Year 11 Science Medium Term Plan
Autumn Term 1

Learning Overview (Contents)	Overview of main learning objectives: Electricity Rate of reaction Defending ourselves from disease
Assessment Opportunities	
Textbooks Published Lesson Resources	

Week Number	Learning Overview / objective (outlined above)	What should pupils know, understand and be able to do by the end of the week? (Use clear Success criteria)
1	Physics: Chapter 14 - Electricity	• **Understand electrical charges** and how objects become charged through static processes like friction. • **Explain circuit fundamentals**, such as current flow, conductors, and circuit diagrams. • **Define potential difference (voltage)** and **resistance**, and understand how they affect current. • **Interpret component characteristics**, including I–V graphs for resistors, bulbs, diodes, and thermistors. • **Analyse series and parallel circuits**, including calculations of total resistance and current distribution.

		• **Understand and design simple sensor circuits**, using components like Light Dependent Resistors (LDRs) and thermistors.
2	Physics: Chapter 15 – Magnetism and the motor effect	• Describe how magnetic field lines form around magnets and current-carrying wires. • Explain how introducing a soft iron core strengthens the field. • Show how coils of wire create electromagnets. • Identify factors that affect their strength (e.g. coil turns, current, core material). • Explain the motor effect: force on a current-carrying wire in a magnetic field. • Use Fleming's left-hand rule to determine force direction. • Understand basic structure and function of electric motors.
3	Physics: Chapter 16 – Household electricity Physics assessment	• Understand that mains electricity is an alternating current supply. • Describe key features: frequency (~50 Hz), voltage (~230 V), and why AC is used for distribution. • Recognize the parts of standard domestic cables: live, neutral, and earth conductors with insulation. • Interpret and draw wiring diagrams for plugs, showing correct connections and polarity. • Explain the function of fuses in protecting circuits.

		• Calculate appropriate fuse ratings based on appliance current (using *I=PVI = \frac{P}{V}*I=VP). • Understand the role of circuit breakers and double-insulated devices. • Apply formulas: *P=IVP = IV*P=IV and *P=I2RP = I^2R*P=I2R. • Calculate power usage of appliances and discuss efficiency. • Use *Q=ItQ = It*Q=It and *E=QVE = QV*E=QV to calculate charge transferred and energy used. • Understand energy consumption and its relationship to cost.
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6		• Analyze typical household appliances, classifying them by power rating and usage time. • Calculate energy consumption (kWh) over time and interpret electricity bills. • Describe common electrical hazards (e.g., overheating, damp environments, damaged insulation). • Explain safety measures: earthing, fuses, circuit breakers, double insulation. • Understand the importance of regular inspections and using safe appliances.

7	Chemistry: Chapter 9 – Rate of reaction	**3.14.1 Rate of reaction** a. The rate of a chemical reaction can be found by measuring the amount of a reactant used or the amount of product formed over time: $\text{Rate of reaction} = \frac{\text{amount of reactant used}}{\text{time}}$ $\text{Rate of reaction} = \frac{\text{amount of product formed}}{\text{time}}$ *Students need to be able to interpret graphs showing the amount of product formed (or reactant used up) with time, in terms of the rate of the reaction.* *Knowledge of specific reactions other than those in the subject content is **not** required, but students will be expected to have studied examples of chemical reactions and processes in developing their skills during their study of this section.* b. Chemical reactions can occur only when reacting particles collide with each other and with sufficient energy. The minimum amount of energy that particles must have to react is called the activation energy. c. Increasing the temperature increases the speed of the reacting particles so that they collide more frequently and more energetically. This increases the rate of reaction. d. Increasing the pressure of reacting gases increases the frequency of collisions and so increases the rate of reaction. e. Increasing the concentration of reactants in solutions increases the frequency of collisions and so increases the rate of reaction. f. Increasing the surface area of solid reactants increases the frequency of collisions and so increases the rate of reaction. Required practical: Investigate factors affecting the rate of a reaction.
8	Biology: Chapter 8 – Defending ourselves against disease	**3.4.6 Infection and response** a. Microorganisms that cause infectious disease are called pathogens. b. Bacteria and viruses may reproduce rapidly inside the body. Bacteria may produce poisons (toxins) that make us feel ill. Viruses live and reproduce inside cells, causing damage. *Knowledge of the structure of viruses is **not** required.*

