Year 9 AQA GCSE Science (TERM 2 BIOLOGY)

Topic 1: Transport in cells

4.1.3 Transport in cells			
4.1.3.1 Diffusion	☺	😐	☹
Substances may move into and out of cells across the **cell membranes** via **diffusion**.			
Diffusion is the spreading of the particles of any substance in solution, or particles of a gas, resulting in a net movement from an area of **higher concentration** to an area of **lower concentration**.			
Some of the substances transported in and out of cells by diffusion are **oxygen** and **carbon dioxide** in **gas exchange**, and of the waste product **urea** from cells into the **blood plasma** for **excretion** in the **kidney**.			
Factors which affect the **rate of diffusion** are: • the difference in concentrations (**concentration gradient**) • the **temperature** • the **surface area** of the membrane.			
A **single-celled organism** has a relatively **large surface area to volume ratio**. This allows sufficient transport of molecules into and out of the cell to meet the needs of the organism.			
In **multicellular organisms**, surfaces and organ systems are specialised for exchanging materials. This is to allow sufficient molecules to be transported into and out of cells for the organism's needs. The effectiveness of an exchange surface is increased by: • having a large surface area • a membrane that is thin, to provide a short diffusion path • (in animals) having an efficient blood supply • (in animals, for gaseous exchange) being ventilated.			
Students should be able to: ★ **Explain** how different **factors** affect the **rate** of diffusion.			
★ **Calculate** and compare **surface area to volume** ratios.			
★ **Explain** the need for **exchange surfaces** and a **transport system** in **multicellular** organisms in terms of surface area to volume ratio.			
★ **Explain** how the small intestine and lungs in **mammals**, gills in **fish**, and the roots and leaves in **plants**, are **adapted** for exchanging materials.			
WS 1.2 Recognise, draw and interpret diagrams that model diffusion.			
WS 1.5 Use of **isotonic drinks** and **high energy drinks** in sport.			

4.1.3.2 Osmosis	☺	😐	☹
Water may move across cell membranes via **osmosis**. Osmosis is the diffusion of **water** from a dilute solution to a concentrated solution through a **partially permeable membrane**.			
<u>Students should be able to:</u> ★ Use simple compound measures of **rate** of water uptake.			
★ Use **percentiles**.			
★ **Calculate** percentage gain and loss of mass of plant tissues.			
★ Plot, draw and interpret appropriate **graphs**.			
WS 1.2 Recognise, draw and interpret diagrams that model osmosis.			

4.1.3.2 Active Transport – *Links with 'Cell specialisation' in term 1.*	☺	😐	☹
Active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). This **requires energy** from **respiration**.			
Active transport allows **mineral ions** to be absorbed into **plant root hairs** from very dilute solutions in the soil. Plants require ions for **healthy growth**.			
It also allows **sugar molecules** to be absorbed from lower concentrations in the **gut** into the blood which has a higher sugar concentration. Sugar molecules are used for **cell respiration**.			
<u>Students should be able to:</u> ★ **Describe** how substances are transported into and out of cells by **diffusion**, **osmosis** and **active transport (link to the treatment for kidney failure - dialysis).**			
★ **Explain** the **differences** between **diffusion**, **osmosis** and **active transport**.			

Year 9 AQA GCSE Science (TERM 2 CHEMISTRY)
Topic 2: The Periodic table and covalent bonding

