MEDIUM TERM PLAN GCSE SYNERGY

Year Group	Topic/National Curriculum	Knowledge	scientific/mathematical skills and vocabulary
GCSE	**4.1 BUILDING BLOCKS** These are the important building blocks for developing scientific ideas and explanations. The topic moves from particles to atoms to cells, showing the links between the world of ideas and the real world of objects and events. The behaviour of particles in liquids and gases can explain how substances move between cells and through membranes. The topic discusses how cells replicate and how the universal genetic code is a particle pattern. The transfer of energy over small and large distances in living and non-living systems helps us to understand the importance of the way these systems react with each other.	**4.1.1 STATES OF MATTER** The model of particles in motion can be used to account for states of matter, differences in density, the pressure of gases, and changes of state. This model is applied in Transport into and out of cells to explain how substances are transported into and out of cells through diffusion and osmosis, and in Systems in the human body, where it is applied to substances crossing exchange surfaces. The nature of the particles (atoms, molecules, and ions) is examined in more detail in atomic structure and Structure and bonding. There are two required practicals: one to study the density of solid and liquid objects, another to investigate energy transfers by measuring the specific heat capacity of materials.	Material (types), properties (types), solid, liquid, gas, solution, mixture, particle, energy,
	4.1.1.1 A PARTICLE MODEL Recall and explain the main features of the particle model in terms of the states of matter and change of state, distinguishing between physical and chemical changes.	The three states of matter are solid, liquid and gas. Melting and freezing take place at the melting point, boiling and condensing take place at the boiling point. The three states of matter can be represented by a simple model. In this model, particles are represented by small solid spheres. Particle theory can help to explain melting, boiling, freezing and condensing.	WS 1.2 Recognise/draw simple diagrams to model the difference between substances in the solid, liquid and gas states. WS 3.5 Predict the states of substances at different temperatures given appropriate data. MS 1d

			Relate the size and scale of atoms to objects in the physical world.
	4.1.1.2 DENSITY Define density and explain the differences in density between the different states of matter in terms of the arrangements of the atoms or molecules. **Required practical activity 1**: use appropriate apparatus to make and record the densities of regular and irregular solid objects and liquids. Volume should be determined from the dimensions of a regularly shaped object and by a displacement technique for irregularly shaped objects. Dimensions to be measured using appropriate apparatus such as a ruler, micrometre or Vernier callipers.	The density of a material is defined by the equation: density = mass volume ρ = m/V density, ρ, in kilograms per metre cubed, kg/m3 mass, m, in kilograms, kg volume, V, in metres cubed, m3	MS Recall and apply this equation to changes where mass is conserved. WS 3.3 Carry out and represent mathematical and statistical analysis. WS 4.3, 4.5 Use and interconvert SI units in calculations.
	4.1.1.3 GAS PRESSURE Explain how the motion of the molecules in a gas is related both to its temperature and its pressure: hence explain the relation between the temperature of a gas and its pressure at constant volume (qualitative only).	The molecules of a gas are in constant random motion. The temperature of the gas is related to the average kinetic energy of the molecules. The higher the temperature, the greater the average kinetic energy and so the faster the average speed of the molecules. When the molecules collide with the wall of their container they exert a force on the wall. The total force exerted by all of the molecules inside the container on a unit area of the walls is the gas pressure. Changing the temperature of a gas, held at constant volume, changes the pressure exerted by the gas.	