		c. White blood cells help to defend against pathogens by: • ingesting pathogens (phagocytosis) • producing antibodies, which destroy particular bacteria or viruses • producing antitoxins, which counteract the toxins released by the pathogens. d. The immune system of the body produces specific antibodies to kill a particular pathogen. This leads to immunity from that pathogen. In some cases, dead or inactivated pathogens stimulate antibody production. If a large proportion of the population is immune to a pathogen, the spread of the pathogen is very much reduced. e. People can be immunised against a disease by introducing small quantities of dead or inactive forms of the pathogen into the body (vaccination). Vaccines stimulate the white blood cells to produce antibodies that destroy the pathogen. This makes the person immune to future infections by the microorganism, because the body can respond by rapidly making the correct antibody, in the same way as if the person had previously had the disease. The MMR vaccine is used to protect children against measles, mumps and rubella. *Details of vaccination schedules and side effects associated with specific vaccines are not required.* *Students should be able to evaluate the advantages and disadvantages of being vaccinated against a particular disease.* f. Antibiotics, such as penicillin, are medicines that help to cure bacterial disease by killing infective bacteria inside the body. It is important that specific bacteria should be treated by specific antibiotics. The use of antibiotics has greatly reduced deaths from infectious bacterial diseases. g. Antibiotics cannot kill viral pathogens. *Students should be aware that it is difficult to develop drugs that kill viruses without also damaging the body's tissues.* h. Mutations of pathogens produce new strains. **Antibiotics kill individual pathogens of the non-resistant strain but individual resistant pathogens survive and reproduce, so the population of the resistant strain rises.** Antibiotics and vaccinations may no longer be effective against a new resistant strain of the pathogen. The new strain will then spread rapidly because people are not immune to it and there is no effective treatment. ***Knowledge of development of resistance in bacteria is limited to the fact that pathogens mutate, producing resistant strains.*** i. Many strains of bacteria, including MRSA, have developed resistance to antibiotics. Overuse and inappropriate use of antibiotics has increased the rate of development of antibiotic-resistant strains of bacteria. **Antibiotics are not currently used to treat non-serious infections such as mild throat infections, in order to slow down the rate of development of resistant strains.** j. The development of antibiotic-resistant strains of bacteria necessitates the development of new antibiotics. Required practical: Investigate the effect of disinfectants and antibiotics on uncontaminated cultures of microorganisms.

Year 11 Science Medium Term Plan
Autumn Term 2

Learning Overview (Contents)	Energy changes (Chemistry) Plants as organisms (Biology) Kinetic theory and energy transfer through heating (Physics) Variation and inheritance (Biology) Genetic manipulation (Biology)
Assessment Opportunities	Highlighted in yellow

Week Number	Learning Overview / objective (outlined above)	What should pupils know, understand and be able to do by the end of the week? (Use clear Success criteria)
1	• Exothermic Reactions • Endothermic Reactions • Practical	**3.15.1 Exothermic and endothermic reactions** a. When chemical reactions occur, energy is transferred to or from the surroundings. *Knowledge of delta H (ΔH) conventions and enthalpy changes, including the use of positive values for endothermic reactions and negative values for exothermic reactions, is required.* b. An exothermic reaction is one that transfers energy to the surroundings. Examples of exothermic reactions include combustion, many oxidation reactions and neutralisation. *Students should be able to give examples of exothermic reactions including combustion, oxidation and neutralisation. Everyday uses of exothermic reactions include self-heating cans (eg for coffee) and hand warmers.* c. An endothermic reaction is one that takes in energy from the surroundings. Endothermic reactions include thermal decompositions. Some sports injury packs are based upon endothermic reactions. d. In some chemical reactions, the products of the reaction can react to produce the original reactants. Such reactions are called reversible reactions and are represented as follows: $A + B \rightarrow C + D$ For example: hydrated copper sulfate (blue) $\underset{\text{exothermic}}{\overset{\text{endothermic}}{\rightarrow}}$ anhydrous copper sulfate (white) + water e. The amount of energy produced by a chemical reaction in solution can be calculated from the measured temperature change of the solution when the reagents are mixed in an insulated container. This method can be used for reactions of solids with water or for neutralisation reactions.

