insoluble in excess
Iron (III) ( $Fe^{3+}$ )	Red-brown precipitate, insoluble in excess



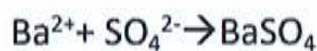
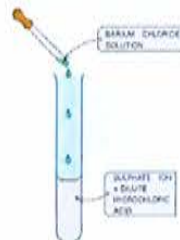
## Testing for carbonate ions $CO_3^{2-}$



- Metal carbonate and hydrochloric acid
- Forms Carbon dioxide
- Turns lime water cloudy



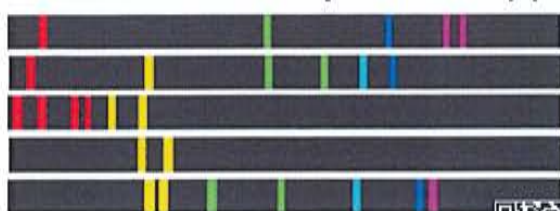
## Testing for Sulphate ions ( $SO_4^{2-}$ )



- Add barium chloride
- White precipitate formed



## Flame emission spectroscopy



An instrumental technique used to identify metal ions.



## Keywords

**Pure** - a substance made from just one element or compound

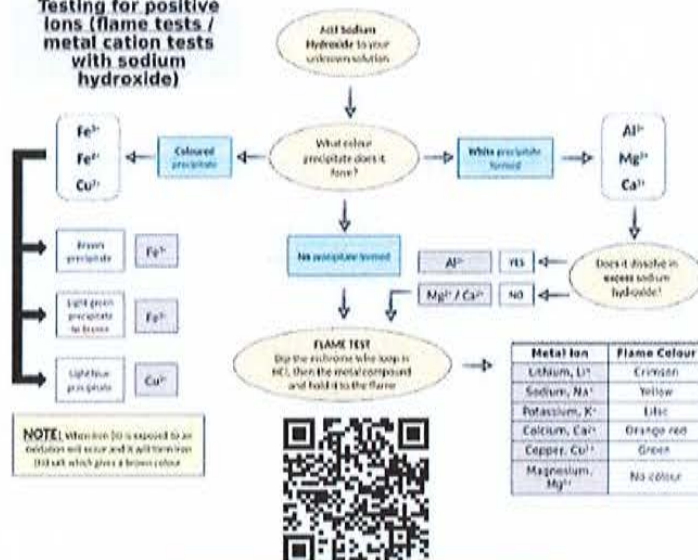
**Impure** - a substance made from more than one element or compound

**Analyse** - to find the chemical composition of a substance

**Sample** - a portion of a substance taken from a larger amount

## Identifying ions required practical

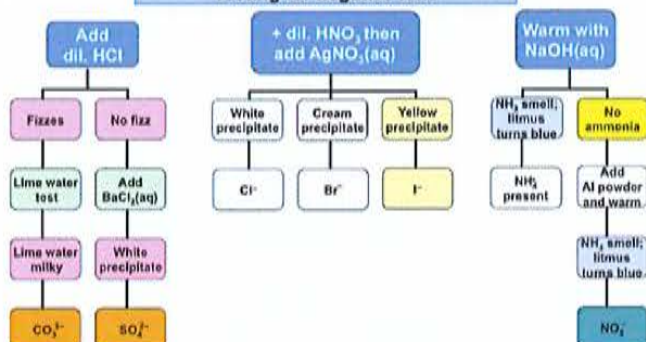
Testing for positive ions (flame tests / metal cation tests with sodium hydroxide)



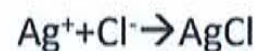
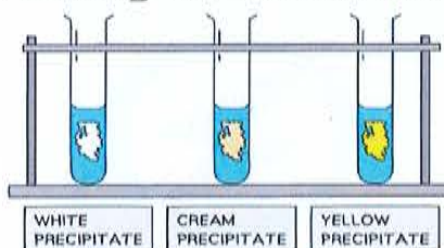
NOTE: Lithium (Li) is exposed to an oxidiser and so will give a brown colour. Do not eat which gives a brown colour.



## Testing for negative ions



## Testing for Halide ions ( $Cl^-$ , $Br^-$ , $I^-$ )



- Add nitric acid
- Add a few drops of silver nitrate
- Chloride forms a white precipitate
- Bromide forms a cream precipitate
- Iodide forms a yellow precipitate



English  
Language



**Threshold Concept- Year 10- Language- Reading:**

TC1 -Understanding texts: identifying explicit and implicit information; selecting accurate and precise quotations.

TC2 – Demonstrate and appreciation of the writer's craft through analysis and critically evaluative comments.

TC4 – Evaluate writer's craft including comparison skills.



**Showing your understanding of texts- use PEEZL to structure your answers.**

Component 1, Question 2 response- 5/5 marks.

**Point**- rephrase key words from question to start your answer.

**Evidence**- introduce quotation(s).

Mention techniques here!

**Explanation**- explain what quotations shows.

**Zoom**- pick a single word choice made by the writer and explain what it implies.

**Link to reader** - mention how reader may react and why.

The writer creates the impression that there is a misunderstanding between the characters of Emma and Robbie. For example, the writer describes how Robbie "was well known for his grumpiness", yet "Emma mistook it for shyness". The fact that Emma mistakes his grumpy attitude for being shy emphasises how the couple do not fully understand each other as they misinterpret each other's behaviour.

The writer also creates the impression that Emma and Robbie are both very different people. While Robbie is "twenty years older than her" and quite grumpy, Emma is impressionable and slightly naive as she believes "he was more mature than me" as a result of his sulking attitude. This impression is reinforced when the writer explains how after a week "Emma was feeling the need for some time apart from Robbie". This highlights the distant nature of their relationship and suggests it may not be as strong or loving as she believes.

You should use this info to get the base knowledge needed to confidently answer the different types of question on component 1 and 2.

Frequent, short quotations weaved into your answers and explained will make your work even more successful

**Expressing higher order ideas in explanations (for analysis/evaluation).**

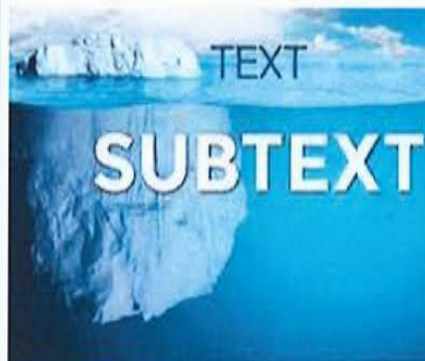
Use this to transform your responses from this...

**Text** = what is directly written in a piece of literature.

(Don't include in your explanations- you'll just be repeating yourself/ retelling the story.)

**Subtext** = the meanings beneath the surface of what is written.

These are the things that show you are thinking deeply about the writer's choices.



What happens.

Connotations of words.

Implied emotions of characters.

Alternative interpretations.

Writer's intentions.

The quotation: "as strong as a bull" reflects that the man is like a strong cow. X

To this...

The quotation "as strong as a bull" shows that the man in question is a powerful physical specimen. It may also reflect the man is mentally tough, perhaps even stubborn. The noun "bull" might reflect the writer's intention to show that the man is aggressive, perhaps foreshadowing harm he does to others later in the story. ✓



**Identifying language and structural features.**

0 2 Read lines 7-16. What impressions does the writer create of Emma and Robbie in these lines? [5] You must refer to the language used in the text to support your answer, using relevant subject terminology where appropriate.

Whenever you see the highlighted words, try to identify and mention the writer's technique choices in your essays.

Common language techniques	Common structural features
Simile Metaphor Personification Adjective Adverb	Lists Repetition of words Lexical (word) patterning Repetition of a technique Tone shift

Use this to transform your responses from this...

The quotation: "as strong as a bull" shows...

Make sure you can confidently identify these!

To this...

The quotation: "as strong as a bull" is a simile, which shows...



**Comparing successfully- using comparative connectives.**

- | Words that signal a comparison | Words that signal a contrast |
|--------------------------------|------------------------------|
| - As                           | - however                    |
| - Also                         | - Although                   |
| - Like                         | - Whereas                    |
| - Alike                        | - In contrast                |
| - Likewise                     | - Yet                        |
| - Resembles                    | - Differs from               |
| - Similar                      | - Instead                    |
| - Just as                      | - Unlike                     |
| - Just like                    | - On the contrary            |
| - Equally                      | - Different from             |
| - Some both                    | - On the other hand          |

Platinum answers may include: The words "more" "less" regularly AND comparative adjectives.

Words that end in 'er' that compare two things i.e. greater.

Use these frequently when comparing non-fiction texts.

Both the 'Penny Review' and the Chilean mining article finish with the miners being rescued. This creates a sense of drama as the rest of the texts build up tension and anticipation for their rescue. However, in the Chilean article the day of the rescue is also mentioned at the beginning: the "scenes of jubilation erupted" as the miners were rescued. This dramatic verb 'erupted' portrays the excitement and



Make sure you clearly mention which specific text you are discussing every time.