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	4.1.1.4 HEATING AND CHANGING STATE Describe how heating a system will change the energy stored within the system and raise its temperature or produce changes of state. Describe how, when substances melt, freeze, evaporate, condense or sublimate, mass is conserved but that these physical changes differ from chemical changes because the material recovers its original properties if the change is reversed. Define the term specific heat capacity and distinguish between it and the term specific latent heat.	Energy is stored inside a system by the particles (atoms and molecules) that make up the system. This is called internal energy. The amount of energy needed to change state from solid to liquid and from liquid to gas depends on the strength of the forces between the particles of the substance. The nature of the particles involved depends on the type of bonding and the structure of the substance. The stronger the forces between the particles the higher the melting point and boiling point of the substance. The increase in temperature of a system depends on the mass of the substance heated, the type of material and the energy input. change in thermal energy = mass × specific heat capacity × temperature change $\Delta E = m c \Delta \theta$ change in thermal energy, ΔE, in joules, J mass, m, in kilograms, kg specific heat capacity, c, in joules per kilogram per degree Celsius, J/kg °C temperature change, $\Delta\theta$, in degrees Celsius, °C The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius. The energy needed for a substance to change state is called latent heat. When a change of state occurs, the energy supplied changes the energy stored (internal energy) but not the temperature.	This topic links with Structure and bonding. WS Carry out and represent mathematical and statistical analysis. WS, MS Interpret heating and cooling graphs that include changes of state. WS, MS. Apply this equation, which is given on the Physics equations sheet, to calculate energy changes when a material is heated or cooled. WS, Carry out and represent mathematical and statistical analysis.
	4.1.1.5 MEANINGS OF PURITY Explain what is meant by the purity of a substance, distinguishing between the scientific and everyday use of the term 'pure'.	In chemistry, a pure substance is a single element or compound, not mixed with any other substance. Pure elements and compounds melt and boil at specific temperatures. Melting point and boiling point data can be used to distinguish pure substances from mixtures. In everyday language, a pure substance can mean a substance that has had nothing added to it, so it is unadulterated and in its natural state.	WS Use melting point data to distinguish pure from impure substances.

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G C S E	**4.1.2 ATMOIC STRUCTURE** The study of atomic structure provides a good opportunity to show how scientific methods and theories develop over time. The model introduced in this topic describes atoms in terms of a central nucleus with protons and neutrons surrounded by electrons in a series of energy levels (shells). The ideas in this topic can account for the existence of isotopes and underpin the study of radioactivity (Radiation and risk), chemical bonding (Structure and bonding) and the periodic table.	Stages in the development of atomic models: Atoms are very small, having a radius of about 0.1 nm (1 x 10–10 m). The radius of a small molecule such as methane, CH4, is about 0.5 nm (5 x 10–10 m). The radius of a nucleus is less than 1/10 000 of that of the atom (about 1 x 10–14 m). The relative masses and charges of protons, neutrons and electrons. The number of protons in an atom of an element is its atomic number. All atoms of a particular element have the same number of protons. Atoms of different elements have different numbers of protons. In an atom, the number of electrons is equal to the number of protons in the nucleus. Atoms have no overall electrical charge.	Explain, with examples, why new data from experiments or observations led to changes in atomic models. Decide whether or not given data supports a particular theory. MS Interpret expressions in standard form. WS Use SI units and the prefix nano. MS Estimate the size of atoms based on scale diagrams.
	4.1.3 CELLS IN ANIMALS AND PLANTS Understanding the structure of cells, the transport of substances into and out of cells, cell division by mitosis and meiosis and cell differentiation lays the foundations for the study of systems in the human body in Systems in the human body, of plant biology in Plants and photosynthesis and of inheritance in Inheritance. There are two required practicals: an activity observing cells under a light microscope and an investigation of the effect of different concentrations of salt	An electron microscope has a much higher resolving power than a light microscope. This means that it can be used to study cells in much finer detail. An electron microscope can magnify up to a million times (× 1000 000) or more, which is much more than a light microscope which has a useful magnification of only about a thousand times (× 1000). magnification = size of image/size of real object . Plant and animal cells (eukaryotic cells) have a cell membrane, cytoplasm and a nucleus containing the genetic material. Bacterial cells (prokaryotic cells) are much smaller	Demonstrate understanding of number, size and scale and the quantitative relationship between units. WS Interconvert units. MS Carry out calculations involving magnification, real size and image size including numbers

