

Curriculum plan 2020-1: Science

1. Overview

1. Coherence and flexibility

We strive to support schools by giving them an online learning offer that can be flexible to fit alongside their existing curriculum. We need to balance this together with coherence as complete flexibility would imply only standalone lessons where none can build upon any other. In striking this balance, we will lean towards giving the maximum flexibility possible (where this does not compromise coherence - see point 3 below for further clarification). All units will have revision lessons at the end to consolidate knowledge, which can be standalone if that topic has been taught, and where disciplinary knowledge is woven into the units there will be reminders of previously used scaffolds and prompts used previously.

2. Subjects first

The science curriculum is structured into biology, chemistry and physics units, with working scientifically skills taught in context throughout. In terms of science's relationship and overlap with other subjects (e.g. geography and maths), we will not be able to create cross-curricular coherence as the units can be taught in multiple orders. Therefore, cross curricular topics, (such as Earth science) will not cohere with other subjects (eg geography).

3. Knowledge organisation

The units in the science curriculum are grouped by key stage, with a suggested route through organised within year groups. In Key Stage 4, units are sequenced according to the AQA specification (with two exceptions, P3 Particles and B7 Ecology). In most circumstances the units within a given year can be sequenced flexibly, but there is an assumption in the creation of the units that knowledge in any given year is building on units from previous years (ie that units in year 5 are planned with assumption that units in year 4 have been taught).

As stated above, the substantive knowledge (ie the science content) will be taught in units, and the disciplinary knowledge (ie working scientifically) is taught in context. Hierarchical elements of working scientifically will be reflected in the units and therefore this will be built up accordingly. While this will take account of prior knowledge assumptions from the previous key stage, or units, there will also be reminders of prompts and scaffolds to help students.

4. Knowledge selection

We are seeking to support schools to deliver the National Curriculum to children who cannot attend school. Our choice of what to teach will primarily be guided by the content specified in the National Curriculum, but we have also chosen to broaden this to increase challenge and build aspiration (eg include more physics at KS1 and 2, introduce some KS4 concepts in KS3).

5. Inclusive and ambitious

We want Oak to be able to support all children. Our units will be pitched so that children with different starting points can access them. Students need to have a large amount of subject knowledge stored in their long-term memory in order to become competent at any subject, and this is especially true of science, where application is often an application of knowledge. For this reason, these lessons are designed to teach science in a clear and deliberate fashion, emphasising secure content knowledge before moving onto tasks. In this approach the teacher is the subject expert and the emphasis is on instruction and explanation, followed by deliberate practice supported by modelling, guided practice and scaffolding.

6. Pupil engagement

We need pupils to be thinking during science lessons - both to engage with the subject and to strengthen memory of what is being learnt. Our lessons will not be video lectures. We seek to exercise pupils' minds throughout their lessons (based on the principles described in point 5 above). This will involve questions and tasks throughout instruction, just as we would with classroom teaching.

7. Motivation through learning

Like all teachers, we recognise that good presentation helps pupils keep participating in our lessons. However, we are teachers, and not entertainers. We seek to motivate children through our subjects. We believe that what we teach is inherently interesting, and that the joy of learning is our primary motivator. In science, we will provide opportunities where possible for students to engage in home experimentation. We will begin each unit with a summary of the relevant careers for that unit, including those outside of science itself. Units will also include short case studies of work by current and past scientists that reflect the diversity of backgrounds of our children. Finally, we will try to be explicit about the real life relevance of each unit so that it is clear why *this* knowledge is important.

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2. Subject structure overview

KS3 units and KS4 and are presented here in a suggested topic order – for further guidance, see section 3 which provides a suggested route through per year group.

KS3 - Biology			
Year group:	Unit title:	Length of unit*:	Prior knowledge required:
7	7CP Particles	15	Key Stage 2 Particles in physical and chemical changes
7	7BC Cells, tissues and organs	16	Key stage 2 Cells
7	7PE Energy	16	Key Stage 2 Energy
7	7BR Reproduction and variation	12	Key stage 2 Reproductive Cycles
7	7CC Chemical reactions	12	KS2 Physical and Chemical Changes
7	7PF Forces and motion	12	KS2 Forces
7	8BE Ecological relationships and classification	13	KS2 Ecosystems, Adaptations, Humans and animal over time
7	Total	97	
KS3 - Chemistry			
8	8PL Light and space	16	<p>In Key Stage 2, students have been taught to:</p> <ul style="list-style-type: none"> ● recognise that light appears to travel in straight lines ● use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye ● explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes ● use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them. ● describe the movement of the Earth, and other planets, relative to the Sun in the solar system ● describe the movement of the Moon relative to the Earth ● describe the Sun, Earth and Moon as approximately spherical bodies ● use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky
38	8CP Atoms and the periodic table	12	In Key Stage 2, students have been taught about everyday materials:

			<ul style="list-style-type: none"> ● identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses ● compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets ● know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution ● use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating ● give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic ● demonstrate that dissolving, mixing and changes of state are reversible changes ● explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda
8	8BD Digestion and nutrition	11	<p>In year 7 students have learned:</p> <ul style="list-style-type: none"> ● The function of the digestive system ● diffusion and the adaptations of the small intestines for efficient diffusion as part of the work on tissues and organ systems ● The meaning of the term 'semi permeable' or 'partially permeable' ● To compare the energy values in kJ of different foods (from labels)
8	8PE Electricity and magnetism	14	<p>In Key Stage 2, students have been taught to:</p> <ul style="list-style-type: none"> ● identify common appliances that run on electricity ● construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers ● identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery ● recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit ● recognise some common conductors and insulators, and associate metals with being good conductors. ● associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit ● compare and give reasons for variations in how components function, including the brightness of bulbs,

			<p>the loudness of buzzers and the on/off position of switches</p> <ul style="list-style-type: none"> use recognised symbols when representing a simple circuit in a diagram
8	8CM Materials and the Earth	12	<p>In Key Stage 2 Science, students have been taught to:</p> <ul style="list-style-type: none"> Recognise that living things have changed over time and that fossils provide information about living things that inhabited Earth millions of years ago. Compare and group together different types of rock based on their appearance and simple physical properties (Year 3) Describe in simple terms how fossils are formed when things that have lived are trapped within rock (Year 3)
8	9BP Plants and photosynthesis	11	<p>In KS2 students have been taught to:</p> <ul style="list-style-type: none"> describe the basic structure of plants, <i>eg leaf, root, stem, flower</i> In year 7 students should have labelled plant and animal cells, described the function of the organelles, compared plant and animal cells and explained how root hair cells are adapted for their role. They have also described the function of flower parts, explained how pollination occurs and explained different seed dispersal techniques. In year 8, students will have described feeding relationships and food webs, and explained how a changing environment may affect them. They have also explained how carbon is recycled in the Earth's atmosphere through the carbon cycle and the link between human activity and climate change.
8	9PM Matter	9	<p>In Key Stage 3 so far, students have been taught:</p> <ul style="list-style-type: none"> use diagrams with correctly labelled force arrows to display a range of forces in different situations interpret force diagrams to determine the motion of an object calculate pressure, weight and average speed using appropriate equations describe the arrangement of particles in a solid, liquid and gas, and link this to their properties explain changes of state in terms of the particle model
8	Total	85	
KS3 - Physics			
9	9PF Forces in action	9	<p>In Key Stage 3 so far, students have been taught about:</p> <ul style="list-style-type: none"> forces as pushes or pulls, arising from the interaction between two objects using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces forces: associated with [...] rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water forces measured in newtons [...]

			<ul style="list-style-type: none"> ● forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) ● change depending on direction of force and its size. ● pressure measured by ratio of force over area –acting normal to any surface. ● gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, [...]
9	9CR Reactivity	16	<p>In Key Stage 3 so far, students have been taught:</p> <ul style="list-style-type: none"> ● To represent elements & compounds using diagrams and formula ● Definitions for elements, compounds & mixtures ● How to write and interpret chemical formulae ● How to represent reactions using word equations ● Atomic structure – protons and electrons only ● Electron configuration ● The link between outer electron number and group number
9	9CE Energetics and rates	11	<p>So far in KS3, students have learned:</p> <ul style="list-style-type: none"> ● To represent reactions as word and symbol equations ● How to name salts from metal and acids ● About how mass is conserved during chemical reactions ● That energy can be transferred during reactions as light and heat ● About the structure of alkanes
9	9PS Sound waves	9	<p>In Key Stage 2, students have been taught to:</p> <ul style="list-style-type: none"> ● Identify how sounds are made, associating some of them with something vibrating ● Recognise that vibrations form sounds travel through a medium to the ear ● Find patterns between the pitch of a sound and features of the object that produced it ● Find patterns between the volume of a sound and the strength of the vibrations that produced it ● Recognise that sounds get fainter as the distance from the sound source increases
9	9BB Biological systems and processes	12	<p>In Key Stage 2, students have been taught to:</p> <ul style="list-style-type: none"> ● Identify that some animals, including humans, have skeletons for support, movement and protection ● In Key Stage 3 so far, students have been taught: ● describe the relationship between cells, tissues and organs; and describe the function of the main organ systems ● describe the structure of the gas exchange system in humans ● outline reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth
	KS3 Total	421	

11	Total	99	
	KS4 total	322	
	Grand total	743	

9	B1 Cell biology	18	20	<p>In KS3 students have been taught to:</p> <ul style="list-style-type: none"> ● use a microscope to produce an image of a cell in focus ● label plant and animal cells; state the function of the organelles; and compare plant and animal cells ● describe how roots take up minerals, nutrients and water from the soil ● make and record observations and measurements and present data using appropriate methods including tables with repeat measurements ● use basic data analysis to calculate means, plot graphs with line of best fit and use this data to draw conclusions ● relate results to predictions and hypotheses, giving reasoned explanations, and identify further questions from their results ● apply mathematical concepts to use and rearrange equations in order to calculate results, using appropriate SI unit
9	C1 Atomic structure and periodic table	18	19	<p>So far in KS3 students have been taught:</p> <ul style="list-style-type: none"> ● Name, describe and explain changes of state in terms of particles ● classify substances as pure and impure, describe techniques to separate mixtures and interpret a chromatogram ● identify, with reasons, differences between atoms, elements and compounds ● represent chemical reactions as word equations and apply this to the idea of conservation of mass ● explain how an element's position in the periodic table links to its properties ● Describe the structure of an atom and draw electron configuration diagrams for named elements (first 20 only)
9	P3 Particle Model of Matter	11	12	<p>In KS3 students have been taught:</p> <ul style="list-style-type: none"> ● the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure ● changes of state in terms of the particle model ● conservation of mass changes of state [...]

				<ul style="list-style-type: none"> ● describe the factors that affect pressure in fluids ● describe the motion of particles in different states of matter and link this to different behaviours ● compare and explain differences in density between solids, liquids and gases
9	Total	104	108	
10	C2 Bonding	12	13	<p>In KS3 students have been taught to:</p> <ul style="list-style-type: none"> ● describe the arrangement of particles in a solid, liquid and gas, and link this to their properties ● explain changes of state in terms of the particle mode ● represent chemical reactions as word equations and apply this to the idea of conservation of mass <p>In GCSE so far, students have been taught to:</p> <ul style="list-style-type: none"> ● draw and write the electron configuration for atoms ● Describe how atoms become ions
10	B2 Organisation	19	19	<p>In KS3 students have been taught to:</p> <ul style="list-style-type: none"> ● describe and explain the components that make up a balanced diet, describing the consequences of an imbalanced diet ● evaluate how different lifestyles have different energy needs ● describe the symbiotic relationship between bacteria and the human digestive system ● describe how and explain why foods are broken down in the digestive system, in terms of enzymes
10	P1 Energy	14	16	<p>In KS3 students have been taught to:</p> <ul style="list-style-type: none"> ● describe examples of energy transfers ● describe how thermal energy transfers from one place to another ● apply the law of conservation of energy to situations involving energy transfers ● distinguish between power and energy ● compare values of energy and power using appropriate SI values ● compare different fuels and energy resources ● measure extension or compression and relate this to the force applied to a spring and to Hooke's law ● describe energy transfers and conservation of energy for the deformation of objects
10	C3 Quantitative Chemistry	12	15	<p>In KS3 so far, students have been taught to:</p> <ul style="list-style-type: none"> ● represent chemical reactions as word equations and apply this to the idea of conservation of mass <p>IN GCSE so far, students have been taught to:</p>

				<ul style="list-style-type: none"> ● use atomic mass number to work out the number of protons and neutrons
10	B3 Infection and response	12	14	<p>In the GCSE Course so far, students have been taught to:</p> <ul style="list-style-type: none"> ● Label plant, animal and bacterial cell and describe the function of the organelles ● Describe the differences between eukaryotic and prokaryotic cells ● Describe specialised features of given cells ● Explain the reason for the special features in terms of the cells function
10	P2 Electricity	19	21	<p>In KS3 students have been taught to:</p> <ul style="list-style-type: none"> ● describe examples of energy transfers ● apply the law of conservation of energy to situations involving energy transfers ● distinguish between power and energy ● compare values of energy and power using appropriate SI values ● define current, and describe its behaviour in series and parallel circuits ● correctly use apparatus to measure current and potential difference ● identify conductors and insulators and calculate resistance values using appropriate units ● explain how insulators are charged by friction, and describe the forces between charged objects
10	C4 Chemical Change	17	19	<p>In KS3, students have been taught to:</p> <ul style="list-style-type: none"> ● identify substances as acid, alkali or neutral based on observations with indicators and the pH scale ● describe neutralisation in terms of acids and alkalis reacting ● use patterns of reactivity to make predictions for chemical reactions ● link the properties and uses of a metal to its position in the reactivity series
10	B4 Bioenergetics	12	12	<p>In KS3, students have been taught to:</p> <ul style="list-style-type: none"> ● Explain the respiratory system as a mechanism of breathing and gas exchange (to allow substances to diffuse) ● Compare aerobic to anaerobic respiration, and describe the situations in which they occur ● Describe how roots take up minerals, nutrients and water from the soil ● Describe photosynthesis in a word equation representing products and reactants ● Describe how leaves are adapted to carry out photosynthesis