**Threshold Concept- Year 10- Writing:**

TC5 - Communicate clearly, effectively, and imaginatively, selecting and adapting tone, style and register for different forms, purposes and audiences.

TC6 - Organise information and ideas, using structural and grammatical features to support coherence and cohesion of texts

TC7 - Use a range of sentence structures for clarity, purpose and effect, with accurate punctuation and spelling.

To be a successful writer, you need to juggle all of these different skills.



### Vocabulary:

Common word	Better word
Big	Vast
Small	Microscopic
Happy	Elated
Sad	Melancholy
Scary	Blood-curdling
Scared	Petrifying
Loud	Thunderous
Quiet	Soundless
Said	Declared
Red	Vermillion

**Ask yourself these questions:**

- Do I know, use and spell correctly plenty of better words for common words?
- Do I push myself to use more ambitious words in all my work- not just English?

### Techniques:

**Ask yourself these questions:**

- Do I know what all these techniques are?
- Do I use a range of these (and maybe even some others!) in my own writing?

### Punctuation:

**Ask yourself these questions:**

- Am I aware of the function and when to use each of these pieces of punctuation?
- Do I consistently use all these pieces of punctuation in my writing?

### Structure:

For fiction texts- SCIT:

**40 min successful plot structure- SCIT.**

**Section 1:** Describe the **setting**.

**Section 2:** Describe the main **character**.

**Section 3:** Describe **ONE incident**.

**Section 4:** Describe how the setting/character has now **transformed**.

For non-fiction texts- PAF:

Purpose	WHY you are writing your non-fiction text.	Inform, persuade, advise, review, entertain.
Audience	WHO you are writing to/for.	Wide audience, council, parents, tourists, teenagers.
Form	WHAT you are writing and HOW it is uniquely laid out.	Letter, magazine article, newspaper article, advertisement, speech.

**Ask yourself these questions:**

- Does my writing achieve what I want it to?
- Do I adapt my writing (i.e. word/language choices) based on the task I am set?



# English Literature

**Threshold Concept- Year 10- A Christmas Carol:**

TC1 - Understanding texts

TC2 - Demonstrate an appreciation of the writer's craft through analysis and critically evaluative comments.

TC3 - Understanding the relationships between texts and the contexts in which they were written.

**A plot and character summary of 'A Christmas Carol:' Full text (if on MS Teams) = [A Christmas Carol Audiobook](#)**



**THE CHARACTERS**

**Scrooge**  
A mean, miserable, lonely old miser. Can he learn the truth about Christmas and about himself before it is too late?

**Bob Cratchit**  
Scrooge's poor office clerk and a loving father. Can he earn enough money to save his son's life?

**Tiny Tim**  
Bob's gentle, frail son. Will he live or will he die?

**Jacob Marley's ghost**  
Scrooge's dead business partner. Will his terrible warning come too late?

**Ghost of Christmas Past**  
Why does this ghost make Scrooge weep with both joy and sorrow?

**Ghost of Christmas Present**  
A cheerful spirit. Will Scrooge heed his warnings?

**Ghost of Christmas Yet to Come**  
A frightening, silent ghost. Can Scrooge change the dreadful future this spirit shows him?

Using this information can you:

- Recount what happens from start to finish in the novella?
- Explain who the primary characters are, and what makes them unique?

You should use this information to get the base knowledge needed for Charles Dickens' story.

E.g. The Ghost of Christmas Yet To Come shows Scrooge a horrible future where he dies- he is a silent, petrifying ghost.

**How to analyse the writer's craft- break the quotation up into smaller chunks. Example on Scrooge.**

**Golden-adjective = suggests value.**  
Noun: Sunlight brings life, light and warmth. Scrooge brings life as he gives money to Bob to ensure Tiny Tim continues to live. He brings light as he is a much more jolly and friendly person. He brings warmth as he is a far warmer, more compassionate man.

Scrooge is a rare and valuable human being- a nice rich man. He is valued by the people around them, now!

Scrooge also now values the sunlight and the world around him = he is appreciative.

Golden sunlight; Heavenly sky; sweet fresh air; merry bells.

**Adjective- links to the idea of rebirth. Scrooge is starting afresh- he is reincarnated as a completely new Scrooge. The whole world is fresh to him and he is fresh to the world and the people around him, too.**

**Adjective- Scrooge sees Heaven above him in the sky. London is now a place he is happy in- it is a heaven to him. It also suggests his new religious side where he follows God's teachings to treat others well.**

In order to be successful, you must know a range of different moments from the whole story. For example, other moments where Scrooge is important include:

- Scrooge's introduction as a miserable boss. "Bah! Humbug!"
- Scrooge as a child. "Poor boy!"
- Scrooge's reaction to the ghosts. "I will honour Christmas in my heart."

**The relationships between A Christmas Carol and the historical context in which they are written.**

Prince Albert and Queen Victoria decorating a Christmas tree 1848. Where the tradition started.

Saint Nicholas- patron saint of children, known for his generosity and kindness.

The Ghost of Christmas Present, who resembles Saint Nicholas and is surrounded by new Victorian Christmas tradition.

Look out for other parts of the novella clearly inspired by the outside world, i.e. poverty, treatment of children, workhouses.



## Threshold Concept- Year 10- Poetry:

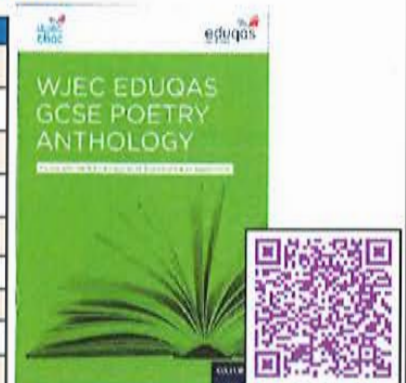
TC1 - Understanding texts

TC2 - Demonstrate an appreciation of the writer's craft through analysis and critically evaluative comments.

TC3 - Show understanding of the relationships between texts, and the contexts in which they were written.

1 sentence summaries of each poem: Full annotations (if on MS Teams) = [Annotated 15 poems.](#)

Poem	1 sentence summary
The Manhunt	The one where a wife writes about her scarred soldier-husband.
Sonnet 43	The one about listing ways you love someone.
London	The one about hating a city and what it represents.
The Soldier	The one about the glory of dying for England.
She Walks in Beauty	The one about the beauty of a mourning woman.
Living Space	The one about the cramped Indian slums.
As Imperceptibly as Grief.	The one about fear of time passing away and death.
Cozy Apologia	The one about the specialness of a normal "boring" relationship.
Valentine	The one about how love is like an onion
A Wife in London	The one about the wife who finds out her husband has died in South Africa.
Death of a Naturalist	The one about where frogs teach a child about reproduction.
Hawk Roosting	The one about where a bird is compared to humanity.
To Autumn	The one where a season is compared to a woman/ goddess.
Afternoons	The one where about the restrictions of motherhood.
Dulce Et Decorum Est	The one about a WW1 gas attack.
Ozymandias	The one about the broken statue of someone who was powerful.
Mametz Wood	The one about soldiers' remains in farming fields.
The Prelude	The one about the magic of cold winter days.



You should use this info to get the base knowledge needed for each poem.

Using this information can you:

- Recount the main idea from each poem?
- Begin to recount quotations/words/the background in the poems?

E.g. London is a poem about how horrible the capital of England is to the poet.

How to analyse the poet's craft- use FLIRT to cover a range of different features in your responses.

<b>F</b> orm	Sonnet? Ballad? Free verse? Ode? Narrative poem?
<b>L</b> anguage	Word choices? Adjectives/adverbs? Verbs? Lexical fields? Connotations?
<b>I</b> magery	Similes? Metaphors? Personification? Hyperbole? Senses? Alliteration? Onomatopoeia?
<b>R</b> hyme/structure	Rhyme scheme? Enjambment? Caesura?
<b>T</b> one	Joyful? Depressed? Angry? Ironic? Nostalgic? Shifting?



### Ozymandias example.

**Sonnet** = love poem = Ozymandias loved his power.

"desert" "boundless" "bare" **lexical field** of loneliness reflects how forgotten Ozymandias is now.

"sneer of cold command" strong sounding **alliteration** suggest violence of Ozymandias to his slaves

"Stand of the desert. Near them..." **Caesura** = isolation of the statue.

"Ozymandias- King of kings" **ironic** tone- Ozymandias' power has faded completely.

Linking the content of the poem to the writer's life/ the history behind it! This links to the context of the poem, because...



1914- Propaganda posters/ poetry persuades men to go to WW1.



1915- Wilfred Owen enlists in the army.



1915- 1918- Wilfred Owen experiences the horrors of war (including gas attacks).



1917- 1918- Wilfred Owen writes a response to the propaganda that persuaded men to go to war.