2	• Calculate enthalpy changes • Revision • Energy Change Assesment • Photosynthesis • Factors affecting photosynthesis	**3.15.2 Calculating and explaining energy changes** a. Simple energy level diagrams can be used to show the relative energies of reactants and products, the activation energy and the overall energy change of a reaction. *Students will be expected to understand simple energy level diagrams showing the relative energies of reactants and products, the activation energy and the overall energy change, with a curved arrow to show the energy as the reaction proceeds.* *Students should be able to relate these to exothermic and endothermic reactions.* b. During a chemical reaction: • energy must be supplied to break bonds • energy is released when bonds are formed. *Students should be able to calculate the energy transferred in reactions and interpret simple energy level diagrams in terms of bond breaking and bond formation (including the idea of activation energy and the effect on this of catalysts).* c. In an exothermic reaction, the energy released from forming new bonds is greater than the energy needed to break existing bonds. *Students should be able to calculate the energy transferred in reactions using bond dissociation energies supplied.* d. In an endothermic reaction, the energy needed to break existing bonds is greater than the energy released from forming new bonds. e. Catalysts provide a different pathway for a chemical reaction that has a lower activation energy. *Students should be able to represent the effect of a catalyst on an energy level diagram.*

		3.2.1 Photosynthesis a. Photosynthesis is summarised by the equations: $\text{carbon dioxide} + \text{water} \xrightarrow{\text{light}} \text{glucose} + \text{oxygen}$ $6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2$ b. During photosynthesis: • light is absorbed by a green substance called chlorophyll, which is found in chloroplasts in some plant cells and in algae • light is used to convert carbon dioxide (from the air) and water (from the soil) into sugar (glucose) • oxygen is released as a by-product. c. The rate of photosynthesis may be limited by: • low temperature • shortage of carbon dioxide • shortage of light. These factors interact and any one of them may be the factor that limits photosynthesis. *Students should be able to relate the principle of limiting factors to the economics of enhancing the following conditions in greenhouses:* • *temperature* • *carbon dioxide concentration* • *light intensity.*
3	• Photosynthesis practical • Photosynthesis practical • States of matter and interconversions	Required practical: Investigate how variables affect the rate of photosynthesis. d. The glucose produced in photosynthesis may be used as a source of chemical energy or converted to larger molecules for storage and use later. The glucose can be: • used for respiration • converted into insoluble starch for storage • used to produce fat or oil for storage • used to produce cellulose, which strengthens the cell wall • used to produce proteins. e. To produce proteins, plants also use nitrate ions that are absorbed from the soil. **3.20.1 Kinetic theory** a. Kinetic theory can be used to explain the different states of matter and their properties. The particles in solids liquids and gases have different amounts of energy. *Students should be able to recognise, use and compare simple diagrams to represent key features of solids, liquids and gases.*

