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OVERVIEW

iLOWERSECONDARY YEAR 7		iLOWERSECONDARY YEAR 8		iLOWERSECONDARY YEAR 9	
Scientific enquiry		Scientific enquiry		Scientific enquiry	
BIOLOGY					
Structure and function of living organisms:	Life processes Cells and organisation	Structure and function of living organisms:	Life processes Cells and organisation Movement of molecules	Structure and function of living organisms:	Life processes Pathogens Movement of molecules
Plants:	External structure of plants	Plants:	Transport of water and minerals Fertilisers	Plants:	Photosynthesis and crop yield
Humans and animals:	The musculo-skeletal system	Humans and animals:	The digestive system Breathing and respiration	Humans and animals:	The circulatory system
Organisms and their environment:	Interactions between living organisms Interactions with the environment	Organisms and their environment:	Interactions between living organisms Interactions with the environment	Organisms and their environment:	Interactions between living organisms Interactions with the environment
CHEMISTRY					
Matter:	Particle model Hazards and safety Pure substances and mixtures Separating mixtures Elements, atoms and compounds	Matter:	Identification of pure substances Elements, atoms and compounds	Matter:	Model of an atom
Chemical reactions:	Chemical reactions introduction Acids, bases and alkalis	Chemical reactions:	Reactions involving oxygen More on combustion Reactions of metals	Chemical reactions:	Formulae and equations More reactions of acids Energy changes in reactions Reactivity series Rate of reaction

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iLOWERSECONDARY YEAR 7		iLOWERSECONDARY YEAR 8		iLOWERSECONDARY YEAR 9	
CHEMISTRY (continued)					
Periodic Table:	Periodic Table introduction	Periodic Table:	Brief history of Periodic Table Trends in Periodic Table	Periodic Table:	Arrangement of elements Group 1
Earth and atmosphere:	Composition of air	Earth and atmosphere:	Earth's structure Types of rocks Oxygen in air	Earth and atmosphere:	Materials made from substances in the Earth
PHYSICS					
Energy:	Energy from food and fuels Energy transfer	Energy:	Energy transfer Conservation of energy States of matter Changes in state	Energy:	More on energy stores and transfers
Electricity:	Electric current Circuits Voltage and potential difference Resistance Electricity in the home	Earth and space:	Models of the Solar System Beyond our Solar System	Electricity:	More on resistance, current and voltage Static electricity Electromagnets
Forces:	Different types of forces Pressure	Forces:	More on pressure More on types of forces More on gravity Magnetism	Forces:	Forces and motion Turning forces Stretching forces
Waves:	Types of waves Introduction to sound Sound waves Sound detection	Waves:	Light Reflection of light Refraction of light		

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SCIENTIFIC ENQUIRY

SCIENTIFIC IDEAS

Reference	Objective	Guidance	Links to subject content
SE1.1	Understand the importance of asking scientific questions.		
SE1.2	Understand the term 'prediction'.		
SE1.3	Be able to make predictions using scientific knowledge and understanding.		
SE1.4	Be able to suggest ideas that could be tested.		
SE1.5	Be able to distinguish between questions that can be tested scientifically and those that cannot using simple reasoning.		

INVESTIGATING

Reference	Objective	Guidance	Links to subject content
SE2.1	Be able to plan ways in which evidence can be obtained to answer scientific questions.		Year 9: Plan an investigation to examine the link between pulse rate and exercise.
SE2.2	Be able to distinguish between independent and dependent variables in an investigation.		
SE2.3	Be able to consider variables that should be controlled in order to obtain valid evidence.		
SE2.4	Be able to evaluate the quality of data obtained, making judgements on whether further repeats are required.		
SE2.5	Be able to evaluate risks associated with an investigation and suggest simple control measures.		