Each of the poems have stories behind them that inspired the writers- make sure you know them and mention them to showcase your knowledge!

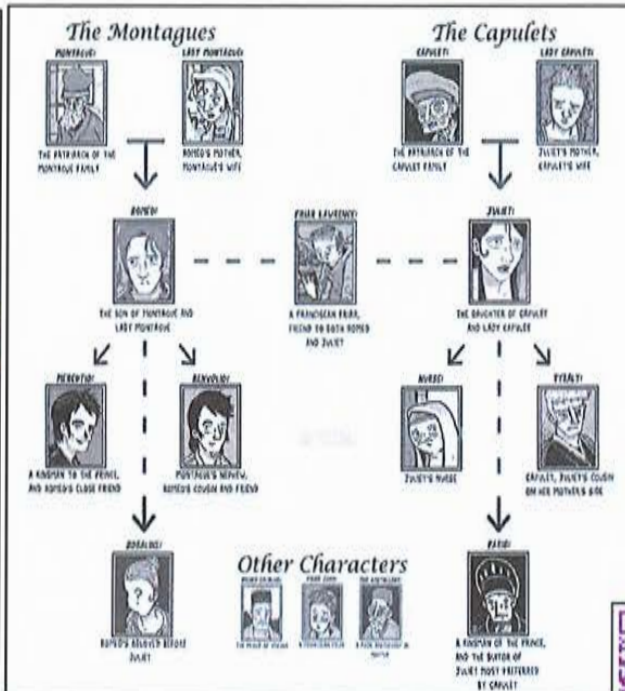


## Threshold Concept- Year 10- Romeo and Juliet:

TC1 - Understanding texts

TC2 - Demonstrate an appreciation of the writer's craft through analysis and critically evaluative comments.

### A plot and character summary of 'Romeo and Juliet:' Full text (if on MS Teams) = [Romeo and Juliet Audiobook](#)



Using this information can you:

- Recount what happens from start to finish in the play?
- Explain who the primary characters are, and what makes them unique?

You should use this information to get the base knowledge needed for Shakespeare's play.

E.g. Juliet is instructed to marry Paris by Capulet and Lady Capulet, but fakes her death to avoid this.

How to analyse the writer's craft- mention the writer's name and all of the choices they make. Example on Tybalt (focus on trying to write explanations like you see in the green box below.)

The character of Tybalt is presented purposely by Shakespeare to be aggressive and deadly: "turn, Benvolio and look upon thy death". Shakespeare has Tybalt use an imperative here to command the Montague characters to do what he says as he feels superior to them. His use of the metaphor "death" to describe his sword, shows that he often uses the object with the intention of killing his opponents. The original audience may celebrate Tybalt being like this, as it reflects his masculinity and strength in a world which promoted warrior culture, but a modern audience would more likely see his language as overly violent and completely unnecessary, as conflict is looked down upon more so now.

Key quote written down

Technique identified.

What it shows

Audience reaction(s).

In order to be successful, you must know a range of different moments from the whole play. For example, other moments where violence is important include:

- Romeo and Juliet's suicide. "Stabs herself"
- Mercutio's death "a plague on both your houses."
- Romeo kills Tybalt. "They fight; TYBALT falls"

### Developing this further- discussing audience reaction.

A really effective way to showcase your understanding of the text is by comparing how an original audience might react vs. how a modern audience might react (see the blue part of the WAGOLL above). This is how we do this:



ORIGINAL AUDIENCE MIGHT THINK

Juliet is ungrateful for refusing to marry a suitable man they've selected for her. They may dislike her for trying to resist the male-dominated society that she (and they) are part of.

MODERN AUDIENCE MIGHT THINK

Juliet is right to do what she does. She should pursue the man she loves and should not bow down to the pressure of her parents. They may celebrate her power, in spite of her youth.

Try to consider, as you read the play, your own reactions to characters/ events. Then compare this to how an audience in the 1590s (with very different views to us) would react.



## Threshold Concept- Year 10- An Inspector Calls:

TC1 - Understanding texts

TC2 - Demonstrate an appreciation of the writer's craft through analysis and critically evaluative comments.

### A plot and character summary of 'An Inspector Calls:' Full text (if on MS Teams) = [An Inspector Calls audiobook](#)



Using this information can you:

- Recount what happens from start to finish in the play?
- Explain who the primary characters are, and what makes them unique?

You should use this information to get the base knowledge needed for J.B. Priestley's play.

E.g. Mr Birling is an ignorant Capitalist who sacked Eva Smith for demanding equal pay.

How to analyse the writer's craft- mention the writer's name and all of the choices they make. Example on Sheila (focus on trying to write explanations like you see in green here.)

The character of Sheila Birling is used to reflect that the younger generation have a chance to be different to their elders. The quotation: **"these girls aren't cheap labour, they're people"** shows Sheila's new understanding that women (regardless of class) should be treated more equally to men. J.B. Priestley has her criticise her male relatives who treat females as lower beings. The adjective "cheap" is used by the writer to show that she feels they are worth more than how society sees them. The original audience may dislike a woman challenging a man at this time as it is not the norm at all, though Sheila would be celebrated by a more modern audience as she is seen more so as a strong feminist figure, similar to the suffragettes.

Key quote written down
Technique identified.
What it shows
Audience reaction(s).

In order to be successful, you must know a range of different moments from the whole play. For example, other moments where Sheila is important include:

- Sheila's introduction as sheltered and childish "mummy" "daddy"
- Sheila's new-found power in her speech and interruptions "(cutting in)"
- Sheila's change and refusal to accept Gerald's engagement ring. "No...I must think"

### Developing this further- discussing audience reaction.

A really effective way to showcase your understanding of the text is by comparing how an original audience might react vs. how a modern audience might react (see the blue part of the WAGOLL above). This is how we do this:



ORIGINAL AUDIENCE MIGHT THINK

Edna is lucky to work for the Birlings. She has a stable job and an opportunity to live in a beautiful house. (Original theatre-goers more likely to have maids and be Capitalists.)

MODERN AUDIENCE MIGHT THINK

Edna is unlucky to work for the Birlings. She would earn very little indeed and has to wait on a whole family at all hours of the day. (Modern audiences more sympathetic to working-class)



Try to consider, as you read the play, your own reactions to characters/ events. Then compare this to how an audience in 1946 (with very different views to us) would react.

Maths



# Year 11 - Reasoning...

## Multiplicative reasoning



### What do I need to be able to do?

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

- Understand and use scale factors
- Understand direct and inverse proportion
- Calculate with pressure and density
- Complete ratio problems

### Keywords

**Scale factor:** the multiplier of enlargement

**Proportion:** a comparison between two numbers

**Direct proportion:** as one variable is multiplied by a scale factor the other variable is multiplied by the same scale factor.

**Inverse proportion:** as one variable is multiplied by a scale factor the other is divided by the same scale factor.

**Pressure** = Force ÷ Area

**Density** = Mass ÷ Volume

**Ratio:** a ratio shows the relative size of two variables

### Direct Proportion

As one variable changes the other changes at the same rate.



4 cans of pop = £2.40

4 cans of pop = £2.40  
 2 cans of pop = £1.20

$\times 0.5$

$\times 2$

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

This is a multiplicative change

4 cans of pop = £2.40  
 12 cans of pop = £7.20

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

### Conversion Graphs

Compare two variables



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

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

### Inverse Proportion

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

Examples of inversely proportional relationships

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

Time taken to paint a room and the number of workers

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

T	1	2	8
G	40	20	5

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

### Direct and inverse proportion equations

$g$  is directly proportional to  $h$ .

When  $g = 120$ ,  $h = 40$

- Work out the constant of proportionality

$$g = kh$$

$$120 = 40k$$

$$k = \frac{120}{40} = 3$$

$$g = 3h$$

- Work out the value of  $g$  when  $h = 25$

$$g = 3h$$

$$g = 3 \times 25$$

$$g = 75$$

- Work out the value of  $h$  when  $g = 25$

$$g = 3h$$

$$25 = 3h$$

$$h = \frac{25}{3}$$

$g$  is inversely proportional to  $h$ .