10	P4 Atomic Structure	11	13	<p>In KS3 students have been taught to:</p> <ul style="list-style-type: none"> Describe the structure of an atom and draw electron configuration diagrams for named elements (first 20 only) In KS4 so far (C1 Atomic structure) students have been taught: The relative mass and charge of subatomic particles
10	C5 Energy Changes	10	11	<p>In KS3, students have been taught to:</p> <ul style="list-style-type: none"> use patterns of reactivity to make predictions for chemical reactions link the properties and uses of a metal to its position in the reactivity series describe combustion, thermal decomposition and oxidation, representing them as symbol equations describe the differences between an exothermic and endothermic reaction, and link these to energy
10	C6 Rates of Reaction	15	15	<p>So far in KS3, students have been taught to:</p> <ul style="list-style-type: none"> describe combustion, thermal decomposition and oxidation, representing them as symbol equations 9CE 2 describe how a catalyst affects the rate of a reaction 9CE 3 describe the differences between an exothermic and endothermic reaction, and link these to energy changes
10	P7 Magnetism	10	11	<p>In KS3 students have been taught to:</p> <ul style="list-style-type: none"> draw and interpret simple magnetic field diagrams describe how electromagnets and direct current motors work
10	B7 Ecology	13	18	<p>In KS3, students have been taught to:</p> <ul style="list-style-type: none"> Describe feeding relationships and food webs, and explain how a changing environment may affect them Explain how variation allow organisms to compete, and the way this drives natural selection Describe how a species may become extinct Describe the importance of maintaining biodiversity and how gene banks can be used for preservation
10	Total	176	197	
11	P5 Forces and Motion	20	22	<p>Summary of KS3 KPIs relevant to the topic:</p> <ul style="list-style-type: none"> use diagrams with correctly labelled force arrows to display a range of forces in different situations interpret force diagrams to determine the motion of an object

				<ul style="list-style-type: none"> ● calculate pressure, weight and average speed using appropriate equations ● relate the description of a journey to a distance-time graph ● measure extension or compression and relate this to the force applied to a spring and to Hooke's law ● describe energy transfers and conservation of energy for the deformation of objects ● describe balanced forces in relation to mechanical systems
11	C7 Organic Chemistry	8	15	<p>So far in the GCSE course, students have been taught to:</p> <ul style="list-style-type: none"> ● recognise substances that form covalent molecules ● Draw covalent bonds ● Explain why simple covalent molecules have low melting and boiling points
11	B5 Homeostasis	12	22	<p>In KS3 students have been taught to:</p> <ul style="list-style-type: none"> ● Label the parts of the structure of the male and female reproductive system, and describe their function ● Describe the processes of menstruation and fertilisation, and identify the stages of gestation and birth ● Use ray diagrams to show how images are formed –such as mirrors, pinhole cameras and the human eye
11	C8 Chemical Analysis	9	14	<p>So far in KS3, students have been taught to:</p> <ul style="list-style-type: none"> ● classify substances as pure and impure, and describe techniques to separate mixtures ● represent chemical reactions as word equations and apply this to the idea of conservation of mass <p>So far in the GCSE course, students have been taught to:</p> <ul style="list-style-type: none"> ● describe how mixtures can be separated by distillation, chromatography and filtering
11	C9 Earth and Atmosphere	9	9	<p>In KS3, students have been taught to:</p> <ul style="list-style-type: none"> ● describe the arrangement of particles in a solid, liquid and gas, and link this to their properties ● represent chemical reactions as word equations and apply this to the idea of conservation of mass ● describe the effects of absorption of light in terms of energy ● explain how carbon is recycled in the Earth's atmosphere and link the impact of human activity to climate change

				<ul style="list-style-type: none"> ● describe the process of reflection, absorption and superposition (add or cancel waves)
11	P6 Waves	12	15	<p>In KS3, students have been taught to:</p> <ul style="list-style-type: none"> ● describe how light interacts with different materials ● describe the effects of absorption of light in terms of energy ● use ray diagrams to show how images are formed –such as mirrors, pinhole cameras and the human eye ● compare light, mechanical and sound waves ● describe the process of reflection, absorption and superposition (add or cancel waves) ● compare human and animal auditory ranges using appropriate units ● describe uses of sound and ultrasound, including industrial and medical uses
11	B6 Inheritance	18	24	<p>In KS3, students have been taught to:</p> <ul style="list-style-type: none"> ● Label plant and animal cells; state the function of the organelles; and compare plant and animal cells ● Identify variation between individuals of a species and state the differences between species, describing the difference between continuous and discontinuous variation ● Explain how variation allows organisms to compete, and the way this drives natural selection ● Describe how a species may become extinct ● Describe how genetic material can be inherited, and the role of Watson, Crick, Wilkins and Franklin in the discovery of DNA structure
11	C10 Using Resources	11	15	<p>In KS3, students have been taught to:</p> <ul style="list-style-type: none"> ● describe the arrangement of particles in a solid, liquid and gas, and link this to their properties ● explain changes of state in terms of the particle model ● classify substances as pure and impure, and describe techniques to separate mixtures ● represent chemical reactions as word equations and apply this to the idea of conservation of mass <p>In previous chemistry units, students have been taught to:</p> <ul style="list-style-type: none"> ● describe metallic bonding ● evaluate methods of metal extraction ● Describe what is meant by dynamic equilibrium

				<ul style="list-style-type: none"> ● Explain why industrial conditions are often a compromise
11	P8 Space		4	<p>In KS3 students have been taught to:</p> <ul style="list-style-type: none"> ● use diagrams with correctly labelled force arrows to display a range of forces in different situations ● interpret force diagrams to determine the motion of an object ● calculate pressure, weight and average speed using appropriate equations ● describe how light interacts with different materials ● describe the properties that affect the sizes of gravitational forces between different objects in the Solar system ● calculate the weight of an object on different planets ● compare the relative sizes of different astronomical structures within the universe using astronomical distances

*all unit lengths include two review lessons, but not a summative assessment lesson

3. Suggested sequence

The science curriculum has been planned on the following basis:

- Before KS3, students have been taught the latest KS2 National Curriculum (2014)
- After KS3, most students will go on to study combined science at GCSE level or GCSE single sciences - biology, chemistry and physics
- As a result of this work, the science curriculum has the following features:
- It takes a year-by-year approach to teaching the curriculum
- The content of each year's units is based on the expectation that the relevant content for each given year is taught by the end of the previous year. Schools may choose teach a given year's topic in an earlier year, such that year 8 content is taught in year 7. In these circumstances, it is recommended that content for the previous year is taught first, in this case, the year 7 topics.
- In KS4, the units are based on the AQA specification, and are ordered to ensure that paper 1 content is taught first. In the suggested sequence, they appear in the same order as the specification, except for B7 Ecology and P3 Particles
- There is no expectation that any given unit in one science (eg physics) is taught before any given unit in another (eg biology), with the exception of 7CP Particles which is recommended to be the first unit taught in year 7
- Many topics within any given year can be taught in a different sequence if schools wish (for example, in year 7, 7PE Energy can be taught after 7PF Forces). However, the lesson by lesson

materials have been written with the suggested route through in mind, and schools will have to consider this in their decisions.

- Each year is divided into topics across biology, chemistry, and physics, but equally weighted across these three disciplines
- Working scientifically is integrated into all the topics and can be identified in the learning outcomes in the topic summaries where relevant.
- The working scientifically programme of study is covered throughout both key stages. The suggested map below is based on finishing KS3 in year 9, and starting the first three units of KS4 at the end of year 9
- The KS4 suggested topic sequence has been split below into biology, chemistry, and physics, but the precise ordering between each science (as opposed to within it) is flexible, and a matter for schools to determine. It is expected that schools will alter this according to their staffing context and curriculum time allocation in year 10 and 11.

Year group	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
7	Particles 7CP	Cells, tissues and organs 7BC	Energy 7PE	Reproduction and variation 7BR	Chemical reactions 7CC	Forces and motion 7PF	Ecological relationships and classification 8BE	
8	Light and space 8PL	Atoms and the periodic table 8CP	Digestion and nutrition 8BD	Electricity and magnetism 8PE	Materials and the Earth 8CM	Plants and photosynthesis 9BP	Matter 9PM	
9	Forces in action 9PF	Reactivity 9CR	Energetics and rates 9CE	Sound waves 9PS	Biological systems and processes 9BB	B1 Cells	C1 Atomic Structure and the Periodic table	P3 Particle theory
Bio	B2 Organisation	B3 Infection and response	B4 Bioenergetics	B7 Ecology	B5 Homeostasis	B6 Inheritance		
Chem	C2 Bonding	C3 Quantitative Chemistry	C4 Chemical Change	C5 Energy Changes	C6 Rates of Reaction	C7 Organic Chemistry	C8 Chemical Analysis	C9 Earth and Atmosphere & C10 Using Resources
Phys	P1 Energy	P2 Electricity	P4 Atomic Structure	P7 Magnetism	P5 Forces and Motion	P6 Waves	P8 Space	

4. Unit specifics

7CP Particles

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe how the movement and spacing of the particles is different in solids, liquids and gases. Draw accurate diagrams to represent the particle arrangement in solids, liquids and gases. Use the particle model to explain properties of solids, liquids and gases
2	<ul style="list-style-type: none"> Define the term 'diffusion' Describe diffusion in terms of particles and high and low concentration Explain why diffusion is different in solids, liquids and gases – relate to particle model
3	<ul style="list-style-type: none"> Describe changes of state that occur from solid to liquid and liquid to gas in terms of particles Interpret melting point and boiling point data Plot secondary data showing changes of state
4	<ul style="list-style-type: none"> Describe gas pressure Explain the effect of gas pressure on containers Describe and explain the effect of temperature on gas pressure in terms of particles
5	<ul style="list-style-type: none"> Draw a particle model for a solution. Make accurate measurements to test the conservation of mass theory Explain the meaning of conservation of mass in terms of particles Check for reproducibility
6	<ul style="list-style-type: none"> Define a pure substance and link this to melting and boiling points Define a mixture Describe simple separation techniques
7	<ul style="list-style-type: none"> Identify parts of a mixture to be separated. Write a method for separating a mixture. Name key pieces of equipment and processes for separation to be successful.
8	<ul style="list-style-type: none"> Investigate the change in mass when separating this mixture. Calculate the yield of pure salt from the starting mass Evaluate the method and suggest improvements
9	<ul style="list-style-type: none"> Explain how a simple distillation works Identify hazards and risks and suggest how to reduce them Identify the components of a Liebig condenser and give reasons for this being more suitable than simple distillation equipment

10	<ul style="list-style-type: none"> Identify mixtures using chromatography. Describe how to separate a mixture using chromatography Interpret chromatograms to describe the composition of mixtures.
11	<ul style="list-style-type: none"> Define the term 'solubility' and determine the solubility of a salt in a given solvent Use the particle model to explain solubility Comment on reproducibility and suggest improvements to a method
12	<ul style="list-style-type: none"> Suggest a hypothesis from an observation Describe the effect of temperature on solubility Process and present data in an appropriate form Identify anomalous results Describe and explain patterns in solubility data using knowledge of particle theory
13	<p>Review 1</p> <ul style="list-style-type: none"> Recall key terms, definitions and structures related to Particles Describe ways mixtures can be separated Explain the factors that affect solubility
14	Assessment
15	Review 2

7BC Cells tissues and organs

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Label the parts of the microscope ● Describe how to use a microscope, using key terms correctly ● Calculate magnification
2	<ul style="list-style-type: none"> ● Define the term unicellular and label common features of unicellular organisms ● Name and describe the functions of some of the structures of unicellular organisms ● Describe some uses and dangers of unicellular organisms
3	<ul style="list-style-type: none"> ● Identify variables to change, measure and control to investigate diffusion ● Draw a table for results, including units ● Work safely to collect and record data to test the hypothesis ● Process the data to calculate a mean, accounting for anomalies
4	<ul style="list-style-type: none"> ● Display data appropriately ● Describe and explain patterns using ideas about diffusion ● Describe some examples of diffusion in cells
5	<ul style="list-style-type: none"> ● Label a typical plant cell ● Describe the function of the organelles in plant cells ● Describe how to use a microscope to view plant cells in focus
6	<ul style="list-style-type: none"> ● Identify the organs of a plant and their functions ● Name some of the tissues found in the leaf and describe their job ● Describe ways in which the leaf is adapted to do its job
7	<ul style="list-style-type: none"> ● Label an animal cell and describe what each cell part does ● Prepare a slide of human cells and observe using the microscope. ● Calculate magnification or image/actual size given the equation
8	<ul style="list-style-type: none"> ● Compare plant and animal cells ● Explain those differences in terms of functions of the parts ● Use evidence to make a reasoned argument
9	<ul style="list-style-type: none"> ● Describe features of specialised cells, using key structures ● Describe specialisation to function in a range of animal and plant cells ● Explain how the specialised features enable the cell to carry out its function.
10	<ul style="list-style-type: none"> ● Identify the major organ systems of the human body and describe their main functions ● Describe the organisation of multicellular organisms, in terms of cells, tissues, organs. ● Explain why multicellular organisms need organ systems
11	<ul style="list-style-type: none"> ● Label a diagram of the organs in the digestive system

	<ul style="list-style-type: none"> ● Describe the function of the digestive system ● Describe and explain some of the adaptations of the digestive system and link these to diffusion
12	<ul style="list-style-type: none"> ● Label the parts of the respiratory system ● Describe the path oxygen takes into the blood ● Describe the adaptations of the breathing system to allow efficient diffusion
13	<ul style="list-style-type: none"> ● Describe the composition of the air we breathe in and out ● Explain the results of an experiment to prove the differences ● Collect, display and process data with good resolution and process it appropriately
14	<p>Review 1</p> <ul style="list-style-type: none"> ● Recall key terms, definitions and structures related to cells, tissues, organs and systems ● Describe ways in which cells, tissues and organs are specialised for function ● Explain adaptations in terms of diffusion
15	Assessment
16	Review 2