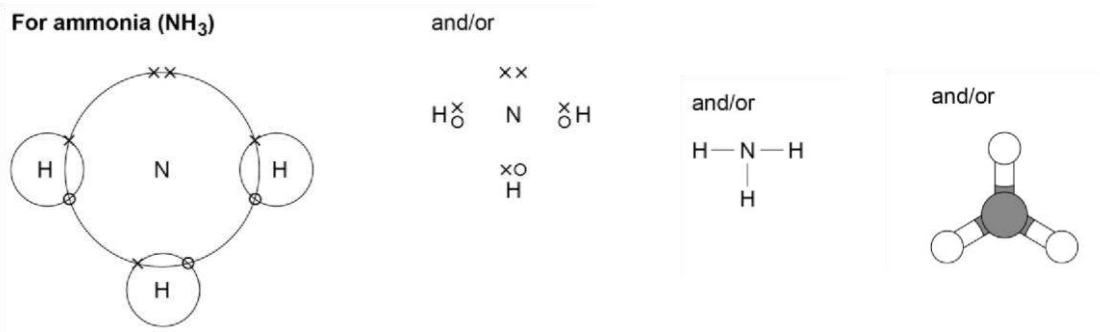
4.1.2 The periodic table			
4.1.2.1 The periodic table	☺	😐	☹
The elements in the **periodic table** are arranged in order of atomic (proton) number and so that elements with similar properties are in columns, known as **groups**. The table is called a periodic table because **similar properties** occur at regular intervals.			
Elements in the **same group** in the periodic table have the same number of electrons in their outer shell (outer electrons) and this gives them **similar chemical properties**.			
Students should be able to: ★ **Explain** how the position of an element in the periodic table is related to the arrangement of electrons in its atoms and hence to its atomic number.			
★ **Predict** possible reactions and probable reactivity of elements from their positions in the periodic table.			
4.1.2.2 Development of the periodic table	☺	😐	☹
Before the discovery of protons, neutrons and electrons, scientists attempted to classify the elements by arranging them in order of their **atomic weights**.			
The early periodic tables were incomplete and some elements were placed in inappropriate groups if the strict order of atomic weights was followed.			
Mendeleev overcame some of the problems by **leaving gaps** for elements that he thought had not been discovered and in some places changed the order based on atomic weights.			
Elements with properties **predicted** by Mendeleev were discovered and filled the gaps. Knowledge of isotopes made it possible to explain why the order based on atomic weights was not always correct.			
Students should be able to: ★ **Describe** these steps in the development of the periodic table.			
WS 1.1+1.6 Explain how testing a prediction can support or refute a new scientific idea.			
4.1.2.3 Metals and non-metals	☺	😐	☹
Elements that react to form **positive ions** are **metals**.			
Elements that do not form positive ions are non-metals.			
The majority of elements are metals. **Metals** are found to the **left** and towards the **bottom** of the periodic table. Non-metals are found towards the right and top of the periodic table.			

Students should be able to: ★ **Explain** the differences between **metals** and **non-metals** on the basis of their characteristic **physical** and **chemical properties**. *Links with 'Group 0', 'Group 1', 'Group 7' and 'Bonding, structure and the properties of matter'.*			
★ **Explain** how the **atomic structure** of metals and non-metals relates to their **position** in the periodic table.			
★ **Explain** how the **reactions of elements** are related to the **arrangement of electrons** in their atoms and hence to their **atomic number**.			
4.1.2.4 Group 0	☺	😐	☹
The elements in **Group 0** of the periodic table are called the **noble gases**. They are **unreactive** and do not easily form molecules because their atoms have **stable arrangements** of electrons. The noble gases have **eight electrons** in their outer energy level, except for helium, which has only two electrons.			
The **boiling points** of the noble gases increase with increasing relative atomic mass (going down the group).			
Students should be able to: ★ **Explain** how properties of the elements in Group 0 depend on the outer shell of electrons of the atoms.			
★ **Predict** properties from given trends down the group.			
4.1.2.5 Group 1	☺	😐	☹
The elements in **Group 1** of the periodic table, known as the **alkali metals** and have characteristic properties because of the **single electron** in their outer shell. E.g. • are metals with **low density** (the first three elements in the group are less dense than water). • react with non-metals to form **ionic compounds** in which the metal ion carries a charge of **+1**. The compounds are white solids that dissolve in water to form colourless solutions. • react with water, releasing **hydrogen**. • form **hydroxides** that dissolve in water to give **alkaline solutions**.			
In Group 1, the **reactivity** of the elements increases going down the group.			
Students should be able to: ★ **Describe** the reactions of the first three alkali metals with oxygen, chlorine and water.			
★ **Explain** how properties of the elements in Group 1 depend on the outer shell of electrons of the atoms. [WS 1.2]			
★ **Predict** properties from given trends down the group. [WS 1.2]			
4.1.2.6 Group 7	☺	😐	☹
The elements in **Group 7** of the periodic table, known as the **halogens** and have similar reactions because they all have **seven electrons** in their outer shell. The halogens are **non-metals** and consist of molecules made of **pairs of atoms**.			