4	• Specific heat capacity • Specific latent heat (higher only) • Specific latent heat (higher only) • Conduction and Convection • Evaporation and condensation (higher only)	b. The specific heat capacity of a substance is the amount of energy required to change the temperature of one kilogram of the substance by one degree Celsius. The relationship between energy, E, mass, m, specific heat capacity, c, and temperature change, $\Delta\theta$, is: $E = m \times c \times \Delta\theta$ c. **The specific latent heat of vaporisation of a substance is the amount of energy required to change the state of one kilogram of the substance from a liquid to a vapour with no change in temperature. The relationship between energy, E, mass, m, and specific latent heat of vaporization, L_V, is:** $E = m \times L_V$ d. **The specific latent heat of fusion of a substance is the amount of energy required to change the state of one kilogram of the substance from a solid to a liquid with no change in temperature. The relationship between energy, E, mass, m, and specific latent heat of fusion, L_F, is:** $E = m \times L_F$ e. The melting point of a solid and the boiling point of a liquid are affected by impurities. Throughout Section 3.19, students should be able to explain the shape of the temperature–time graph for a substance that is either cooled or heated through changes in state. **3.20.2 Energy transfers and particle motion** a. Energy may be transferred by conduction and convection. *Students should be able to explain, in terms of particles, how these energy transfers take place. They should understand in simple terms how the arrangement and movement of particles determine whether a material is a conductor or an insulator and understand the role of free electrons in conduction through a metal. They should be able to use the idea of particles moving apart to make a fluid less dense, to explain and apply the concept of convection.* b. **Energy may be transferred by evaporation and condensation.** ***Students should be able to explain evaporation, and the cooling effect this causes, using kinetic theory. Students should be able to discuss the factors that affect the rate of evaporation.*** c. The rate at which an object transfers energy by heating depends on: • its surface area and volume • the material from which the object is made • the nature of the surface with which the object is in contact.
5	• Review • Kinetic theory and energy transfer assessment • Inheritance	**3.5.3 Genetic variation** a. Differences in the characteristics of individuals of the same kind may be due to differences in: • the genes they have inherited (genetic causes) • the conditions in which they have developed (environmental causes) • a combination of genetic and environmental causes. b. The information that results in plants and animals having similar characteristics to their parents is carried by genes, which are passed on in the sex cells (gametes) from which the offspring develop. c. The nucleus of a cell contains chromosomes. Chromosomes carry genes that control the characteristics of the body. Chromosomes are normally found in pairs. d. In human body cells, one of the 23 pairs of chromosomes carries the genes that determine sex. In females the sex chromosomes are the same (XX); in males the sex chromosomes are different (XY).

6

- Asexual and sexual reproduction
- Variation
- Punnet square
- Punnet square and family trees
- Inherited disorders

3.5.1 Reproduction

There are two forms of reproduction:

- sexual reproduction – the joining (fusion) of male and female gametes. The mixture of the genetic information from two parents leads to variety in the offspring
- asexual reproduction – no fusion of gametes and only one individual is needed as the parent. There is no mixing of genetic information and so no genetic variation in the offspring. These genetically identical individuals are known as clones.

a. Differences in the characteristics of individuals of the same kind may be due to differences in:

- the genes they have inherited (genetic causes)
- the conditions in which they have developed (environmental causes)
- a combination of genetic and environmental causes.

f. If both chromosomes in a pair contain the same allele of a gene, the individual is homozygous for that gene. If the chromosomes in a pair contain different alleles of a gene, the individual is heterozygous for that gene.

g. An allele that controls the development of a characteristic when it is present on only one of the chromosomes is called a dominant allele. An allele that controls the development of a characteristic only if the dominant allele is not present is called a recessive allele.

Students should be familiar with principles used by Mendel in investigating monohybrid inheritance in peas. They should understand that Mendel's work preceded the work by other scientists which linked Mendel's 'inherited factors' with chromosomes.

Extension Tier students should be able to construct genetic diagrams of monohybrid crosses and to predict the outcomes of monohybrid crosses. They should be able to use the terms homozygous, heterozygous, phenotype and genotype.

*Core Tier students should be able to interpret genetic diagrams of monohybrid inheritance and sex inheritance, but will **not** be expected to construct genetic diagrams or use the terms homozygous, heterozygous, phenotype of genotype.*

Students should understand that genetic diagrams are biological models which can be used to predict the outcomes of crosses.

Students should be able to interpret genetic diagrams, including family trees.

3.5.4 Genetic disorders

Attention is drawn to the potential sensitivity needed in teaching about inherited disorders.

a. Some disorders are inherited.

Students should be able to interpret data relating to genetic disorders such as polydactyly, cystic fibrosis and sickle cell anaemia.

b. Some inherited conditions are caused by inheritance of abnormal numbers of chromosomes, eg Down's Syndrome is caused by the presence of an extra chromosome.

