Year 9 AQA GCSE Science (TERM 3 BIOLOGY)

Health

4.2.2.2 The heart and blood vessels	☺	😐	☹
The **heart** is an organ that **pumps blood** around the body in a **double circulatory system**.			
The **right ventricle** pumps blood to the **lungs** where gas exchange takes place.			
The **left ventricle** pumps blood around the rest of the **body**.			
Knowledge of the blood vessels associated with the heart is limited to the **aorta**, **vena cava**, **pulmonary artery**, **pulmonary vein** and **coronary arteries**. *Knowledge of the names of the heart valves is not required.*			
Knowledge of the lungs is restricted to the **trachea**, **bronchi**, **alveoli** and the **capillary network** surrounding the **alveoli**.			
The natural resting heart rate is controlled by a group of cells located in the right atrium that act as a **pacemaker**.			
Artificial pacemakers are electrical devices used to correct irregularities in the heart rate.			
The body contains three different types of blood vessel: • **arteries** **veins** • **capillaries**.			
Students should be able to: ★ **Describe** the **structure** and **functioning** of the **human heart** and **lungs**, including how lungs are adapted for gaseous exchange.			
★ **Explain** how the **structure** of the blood vessels relates to their **functions**.			
★ Use simple compound measures such as **rate** and carry out rate calculations for blood flow.			

4.2.2.3 Blood	☺	😐	☹
Blood is a **tissue** consisting of **plasma**, in which the **red blood cells**, **white blood cells** and **platelets** are suspended.			
Plasma transports **proteins** and other chemical substances around the body.			
Red blood cells contain **haemoglobin** which binds to **oxygen** to transport it from the lungs to the tissues.			
White blood cells help to **protect** the body against infection.			
Platelets are fragments of cells which initiate the **clotting** process at wound sites.			

Students should be able to: ★ **Recall** the **functions** of each of the **blood components**.			
★ Recognise different types of blood cells in a **photograph** or **diagram**, and explain how they are **adapted** to their functions.			
WS 1.5 Evaluate risks related to use of blood products.			
4.2.2.4 Coronary heart disease: a non-communicable disease	☺	😐	☹
In **coronary heart disease** layers of **fatty material** build up inside the **coronary arteries**, narrowing them. This reduces the flow of blood through the coronary arteries, resulting in a lack of **oxygen** for the heart muscle.			
Stents are used to keep the coronary arteries open.			
Statins are widely used to reduce blood cholesterol levels which slow down the rate of fatty material deposit.			
In some people heart valves may become **faulty**, preventing the valve from opening fully, or the heart valve might develop a leak. Faulty heart valves can be replaced using **biological** or **mechanical valves**.			
In the case of heart failure, a **donor** heart, or heart and lungs can be transplanted. **Artificial hearts** are occasionally used to keep patients alive whilst waiting for a heart transplant, or to allow the heart to rest as an aid to recovery.			
Students should be able to: ★ **Evaluate** the advantages and disadvantages of treating cardiovascular diseases by **drugs**, **mechanical devices** or **transplant**.			
★ **Understand** the **consequences** of faulty heart valves.			
WS 1.3 Evaluate methods of treatment bearing in mind the benefits and risks associated with the treatment.			
4.2.2.5 Health issues	☺	😐	☹
Health is the state of **physical** and **mental** wellbeing.			
Diseases, both **communicable** and **non-communicable**, are major causes of ill health. Other factors including **diet**, **stress** and **life situations** may have a profound effect on both **physical** and **mental** health.			