When  $g = 12$ ,  $h = 4$

- Work out the constant of proportionality

$$g = \frac{k}{h}$$

$$12 = \frac{k}{4}$$

$$k = 12 \times 4 = 48$$

$$g = \frac{48}{h}$$

- Work out the value of  $g$  when  $h = 3$

$$g = \frac{48}{h}$$

$$g = \frac{48}{3}$$

$$g = 16$$

- Work out the value of  $h$  when  $g = 6$

$$g = \frac{48}{h}$$

$$6 = \frac{48}{h}$$

$$h = \frac{48}{6}$$

$$h = 8$$

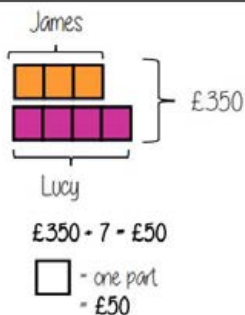
### Sharing a whole into a given ratio



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

Model the Question

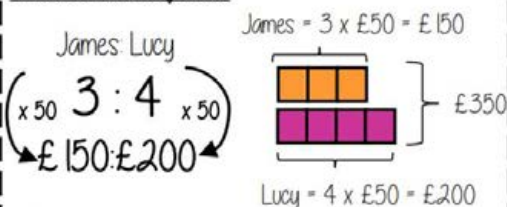
James: Lucy  
3 : 4



Find the value of one part

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

Put back into the question



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

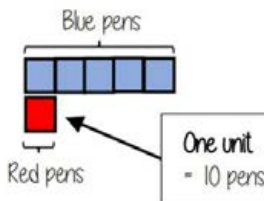


Inside a box are blue and red pens in the ratio 5:1. If there are 10 red pens how many blue pens are there?

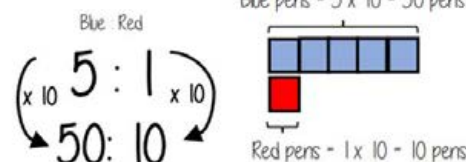
Model the Question

Blue : Red  
5 : 1

□ = one part = 10 pens



Put back into the question



There are 50 Blue Pens

# Year 11 - Reasoning...

## Geometric reasoning

### What do I need to be able to do?

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

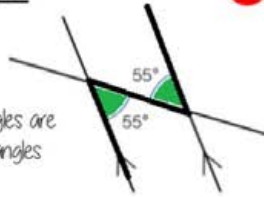
- Understand angles facts
- Calculate exterior/interior angles of polygons
- Proving geometric facts
- Problem solving with angles
- **Circle Theorems (H)**

### Keywords

- Angle:** the amount of turn between two lines around their common point
- Parallel:** straight lines always the same distance apart and never touch. They have the same gradient
- Bearing:** the angle in degrees measured clockwise from North. Given as 3 digits
- Interior angles:** angles inside the shape
- Exterior angles:** angles outside the shape on a straight line. Int + ext = 180
- Polygon:** A 2D shape made with straight lines
- Regular:** when a shape is regular all sides are the same length and all angles are the same
- Irregular:** shape with sides of different lengths and angles of different sizes
- Sum:** total, add all the angles together

### Alternate angles

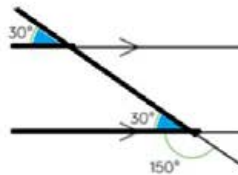
Because alternate angles are equal the highlighted angles are the same size



R

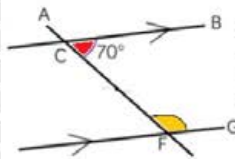
### Corresponding angles

Because corresponding angles are equal the highlighted angles are the same size



R

### Co-interior angles

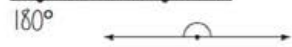


Because co-interior angles have a sum of 180° the highlighted angle is 110°  
As angles on a line add up to 180° co-interior angles can also be calculated from applying alternate/ corresponding rules first

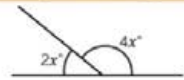
R

### Solving angle problems

#### Angles on a straight line



Link angle facts to algebra



Form an equation

$$2x + 4x = 180^\circ$$

State the reason

The sum of angles on a straight line is 180°

Solve

$$2x + 4x = 180^\circ$$

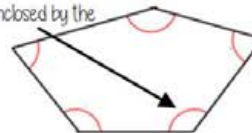
$$6x = 180^\circ$$

$$x = 30^\circ$$

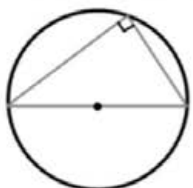
Vertically opposite angles  
Equal  
Angles around a point  
360°

Triangles  
Sum of angles is 180°  
Isosceles have the same base angles

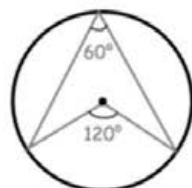
Interior Angles  
The angles enclosed by the polygon



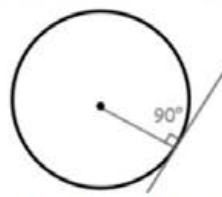
$$(\text{number of sides} - 2) \times 180$$



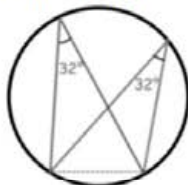
The angle in a semi-circle is 90°



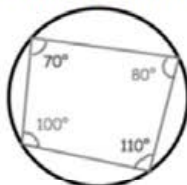
The angle in the centre is double the angle at the circumference



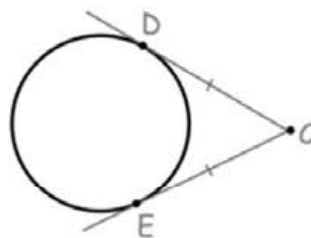
A radius and a tangent meet at 90°



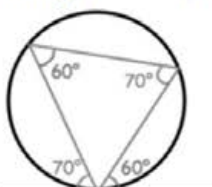
Angles in the same segment are equal



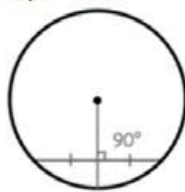
Opposite angles in a cyclic quadrilateral add up to 180°



Tangents to a point are the same length



The Alternate Segment Theorem



The perpendicular bisector of a chord is a radius

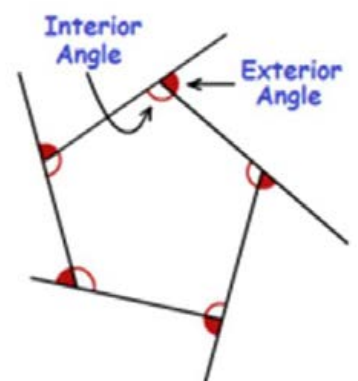


### Interior and exterior angles

The sum of exterior angles in any polygon is 360°

The size of each exterior angle in a regular polygon is  $360^\circ \div \text{number of sides}$

Interior + exterior angle = 180°





# Year 11 - Reasoning...

## Algebraic reasoning

### What do I need to be able to do?

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

- Simplify expressions
- $N^{\text{th}}$  term for linear sequences
- $N^{\text{th}}$  term for quadratic sequences
- Solve simultaneous equations

### Keywords

**Expression:**

**Sequence:** items or numbers put in a pre-decided order

**Term:** a single number or variable

**Position:** the place something is located

**Linear:** the difference between terms increases/decreases by a constant each time

**Non-Linear:** the difference between terms increases/decreases in different amounts

**Quadratic:** where the highest power of the variable is squared ( $x^2$ )

**Difference:**

**Co-efficient:** number in front of the variable

### Linear and Non Linear Sequences

**Linear Sequences** – increase by addition or subtraction and the same amount each time

**Non-linear Sequences** – do not increase by a constant amount – quadratic, geometric and Fibonacci

- Do not plot as straight lines when modelled graphically
- The differences between terms can be found by addition, subtraction, multiplication or division

**Fibonacci Sequence** – look out for this type of sequence

0 | 1 | 1 | 2 | 3 | 5 | 8 | ...

Each term is the sum of the previous two terms



### Solve Simultaneous Equations

#### 1. Linear

$$\begin{aligned} (1) \quad 2a + c &= 34.45 \\ (2) \quad 2a + 3c &= 52.35 \\ (2) - (1) \quad 2c &= 17.90 \\ c &= 8.95 \end{aligned}$$

#### 2. With one quadratic

$$\begin{aligned} y &= x^2 & x^2 &= x + 2 \\ y &= x + 2 & x^2 - x - 2 &= 0 \\ & & (x - 2)(x + 1) &= 0 \\ & & x &= 2, x = -1 \\ & & y &= x^2 \\ & & y &= (2)^2 & y &= (-1)^2 \\ & & y &= 4 & y &= 1 \\ & x = 2 \text{ and } y = 4 & x = -1 \text{ and } y = 1 \end{aligned}$$

### Sequences from algebraic rules

This is substitution!

$$3n + 7$$

$$3n^2 + 7$$

This will be linear - note the single power of  $n$ . The values increase at a constant rate

This is not linear as there is a power for  $n$

$$2n - 5 \rightarrow$$

Substitute the number of the term you are looking for in place of 'n'

eg  
1<sup>st</sup> term =  $2(1) - 5 = -3$   
2<sup>nd</sup> term =  $2(2) - 5 = -1$   
100<sup>th</sup> term =  $2(100) - 5 = 195$

### Checking for a term in a sequence

Form an equation

Is 201 in the sequence  $3n - 4$ ?

$$3n - 4 = 201 \quad \leftarrow \text{Term to check}$$

Solving this will find the position of the term in the sequence. ONLY an integer solution can be in the sequence.

