Year 10 Separate Science KO
Autumn Term 2026

Pages	Topic
2 – 3	Digestion and Respiration
4 – 5	IV Relationships
6	Types of Bonding
7 – 8	Quantitative Chemistry
9 – 10	Principles of Waves
11 – 12	Velocity and Acceleration
13 – 14	Human Health
15 – 16	Carbon Chemistry
17 – 18	Trends and Patterns in the reactivity series
19 – 20	Homeostasis

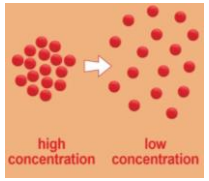
Year 10 Science Knowledge Organiser – BBL7 Digestion and Respiration

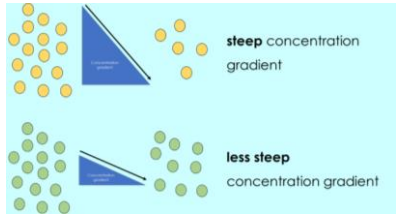
Lesson 1 – Diffusion

Key Terms

Rate - How quickly or slowly a particular process occurs.
Diffusion - the net movement of particles (atoms, molecules, or ions) from an area of higher concentration to an area of lower concentration
Concentration - the amount of a substance (solute) dissolved in a certain volume of a liquid (solvent)
Surface area - The surface area of a 3D shape is the total area of all the faces

- Rate of diffusion is a measure of how quickly particles diffuse from one area to another
- Rate of diffusion increases when:
  - Temperature is high
  - Concentration gradient is high/steep
  - Surface area is large





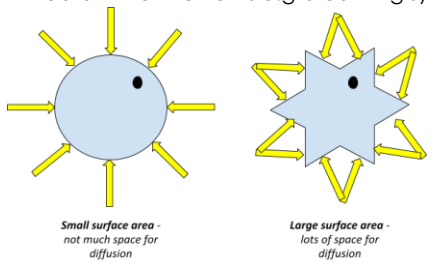
Lesson 2 – Surface Area and Diffusion

Key Terms

Specialised exchange surface - A part of a multicellular organism with a large surface area that allows them to exchange substances with the environment at a greater rate.

Volume - the amount of three-dimensional space occupied by an object or substance

- Organisms with a large surface area to volume ratio (SA:V) can rely on diffusion to obtain their nutrients e.g absorbing oxygen from surroundings
- Organisms with a small surface area to volume ratio (SA:V) cannot rely on diffusion alone as diffusion would be too slow. They need specialised exchange surfaces to obtain their nutrients e.g breathing system to get oxygen.



Calculating the SA:V of *E. coli*

Step 1: Identify the surface area (SA) and volume (V) of *E. coli*
Surface area (SA) of *E. coli*: 4.7 μm²
Volume (V) of *E. coli*: 0.29 μm³

Step 2: Write these figures as a ratio of SA to V
SA:V = 4.7 : 0.29

Step 3: Write this ratio in the form n:1
÷ 0.29 ÷ 0.29
SA:V = 16.2 : 1

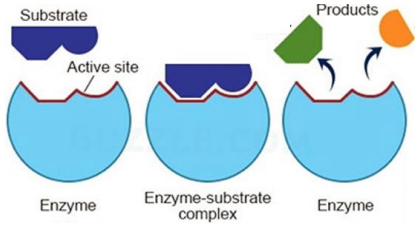
Lesson 4 – Enzymes structure and function

Key Terms

Active site - The active site is the part of an enzyme with a specific shape where a substrate binds. It is where the chemical reaction takes place.
Substrate - A substrate is the molecule that the enzyme acts on. It binds to the enzyme's active site, forming an enzyme-substrate complex.
Optimum - The optimum is the temperature or pH at which an enzyme works fastest, giving the highest rate of reaction.
Enzyme - Enzymes are **biological catalysts**. They speed up metabolic reactions (chemical reactions in the body) without being used up themselves

- Enzymes have an active site with a specific shape with where the substrate fits, forming an enzyme–substrate complex.
- Enzymes work fastest at an optimum temperature and pH
  - Low temperature: Enzyme activity is slow
  - High temperature: Enzyme activity stops as enzymes denature
  - Too high/low pH: Enzyme activity stops as enzymes denature

You can work out the rate of enzyme activity on a graph.
Rate = gradient, so work out the slope (rise ÷ run), often by drawing a tangent.



Lesson 5 – Type of enzymes and rate of action

Key Terms

Carbohydrase - A type of enzyme that breaks down carbohydrates
Protease - A type of enzyme that breaks down proteins.
Lipase - A type of enzyme that breaks down lipids (fats).
Bile - Bile is alkaline to neutralise hydrochloric acid from the stomach. It also emulsifies fat to form small droplets, which increases the surface area for lipase to act on.

- Specific enzymes are needed to break down food group substrates. For example, proteins are broken down by proteases to make amino acids.

Reactants	Enzyme	Products
Carbohydrates (e.g. sugar or starch)	carbohydrase	Simple sugars
Proteins	Proteases	Amino acids
Lipids	lipases	Fatty acid & glycerol

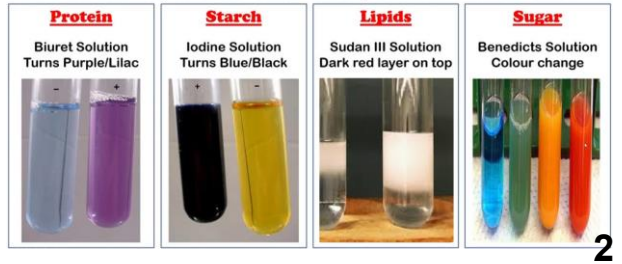
Lesson 3 – AQA RP4 Food tests

Key Terms

Iodine solution - A reagent used to test for the presence of starch
Biuret solution - A reagent used to test for the presence of protein
Benedict's solution - A reagent used to test for the presence of reducing sugar
Reducing sugar - A type of sugar that will turn Benedict's solution brick red when heated. (E.g. Glucose and fructose)

Chemical	Testing for	How to do the test	Results
Iodine	Starch	Add a drop of iodine to the food sample	Turns blue/black
Benedict	Glucose	Add a drop of Benedict's to the food sample. Heat the sample.	Turns yellow/green if there's less glucose Turns brick red if there's more glucose
Biuret	Protein	Add a drop of Biuret to the food sample	Turns purple
Ethanol	Lipid/Fat	Add the ethanol to the sample and shake. Add water.	Turns cloudy/milky

To summarise, each test and what a positive result looks like:



Year 10 Science Knowledge Organiser – BBL7 Digestion and Respiration

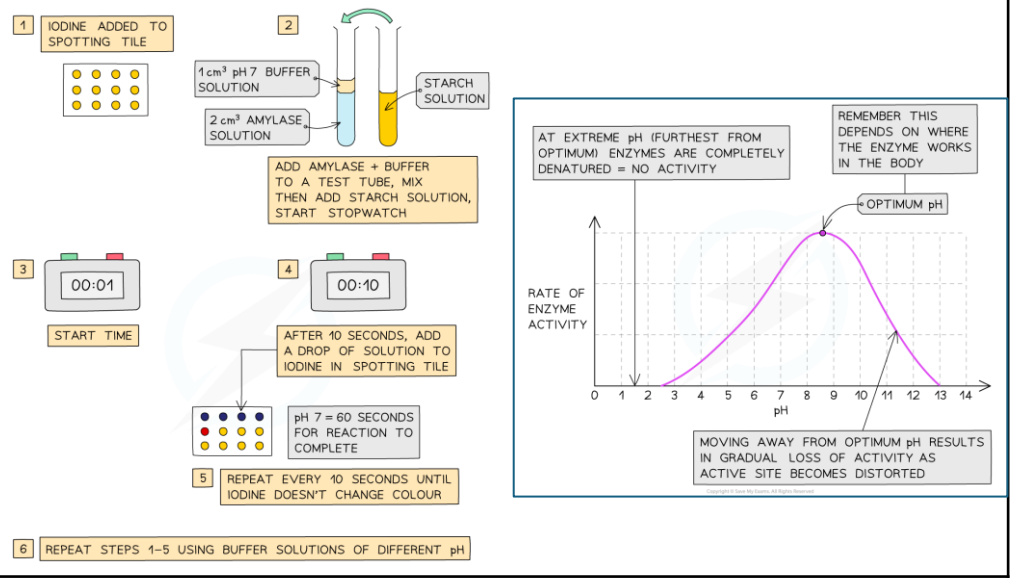
Lesson 6 – AQA RP5 pH and enzyme action

Key Terms

Plot - Mark on a graph using data given.

Give - Only a short answer is required, not an explanation or a description.

Explain - Students should make something clear or state the reasons for something happening.

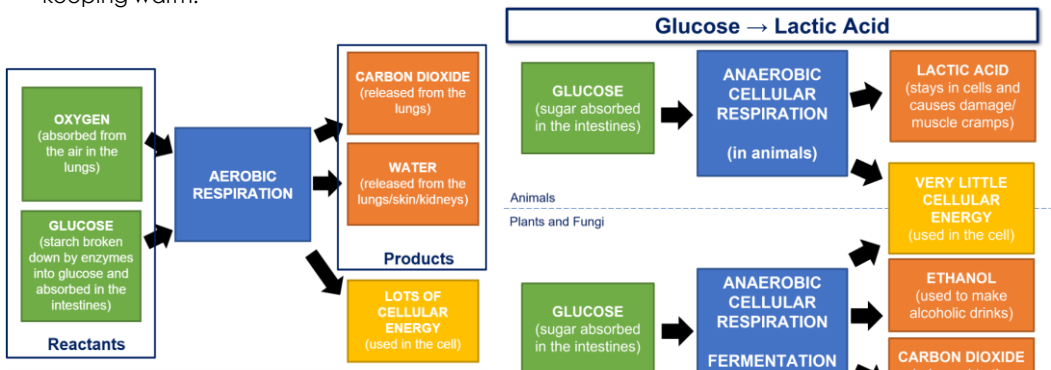


Lesson 7 – Cellular respiration

Key Terms

Respiration - Respiration is a chemical reaction that happens in all living cells to release energy from glucose
Aerobic - Aerobic respiration uses oxygen to break down glucose and release energy
Anaerobic - Anaerobic respiration only uses glucose to release energy
Exothermic – A chemical reaction that transfers energy to surroundings.

- Respiration is an exothermic reaction which means energy is released to surroundings
- Respiration takes place in the mitochondria of cells
- Respiration is important because energy is needed to build large molecules, movement and keeping warm.



Lesson 8 – Response to exercise (FOUNDATION)

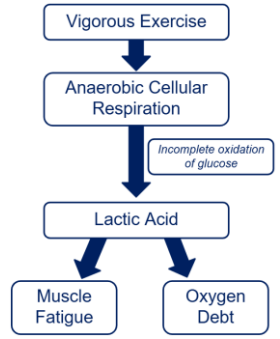
Key Terms

Breathing rate - Number of breaths taken per minute
Heart rate - Number of times the heart beats per minute (bmp)
Lactic acid - Toxic waste product produced in animal muscles during anaerobic respiration
Fatigue - Extreme physical and mental tiredness where the muscles no longer contracting efficiently
Oxygen debt - The amount of extra oxygen the body needs after vigorous exercise to recover from a period of anaerobic respiration.