	or sugar solutions on plant tissues. Microscopes are used to study cells and so practical work can include the microscopic examination of plant and animal cells.	in comparison. They have cytoplasm and a cell membrane surrounded by a cell wall. The genetic material is not enclosed in a nucleus. It is a single DNA loop and may have one or more small rings of DNA called plasmids.	written in standard form. WS Carry out and represent mathematical and statistical analysis.
	4.1.4 Waves Water waves and sound waves are used here to distinguish between transverse and longitudinal waves, which transfer energy and information without transferring matter. This leads to the study of the continuous spectrum of electromagnetic waves. The hazards associated with some electromagnetic waves feature in Radiation and risk. There are two required practical: one studying waves in a ripple tank and a metal rod, and the other looking at infrared radiation from different surfaces. Knowledge of properties of parts of the electromagnetic spectrum is needed to explain the greenhouse effect.	In a transverse wave the oscillations are perpendicular to the direction of energy transfer. The ripples on a water surface are an example of a transverse wave. In a longitudinal wave the oscillations are parallel to the direction of energy transfer. Longitudinal waves show areas of compression and rarefaction. Sound waves travelling through air are longitudinal. Waves are described by their amplitude, wavelength, frequency and period. The amplitude of a wave is the maximum displacement of a point on a wave away from its undisturbed position. The wavelength of a wave is the distance from a point on one wave to the equivalent point on the adjacent wave. The frequency of a wave is the number of waves passing a point each second. The wave speed is the speed at which the energy is transferred (or the wave moves) through the medium. All waves obey the wave equation: wave s peed = frequency × wavelength $v = f\lambda$ Examples of uses of electromagnetic waves include: • radio waves – television, radio and radio telescopes • microwaves – satellite communications, cooking food • infrared – electrical heaters, cooking	WS 2.3 Describe one method to measure the speed of sound waves in air. WS 2.2, 2.3 Describe one method to measure the speed of ripples on a water surface. WS 3.5 Interpret given data from experiments to measure the speed of sound or water waves. WS 4.6, MS 1b, 2a Calculate with numbers written in standard form and give answers to an appropriate number of significant figures. MS 1c, 3b, 3c Recall and apply the wave equation. MS1a, 1c, 3b, 3c Apply the equation for relationship between

		food, infrared cameras • visible light – fibre optic communications • ultraviolet – fluorescent lamps, sun tanning • X-rays – medical imaging and treatments • gamma rays – sterilising surgical instruments, treatment of cancer.	period and frequency, which is given on the Physics equations sheet. WS 3.3 Carry out and represent mathematical and statistical analysis.
	4.2 Transport over larger distances Larger organisms need systems to transport solids, liquids and gases over larger distances. These systems and processes are monitored and controlled by the human body, but this delicate balance can be disrupted. The topic moves from simple to complex, and outlines the challenges that this presents for any transport system in plants and animals. Systems in the human body can be studied at macroscopic, microscopic and molecular scales. The study of respiration helps to account for the need for exchange surfaces in multicellular organisms, illustrated by the human circulatory system. The study of the digestive system focuses on the chemical changes to the main nutrients in the diet.	Respiration in cells can take place aerobically (using oxygen) or anaerobically (without oxygen). Aerobic respiration is an exothermic reaction that can be represented by word and symbol equations. glucose + oxygen carbon dioxide + water An exothermic reaction is one that transfers energy to its surroundings. Organisms need energy for: • chemical reactions to build larger molecules • movement • keeping warm. Anaerobic respiration in muscles is also exothermic but it gives out less energy. It is represented by the word equation: glucose lactic acid Because the oxidation of glucose is incomplete in anaerobic respiration much less energy is given out than in aerobic respiration. If insufficient oxygen is supplied, anaerobic respiration takes place in muscles. The incomplete oxidation of glucose causes a build-up of lactic acid and creates an oxygen debt. Water is drawn into the roots of plants from the soil. Water moves into the root hairs by osmosis. Mineral ions move	MS 1c Calculate and compare surface area:volume ratios MS 1a, 1c Use simple compound measures such as rate. MS 1a, 1c Carry out rate calculations. WS 3.5 Identify different types of blood cells in a photograph or diagram. MS 1a Recognise and use expressions in decimal form. MS 1c Use ratios and percentages. WS 3.3

	Finally, examples of the way that body systems are controlled is illustrated with reference to the nervous system and the endocrine system. In Lifestyle and health the importance of the endocrine system is further illustrated in the context of lifestyle and health.	from the soil into the root hairs by active transport. Water flows from the roots through xylem in its stems to its leaves. Xylem tissue is composed of hollow tubes strengthened by lignin adapted for the transport of water in the transpiration stream from the roots to the leaves. Water evaporates in the leaves and the water vapour escapes through tiny holes in the surface of leaves called stomata. The stomata can open or close as conditions change because the guard cells can gain or lose water by osmosis. Tobacco mosaic virus is a widespread plant pathogen affecting many species of plants, including tomatoes. It gives a distinctive 'mosaic' pattern of discolouration on the leaves, which affects the growth of the plant due to lack of photosynthesis. Rose black spot is a fungal disease where purple or black spots develop on leaves, which often turn yellow and drop early. It affects the growth of the plant as photosynthesis is reduced. The disease is spread by spores of the fungus that are produced in the black spots.	Carry out and represent mathematical and statistical analysis. MS 1d Make estimates of the results of simple calculations. WS 4.6, MS 2a Use an appropriate number of significant figures. MS 4a Extract and interpret information from charts and tables. Translate information between graphical and numeric form when calculating Rf values.
	4.3 looks at the macro- and micro-effects of the interaction between organisms and the environment. It introduces the effects of lifestyle on the delicate balance within the human body. The topic shows how our understanding of electromagnetic waves has developed by investigating how they interact with different materials.	Health can be defined as 'a state of physical, mental and social well-being' and not merely the absence of disease. Factors including diet, stress and life situations can affect both physical and mental health. Diseases stop part of the body from working properly. This causes symptoms, which are experienced by the person affected by the disease. Communicable (infectious) diseases are caused by microorganisms called pathogens. They may infect plants as well as animals and are spread by	WS 1.5 Interpret data about risk factors, or about differences in the incidence of non-communicable diseases in different

