Science Year 11 – Spring Term 2021/2022

	What? **When?** **Why?**				
	BIOLOGY **B8 Exchange & Transport**	**CHEMISTRY** **C13-15 Groups & rates**	**PHYSICS** **P10&11 Magnetism**	**BIOLOGY** **B9 Ecosystems**	**CHEMISTRY** **C16&17 Fuels & Earth Science**
Lesson 1 Learning intentions	**Surface area: volume ratio** Describe the need to transport substances into and out of a range of organisms including oxygen, carbon dioxide, water, dissolved food molecules, mineral ions and urea. Explain the need for exchange surfaces and a transport system in multicellular organisms including the calculation of surface area: volume ratio.	**Group 1** Explain why some elements can be classified as alkali metals (group 1), halogens (group 7), or noble gases (group 0), based on their position in the periodic table. Recall that alkali metals: a) are soft b) have relatively low melting points. Describe the reactions of lithium, sodium and potassium with water. Describe the pattern in reactivity of the alkali metals, lithium, sodium and potassium, with water; and use this pattern to predict the reactivity of other alkali metals.	**Magnets & magnetic fields** Recall that unlike magnetic poles attract and like magnetic poles repel Explain the difference between permanent and induced magnets Describe the uses of permanent and temporary magnetic materials including cobalt, steel, iron and nickel Describe the shape and direction of the magnetic field around bar magnets and for a uniform field, and relate the strength of the field to the concentration of lines Describe the use of plotting compasses to show the shape and direction of the field of a magnet and the Earth's magnetic field	**Ecosystems** Describe the different levels of organisation from individual organisms, populations, communities, to the whole ecosystem. Explain how to determine the number of organisms in a given area using raw data from field-work techniques, including quadrats and belt transects. Describe the importance of interdependence in a community. Explain how to determine the number of organisms in a given area using raw data from field-work techniques, including quadrats and belt transects.	**Hydrocarbons in crude oil and natural gas** Recall that hydrocarbons are compounds that contain carbon and hydrogen only Describe crude oil as: a) a complex mixture of hydrocarbons b) containing molecules in which carbon atoms are in chains or rings (names, formulae and structures of specific ring molecules not required) c) an important source of useful substances (fuels and feedstock for the petrochemical industry) d) a finite resource

		Explain this pattern in reactivity in terms of electronic configurations. Write word equations Write balanced chemical equations, including the use of the state symbols (s), (l), (g) and (aq)	Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic		Recall that petrol, kerosene and diesel oil are non-renewable fossil fuels obtained from crude oil and methane is a non-renewable fossil fuel found in natural gas.
Lesson 2 Learning intentions	**Lung adaptations** Explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries.	**Group 7** Recall the colours and physical states of chlorine, bromine and iodine at room temperature. Describe the pattern in the physical properties of the halogens, chlorine, bromine and iodine, and use this pattern to predict the physical properties of other halogens. Describe the chemical test for chlorine. Describe the reactions of the halogens, chlorine, bromine and iodine, with metals to form metal halides, and use this pattern to predict the reactions of other halogens.	**Electromagnetism** Describe how to show that a current can create a magnetic effect and relate the shape and direction of the magnetic field around a long straight conductor to the direction of the current Recall that the strength of the field depends on the size of the current and the distance from the long straight conductor Explain how inside a solenoid (an example of an electromagnet) the fields from individual coils a) add together to form a very strong almost uniform field along the centre of the solenoid b) cancel to give a weaker field outside the solenoid	**Abiotic factors & communities** Explain how communities can be affected by abiotic and biotic factors, including: (a) temperature, light, water, pollutants.	**Fractional distillation of crude oil** Describe and explain the separation of crude oil into simpler, more useful mixtures by the process of fractional distillation Recall the names and uses of the following fractions: a) gases, used in domestic heating and cooking b) petrol, used as fuel for cars c) kerosene, used as fuel for aircraft d) diesel oil, used as fuel for some cars and trains e) fuel oil, used as fuel for large ships and in some power stations