7PE Energy

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Name the main energy stores and give examples ● Describe energy transfers, identifying pathways ● Apply the conservation of energy to examples
2	<ul style="list-style-type: none"> ● Light and use a Bunsen burner safely ● Use a thermometer accurately ● Calculate averages ● Write a conclusion from whole class data
3	<ul style="list-style-type: none"> ● Calculate energy stores in different contexts ● Calculate the efficiency of energy transfers ● Interpret Sankey diagrams
4	<ul style="list-style-type: none"> ● Identify hazards and risks and suggest appropriate safety measures ● Draw a table for results, including units ● Describe patterns in data collected, using data to back up statements ● Explain how heat is transferred by conduction
5	<ul style="list-style-type: none"> ● Describe how heat transfers occurs by convection ● Explain what is meant by a convection current ● Explain everyday observations using ideas on convection.
6	<ul style="list-style-type: none"> ● Explain how heat is transferred by radiation ● Explain everyday observations using an understanding of absorption and emission of radiation ● Apply knowledge of conduction, convection and radiation to questions.
7	<ul style="list-style-type: none"> ● Write a hypothesis to test based on information about radiation ● Identify variables to change, measure and control to test the hypothesis ● Draw conclusions from evidence collected ● Identify sources of error in the investigation and suggest improvements
8	<ul style="list-style-type: none"> ● Describe an insulator in terms of energy transfers ● Identify methods of reducing energy transfers and explain how they work ● Apply knowledge of conduction, convection and radiation to exam questions
9	<ul style="list-style-type: none"> ● Explain the relationship between energy and power. ● Convert given between watts and kilowatts and hours and minutes ● Use the equation $p=e/t$ to calculate power
10	<ul style="list-style-type: none"> ● Convert between units for power, time and units ● Calculate how much energy devices transfer from their power rating and the time of operation. ● Calculate the costs of running home appliances

11	<ul style="list-style-type: none"> ● Identify variables to change, measure and control given a hypothesis ● Write a method to test the hypothesis, including named equipment ● Identify hazards and risks and suggest ways to reduce these with given equipment ● Collect and record accurate data
12	<ul style="list-style-type: none"> ● Process and display data collected appropriately ● Write a conclusion using data collected ● Compare energy values of different foods from food labels
13	<ul style="list-style-type: none"> ● Describe how fossil fuels are formed. ● Describe how electricity is generated in a fossil fuel power station. ● Explain advantages and disadvantages of fossil fuel use.
14	<ul style="list-style-type: none"> ● Define renewable energy resources and give examples ● Describe how renewable sources produce electricity using energy transfers ● Describe the advantages and disadvantages of different renewable energy sources
15	Review 1
16	Assessment
17	Review 2

7BR Reproduction

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe adaptations of the egg and sperm cells for their job Label diagrams of the human male and female reproductive system Describe the function of each of the parts
2	<ul style="list-style-type: none"> Describe how reproduction takes place in humans Describe the process fertilisation and implantation Explain the role of cilia found in the oviduct
3	<ul style="list-style-type: none"> Describe the development of the foetus and the function of the placenta, umbilical cord and amniotic fluid Explain how the foetus gets its nutrition and oxygen, and how waste is excreted Use data to describe the impact of smoking on the unborn baby
4	<ul style="list-style-type: none"> Describe patterns in secondary data Describe how a baby is born Explain differences in numbers of offspring for different animals
5	<ul style="list-style-type: none"> Describe the process of cell division Describe some of the changes in males and female bodies during puberty Describe the main events in the menstrual cycle
6	<ul style="list-style-type: none"> Identify and describe the function of the parts of the flower Describe pollination and fertilization Describe the formation of seeds and fruit
7	<ul style="list-style-type: none"> Describe how seeds are adapted for specific dispersal mechanisms. Identify variables to change, measure and control Process data collected and use it to describe a relationship
8	<ul style="list-style-type: none"> Explain what is meant by a 'species' Give examples of continuous and discontinuous variation Collect and display data on variation, explaining the choice of graph
9	<ul style="list-style-type: none"> Use and explain a simple model to represent sexual reproduction Compare chromosome content in body cells and gametes Explain why sexual reproduction leads to variation
10	<p>Review 1</p> <ul style="list-style-type: none"> Recall key terms and definitions Use scientific language accurately to correct statements Review and consolidate knowledge
11	Assessment
12	Review 2

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7CC Chemical Reactions

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe evidence for a chemical reaction Apply conservation of mass to simple chemical change Explain why, in terms of particles, mass stays the same in a reaction
2	<ul style="list-style-type: none"> Describe evidence reactions with oxygen Represent oxidation reactions using word equations and diagrams Apply the conservation of mass theory to oxidation reactions
3	<ul style="list-style-type: none"> Identify common hazard symbols and describe appropriate safety precautions Record observations accurately and using good language Classify substances as acid, alkali or neutral using simple indicators
4	<ul style="list-style-type: none"> Use Universal Indicator to determine the pH of a range substances Classify substances as strong or weak acids or alkalis based on their pH Explain why universal indicator is better than simple indicators
5	<ul style="list-style-type: none"> Describe evidence for the reaction of metals and acids Write word equations to represent the reaction of metals and acids Describe the test for hydrogen gas and the positive result
6	<ul style="list-style-type: none"> Describe what happens to the pH when acids are added to alkalis or vice versa Represent the reaction of acids and alkalis using word equations Name the salt produced in acid alkali reactions
7	<ul style="list-style-type: none"> Suggest control variables needed to test a hypothesis Make and record repeatable results and describe how these are recognized Process repeated results appropriately and use them to write a conclusion
8	<ul style="list-style-type: none"> Describe a method to find the best antacid medicine Identify variables to change, measure and control Design a table for results
9	<ul style="list-style-type: none"> Collect accurate results and check for reproducibility Display the results appropriately, explaining the choice of graph Use the results to write a conclusion saying which is the best antacid
10	<p>Review 1</p> <ul style="list-style-type: none"> Recall key terms, definitions and structures related to chemical reactions
11	Assessment
12	Review 2

7PF Forces

Lesson number	Core content
1	<ul style="list-style-type: none"> identify forces in a range of context represent the size and direction of force using arrows use a newton meter to accurately measure force
2	<ul style="list-style-type: none"> Represent the size and direction of force using arrows State whether opposing forces are balanced or unbalanced Describe the effect of balanced and unbalanced forces on the motion of an object Calculate resultant forces
3	<ul style="list-style-type: none"> Measure and record the weight of known masses Correctly plot a graph with a line of best fit Describe the relationship between mass and weight on Earth
4	<ul style="list-style-type: none"> Use an equation to calculate weight Explain why weight changes on different planets Use a rearranged equation to calculate mass
5	<ul style="list-style-type: none"> State what is meant by pressure Use an equation to calculate pressure Apply knowledge to explain why pressure may be high or low in everyday situations
6	<ul style="list-style-type: none"> Formulate a hypothesis to investigate Identify the variables in an investigation Obtain a set of results, Describe the pattern seen in the results
7	<ul style="list-style-type: none"> Present data as a suitable graph Write a conclusion Apply knowledge of resistive forces to explain design modifications
8	<ul style="list-style-type: none"> Use an equation to calculate speed Give the correct units in all cases. Calculate the relative speed of objects passing one another
9	<ul style="list-style-type: none"> Describe the features of distance time graph Use a distance-time graph to calculate speed Represent a journey using a distance time graph
10	<p>Review 1</p> <ul style="list-style-type: none"> Recall key terms, definitions and structures related to forces and speed
11	Assessment
12	Review 2

8BE Ecological relationships and classification

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Interpret food webs ● Describe ways in which animals and plants are interdependent ● Draw and interpret pyramids of number
2	<ul style="list-style-type: none"> ● State the best conditions for decay ● Explain the importance of decay. ● Describe what causes decay ● Explain the design features of a compost bin
3	<ul style="list-style-type: none"> ● Describe how changes in the environment can affect different organisms ● Explain how changes in the environment can affect organisms within a food web ● Explain the process of bioaccumulation
4	<ul style="list-style-type: none"> ● Make and record measurements to estimate a population ● Process results appropriately and compare with given values ● Suggest how to improve accuracy
5	<ul style="list-style-type: none"> ● Make and record measurements to estimate the population of daisies ● Process the results appropriately ● Apply learning to process secondary data
6	<ul style="list-style-type: none"> ● Name the main features of the five chordate groups ● Classify organisms given appropriate information ● Explain the basis of the Linnaeus classification
7	<ul style="list-style-type: none"> ● Suggest things organisms may compete for ● Describe ways in which organisms are adapted to be better competitors ● Explain how these adaptations help them survive in given conditions
8	<ul style="list-style-type: none"> ● Describe ways in which organisms may vary within a species ● Explain why some organisms within a species are better adapted to their environment ● Explain why genetic variation within a species can drive natural selection
9	<ul style="list-style-type: none"> ● Describe evidence for evolution ● Explain how the evidence supports the evolution theory ● Describe the changes that can lead to extinction
10	<ul style="list-style-type: none"> ● Describe the importance of biodiversity ● Describe some of the methods being employed to maintain biodiversity ● Explain how some scientific methods will support maintaining biodiversity
11	<p>Review 1</p> <ul style="list-style-type: none"> ● Recall and apply key knowledge from the ecology SOW



12	Assessment
13	Review 2

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8PL Light and Space

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe some properties of light waves Describe what happens when light meets a surface Draw accurate light ray diagrams to illustrate light travelling and meeting different surfaces
2	<ul style="list-style-type: none"> Identify variables to change, measure and control to test a hypothesis Draw a table for repeatable results and process results appropriately Write a conclusion for the data collected
3	<ul style="list-style-type: none"> Follow a method to test a given hypothesis Make a conclusion from data collected Process secondary data appropriately and use it to check for reproducibility
4	<ul style="list-style-type: none"> Apply the law of reflection to different scenarios Describe properties of reflected images Describe and explain specular and diffuse reflections
5	<ul style="list-style-type: none"> Draw the pathway light takes through a glass block. Measure the angle of refraction using a protractor. Describe how refraction takes place using key words and phrases.
6	<ul style="list-style-type: none"> Label the parts of the eye Use ray diagrams to show how images are formed in pinhole cameras and the eye Describe how an image is formed and how we see
7	<ul style="list-style-type: none"> Safely carry out an eye dissection Describe how the eye focuses on near and far objects Explain the cause of long and short sightedness and how this can be corrected
8	<ul style="list-style-type: none"> List the colours of the visible spectrum. Describe how white light can be dispersed to give a range of different colours. Explain why we see objects as a particular colour.
9	<ul style="list-style-type: none"> Describe and explain how coloured filters change white light. Predict the colours of coloured objects in coloured light Apply knowledge to a range of exam questions
10	<ul style="list-style-type: none"> Describe the term 'non-contact force' and give examples Describe the forces of attraction between the Earth & moon and the Earth and the Sun

	<ul style="list-style-type: none"> Describe the properties that affect the sizes of gravitational forces between different objects in the Solar system
11	<ul style="list-style-type: none"> Describe how gravity varies in the solar system Calculate weight, mass and gravitational field strength on Earth and other planets Change units and express answers to a given number of significant figures
12	<ul style="list-style-type: none"> Use secondary data to describe and explain patterns in year lengths in the solar system Describe and explain differences in day length, position of the sun and temperatures in different seasons Explain why the Earth experiences seasons, but no other planet in the solar system does
13	<ul style="list-style-type: none"> Define a light year and explain why they are used Describe Earth's place in the universe Describe what a star is and why it emits light
14	<p>Review 1</p> <ul style="list-style-type: none"> Recall key terms, definitions and structures related to light, space and gravity Describe how light behaves at different surfaces Apply knowledge to a range of questions
15	Assessment
16	Review 2

8CP Atoms and the periodic table

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Define elements, name the two types of elements and locate them on the periodic table ● Recognize elements from drawings or names ● Describe the rules for writing chemical symbols
2	<ul style="list-style-type: none"> ● Label a diagram of the atom and describe its structure ● Draw and write electron configuration for any of the first 20 elements ● Describe the link between electron configuration and place in the periodic table
3	<ul style="list-style-type: none"> ● Describe some properties and uses of metals and non-metal elements ● Describe some of the stages in the formation of the periodic table ● Explain how the properties of the elements were used in early versions of the periodic table
4	<ul style="list-style-type: none"> ● Describe compounds and use particle diagrams to represent them ● Make a simple compound and explain how it is different from the elements it is made of ● Name compounds given the elements contained
5	<ul style="list-style-type: none"> ● Name compounds given the elements or formulae ● Write formula using ideas of valency ● Interpret formulae in terms of number of each atom are present
6	<ul style="list-style-type: none"> ● Safely make a compound and predict the change in mass during the reaction ● Make accurate measurements to test the prediction made ● Use data collected to check the prediction and explain observations
7	<ul style="list-style-type: none"> ● Apply conservation of mass ideas to physical and chemical changes ● Plot secondary data and draw a line of best fit ● Describe and explain patterns in data ● Use secondary data to check for reproducibility
8	<ul style="list-style-type: none"> ● Describe some of the properties of group 1 elements ● Describe trends in physical and chemical properties of group 1 ● Write word (or symbol) equations to represent their reaction with oxygen and water
9	<ul style="list-style-type: none"> ● Describe trends in physical properties of group 7 ● Describe the trend in reactivity of group 7 ● Write word equations to represent their reaction with iron
10	<p>Review 1</p> <ul style="list-style-type: none"> ● identify, with reasons, differences between atoms, elements and compounds

	<ul style="list-style-type: none">represent chemical reactions as word equations and apply this to the idea of conservation of massexplain how an element's position in the periodic table links to its properties and reactivity (groups 1 and 7)
11	Assessment
12	Review 2

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8BD Digestion

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Name the components of food and describe what each is needed for in the body ● Interpret and make calculations from nutrition labels ● Calculate energy requirements for different activities
2	<ul style="list-style-type: none"> ● Describe some of the diseases linked with nutrient deficiency ● Describe some of the diseases linked with imbalances in energy intake ● Interpret data on the incidence of food related diseases
3	<ul style="list-style-type: none"> ● State uses for the energy released ● Describe how energy is released from the food we eat ● Evaluate a model for respiration
4	<ul style="list-style-type: none"> ● Describe the difference between the two carbohydrates ● Describe how to test for starch and sugar and their positive result ● Work safely to carry out chemical tests for the presence of starch and sugar and record the results
5	<ul style="list-style-type: none"> ● Describe the chemical test for protein and fat and their positive results ● Safely carry out the tests for protein and fat and record the results ● Use the results collected to draw conclusions
6	<ul style="list-style-type: none"> ● Explain why digestion is necessary ● Label the organs of the digestive system and describe their function ● Explain the importance of gut bacteria ● Describe how the intestines are adapted for their function
7	<ul style="list-style-type: none"> ● Describe the action of the enzymes in the digestive system ● Explain the results of the 'model gut' experiment ● Evaluate the model
8	<ul style="list-style-type: none"> ● Identify variables to change, measure and control to test a hypothesis ● Draw a table to record results ● Draw a conclusion from results obtained
9	<p>Review 1</p> <ul style="list-style-type: none"> ● recall key terms, definitions and structures related to digestion and nutrition ● Use scientific language accurately to correct statements ● describe how temperature affects enzyme activity
10	Assessment
11	Review 2