	The way in which people live their lives can have long-term consequences for their health. The chances that someone will be affected by conditions such as cardiovascular disease, diabetes or cancer may depend on lifestyle factors, including exercise, diet, alcohol consumption and smoking. Treatments are available to control the symptoms of non-communicable diseases Preventing, treating and curing diseases but the benefits have to be weighed against the risks. The scientific understanding of the reproductive hormones can help people to control their fertility and also to receive treatment for infertility.	direct contact, by water or by air. Non-communicable diseases, such as heart disease, cancer and diabetes, are the leading cause of death in the world. Risk factors are aspects of a person's lifestyle, or substances present in a person's body or environment, that have been shown to be linked to an increased rate of a disease. For some a causal mechanism has been proven. Examples are: • the effects of diet, smoking and exercise on cardiovascular disease • obesity as a risk factor for Type 2 diabetes • the effect of alcohol on liver and brain function • the effect of smoking on lung disease and lung cancer • the effects of smoking and alcohol on unborn babies • carcinogens and ionising radiation as risk factors in cancer.	parts of the world. WS 1.4 Discuss the human and financial cost of these non-communicable diseases to an individual, a local community, a nation or globally. MS 4a Translate information between graphical and numerical forms. MS 2c, 4a Extract and interpret information from charts, graphs and tables. .
	4.4 Explaining change This topic explores how species, living systems and non-living systems change over time. It explores how scientists think the changes happen in global systems such as Spaceship Earth as well as the tiny changes that happen at a molecular level in	The study of the development of the Earth's atmosphere shows how scientists base their theories on clues from the past that may be uncertain or incomplete. Knowledge of the carbon cycle is crucial to understanding how human activities have changed the atmosphere on a global scale in ways that affect the climate. Climate scientists explore climate change with the help of models. Earth systems are very complex and the data is often incomplete, so simplifying assumptions have to be made when setting up and testing the models	WS 1.1 Given appropriate information, interpret evidence and evaluate different theories about the Earth's early atmosphere. WS 1.3 Explain why evidence is uncertain or

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	the cells of living organisms. The topic discusses how humans affect systems and speculates on how our impact can become benign. The study of the development of the Earth's atmosphere shows how scientists base their theories on clues from the past that may be uncertain or incomplete. Knowledge of the carbon cycle is crucial to understanding how human activities have changed the atmosphere on a global scale in ways that affect the climate. Climate scientists explore climate change with the help of models. Earth systems are very complex and the data is often incomplete, so simplifying assumptions have to be made when setting up and testing the models that can then be used to evaluate possible methods for mitigating changes to the climate. Human activities can also cause pollution on a more local scale, affecting air quality in areas with high traffic levels and contaminating water supplies with sewage. Water cycles through the environment and is crucial to all living organisms. Various	that can then be used to evaluate possible methods for mitigating changes to the climate. Human activities can also cause pollution on a more local scale, affecting air quality in areas with high traffic levels and contaminating water supplies with sewage. Water cycles through the environment and is crucial to all living organisms. Various technologies have been developed to purify water so that it is safe to drink, and to treat sewage so that it does not harm the environment. The required practical investigates the use of distillation to purify water. Life depends on photosynthesis in producers such as green plants, which make carbohydrates from carbon dioxide in the air. Animals feed on plants, passing the carbon compounds along food chains. Animals and plants respire and release carbon dioxide back into the air. Human activities that involve burning fossil fuels (coal, oil and gas) for generating electricity, transport and industry all add carbon dioxide to the atmosphere. These activities have led to a large rise in the concentration of carbon dioxide in the air over the last 150 years. Over the same time the average temperature of the surface of the Earth has risen. The scientific consensus is that this is more than correlation and that the rise in greenhouse gas concentrations has caused the rise in temperature. Water is found in the solid state in glaciers and ice sheets, in the liquid state in the oceans, rivers, lakes and aquifers and in the gas state in the atmosphere. Water cycles through the environment by processes that include melting,	incomplete in a complex context. MS 1c Use ratios, fractions and percentages. WS 1.2 Draw and interpret diagrams to represent the main stores of carbon and the flows of carbon between them in the cycle. WS 1.6 Explain the importance of scientists publishing their findings and theories so that they can be evaluated critically by other scientists. Understand that the scientific consensus about global warming and climate change is based on systematic reviews of thousands of peer reviewed publications. WS 1.3 Explain why evidence is uncertain or incomplete in a complex context.

