

SCIENCE KS4 MEDIUM-TERM OVERVIEW, 2020-21

Note: Only one component from the Biology, Chemistry, and Physics areas is covered per year.

| Term | Unit | Learning outcomes | Assessment criteria |
|--------|--|--------------------------------|--|
| Autumn | (either) Component 1: Biology: The Human Body | 1. What is the body made from? | <p>1.1 Know that living organisms are made from cells</p> <p>1.2 Know the main organelles of plant and animal cells (nucleus, cytoplasm, cell membrane, vacuole, chloroplast, cell wall)</p> <p>1.3 Explore the structures and roles of some common specialised cells (sperm, egg, muscle, neuron); explaining how their structures related to their functions</p> <p>1.4 Explain how a tissue is made from cells, organs from cells, organ systems from organs, and organisms from organ systems; exploring the relative size of each</p> <p>1.5 Describe the positions of a human body's major organs (brain, heart, stomach, liver, intestines, lungs, kidneys, reproductive organs)</p> <p>1.6 Describe how the circulatory system, including the heart, pump blood around a human body, carrying oxygen and other nutrients with it; distinguishing the red blood cells from white blood cells</p> <p>1.7 Describe the entire process of the human digestive system, including the positions and functions of salivary glands, stomach, liver, gallbladder, pancreas, and intestines</p> <p>1.8 Explore the role of enzymes in the human digestive system, including their role in helping the body absorb nutrients into the blood</p> |
| | | 2. How the body works | <p>2.1 Explain how respiration releases energy from food, including its word equation, where oxygen comes from, and where carbon dioxide goes</p> <p>2.2 Explore how a person's lifestyle affects health: diet, exercise, obesity, smoking and cancer, alcohol and brain/liver function</p> <p>2.3 Explain what a healthy diet contains</p> <p>2.4 Explore how exercise makes you fitter, including the measuring of pulse</p> |
| | | 3. How the body fights disease | <p>3.1 Explain how communicable diseases are caused by microorganisms (bacteria and viruses only), including how viruses</p> |

| | | | |
|--|--|---|---|
| | | | <p>damage their hosts to cause illness</p> <p>3.2 Explain how white blood cells help to defend our bodies</p> <p>3.3 Explain what vaccination is, why it is important, and how it works: including an explanation of how a disabled vector is sometimes used to produce antibodies</p> <p>3.4 Explain how medicines are developed and test, including how all drugs change the body's internal processes; how people may become addicted or dependent on drugs and suffer withdrawal symptoms</p> <p>3.5 Explore how antibiotics kill bacteria, but not viruses</p> |
| | | <p>4. How the body is coordinated</p> | <p>4.1 Describe how the human body has automatic control systems, including the nervous system and hormones, reflex actions, and hormones sources and targets</p> <p>4.2 Describe the main hormones involved in a woman's menstrual cycle, and explore a diagram of the menstrual cycle</p> <p>4.3 Explain the different types of contraceptive available, their effects, and their relative benefits and disadvantages</p> |
| <p>(or) Component 2: Biology: Environment, evolution and inheritance</p> | | <p>1. Feeding relationships between living organisms</p> | <p>1.1 Explain from where all energy originates (Sun) and how plants convert this into chemical energy (photosynthesis), including the word equation for it</p> <p>1.2 Describe how organisms adapt to their environment (polar bears, cacti)</p> <p>1.3 Describe feeding relationships with food chains/webs</p> <p>1.4 Describe how dead organisms are 'recycled' by the carbon cycle</p> |
| | | <p>2. What determines where a particular species lives?</p> | <p>2.1 Describe how plants compete for light, water and nutrients</p> <p>2.2 Describe how animals compete for food, territory and mates</p> <p>2.3 Describe how changes in an organism's environment may affect it (rainfall/temperature change, competitors, predators)</p> <p>2.4 Describe the different types of pollution: water, air, noise, land, etc.; and how human population growth has affected these</p> |

| | | | |
|--------|--|-------------------------------------|--|
| | | 3. How life has developed on Earth | <p>3.1 Describe Darwin's theory of evolution, explaining how fossils are used as evidence</p> <p>3.2 Explain how natural selection selects organisms with characteristics favourable for their environment</p> <p>3.3 Describe the processes of artificial selection, e.g. in plant breeding, dogs, or crops</p> <p>3.4 Describe the processes of sexual and asexual reproduction</p> <p>3.5 Explore how the genetic information of cells is contain in DNA, including the structure of cells and DNA itself</p> <p>3.6 Explain how chromosomes organise DNA information, including the importance of the sex chromosomes</p> <p>3.7 Briefly describe the process of genetic engineering, including its risks and benefits</p> |
| Spring | (either) Component 3: Chemistry: Elements, mixtures and compounds | 1. Atoms, elements and compounds | <p>1.1 Describe what atoms, elements and compounds are</p> <p>1.2 Explore the periodic table, recalling where metals and non-metals are on it</p> <p>1.3 Investigate how elements from the same group have similar chemical properties</p> <p>1.4 Recognise simple compounds by name (NaCl, MgO, CO₂)</p> <p>1.5 Represent chemical reactions with word equations, including metals with non-metals, etc.</p> |
| | | 2. How structure affects properties | <p>2.1 Name the three states of matter and illustrate their gross structures with diagrams</p> <p>2.2 Describe the particle model of matter and what happens when substances melt, boil, condense and freeze (including intermolecular forces in simple terms)</p> <p>2.3 Describe and illustrate the different allotropes of carbon, including why graphite is slippery and diamond hard</p> |
| | | 3. Separating mixtures | <p>3.1 Describe what mixtures and solutions are, and how to separate them with filtration, distillation, crystallisation and chromatography</p> <p>3.2 Describe and investigate how chromatography works</p> |