OBTAINING AND PRESENTING EVIDENCE

Reference	Objective	Guidance	Links to subject content
SE3.1	Understand the importance of obtaining evidence in order to answer scientific questions.		
SE3.2	Understand simple scientific conventions used when presenting data.	For example, units in column headings of tables.	
SE3.3	Be able to record data using appropriate methods, including labelled scientific diagrams, tables, bar graphs, scatter graphs and line graphs.		
SE3.4	Be able to use lines of best fit where appropriate.		

CONCLUSIONS

Reference	Objective	Guidance	Links to subject content
SE4.1	Be able to apply mathematical skills to calculate results.		
SE4.2	Be able to interpret observations and data, including identifying patterns and trends.		Year 9: Understand how to construct and interpret speed–time graphs, describing patterns or relationships.
SE4.3	Be able to use comparative statements to describe patterns and trends shown in data.		Year 9: Plot and interpret line graphs showing how pulse rate changes with exercise.
SE4.4	Be able to relate evidence gathered to prediction(s) made.		
SE4.5	Understand the term 'conclusion'.		
SE4.6	Be able to use observations, measurements and data to draw conclusions consistent with the evidence.		
SE4.7	Explain patterns and trends in data using scientific knowledge and terminology.		

EVALUATING

Reference	Objective	Guidance	Links to subject content
SE5.1	Understand the term 'evaluate'.		
SE5.2	Be able to consider the extent to which the evidence obtained from an investigation answers the question asked.		
SE5.3	Be able to evaluate ways in which an investigation could be improved, in order to improve reliability and/or to answer further questions.		
SE5.4	Be able to consider simple sources of random or systematic error.		
SE5.5	Be able to identify further questions that can be tested scientifically.		

Where possible, each year group's objectives should be taught through practical investigation in order to embed learning and provide definite links with enquiry objectives.
An example of where practical investigations may be carried out is:
Year 7 Biology: **B7.1.2D** Understand the level of cellular detail that can be seen with a simple light microscope.
Other examples are highlighted in the 'Possible links to enquiry' column on each year group's objective page.

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YEAR 7

BIOLOGY

STRUCTURE AND FUNCTION OF LIVING ORGANISMS

LIFE PROCESSES

Reference	Objective	Guidance	Possible links to enquiry
B7.1.1A	Know the seven shared characteristics of living things and be able to relate them to a wide range of organisms in the local and the wider environment.	Movement (even plants move in some way, e.g. tracking the Sun), respiration, sensitivity, growth, reproduction, excretion and nutrition.	

CELLS AND ORGANISATION

Reference	Objective	Guidance	Possible links to enquiry
B7.1.2A	Know the structure of a typical animal cell.	Membrane surrounds cell; cell contains cytoplasm, mitochondria and nucleus.	
B7.1.2B	Know the similarities and differences between plant and animal cells.	Know that plant cells have a cell wall, chloroplasts and permanent vacuole, in addition to the parts an animal cell has.	
B7.1.2C	Understand the basic parts of a simple light microscope and their functions.	Eye piece, barrel and lenses, and what each is used for.	
B7.1.2D	Understand the level of cellular detail that can be seen with a simple light microscope.	Can be used to identify features of objective B7.1.2E.	Opportunity to use a simple light microscope to examine cells and to identify and note details.
B7.1.2E	Know the cell wall, cell membrane, cytoplasm, nucleus, permanent vacuole, mitochondria and chloroplasts in a range of familiar and less familiar animal and plant cells.		
B7.1.2F	Know the functions of the cell wall, cell membrane, cytoplasm, nucleus, permanent vacuole, mitochondria and chloroplasts.		
B7.1.2G	Know the hierarchical organisation of multicellular organisms from cells to tissues to organs to organ systems to organisms.		

B7.1.2H	Know the major organs and organ systems of the human body and describe their functions.	Lungs, kidney, skin, brain, heart, liver, stomach (small and large intestine), nervous system, spine/spinal column and muscles.	
B7.1.2I	Apply knowledge of human organs and organ systems to other vertebrates.	Know that other vertebrates have a skeletal system that supports muscles, organs, etc. Know that, for example, a cat has a heart that works as part of a circulatory system and intense activity is likely to make that system run quicker.	