Heart rate, breathing rate and temperature increases when exercise increases.

This is so that more blood and oxygen can be supplied to muscles/cells to increase respiration rate and release more energy.

If there is a lack of oxygen, the muscle will build up lactic acid.



Lesson 9 – Response to exercise (HIGHER)

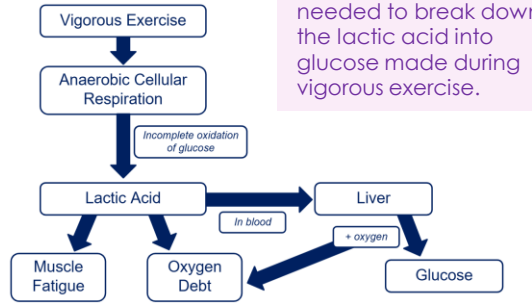
Key Terms

Same as above

Heart rate, breathing rate and temperature increases when exercise increases.

This is so that more blood and oxygen can be supplied to muscles/cells to increase respiration rate and release more energy.

If there is a lack of oxygen, the muscle will build up lactic acid.



HIGHER TIER: The liver is needed to break down the lactic acid into glucose made during vigorous exercise.

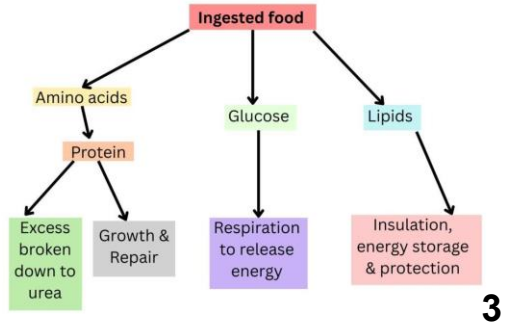
Lesson 10 – Metabolism

Key Terms

Metabolism - The sum of all the reaction in a cell or the body

Metabolic - A word used to describe a type of reaction that happens in the body.

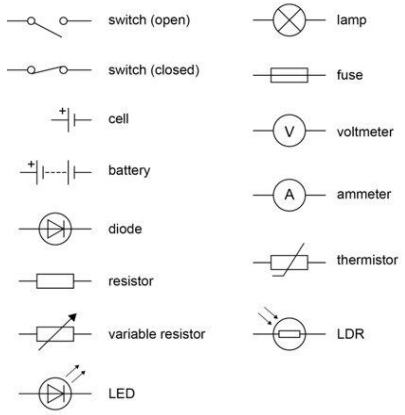
- metabolism is the sum of all the chemical reactions that occur in a cell or body.
- The formation of proteins, carbohydrates and lipids are examples of metabolic processes.
- Cellular respiration is an example of a metabolic process.



Year 10 Science Knowledge Organiser – OEOO12 IV Relationships

Lesson 1 – Common Circuit Symbols

Component –
a part of the circuit
Symbol –
a pictoral image of a component
Circuit –
a path of electric current



•**Switch (open/closed)** – A device that either completes or breaks the circuit, allowing or stopping the flow of current.
•**Battery** – Two or more cells connected to provide a greater potential difference and supply energy to the circuit.
•**Resistor** – A component that limits or controls the flow of electric current in a circuit.
•**Lamp** – A device that converts electrical energy into light energy when current passes through it.
•**Voltmeter** – A measuring device used to measure the potential difference (voltage) across a component; must be connected in parallel.
•**Ammeter** – A measuring device used to measure the electric current flowing through a circuit; must be connected in series.

Lesson 2 – Series Circuits

Key Terms

Series – an electrical pathway where all components are connected sequentially in a single loop. The electric current flows through each component one after another, meaning there is only one route for the electrons to travel.
Current – the rate at which electric charge flows through a conductor (such as a metal wire). It is driven by a voltage and is defined fundamentally by the equation.

The current is the same (equal the whole way around a series circuit.

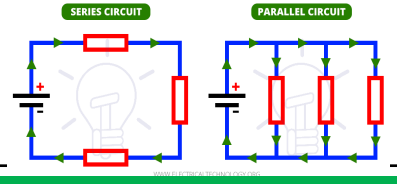
The total potential difference of the power supply is shared between the components.

The total resistance of each component is the sum resistance of each component.

Lesson 3 – Parallel Circuits

Key Terms

Parallel - an electrical circuit with multiple branches, providing more than one path for current to flow. If one component breaks, the other branches continue to work. It is the standard setup for household wiring.



The total current is sum of the current through each component or A total = A2 + A3

The potential difference across each component is the same or VTOTAL = V2 = V3..

The total resistance of two resistors in a parallel circuit is less than the resistance of the smallest individual resistor.

Lesson 4 – Qualitative Relationships

Key Terms

Potential difference – a measure of the energy transferred per unit of charge as it moves between two points in a circuit

Resistance – a measure of how much a component opposes the flow of electric current

The unit measure for energy is Joules, J
Changes in energy stores can be described.

Work done is the change energy stores due to a process or action taking place.
Chemical, gravitational, kinetic, thermal, and elastic are examples of stores.

There are 4 pathways: Heating by particles, Work (mechanical), electrical working and heating by radiation.

Lesson 5 – Quantitative Relationships

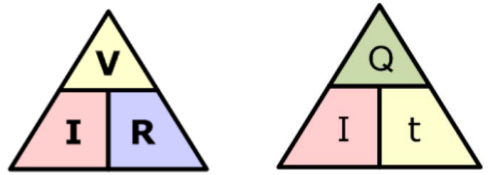
Key Terms

Determine – to firmly decide, establish, or ascertain facts after investigation, reasoning, or calculation

Calculate – to determine a numerical value, amount, or outcome by using mathematical, logical, or statistical processes

Potential difference (V) = current (A) x resistance (Ω)
V = I x R

Charge flow (C) = current (A) x time (s)
Q = I x t



Lesson 6 – IV Graphs

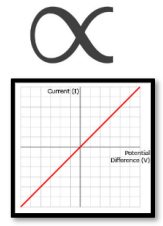
Key Terms

Ohmic – any electrical component or material that strictly obeys Ohm's Law, maintaining a constant resistance regardless of the voltage applied or current flowing through it

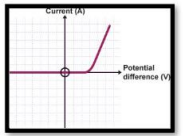
Resistance – The measure of an object's or material's opposition to the flow of an electric current.

Directly proportional – if when one changes, the other changes at the exact same relative rate. Line goes through the origin (0,0)

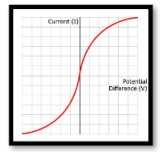
- This symbol means directly proportional



Diode – non ohmic conductor



Filament bulb – non ohmic conductor



←Resistor – ohmic conductor. Directly proportional

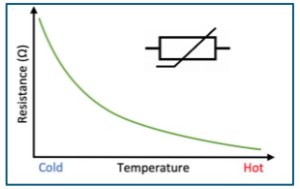
Year 10 Science Knowledge Organiser – OEOO12 IV Relationships

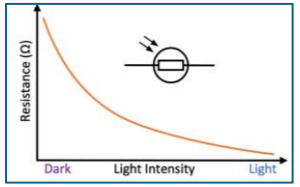
Lesson 7 – Specialist Resistors

Key Terms

Diode – a non-ohmic semiconductor component that allows electric current to flow in only one direction

Thermistor - a temperature-dependent resistor. Unlike a standard resistor, its resistance changes dramatically with temperature.





LDRs or light dependent resistors are a type of specialist resistor. As light intensity increases, the resistance decreases.

A thermistor is another specialist resistor. As temperature increases, the resistance decreases.

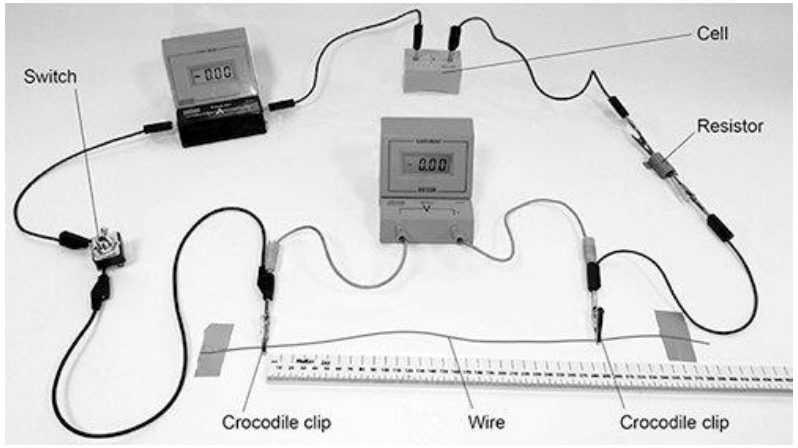
The graphs that are created by these resistors are in the key terms box.

Lesson 8 and 9 – Resistance in a Wire (RP)

Key Terms

Calculate – to determine an amount, number, or outcome using mathematical processes.

Determine - to firmly decide something or to discover the facts of a situation through investigation or calculation



1. A student set up the equipment as shown.
2. Measured the length of the wire between the crocodile clips
3. Measure the current with the ammeter
4. Measure the potential difference with the voltmeter
5. Calculate the resistance at each length
6. Using V = I x R
7. Repeat the readings
8. Calculate mean averages
9. Ensure the circuit is disconnected off for 30s between reading to ensure temperature remains
10. Keep the materials the wire is made from and the diameter of the wire the same

Year 10 Science Knowledge Organiser – BOM12 Types of Bonding

Lesson 1 – Introduction to Bonding

Key terms

Chemical bonding - the process by which atoms join together to form molecules and compounds, either by losing or gaining electrons.

Electrostatic Force- The force between oppositely charged particles

Element – A pure substance made of only one type of atom

- Atoms want a full outer shell of electrons so that they are stable.
- The first shell can hold a maximum of 2 electrons, every other shell can hold up to 8.
- Ionic bonds form between atoms of metals and non-metals
- Covalent bonds form between non-metal atoms
- Metallic bonds form between metals
- Electron configurations tell you how many electrons are in each shell (2,8,1) – 2 in first, 8 in second, 1 in third

Lesson 2 – Ionic Bonding

Key Terms

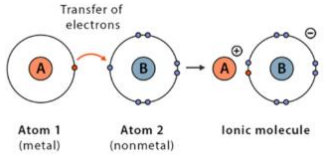
Ion – an atom with a charge

Ionic - The electrostatic force of attraction between oppositely charged ions

Cation – positively charged ion

Anion – negatively charged ion

- Ionic bonds are formed from the transfer of electrons between a metal and a non-metal.
- When atoms lose or gain electrons they become ions which have a positive/negative charge – and OPPOSITES ATTRACT.
- Metals always lose electrons forming positively charged cations.
- Non-metals always gain electrons forming negatively charged anions.