7	• Cloning techniques • Genetic engineering • Review	b. **In genetic engineering, genes from the chromosomes of humans and other organisms can be 'cut out' and transferred to cells of other organisms:** • **enzymes are used to isolate the required gene** • **this gene is inserted into a vector, usually a bacterial plasmid or a virus** • **the vector is used to insert the gene into the required cells.** c. Genes can also be transferred to the cells of animals, plants or microorganisms at an early stage in their development so that they develop with desired characteristics. d. Crops that have had their genes modified in this way are called genetically modified (GM) crops. GM crops include ones that are resistant to insect attack or to herbicides. e. GM crops generally show increased yields.

Year 11 Science Medium Term Plan
Spring 1

Learning Overview (Contents)	Organic chemistry Ecology Nuclear physics Space physics
Assessment Opportunities	Highlighted in yellow

Week Number	Learning Overview / objective (outlined above)	What should pupils know, understand and be able to do by the end of the week? (Use clear Success criteria)
1	• **Fractional distillation** • **Burning fuels** • **Hydrocarbons** • **Cracking** • **Polymers**	**3.16.1.1 Crude oil** a. Crude oil is a mixture of a very large number of compounds. b. Most of the compounds in crude oil are hydrocarbons, which are molecules made up of hydrogen and carbon atoms only. c. The many hydrocarbons in crude oil may be separated into fractions, each of which contains molecules with a similar number of carbon atoms, by evaporating the oil and allowing it to condense at a number of different temperatures. This process is called fractional distillation. *Students should know and understand the main processes in continuous fractional distillation in a fractionating column.* *Knowledge of the names of specific fractions or fuels is **not** required.*

d. Most fuels, including coal, contain carbon and/or hydrogen and may also contain some sulfur. The gases released into the atmosphere when a fuel burns may include carbon dioxide, water (vapour), carbon monoxide, sulfur dioxide and oxides of nitrogen. Solid particles (particulates) may also be released. Solid particles may contain soot (carbon) and unburnt fuels.

Sulfur dioxide and oxides of nitrogen cause acid rain, an increase in carbon dioxide may result in climate change, and solid particles cause global dimming.

Students should be able to relate products of combustion to the elements present in compounds in the fuel and to the extent of combustion (whether complete or incomplete).

No details of how the oxides of nitrogen are formed are required, other than the fact that they are formed at high temperatures.

e. The combustion of hydrocarbon fuels releases energy. During combustion, the carbon and hydrogen in the fuels are oxidised.

f. Biofuels, including biodiesel and ethanol, are produced from plant material, and are possible alternatives to hydrocarbon fuels.

Students should know and understand the benefits and disadvantages of biofuels in terms of:

- *use of renewable resources*
- *their impacts on land use*
- *their carbon footprint.*

*Students should know that ethanol for use as a biofuel is produced from a dilute solution of ethanol obtained by the fermentation of plant materials at a temperature between 20 °C and 35 °C. Detailed knowledge of the methods used to produce other biofuels is **not** required.*

3.16.1.3 Obtaining useful substances from crude oil

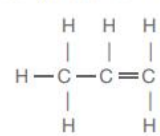
a. Hydrocarbons can be broken down (cracked) to produce smaller, more useful molecules. This process involves heating the hydrocarbons to vaporise them. The vapours are either passed over a hot catalyst or mixed with steam and heated to a very high temperature so that thermal decomposition reactions then occur.

b. The products of cracking include alkanes and unsaturated hydrocarbons called alkenes. The general formula for the homologous series of alkenes is C_nH_{2n}

Students should know that in unsaturated hydrocarbons some of the carbon–carbon bonds are double covalent bonds.

c. Unsaturated hydrocarbon molecules can be represented in the following forms:

C_3H_6 or



Students should know that in displayed structures ═ represents a double bond.

*Students should be able to recognise alkenes from their names or formulae, but do **not** need to know the names of individual alkenes other than ethene and propene.*

d. Alkenes react with bromine water, turning it from orange to colourless.

e. Some of the products of cracking are useful as fuels.