8PE Electricity and Magnetism

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Name common circuit symbols ● Make basic observations on what is needed for a circuit to work ● Use a model to describe electricity
2	<ul style="list-style-type: none"> ● Use an ammeter to make and record measurements of current at different points in a series circuit ● Describe how current behaves in a series circuit ● Describe and explain the effect of adding extra bulbs on current
3	<ul style="list-style-type: none"> ● Recognise and draw parallel circuits ● Make and record measurements of current in parallel ● Describe how current behaves in parallel ● Make predictions for untested circuits.
4	<ul style="list-style-type: none"> ● Describe potential difference using a model ● Use a voltmeter to measure potential difference across components ● Describe pd in series and parallel circuits
5	<ul style="list-style-type: none"> ● Investigate the relationship between current, pd and resistance ● Use data collected to inform a conclusion ● Use an equation to calculate current, pd or resistance
6	<ul style="list-style-type: none"> ● Identify variables to change, measure and control ● Collect and display results appropriately ● Describe and explain the effect of length of wire on resistance
7	<ul style="list-style-type: none"> ● Describe what is meant by static electricity ● Describe how objects can become charged ● Describe how the charge can produce a force between charged objects
8	<ul style="list-style-type: none"> ● Draw the field lines around a magnet ● Describe the magnetic field around a magnet, or the Earth, using fields lines ● Explain attraction and repulsion of magnets using field line patterns.
9	<ul style="list-style-type: none"> ● Describe how to make a simple electromagnet ● Draw the shape of the magnetic field around a straight wire ● Identify key variables for an investigation of electromagnets
10	<ul style="list-style-type: none"> ● Investigate the factors which affect the strength of an electromagnet ● Plot a graph of data ● Analyse secondary data to draw conclusions
11	<ul style="list-style-type: none"> ● To state how electromagnets are used in a variety of devices ● To understand how the motor effect is caused by magnetic fields ● To state the factors affecting the speed of a direct motor



12	Review 1
13	Assessment
14	Review 2

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8CM Materials and the Earth

Lesson number	Core content
1	<ul style="list-style-type: none"> Label a diagram showing the structure of the Earth and compare the layers in terms of composition, thickness and temperature Explain how the continents move Describe some of the evidence for ‘continental drift’
2	<ul style="list-style-type: none"> Describe the formation of intrusive and extrusive igneous rocks Explain the link between cooling rate and crystal sizes Describe the properties of igneous rock
3	<ul style="list-style-type: none"> Describe the weathering, transportation and deposition of rocks at the Earth’s surface Describe the formation of sedimentary rocks Describe the properties of sedimentary rocks
4	<ul style="list-style-type: none"> Describe the formation of metamorphic rocks Describe the properties of metamorphic rocks Apply knowledge of all 3 rock type formations to questions on the rock cycle
5	<ul style="list-style-type: none"> Describe how fossils are formed Explain how fossils move to the surface of the Earth Interpret diagrams to identify the relative age of fossils
6	<ul style="list-style-type: none"> Describe the composition of crude oil using key words Draw the first 5 alkanes Evaluate the extraction and use of crude oil
7	<ul style="list-style-type: none"> Compare the earth’s early atmosphere to the atmosphere today Explain why carbon dioxide and oxygen levels changed in Earth’s early history Describe the main processes involved in the cycling of carbon
8	<ul style="list-style-type: none"> Describe the greenhouse effect Explain the significance of an increased greenhouse effect Describe some of the potential consequences of climate change
9	<ul style="list-style-type: none"> Describe some of the properties of ceramics, polymers and composites Interpret secondary data Explain the importance of reducing, reusing and recycling
10	<p>Review 1</p> <ul style="list-style-type: none"> Recall key terms and definitions Use scientific language accurately to correct statements
11	Assessment
12	Review 2

9BP Plants and Photosynthesis

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe the function of the root and root hair cells Compare root hair cells to ‘typical’ plant cells Explain how the adaptations of the root are related to its function
2	<ul style="list-style-type: none"> Identify the reactants and products of photosynthesis Describe photosynthesis using a word equation Interpret and draw conclusions from data
3	<ul style="list-style-type: none"> identify hazards and risks and suggest appropriate ways to reduce the risks Make observations and describe results Draw conclusions from results related to photosynthesis
4	<ul style="list-style-type: none"> Identify factors to change, measure and control to test a hypothesis Collect and display data appropriately Draw conclusions from data collected
5	<ul style="list-style-type: none"> Describe how leaves are adapted for their function Use a microscope correctly to observe stomata Explain how features enable the leaf to do its job
6	<ul style="list-style-type: none"> Label the xylem and phloem Describe the role of the xylem and phloem in transporting water and sugars Describe the path of water and glucose around the plant
7	<ul style="list-style-type: none"> Describe how carbon dioxide and oxygen levels have changed over the Earth’s history Explain how plants have affected the levels of oxygen and carbon dioxide in the atmosphere Describe and explain recent human activities that are affecting carbon dioxide levels.
8	<ul style="list-style-type: none"> Describe the role of plants as producers Test for starch in common diet items Describe the importance of insect pollination to food security
9	<p>Review 1</p> <ul style="list-style-type: none"> Recall key terms, definitions and structures related to biological systems and processes Use scientific language accurately to correct statements Review and consolidate knowledge
10	Assessment
11	Review 2

9PM Matter

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Describe the arrangement and motion of particles in a solid, liquid and gas ● Define diffusion in terms of particle concentration and explain effect of temperature on diffusion ● Explain changes of state in terms of particles
2	<ul style="list-style-type: none"> ● Explain observations using particle model and density ● Compare densities and predict if objects will float or sink ● Calculate the density of regular objects
3	<ul style="list-style-type: none"> ● Define diffusion and Brownian motion ● Describe how diffusion affects a substance in solution or the air ● Explain why diffusion is passive using Brownian motion
4	<ul style="list-style-type: none"> ● Describe the action of pressure in liquids and the cartesian diver ● Describe how the pressure changes as you go deeper in a liquid ● Calculate pressure and forces in hydraulic systems
5	<ul style="list-style-type: none"> ● Describe the effect of upthrust on the weight of objects ● Explain why objects float in terms of resultant forces ● Explain how upthrust can vary in water
6	<ul style="list-style-type: none"> ● Define atmosphere and describe how atmospheric pressure is caused ● Explain how changes in atmospheric pressure can happen and what the effects are ● Calculate percentage change
7	<p>Review 1</p> <ul style="list-style-type: none"> ● Recap aspects of the matter topic ● Practice recall of key facts, skills and answering exam questions
8	Assessment
9	Review 2

9PF Forces in Action

Lesson number	Core content
1	<ul style="list-style-type: none"> Identify pivots and levers Calculate moments Explain why levers are force multipliers
2	<ul style="list-style-type: none"> Explain, in terms of turning forces, how an object can be made to balance. Collect data to test a hypothesis Use the moment equation to calculate force needed or distance to make turning forces balance.
3	<ul style="list-style-type: none"> Define and calculate work done Use the formula for work done to calculate work done, force or distance Change units where appropriate and round answers to 3 significant figures
4	<ul style="list-style-type: none"> Define and give examples of simple machines Describe how some simple machines work Process and describe patterns in secondary data
5	<ul style="list-style-type: none"> Identify variables to change and measure to test a hypothesis Design a table to ensure repeatable readings Collect, process and display repeatable data
6	<ul style="list-style-type: none"> Recognise and explain what is meant by 'elastic limit' Use Hooke's Law to calculate force, extension or spring constant Describe a use of an elastic object and explain the significance of Hooke's Law in context
7	<p>Review 1</p> <ul style="list-style-type: none"> Recall definitions and equations covered in the unit Apply knowledge to a range of exam style questions Change units, rearrange formula and round answers where appropriate
8	Assessment
9	Review 2

9CR Reactivity

Lesson number	Core content
1	<ul style="list-style-type: none"> Use the periodic table to work out numbers of protons, neutrons and electrons Draw and write the electron configuration for given atoms Explain why most atoms react but group 0 do not
2	<ul style="list-style-type: none"> Draw and describe the formation of ions Describe the formation of one type of chemical bond Describe the link between place in the periodic table and the ion formed
3	<ul style="list-style-type: none"> Write and interpret chemical formulae Calculate relative formula mass Balance symbol equations
4	<ul style="list-style-type: none"> Record observations and evidence for a chemical reaction Write word (balanced symbol) equations for the reactions of metals and acids Describe the test for hydrogen gas
5	<ul style="list-style-type: none"> Write equations to describe the reactions of metal oxides and acids Describe the steps in the production of a salt from a given metal oxide and an acid Compare the reactions of metal oxides with those of metals and acids.
6	<ul style="list-style-type: none"> Make and record observations of evidence for a chemical reaction Write word and symbol equations for the reaction of metal carbonates with acids Describe the test for carbon dioxide and the positive result
7	<ul style="list-style-type: none"> Write word equations to represent the products and reactants in acid and alkali reactions Collect repeatable measurements and calculate a mean Describe a method to produce crystals of a named salt.
8	<ul style="list-style-type: none"> Choose appropriate chemicals and equipment to prepare a given salt Write a risk assessment for the chosen practical Produce a detailed method or flowchart showing how to prepare crystals of the salt
9	<ul style="list-style-type: none"> Describe the reactivity series for metals Use the reactivity series to predict a reaction Write word and symbols equations to represent the reactions
10	<ul style="list-style-type: none"> Explain why most metals are not found in their element form Describe how metals can be extracted using carbon Write word and symbol equations to represent the reactions

11	<ul style="list-style-type: none"> • Use the reactivity series to predict whether a reaction will occur • Make and record observations for evidence for a reaction • Write word and symbol equations to represent reactions seen.
12	<ul style="list-style-type: none"> • Link properties of metals to their uses • Describe the difference between a pure metal and an alloy • Explain why alloys are more useful than pure metal
13	<ul style="list-style-type: none"> • Form a hypothesis to investigate • Identify variables to change, measure and control • Produce a table of results to test the hypothesis • Form a conclusion based on evidence collected and back it up with data • Check the reproducibility of the conclusion
14	<p>Review 1</p> <ul style="list-style-type: none"> • Recall and apply knowledge from unit 9CR • Use good scientific terminology to correct poorly written statements
15	Assessment
16	Review 2

9CE Energetics

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe ways to measure the rate of a reaction Collect and correctly record data to measure the rate of a given reaction Display the data appropriately
2	<ul style="list-style-type: none"> Take readings from reaction rate curves Describe how and explain why reaction rate changes during a reaction Process secondary data, identifying anomalies, calculation means and rounding answers to the correct number of decimal places.
3	<ul style="list-style-type: none"> Identify variables to change, measure and control to test a hypothesis Collect and display data appropriately Describe and explain the effect of concentration on the rate of reaction
4	<ul style="list-style-type: none"> Identify variables to change, measure and control to test the given hypothesis Process and display data appropriately Describe and explain the effect of surface area on the rate of reaction
5	<ul style="list-style-type: none"> Describe what a catalyst is and how it affects the rate of a reaction Perform a fair comparison of three catalyst sources Describe the test for oxygen and its positive result
6	<ul style="list-style-type: none"> Define endothermic and exothermic reactions Recognize endothermic and exothermic reactions from temperature changes Make and explain suggestions to changes in the equipment that would improve the data collected.
7	<ul style="list-style-type: none"> Define a combustion reaction Explain what is meant by complete and incomplete combustion and name the products Compare complete and incomplete combustion
8	<ul style="list-style-type: none"> Define thermal decomposition Write word and symbol equations to represent thermal decomposition reactions Carry out a thermal decomposition reaction and explain it in terms of conservation of mass
9	<p>Review 1</p> <ul style="list-style-type: none"> Recall key terms, definitions and structures related to energetics and rates Use scientific language accurately to correct statements
10	Assessment
11	Review 2

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9PS Sound waves

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Label the main features of a wave diagram ● Compare light and sound waves ● Describe what happens when waves meet
2	<ul style="list-style-type: none"> ● Describe how pitch and loudness of sounds are determined ● Interpret oscilloscope traces ● Describe what happens when sound meets a surface
3	<ul style="list-style-type: none"> ● Calculate the speed of sound in air, identifying anomalies ● Calculate uncertainty in the results and suggest sources of error ● Describe how and explain why the speed of sound varies in different media in terms of particles
4	<ul style="list-style-type: none"> ● Describe how sounds are heard ● Explain what is meant by 'hearing range' and how this differs with age and in different animals ● Measure the loudness of common sounds using appropriate units
5	<ul style="list-style-type: none"> ● Describe what is meant by ultrasound ● Describe uses of ultrasound ● Explain how the sound waves are used in given contexts
6	<ul style="list-style-type: none"> ● Describe how a microphone works ● Describe how a loudspeaker works ● Explain why the frequency of the sound produced in the speaker is the same as the original sound wave
7	<p>Review 1</p> <ul style="list-style-type: none"> ● Recall key terms and definitions ● Use scientific language accurately to correct statements ● Review and consolidate knowledge
8	Assessment
9	Review 2

9BB Biological Systems and Processes

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe the functions of the skeletal system Describe the role of different parts of joints Describe the function and give examples of antagonistic muscle pairings
2	<ul style="list-style-type: none"> Identify major muscle groups involved in common movements Describe how some of the muscular tissue in our organs work Measure the force of some of the skeletal muscles in the body
3	<ul style="list-style-type: none"> Describe the function of the structures in the respiratory system Describe, using knowledge of diffusion, how gases are absorbed from the alveoli into the blood stream Explain how alveoli are adapted for their function
4	<ul style="list-style-type: none"> Explain the process involved in breathing Compare lung volumes in boys and girls Calculate means and identify the range in data collected
5	<ul style="list-style-type: none"> Describe the effects of exercise on the respiratory system Explain the effects of exercise on the respiratory system Compare aerobic and anaerobic respiration
6	<ul style="list-style-type: none"> Describe the effects of cigarettes on the tissues of the lungs and on gaseous exchange Describe and explain the impacts on the health of smokers and their unborn babies Describe trends in secondary data
7	<ul style="list-style-type: none"> Describe the effects of alcohol on the body and behaviour Describe the effects of alcohol on health and the developing foetus Display secondary data appropriately
8	<ul style="list-style-type: none"> Define the term DNA, gene and chromosome Describe the work of Franklin, Wilkins, Watson and Crick Create a model of DNA
9	<ul style="list-style-type: none"> Use genetic terms correctly Draw a simple Punnett square to show inheritance Determine the probability of offspring displaying a particular characteristic
10	<p>Review 1</p> <ul style="list-style-type: none"> Recall key terms, definitions and structures related to biological systems and processes Use scientific language accurately to correct statements Review and consolidate knowledge