More details on the next page ☺

### Finding the algebraic rule

This is the 4 times table  $\rightarrow$  4, 8, 12, 16, 20, ...

$$4n$$

$$7, 11, 15, 19, 22$$

This has the same constant difference – but is 3 more than the original sequence

$$4n + 3$$

This is the constant difference between the terms in the sequence

This is the comparison (difference) between the original and new sequence

# Year 11 - Reasoning...

@whisto\_maths

## Simultaneous Equations

### What do I need to be able to do?

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

- Determine whether (x,y) is a solution
- Solve by substituting a known variable
- Solve by substituting an expression
- Solve graphically
- Solve by subtracting/ adding equations
- Solve by adjusting equations
- Form and solve linear simultaneous equations

### Keywords

**Solution:** a value we can put in place of a variable that makes the equation true

**Variable:** a symbol for a number we don't know yet

**Equation:** an equation says that two things are equal - it will have an equals sign =

**Substitute:** replace a variable with a numerical value

**LCM:** lowest common multiple (the first time the times table of two or more numbers match)

**Eliminate:** to remove

**Expression:** a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)

**Coordinate:** a set of values that show an exact position

**Intersection:** the point two lines cross or meet

### Is (x, y) a solution?

x and y represent values that can be substituted into an equation

Does the coordinate (1,8) lie on the line  $y=3x+5$ ?

This coordinate represents  $x=1$  and  $y=8$

$$y = 3x + 5$$

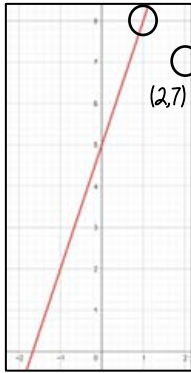
$$8 = 3(1) + 5$$

As the substitution makes the equation correct the coordinate (1,8) IS on the line  $y=3x+5$

Is (2,7) on the same line?

$$7 \neq 3(2) + 5$$

No 7 does NOT equal  $6+5$



### Substituting known variables

A line has the equation  $3x + y = 14$

Two different variables, two solutions

Stephanie knows the point  $x = 4$  lies on that line. Find the value for y

$$3x + y = 14$$

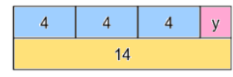
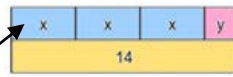
$$3(4) + y = 14$$

$$12 + y = 14$$

$$-12 \quad -12$$

$$y = 2$$

$$x = 4$$



### Substituting in an expression

Substitute 2y in place of the x variable as they represent the same value

$$x = 2y$$



$$x = 2y$$

$$x + y = 30$$

$$x + y = 30$$



$$3y = 30$$

$$3y = 30$$

$$\div 3$$

$$y = 10$$

$$x = 2y$$



$$x = 20$$

Pair of simultaneous equations (two representations)

### Solve graphically

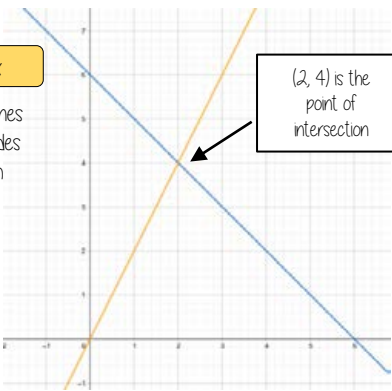
$$x + y = 6$$

$$y = 2x$$

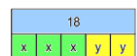
Linear equations are straight lines. The point of intersection provides the x and y solution for both equations.

The solution that satisfies both equations is

$$x = 2 \text{ and } y = 4$$



### Solve by subtraction



$$3x + 2y = 18$$



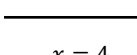
$$- \quad x + 2y = 10$$



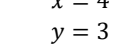
$$2x = 8$$



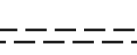
$$\div 2 \quad \div 2$$



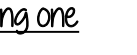
$$x = 4$$



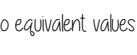
$$x + 2y = 10$$



$$(4) + 2y = 10$$



$$-4 \quad -4$$



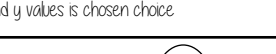
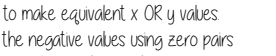
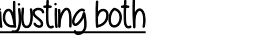
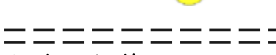
$$2y = 6$$



$$\div 2 \quad \div 2$$

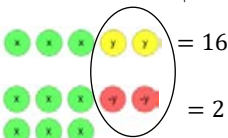


$$y = 3$$



### Solve by addition

Addition makes zero pairs



$$3x + 2y = 16$$

$$+ 6x - 2y = 2$$

$$9x = 18$$

$$\div 9 \quad \div 9$$

$$x = 2$$

$$3x + 2y = 16$$

$$3(2) + 2(y) = 16$$

$$6 + 2y = 16$$

$$-6 \quad -6$$

$$2y = 10$$

$$y = 5$$

### Solve by adjusting one

$$h + j = 12$$

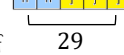
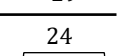
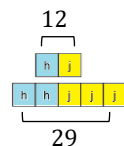
No equivalent values

$$2h + 2j = 29$$

$$2h + 2j = 24$$

$$2h + 2j = 29$$

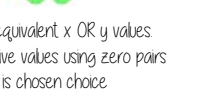
By proportionally adjusting one of the equations - now solve the simultaneous equations choosing an addition or subtraction method



### Solve by adjusting both

$$2x + 3y = 39$$

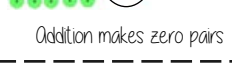
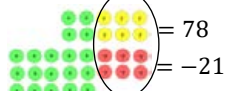
$$5x - 2y = -7$$



Use LCM to make equivalent x OR y values. Because of the negative values using zero pairs and y values is chosen choice

$$4x + 6y = 78$$

$$15x - 6y = -21$$



Now solve by addition

Addition makes zero pairs



# Year 11 - Reasoning...

## Transforming & Constructing

### What do I need to be able to do?

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

- Draw and measure angles
- Construct scale drawings
- Find locus of distance from points, lines, two lines
- Construct perpendiculars from points, lines, angles
- Identify congruence
- Identify congruent triangles

### Keywords

- Protractor:** piece of equipment used to measure and draw angles
- Locus:** set of points with a common property
- Equidistant:** the same distance
- Discorectangle:** (a stadium) — a rectangle with semi circles at either end
- Perpendicular:** lines that meet at  $90^\circ$
- Arc:** part of a curve
- Bisector:** a line that divides something into two equal parts
- Congruent:** the same shape and size

### Draw and measure angles

**R**

Draw a  $35^\circ$  angle

Make a mark at  $35^\circ$  with a pencil and join to the angle point (use a ruler)

The angle

Make sure the cross is at the end of the line (where you want the angle)

### Scale drawings

**R**

A picture of a car is drawn with a scale of 1:30

For every 1cm on my image is 30cm in real life

The car image is 10cm

Image : Real life  
1cm : 30cm  
 $\times 10$   $\leftarrow$   $\rightarrow$   $\times 10$   
10cm : 300cm

### Locus of a distance from a point

All points are equidistant (the same distance) from the fixed point in the middle

Equipment needed  
The radius is the distance from the fixed point

If the point is in the corner it can only make a quarter circle

### Locus of a distance from a straight line

All points are equidistant (the same distance) from line

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

The ends of the line are fixed points

### Locus equidistant from two points

Also a perpendicular bisector  
Because if the points are joined this new line intersects it at a  $90^\circ$

Join the intersections with a ruler.  
All points on this line are equidistant from both points

Keep the compass the same size and draw two arcs from each point

### Construct a perpendicular from a point

Use a compass and draw an arc that cuts the line. Use the point to place the compass

Keep the compass the same distance and now use your new points to make new intersecting arcs

Connecting the arcs makes the bisector

If P is a point on the line the steps are the same

### Locus of a distance from two lines

Also an angle bisector  
This cuts the angle in half

From the angle vertex draw two arcs that cut the lines forming the angle

Keep the compass the same size and use the new arcs as centres to draw intersecting arcs in the middle

Join the vertex to the intersection

### Congruent figures

Congruent figures are identical in size and shape — they can be reflections or rotations of each other

### Congruent triangles

**Side-side-side**  
All three sides on the triangle are the same size

**Angle-side-angle**  
Two angles and the side connecting them are equal in two triangles

**Side-angle-side**  
Two sides and the angle in-between them are equal in two triangles (it will also mean the third side is the same size on both shapes)

**Right angle-hypotenuse-side**  
The triangles both have a right angle, the hypotenuse and one side are the same

### Constructing Triangles

Link to steps **R**

Side, Angle, Angle

Side, Angle, Side

Side, Side, Side

Congruent shapes are identical — all corresponding sides and angles are the same size

$\triangle ABC = \triangle KLM$

Because all the angles are the same and  $AC = KM$   $BC = LM$  triangles ABC and KLM are **congruent**