PLANTS

EXTERNAL STRUCTURE OF PLANTS

Reference	Objective	Guidance	Possible links to enquiry
B7.2.1A	Identify the relative positions of roots, stems and leaves in a variety of flowering plants in the local and the wider environment.		Examine plant specimens and identify these features.
B7.2.1B	Know the functions of roots, stems and leaves.		
B7.2.1C	Apply knowledge of roots, stems and leaves to a variety of familiar and less familiar flowering plants.		Investigate local flora and compare to a range of other plants, using local and less local examples. Books or the internet may also be used if a wide range of examples is not available.
B7.2.1D	Know the simple external features of plants living in different habitats.	For example, compare leaf structure of desert plants, arctic plants and temperate zone; compare sizes, closeness, textures, etc.	Opportunity for students to examine plant specimens and compare these features.

HUMANS AND ANIMALS

THE MUSCULO-SKELETAL SYSTEM

Reference	Objective	Guidance	Possible links to enquiry
B7.3.1A	Understand the structure and functions of the human skeleton, to include support, protection, movement and making blood cells.		

B7.3.1B	Understand the function of antagonistic muscles in movement.	Understand that muscles may be in antagonistic pairs: when one contracts the other relaxes and this results in movement. Examples include the biceps and triceps in the arm.	
B7.3.1C	Explain the relationship between muscles and bones to bring about movement at the elbow and shoulder.		
B7.3.1D	Compare the range of movement of a variety of human joints.		Students can compare joint movement in own bodies and note key differences and similarities.

ORGANISMS AND THEIR ENVIRONMENT

INTERACTIONS BETWEEN LIVING ORGANISMS

Reference	Objective	Guidance	Possible links to enquiry
B7.4.1A	Understand the terms ‘producer’, ‘primary consumer’, ‘secondary consumer’, ‘tertiary consumer’ and ‘decomposer’.		
B7.4.1B	Know the interdependence of organisms in the environment in terms of feeding relationships by drawing and interpreting food chains and food webs.		

INTERACTIONS WITH THE ENVIRONMENT

Reference	Objective	Guidance	Possible links to enquiry
B7.4.2A	Know how living organisms are adapted to their habitat, relating these principles to a range of organisms in the local and the wider environment.	Students might identify, from a factsheet or picture, how a polar bear, a tiger or an acacia tree are adapted to their environments.	Investigate local plants and animals, sketching and identifying them and then identifying the features that show adaptation to their habitat.
B7.4.2B	Know the difference between abiotic and biotic factors, using examples of each.	For example, an abiotic factor may be the temperature or the light intensity; a biotic factor may be competition with other animals, predation or disease.	
B7.4.2C	Understand the effect of changing environmental conditions on the number and distribution of organisms in a variety of habitats.		

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CHEMISTRY

MATTER

PARTICLE MODEL

Reference	Objective	Guidance	Possible links to enquiry
C7.1.1A	Know the term ‘particle’.		
C7.1.1B	Know the arrangement of particles in solids, liquids and gases.		
C7.1.1C	Explain the properties of solids, liquids and gases in terms of particles.	Include gas pressure.	
C7.1.1D	Understand changes of state in terms of arrangement, movement and energy of particles.	Use the terms ‘melting’, ‘freezing’, ‘evaporation’ and ‘condensation’.	
C7.1.1E	Describe diffusion using the particle model.		

HAZARDS AND SAFETY

Reference	Objective	Guidance	Possible links to enquiry
C7.1.2A	Recognise common hazard symbols.	Students recognise symbols for toxicity, corrosive, irritant, flammable, explosive, hazardous to aquatic environment, harmful and oxidising.	
C7.1.2B	Understand how to work safely in a laboratory.	For example, precautions when using a Bunsen burner for heating/evaporating; use of goggles, fume cupboards, etc.	