| | | | |
|--|--|---|---|
| | | <p>4. Metals and alloys</p> | <p>4.1 Describe the reactivity of metals series, including mining and how metals are produced from their ores</p> <p>4.2 Describe the social, economic and environmental effects of mining and recycling</p> <p>4.3 Explain why metals have relatively high melting temperatures, and are good conductors; including the use of copper for wiring and plumbing</p> <p>4.4 Explain what an alloy is, and describe their use in everyday materials (including steel alloys)</p> |
| | | <p>5. Polymers</p> | <p>5.1 Describe what polymers are, including the names of common polymers (polythene, polystyrene, PVC); describe the uses of polymers</p> <p>5.2 Explain why polymers' being non-biodegradable is a problem for the environment</p> |
| <p>(or) Component 4: Chemistry: Chemistry in our world</p> | | <p>1. Reactions of acids</p> | <p>1.1 Describe and investigate the reactions of acids, including word equations and the test for hydrogen</p> <p>1.2 Investigate how acids may be neutralised with alkalis/bases to make salts (with crystallisation of the solution)</p> <p>1.3 Investigate how acids may be neutralised with carbonates to make salts and carbon dioxide, including the limewater test for carbon dioxide</p> |
| | | <p>2. Energy and rate of reaction</p> | <p>2.1 Investigate reactions which cause temperature changes: combustion, oxidation, neutralisation (including some endothermic reactions)</p> <p>2.2 Explain how the rate of reaction may be changed: temperature, concentration, surface area, catalyst</p> |
| | | <p>3. Earth's atmosphere</p> | <p>3.1 Describe how Earth's atmosphere formed, including oxygenation from plants and the word equation for photosynthesis; including the percentage/fractional amounts of each gas</p> <p>3.2 Describe how carbon dioxide was removed from the early atmosphere by ocean dissolution and rocks (fossils and carbonates)</p> |
| | | <p>4. Fuels and human impacts on the atmosphere</p> | <p>4.1 Describe what crude oil is and where it is found</p> <p>4.2 Describe how crude oil is separated by fractional distillation into useful products</p> |

| | | | |
|--------|---|--|--|
| | | | <p>4.3 Describe what happens when fuels burn, including gases released (CO₂, H₂O, NO_x, SO_x, particulates)</p> <p>4.4 Describe how and why CO is made, and how to take care against it</p> <p>4.5 Explain why NO_x, SO_x and particulates are harmful to the environment</p> <p>4.6 Explain how human activities are changing Earth's atmosphere, what 'greenhouse gases' are, and what climate change is</p> |
| | | 5. Water for drinking | <p>5.1 Describe what may be found in drinking water and how to purify water (solids, microbes)</p> <p>5.2 Explain how to make fresh water from distillation</p> |
| Summer | (either) Component 5: Physics: Energy, forces and the structure of matter | 1. Energy, energy transfers and energy resources | <p>1.1 Describe how energy is stored in different situations</p> <p>1.2 Describe how energy may be transferred or stored</p> <p>1.3 Describe the ideas of energy efficiency and energy waste (lubrication, insulation)</p> <p>1.4 Explore how cooling is affected by insulation and conduction</p> <p>1.5 Describe the Earth's energy resources (fossil fuels, nuclear, wind, etc.), distinguishing renewable and non-renewable</p> |
| | | 2. Forces at work | <p>2.1 Explore push, pull, contact and non-contact forces</p> <p>2.2 Describe how objects move when forces act on them</p> <p>2.3 Explore how friction can cause changes in temperature</p> |
| | | 3. Speed and stopping distances | <p>3.1 Simply calculate speed from distance and time</p> <p>3.2 Use different units for speed (m/s, kph, mph)</p> <p>3.3 Describe what stopping distance is and explore how it is affected by speed and surface and weather</p> <p>3.4 Describe and investigate reaction time and how it is affected by tiredness and drugs</p> |
| | | 4. Atoms and nuclear radiation | 4.1 Name the three types of radiation, |

| | | | |
|---|--|---|--|
| | | | describing their penetrative properties and uses |
| (or) Component 6: Physics: Electricity, magnetism and waves | 1. Electrical current | 1.1 Describe what electrical current is and how it depends on voltage and resistance (describing what resistance is) | 1.2 Explore how to create simple electrical circuits |
| | | 1.3 Explain and explore DC and AC electricity, and what is used in British mains supply | |
| | 2. Domestic electricity | 2.1 Explain and explore the colour-coding of British mains wiring, explaining what earth/earthing means | 2.2 Select the correct fuse for an appliance with a given power rating |
| | | 2.3 Calculate the energy consumption of an appliance ($E = Wt$) | |
| | 3. Magnetism and electromagnetism | 3.1 Explain how magnets attract and repel themselves and materials, describing the shape/pattern of their magnetic fields | 3.2 Describe the pattern of magnetic fields between two bar magnets |
| | 3.3 Explore how magnetic fields are made around wires carrying a current, including their use as electromagnets | | |
| 4. Different types of waves | 4.1 Describe the two types of wave | 4.2 Explore the properties of waves: amplitude, wavelength, frequency; including the $v = \lambda f$ equation | |
| 5. Electromagnetic waves | 5.1 Describe how EM waves are grouped by their energies, including radio, microwave, IR, visible, UV, X-rays and gamma | 5.2 Describe how UV, X-rays and gamma are harmful to humans | 5.3 Explore the different uses of each EM wave type, explaining why each is useful |