# Year 11 - Listing & describing...

@whisto\_maths

## Collecting, representing and interpreting

### What do I need to be able to do?

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

- Construct and interpret frequency tables and polygon two-way tables, line, bar, & pie charts
- Find and interpret averages from a list and a table
- Construct and interpret time series graphs, stem and leaf diagrams and scatter graphs

### Keywords

- Population:** the whole group that is being studied
- Sample:** a selection taken from the population that will let you find out information about the larger group
- Representative:** a sample group that accurately represents the population
- Random sample:** a group completely chosen by chance. No predictability to who it will include.
- Bias:** a built-in error that makes all values wrong by a certain amount
- Primary data:** data collected from an original source for a purpose.
- Secondary data:** data taken from an external location. Not collected directly.
- Outlier:** a value that stands apart from the data set

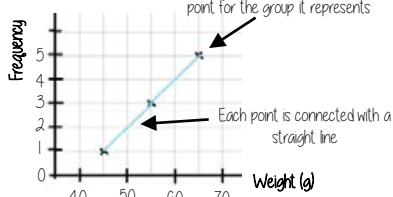
### Frequency tables and polygons

x Weight(g)	Frequency
$40 < x \leq 50$	1
$50 < x \leq 60$	3
$60 < x \leq 70$	5

We do not know from grouped data where each value is placed so have to use an estimate for calculations

#### MID POINTS

Mid-points are used as estimated values for grouped data. The middle of each group

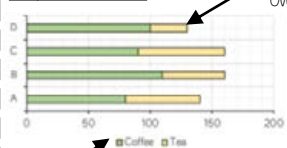


The data about weight starts at 40 So the axis can start at 40

Mid-point  
Start point + End point  
2

### Bar and line charts

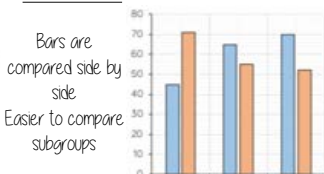
#### Composite bar charts



Categories clearly indicated

Compare the bars green compared to yellow. The size of each bar is the frequency. Overall total easily comparable

#### Dual bar charts



Bars are compared side by side. Easier to compare subgroups

Categories clearly indicated

### Averages from a table

#### Non-grouped data

Number of Siblings	0	1	2
Frequency	6	8	6
Subtotal	0	8	12

Overall Frequency: 20

Total number of siblings: 20

The data in a list: 0,0,0,0,0,1,1,1,1,1,1,1,2,2,2,2,2,2,2

Mean:  $\frac{\text{total number of siblings}}{\text{Total frequency}} = 1$

#### Grouped data

x Weight(g)	Frequency	Mid Point	MP x Freq
$40 < x \leq 50$	1	45	45
$50 < x \leq 60$	3	65	195
$60 < x \leq 70$	5	65	325

Overall Frequency: 9

Overall Total: 565

Mean: 62.8g

The data in a list: 45, 55, 55, 55, 65, 65, 65, 65, 65

### Two way tables

60 people visited the zoo one Saturday morning. 26 of them were adults. 13 of the adults' favourite animal was an elephant. 24 of the children's favourite animal was an elephant.

Extract information to input to the two-way table

	Adult	Child	Total
Elephant	13	24	37
Other	13	10	23
Total	26	34	60

Subgroups each have their own heading

Needs subgroup totals

Overall total

### Draw and interpret Pie Charts

Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

There were 60 people asked in this survey (Total frequency)

$\frac{32}{60}$  "32 out of 60 people had a dog"

This fraction of the 360 degrees represents dogs

$\frac{32}{60} \times 360 = 192^\circ$



Use a protractor to draw. This is  $192^\circ$

Multiple method  
As 60 goes into 360 - 6 times. Each frequency can be multiplied by 6 to find the degrees (proportion of 360)

Comparing Pie Charts  
You NEED the overall frequency to make any comparisons

### Averages from lists

#### The Mean

A measure of average to find the central tendency... a typical value that represents the data

24, 8, 4, 11, 8

Find the sum of the data (add the values)

55

Divide the overall total by how many pieces of data you have

$55 \div 5$

Mean = 11

#### The Mode (The modal value)

This is the number OR the item that occurs the most (it does not have to be numerical)

24, 8, 4, 11, 8

Mode = 8

This can still be easier if the data is ordered first

#### The Median

The value in the center (in the middle) of the data

24, 8, 4, 11, 8

Put the data in order

4, 8, 8, 11, 24

Find the value in the middle

4, 8, 8, 11, 24

Median = 8

NOTE: If there is no single middle value find the mean of the two numbers left

#### For Grouped Data

The modal group - which group has the highest frequency



# YEAR 10 — DELVING INTO DATA...

## Collecting, representing and interpreting

@whisto\_maths

### What do I need to be able to do?

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

- Construct and interpret frequency tables and polygon two-way tables, line, bar, & pie charts
- Find and interpret averages from a list and a table
- Construct and interpret time series graphs, stem and leaf diagrams and scatter graphs

### Keywords

**Population:** the whole group that is being studied

**Sample:** a selection taken from the population that will let you find out information about the larger group

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**Bias:** a built-in error that makes all values wrong by a certain amount

**Primary data:** data collected from an original source for a purpose.

**Secondary data:** data taken from an external location Not collected directly

**Outlier:** a value that stands apart from the data set

### Stem and leaf

0 way to represent data and use to find averages

This stem and leaf diagram shows the age of people in a line at the supermarket

0	7 9
1	4 5 6 8 8
2	1 3
3	0

Key: 1|4 Means 14 years old

Stem and leaf diagrams

Must include a key to explain what it represents  
The information in the diagram should be ordered

Back to back stem and leaf diagrams

Girls	Boys
5	14
7, 5, 5, 5, 4	15 3, 8, 9
8, 4, 2, 1, 0	16 2, 5, 7, 7, 8, 8, 9
9, 8, 7, 6, 6, 4, 2, 1, 1, 0, 0	17 0, 2, 3, 6, 6, 7, 7
	18 0, 1, 4, 5

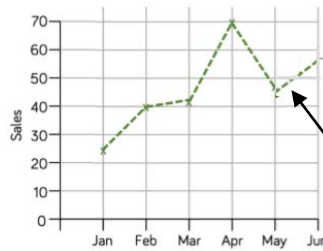
15 | 3,  
Means 153 cm tall

Back to back stem and leaf diagrams

Allow comparisons of similar groups  
Allow representations of two sets of data

### Time-Series

This time-series graph shows the total number of car sales in £1000 over time



Look for general trends in the data. Some data shows a clear increase or a clear decrease over time.

Readings in-between points are estimates (on the dotted lines). You can use them to make assumptions.

### Comparing distributions

Comparisons should include a statement of average and central tendency, as well as a statement about spread and consistency

Mean, mode, median — allows for a comparison about more or less average

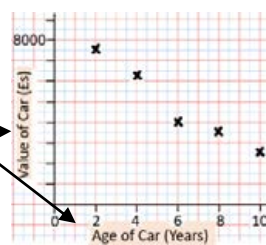
Range — allows for a comparison about reliability and consistency of data

### Draw and interpret a scatter graph

Age of Car (Years)	2	4	6	8	10
Value of Car (£s)	7500	6250	4000	3500	2500

- This data may not be given in size order
- The data forms information pairs for the scatter graph
- Not all data has a relationship

All axes should be labelled

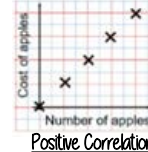


The axis should fit all the values on and be equally spread out

"This scatter graph shows as the age of a car increases the value decreases"

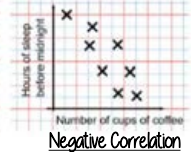
The link between the data can be explained verbally

### Linear Correlation



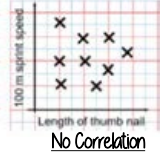
Positive Correlation

As one variable increases so does the other variable



Negative Correlation

As one variable increases the other variable decreases



No Correlation

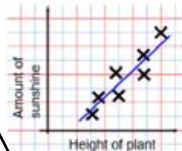
There is no relationship between the two variables

### The line of best fit

The Line of best fit is used to make estimates about the information in your scatter graph

Things to know:

- The line of best fit **DOES NOT** need to go through the origin (The point the axes cross)
- There should be approximately the same number of points above and below the line (It may not go through any points)
- The line extends across the whole graph



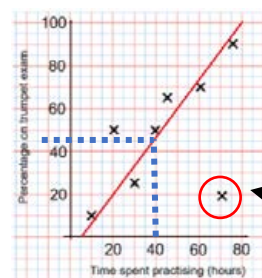
It is only an estimate because the line is designed to be an average representation of the data

It is always a straight line.