PURE SUBSTANCES AND MIXTURES

Reference	Objective	Guidance	Possible links to enquiry
C7.1.3A	Know the difference between a pure substance and a mixture.	For example, water is pure if it contains only water molecules; sugar water is a mixture.	
C7.1.3B	Understand dissolving in terms of particles.	For example, sand does not dissolve in water; salt and sugar do dissolve in water as their particles break apart to form a loose association with the liquid particles.	Investigate dissolving with a range of solid/liquid mixtures, and use a variety of appropriate methods to extract the solute.

C7.1.3C	Know what is meant by the terms ‘solvent’, ‘solute’, ‘solution’, ‘saturated solution’ and ‘suspension’.	Use making solutions as a simple introduction to the principle of conservation of mass, to be built upon later.	
C7.1.3D	Know what is meant by the term ‘colloid’.	For example, paint or milk – particles of one substance are mixed and dispersed with particles of another, not dissolved.	

SEPARATING MIXTURES

Reference	Objective	Guidance	Possible links to enquiry
C7.1.4A	Know methods of separation: filtration, evaporation, simple distillation and paper chromatography.	For example, filtration – sand can be separated from water through filter paper or a sieve; evaporation – saltwater can be boiled to evaporate the water, leaving the salt behind.	Opportunities for students to attempt the separation of various mixtures using these methods and see the appropriateness/non-appropriateness of each.

ELEMENTS, ATOMS AND COMPOUNDS

Reference	Objective	Guidance	Possible links to enquiry
C7.1.5A	Understand the meaning of the terms ‘element’, ‘atom’, ‘compound’ and ‘molecule’.		

CHEMICAL REACTIONS

CHEMICAL REACTIONS INTRODUCTION

Reference	Objective	Guidance	Possible links to enquiry
C7.2.1A	Understand the difference between physical changes and chemical changes.	Know that both physical and chemical changes may result in a change of appearance, but that only chemical changes result in the formation of one or more new substances.	
C7.2.1B	Describe reactions in terms of rearrangement of atoms to form new substance(s)/ compound(s).	Introduce word equations, for example, sodium + chlorine = sodium chloride.	

C7.2.1C	Understand the terms 'reactants' and 'products'.		
C7.2.1D	Know combustion as an example of a type of reaction.	For example, burning magnesium or methane.	Learn about observations by watching a teacher-led controlled combustion of magnesium or methane.
C7.2.1E	Understand what is meant by a thermal decomposition reaction.	A single compound breaks down into two or more new compounds, for example, calcium carbonate plus heat creates calcium oxide and carbon dioxide.	
C7.2.1F	Describe the formation of carbon dioxide from the thermal decomposition of copper(II) carbonate.	Include the word equation and limewater test for carbon dioxide.	Learn about observations by carrying out the thermal decomposition of copper(II) carbonate and testing for carbon dioxide gas using the limewater test, showing appropriate awareness of risks associated with corrosive materials.

ACIDS, BASES AND ALKALIS

Reference	Objective	Guidance	Possible links to enquiry
C7.2.2A	Know names and occurrences of common acids, bases and alkalis.	Include hazard symbols.	
C7.2.2B	Know how to detect acids and alkalis using indicators.	Use universal indicator solution or base indicators and know what the colour changes mean.	Opportunity for students to test various substances using indicators.
C7.2.2C	Know the pH scale as a scale from 0 to 14 of acidity and alkalinity.	Include colours and pH values and relate the two.	
C7.2.2D	Know the reaction between an acid and an alkali as neutralisation.	Include preparation of a salt.	Investigate and observe neutralisation reactions practically.
C7.2.2E	Know the general equation for reactions between acids and alkalis.	Know that a salt and water is produced (e.g. hydrochloric acid + sodium hydroxide = sodium chloride + water).	
C7.2.2F	Know how to name salts from the names of acids and alkalis and use these in word equations.	Know that a salt and water is produced (e.g. hydrochloric acid + sodium hydroxide = sodium chloride + water).	