11	Assessment
12	Review 2

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B1 Cells], Year 9/10

Lesson number	Core content
1	<ul style="list-style-type: none"> • Label plant, animal and bacterial cell and describe the function of the organelles • Describe the differences between eukaryotic and prokaryotic cells • Make order of magnitude calculations • Compare different types of cells
2	<ul style="list-style-type: none"> • Describe the differences between images produced by light and electron microscopes • Explain how electron microscopes have enhanced our understanding of cell structures and processes • Explain what is meant by resolution and magnification
3	<ul style="list-style-type: none"> • Describe how to use a microscope to view plant cells in focus • View plant cells and make accurate drawings • Use the equation $M=I/A$ to calculate any value given the other two • Change the units if necessary
4	<ul style="list-style-type: none"> • Find and view animal cells using a microscope • Use the magnification equation to calculate the magnification, image or actual size • Compare the size of cells and organelles
5	<ul style="list-style-type: none"> • Describe specialised features of given cells • Explain the reason for the special features in terms of the cells function • Explain the importance of cell differentiation.
6	<ul style="list-style-type: none"> • Describe and explain the results of an investigation on diffusion • Describe how substances move in and out of cells by diffusion, giving examples • Describe and explain factors that can affect the rate of diffusion
7	<ul style="list-style-type: none"> • Calculate surface area to volume ratios • Explain the need for internal surfaces and circulatory systems in larger organisms • Describe and explain the adaptations in plants and animals for the exchange of materials
8	<ul style="list-style-type: none"> • Define the term osmosis and give some examples in living things • Use a microscope to observe osmosis and sketch the cells seen • Explain the changes to the cells
9	<ul style="list-style-type: none"> • Identify variables to change, measure and control to test a hypothesis • Explain reasons for given method steps • Make and record accurate mass measurements
10	<ul style="list-style-type: none"> • Measure change in mass accurately and calculate percentage change

	<ul style="list-style-type: none"> Display and interpret results appropriately Describe and explain the patterns in the results
11	<ul style="list-style-type: none"> Describe how substances are taken up by active transport Compare diffusion, osmosis and active transport Apply knowledge to exam questions
12	<ul style="list-style-type: none"> Identify DNA, genes, chromosomes on a diagram Describe the main stages in the cell cycle Use information provided to calculate time spent in different phases
13	<p>GCSE Biology only</p> <ul style="list-style-type: none"> Calculate the number of bacteria in a population given mean division time Describe how to produce an uncontaminated culture of bacteria using aseptic technique Identify variables to change, measure and control to test the action of disinfectants or antibiotics
14	<p>GCSE Biology only</p> <ul style="list-style-type: none"> Make and record accurate measurements Describe conclusions from the data and use data to support Check for reproducibility in the conclusions Calculate the area of the clear zone using πr^2
15	<ul style="list-style-type: none"> Name sources of stem cells and their uses Describe some potential uses of stem cell technology Evaluate different stem cell sources
20	Review 1
21	Assessment
22	Review 2

[B2 Organisation, Year 10]

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe how to test for starch, sugars, proteins and fats Describe the positive and negative results of these tests Describe the safety precautions needed
2	<ul style="list-style-type: none"> Describe the structure and function of the digestive system Describe the action of enzymes in digestion using the 'lock and key' model Name the 3 main digestive enzymes, where they are produced and the substrate and products of their action
3	<ul style="list-style-type: none"> Describe the purpose and action of acid and bile in the digestive system Describe the process of absorption and how the intestines are well adapted for this Describe uses for the absorbed food particles
4	<ul style="list-style-type: none"> Describe ways to measure the rate of enzyme action Identify variables to change measure and control to test the effect of temperature on enzyme action Describe and explain the effect of temperature on the rate of enzyme action
5	<ul style="list-style-type: none"> Identify variables to change, measure and control to test a hypothesis Collect and record data accurately Process and display the results appropriately Describe and explain the effect of pH on enzyme activity
6	<ul style="list-style-type: none"> Describe and explain the effect of pH on amylase activity Suggest improvements to the method Apply knowledge and understanding to secondary investigations
7	<ul style="list-style-type: none"> Label the major structures in the lungs Describe gaseous exchange Describe and explain how the lungs are adapted for efficient gaseous exchange.
8	<ul style="list-style-type: none"> Describe the components of the blood and their function Describe the structure and function of arteries and veins Explain how blood components and blood vessels are adapted for their function
9	<ul style="list-style-type: none"> Label the major structures in the heart Describe the path blood takes through the heart and around the body Calculate blood flow using appropriate equations Describe how heart rate is controlled
10	<ul style="list-style-type: none"> Describe some of the causes of heart disease Explain how coronary heart disease can lead to a heart attack Evaluate treatments for heart disease

11	<ul style="list-style-type: none"> Describe some risk factors for diseases Explain the impacts of lifestyle choices and disease at local, national and global levels Analyse and interpret secondary data on disease incidence rates
12	<ul style="list-style-type: none"> Describe how cancer forms in the body Describe the risk factors associated with cancer development Explain the difference between 'benign' and 'malignant' tumours Explain how malignant cancer can spread
13	<ul style="list-style-type: none"> Describe the job of the different types of plant tissue and how they are adapted for function Describe the structure of a leaf and how it is adapted for gas exchange Explain the function and location of stomata
14	<ul style="list-style-type: none"> Describe the movement of water and dissolved sugars around the plant Describe factors that can affect the rate at which water moves Explain how changes in temperature, humidity, air movement and light intensity affect rates of water movement
15	Review 1
16	Assessment
17	Review 2

B3 Infection & Response, Year 10

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Name the cause of infectious disease and describe how they make us ill ● Describe how pathogens can be spread, and how this spread can be reduced ● Describe the main defence mechanisms of the body
2	<ul style="list-style-type: none"> ● Describe the symptoms, spread and prevention of the viruses measles, HIV and TMV ● Describe the symptoms, spread and prevention of bacterial diseases salmonella and gonorrhoea ● Explain why antibiotics can be used to treat bacterial infections but not viral ones. ● Process secondary data related to infection rates
3	<ul style="list-style-type: none"> ● Describe the symptoms, spread and prevention of rose black spot ● Describe the spread, symptoms and prevention of malaria ● Explain what is meant by the term 'vector'
4	<ul style="list-style-type: none"> ● Describe how white blood cells respond to destroy pathogens ● Explain the difference between the primary and secondary response ● Explain what is meant by immunity
5	<ul style="list-style-type: none"> ● Describe what is in a vaccine ● Explain how vaccines prevent infection ● Explain the advantages of large scale vaccination
6	<ul style="list-style-type: none"> ● Explain the difference between antibiotics and over the counter medications ● Collect data on the action of different antibiotics and process it appropriately ● Use the data collected to draw conclusions
7	<ul style="list-style-type: none"> ● Describe the stages in developing new drugs to treat disease ● Describe the use of placebos and explain why they are needed ● Explain how a double blind trial is carried out
8	<p>GCSE Biology only</p> <ul style="list-style-type: none"> ● Describe how monoclonal antibodies are made ● Describe some uses of monoclonal antibodies ● Explain why monoclonal antibodies are not as widely used as first hoped
9	<p>GCSE Biology only</p> <ul style="list-style-type: none"> ● Describe physical and chemical defences in plants to prevent infectious disease ● Describe the use of nitrate and magnesium ions by plants ● Describe the symptoms shown by plants deficient in these ions
10	Review 1
11	Assessment

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B4 Bioenergetics, Year 10

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Name the reactants and products needed for photosynthesis and represent it using a word and symbol equation ● Describe the uses for the glucose made during photosynthesis ● Carry out a test for starch and explain the results
2	<ul style="list-style-type: none"> ● Identify variables to change, measure and control to test a hypothesis ● Explain the steps in a given method to test a hypothesis ● Collect and record data to test the hypothesis
3	<ul style="list-style-type: none"> ● Plot a graph of the data collected ● Describe and explain the relationship between light intensity and rate of photosynthesis ● Describe and explain the effect of carbon dioxide concentration and temperature on the rate of photosynthesis
4	<ul style="list-style-type: none"> ● Interpret graphs of photosynthesis rate with multiple factors and decide which is limiting ● Describe some ways of manipulating conditions for plant growth ● Evaluate these methods
5	<ul style="list-style-type: none"> ● Define respiration and explain its importance in the body ● Describe the changes in the body during exercise ● Explain why these changes are necessary
6	<ul style="list-style-type: none"> ● Describe the consequences of anaerobic respiration ● Explain the results of a simple experiment into anaerobic respiration using knowledge and understanding ● Compare aerobic respiration with anaerobic respiration
7	<ul style="list-style-type: none"> ● Define the term metabolism ● Give examples of reactions in metabolism ● Describe the formation of lipids, amino acids and urea
8	Review 1
9	Assessment
10	Review 2

B5 Homeostasis, Year 11

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe the role of receptors, neurons and effectors in responding to a stimulus Collect data on skin receptors and write a conclusion using data collected Describe an appropriate response pathway to any given stimulus
2	<ul style="list-style-type: none"> Describe what is meant by a reflex and give some examples Explain the difference between a reflex and a conscious action Label a diagram of a reflex arc, using key terms correctly Describe how nerve cells communicate with each other in a simple reflex action
3	<ul style="list-style-type: none"> Identify the hypothesis and variables from a given method Collect and record data accurately Process and display data collected (including uncertainties if appropriate) Write a conclusion using evidence collected
4	<ul style="list-style-type: none"> Decide on the reproducibility of class data Evaluate the practical procedure Describe and explain patterns in secondary data
5	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> Name the main parts of the brain and describe their function Describe how knowledge of the brain has developed Evaluate the benefits and risks of procedures carried out on the brain and nervous system
6	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> Label the parts of the eye and describe their functions Describe how the eye responds to changes in light levels Describe how the eye focuses on near and far objects
7	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> Explain how defects of the eye can lead to short and long sightedness Explain how treatments of long and shortsightedness work Interpret ray diagrams that show long and short sightedness and how these are treated with lenses
8	<ul style="list-style-type: none"> Describe how the endocrine system brings about responses in the body Label the main endocrine glands of the body Compare hormonal responses with nervous responses Describe the action of thyroxine and adrenaline (HT) Explain the concept of negative feedback (HT)
9	<ul style="list-style-type: none"> Define homeostasis and give examples of conditions kept constant inside the body Explain the importance of homeostasis in terms of enzymes and osmosis

	<ul style="list-style-type: none"> • (HT) describe the general concept of negative feedback
10	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> • Describe how body temperature is monitored • Describe the responses to a rise or drop in core body temperature • Explain how these mechanisms restore body temperature
11	<ul style="list-style-type: none"> • Describe how blood glucose levels are monitored • Explain the response to an increase in blood glucose • Explain how insulin controls blood glucose levels in the body • (HT) Explain the role of glucagon in blood sugar level maintenance and how negative feedback is used
12	<ul style="list-style-type: none"> • Compare Type 1 and Type 2 diabetes • Describe some treatments for both types of diabetes • Interpret data from graphs on the effect of insulin on blood glucose in people with diabetes
13	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> • Describe ways in which water is gained and lost by the body • Describe how water levels are monitored • Describe the response when water levels in the body varies
14	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> • Describe the function of the kidneys in producing urine • Describe and explain the differences in blood composition before and after filtration • Explain the role of ADH in water balance
15	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> • Interpret secondary data on blood composition before and after filtration • Describe how dialysis works • Evaluate the treatment of kidney failure by dialysis or transplant
16	<ul style="list-style-type: none"> • Describe the roles of male and female reproductive hormones • Explain the interactions of FSH, LH, oestrogen and progesterone in the menstrual cycle (HT) • Extract and use information from graphs showing hormone levels
17	<ul style="list-style-type: none"> • Describe how fertility drugs and IVF work • Interpret secondary data on fertility treatments and IVF • Evaluate fertility treatments from the perspective of doctors and patients
18	<ul style="list-style-type: none"> • Describe how different methods of contraception prevent pregnancy • Interpret data on the effectiveness of contraception methods • Evaluate different hormonal and non-hormonal methods
19	GCSE Biology only:

	<ul style="list-style-type: none"> ● Describe the responses to light and gravity by plants ● Describe how growth is achieved in roots and shoots ● Investigate the effect of light or gravity on seedlings. ● Describe the role of gibberellins and ethane (HT)
20	GCSE Biology only: <ul style="list-style-type: none"> ● Display results appropriately ● Draw conclusions consistent with results from the seedling practical ● Describe uses of plant hormones in agriculture and the food industry ● Interpret secondary data on the effect of hormones
21	Review 1
22	Assessment
23	Review 2

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B6 Inheritance & evolution, Year 11

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Describe the main features of meiosis ● Compare mitosis with meiosis ● Explain the importance of meiosis in reproduction
2	<ul style="list-style-type: none"> ● Describe sexual and asexual reproduction in animals and plants ● Explain why asexual reproduction leads to identical offspring ● Explain why sexual reproduction leads to variation
3	GCSE Biology only <ul style="list-style-type: none"> ● Describe the advantages and disadvantages of sexual and asexual reproduction ● Give examples of organisms that can reproduce by both methods ● Apply knowledge to novel organisms
4	<ul style="list-style-type: none"> ● Define and recognize diagrams of DNA, genes and chromosomes ● Describe the structure and function of DNA ● Describe the advantages of understanding the human genome
5	GCSE Biology only <ul style="list-style-type: none"> ● Describe how DNA bases code for proteins ● Describe protein synthesis ● Explain how mutations can affect the protein made
6	<ul style="list-style-type: none"> ● Construct and interpret genetic diagrams. ● Calculate the probability of inheriting particular characteristics given information about the parents ● Use genetic terms to describe parents & offspring characteristics
7	<ul style="list-style-type: none"> ● Describe the symptoms of the genetic diseases cystic fibrosis & polydactyly ● Use genetic cross diagrams and family tree diagrams to calculate probability of offspring inheriting these diseases ● Evaluate the use of embryo screening for inherited disorders
8	<ul style="list-style-type: none"> ● Name and recognise the chromosomes that determine sex ● Construct and interpret diagrams to show how sex is inherited ● Interpret family tree diagrams to explain the pattern of inheritance
9	GCSE Biology only: <ul style="list-style-type: none"> ● Describe the work of Gregor Mendel ● Interpret his results and describe how it furthered our understanding of genetics ● Explain why Mendel's work was not accepted until after his death
10	<ul style="list-style-type: none"> ● Describe reasons for extensive variation within species ● Describe the effects of mutations ● Explain how variation can lead to evolution by natural selection