		Recall that the halogens, chlorine, bromine and iodine, form hydrogen halides which dissolve in water to form acidic solutions, and use this pattern to predict the reactions of other halogens.			f) bitumen, used to surface roads and roofs Explain how hydrocarbons in different fractions differ from each other in: a) the number of carbon and hydrogen atoms their molecules contain b) boiling points c) ease of ignition d) viscosity
Lesson 3 Learning intentions	**<u>Blood</u>** Explain how the structure of the blood is related to its function: a) red blood cells (erythrocytes) b) white blood cells (phagocytes and lymphocytes) c) plasma d) platelets	**<u>Halogen Reactivity</u>** Describe the relative reactivity of the halogens chlorine, bromine and iodine, as shown by their displacement reactions with halide ions in aqueous solution, and use this pattern to predict the reactions of astatine. **(H) Explain why these displacement reactions are redox reactions in terms of gain and loss of electrons, identifying which of these are oxidised and which are reduced.** Explain the relative reactivity of the halogens in	**<u>Magnetic forces – higher tier only (H)</u>** **Recall that a current carrying conductor placed near a magnet experiences a force and that an equal and opposite force acts on the magnet** **(H) Explain that magnetic forces are due to interactions between magnetic fields** **(H) Recall and use Fleming's left-hand rule to represent the relative directions of the force, the current and the magnetic field for cases where they are mutually perpendicular**	**<u>Core Practical</u>** Core practical: Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects.	**<u>The alkane homologous series</u>** Explain how hydrocarbons … are mostly members of the alkane homologous series Explain an homologous series as a series of compounds which: a) have the same general formula b) differ by CH_2 in molecular formulae from neighbouring compounds c) show a gradual variation in physical properties, as exemplified by their boiling points

		terms of electronic configurations. **(H) Write balanced ionic equations**	**(H) Use the equation: force on a conductor at right angles to a magnetic field carrying a current (newton, N) = magnetic flux density (tesla, T, or newton per amp metre, N/A m) × current (ampere, A) × length (metre, m)** ***F = B × I × l***		d) have similar chemical properties
Lesson 4 Learning intentions	**<u>Blood vessels</u>** Explain how the structure of the blood vessels is related to their function.	**<u>Group 0</u>** Explain why the noble gases are chemically inert, compared with the other elements, in terms of their electronic configurations. Explain how the uses of noble gases depend on their inertness, low density and/or non-flammability. Describe the pattern in the physical properties of some noble gases and use this pattern to predict the physical properties of other noble gases.	**<u>Transformers</u>** Explain why, in the national grid, electrical energy is transferred at high voltages from power stations, and then transferred at lower voltages in each locality for domestic uses as it improves the efficiency by reducing heat loss in transmission lines Explain where and why step-up and step-down transformers are used in the transmission of electricity in the national grid	**<u>Biotic factors & communities</u>** Explain how communities can be affected by abiotic and biotic factors, including:… (b) competition, predation.	**<u>Complete combustion</u>** Describe the complete combustion of hydrocarbon fuels as a reaction in which: a) carbon dioxide and water are produced b) energy is given out
Lesson 5 Learning intentions	**<u>The heart</u>** Explain how the structure of the heart and circulatory system is related to its function including the role of the major blood vessels,	**<u>Rates of reaction</u>** Suggest practical methods for determining the rate of a given reaction.Interpret graphs of mass, volume or	**<u>Transformers & energy</u>** Use the power equation (for transformers with 100% efficiency): potential difference across primary coil (volt, V) × current in primary	**<u>Parasitism & mutualism</u>** Describe how the survival of some organisms is dependent on other species,	**<u>Incomplete combustion</u>** Explain why the incomplete combustion of hydrocarbons can

	the valves and the relative thickness of chamber walls.	concentration of reactant or product against time	coil (ampere, A) = potential difference across secondary coil (volt, V) × current in secondary coil (ampere, A) $V_p \times I_p = V_s \times I_s$	including parasitism and mutualism. Explain how to determine the number of organisms in a given area using raw data from field-work techniques, including quadrats and belt transects.	produce carbon and carbon monoxide Explain how carbon monoxide behaves as a toxic gas Describe the problems caused by incomplete combustion producing carbon monoxide and soot in appliances that use carbon compounds as fuels
Lesson 6 Learning intentions	**Effect of exercise** Calculate heart rate, stroke volume and cardiac output, using the equation cardiac output = stroke volume × heart rate.	**Factors affecting reaction rate** Explain how reactions occur when particles collide and that rates of reaction are increased when the frequency and/or energy of collisions is increased. Explain the effects on rates of reaction of changes in temperature, concentration, surface area to volume ratio of a solid, and pressure (on reactions involving gases) in terms of frequency and/or energy of collisions between particles.	**Electromagnetic Induction (Higher tier only)** **(H) Recall the factors that affect the size and direction of an induced potential difference, and describe how the magnetic field produced opposes the original charge** **(H) Explain how an alternating current in one circuit can induce a current in another circuit in a transformer** **(H) Recall that a transformer can change the size of an alternating voltage**	**Biodiversity & humans** Explain the positive and negative human interactions within ecosystems and their impacts on biodiversity, including: a) fish farming b) introduction of non-indigenous species c) eutrophication	**Combustible fuels and pollution** Explain how impurities in some hydrocarbon fuels result in the production of sulfur dioxide. Explain some problems associated with acid rain caused when sulfur dioxide dissolves in rain water Explain why, when fuels are burned in engines, oxygen and nitrogen can react together at high temperatures to produce oxides of nitrogen, which are pollutants