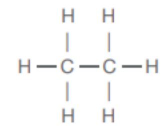
3.16.1.2 Hydrocarbons

a. Most of the hydrocarbons in crude oil are saturated hydrocarbons called alkanes. The general formula for the homologous series of alkanes is C_nH_{2n+2}

Students should know that in saturated hydrocarbons all the carbon–carbon bonds are single covalent bonds.

b. Alkane molecules can be represented in the following forms:

C_2H_6 or



Students should know that in displayed structures — represents a covalent bond.

Students should be able to recognise alkanes from their formulae in any of the forms, but do not need to know the names of specific alkanes other than methane, ethane and propane.

c. Some properties of hydrocarbons depend on the size of their molecules. These properties influence how hydrocarbons are used as fuels.

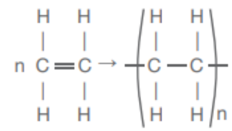
Knowledge and understanding of trends in properties of hydrocarbons is limited to:

- *boiling points*
- *viscosity*
- *flammability.*

3.16.2 Synthetic and naturally occurring polymers

a. Alkenes can be used to make polymers such as poly(ethene) and poly(propene). In polymerisation reactions, many small molecules (monomers) join together to form very large molecules (polymers).

For example:



ethene poly(ethene)

Students should be able to recognise the molecules involved in these reactions in the forms shown in the subject content. They should be able to represent the formation of a polymer from a given alkene monomer.

*Further details of polymerisation are **not** required.*

b. The properties of polymers depend on what they are made from and the conditions under which they are made. For example, low-density (LD) and high-density (HD) poly(ethene) are produced using different catalysts and reaction conditions.

c. Thermosoftening polymers consist of individual, tangled polymer chains. Thermosetting polymers consist of polymer chains with cross-links between them so that they do not melt when they are heated.

Extension Tier students should be able to explain thermosoftening polymers in terms of intermolecular forces.

d. Polymers have many useful applications and new uses are being developed. Examples include: new packaging materials, waterproof coatings for fabrics, dental polymers, wound dressings, hydrogels, and smart materials (including shape memory polymers).

Students should consider the ways in which new materials are being developed and used, but will not need to recall the names of specific examples.

e. Many polymers are not biodegradable, ie they are not broken down by microbes. This can lead to problems with waste disposal.

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• Alcohols
• Carboxylic acids
• Organic Chemistry Assessment
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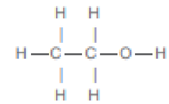
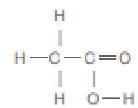
3.16.3.1 Alcohols
a. Alcohols contain the functional group –OH. Methanol, ethanol and propanol are the first three members of a homologous series of alcohols. Alcohols can be represented in the following forms:
CH_3CH_2OH or 
Students should be able to recognise alcohols from their names or formulae, but do not need to know the names of individual alcohols other than methanol, ethanol and propanol.
b. Methanol, ethanol and propanol:
• dissolve in water to form a neutral solution
• react with sodium to produce hydrogen
• burn in air
• are used as fuels and solvents, and ethanol is the main alcohol in alcoholic drinks.
c. Ethanol can be oxidised to ethanoic acid, (a carboxylic acid) either by chemical oxidising agents or by microbial action. Ethanoic acid is the main acid in vinegar.
3.16.3.2 Carboxylic acids
a. Ethanoic acid is a member of the homologous series of carboxylic acids, which have the functional group –COOH. The structures of carboxylic acids can be represented in the following forms:
CH_3COOH or 
Students should be able to recognise carboxylic acids from their names or formulae, but do not need to know the names of individual carboxylic acids other than methanoic acid, ethanoic acid and propanoic acid.
b. Carboxylic acids:
• dissolve in water to produce acidic solutions
• react with carbonates to produce carbon dioxide
• react with alcohols in the presence of an acid catalyst to produce esters
• do not ionise completely when dissolved in water and so are weak acids
• aqueous solutions of weak acids have a higher pH value than aqueous solutions of strong acids with the same concentration.
Students are expected to write balanced chemical equations for the reactions of carboxylic acids.
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3	• Evolution • Natural selection • Competition • Adaptations • Biomass and food webs	**3.6.2 Natural selection** a. Theories of how organisms have evolved include: • the theory of evolution by natural selection • other theories, including that of Lamarck, are based mainly on the idea that changes that occur in an organism during its lifetime can be inherited. We now know that in the vast majority of cases this type of inheritance cannot occur. b. Evolution occurs via natural selection. • Individual organisms within a particular species may show a wide range of variation because of differences in their genes. • Individuals with characteristics most suited to the environment are more likely to survive to breed successfully. • The genes that have enabled these individuals to survive are then passed on to the next generation. *Students should develop an understanding of the time scales involved in evolution.* c. New species arise as a result of: • isolation: two populations of a species become separated, eg geographically • genetic variation: each population has a wide range of alleles that control their characteristics • natural selection: in each population, the alleles that control the characteristics which help the organism to survive are selected • speciation: the populations become so different that successful interbreeding leading to fertile offspring, is no longer possible.
4	• Decomposition • Carbon cycle • Ecology Assessment	**3.3.1 Energy transferred in ecosystems** a. Radiation from the Sun is the source of energy for most communities of living organisms. Plants and algae transfer about 1 % of the incident energy from light for photosynthesis. This energy is stored in the substances that make up the cells of the plants. b. Only approximately 10 % of the biomass from each trophic level is transferred to the level above it because: • some materials and energy are always lost in the organisms' waste materials • respiration supplies all the energy needs for living processes, including movement. Much of this energy is eventually transferred to the surroundings. *Construction of food webs and chains, and of pyramids of numbers, is not required. An understanding of pyramids of numbers is not required.* c. The biomass at each stage can be drawn to scale and shown as a pyramid of biomass. *Students should be able to interpret pyramids of biomass and construct them from appropriate information.*