11	<ul style="list-style-type: none"> Describe the theory of evolution Interpret evolutionary trees Explain why some organisms are now extinct
12	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> Compare Lamarck's model for evolution with Darwin's Describe the work of Darwin and Wallace in the development of evolutionary theory Explain why many of these ideas were controversial
13	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> Define the terms species and speciation Describe how different species can arise from a common ancestor Describe Wallace's work on speciation
14	<ul style="list-style-type: none"> Describe some of the ways fossils are produced Explain how this and other evidence gives us information about the development of life on earth Explain why we cannot be certain about how life on earth began
15	<ul style="list-style-type: none"> Describe how bacteria have evolved to become resistant to antibiotics Describe ways of reducing the development of antibiotic resistant bacteria Evaluate the use of antibiotics in agriculture
16	<ul style="list-style-type: none"> Describe the process of selective breeding in plants and animals Explain the impact of selective breeding Evaluate the use of selective breeding in food plants and domesticated animals
17	<ul style="list-style-type: none"> Describe genetic engineering Give examples of genetically modified organisms Explain some potential benefits and risks of genetic engineering in agriculture and medicine (HT) describe the process of producing a genetically modified organism
18	<p>GCSE Biology only</p> <ul style="list-style-type: none"> Describe cloning techniques in plants and animals Evaluate cloning methods for medicine and agriculture Explain the ethical objections to animal cloning
19	<ul style="list-style-type: none"> Describe and apply the Linnaean system for classification Explain why new models of classification have been proposed Describe the 'three domain' classification system
20	Review 1
21	Assessment
22	Review 2

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B7 Ecology, Year 11

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Identify examples of interdependence within an ecosystem ● Predict the impact of changes to one species on the rest of the community ● Extract and interpret information from charts, tables and graphs relating to interaction of organisms in a community
2	<ul style="list-style-type: none"> ● Identify biotic and abiotic factors within an ecosystem ● Explain how a change in a biotic or abiotic factor can affect a community ● Extract and interpret information from secondary data
3	<ul style="list-style-type: none"> ● Give examples of behavioural, structural or functional adaptations ● Suggest factors that organisms are competing for given information ● Identify and explain how organisms are adapted to live in their natural environment
4	<ul style="list-style-type: none"> ● Use a quadrat to collect valid data to estimate a population size ● Describe how to make the data as accurate as possible ● Calculate population estimates
5	<ul style="list-style-type: none"> ● Calculate percentage cover of organisms ● Describe how to use a transect line to test a hypothesis ● Process and interpret secondary data, identifying variables
6	<p>GCSE Biology only</p> <ul style="list-style-type: none"> ● Construct pyramids of biomass from information given ● Explain the losses of energy at each stage ● Calculate the efficiency of organisms in turning food into new biomass
7	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> ● Describe some of the biological factors that can affect levels of food security ● Describe some of the ways farming methods can increase levels of efficiency of food production ● Evaluate methods to improve efficiency of food production
8	<ul style="list-style-type: none"> ● Describe the water cycle and explain its importance to living things ● Identify the processes by which carbon is cycled through biotic and abiotic parts of ecosystems ● Describe the processes involved accurately
9	<p>GCSE Biology only:</p> <ul style="list-style-type: none"> ● Name the causes of decay and describe conditions that can speed it up ● Identify variables to change, measure and control to test a hypothesis involving the rate of decay ● Collect and record data to test the hypothesis ● Process and display the data appropriately.

10	<p>GCSE Biology only:</p> <ul style="list-style-type: none">● Describe and explain the effect of temperature on the rate of decay● Interpret secondary data to describe and explain the effect of oxygen on the rate of decay● Apply knowledge to uses of decay
11	<ul style="list-style-type: none">● Describe and explain ways in which humans affect ecosystems● Evaluate the data linking greenhouse gases to global warming● Describe some of the consequences of global warming
12	<ul style="list-style-type: none">● Describe some impacts of humans on biodiversity● Explain the importance of biodiversity● Describe ways that humans have tried to restore or maintain biodiversity
13	Review 1
14	Assessment
15	Review 2

C1 Atomic Structure and the periodic table, Year 9/10

Lesson number	Core content
1	<ul style="list-style-type: none"> Define Identify elements and compounds and identify them from diagrams Name compounds from word equations and formulae reactants and products in equations Apply conservation of mass to equations
2	<ul style="list-style-type: none"> Define, identify and describe mixtures Explain the steps in the separation of mixtures of soluble and insoluble substances Explain how mixtures of soluble and insoluble substances are represented and recognised
3	<ul style="list-style-type: none"> Describe how to separate a mixture of two or more liquids, identifying key equipment Explain the processes and equipment involved Apply particle theory to distillation
4	<ul style="list-style-type: none"> Describe the process of chromatography Carry out the chromatography of chlorophyll, explaining key steps Interpret chromatograms
5	<ul style="list-style-type: none"> Describe atoms using the nuclear model State the charges and mass of the three subatomic particles Use the periodic table to calculate the number of protons, neutrons and electrons for any given element
6	<ul style="list-style-type: none"> Describe the development of the atomic model Compare the nuclear model with the plum pudding model Explain how new evidence from the scattering experiment led to a change in the atomic model
7	<ul style="list-style-type: none"> State the definition of an isotope Compare isotopes from given information Calculate RAM of isotopes given their abundance and give answers to specified number of significant figures or decimal places
8	<ul style="list-style-type: none"> Describe what keeps electrons in their orbits Draw and write the electron configuration for any of the first 20 elements Describe the link between outer shell electron number, number of shells and location in the periodic table
9	<ul style="list-style-type: none"> Describe the layout of the modern periodic table Compare the early versions of the periodic table with the modern one Explain how the periodic table was developed as ideas changed

10	<ul style="list-style-type: none"> Explain the difference between metals and non-metals in terms of reactions and electrons Explain why group 0 do not react in terms of electrons Describe trends in physical properties of group 0
11	<ul style="list-style-type: none"> Describe physical and chemical properties of the group 1 elements Write equations to represent their reaction with water Describe and explain trends in reactivity of group 1
12	<ul style="list-style-type: none"> Describe trends in physical properties of group 7 elements Describe trends in reactivity going down group 7 Explain the trend in boiling point and reactivity in group 7
13	<ul style="list-style-type: none"> Describe the results of a series of reactions of group 7 elements and their compounds Explain the results using knowledge of reactivity Write word and symbol equations to represent the reactions
14	<u>GCSE Chemistry only</u> <ul style="list-style-type: none"> Describe typical properties of the transition elements Compare transition elements and their compounds with those of group 1 Give uses of transition metals linked to their properties
15	Review 1
16	Assessment
17	Review 2

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe the formation of an ionic bond Represent ionic bonding using diagrams Write formula for ionic compounds
2	<ul style="list-style-type: none"> Make and record observations, working safely Describe some of the properties of ionic compounds Explain some of the properties of ionic compounds using knowledge of the structure
3	<ul style="list-style-type: none"> Define a covalent bond Draw and describe covalent bonds using structural, ball and stick and displayed formula Describe the limitations of the different models Represent polymers using diagrams
4	<ul style="list-style-type: none"> Explain why some covalent substances form molecules and others form giant structures Compare the properties of simple and giant covalent substances Describe and explain their properties in terms of bonding Explain why polymers tend to be solids at room temperature
5	<ul style="list-style-type: none"> Describe the properties of diamond, graphite, fullerenes and graphene Explain the properties using knowledge of the bonding and structure Relate properties of these carbon allotropes to their uses
6	<ul style="list-style-type: none"> Describe the structure and bonding in metals Describe and explain the properties of metals Explain why alloys are harder than pure metals
7	<ul style="list-style-type: none"> Predict the state of substances at different temperatures, and the type of bonding present given melting and boiling point data Describe what happens in terms of particles and forces during a change of state (HT) Explain the limitations of the particle model in relation to changes of state
8	<p>GCSE Chemistry only:</p> <ul style="list-style-type: none"> Compare dimensions of particles of different sizes Describe some uses of nanoparticles Evaluate the use of nanoparticles given appropriate information
9	Review 1
10	Assessment
11	Review 2

C3 Quantitative Chemistry

Lesson number	Core content
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1	<ul style="list-style-type: none"> • Use the periodic table and formulae to determine the relative formula mass of compounds • Work out percentage of given elements in a compound • Work out the mass of a particular element in a given mass of a compound
2	<u>Higher tier only</u> <ul style="list-style-type: none"> • Use $\text{Mass} = \text{Mr} \times \text{moles}$ to find any one value given the other two • Use Avogadro's constant to calculate number of atoms/molecules in a given mass • Calculate the mass of a given number of atoms using avogadros constant
3	<ul style="list-style-type: none"> • Write chemical formulae using knowledge of ion charges • Balance equations using the same number of atoms rule • Balance equations using moles (HT only)
4	<ul style="list-style-type: none"> • Apply conservation of mass to equations • Use a balanced equation to work out the quantity of reacting elements needed to produce a specified quantity of product • Predict the mass of product from a specified starting mass
5	<u>Higher Tier only</u> <ul style="list-style-type: none"> • Predict the mass of product from a specified starting mass • Use a balanced equation to work out the quantity of reacting elements needed to produce a specified quantity of product • (GCSE Chem only) Calculate the yield and suggest why the mass obtained may be less than that calculated
6	<u>GCSE Chemistry only</u> <ul style="list-style-type: none"> • Balance equations using same number of atoms and moles • Calculate atom economy for given reactions • Choose and justify a reaction pathway
7	<ul style="list-style-type: none"> • Define the term 'concentration' • Calculate concentration from mass and volume • Work out the mass of a substance in a given volume of a solution of a known concentration
8	<u>GCSE Chemistry only</u> <ul style="list-style-type: none"> • Calculate mean volumes from experimental results • Calculate the uncertainty in the readings • Calculate the concentration of an unknown using a balanced equation and volumes of reacting solutions.
9	<u>Higher tier only</u> <ul style="list-style-type: none"> • Define a limiting reactant • Describe the effect of a limiting reactant on the amount of products it is possible to achieve • Calculate the limiting reactant from a balanced symbol equation
10	<u>GCSE Chemistry only</u>

	<ul style="list-style-type: none">• Calculate the volume of a gas at room temperature and pressure from its mass and formula mass• Calculate volumes of gaseous reactants and products from a given volume of a gaseous reactant or product.
11	Review 1
12	Assessment
13	Review 2

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C4 Chemical Change, year 10

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe oxidation and reduction in terms of oxygen (HT and electrons) Identify where oxidation and reduction have happened given an equation Explain how carbon can be used to extract metals from their ores using redox reactions
2	<ul style="list-style-type: none"> Identify variables to change, measure and control to test the reactivity of metals Write equations for the reactions of acids and metals, naming salts Use observations to order metals in terms of reactivity (HT) identify which species has been oxidised and reduced
3	<ul style="list-style-type: none"> Explain how the reactivity of a metal is related to forming ions Record observations on whether or not displacement reactions occur Write equations for displacement reactions Identify oxidised or reduced species (HT)
4	<ul style="list-style-type: none"> Write word equations to represent the reactions of metal oxides and acids Explain steps in a given method to produce a pure, dry sample of a soluble salt Use ion charges to write formulae for salts
5	<ul style="list-style-type: none"> Write equations to represent the reactions of metal carbonates and acids Describe evidence for a chemical reaction Describe the test for carbon dioxide and its positive result
6	<ul style="list-style-type: none"> Suggest corrections to a given method to make a salt Write a method to prepare a salt using a metal carbonate or metal oxide Write equations for the reactions
7	<ul style="list-style-type: none"> Describe the use of universal indicator to classify substances and measure approximate pH values Evaluate the use of universal indicator and suggest why pH probe may be more accurate Write equations to represent the reaction of acids and alkalis, including the ionic equation Process secondary data, calculating means and uncertainty
8	<p>Higher Tier only</p> <ul style="list-style-type: none"> Describe how to use indicator to classify substances as strong or weak acids Explain what strong and weak acids are and concentrated and dilute Make order of magnitude calculations to describe changes in pH
9	<p>GCSE Chemistry only</p> <ul style="list-style-type: none"> Make and record accurate measurements Calculate means and uncertainties, dealing with anomalies appropriately Calculate the concentration of an unknown acid or alkali from measurements taken

10	GCSE Chemistry only <ul style="list-style-type: none"> Write a method to find the concentration of an unknown acid or alkali Calculate the concentration of an unknown acid or alkali from data and equations provided Suggest ways of improving accuracy
11	<ul style="list-style-type: none"> Explain the use of electrolysis to extract metals Describe the extraction of Aluminium from its ore, including the use of a mixture and the need to continually replace the anode Explain why electrolysis is so expensive and describe measures to try to reduce this (HT) Write the ionic equations for the reaction
12	<ul style="list-style-type: none"> Predict the products of the electrolysis of given solutions Electrolyse solutions of ionic compounds and identify the products Explain why the products are obtained (HT) Write half equations to represent the products
13	<ul style="list-style-type: none"> Develop a hypothesis to test Electrolyse given solutions, collecting and identifying the products Apply knowledge to other related hypotheses (HT) Write ionic equations for the reactions at the electrodes
14	Review 1
15	Assessment
16	Review 2

C5 Energy Changes, year 10

Lesson number	Core content
1	<ul style="list-style-type: none"> Define endothermic and exothermic reactions and give examples of each type Describe some everyday uses of exothermic and endothermic reactions Evaluate applications of exothermic and endothermic reactions
2	<ul style="list-style-type: none"> Investigate one of the variables affecting the temperature change, identifying variables to change, measure and control Collect accurate and repeatable data Process and display results appropriately
3	<ul style="list-style-type: none"> Draw conclusions from data collected or provided Explain the changes in temperature during the experiment Evaluate the equipment and method used, making and explaining suggestions for improvement
4	<ul style="list-style-type: none"> Draw and interpret energy level diagrams to represent endothermic and exothermic reactions Label and define activation energy Explain why reactions are endothermic or exothermic overall
5	<p>Higher tier only</p> <ul style="list-style-type: none"> Calculate bond energy values and use them to predict whether a reaction will be exothermic or endothermic Relate bond energies to the correct part of energy level diagrams Explain why bond energy calculations have a margin of error
6	<p>GCSE Chemistry only</p> <ul style="list-style-type: none"> Describe how cells and batteries can be made and how the voltage can vary Describe how a fuel cell works Write the half equations for the electrode reactions in a fuel cell Evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries
7	Review 1
8	Assessment
9	Review 2