### Using a line of best fit

**Interpolation** is using the line of best fit to estimate values inside our data point

e.g. 40 hours revising predicts a percentage of 45



**Extrapolation** is where we use our line of best fit to predict information outside of our data

\*\*This is not always useful — in this example you cannot score more than 100%. So revising for longer can not be estimated\*\*

This point is an "outlier" It is an outlier because it doesn't fit this model and stands apart from the data

# Year 11 - Listing & describing

## Probability

@whisto\_maths

### What do I need to be able to do?

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

- Add, Subtract and multiply fractions
- Find probabilities using likely outcomes
- Use probability that sums to 1
- Estimate probabilities
- Use Venn diagrams and frequency trees
- Use sample space diagrams
- Calculate probability for independent events
- Use tree diagrams

### Keywords

- Event:** one or more outcomes from an experiment
- Outcome:** the result of an experiment
- Intersection:** elements (parts) that are common to both sets
- Union:** the combination of elements in two sets
- Expected Value:** the value/ outcome that a prediction would suggest you will get
- Universal Set:** the set that has all the elements
- Systematic:** ordering values or outcomes with a strategy and sequence
- Product:** the answer when two or more values are multiplied together.

### Add, Subtract and multiply fractions

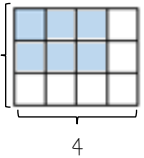
Addition and Subtraction

$$\frac{4}{5} - \frac{2}{3} = \frac{12}{15} - \frac{10}{15} = \frac{2}{15}$$

Use equivalent fractions to find a common multiple for both denominators

Multiplication

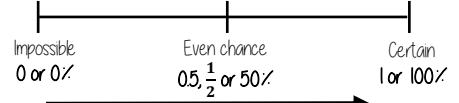
$$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$$

Modelled: 

Parts shaded: 6

Total number of parts in the diagram: 12

### Likelihood of a probability



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

### Sum to 1

Probability is always a value between 0 and 1

The probability of getting a blue ball is  $\frac{1}{5}$   
 ∴ The probability of NOT getting a blue ball is  $\frac{4}{5}$

The sum of the probabilities is 1

### Experimental data

Theoretical probability

What we expect to happen

Experimental probability

What actually happens when we try it out

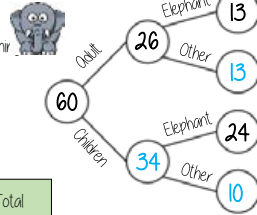
The more trials that are completed the closer experimental probability and theoretical probability become

The probability becomes more accurate with more trials.  
 Theoretical probability is proportional

### Tables, Venn diagrams, Frequency trees

#### Frequency trees

60 people visited the zoo one Saturday morning. 26 of them were adults. 13 of the adults' favourite animal was an elephant. 24 of the children's favourite animal was an elephant.



Frequency trees and two-way tables can show the same information

The total columns on two-way tables show the possible denominators

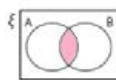
$$P(\text{adult}) = \frac{26}{60}$$

$$P(\text{Child with favourite animal as elephant}) = \frac{13}{37}$$

#### Two-way table

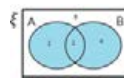
	Adult	Child	Total
Elephant	13	24	37
Other	13	10	23
Total	26	34	60

#### Venn diagram



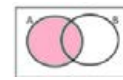
in set A AND set B

$$P(A \cap B)$$



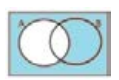
in set A OR set B

$$P(A \cup B)$$



in set A

$$P(A)$$



NOT in set A

$$P(A')$$

### Sample space

The possible outcomes from rolling a dice

The possible outcomes from tossing a coin

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

$$P(\text{Even number and tails}) = \frac{3}{12}$$

### Independent events

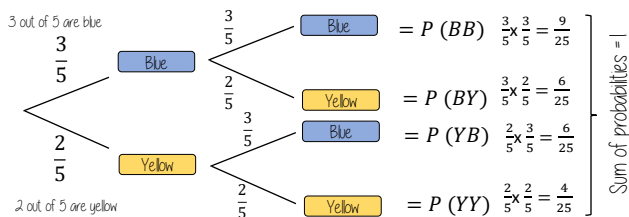
The outcome of two events happening. The outcome of the first event has no bearing on the outcome of the other

$$P(A \text{ and } B) = P(A) \times P(B)$$

#### Tree diagram for independent event

Isobel has a bag with 3 blue counters and 2 yellow. She picks a counter and replaces it before the second pick.

Because they are replaced the second pick has the same probability

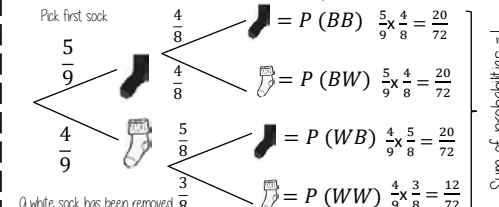


### Dependent events

Tree diagram for dependent event

The outcome of the first event has an impact on the second event

A sock drawer has 5 black and 4 white socks. Jamie picks 2 socks from the drawer.



NOTE: as 'socks' are removed from the drawer the number of items in that drawer is also reduced ∴ the denominator is also reduced for the second pick



PSHE

## Key Terms

New Psychoactive Substances (NPS)	Drugs that are designed to replicate the effects of other illegal substances
Nitrous Oxide	An anaesthetic without complete unconsciousness - commonly called 'Laughing Gas'
Festival	An organised event, usually involving music. Typically happens over a number of days
Trafficking	To deal or trade in something that is illegal
Addiction	Compulsive drug seeking and use despite adverse consequences
Stress	An automatic response to dealing with challenges

PSHE covers a variety of topics that focus on developing understanding in four key areas: personal, social, health and economic.

### NPS

New Psychoactive Substances are drugs that are designed to replicate the effects of other illegal substances. They used to be called 'legal highs' before the law was changed. Examples include Spice and Black Mamba

### Nitrous Oxide

Also called 'Laughing Gas', street name Whippets. Taking it has effects like: an altered state of reality and a sense of euphoria. Vomiting, High blood pressure, Nausea, numbness of the muscles

### Drug Addiction

Addiction is compulsive drug seeking and use despite adverse consequences.

Young people can turn to drugs and alcohol for many different reasons - peer pressure, loneliness, experimentation, coping mechanism.



## Key Skills

- Active listening and communication
- Teamwork
- Negotiation and self advocacy
- Leadership
- Presentation and debate

## Stress

Stress is an automatic response to dealing with challenges. Year 11 can be a very stressful time because of exams and other pressures.

Stress can make it hard to sleep, make you irritable and effect your appetite.

But there are things to help, including: yoga, mindfulness, exercise, reading and taking rest breaks.



# Physics

# Vehicle Safety

## Threshold Concept

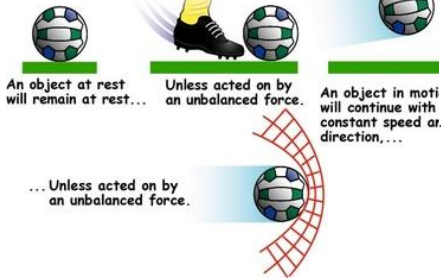
Cars have safety features to reduce impact forces

## Safety Features in Cars



## Newton's First Law

### Newton's First Law of Motion



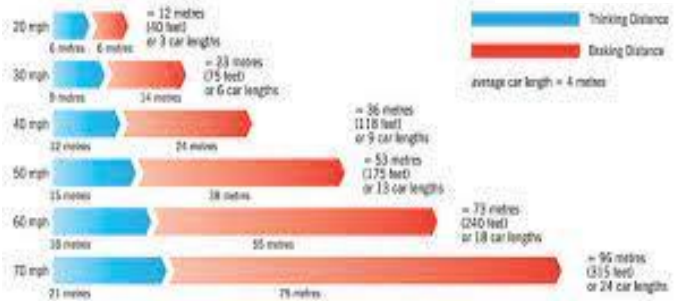
## Keywords

**Newtons Laws** - Three guiding principles stating the movement and reactions of all things due to physics

**Impact forces** - The forces occurring when two objects collide

**Momentum** - A measure of how difficult it is to stop a moving objects

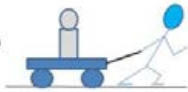
## Stopping Distances



**IT TAKES NEARLY TWICE AS FAR TO STOP at 70mph AS IT DOES TO STOP at 50mph**

## Newton's Second Law

To get the wagon to accelerate, you have to apply a PULL (Force).



If the MASS of the wagon increases, a greater PULL is necessary to accelerate it.



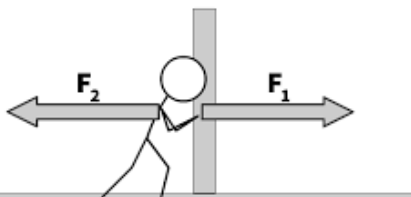
## Momentum



Fig 1. The Conservation of Momentum Applies to a Closed System Not an Open System.