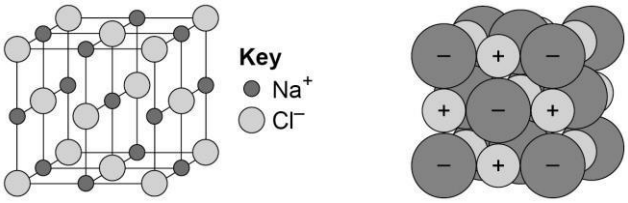
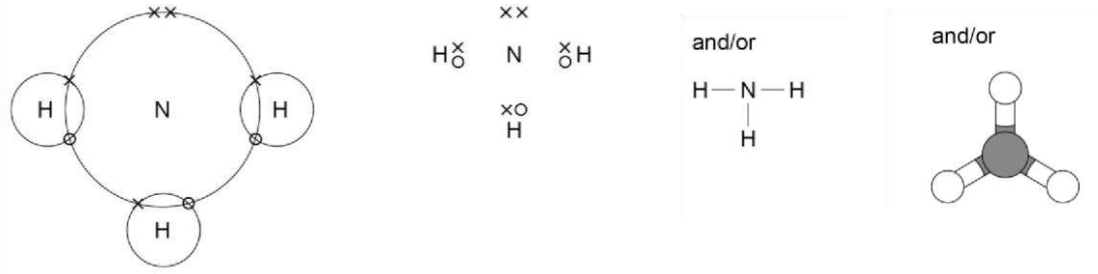
Different types of disease may interact: • Defects in the **immune system** mean that an individual is more likely to suffer from infectious diseases. • **Viruses** living in cells can be the trigger for **cancers**. • Immune reactions initially caused by a pathogen can trigger **allergies** such as **skin rashes** and **asthma**. • Severe physical ill health can lead to **depression** and other mental illness.			

Students should be able to: ★ **Describe** the **relationship** between **health** and **disease** and the interactions between different types of disease.			
★ Translate information between graphical and numerical forms, construct and interpret frequency tables and diagrams, bar charts and histograms, and use a scatter diagram to identify a correlation between two variables.			
★ **Understand** the principles of sampling as applied to scientific data, including epidemiological data.			
4.2.2.6 The effect of lifestyle on some non-communicable diseases	☺	😐	☹
Risk factors are linked to an increased rate of a disease. They can be: • aspects of a person's **lifestyle** • **substances** in the person's body or environment.			
A **causal mechanism** has been proven for some risk factors, but not in others. • The effects of **diet**, **smoking** and **exercise** on **cardiovascular disease**. • **Obesity** as a risk factor for **Type 2 diabetes**. • The effect of **alcohol** on the **liver** and **brain** function. • The effect of **smoking** on **lung disease** and **lung cancer**. • The effects of **smoking** and **alcohol** on **unborn babies**. • **Carcinogens**, including **ionising radiation**, as risk factors in **cancer.**			
Many diseases are caused by the **interaction of a number of factors** (e.g. cardiovascular disease, some lung and liver diseases and diseases influences by nutrition, including Type 2 diabetes).			
★ **Discuss** the **human** and **financial cost** of these non-communicable diseases to an individual, a local community, a nation or globally.			
★ **Explain** the effect of **lifestyle factors** including diet, alcohol and smoking on the incidence of non-communicable diseases at local, national and global levels.			
★ **Understand** the principles of sampling as applied to scientific data in terms of risk factors.			
★ Translate information between graphical and numerical forms; and extract and interpret information from charts, graphs and tables in terms of risk factors.			
★ Use a scatter diagram to identify a correlation between two variables in terms of risk factors.			
WS 1.5 Interpret data about risk factors for specified diseases.			
4.2.2.7 Cancer	☺	😐	☹
★ **Describe cancer** as the result of changes in **cells** that lead to **uncontrolled growth** and **division.**			
Benign tumours are growths of abnormal cells which are **contained in one area**, usually within a membrane. They do not invade other parts of the body.			
Malignant tumour cells are **cancers**. They invade neighbouring tissues and spread to different parts of the body in the blood where they form **secondary tumours**.			
Scientists have identified **lifestyle risk factors** for various types of cancer (including **smoking**, **obesity**, common **viruses** and **UV** exposure). There are also **genetic** risk factors for some cancers.			

Year 9 AQA GCSE Science (TERM 3 CHEMISTRY)