Lesson 3 – Ionic Compounds

Key Terms

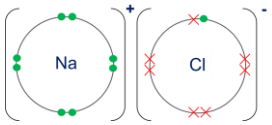
Lattice - A regular, repeating arrangement of particles

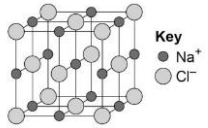
Compound – more than 1 type of element chemically bonded in fixed proportions

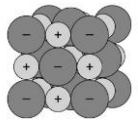
Evaluate - Consider strengths and weaknesses and come to a conclusion.

Empirical Formula - The simplest whole-number ratio of atoms or ions of each element in a compound

- Ionic compounds form a giant lattice structure of ions, held together by strong electrostatic forces of attraction between oppositely charged ions. These forces act in all directions within the lattice.
- Dot and cross, ball and stick, and 2D/3D diagrams







can be used to represent them.

Lesson 4 – Covalent Bonding

Key Terms

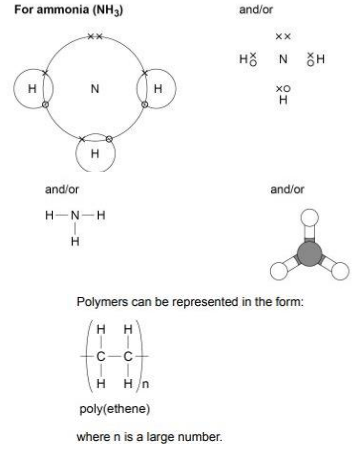
Covalent - The electrostatic attraction between a shared pair of outer electrons and the two positively charged nuclei of the bonded atoms

Simple molecule -A substance made of molecules with strong covalent bonds within the molecule and weak forces between molecules.

Giant covalent - A 3D network of atoms joined by covalent bonds.

Polymer - A very large molecule made by joining together many smaller repeating units called monomers.

- Covalent bonds are formed when non-metallic atoms share pairs of electrons.
- These bonds are very strong.
- Some covalent substances form simple molecules, such as oxygen (O_2)
- Some substances form very large polymer molecules.
- Some covalent substances form giant covalent structures, such as diamond and silicon dioxide (SO_2).
- There are several ways to represent covalent bonds:



Lesson 5 – Metallic Bonding

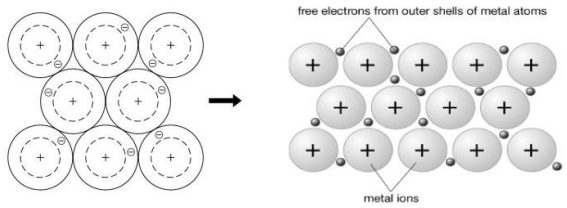
Key Terms

Metallic Bond- The electrostatic force of attraction between positive metal ions and delocalised electrons

Delocalised - Electrons that are free to move through a structure

Conductivity - Ability to allow charge to flow

- Metals consist of giant structures of atoms arranged in a regular pattern.
- The electrons in the outer shell of metals atoms are delocalised and move through the whole structure, allowing metals to conduct electricity.
- The sharing of these delocalised electrons forms strong metallic bonds.
- Bonding in metals is represented like this:



Year 10 Science Knowledge Organiser – BOM13 Quantitative chemistry

Lesson 1 – Chemical measurements and uncertainty

Key terms

Uncertainty - the range within which the true value is expected to lie.

Resolution - the smallest change in a quantity that an instrument can detect.

- The uncertainty of a measurement is the range within which the true value is likely to lie, and it is equal to ± half the smallest scale division.
- Repeats allow a mean to be calculated which produce more
- accurate data than using a single measurement.
- Using equipment with a greater resolution can reduce uncertainty.
- When we carry out multiple repeats during an experiment, we can also estimate the uncertainty in our repeated values. This shows how precise our measurements are – if the values vary a lot, precision is low; if they are close together, precision is high. To do this, we must calculate the range between our highest and lowest result.

Lesson 2 – Relative Formula Mass and % Composition

Key Terms

Relative atomic mass - is the average mass of its atoms, compared to 1/12th the mass of a carbon-12 atom

Relative formula mass – is the relative mass of the entire formula (the total of all of the relative atomic mass in the molecule or compound).

- Relative atomic mass (Ar) can be found on the Periodic Table. It is often a whole number because it has been rounded.
- The relative formula mass (Mr) of compounds using the sum of relative atomic masses.
- H_2SO_4 = (2 x 1) + (1 x 32) + (4 x 16) = 98
- In a reaction, mass is conserved. The mass of reactants = the mass of products.

$M_r: CH_4 = 16$ + $M_r: 2O_2 = 64$ $M_r: CO_2 = 44$ + $M_r: 2H_2O = 36$

Total Reactant M_r = 80 ***Total Product M_r = 80***

- Percentage composition tells us how much of a compound's total mass is made up of a specific element.

Lesson 3 – Measuring Changes of Mass

Key terms

Conservation of mass - The law of conservation of mass states that no atoms are lost or made in a chemical reaction. The mass of reactants = the mass of products.

- In a reaction, mass is conserved. The law of conservation of mass states that no atoms are lost or made in a chemical reaction. The mass of reactants = the mass of products.

$M_r: CH_4 = 16$ + $M_r: 2O_2 = 64$ $M_r: CO_2 = 44$ + $M_r: 2H_2O = 36$

Total Reactant M_r = 80 ***Total Product M_r = 80***

- Mass appears to change in a reaction where a gas is produced. The mass will go down because gas particles spread out and escape into the air, so their mass was no longer measured. The particles are far apart in a gas and can leave the flask easily, meaning measured mass decreases.
- You can measure the loss of mass of a reaction, by placing the reaction flask on a balance and monitoring the mass.

Lesson 4 – Concentration of Solutions

Key Terms

Solution - A solution forms when a solute dissolves in a solvent.

Concentration - measure how much solute is dissolved in a specific volume of solvent

- To convert cm^3 into dm^3: $cm^3 \div 1000 = dm^3$
- To convert dm^3 into cm^3: $dm^3 \times 1000 = cm^3$
- The units for concentration are g/dm^3.
- Mass is measured in g, using a balance. Volume is measured in cm^3 and then converted to dm^3.
- We are able to calculate concentration as the mass per unit volume.

$$\text{Concentration (g/dm}^3\text{)} = \frac{\text{mass (g)}}{\text{volume (dm}^3\text{)}}$$

- To calculate the mass of a solute in a given volume of solution, we rearrange the formula to give us:
- concentration (g/dm^3) x volume (dm^3) = mass (g)

- HT Volume of solution will affect the concentration. If we add more water (solvent) but keep the mass of the solute the same, the concentration decreases. This is called dilution. The solvent (water) could evaporate on a hot day. This would cause the concentration to increase because volume decreases.

- HT If the volume remains constant, adding more solute will increase the concentration of a solution.

Year 10 Science Knowledge Organiser – BOM13 Quantitative chemistry

Lesson 5 – Moles (HT only)

Key terms

Mole - the amount of a substance that contains the same number of particles as there are atoms in 12 grams of carbon-12.

Avagadro - Number of particles are in one mole (6.02×10^{23})

- Avogadro's Constant tells us how many particles are in
- one mole of a substance.
- The symbol for moles is mol.
- One mole of an element has a mass (in grams) equal to its relative atomic mass. Because one mole weighs the same (in grams) as the Ar, we can calculate moles
- using:

$$\text{number of moles (mol)} = \frac{\text{mass (g)}}{A_r}$$

- To calculate the number of particles, we use the following equation:

$$\text{no. of particles} = \text{no. of moles} \times \text{Avogadro's constant}$$

Lesson 6 – Reacting masses (HT only)

Key Terms

Actual yield – the amount of product actually obtained from a chemical reaction.

Predicted yield – The maximum calculated mass of a product that could possibly be formed, predicted using the balanced symbol equation and reacting masses.

Excess - the reactant that is not completely used up in a reaction.

- A reacting mass calculation is when we can use a known mass of any substance in a balanced equation to calculate the theoretical mass of any other substance involved – whether it's a reactant or a product.

- Some uses of reacting masses:
  1. To work out how much product we can make
  2. To scale up a reaction for industrial production
  3. To make sure no reactant is wasted
  4. To check if a reaction has gone to completion
  5. To compare actual vs predicted yield

- To calculate the theoretical mass of a product, we only need the mass of one reactant. This is because we assume all other reactants are in excess.

Lesson 7 – Limiting reactants

Key terms

Limiting reactant - the reactant that is completely used up first in a reaction, which limits the amount of product formed.

Excess - the reactant that is not completely used up in a reaction.

- We identify the limiting reactant by calculating available moles ÷ required moles. This tells us how many times each reactant could provide its needed amount.

- The reactant that can do it the fewest times is the limiting reactant, because it is used up first.

Lesson 8 – Balancing equations using moles

Key Terms

Transition metals – elements found in the centre of the periodic table

Mole - the amount of a substance that contains the same number of particles as there are atoms in 12 grams of carbon-12.

- Transition metals can form more than one possible compound with different ratios. For example, iron can form FeO, Fe_2O_3, or Fe_3O_4.

- It is important that we work out the ratio of transition metal to the other reactant in a reaction to determine the correct formula, rather than assuming.

- We use moles and ratios to determine formulae and balance equations.

Year 10 Science Knowledge Organiser – BOE15 Principles of Waves

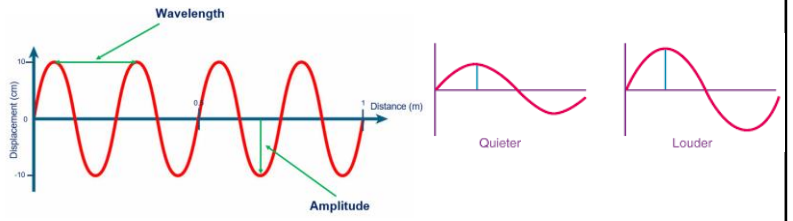
Lesson 1 – Graphing Waves

Key Terms

Wavelength - The distance from one point on one wave, to the equivalent point on the adjacent wave

Amplitude - The maximum displacement of a point on the wave away from its undisturbed position

Waveform - a visual representation of a wave



- A greater amplitude means a louder sound
- Microphones can be plugged into an amplifier, to amplify the sound – to make the sound louder.

Lesson 2 – Transverse vs longitudinal

Key Terms

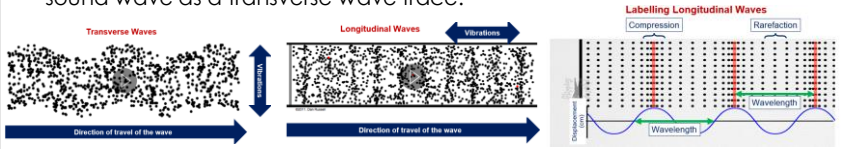
Transverse wave - The vibrations of the particles are perpendicular to the direction of travel of the wave.

Longitudinal wave - The vibrations of the particles are parallel to the direction of travel of the wave.