		### 3.3.3 Decay and the carbon cycle a. Living organisms remove materials from the environment for growth and other processes. These materials are returned to the environment either in waste materials or when living things die and decay. b. Materials decay because they are broken down (digested) by microorganisms. Microorganisms are more active and digest materials faster in warm, moist, aerobic conditions. c. The decay process releases substances that plants need to grow. d. In a stable community, the processes that remove materials are balanced by processes that return materials. The materials are part of a constant cycle. e. The constant cycling of carbon is called the carbon cycle. In the carbon cycle: • carbon dioxide is removed from the environment by green plants and algae during photosynthesis • the carbon from the carbon dioxide is used to make carbohydrates, fats and proteins, which make up the body of plants and algae • when green plants and algae respire, some of this carbon becomes carbon dioxide and is released into the atmosphere • when green plants and algae are eaten by animals and these animals are eaten by other animals, some of the carbon becomes part of the fats and proteins that make up the bodies of the consumers • when animals respire, some of this carbon becomes carbon dioxide and is released into the atmosphere • when plants, algae and animals die, some animals and microorganisms feed on their bodies • carbon is released into the atmosphere as carbon dioxide when microorganisms respire • by the time the microorganisms and detritus feeders have broken down the waste products and dead bodies of organisms in ecosystems and cycled the materials as plant nutrients, all the energy originally absorbed by green plants and algae has been transferred • combustion of wood and fossil fuels releases carbon dioxide into the atmosphere. *Students should be able to apply the principles of the carbon cycle.*
5	• Radioactive decay • Nuclear equations • Nuclear fission • Life cycle of a star • Solar system	### 3.23.2 Ionizing radiation from the nucleus a. Some atomic nuclei are unstable. The nucleus emits particles or radiation and the nucleus changes to that of a different element and becomes more stable. This is a random process called radioactive decay. b. Energy is emitted by changes in the nucleus. c. Unstable nuclei emit alpha particles, beta particles, or neutrons, and electromagnetic radiation as gamma waves. Neither chemical nor physics processes affect this behaviour. These substances are said to be radioactive and although the general process follows a pattern this radioactive decay is a random process. It is impossible to predict when a particular atom might decay. d. Background radiation is around us all of the time. It comes from a range of sources, such as radioactive substances in the environment, from space or from devices such as X-ray machines in hospitals. e. An alpha particle consists of two neutrons and two protons (i.e. a Helium nucleus). A beta particle is a high speed electron ejected from the nucleus as a neutron turns into a proton. Gamma radiation is electromagnetic radiation from the nucleus.