Lesson 7 Learning intentions	**Aerobic respiration** Describe cellular respiration as an exothermic reaction which occurs continuously in living cells to release energy for metabolic processes, including aerobic and anaerobic respiration.	**Core Practical** Core Practical: Investigate the effects of changing the conditions of a reaction on the rates of chemical reactions by: a) measuring the production of a gas (in the reaction between hydrochloric acid and marble chips)		**Preserving biodiversity** Explain the benefits of maintaining local and global biodiversity including the conservation of animal species and the impact of reforestation.	**Breaking down hydrocarbons** Evaluate the advantages and disadvantages of using hydrogen, rather than petrol, as a fuel in cars Explain how cracking involves the breaking down of larger, saturated hydrocarbon molecules (alkanes) into smaller, more useful ones, some of which are unsaturated (alkenes) Explain why cracking is necessary
Lesson 8 Learning intentions	**Anaerobic respiration** Describe cellular respiration as an exothermic reaction which occurs continuously in living cells to release energy for metabolic processes, including aerobic and anaerobic respiration. Compare the process of aerobic respiration with the process of anaerobic respiration.	**Core Practical** Core Practical: Investigate the effects of changing the conditions of a reaction on the rates of chemical reactions by: b) observing a colour change (in the reaction between sodium thiosulfate and hydrochloric acid)		**The water cycle** Describe how different materials cycle through the abiotic and biotic components of an ecosystem. Explain the importance of the water cycle including the processes involved and the production of potable water in areas of drought including desalination.	**The early atmosphere** Recall that the gases produced by volcanic activity formed the Earth's early atmosphere Describe that the Earth's early atmosphere was thought to contain: a) little or no oxygen b) a large amount of carbon dioxide

					c) water vapour d) small amounts of other gases and interpret evidence relating to this Explain how condensation of water vapour formed oceans
Lesson 9 Learning intentions	**Core Practical** Core practical: Investigate the rate of respiration in living organisms.	**Catalysts & activation energy** Describe a catalyst as a substance that speeds up the rate of a reaction without altering the products of the reaction, being itself unchanged chemically and in mass at the end of the reaction. Explain how the addition of a catalyst increases the rate of a reaction in terms of activation energy. Recall that enzymes are biological catalysts and that enzymes are used in the production of alcoholic drinks		**The carbon cycle** Explain the importance of the carbon cycle including the processes involved and the role of microorganisms as decomposers.	**A changing atmosphere** Explain how the amount of carbon dioxide in the atmosphere was decreased when carbon dioxide dissolved as the oceans formed Explain how the growth of primitive plants used carbon dioxide and released oxygen by photosynthesis and consequently the amount of oxygen in the atmosphere gradually increased Describe the chemical test for oxygen
Lesson 10 Learning intentions		**Exothermic & Endothermic reactions** Recall that changes in heat energy accompany the		**The nitrogen cycle** Explain how nitrates are made available for plant uptake including the use of	**The atmosphere** Describe how various gases in the atmosphere, including

		following changes: a) salts dissolving in water b) neutralisation reactions c) displacement reactions d) precipitation reactions and that, when these reactions take place in solution, temperature changes can be measured to reflect the heat changes. Describe an exothermic change or reaction as one in which heat energy is given out. Describe an endothermic change or reaction as one in which heat energy is taken in.		fertilisers, crop rotation and the role of bacteria in the nitrogen cycle.	carbon dioxide, methane and water vapour, absorb heat radiated from the Earth, subsequently releasing energy which keeps the Earth warm: this is known as the greenhouse effect Evaluate the evidence for human activity causing climate change, considering: a) the correlation between the change in atmospheric carbon dioxide concentration, the consumption of fossil fuels and temperature change b) the uncertainties caused by the location where these measurements are taken and historical accuracy
Lesson 11 Learning intentions		**<u>Energy changes in reactions</u>** Recall that the breaking of bonds is endothermic and the making of bonds is exothermic Recall that the overall heat energy change for a			**<u>Climate change</u>** Describe: a) the potential effects on the climate of increased levels of carbon dioxide and methane generated by

		reaction is: a) exothermic if more heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants b) endothermic if less heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants **(H) Calculate the energy change in a reaction given the energies of bonds (in kJ mol^{-1})** Explain the term activation energy Draw and label reaction profiles for endothermic and exothermic reactions, identifying activation energy			human activity, including burning fossil fuels and livestock farming b) that these effects may be mitigated: consider scale, risk and environmental implications