Vacuum - A space where there is no matter or particles

- All waves transfer energy, but not matter
- Water waves and electromagnetic waves (e.g. light) are examples of transverse waves
- Transverse waves can travel through a vacuum

- Longitudinal waves cannot travel through a vacuum
- Sound waves are an example of a longitudinal wave
- An oscilloscope is a piece of equipment that can be used to represent a sound wave as a transverse wave trace.

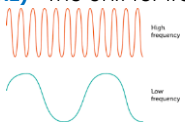


Lesson 3 – Frequency and periods

Key Terms

Frequency - The number of waves passing a point each second.

Hertz (Hz) - The unit for frequency



Period - The time taken for one complete wave cycle (oscillation) to pass a specific point.

$$\text{frequency (Hz)} = \frac{\text{number of waves}}{\text{time (s)}}$$

A buoy in the sea moves up and down as waves pass it. **200 waves** pass the buoy in **40 seconds.** Calculate the frequency of the waves.

$$\text{frequency (Hz)} = \frac{200}{40}$$

$$\text{frequency (Hz)} = 5 \text{ Hz}$$

$$\text{Period} = \frac{1}{\text{Frequency}}$$

↓ frequency = ↑ period
↑ frequency = ↓ period

A sound wave has a frequency of 250 Hz. **Calculate** its period.

$$Period = \frac{1}{250}$$

$$Period = 0.004\ s$$

Lesson 4 – Wave speed

Key Terms

Oscilloscope - used to record the waveform of a sound wave.

Frequency - The number of waves passing a point each second.

Wavelength - The distance from one point on one wave, to the equivalent point on the adjacent wave

- Light travels significantly faster than sound.
- The speed of sound can be determined by getting two students to stand a set, measured distance apart. Person A raises their hand and fires a pistol and then lowers their hands. Person B starts the stopwatch when they see the hand lower and stop the stopwatch when they hear the bang. They record the data, repeat and calculate the mean. Calculate speed: ***Speed (m/s) = distance (m) / time (s).***

$$\text{wave speed} = \text{frequency} \times \text{wavelength} \textbf{ or } v = f\,\lambda$$

A water wave has a frequency of 3 Hz and a wavelength of 5 m.

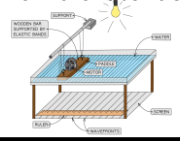
$$\text{wave speed (m/s)} = \text{frequency (Hz)} \times \text{wavelength (m)}$$
$$\text{wave speed (m/s)} = 3\ (Hz) \times 5h\ (m)$$
$$\text{wave speed} = 15 \text{ m/s}$$

- An oscilloscope trace is to be used to determine the frequency.

Lesson 5 – RP8 (RP20) – Ripple Tank

Key Terms

Ripple tank - a shallow, transparent glass-bottomed tray of water with a light shining down through it onto a white card below to clearly see the motion of the ripples created on the water's surface



1. Set up the ripple tank as shown in the diagram.
2. Pour water to a depth of about 5mm into the tank.
3. Switch on the overhead lamp and electric motor
4. Adjust the speed of the motor to produce low frequency water waves.
5. Adjust the height of the lamp so that the pattern of the waves can be clearly seen on the white card below.
6. Place a meter rules at right angles to the waves shown in the pattern on the card. Measure across as many waves as you can. Then, divide that length by the number of waves. This gives the wavelength of the waves.
7. Count the number of waves passing a point in the pattern over a given time (e.g. 10 seconds). Divide the number of wavs counted by 10. This gives the frequency of the waves.
8. Calculate the speed of the waves using the equation: $v = f\lambda$

Lesson 6 – Properties of EMS

Key Terms

Electromagnetic wave - Transverse waves that transfer energy from the source of the waves to an absorber
Reflection - When a wave bounces at the boundary between two different materials
Refraction -When a wave changed direction at the boundary between two different materials, due to a change in wave speed
Normal - A line drawn perpendicularly to the boundary between materials.
Incident Ray - The incoming ray of light or wave that travels toward and hits a surface, boundary, or medium

- All electromagnetic waves travel at the same velocity in a vacuum (space) or air.
- They have different wavelengths and frequencies.
- These form the electromagnetic spectrum.



- Our eyes only detect **visible light**, so we can only see a small part of the electromagnetic spectrum.
- In reflection, the angle of incidence = angle of reflection



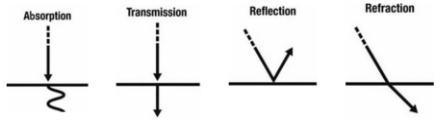
Year 10 Science Knowledge Organiser – BOE15 Principles of Waves

Lesson 7 – The interaction of waves (FT)

Key Terms

Absorbed: the wave's energy is taken in by the material.
Transmitted: The wave passes through the material. (Seeing through glass – light can pass through)
Reflected: The wave bounces off the surface. (Looking in the mirror – light is reflected)
Refracted: The wave changes direction as it passes from one substance to another.
Emission - The process of an object giving out energy
Matt - A surface that is microscopically textured so that the reflected light reflects over a wide area.

- When a wave meets a boundary, it can be absorbed, transmitted, reflected or refracted.



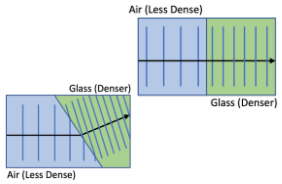
- The darker and more matt the surface is, the greater the absorption and emission of infrared waves.
- The lighter and shinier the surface is, the poorer the absorption and emission of infrared waves, they reflect the radiation.



Lesson 7 – The interaction of waves (HT)

Key Terms

Explain - Say why something has happened or is the way it is



- EM waves have different wavelengths and therefore behave differently at boundaries depending on the material that boundary is made from.
- Visible light has a longer wavelength than ultraviolet waves. Much of the UV waves that hit glass are absorbed, while the visible light is transmitted.
- Metal object reflect most EM waves like visible waves and radio waves. However, it absorbs microwaves strongly.
- If a wave hits a boundary at right angles (perpendicular), there is no change in direction, and no refraction takes place.
- Waves will travel at different velocities in different media (Eg: Light slows down as it enters glass)
- If the wave front hits a denser medium at an angle, that part of the wave front will slow down first. This causes refraction of the wave.

Lesson 8 – RP10 (RP21) – Radiation

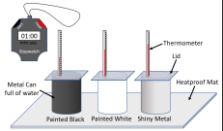
Key Terms

Leslie cube - A hollow metal cube with different surfaces on each side.

Matt - A surface that is microscopically textured so that the reflected light reflects over a wide area.

- A matt black container will cool down the quickest, as it will emit the most Infrared radiation
- A silver container will cool down the slowest, as it will emit the least Infrared radiation

Investigating the amount of infrared radiation radiated from different surfaces



- Set up at least 3 different flasks/cans like the diagram.
- Ensure that there is adequate insulation to place on top of the cans.
- Fill the first can with 50cm^3 of water from a kettle that has just boiled.
- Record the initial temperature and start the stopwatch.
- Record the temperature of the can every 20s for a total of 3 minutes.
- Repeat with each can in turn, ensuring the starting temperature of the water is the same for each can.

Investigating the amount of infrared radiation radiated from different surfaces



- Use a Leslie cube (or cans with different surfaces) and an infrared detector.
- Measure the amount of the infrared radiation emitted from each surface.
- Compare the amount of infrared radiation emitted from the difference surfaces.

Lesson 9 – Uses of EMS

Key Terms

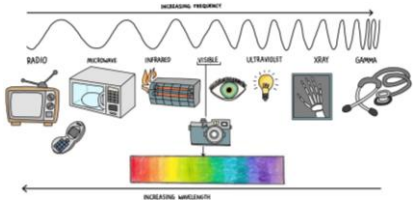
Ultraviolet - Waves that have a shorter wavelength than visible like but longer wavelength than x-rays

Infrared - Waves that have a longer wavelength than visible light but shorter than microwaves

X-ray - Waves that have a shorter wavelength than ultraviolet but a longer wavelength than gamma

Gamma Ray - Waves that have a shorter wavelength than x-rays

- **Radio waves** are used for communication (TV and Radio)
- **Microwave**s are used for satellite communication and for cooking food
- **Infra red** is used for thermal imaging, IR cameras, electrical heaters and also used for cooking
- **Visible light** is used for fibre optic communication.
- **Ultraviolet light** is used for tanning and some energy efficient lamps.
- **X-rays** are used for medical imaging.
- **Gamma rays** can be used to treat cancer.



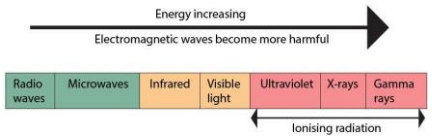
Lesson 10 – EMS and Ionising Radiation

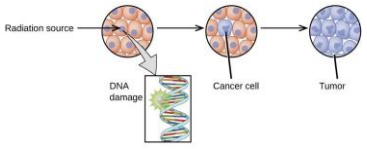
Key Terms

Describe - To recall some facts, events or process in an accurate way.
Compare - List the similarities and differences
Ionising Radiation - Radiation with enough energy to remove electrons from atoms or molecules, turning them into ions.
Radiation dose - A measure of the risk of harm from exposure to ionising radiation, measured in sieverts (Sv)
Sievert (sv) - The unit used for the biological effect of ionising radiation.

- All electromagnetic waves travel at the same speed in a vacuum — but they differ in frequency and energy.
- As we move from left to right across the spectrum, the frequency and energy increase.
- The waves at the lower-energy end, like radio and infrared, can make particles vibrate or heat up — but they don't have enough energy to remove electrons. These are called **non-ionising.**
- In Ultraviolet, X-rays, and gamma rays, the energy is high enough to remove electrons from atoms. These are what we call **ionising radiation.**

- UV radiation can penetrate the skin and damage the DNA inside skin cells, causing the skin to age more quickly (wrinkles, sunspots) and, in some cases, mutations that can lead to skin cancer.
- Ionising radiation has enough energy to damage or change the structure of DNA. Most of the time, the body repairs this damage but if the DNA is copied before it's repaired, it can cause a mutation. A mutation in the DNA of a cell can make that cell divide uncontrollably. That's how cancer can form.





- Ionising radiation can be very useful in medicine — for example, in treating tumours — but it also has potential risks, depending on the type of radiation and the dose absorbed.

Year 10 Science Knowledge Organiser – OEOO13 Velocity and Acceleration

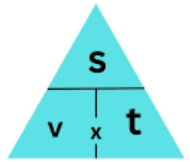
Lesson 1 – Speed

Key Terms

- **Uncertainty**: The interval or range of possible values within which the true value of a measurement lies
- **Speed**: A scalar quantity that is the rate of change of distance with time. It does not involve direction.
- **Velocity**: A vector quantity that is speed in a given direction.
- **Determine**: Use the information given (often through practical work or data) to work out the answer

- Uniform motion means that speed is constant
- Linear motion is the motion path being straight
- Typical walking speed is 1.5m/s
- Typical running speed is 3m/s
- Typical cycling is 6m/s
- Typical speed of sound is 330m/s

Distance travelled,s = Speed,v x time,t
(m) (m/s) (s)



$s = v \times t$

$t = \frac{s}{v}$

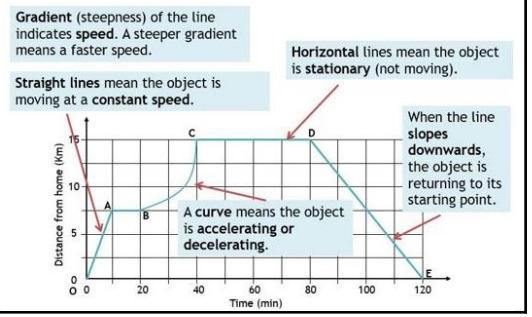
$v = \frac{s}{t}$

Lesson 2 – Distance time graphs

Key Terms

- **Proportional:** as one variable increases, the other increases at a constant rate. straight-line relationship, not necessarily through the origin
- **Distance-time graph:** A graph that shows how distance travelled changes with time; the gradient represents speed.