	technologies have been developed to purify water so that it is safe to drink, and to treat sewage so that it does not harm the environment. The required practical investigates the use of distillation to purify water.	freezing, evaporation and condensation. Precipitation of water from the atmosphere can take the form of rain, sleet or snow.	MS 2c, 4a Extract and interpret information from charts, graphs and tables.
	4.5 Building blocks for understanding The periodic table has many patterns and relationships, and is used by chemists to observe patterns and relationships between the elements. These patterns help to predict properties. For example, elements to the bottom and far left of the table are the most metallic and elements on the top right are the least metallic. It is also possible to analyse substances to find out how these elements have combined to form compounds and from this to deduce chemical equations. Chemists have a common language for talking about reactions that is understood across the world. This means that they can share their knowledge about chemical reactions and	The elements in the periodic table are arranged in order of atomic (proton) number, 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. 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. Elements that react by losing their outer electrons to form positive ions are metals. Elements that do not form positive ions are non-metals. The more reactive non-metals, such as the halogens, react with metals by gaining electrons to form negative ions. Compounds contain two or more elements chemically combined in fixed proportions and can be represented by formulae using the symbols of the atoms from which they were formed. Compounds can only be separated into elements by chemical reactions. The relative formula mass of a compound is the sum of the relative atomic masses of the atoms in the numbers shown in the formula. In a balanced chemical equation, the sum of the relative formula masses of the reactants in the quantities shown equals the sum of the relative formula masses of the products in the quantities shown.	Predict possible reactions and probable reactivity of elements from their positions in the periodic table. Show how scientific methods and theories have changed over time. Describe metals and non-metals and explain the differences between them in terms of their characteristic physical and chemical properties Use the names and symbols of the first 20 elements, groups 1, 7 and 0 and other common elements from a supplied periodic table to write

	solutions to problems such as ways to improve product yield.		formulae and balanced chemical equations where appropriate.
	4.6 Interactions over small and large distances This topic looks at strong forces and weak forces between atoms, molecules and much larger structures. Understanding how these interactions take place helps to explain how matter behaves, and enables engineers and scientists to design materials that can withstand forces and to provide the materials and devices that we need for a wide range of purposes. The communications, security and transport industries make great use of electromagnetic forces to control and move devices. By representing forces as vectors it is possible to explain how objects interact by a variety of contact and non-contact forces. Work is introduced as an important means of energy transfer. A force acts on an object with mass when in a gravitational field and thus distinguishes	Scalar quantities have magnitude only. Vector quantities have magnitude and an associated direction. Force is a vector quantity. A vector quantity may be represented by an arrow. The length of the arrow represents the magnitude, and the direction of the arrow the direction of the vector quantity. A force is a push or pull that acts on an object due to the interaction with another object. All forces between objects are either: • contact forces – the objects are physically touching or • non-contact forces – the objects are physically separated. Weight is the force acting on an object due to gravity. The force of gravity close to the Earth is due to the gravitational field around the Earth. The weight of an object depends on the gravitational field strength at the point where the object is: weight = mass × gravitational field strength $W = m g$ weight, W, in newtons , N mass, m, in kilograms, kg 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 that share pairs of electrons.	Recall and apply this equation. In any calculation the value of the gravitational field strength (g) will be given. MS 3a Understand and use the symbol for proportionality, 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. Describe the limitations of particular representations and