Halogens: □ react with **metals** to form **ionic compounds** in which the halide ion carries a charge of **−1** □ form **molecular compounds** with other **non-metallic** elements.			
In Group 7, the further down the group an element is the higher its relative molecular mass, **melting point** and **boiling point**.			
In Group 7, the **reactivity** of the elements decreases going down the group.			
A more reactive halogen can **displace** a less reactive halogen from an aqueous solution of its salt.			
Students should be able to: ★ **Describe** the nature of the compounds formed when chlorine, bromine and iodine react with metals and non-metals.			
★ **Explain** how properties of the elements in Group 7 depend on the outer shell of electrons of the atoms.			
★ **Predict** properties from given trends down the group.			

4.2.1.4 Covalent bonding	☺	😐	☹
When atoms **share** pairs of **electrons**, they form **covalent bonds**. These bonds between atoms are **strong**.			
Covalently bonded substances may consist of **small molecules** (such as H_2, Cl_2, O_2, N_2, HCl, H_2O, NH_3 and CH_4).			

Some covalently bonded substances have very **large molecules**, such as **polymers**.			
Some covalently bonded substances have **giant covalent structures**, such as **diamond** and **silicon dioxide**.			
The covalent bonds in **molecules** and **giant structures** can be represented in the following forms:			

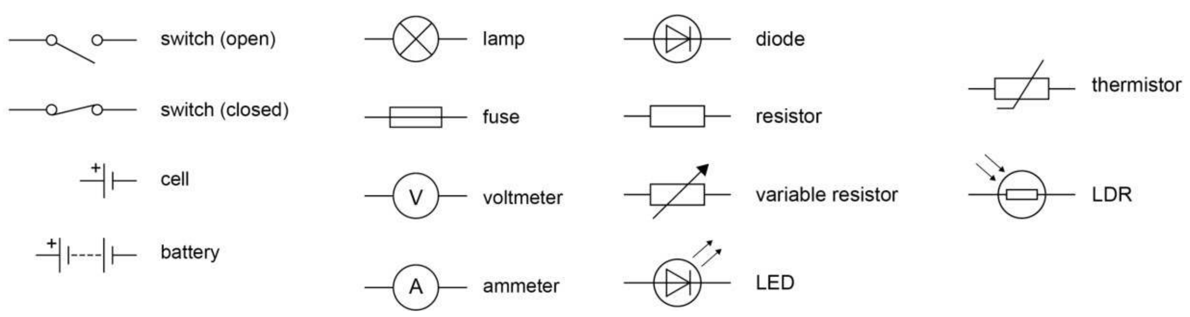


Year 9 AQA GCSE Science (TERM 3 PHYSICS)

Topic 3: Electricity

4.2.1 Current, potential difference and resistance

4.2.1.1 Standard circuit diagram symbols	☺	😐	☹
Circuit diagrams use standard symbols.			



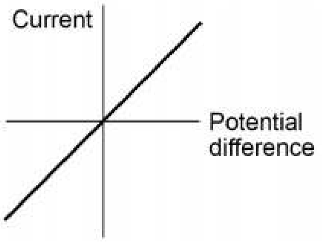
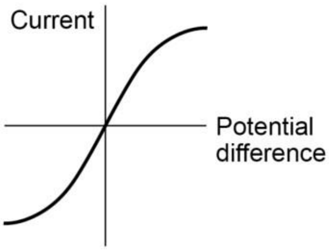
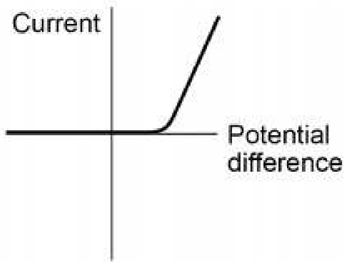
Students should be able to: ★ Draw and interpret **circuit diagrams**.			
★ **Recall** all the circuit symbols shown above			

4.2.1.2 Electrical charge and current	☺	😐	☹
For **electrical charge** to flow through a closed circuit the circuit must include a source of **potential difference**.			
Electric current is a flow of electrical charge. The size of the electric current is the **rate** of **flow** of electrical **charge**.			