- Speed can be calculated from a distance time graph by calculating the gradient.
- Steeper gradient means faster speed
- (HT) a tangent can be drawn to the curve at a specific point to calculate speed at a specific time

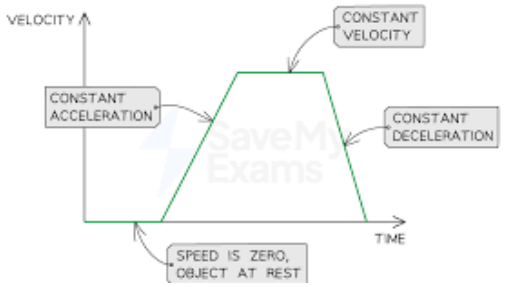


Lesson 3 – Velocity

Key Terms

Velocity: A vector quantity that is speed in a given direction.

- Distance is a scalar quantity showing how far an object moves
- Displacement is a vector quantity including both the distance an object moves, (measured in a straight line from the start point to the finish point) and the direction of that straight line
- Acceleration = rate of change of velocity
- Steeper the gradient of a velocity time graph, the greater the rate of change



Lesson 4 – Acceleration and Velocity time graphs

Key Terms

Acceleration: The rate of change of velocity with respect to time
Velocity-time graph: A graph that shows how velocity changes with time.
Terminal velocity: The constant speed reached by a falling object when the force of gravity is balanced by the resistive forces (such as air resistance)

- Acceleration can be calculated from the gradient on a velocity-time graph
- The area under the velocity-time graph represents distance travelled.
- Acceleration is a vector quantity
- Acceleration is measured in m/s^2

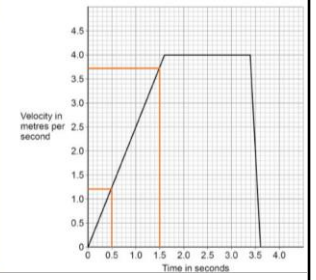
$$\text{Acceleration (m/s}^2\text{)} = \frac{\text{change in velocity (m/s)}}{\text{time taken (s)}}$$

End velocity 3.7 m/s
Starting velocity 1.2 m/s
Time taken for the change 1 s

$$\text{Acceleration (m/s}^2\text{)} = \frac{3.7 - 1.2 \text{ (m/s)}}{1 \text{ (s)}}$$

$$\text{Acceleration (m/s}^2\text{)} = \frac{2.5 \text{ (m/s)}}{1 \text{ (s)}}$$

Acceleration (m/s²) = 2.5 m/s² Why is the answer the same?



- Linear acceleration is shown by a straight line
- Non-linear acceleration is shown by a curve

Lesson 5 – Area under the graph (HT)

Key Terms

- **Distance**: a scalar quantity showing how far an object moves
- **Displacement**: a vector quantity including both the distance an object moves, (measured in a straight line from the start point to the finish point) and the direction of that straight line

- Displacement (m) = Velocity (m/s) x time (s)
- The area under a velocity time graph can determine the distance/displacement of an object
- The total distance travelled is equal to the total area, negative values are ignored
- The displacement is equal to the sum of total area in sections A and B, taking into account the negative values

Lesson 6 – Acceleration in context

Key Terms

Acceleration: The rate of change of velocity with respect to time

Estimate: Use approximate values or reasoning to make an approximate but sensible answer.

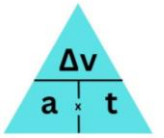
- The symbol Δ mean 'change'.
- Δv = final velocity – initial velocity

$$a = \frac{v-u}{t}$$

v = final velocity in metres per second
u = initial velocity in metres per second

- An object that is slowing down is decelerating.

Acceleration,a (m/s²) = Change in velocity, Δv (m/s) / time,t (s)



$a = \frac{\Delta v}{t}$

$\Delta v = a \times t$

$t = \frac{\Delta v}{a}$

Year 10 Science Knowledge Organiser – OEOO13 Velocity and Acceleration

Lesson 7 – Uniform Acceleration

Key Terms

Uniform acceleration: When an object's velocity is changing by the same amount during each equal time interval.

Calculate: Use numbers given in the question to work out the answer, showing steps where appropriate.

- This equation is used to calculate quantities such as initial or final speed, acceleration, or distance travelled in cases where the time taken is not known

$$\text{Final Velocity}^2 - \text{Initial Velocity}^2 = 2 \times \text{acceleration} \times \text{distance}$$

(m/s) (m/s) (m/s^2) (m)

$$v^2 - u^2 = 2as$$

Final velocity = v

Initial velocity = u $\quad a = \frac{v^2 - u^2}{2s} \quad s = \frac{v^2 - u^2}{2a}$

Acceleration = a

Distance = s $\quad u = \sqrt{v^2 - 2as} \quad v = \sqrt{u^2 + 2as}$

Lesson 10 – Elastic potential energy

Key Terms

Elastic potential energy: The energy stored in a stretched or compressed object, such as a spring or rubber band

Work Done: The amount of energy transferred when a force moves an object over a distance

- Elastic potential energy can be calculated by:

Elastic potential (E_e) = 0.5 x spring constant (k) x extension^2

- E_e is measured in Joules (J)
- k is measured in Newtons per metre, (N/m)
- e is measured in meters (m)

A spring has a hanging mass placed on it. It extends by 0.2m

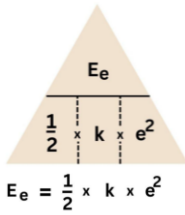
The spring constant for the spring is 150 N/m

Calculate the change in elastic potential energy stored in the spring.

Step 1 $Elastic\ potential\ energy = 0.5\ x\ spring\ constant\ x\ extension^2$

Step 2 $Elastic\ potential\ energy = 0.5\ x\ 150\ x\ 0.22$

Step 3 $Elastic\ potential\ energy = 3J$



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

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

$$e = \sqrt{\frac{2 \times E_e}{k}}$$

Lesson 8 – Acceleration in Fluids

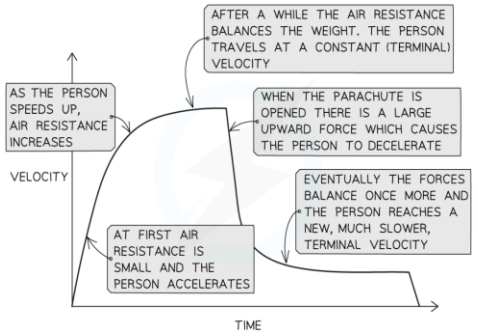
Key Terms

Viscosity: Viscosity is a measure of a fluid's resistance to flow

Terminal velocity: The constant speed reached by a falling object when the force of gravity is balanced by the resistive forces (such as air resistance)

- Near the Earths surface, any object falling freely under gravity has an acceleration of **9.81 m/s/s**
- The pull of gravity will remain the same during a falling object, the resistant forces will change.
- When resistant forces and gravitational pull equal when an object is falling, the object has reached terminal velocity.
- Terminal velocity is affected by **mass** and **surface area** of the object falling.
- A parachute will increase the surface area of a falling object and slow it down.
- An object falling through a fluid, initially accelerated due to the force of gravity.
- If a fluid is more **viscous**, object will fall slower through them.
- Faster an object decelerates, the quicker terminology velocity is a reached.



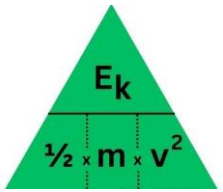


Lesson 9 – Kinetic energy

Key Terms

Kinetic energy: The amount of energy a moving object has in its kinetic store as a result of its mass and speed

- Kinetic energy increases when the objects are moving quicker
- Kinetic energy can be calculated by using: **Kinetic energy (E_k) = 0.5 x mass (m) x speed^2 (v)**
- Kinetic energy is measured in joules (J)
- Mass is measured in kilograms (kg)
- Speed is measured in meters per second (m/s)
- Objects moving at the same speed can have different stores of kinetic energy if they have different masses.



$$E_k = \frac{1}{2}mv^2$$

$$m = \frac{2 \times E_k}{v^2}$$

$$v = \sqrt{\frac{2 \times E_k}{m}}$$

800kg  30 m/s

Step 1 $Kinetic\ energy = 0.5 \times mass \times speed^2$

Step 2 $Kinetic\ energy = 0.5 \times 800 \times 30^2$

Step 3 $Kinetic\ energy = 360\ 000\ J$

Year 10 Science Knowledge Organiser – IOL14 Human Health

Lesson 1 – Chromosomes

Key Terms

Eukaryote – A cell with a nucleus containing chromosomes

Prokaryote – A cell which has chromosomes found in the nucleus

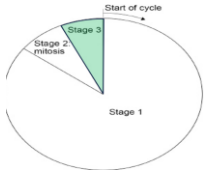
Chromosome - Long, coiled DNA molecule carrying many genes; found in the nucleus. In human body cells they occur in pairs.

- The nucleus of eukaryotic cells contains DNA.
- The DNA is arranged into very long molecules called **chromosomes.**
- These chromosomes are usually found in pairs.
- One of the pairs comes from our biological mother, and the other comes from our biological father.
- Humans have 23 pairs of chromosomes (46 in total)
- Prokaryotic organisms have chromosomes, but theses are just found in the cytoplasm – as prokaryotes do not have a nucleus

Lesson 2 – Mitosis and the Cell Cycle

Key Terms

Mitosis - Part of the cell cycle that separates cell content to either side of the cell before the cell splits.



- All living cells go through a life cycle called the cell cycle
- This cycle is needed for the growth and repair of organisms
- Phase 1 is the growth phase (number of subcellular structures increase and DNA is copied)
- Phase 2 is mitosis (, Nucleus and cell divides to form two identical cells
- Phase 3 – Cytoplasm and cell membranes divide

Lesson 3 – Cancer

Key Terms

Benign – Abnormal growth that does NOT invade nearby tissues

Malignant – A Tumour that DOES invade nearby tissues

Carcinogen – An agent (substance, radiation or organism) capable of causing cancer; IARC classifies such hazards.