Bonding and properties

4.2.1 Chemical bonds, ionic, covalent and metallic			
4.2.1.1 Chemical bonds	☺	😐	☹
There are three types of strong chemical bonds: ionic, covalent and metallic. For **ionic bonding** the particles are oppositely **charged ions**. For **covalent bonding** the particles are atoms which **share pairs of electrons**.			
Ionic bonding occurs in compounds formed from **metals** combined with **non-metals**.			
Covalent bonding occurs in non-metallic elements and in compounds of **non-metals**.			
Students should be able to: ★ **Explain** chemical bonding in terms of **electrostatic forces** and the **transfer or sharing of electrons**.			
4.2.1.2 Ionic bonding (Recap)	☺	😐	☹
When a metal atom reacts with a non-metal atom, **electrons** in the outer shell of the metal atom are **transferred**. **Metal atoms lose electrons** to become **positively charged ions**. **Non-metal atoms gain electrons** to become **negatively charged ions**. The ions produced by metals in Groups 1 and 2 and by non-metals in Groups 6 and 7 have the electronic structure of a **noble gas** (Group 0).			
The electron transfer during the formation of an ionic compound can be represented by a **dot and cross** diagram e.g. for sodium chloride:  (2,8,1) (2,8,7) (2,8) (2,8,8)			
The **charge** on the ions produced by metals in Groups 1 and 2 and by non-metals in Groups 6 and 7 relates to the **group number** of the element in the periodic table.			
Students should be able to: ★ Draw **dot and cross diagrams** for ionic compounds formed by metals in Groups 1 and 2 with non-metals in Groups 6 and 7.			
★ Work out the **charge** on the ions of metals and non-metals from the group number of the element, limited to the metals in Groups 1 and 2, and non-metals in Groups 6 and 7.			

4.2.1.3 Ionic compounds (Recap)	☺	😐	☹
An ionic compound is a **giant structure** of ions. Ionic compounds are held together by **strong electrostatic forces** of attraction between **oppositely charged ions**. These forces act in all directions in the lattice and this is called **ionic bonding**.			
The structure of **sodium chloride** can be represented in the following forms:  *Students should be familiar with the structure of **sodium chloride** but do not need to know the structures of other ionic compounds.*			
Students should be able to: ★ **Deduce** that a **compound is ionic** from a diagram of its structure in one of the specified forms			
★ **Describe** the **limitations** of using dot and cross, ball and stick, two and three dimensional diagrams to represent a **giant ionic structure**			
★ Work out the **empirical formula** of an ionic compound from a given model or diagram that shows the ions in the structure.			
4.2.1.4 Covalent bonding (Recap)	☺	😐	☹
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: **For ammonia (NH_3)** and/or and/or and/or 			

4.2.2.3 Properties of ionic compounds	☺	😐	☹
Ionic compounds have **regular structures** (**giant ionic lattices**) in which there are **strong electrostatic forces** of attraction in all directions between oppositely charged ions. *Knowledge of the structures of specific ionic compounds other than **sodium chloride** is not required*			
These compounds have **high melting points** and **high boiling points** because of the large amounts of **energy** needed to break the many **strong bonds**.			
When melted or dissolved in water, ionic compounds **conduct electricity** because the **ions are free to move** and so charge can flow.			
4.2.2.4 Properties of small covalent molecules	☺	😐	☹
Substances that consist of **small molecules** are usually **gases** or **liquids** that have relatively **low melting points** and **boiling points**.			
These substances have only **weak forces** between the molecules (**intermolecular forces**). It is these intermolecular forces that are overcome, not the covalent bonds, when the substance melts or boils.			
The intermolecular forces increase with the size of the molecules, so **larger molecules** have **higher melting** and **boiling points**.			
These substances do not conduct electricity because the molecules do not have an overall electric charge.			
<u>Students should be able to:</u> ★ Use the idea that intermolecular forces are weak compared with covalent bonds.			
4.2.2.6 Giant covalent structures	☺	😐	☹
Substances that consist of **giant covalent structures** are **solids** with very **high melting points**. All of the atoms in these structures are linked to other atoms by **strong covalent bonds**. These bonds must be overcome to melt or boil these substances.			
Diamond and **graphite** (forms of carbon) and **silicon dioxide** (silica) are examples of giant covalent structures.			
4.2.3.1 Diamond	☺	😐	☹
In **diamond**, each carbon atom forms **four covalent bonds** with other carbon atoms in a **giant covalent structure**, so diamond is **very hard**, has a **very high melting point** and does not conduct electricity.			
<u>Students should be able to:</u> ★ **Explain** the **properties** of **diamond** in terms of its structure and bonding.			

4.2.3.2 Graphite	☺	😐	☹
In **graphite**, each carbon atom forms **three covalent bonds** with three other carbon atoms, forming layers of **hexagonal rings** which have no covalent bonds between the **layers**.			
Graphite has a **high melting point**. The layers are free to **slide** over each other because there are no covalent bonds between the layers and so graphite is **soft** and **slippery**.			
In graphite, **one electron** from each carbon atom is **delocalised**. These delocalised electrons allow graphite to **conduct** thermal energy and electricity.			
Students should be able to: ★ **Explain** the **properties** of **graphite** in terms of its structure and bonding.			
★ Know that graphite is similar to metals in that it has **delocalised electrons**.			