Charge flow, current and time are linked by the equation: charge flow = current × time $Q = I\ t$			
• charge flow, Q, in coulombs, **C** • current, I, in amperes, **A** (amp is acceptable for ampere) • time, t, in seconds, **s**			
The current at any point in a single closed loop of a circuit has the same value as the current at any other point in the same closed loop.			
Students should be able to: ★ **Recall** and apply the equation for **current** stated above.			

4.2.1.3 Current, resistance and potential difference	☺	😐	☹
The **current** (I) through a component depends on both the **resistance** (R)of the component and the **potential difference** (V) across the component.			
The **greater the resistance** of the component the **smaller the current** for a given potential difference (p.d.) across the component.			
Current, potential difference or resistance can be calculated using the equation: potential difference = current × resistance $V = I R$			
• potential difference, V, in volts, **V** • current, I, in amperes, **A** (amp is acceptable for ampere) resistance, R, in ohms, **Ω**			

4.2.2 Series and parallel circuits			
There are two ways of joining electrical components, in **series** and in **parallel**. Some circuits include both series and parallel parts.			
For components connected in <u>**series**</u>: • there is the **same current** through each component. • the total **potential difference** of the power supply is **shared** between the components. • the total **resistance** of two components is the **sum** of the resistance of each component:			
For components connected in <u>**parallel**</u>: $\boldsymbol{R_{total} = R_1 + R_2 + ...}$			
• the **potential difference** across each component is the **same**. • the **total current** through the whole circuit is the **sum of the currents** through the separate components. • the **total resistance** of two resistors is **less** than the resistance of the smallest individual resistor.			
<u>Students should be able to:</u> ★ **Describe** the **difference** between **series** and **parallel** circuits.			
★ **Explain** qualitatively why adding resistors in **series increases** the total resistance whilst adding resistors in **parallel decreases** the total resistance.			
★ **Explain** the design and use of d.c. **series circuits** for measurement and testing purposes.			
★ **Calculate** the currents, potential differences and resistances in d.c. **series** circuits.			
❖ **Recall** and apply the equation linking **current**, **potential difference** and **resistance.**			
REQUIRED PRACTICAL – Resistance. **AT 1, 6 and 7**			

4.2.1.4 Resistors	☺	😐	☹
The current through an **ohmic conductor** (at a constant temperature) is **directly proportional** to the potential difference across the resistor. This means that the resistance remains constant as the current changes.  			
The **resistance** of components such as **lamps**, **diodes**, **thermistors** and **LDRs** is not constant; it changes with the **current** through the component.			
The resistance of a **filament lamp** increases as the temperature of the filament increases.  			
The current through a **diode** flows in one direction only. The diode has a very high resistance in the reverse direction.  			
The resistance of a **thermistor** decreases as the **temperature** increases.			
The **applications** of thermistors in circuits e.g. a **thermostat** is required.			
The resistance of an **LDR** decreases as **light** intensity increases.			
The **application** of LDRs in circuits e.g. **switching lights on** when it gets dark is required.			
Students should be able to: ★ **Explain** that, for some resistors, the value ***R*** remains **constant** but that in others it can **change** as the **current** changes.			
★ **Explain** the design and use of a circuit to measure the **resistance** of a component by measuring the **current** through, and **potential difference** across, the component.			
★ **Draw** an appropriate circuit diagram using correct circuit symbols.			
★ Use **graphs** to determine whether circuit components are linear or non-linear and relate the curves produced to the function and properties of the component.			