## Newton's Third Law

### Newton's Third Law



**Forces always Come in Pairs:  
You Push on a Wall  
the Wall Pushes Back**

## Equations for this topic

Force = Mass x Acceleration

Momentum = Mass x Velocity



RSE

# Year 11 - RSE - Sexual and Intimate Relationships

## Key Terms

Chemsex	Sexual activity engaged in while under the influence of stimulant drugs such as methamphetamine, GHB or mephedrone
GHB/GBL	Developed in the 1960s as an anaesthetic
Fertility	The capability of becoming pregnant

RSE covers a variety of topics and focuses on developing understanding of different aspects of relationships. This includes with yourself, friendships, romantic and sexual relationships



## Key Skills

- Active listening and communication
- Teamwork
- Presentation and debate

## What is Healthy Sex?

Much of the time when sex is talked about in sex education lessons, it all seems to be about what people shouldn't do.

However, many people would say that sex should be a pleasurable experience and that sex is best with someone who cares about you. This is because if you know the person cares about you, you will feel safe. When you feel safe you can relax and when you relax you can enjoy the experience.

Consent is always required!

## Contraception

Condom - Made of latex, put on to an erect penis before penetration

Abstinence - Restraining yourself from having any form of sexual contact

Contraceptive Pill - Contains hormones and is taken daily (often at the same time every day) by women. Stops the lining of the Womb thickening

Implant - A small tube inserted under the skin (usually in the arm). It releases hormones which prevent pregnancy

## Fertility and What Impacts It

### Biologically Female

Fertility is mostly determined by genetics, which influences how many eggs you are born with.

Doctors believe that the number of eggs at birth determines the length of time a person will remain fertile.

Weight and age can affect fertility levels..

### Biologically Male

Quality of sperm can decrease with age. Diet can have an effect too. Older men can have fertility issues due to dipping testosterone levels.

IVF and other fertility treatments can help people conceive if they are having difficulties.





# Triple Science

# Space (TRIPLE)

## Threshold Concept

The Solar System is made up of many types of objects.

## Keywords

**Solar System** - the collection of eight planets and their moons in orbit round the Sun, together with smaller bodies in the form of asteroids, meteoroids, and comets.

**Orbit** - the curved path of a celestial object or spacecraft round a star, planet, or moon

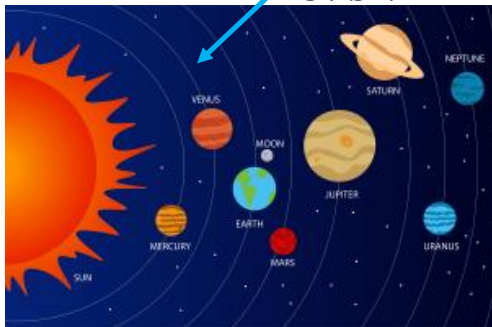
**Sun** - the star around which the 8 planets of the Solar System orbits.

**Planet** - a celestial body moving in an elliptical orbit round a star.

**Moon** - a celestial body moving in orbit around a planet. They are natural satellites.

**Satellite** - an object, either natural (e.g. The Moon), or artificial, that orbits a moon, planet or star. Artificial satellites are for information gathering.

## Solar System Orbit



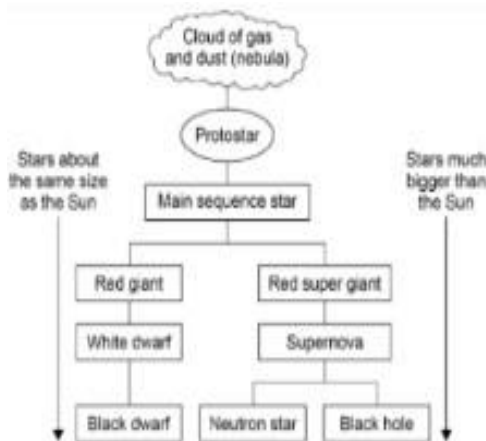
Link to information on the whole topic, consisting of slides, videos, and quizzes

## Orbital Motion & Satellites

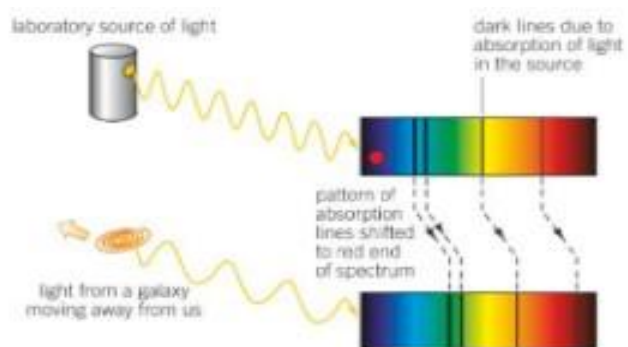
Planets orbit in near-circular orbits: they maintain a constant speed but are always changing direction. This means they have a constant speed but NOT a constant velocity

The Moon is a Natural Satellite. All other satellites of Earth are artificial, such as weather, military, ISS, GPS etc. Geostationary satellites follow the same point above Earth, so have an orbital period of 24 hours.

## Life Cycle of Stars



## Red-shift and Big Bang



## Equations for this topic

## Required Practical



# Chemical analysis Triple

## Threshold Concept

How do we identify a substance?

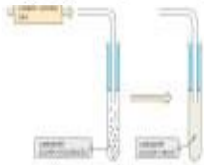
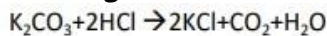
## Testing for metal ions

Metal ions will form coloured precipitates when they react with sodium hydroxide.

Metal Cation	Effect of adding NaOH
Aluminium ( $Al^{3+}$ )	White precipitate, dissolves in excess NaOH to form a colourless solution
Magnesium ( $Mg^{2+}$ )	White precipitate, insoluble so remains in excess NaOH
Calcium ( $Ca^{2+}$ )	White precipitate, insoluble so remains in excess NaOH
Copper (II) ( $Cu^{2+}$ )	Light blue precipitate, insoluble in excess
Iron (II) ( $Fe^{2+}$ )	Green precipitate, insoluble in excess
Iron (III) ( $Fe^{3+}$ )	Red-brown precipitate, insoluble in excess



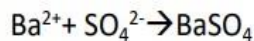
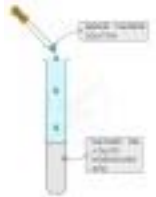
## Testing for carbonate ions $CO_3^{2-}$



Metal carbonate and hydrochloric acid  
Forms Carbon dioxide  
Turns lime water cloudy



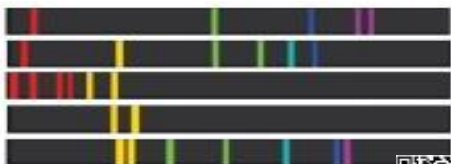
## Testing for Sulphate ions ( $SO_4^{2-}$ )



Add barium chloride  
White precipitate formed



## Flame emission spectroscopy



An instrumental technique used to identify metal ions.



## Keywords

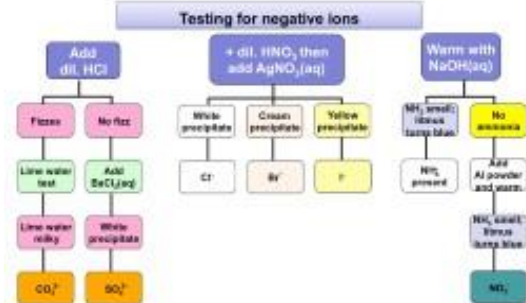
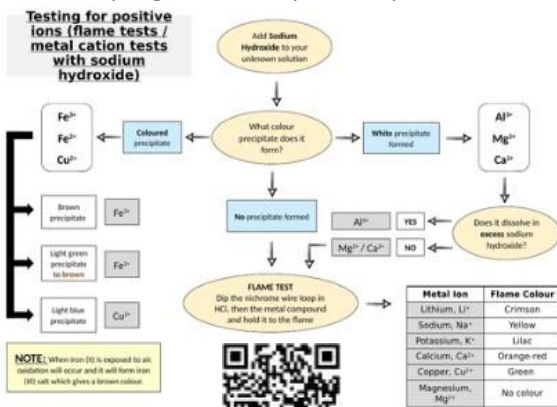
**Pure** - a substance made from just one element or compound

**Impure** - a substance made from more than one element or compound

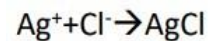
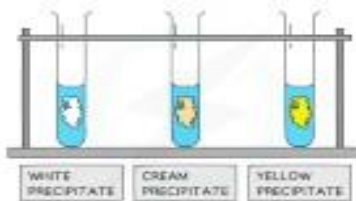
**Analyse** - to find the chemical composition of a substance

**Sample** - a portion of a substance taken from a larger amount

## Identifying ions required practical



## Testing for Halide ions ( $Cl^-$ , $Br^-$ , $I^-$ )



Add nitric acid  
Add a few drops of silver nitrate  
Chloride forms a white precipitate  
Bromide forms a cream precipitate  
Iodide forms a yellow precipitate