4.2.3.3 Graphene and fullerenes	☺	😐	☹
Graphene is a **single layer** of graphite (one atom thick) and has properties that make it useful in electronics and composites.			
Fullerenes are molecules of carbon atoms with **hollow shapes**. The structure of fullerenes is based on **hexagonal rings** of carbon atoms but they may also contain rings with five or seven carbon atoms. The first fullerene to be discovered was **Buckminsterfullerene** (C_{60}) which has a **spherical** shape.			
Carbon **nanotubes** are **cylindrical** fullerenes with very high length to diameter ratios. Their **properties** make them useful for nanotechnology, electronics and materials (e.g. high tensile strength, high electrical conductivity and high thermal conductivity).			
Students should be able to: ★ **Explain** the **properties** of **graphene** in terms of its structure and bonding.			
★ Recognise graphene and fullerenes from diagrams and descriptions of their bonding and structure.			
★ Give examples of the uses of fullerenes, including carbon nanotubes (e.g. **drug delivery** into the body, as **lubricants**, as **catalysts** and carbon nanotubes can be used for **reinforcing materials**, e.g. in tennis rackets).			

Year 9 AQA GCSE Science (TERM 3 PHYSICS)

Atomic structure and radiation

4.4.2 Atoms and nuclear radiation			
4.4.2.1 Radioactive decay and nuclear radiation	☺	😐	☹
Some atomic nuclei are **unstable**. The nucleus gives out radiation as it changes to become more stable. This is a **random** process called **radioactive decay**.			
Activity is the **rate** at which a source of unstable nuclei decays.			
Activity is measured in **becquerel** (Bq)			
Count-rate is the number of decays recorded **each second** by a detector (e.g. Geiger-Muller tube).			
The nuclear radiation emitted may be: • an **alpha particle** (α) – this consists of **two neutrons** and **two protons**, it is the same as a helium nucleus			
• a **beta particle** (β) – a high speed **electron** ejected from the nucleus as a neutron turns into a proton			
• a **gamma ray** (γ) – **electromagnetic radiation** from the nucleus			
• a **neutron** (n).			
Alpha particles have a range in air of just a **few centimetres** and are absorbed by a thin sheet of **paper**. Alpha particles are **strongly ionising**.			
Beta particles have a range in air of a **few metres** and are completely absorbed by a sheet of **aluminium** about 5 mm thick. Beta particles are **moderately ionising**.			

Gamma rays travel great distances through the air and pass through most materials but are absorbed by a **thick sheet of lead** or several metres of **concrete**. Gamma rays are **weakly ionising**.			
Students should be able to: ★ **Apply** their knowledge to the uses of radiation and **evaluate** the best sources of radiation to use in a given situation.			
Required knowledge of the properties of alpha particles, beta particles and gamma rays is limited to their **penetration** through materials, their **range** in air and **ionising power**.			

4.4.2.2 Nuclear equations	☺	😐	☹
Nuclear equations are used to represent radioactive decay.			
In a nuclear equation an **alpha particle** may be represented by the symbol: $^{4}_{2}He$			
And a **beta particle** by the symbol: $^{0}_{-1}e$			
The emission of the different types of nuclear radiation may cause a change in the **mass** and /or the **charge** of the **nucleus**. For example: $^{219}_{86}\text{radon} \longrightarrow {}^{215}_{84}\text{polonium} + {}^{4}_{2}He$ So **alpha decay** causes both the **mass** and **charge** of the nucleus to decrease.			
$^{14}_{6}\text{carbon} \longrightarrow {}^{14}_{7}\text{nitrogen} + {}^{0}_{-1}e$ So **beta decay** does not cause the mass of the nucleus to change but does cause the **charge** of the nucleus to increase. *Students are not required to recall these two examples.*			
The emission of a **gamma ray** does not cause the mass or the charge of the nucleus to change.			
<u>Students should be able to:</u> ★ Use the **names** and **symbols** of common nuclei and particles to write **balanced equations** that show single **alpha** (α) and **beta** (β) decay. This is limited to balancing the atomic numbers and mass numbers. *The identification of daughter elements from such decays is not required.*			