Mutation – A change in DNA sequence caused by DNA replication or mutagens

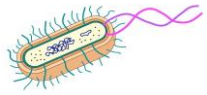
- Cancer is the result of changes to the cell that lead to uncontrolled growth and cell division
- Benign tumours are growths of abnormal cells that do not invade other parts of the body
- Malignant tumours can spread around the body through the blood to form secondary tumours
- Risk factors for developing cancer include : Carcinogens , Genetics , Viral infections and environmental factors

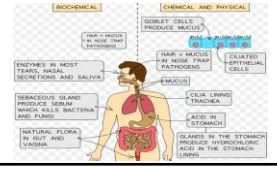
Lesson 4 – How Bacteria Cause Disease

Key Terms

Pathogen – A microorganism (virus, bacterium, protist or fungus) that causes infectious disease.

Toxins – A Poison produced by microorganisms that damages tissues and makes us feel ill





- Pathogens are microorganisms that cause infectious disease
- Bacteria are an example of pathogens they can infect animals and plants through direct contact, by water or by air
- Bacteria can produce toxins that damage tissues and make us feel unwell.

- The human body has a wide variety of defences against pathogens these include

1. The skin
2. Nose hairs and mucus
3. Cilia and mucus in the airways
4. Stomach acid

Lesson 5 – Types Of Bacterial Disease

Key Terms

Gonorrhoea – sexually transmitted **bacterial** infection causing pain on urinating and a yellow/green discharge; controlled with antibiotics and barrier contraception.

Salmonella – Bacterial disease spread via contaminated food; causes fever, abdominal cramps, vomiting and diarrhoea. UK poultry are vaccinated to reduce spread.

- Both Salmonella and Gonorrhoea are bacterial infections, but they are spread in different ways.
- Salmonella is usually caught by eating contaminated food, such as raw or undercooked poultry, whereas Gonorrhoea is a sexually transmitted infection.
- Salmonella typically causes fever, stomach cramps, vomiting, and diarrhoea.
- Gonorrhoea causes pain when urinating and a thick yellow or green discharge from the penis or vagina.
- To prevent Salmonella, food should be cooked thoroughly, good hygiene should be used,
- Gonorrhoea can be prevented by using condoms and can be treated with antibiotics,

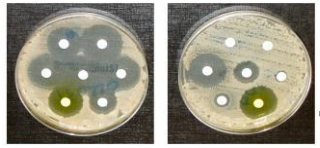
Lesson 6 – Antibiotics And Painkillers

Key Terms

Antibiotic – A medicine that kills bacteria inside the body (not effective against viruses); specific antibiotics treat specific bacteria.

Zone of inhibition – The clear area around an antimicrobial disc on an agar plate where bacteria do not grow; used to judge effectiveness.

- Antibiotics such as penicillin are medicine that are used to help treat bacterial infections
- Specific bacteria need to be treated with specific antibiotics
- The use of antibiotics has greatly reduced deaths from infectious bacterial diseases however bacteria that are resistant to antibiotics have started to emerge

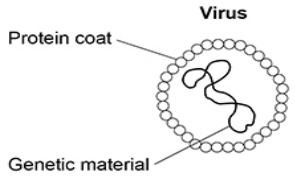


Year 10 Science Knowledge Organiser – IOL14 Human Health

Lesson 7 – How Viruses Cause Disease

Key Terms

Virus– Tiny structures consisting genetic material, surrounded by a protein coat



- `Viruses are tiny structures consisting genetic material, surrounded by a protein coat.
- They insert their genetic material into living cells and use the sub-cellular structures of those living cells to make more copies of itself.
- Eventually, the cell will die, damaging tissue and making us ill.
- Viral disease are difficult to treat as antibiotics cannot be used
- Spread of viral diseases can be prevented by methods such as vaccination , good hygiene and wearing face masks.

Lesson 8 – Types Of Viral Disease

Key Terms

Measles – A highly contagious **viral** disease causing fever and a red rash; best prevented by the MMR vaccine.

Tobacco Mosaic Virus– A plant virus that causes a mosaic pattern of discolouration on leaves and stunted growth due to reduced photosynthesis.

- Measles symptoms include fever and a red skin rash. It is spread through inhaling droplets from coughs and sneezes it can be prevented by vaccination
- Tobacco mosaic virus is a plant virus that causes patterns on the leaf preventing photosynthesis , it is passed on from contact with infected plants and can be managed using good hygiene and careful plant management

Lesson 9 – The Immune System

Key Terms

Antibody - A protein made by white blood cells that binds specifically to an antigen to help destroy a pathogen.

Antigen- A molecule (often a protein) on a cell or pathogen that is recognised by antibodies; antibodies are specific to one binding site on one antigen.

Antitoxin - A substance produced by white blood cells that neutralises toxins released by pathogens

- The immune system provides three main responses to infection

1. Antibodies bind to surface antigens on a pathogen. This causes them to clump together.
2. Phagocytosis –where phagocytes engulf and destroy pathogens
3. White blood cells also produce antitoxins that will neutralise toxins that are released by bacteria as they reproduce in the body.

Lesson 10 – Vaccination

Key Terms

Vaccine- Introducing small amounts of dead or inactive pathogen to stimulate antibody production and create immunity without causing disease.

Herd Immunity- When a high proportion of people are immune (usually via vaccination), disease spread is greatly reduced, protecting those not immune.

- Vaccination involves introducing small quantities of a dead or inactive form of a pathogen to the body to stimulate the white blood cells to produce antibodies
- If the same pathogen infects the body , white blood cells respond quickly to produce the correct antibodies to prevent infection.
- Some unreliable studies have been conducted linking vaccinations to other health problems - people may stop vaccinating their children because of false information, This means diseases like spread again and cause outbreaks, even though they can be prevented by vaccines.

Lesson 11 – Other Diseases

Key Terms

Protist - A mostly single-celled eukaryotic organism (not a plant, animal or fungus); some are pathogens (e.g. malaria).

Malaria- A **protist** disease causing recurrent fever; spread by mosquitoes in whose life cycle the protist develops.

Vector – A living organism (often a mosquito, tick or flea) that transmits pathogens between hosts

- Rose black spot is a fungal disease where purple or black spots develop on leaves
- Malaria is a protist that lives in the blood.
- Mosquitos are considered a **vector** for the malaria protist.
- Malaria causes recurring fever and can be fatal
- We can prevent the spread of malaria by controlling the mosquito population , using mosquito nets and medication

Lesson 12 – Drug Trials

Key Terms

Placebo– A treatment with no active drug used in trials to compare against the real drug.

Double blind trial – A clinical trial in which neither the participants nor the researchers know who receives the drug or the placebo until the end; reduces bias.

Peer review - Independent checking of scientific results by other experts before publication, to ensure quality and reliability.

- Global deforestation is causing issues with drug development as most traditional drugs were extracted by from plants and microorganisms



- Peer review involves reviewing the results of the drug trial.
- These people should not have any stake in the outcome of the paper to ensure that they avoid bias and that the results are valid

Year 10 Science Knowledge Organiser – OE5: Carbon Chemistry

Lesson 1 – The Earth's Early Atmosphere

Key Terms:

Explain - Make something clear, or state the reasons for something happening.

Compare - Describe the similarities and/or differences between things, not just write about one.

Describe - Recall some facts, events or process in an accurate way.

Scientists believe that Earth's early atmosphere was comprised of mainly carbon dioxide and water vapour with small amounts of nitrogen due to excess volcanic activity.
But evidence is limited because it is based on indirect data from volcanic gas composition and ancient rock composition.

As the Earth cooled, the water vapour in the atmosphere (from volcanic eruptions) condensed into liquid water and formed the oceans.

Both the Earth's early atmosphere and Mas today have high percentages of carbon dioxide in their atmospheres and trace amounts of oxygen. Earth's early atmosphere had more nitrogen than Mars and Mars only has trace water whereas Earth has significantly more.

Lesson 2 – The Changing Atmosphere

Key Terms :

Atmospheric – A gas found within the Earth's atmosphere

Marine – Relating to or found in the sea/ocean

Sedimentary - Small pieces of material that do not dissolve in water and are accumulated and compressed over time.

Atmospheric carbon dioxide dissolved into the seas and oceans.
Atmospheric carbon dioxide further decreased and oxygen increased due to plants and algae photosynthesising – absorbing carbon dioxide and releasing oxygen.

Marine organisms use dissolved carbon dioxide in the oceans to form their shells and skeletons in the form of carbonates.

Sedimentary rocks are formed from many layers of skeletons, shells and sediment built up on the seabed over millions of years.

Fossil fuels (coal, crude oil and natural gas) are formed when organic matter (deceases marine plants and animals) undergoes heat and pressure over millions of years.

Lesson 4 – Crude Oil and it's Composition

Key Terms

Hydrocarbon - A compound made up only of hydrogen and carbon atoms.

Homologous - A series of organic compounds that have the same general formula, similar chemical properties, and show a gradual change in physical properties.

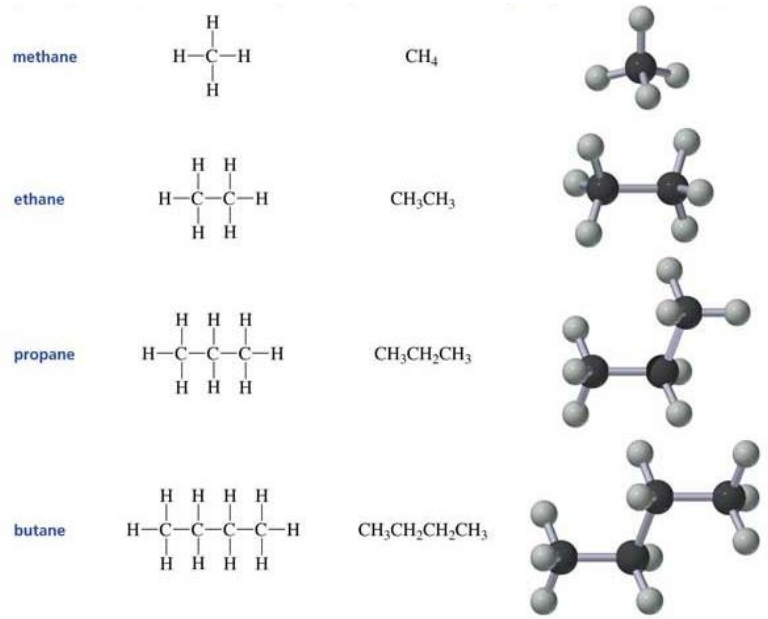
Alkane - A hydrocarbon containing o nly single bonds between carbon atoms.

Finite - A resource that will run out because nature replaces it very slowly.

Biomass - The dry mass of living or recently living organisms, representing sto red chemical energy.

Crude oil is a finite resource and a complex mixture of hydrocarbons formed from the remains of ancient biomass (mainly plankton) buried in the mud.

All alkanes share the general formula C_nH_{2n+2}
This means that the chemical reactivity of all the alkanes is the same, but their physical properties depend on the size of the molecule.



Lesson 3 – The Greenhouse Effect

Key Terms:

Absorption - The process by which energy is taken up by a substance or material.

Emitting - The process of giving out energy from a substance or object.

The transparent walls of a greenhouse let sunlight in, which warms the surfaces inside. These surfaces then release heat, but the glass or plastic traps this heat and prevents it escaping easily. The enclosed structure also reduces air movement, so warm air stays inside.