C6 Rates of reaction, Year 10/11

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Collect data to measure the rate of reaction ● Plot a graph of the data obtained. ● Describe and explain patterns in the data collected ● Calculate the rate of the reaction
2	<ul style="list-style-type: none"> ● Develop a hypothesis that can be tested ● Collect data to investigate the hypothesis ● Display the data appropriately ● <u>Describe and explain</u> the effect of concentration on the rate of reaction
3	<ul style="list-style-type: none"> ● Collect data to investigate the effect of concentration on rates of reaction ● Display this data appropriately, explaining choice of graph ● Describe and explain the effect of concentration on the rate of reaction ● Check for reproducibility in data collected
4	<ul style="list-style-type: none"> ● Describe and explain the effect of temperature on rates of reaction, using particle theory. ● Interpret secondary data on the effect of temperature on the rate of reaction ● Explain the observations using particle theory
5	<ul style="list-style-type: none"> ● Identify variables to change, measure and control to test a hypothesis ● Process and display data appropriately ● Use the data to describe and explain the effect of changing surface area on the rate of reaction
6	<ul style="list-style-type: none"> ● Recognise reactions involving gases ● Describe and explain the effect of pressure on gaseous reaction ● Apply knowledge to novel reactions
7	<ul style="list-style-type: none"> ● Describe what a catalyst is and how it affects the rate of a reaction ● Explain why more than one catalyst is often needed ● Describe the test for oxygen gas ● Draw a reaction profile for a reaction with and without a catalyst
8	<ul style="list-style-type: none"> ● Describe what is meant by a reversible reaction and how to represent it ● Explain how reversible exothermic and endothermic reactions are linked ● Explain what is meant by 'dynamic equilibrium'
9	<p>Higher tier only</p> <ul style="list-style-type: none"> ● State and apply Le Chatelier's principle to any reversible reaction ● Describe the effect on equilibrium of changes to temperature and concentration ● Choose and explain the conditions needed to achieve a high yield
10	<p>Higher tier only</p> <ul style="list-style-type: none"> ● Describe and explain the effect of changes in pressure on the equilibrium of gaseous reactions

	<ul style="list-style-type: none">● Describe and explain the conditions for optimum yield for a given reaction● Explain why optimum yield conditions are not always the ones chosen
11	Review 1
12	Assessment
13	Review 2

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C7 Organic Chemistry, Year 11

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe the composition of crude oil Define and recognise hydrocarbons and recall their general formula Draw and name the first four hydrocarbons Describe trends in physical properties of the hydrocarbons
2	<ul style="list-style-type: none"> Describe how crude oil is separated into fractions Carry out the distillation of crude oil Describe trends in the physical and chemical properties of the fractions collected
3	<ul style="list-style-type: none"> Explain why cracking is necessary describe the process and products of cracking describe the test for alkenes and its positive result represent cracking using equations
4	<ul style="list-style-type: none"> Describe uses for the different fractions of crude oil Write equations for the complete combustion of hydrocarbons, identifying oxidation Describe uses for the alkenes produced in cracking
5	<p>GCSE Chemistry only:</p> <ul style="list-style-type: none"> Draw and name alkenes Compare the combustion of alkenes with that of alkanes Describe and draw the reaction of alkenes with hydrogen, water and the halogens
6	<p>GCSE Chemistry only:</p> <ul style="list-style-type: none"> Draw and name alcohols Describe the production of alcohol from sugar Describe the uses of alcohols and reactions with sodium, water and oxidising agents
7	<p>GCSE Chemistry only:</p> <ul style="list-style-type: none"> Describe the combustion of alcohols Identify variables to change, measure and control to test a hypothesis Evaluate data collected and make suggestions on how to improve it
8	<p>GCSE Chemistry only:</p> <ul style="list-style-type: none"> Name and draw carboxylic acids Describe the properties and reactions of carboxylic acids Explain why carboxylic acids are weak acids
9	<p>GCSE Chemistry only:</p> <ul style="list-style-type: none"> Describe the processes of addition and condensation polymerisation Draw and name polymers Recognise monomers from given polymers
10	<p>GCSE Chemistry only:</p>

	<ul style="list-style-type: none">• Draw and describe polymerisation of amino acids• Describe the natural polymers starch, cellulose and DNA
11	Review 1
12	Assessment
13	Review 2

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C8 Analysis, year 11

Lesson number	Core content
1	<ul style="list-style-type: none"> Identify pure and impure substances using diagrams or data Describe how to test for purity Describe and give examples of formulations
2	<ul style="list-style-type: none"> Describe how to correctly use chromatography to separate mixtures Interpret chromatograms to determine the contents of a provided mixture Calculate Rf values giving answers to an appropriate number of significant figures
3	<ul style="list-style-type: none"> Identify mistakes in practical set up and suggest how to rectify them Interpret chromatography data, identifying pure substances and mixtures Calculate Rf values and using significant figures appropriately
4	<ul style="list-style-type: none"> Carry out tests for the oxygen, carbon dioxide and hydrogen Describe the tests for oxygen, carbon dioxide, hydrogen and chlorine and their positive results Write and balance chemical equations to represent some of the reactions.
5	<p>GCSE Chemistry only:</p> <ul style="list-style-type: none"> Describe how to identify metal ions using flame tests and precipitation Name the colours produced by given metal ions in flame tests Write and balance chemical equations for the reactions of metal salts with sodium hydroxide
6	<p>GCSE Chemistry only:</p> <ul style="list-style-type: none"> Describe the tests for anions – carbonate, halide and sulphate Safely carry out the tests and record the results Describe the positive results
7	<p>GCSE Chemistry only:</p> <ul style="list-style-type: none"> Safely carry out a series of a series of chemical tests to identify unknown solutions Describe the tests used and the positive results Write chemical formula for the identified compounds
8	<p>GCSE chemistry only:</p> <ul style="list-style-type: none"> Evaluate the use of instrumental methods to identify unknowns Describe uses of flame emission spectroscopy Interpret results from spectroscopy analysis to identify unknowns
9	Review 1
10	Assessment
11	Review 2

C9, Atmosphere, Year 11

Lesson number	Core content
1	<ul style="list-style-type: none"> • Compare the compositions of Earth's atmosphere with the modern one • Describe and explain the changes in the composition of the atmosphere over Earth's history • Evaluate different theories about the Earth's early atmosphere • Describe and explain the formation of limestone, coal, crude oil and natural gas
2	<ul style="list-style-type: none"> • Describe the greenhouse effect • Describe the reasons for and the impacts of increasing greenhouse gases on the temperature of the Earth's atmosphere • Evaluate the strength of the evidence for the link between CO₂ levels and global temperature rise
3	<ul style="list-style-type: none"> • Describe potential consequences of climate change • Define the carbon footprint in a range of contexts • Suggest ways of reducing carbon footprints in different contexts and why actions to reduce carbon footprints may be limited
4	<ul style="list-style-type: none"> • Describe how carbon monoxide, soot, sulphur dioxide and nitrogen oxides are produced and released into the atmosphere • Predict the products of the combustion of a fuel given appropriate information • Describe the problems caused by these pollutants
5	Review 1
6	Assessment
7	Review 2

C10, using Resources, Year 11

Lesson number	Core content
1	<ul style="list-style-type: none"> ● State ways in which natural products are supported or replaced by man-made products ● Extract and interpret information in charts, graphs and tables ● Evaluate the use of finite and renewable resources
2	<ul style="list-style-type: none"> ● Describe some ways of reducing our use of finite resources ● Evaluate ways of reducing our use of limited resources ● Carry out life cycle assessments given appropriate information
3	Higher Tier <ul style="list-style-type: none"> ● Describe the processes of phytomining and bioleaching to extract metals ● Compare alternative methods of metal extraction using information given ● Link the processes to displacement and energy change graphs
4	GCSE Chemistry only <ul style="list-style-type: none"> ● Describe experiments to prove the need for oxygen and water for rusting to occur ● Interpret results from rusting experiments ● Describe methods of preventing corrosion, including sacrificial protection
5	GCSE Chemistry only <ul style="list-style-type: none"> ● State uses of the alloys bronze, brass and steel ● Interpret and evaluate the composition and uses of alloys given appropriate information ● Explain why alloys are more useful than pure metals
6	GCSE Chemistry only <ul style="list-style-type: none"> ● Give uses for different types of polymer ● Explain how low density and high density poly(ethene) are both produced from ethene ● Explain the difference between thermosoftening and thermosetting polymers in terms of their structures
7	GCSE Chemistry only <ul style="list-style-type: none"> ● Describe the production of glass ● Give some uses for composites ● Compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals ● Explain how the properties of materials are related to their uses and select appropriate materials.
8	<ul style="list-style-type: none"> ● Distinguish between pure and potable water ● Describe and explain the steps involved in the treatment of safe drinking water ● Test water for pH and dissolved solid content and calculate the concentration of dissolved solids
9	<ul style="list-style-type: none"> ● Describe methods of producing potable water from salty water

	<ul style="list-style-type: none"> Carry out the distillation of a water sample Describe the differences between the water samples before and after distillation and how to test for these
10	<ul style="list-style-type: none"> State components of waste water that can cause problems in the environment Describe how waste water is treated to make it safe to release into the environment Compare the treatments of waste, ground and salt water in terms of ease of producing potable water
11	<p>GCSE Chemistry only</p> <ul style="list-style-type: none"> Name the source of the reactants in the Haber process Predict the effect of temperature, concentration and pressure on yield and rate of reaction in the Haber process Interpret graphs of reaction conditions versus rate Explain why industrial conditions for the Haber process are a compromise, taking into account multiple factors
12	<p>GCSE Chemistry only</p> <ul style="list-style-type: none"> State the use and composition of NPK fertilisers Describe the production of NPK fertilisers, naming reactants and products Compare the industrial production of fertilisers with laboratory preparations of the same compounds given appropriate information.
13	Review 1
14	Assessment
15	Review 2

P1 Energy

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Name the 8 energy stores ● Describe the transfer of energy from one store to another, identifying pathways ● Describe how energy is dissipated and calculate efficiency
2	<ul style="list-style-type: none"> ● Calculate the energy stored in a moving object ● Rearrange the equation to calculate velocity or mass ● Change units where necessary and express answers to given numbers of significant figures
3	<ul style="list-style-type: none"> ● Use an equation to calculate GPE, mass or height ● Use values for GPE to calculate the theoretical velocity of an object ● Explain why the maximum theoretical velocity is never actually reached.
4	<ul style="list-style-type: none"> ● Define an elastic object ● Calculate the energy stored in a stretched or compressed object ● Describe the energy transfers in a bouncing object
5	<ul style="list-style-type: none"> ● Describe, using examples, what is meant by power ● Calculate power using energy transferred or work done ● Compare the power of different appliances or machines
6	<ul style="list-style-type: none"> ● Explain what is meant by specific heat capacity ● Use the specific heat capacity equation to calculate unknown values ● Explain the method steps used to find the SHC of a substance
7	<ul style="list-style-type: none"> ● Plot a graph of results to determine specific heat capacity ● Calculate the SHC of the blocks investigated ● Write a method for an alternative SHC investigation
8	<ul style="list-style-type: none"> ● Calculate efficiency from numbers or a Sankey diagram ● Describe ways of reducing unwanted energy transfers ● Explain method for reducing unwanted energy transfers
9	<p>GCSE Physics only</p> <ul style="list-style-type: none"> ● Explain the steps in a given method to test a hypothesis ● Collect and display data appropriately ● Describe and explain patterns in results.
10	<p>GCSE Physics only</p> <ul style="list-style-type: none"> ● Describe hazards, risks and safety precautions associated with a given method ● Collect and display results appropriately ● Calculate the rate of cooling using tangents ● Draw conclusions consistent with results
11	<ul style="list-style-type: none"> ● Describe uses of renewable and non-renewable energy resources ● Evaluate the use of energy resources

	<ul style="list-style-type: none">• Compare the use of different energy resources
12	Review 1 <ul style="list-style-type: none">• Choose correct equations to use in calculations.• Recall definitions of key terms and use them correctly• Correct key misconceptions on this topic
13	Assessment
14	Review 2

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P2 Electricity

Lesson number	Core content
1	<ul style="list-style-type: none"> Draw circuits, using correct common circuit symbols Describe electrical current Use the equation $Q=It$ to calculate any value given the other two, changing units where necessary
2	<ul style="list-style-type: none"> Describe what is meant by potential difference and resistance in circuits Describe what happens to current when potential difference and resistance are varied Use an equation linking potential difference, current and resistance to calculate any value given the other two
3	<ul style="list-style-type: none"> Identify variables to change, measure and control to test a hypothesis Collect and record measurements of current and potential difference for different lengths of wire Use the readings to calculate resistance in the wire Plot a graph of the results
4	<ul style="list-style-type: none"> Predict current and pd in series circuits Describe the effect of adding resistors in series circuits Use Ohm's Law to calculate current, resistance or pd
5	<ul style="list-style-type: none"> Describe and apply the rules for pd and current in a parallel circuit Describe the effect of adding resistors in parallel Use Ohms law to find pd, resistance or current in parallel circuits.
6	<ul style="list-style-type: none"> Make and record measurements to find the pattern of resistance in a fixed resistor Plot a graph of the data obtained Describe and explain the relationship between current, pd and resistance in a fixed resistor
7	<ul style="list-style-type: none"> Make and record measurements to find the pattern of resistance in a filament lamp Plot a graph of the data obtained Calculate resistance for the values collected Describe and explain the relationship between current, pd and resistance in a filament lamp
8	<ul style="list-style-type: none"> Recognise and draw the symbol for a diode Process secondary data and plot a graph of the data Describe and explain the pattern of current and pd with a diode
9	<ul style="list-style-type: none"> Identify variables to change, measure and control to test a hypothesis Collect and display results appropriately Explain how resistance changes with light levels in an LDR Explain how LDRs can be used to switch lights on when it gets dark
10	<ul style="list-style-type: none"> Draw a circuit diagram to illustrate how to test the resistance of a thermistor Process secondary data appropriately and use it to inform a conclusion Explain the use of thermistors as a thermostat