		f. **Nuclear equations are used to represent radioactive decay.** ***Students will be required to balance equations for single alpha and beta decay, limited to the completion of atomic number and mass number. The identification of daughter elements from such decays is not required.*** g. Properties of the alpha, beta and gamma radiations are limited to their relative ionising power, their penetration through materials and their range in air. **3.23.3 Nuclear fission** a. Nuclear fission is the splitting of a large and unstable nucleus and the release of energy. b. **For fission to occur the uranium-235 or plutonium-239 nucleus must first absorb a neutron to make the nucleus unstable. The nucleus undergoing fission splits into two smaller nuclei, releasing two or three neutrons and energy. The amount of energy released during nuclear fission is much greater than that released in a chemical reaction involving a similar mass of material.** c. A chain reaction occurs when neutrons from the fission go on to cause further fission. In a nuclear reactor control rods absorb fission neutrons to ensure that on average only one neutron per fission goes on to produce further fission and energy transfer. *Students should be able to sketch or complete a labelled diagram to illustrate how a chain reaction may occur.* d. Nuclear reactions produce waste which may be dangerous due to its radioactive nature and may remain so for a long time, depending upon its half life and products. The disposal of such waste needs to be managed with care and is a factor that may influence the use of nuclear power for the generation of electricity. **3.24.1 Life cycle of a star** a. Stars form when enough dust and gas (mainly hydrogen and helium) from space are pulled together by gravitational attraction. Smaller masses may form and be attracted by a larger mass to become planets, or even stars. b. During the 'main sequence' period of its life cycle, energy is released by the fusion of hydrogen nuclei to make helium nuclei in the core and a star is stable because the forces within it are balanced. *The term 'radiation pressure' will **not** be required.* c. The core (centre) of a star is where the temperature and density are greatest and where most nuclear fusion takes place. d. The more massive a star, the hotter its core and the heavier the nuclei it can create by fusion. e. Stars change over time; they have a life cycle. This life cycle is determined by the mass of the star. f. A main sequence star uses nuclear reactions to produce light and heat. When it runs out of hydrogen, what happens next in its life cycle depends upon its mass.

		3.24.2 Solar system and orbital motion a. The Earth is one of eight planets orbiting the Sun (a medium sized star), which together with other smaller objects (asteroids, dwarf planets, comets) and moons orbiting several planets, make up the solar system. *Students should be able to describe the principal differences between planets, moons, the Sun, comets and asteroids in terms of relative size and motion.* b. Our universe is made up of: • thousands of millions of galaxies that are each made up of thousands of millions of stars • our Sun is one of thousands of millions of stars in our galaxy called the Milky Way. c. Planets orbit the Sun and a moon is a natural satellite of a planet. Artificial satellites orbit the Earth and can be in geostationary or low polar orbits. d. Gravity provides the centripetal force that keeps planets and satellites (both natural and artificial) in orbit.
6	Review	

Year 11 Subject Name Medium Term Plan
Autumn Term

Learning Overview (Contents)	Overview of main learning objectives: (Taken from the National Curriculum) *(This should be a list of the learning objectives / skills cover over this term)* • Adding Fractions using the same denominator • Using mixed numbers
Assessment Opportunities	There needs to be a minimum of 2 formal assessments per term. These formal assessments will inform the 'working at grades' and the AOB reported to parents. There may be additional unit tests depending on a subject
Textbooks Published Lesson Resources	Please include ISBN numbers of all published textbooks and other published resources if available

Home Learning Resources	Specific Links to Oak Academy (This will be shared with parents on *Teams* to help them supplement the classroom learning revision)
Knowledge organisers	Link to knowledge Organisers (look on the TES!)

Week Number	Learning Overview / objective (outlined above)	What should pupils know, understand and be able to do by the end of the week? (Use clear Success criteria)
1	Adding Fractions using the same denominator Using mixed numbers	know what a common denominator is Understand that when they add fractions, they need a common denominator Extension: introduce algebraic fractions
2		
3	Unit test at end of Week 3	
4		
5		
6		
7	Formal Assessment 1	