The greenhouse effect keeps Earth warm by trapping heat in the atmosphere.
Sunlight passes through the atmosphere and warms Earth's surface. The surface then emits infrared radiation. Greenhouse gases absorb this radiation and re-emit it back towards the surface, reducing heat loss to space.

Both the garden greenhouse and greenhouse effect feature shortwave radiation passing through a transparent layer, particles absorbing radiation and warming up and then later emitting longwave radiation as infrared. The greenhouse effect does not prevent warm air from rising and mixing freely so convection is reduced but a garden greenhouse does.

Year 10 Science Knowledge Organiser – OE5: Carbon Chemistry

Lesson 5 – Separating Crude Oil

Key Terms

Fractional distillation - Refers to separating a mixture into parts (fractions) based on differences in boiling points.

Vaporise - To change from a liquid state into a gas.

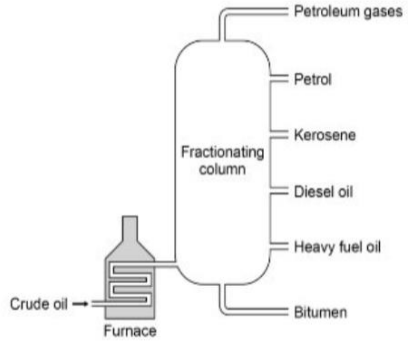
Petrochemical - A chemical substance made from crude oil or natural gas, used to manufacture products such as plastics and detergents.

Crude oil is heated to 450°C in a furnace then vaporises, the hot vapours enter the fractionating column and begin to rise.

The column is hotter at the bottom and cooler at the top.

The smaller hydrocarbons have lower boiling points so rise and condense toward the top of the column.

Larger hydrocarbons have higher boiling points so condense lower down the column.



Lesson 6 – Properties of hydrocarbons and their uses

Key Terms:

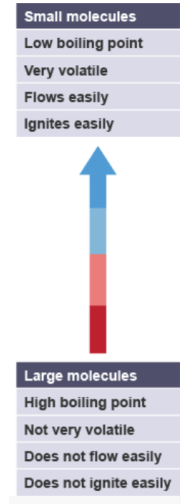
Flammability - A measure of how easily a substance ignites and burns in air.

Viscosity - A measure of how easily a liquid flows; liquids with high viscosity flow slowly, and those with low viscosity flow easily

As carbon chain length of a hydrocarbon increases, boiling point and viscosity increases but flammability decreases.

Small hydrocarbons (low boiling point, high flammability, low viscosity) are used as fuels because they ignite easily and flow well. Large hydrocarbons (high boiling point, low flammability, high viscosity) are used for lubricants, fuels for heavy engines, or surfacing because they are thicker, less volatile, and burn slowly or not at all.

Viscosity can be investigated experimentally by using a filter funnel and paper over a beaker, timing how long it takes for different liquids (water, golden syrup, oil and washing up liquid) to pass through the filter paper into the beaker.



Lesson 7 – Making the most of every barrel

Key Terms :

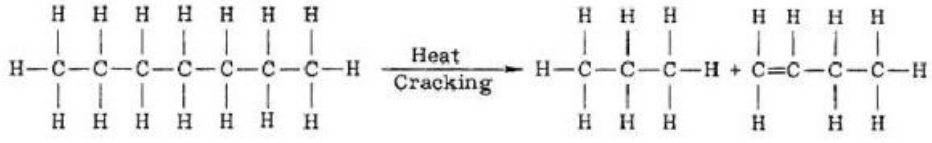
Cracking – thermal decomposition of longer hydrocarbons into shorter more useful ones

Unsaturated – a hydrocarbon that contains at least one carbon-carbon double bond

Alkene – a hydrocarbon with the general formula C_nH_{2n} that contains a carbon-carbon double bond

Cracking is required to thermally decompose (break down using heat) longer, less useful hydrocarbons into smaller, more useful ones and an alkene. The cracking conditions vary depending on the method used: steam cracking uses high temperatures and steam (usually used to produce small gaseous hydrocarbons) whereas catalytic cracking uses high temperatures and a catalyst (this is the process most used in industry as it can occur more quickly and at lower temperatures).

During cracking a long chain alkane is split into a shorter alkane and an alkene. **E.g. $C_7H_{16} \rightarrow C_3H_8 + C_4H_8$**



Alkenes can be tested using bromine water – the orar



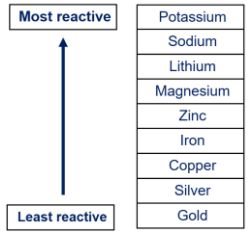
Year 10 Science Knowledge Organiser – CR7 Trends and Patterns in the reactivity series

Lesson 1 – Reactivity Series

Key Terms

Displacement – the distance an object moves in a straight line from its starting point to its finishing point, including the direction of that straight line

Shielding - describes how inner electron shells repel outer electrons, reducing the pull of the positive nucleus on the outermost shell



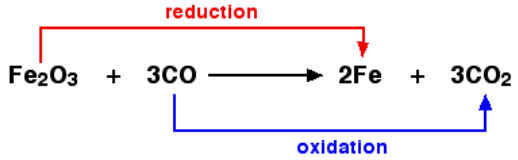
Metals react by **losing electrons to form positive ions**.
The **reactivity series** orders metals by their **tendency to form positive ions**.
A metal that **loses electrons easily** has a **high tendency** and is **more reactive**.
Sodium loses its outer electron easily, so it is very reactive.Copper does not lose electrons easily, so it is much less reactive.

Displacement reactions are where a more reactive element takes the place of a less reactive element in a chemical compound.

Lesson 2 – Metal oxides and the extraction of metals - VCH

Key Terms

Oxidation – a reaction in which a substance gains oxygen
Reduction – a reaction in which a substance loses oxygen
ores - a rock containing metal



Metals react with oxygen to form metal oxides.

Due to carbons position in the reactivity series, it can be used to extract some metals from metal oxides.

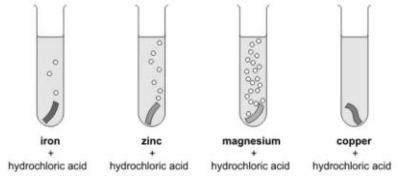
Reacting metals with carbon is a reudction reaction.

Extracting metals using carbon has a negative environmental impact because it produces carbon dixoide which is a greenhouse gas.

Lesson 3 – Reactions of acids and metals

Key Terms

Corrosion - the destruction of metals by chemical reactions with substances in their environment
.



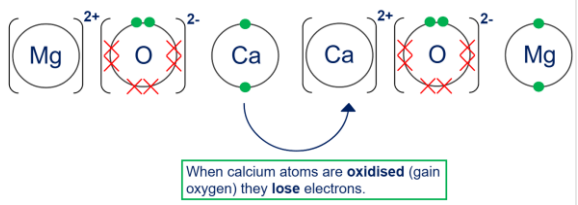
Metals react differently in acids due to their position in the reactivity series.

Some will react vigorously to produce hydrogen gas and salt.
Others will not react with acids.

Lesson 4 – Redox in terms of electrons (HT only)

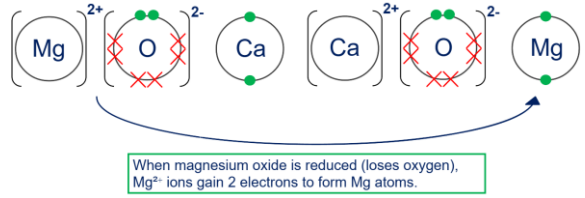
Key Terms

Oxidation - the **loss of electrons** or the **gain of oxygen** in a chemical reaction
Reduction - the loss of oxygen or the gain of electrons by a substance during a chemical reaction
REDOX - a chemical reaction where **reduction** and **oxidation** happen simultaneously



Reduction is gaining electrons and oxygen being removed.

Oxidation is electrons being lost and oxygen being added.



Lesson 5 – Neutralisation - VCH

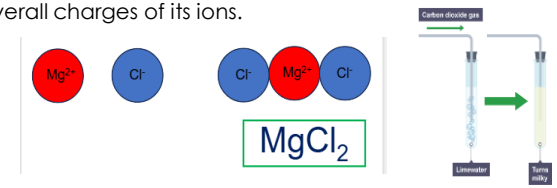
Key Terms

Neutralisation – a reaction between an acid and a base to form salt and water.
Salt - substance formed when the hydrogen ion in an acid is replaced by a metal ion.
Charge – postive or negative
Ion – an atom with a charge
Carbonate – compound containing the ion CO_3^{2-}

Carbonate + acid --> salt + water + carbon dioxide

The test for carbon dixoide gas is limewater

The formula for salts can be deducted by balancing the overall charges of its ions.



Lesson 6 – Soluble Salts RP

Key Terms

Insoluble base – a substance that reacts with an acid to neutralise it and form a salt and water, but does *not* dissolve in water
Filtering - a physical method used to separate an **insoluble solid** from a liquid or solution
Excess – any reactant present in a greater amount than is necessary to completely react

- Add excess of powder
- Dissolving
- Filtering
- Crystallising
- Evaporation



Year 10 Science Knowledge Organiser – CR7 Trends and Patterns in the reactivity series

Lesson 7 – Soluble Salts - VCH

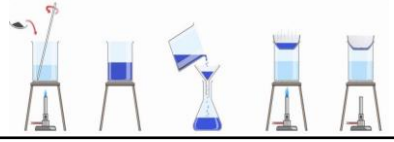
Key Terms

Acid – substances that form H+ ions when dissolved in water.
Base – substaces that neutralise acids to form salt and water.
Insoluble - a substance that cannot dissolve.

An acid can react with an insoluble base to produce a pure, dry sample of soluble salt and water
.
Acid + base--> salt + water.
An alkali cannot be used to make a pure dry salt sample.

Preparation of salts with insoluble bases can be summarised with in these steps:

- Warm the acid to speed up the reaction
- Add an excess of base to neutralise all the acid
- Filter the mixture
- Heat the solution using an evaporating basin to evaporate the liquid and leave
- behind the solid salt crystals.



A table to show the salts produced by the reaction of insoluble bases and acids.

	Hydrochloric acid	**Sulfuric acid**	**Nitric acid**
Copper oxide	Copper chloride	Copper sulfate	Copper nitrate
Aluminum hydroxide	Aluminum chloride	Aluminum sulfate	Aluminum nitrate
Zinc carbonate	Zinc chloride	Zinc sulfate	Zinc nitrate

Lesson 8 – pH scale - VCH

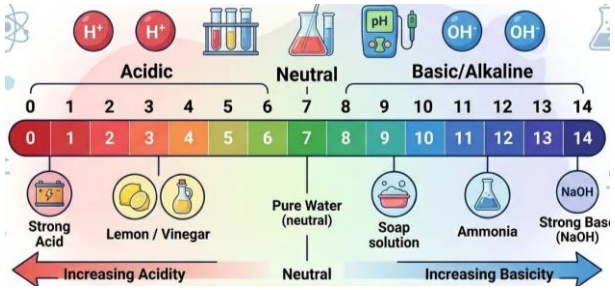
Key Terms

Acid – substances that form H+ ions in water.
Alkali - a type of base that dissolves in water to produce hydroxide ions (OH−)
Hydrogen ion - a charged particle that forms when a hydrogen atom loses its electron
Hydroxide ion - a type of charged particle that you find in certain solutions, such as when a substance is dissolved in water

Acids produce H+ ions in solution.
Alkalis produce OH- ions in solution.
OH- ions react with H+ ions to form water
In a neutralisation reaction.