11	<ul style="list-style-type: none"> Describe the features of UK mains supply and three core cable Explain the use of live, neutral and earth wires Explain the difference between direct and alternating potential difference
12	<ul style="list-style-type: none"> Recall and apply the equation linking current, potential difference and power Recall and apply the equation to calculate power, current or resistance Change units and the subject of equations where necessary
13	<ul style="list-style-type: none"> Recall and apply the equation linking energy, power and time Recall and apply the equation linking charge, energy and potential difference Choose the correct equation to use to calculate values given appropriate information HT use multi step or multiple equations
14	<ul style="list-style-type: none"> Describe how electricity is transmitted in the national grid, naming the components Explain the use of transformers in the national grid Evaluate the use of underground or overhead cables. (HT) use a given equation to calculate current or pd given appropriate information
15	<p>GCSE Physics</p> <ul style="list-style-type: none"> Describe the production of static electricity and sparking by rubbing surfaces Describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact Explain how the transfer of electrons between objects can explain static electricity
16	<p>GCSE Physics</p> <ul style="list-style-type: none"> Draw the electric field pattern for isolated charged spheres Explain the concept of an electric field Explain how the concept of electric fields help explain non-contact forces between charged objects, sparking and other electrostatic phenomena
17	Review 1
18	Assessment
19	Review 2

P3 Particle model of matter

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe the arrangement of particles in solids, liquids and gases and represent them with accurate drawings Use the particle model to explain differences in properties of solids, liquids and gases Evaluate the particle models
2	<ul style="list-style-type: none"> Use an equation to calculate density, mass or volume of an object Describe how to measure the density of regular and irregular solids Make and record accurate measurements
3	<ul style="list-style-type: none"> Describe how to measure the density of liquids Make and record accurate measurements Suggest possible sources of error and how to correct them
4	<ul style="list-style-type: none"> Describe the two results of changing the internal energy of a system and recognize them on heating/cooling graphs Plot secondary data for heating a substance Describe heating and changes of state in terms of kinetic and potential energy stores Use the specific heat capacity equation to calculate any value given the others
5	<ul style="list-style-type: none"> Describe changes to particle arrangement and movement during a change of state Describe latent heat of vaporization and fusion and recognize them on a graph Use an equation to calculate energy, mass or latent heat values
6	<ul style="list-style-type: none"> Use the particle model to explain gas pressure Plot data to show the effect of temperature on gas pressure and describe the pattern shown Explain why changing the temperature of a gas affects the pressure
7	<p>GCSE Physics</p> <ul style="list-style-type: none"> Describe how volume changes affect pressure Use the particle model to explain how changes in volume can result in changes in pressure Calculate the resulting pressure or volume when one is changed using an equation Explain how work done affects the internal energy of a gas (HT only) •
8	<p>Review 1</p> <ul style="list-style-type: none"> Recall definitions of key terms and use them correctly Application of knowledge to exam questions Correct key misconceptions on this topic
9	Assessment
10	Review 2

P4 Atomic Structure

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe the current atomic model Explain how EM radiation can cause changes in electron arrangement or ionisation Compare isotopes in terms of their sub atomic particles
2	<ul style="list-style-type: none"> Compare the nuclear model of the atoms with the plum pudding model Describe how evidence led to changes in the atomic model Explain why Rutherford's atomic model was readily accepted
3	<ul style="list-style-type: none"> Describe the effect of alpha, beta and gamma radiation on the nucleus Describe properties of alpha beta and gamma radiation Write nuclear equations to represent decay
4	<ul style="list-style-type: none"> Describe what is meant by the radioactive half life of a sample. Plot a graph representing the number of decays in a sample. Determine half lives from information given (HT) calculate net decline and express as a ratio
5	<ul style="list-style-type: none"> Describe some uses and dangers of radioactive sources Explain the relative dangers in terms of properties and half lives Evaluate the use of radioactive sources for given situations
6	<ul style="list-style-type: none"> Describe and identify examples of radioactive contamination and irradiation Compare the hazards associated with contamination and irradiation Explain how the risk changes over time and distance from the source (GCSE Physics only) Describe sources of background radiation.
7	<p>GCSE Physics only</p> <ul style="list-style-type: none"> Explain why the hazards of a radioactive source varies according to half life Describe uses of radioactive isotopes in relation to the exploration of body organs and destruction of unwanted tissue Evaluate uses of radioactive isotopes for exploration of body organs
8	<p>GCSE Physics only</p> <ul style="list-style-type: none"> Describe the process of nuclear fusion and nuclear fission Draw and interpret diagrams representing nuclear fission Explain what is meant by a chain reaction
9	Review 1
10	Assessment
11	Review 2

P5 Forces and Motion

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe the difference between scalar and vector quantities Describe forces as contact or non-contact and give examples Describe the interaction between forces between pairs of objects
2	<ul style="list-style-type: none"> Describe how to find and represent the centre of mass of an object Describe the relationship between mass, weight and gravity Use the mathematical relationship to calculate any value, given the other two
3	<ul style="list-style-type: none"> Calculate resultant forces of forces acting in a straight line Describe the effect of resultant forces on objects Describe scalar and vector quantities and give examples (HT) Represent and interpret vector quantities using scale diagrams (HT) Draw and interpret vector diagrams representing multiple forces
4	<ul style="list-style-type: none"> Describe energy transfers when work is done, including the effect of work done against frictional forces Calculate work done, force or distance given appropriate information Convert units where needed.
5	<ul style="list-style-type: none"> Identify variables to change, measure and control in a given hypothesis Construct a table for result, including units Explain the steps in the method to test a given hypothesis Collect and display data appropriately.
6	<ul style="list-style-type: none"> Recall and use a formula to calculate extension, force or spring constant Process secondary data Plot a graph of the data and use it to explain the limit of proportionality Relate stretching and compression to work done and calculate this.
7	<p>GCSE Physics only</p> <ul style="list-style-type: none"> Describe examples in which forces cause rotation. Calculate the size of a force, or its distance from a pivot, acting on an object that is balanced. Explain how levers and gears transmit the rotational effects of forces.
8	<p>GCSE Physics only</p> <ul style="list-style-type: none"> (HT) Explain why, in a liquid, pressure at a point increases with the height of the column of liquid above that point and with the density of the liquid. (HT) Calculate the differences in pressure at different depths in a liquid. (HT) Describe the factors which influence floating and sinking.
9	<p>GCSE Physics only</p> <ul style="list-style-type: none"> Describe a simple model of the Earth's atmosphere and of atmospheric pressure Explain why atmospheric pressure varies with height above a surface.
10	<ul style="list-style-type: none"> Explain what is meant by the term 'average speed'

	<ul style="list-style-type: none"> Recall and apply a formula to calculate average speed, distance or time. Interpret distance time graphs and use them to calculate speed (HT only) Explain qualitatively that motion in a circle involves constant speed but changing velocity.
11	<ul style="list-style-type: none"> Calculate resultant forces Describe the effect of resultant forces on stationary and moving objects Calculate acceleration and use the correct units Use and manipulate the equation for uniform acceleration
12	<ul style="list-style-type: none"> Draw velocity-time graphs from measurements Interpret lines and slopes to determine acceleration (HT only) Determine distance travelled by an object (or displacement of an object) from a velocity-time graph
13	<ul style="list-style-type: none"> Describe and recognise terminal velocity Explain why falling objects have different terminal velocities (Physics only) Draw and interpret velocity-time graphs for objects reaching terminal velocity (Physics only) Interpret the changing motion in terms of the forces acting.
14	<ul style="list-style-type: none"> Use Newton's second law to calculate force, mass or acceleration Estimate the speed, accelerations and forces involved in large accelerations for everyday road transport. Recognise and use the symbol that indicates an approximate value (HT only) Define and explain that what we mean by inertial mass
15	<ul style="list-style-type: none"> Describe a method for investigating how force or mass affects acceleration Select appropriate apparatus for determining the acceleration of an object. Describe how to manage the risks associated with the practical Correctly calculate means
16	<ul style="list-style-type: none"> Interpret graphs to make conclusions Use the equation $F=ma$ to calculate theoretical acceleration. Explain differences between experiment data and theoretical values Calculate acceleration using speed and distance measurements
17	<ul style="list-style-type: none"> Identify and sort factors which could affect thinking and/or braking distance. Calculate the stopping distance of a vehicle using an equation. Write a conclusion with values quoted. Rearrange the equation for stopping distance to calculate braking or thinking distance.
18	<p>Higher tier only</p> <ul style="list-style-type: none"> State what is meant by momentum. Calculate the momentum of objects. Apply the conservation of momentum to collisions and explosions.
19	<p>Physics Only</p> <ul style="list-style-type: none"> Explain how certain car safety features work. Calculate quantities from an equation related to car safety features.

	<ul style="list-style-type: none">• Rearrange an equation to calculate other values.
20	Review 1
21	Assessment
22	Review 2

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P6 Waves

Lesson number	Core content
1	<ul style="list-style-type: none"> ● Identify the features of a longitudinal and transvers waves ● Describe the production of longitudinal and transverse waves ● Compare light and sound waves
2	<ul style="list-style-type: none"> ● Calculate frequency from diagrams or information ● Make and record measurements to calculate the speed of sound in air ● Use the wave equation to calculate speed, frequency or wavelength
3	<ul style="list-style-type: none"> ● Explain the steps taken in measuring the speed of waves in water ● Process results appropriately ● Describe how to minimise error in the readings
4	<p>GCSE Physics</p> <ul style="list-style-type: none"> ● Construct ray diagrams to illustrate the reflection of a wave at a surface ● Describe the effects of reflection, transmission and absorption of waves at material interfaces. ● Investigate the reflection of light by different types of surface and the refraction of light by different substances
5	<p>GCSE Physics</p> <ul style="list-style-type: none"> ● Describe the range of normal human hearing ● Describe processes which convert wave disturbances between sound waves and vibrations in solids. ● Explain why such processes only work over a limited frequency range and the relevance of this to human hearing
6	<p>GCSE Physics</p> <ul style="list-style-type: none"> ● Explain how ultrasound waves are used for both medical and industrial imaging ● Describe how high frequency sound waves is used to detect objects in deep water and measure water depth. ● Explain how seismic waves provide evidence for the structure of the Earth
7	<ul style="list-style-type: none"> ● Describe properties of the EM spectrum waves ● Describe uses of each type of wave ● (HT) explain why each wave is suitable for the application
8	<ul style="list-style-type: none"> ● Describe the effect of different substances on EM waves ● Describe some of the dangers of EM waves ● Draw conclusions from secondary data on the risks and consequences of exposure to radiation
9	<ul style="list-style-type: none"> ● Identify variables to change, measure and control to test a hypothesis ● Collect and record data ● Process data collected and use it to inform a conclusion
10	<p>GCSE Physics</p>

	<ul style="list-style-type: none"> Students should be able to construct ray diagrams to illustrate the similarities and differences between convex and concave lenses. Describe the image formed by lenses Calculate the magnification of an image formed by a lens
11	GCSE Physics <ul style="list-style-type: none"> Explain how the colour is related to absorption, transmission and reflection of different wavelengths of light Explain the effect of viewing objects through filters or the effect on light of passing through filters Explain why an opaque object has a particular colour
12	GCSE Physics <ul style="list-style-type: none"> Explain the intensity and wavelength distribution of radiation emitted by all bodies (HT only) Explain how the temperature of a body is related to the balance between incoming radiation (HT only) Draw/interpret diagrams to show how radiation affects the temperature of the Earth's surface and atmosphere.
13	Review 1
14	Assessment
15	Review 2

P7 Magnetism ad Electromagnetism

Lesson number	Core content
1	<ul style="list-style-type: none"> Describe what happens when poles of a magnet are brought together Describe how to test to see if a material is magnetic or a magnet Interpret secondary data on an experiment to test the variation in magnetic field Describe how the strength of a magnetic field varies
2	<ul style="list-style-type: none"> Describe and draw the direction of the magnetic field around a bar magnet Describe how to plot the magnetic field pattern of a magnet using a compass Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic
3	<ul style="list-style-type: none"> Describe and draw the magnetic field around a wire carrying a current Describe the magnetic field in and around a solenoid Explain how the strength of the magnetic field can be varied
4	HT Only <ul style="list-style-type: none"> Describe the motor effect and the factors that affect the size of the force on the conductor Use Flemings left hand rule to predict the direction of movement of a wire in a field Use the equation linking force, magnetic flux density, current and length to calculate any value, changing units where appropriate
5	HT Only <ul style="list-style-type: none"> Combine equations to calculate missing values Change units and use standard form Explain how a DC motor works, using Flemings left hand rule to predict direction of rotation (Physics only) Explain how a moving-coil loudspeaker and headphones work
6	GCSE Physics only <ul style="list-style-type: none"> Describe the factors affecting size and direction of induced pd/current Explain how the generator effect is used in an alternators (ac) and dynamos (dc) Draw/interpret graphs of potential difference generated in the coil against time Explain how a moving-coil microphone works.
7	GCSE Physics Only <ul style="list-style-type: none"> Describe the structure of a transformer Explain how an alternating current in one coil induces a current in another Explain how the ratio of pds across the two coils depends on the ratio of turns Carry out calculations linking both transformer equations and relate to advantages of power transmission at high potential differences
8	Review 1
9	Assessment
10	Review 2



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P8 Space (Physics GCSE only)

Lesson number	Core content
1	<ul style="list-style-type: none"> Calculate distances in space Describe the solar system and how the sun was formed Describe the process of nuclear fusion
2	<ul style="list-style-type: none"> Describe the process of circular motion Describe similarities and differences between planets, moons and artificial satellites. Explain how the force of gravity can lead to changing velocity but unchanging speed Explain how the radius of an orbit must change if speed changes.
3	<ul style="list-style-type: none"> Describe the life cycle of stars similar to our sun and larger Describe the role supernovae play in the formation of elements heavier than iron Explain how fusion processes lead to the formation of new elements
4	<ul style="list-style-type: none"> Describe nuclear fusion of hydrogen into helium Explain how elements heavier than iron are made
5	<ul style="list-style-type: none"> Qualitatively explain the red-shift of light from galaxies that are receding Explain that the change of each galaxy's speed with distance is evidence of an expanding universe Explain how red-shift provides evidence for the Big Bang model
6	<ul style="list-style-type: none"> Explain how CMBR provides evidence for the big bang theory Describe how the CMBR was discovered and led to the acceptance of the Big Bang Theory Describe what is not understood about the universe (eg dark mass and dark energy)
7	Review 1
8	Assessment
9	Review 2