Science Year 10 – Autumn Term 2022

	What? **When?** **Why?**			
	BIOLOGY **B4 Natural selection and genetic modification**	**CHEMISTRY** **C5,6,7 Bonding and substance**	**PHYSICS** **P3 Conservation of energy**	**BIOLOGY** **B5 Health & disease**
Lesson 1 Learning intentions	**Human Evolution** Describe the evidence for human evolution, based on fossils, including: a) Ardi from 4.4 million years ago b) Lucy from 3.2 million years ago c) Leakey's discovery of fossils from 1.6 million years ago. Describe the evidence for human evolution based on stone tools, including: a) the development of stone tools over time b) how these can be dated from their environment.	**Ionic bonds** Explain how ionic bonds are formed by the transfer of electrons between atoms to produce cations and anions, including the use of dot and cross diagrams. Recall that an ion is an atom or group of atoms with a positive or negative charge. Calculate the numbers of protons, neutrons and electrons in simple ions given the atomic number and mass number Explain the formation of ions in ionic compounds from their atoms, limited to compounds of elements in groups 1, 2, 6 and 7. Recall the formulae of elements, simple compounds and ions	**Energy stores & transfers** Explain that where there are energy transfers in a closed system there is no net change to the total energy in that system. Analyse the changes involved in the way energy is stored when a system changes, including: a) an object projected upwards or up a slope b) a moving object hitting an obstacle c) an object being accelerated by a constant force d) a vehicle slowing down e) bringing water to a boil in an electric kettle. Draw and interpret diagrams to represent energy transfers. Explain, using examples, how in all system changes energy is dissipated so that it is stored in less useful ways.	**Health** Describe health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, as defined by the World Health Organisation (WHO) Describe the difference between communicable and non-communicable diseases. Explain why the presence of one disease can lead to a higher susceptibility to other diseases

Lesson 2 Learning intentions	**Darwin's Theory** Explain Darwin's theory of evolution by natural selection. Explain how the emergence of resistant organisms supports Darwin's theory of evolution including antibiotic resistance in bacteria.	**Ionic lattices** Explain the use of the endings –ide and –ate in the names of compounds. Recall the formulae of elements, simple compounds and ions. Deduce the formulae of ionic compounds (including oxides, hydroxides, halides, nitrates, carbonates and sulfates) given the formulae of the constituent ions. Explain the structure of an ionic compound as a lattice structure a) consisting of a regular arrangement of ions b) held together by strong electrostatic forces (ionic bonds) between oppositely-charged ions.	**Energy efficiency** **(H) Explain how efficiency can be increased** Recall and use the equation: efficiency = (useful energy transferred by the device) / (total energy supplied to the device) Explain that mechanical processes become wasteful when they cause a rise in temperature so dissipating energy in heating the surroundings. Explain ways of reducing unwanted energy transfer, including through lubrication…	**Non-communicable** Describe that many non-communicable human diseases are caused by the interaction of a number of factors including cardiovascular diseases, many forms of cancer, some lung and liver diseases and diseases influenced by nutrition. Explain the effect of lifestyle factors on non-communicable diseases at local, national and global levels, including: a) … diet on … malnutrition… b) alcohol on liver diseases
Lesson 3 Learning intentions	**Classification** Describe how genetic analysis has led to the suggestion of the three domains rather than the five kingdoms classification method.	**Properties of ionic compounds** Explain the properties of ionic compounds limited to: a) high melting points and boiling points, in terms of forces between ions b) whether or not they conduct electricity as solids, when molten and in aqueous solution.	**Keeping warm** Explain ways of reducing unwanted energy transfer, including through… thermal insulation… Describe the effects of the thickness and thermal conductivity of the walls of a building on its rate of cooling qualitatively	**Cardiovascular disease** Explain the effect of lifestyle factors on non-communicable diseases at local, national and global levels, including: a) exercise and diet on obesity and malnutrition, including BMI and waist:hip calculations using the BMI equation:

				$\text{BMI} = \frac{\text{weight (kg)}}{(\text{height (m)})^2}$ … c) smoking on cardiovascular diseases Evaluate some different treatments for cardiovascular disease including: a) life-long medication b) surgical procedures c) lifestyle changes
Lesson 4 Learning intentions	**<u>Breeds & varieties</u>** Explain selective breeding and its impact on food plants and domesticated animals Describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics	**<u>Covalent bonding</u>** Explain how a covalent bond is formed when a pair of electrons is shared between two atoms. Recall that covalent bonding results in the formation of molecules. Recall the typical size (order of magnitude) of atoms and small molecules. Explain the formation of simple molecular, covalent substances, using dot and cross diagrams, including: a) hydrogen b) hydrogen chloride c) water d) methane	**<u>Stored energies</u>** Recall and use the equation to calculate the change in gravitational PE when an object is raised above the ground: change in gravitational potential energy (joule, J) = mass (kilogram, kg) × gravitational field strength (newton per kilogram, N/kg) × change in vertical height (metre, m) $\Delta GPE = m \times g \times \Delta h$ Recall and use the equation to calculate the amounts of energy associated with a moving object: kinetic energy (joule, J) = ½ × mass (kilogram, kg) × (speed)^2 ((metre/second)^2, (m/s)^2) $KE = ½ \times m \times v$	**<u>Pathogens</u>** Describe a pathogen as a disease-causing organism including viruses, bacteria, fungi and protists. Describe some common infections, including: a) cholera (bacteria) causes diarrhoea b) tuberculosis (bacteria) causes lung damage c) chalara ash dieback (fungi) causes leaf loss and bark lesions d) malaria (protists) causes damage to blood and liver e) HIV (virus) destroys white blood cells, leading to the onset of AIDS f) stomach ulcers caused by Helicobacter (bacteria)

		e) oxygen f) carbon dioxide		g) Ebola (virus) causes haemorrhagic fever
Lesson 5 Learning intentions	**<u>Genes in agriculture & medicine</u>** Evaluate the benefits and risks of genetic engineering and selective breeding in modern agriculture and medicine including practical and ethical implications. **(H) Describe the main stages of genetic engineering including the use of:** **a) restriction enzymes** **b) ligase** **c) sticky ends** **d) vectors**	**<u>Molecular compounds</u>** Explain the properties of typical covalent, simple molecular compounds limited to a) low melting points and boiling points, in terms of forces between molecules (intermolecular forces) b) poor conduction of electricity Describe, using poly(ethene) as the example, that simple polymers consist of large molecules containing chains of carbon atoms	**<u>Non-renewable resources</u>** Describe the main energy sources available for use on Earth (including fossil fuels, nuclear fuel…), and compare the ways in which both renewable and non-renewable sources are used. Explain patterns and trends in the use of energy resources	**<u>Spreading pathogens</u>** Explain how pathogens are spread and how this spread can be reduced or prevented, including: a) cholera (bacteria) – water b) tuberculosis (bacteria) – airborne c) chalara ash dieback (fungi) – airborne d) malaria (protists) – animal vectors e) stomach ulcers caused by Helicobacter (bacteria) – oral transmission f) Ebola (virus) – body fluids
Lesson 6 Learning intentions		**<u>Allotropes of carbon</u>** Recall that graphite and diamond are different forms of carbon and that they are examples of covalent giant molecular substances. Describe the structures of graphite and diamond. Explain, in terms of structure and bonding, why graphite is used to make electrodes and as a lubricant, whereas diamond is used in cutting tools.	**<u>Renewable resources</u>** Describe the main energy sources available for use on Earth (including… bio-fuel, wind, hydro-electricity, the tides and the Sun), and compare the ways in which both renewable and non-renewable sources are used. Explain patterns and trends in the use of energy resources	**<u>Physical and chemical defences</u>** Describe how the physical barriers and chemical defences of the human body provide protection from pathogens, including: a) physical barriers including mucus, cilia and skin b) chemical defence including lysozymes and hydrochloric acid

		Explain the properties of fullerenes (e.g. C_{60}) and graphene in terms of their structures and bonding.		
Lesson 7 Learning intentions		**Properties of metals** Explain the properties of metals, including malleability and the ability to conduct electricity. Describe most metals as shiny solids which have high melting points, high density and are good conductors of electricity whereas most non-metals have low boiling points and are poor conductors.		**Immune system** Explain the role of the specific immune system of the human body in defence against disease including: a) exposure to pathogen b) the antigens trigger an immune response which causes the production of antibodies c) the antigens also trigger production of memory lymphocytes d) the role of memory lymphocytes in the secondary response to the antigen.
Lesson 8 Learning intentions		**Bonding models** Explain why elements and compounds can be classified as: a) ionic b) simple molecular (covalent) c) giant covalent d) metallic and how the structure and bonding of these types of substances results in different physical properties, including relative melting point and boiling point, relative solubility in water and ability to conduct electricity (as solids and in solution)		**Immunisation** Explain the body's response to immunisation using an inactive form of a pathogen.

		Describe the limitations of particular representations and models to include dot and cross, ball and stick models and two- and three-dimensional representations		
				Antibiotics Explain that antibiotics can only be used to treat bacterial infections because they inhibit cell processes in the bacterium but not the host organism.
				New medicines & drug trials Describe that the process of developing new medicines, including antibiotics, has many stages including discovery, development, preclinical and clinical testing.
				STI's Explain how sexually transmitted infections (STIs) are spread and how this spread can be reduced or prevented, including: a) Chlamydia (bacteria) b) HIV (virus)