	between mass and weight. An object gains potential energy when raised in a gravitational field because of the work done. Forces can stretch, bend or compress objects. The deformation may be elastic or inelastic depending on the material and the size of the forces involved. The work done in stretching can be used to calculate the potential energy of a spring.	For metallic bonding the particles are atoms that share delocalised 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. Metallic bonding occurs in metallic elements and alloys. A magnetic compass contains a small bar magnet. The Earth has a magnetic field. The compass needle points in the direction of the Earth's magnetic field.	models to include dot and cross diagrams, ball and stick models and two- and three-dimensional representations.
	4.7 Movement and interactions Movement can take place over small and large distances, and can happen at very different speeds. Crashes, bangs and collisions can take place between sub-atomic particles or between large, moving vehicles. Scientists try to learn as much as possible about these interactions so that they can make it safer and healthier to travel and keep our homes and cities running. Forces can change the motion of objects. Objects can move in a straight line at a constant speed.	Distance is how far an object moves. Distance does not involve direction. Distance is a scalar quantity. Displacement includes both the distance an object moves, measured in a straight line from the start point to the finish point, and the direction of that straight line. Displacement is a vector quantity. Speed does not involve direction. Speed is a scalar quantity. The velocity of an object is its speed in a given direction. Velocity is a vector quantity. The distance travelled by an object moving at constant speed increases with time. distance travelled = s peed × time $s = v t$ distance, s, in metres, m speed, v, in metres per second, m/s time, t, in seconds, s The stopping distance of a vehicle is the sum of the distance the vehicle travels during the driver's reaction time (thinking distance) and	Analyse a given situation to explain why braking could be affected. WS 1.5 Discuss the implications for safety. WS 3.5, MS 4a Interpret graphs relating speed to stopping distance for different types of vehicles. WS 1.5, 2.2, MS 1a, 1c Evaluate the effect of various factors on thinking distance based on given data.

	They can also change their speed and/or direction (accelerate or decelerate). This topic shows how observations of moving objects can be accounted for in terms of Newton's laws of motion. Graphs can help to describe the movement of objects. These may be distance–time or velocity–time graphs. When an object speeds up or slows down, its kinetic energy increases or decreases. The forces that cause the change in speed do so by doing work. The topic ends by showing that these ideas can be applied to the issue of road safety.	the distance it travels under the braking force (braking distance). For a given braking force the greater the speed of the vehicle, the greater the stopping distance. The braking distance of a vehicle can be affected by wet or icy weather and poor condition of the vehicle's brakes or tyres. Power is defined as the rate at which energy is transferred or the rate at which work is done. power = energy trans f erred time power, P, in watts, W energy transferred, E, in joules, J time, t, in seconds, s work done, W, in joules, J An energy transfer of 1 joule per second is equal to a power of 1 watt.	
	4.8 Guiding Spaceship Earth towards a sustainable future Many scientists are involved in the search for solutions to the great challenges facing humanity such as how we might use our resources more effectively. When developing new materials and processes, how do chemists and engineers ensure that their products do no harm? The study of forms of carbon provides an opportunity to	Crude oil is a finite resource found in rocks. Crude oil is the remains of an ancient biomass consisting mainly of plankton that was buried in mud. Crude oil is a mixture of a very large number of compounds. Most of the compounds in crude oil are hydrocarbons, which are molecules made up of hydrogen and carbon atoms only. Some properties of hydrocarbons depend on the size of their molecules, including: • boiling point • viscosity, and • flammability.	WS 1.4 Explain technological applications of science. Explain patterns and trends in given data about the use of energy resources. Evaluate the use of different energy resources, taking into account reliability, cost and impact on the

	revisit ideas about structure and bonding from Chemical quantities. Other ideas from Structure and bonding are applied to explain how new chemicals and materials are made from the hydrocarbons in crude oil. Featured processes include fractional distillation, cracking and polymerisation.	These properties influence how hydrocarbons are separated and how they are used as fuels. Non-renewable resources of energy include: • coal • crude oil • natural gas • nuclear fuel. A renewable energy resource is one that is being (or can be) replenished as it is used. Examples include: • plants that provide biofuel • wind turbines • hydroelectricity • tidal barrages or undersea turbines • solar panels that produce electricity or heat water.	environment. WS 4.4, MS 1c, 2c, 4a Interpret data with energy quantities given, using the prefixes kilo, mega, giga and tera.