Universal indicator (UI) is a pH indicator that can Indicate the acidity or alkalinity of solutions.

A pH probe measures pH electronically, using a sensor that responds to the concentration of H+ ions.
A pH probe is more accurate than using UI



Lesson 9 – Strong and Weak Acids (HT only)

Key Terms

Dilute -a solution containing a relatively small amount of solute (the substance being dissolved) dissolved in a large volume of solvent (usually water)
Concentrated - a solution containing a large mass of dissolved solute in a given volume of solvent, with little to no water added
Strong - an acid that completely ionises (dissociates) in an aqueous solution
Weak - an acid that only partially ionises (or dissociates) in an aqueous solution

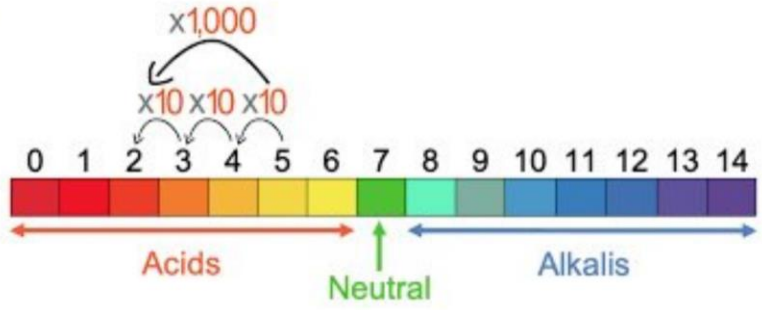
A concentrated acid has many acid particles per unit volume

A weak or dilute acid had fewer acid particles per unit volume

A strong acid completely ionises in water e.g. nitric, sulphuric or hydrochloric acids.

A weak or dilute acid partially ionises in water e.g. citric, ethanoic or carbonic acids.

Each decrease of 1 in pH represents a tenfold increase in hydrogen ion concentration.



Year 10 Science Knowledge Organiser – THB10 Homeostasis

Lesson 1 - Homeostasis

Key Terms

Homeostasis – The regulation of internal conditions of a cell or organism to maintain optimum conditions for function in response to internal and external changes.

Coordinator – such as the brain, spinal cord or pancreas, which receives and processes information from receptors around the body.

Receptor - A cell or group of cells that detect stimuli such as light, temperature, or chemical changes.

Effector - A muscle or gland that brings about a response to a stimulus, for example by contracting or secreting substances.

Homeostasis = keeping internal conditions stable at the optimum.

Needed so enzymes and cells work properly.

Key conditions to keep stable: temperature, water, glucose.

If conditions change, the body detects and corrects them.

Control system = receptor → coordination centre → effector.

Negative feedback brings conditions back to normal.

Lesson 2 – The Nervous System

Key Terms

Nervous System – A system of cells and tissues that uses electrical impulses to transmit information rapidly around the body and coordinate responses.

Stimulus – a detectable change in an organism's environment

The nervous system detects stimuli (changes in the environment) and coordinates the body's response. It allows the body to react quickly to changes inside and outside the body.

The central nervous system (CNS) = brain and spinal cord (control centre).The peripheral nervous system (PNS) = receptors and neurones that carry information.
Neurones carry impulses from receptors to the CNS. Relay neurones connect neurones within the CNS. Motor neurones carry impulses to effectors (muscles/glands

Reflexes are fast, automatic responses that do not require thinking. They help protect the body from harm (e.g. blinking, pulling away from heat). Reflex Arc Pathway -The sequence is: Stimulus → receptor → sensory neurone → relay neurone → motor neurone → effector → response. This pathway allows a rapid response, often through the spinal cord instead of the brain.

Lesson 3 – Reaction time

Key Terms

Compare – describe the similarities and/or differences between things, not just write about one

Reaction time is how quickly the brain processes a stimulus and sends signals to effectors (typically 0.2–0.9 seconds).

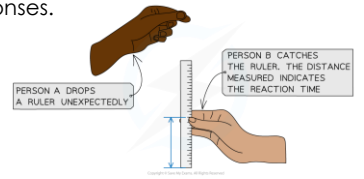
It depends on the speed of nerve impulses and synapse transmission, and whether a response is conscious or reflex. Factors affecting reaction time include age, distractions (e.g. phone use), alcohol, drugs, and caffeine.

Reaction time can be measured using the ruler drop test, where distance fallen indicates reaction speed.

Lesson 4 – RP Reaction time

Key Terms

Identify – name or otherwise characterise
Stimulant - A stimulant is a drug that increases the activity of the central nervous system, speeding up body processes and increasing alertness and reaction speed.
Depressant -A depressant is a drug that slows down the activity of the central nervous system, reducing brain activity and slowing reactions and responses.



In this practical, it is measured by how far the ruler falls – shorter distance = faster reaction time.

The method (ruler drop test)A ruler is dropped without warning and the participant catches it. You record the distance fallen. Repeat at least 3 times and calculate a mean to improve reliability.

Independent variable = what you change (e.g. gender).Dependent variable = what you measure (reaction distance/time).Control variables = what you keep the same (same ruler, same starting position, same dropper).

Reliability: repeat tests and calculate a mean.
Accuracy: reduce human error (e.g. use electronic timers)

Lesson 5 – The endocrine system

Key Terms

Endocrine System – A system of glands that secrete hormones directly into the bloodstream to regulate body processes.
Gland – An organ that produces and secretes hormones or other substances.
Hormone – A chemical messenger produced by a gland and carried in the blood to a target organ, where it causes a response.

The endocrine system is a group of glands that produce hormones. Hormones are chemical messengers that travel in the bloodstream to target organs. [Hormones cause changes in the body to help maintain homeostasis. They only affect target cells with specific receptors.

Pituitary gland – "master gland", controls other glands, Thyroid – controls metabolism, Adrenal glands – fight or flight response, Pancreas – controls blood glucose, Ovaries/Testes – control puberty and reproduction

Endocrine system: slow, long-lasting, affects many organs, uses hormones in blood. Nervous system: fast, short-lived, targets specific areas, uses electrical impulses.

Lesson 6 – Controlling blood glucose (H)

Key Terms

Negative Feedback – A control mechanism in which any change from the normal level triggers responses that restore conditions back to the optimum.
Insulin - a hormone released by the pancreas that lowers blood glucose concentration by causing cells to take in glucose and store it as glycogen.
Glycogen - an insoluble storage form of glucose found in the liver and muscles.
Glucagon - a hormone released by the pancreas that increases blood glucose concentration by causing glycogen to be converted into glucose.

Pancreas controls blood glucose – detects changes and releases hormones. Insulin causes liver & muscles to absorb glucose and store it as glycogen. Glucagon (low glucose) – causes glycogen → glucose conversion in the liver.

Negative feedback keeps glucose levels stable after meals or between meals. Type 1 diabetes – no insulin produced; treated with insulin injections. Type 2 diabetes – insulin resistance; linked to obesity, treated with diet/exercise (and sometimes insulin)

Year 10 Science Knowledge Organiser – THB10 Homeostasis

Lesson 6 – Controlling blood glucose (F)

Key Terms

Insulin - a hormone released by the pancreas that lowers blood glucose concentration by causing cells to take in glucose and store it as glycogen.

Glycogen - an insoluble storage form of glucose found in the liver and muscles.

Glucagon - a hormone released by the pancreas that increases blood glucose concentration by causing glycogen to be converted into glucose.

Pancreas controls blood glucose levels in the blood. Insulin lowers blood glucose by moving glucose into cells. Excess glucose is stored as glycogen in liver and muscles.

Glycogen can be turned back into glucose when levels are too low.

Type 1 diabetes – body cannot produce insulin → needs injections.

Type 2 diabetes – body doesn't respond to insulin → linked to lifestyle, managed with diet/exercise.

Lesson 7 – The menstrual cycle (H)

Key Terms

Hormone – A chemical messenger produced by a gland and carried in the blood to a target organ, where it causes a response.

Pituitary gland – the master gland in the brain that releases hormones which control other endocrine glands and regulate body processes

A menstrual cycle lasts 28 days. It goes: menstruation → lining rebuild → ovulation → lining maintained.

Hormones control cycle: FSH matures eggs, LH causes ovulation, Oestrogen thickens lining Progesterone maintains lining.

Negative feedback: oestrogen & progesterone inhibit FSH/LH to control the cycle.

If no pregnancy: hormone levels drop → lining breaks down → cycle restarts.

Lesson 7 – The menstrual cycle (F)

Key Terms

Hormone – A chemical messenger produced by a gland and carried in the blood to a target organ, where it causes a response.

Testosterone - a hormone produced by the testes that controls male puberty and stimulates sperm production.

The menstrual cycle prepares the body for pregnancy.

Day 1–5: menstruation – uterus lining breaks down and leaves the body.

Days 6–14: uterus lining thickens.

Day 14: ovulation – an egg is released.

Days 14–28: lining stays thick in case of pregnancy.

Hormones involved: Oestrogen thickens lining, Progesterone maintains lining, Pituitary hormones control egg release

Lesson 8 – Contraception

Key Terms

Contraceptive - a method or device used to prevent pregnancy.

Hormone – A chemical messenger produced by a gland and carried in the blood to a target organ, where it causes a response.

Barrier method – a method of contraception, such as a condom that prevents sperm from reaching the egg by creating a physical barrier

Contraception methods are used to prevent pregnancy.
Barrier methods - Stop sperm reaching the egg (e.g. condom).Also protect against STIs.

Hormonal methods: Use hormones (oestrogen/progesterone) to prevent ovulation. Do not protect against STIs.
Permanent methods (e.g. vasectomy).Stop sperm or eggs being released.

Comparing methods Barrier: easy, protect from STIs, less reliable.
Hormonal: more reliable, longer-lasting, possible side effects.
Methods vary in effectiveness, duration, and protection (STIs vs pregnancy).

Lesson 9 – Infertility (H)

Key Terms

Fertility – the ability to produce offspring

Fertilisation – the fusion of the nucleus of a sperm cell with the nucleus of an egg cell to form a fertilized egg (zygote)

Infertility = difficulty getting pregnant after trying.

FSH stimulates eggs to mature and LH triggers ovulation. Used to increase chances of pregnancy.

IVF is used if other treatments fail or there are issues like blocked oviducts or poor sperm quality.

Eggs collected → fertilised in a lab → embryos placed into uterus

Multiple embryos are transferred to increase success rate. Success affected by age, lifestyle (e.g. smoking), health.

Advantages: allows people to have children, can screen for disease. Disadvantages: expensive, stressful, ethical issues (unused embryos)