PERIODIC TABLE

PERIODIC TABLE INTRODUCTION

Reference	Objective	Guidance	Possible links to enquiry
C7.3.1A	Know the names and chemical symbols of some common elements.	hydrogen – H; oxygen – O; nitrogen – N; carbon – C; magnesium – Mg; copper – Cu; zinc – Zn; aluminium – Al; iron – Fe; chlorine – Cl; helium – He	
C7.3.1B	Understand how to identify an element as a metal or a non-metal from its position in the Periodic Table.		
C7.3.1C	Know and describe the typical physical properties of metals and non-metals.		
C7.3.1D	Relate the physical properties of metals to their uses.	Describe why a flexible metal might be chosen in certain circumstances, or a strong and light metal in others.	
C7.3.1E	Know a vertical column of elements as a 'group'.		
C7.3.1F	Know a horizontal row of elements as a 'period'.		

EARTH AND ATMOSPHERE

COMPOSITION OF AIR

Reference	Objective	Guidance	Possible links to enquiry
C7.4.1A	Know the approximate composition of gases found in dry air.	Approximately, 78% nitrogen, 21% oxygen, 0.9% argon and 0.1% others.	
C7.4.1B	Know uses of the gases found in air.		

PHYSICS

ENERGY

ENERGY FROM FOOD AND FUELS

Reference	Objective	Guidance	Possible links to enquiry
P7.1.1A	Understand that energy is something that is needed to make things change or happen.		
P7.1.1B	Know joules (J) and kilojoules (kJ) as units of energy.		
P7.1.1C	Understand that the energy we need is obtained from food.	See also Biology Year 8, for example, measuring the temperature increase in water heated by burning specific foodstuffs.	
P7.1.1D	Know a simple method for comparing the amount of energy stored in foods.	See also Biology Year 8, for example, measuring the temperature increase in water heated by burning specific foodstuffs.	Investigate practically by burning food samples to heat water and measuring the temperature increase so as to calculate the energy used.
P7.1.1E	Understand that energy is stored in different ways: thermal energy, chemical energy, kinetic energy, gravitational potential energy, elastic potential energy (strain energy) and nuclear energy.		

ENERGY TRANSFER

Reference	Objective	Guidance	Possible links to enquiry
P7.1.2A	Understand that energy can be transferred between energy stores but no energy is created or lost.	Introduce the law of conservation of energy.	
P7.1.2B	Know ways in which energy is transferred, such as by light, heating, sound, electricity and forces.	Introduce the idea that energy can be wasted and hold a simple discussion of efficiency. For example, heat from an electric light is 'wasted': it is transferred to the surroundings and is not useful.	
P7.1.2C	Explain what a fuel is and know examples.	Know that fuels are burnt to release energy.	
P7.1.2D	Know what fossil fuels are and how they were formed.	For example, coal, natural gas and oil.	

P7.1.2E	Know the difference between renewable and non-renewable energy sources.	For example, wind power, solar power or tidal power are renewable; coal, gas and oil are non-renewable.	
P7.1.2F	Know how some renewable energy resources can be used to generate electricity and provide heat.		
P7.1.2G	Know some advantages and disadvantages of renewable energy sources.	For example, an advantage of renewable sources is that there are no fuel costs and no harmful polluting gases are produced; disadvantages can include solar cells not working at night or in cloud and wind turbines being dependent on the strength of the wind.	

ELECTRICITY

ELECTRIC CURRENT

Reference	Objective	Guidance	Possible links to enquiry
P7.2.1A	Know electric current as a flow of negative charges or flow of electrons, which are negatively charged particles.		Build circuits that include ammeters connected in series and use them to measure currents.
P7.2.1B	Know that current is measured in amperes (A) using an ammeter connected in series.	Students should know the universal symbol for ammeter.	

CIRCUITS

Reference	Objective	Guidance	Possible links to enquiry
P7.2.2A	Understand that in a series circuit the current can only take one route and is the same everywhere.		Build series circuits and measure the current at different points to demonstrate that it is always the same.
P7.2.2B	Understand that in a parallel circuit there are junctions where the current splits and takes different routes/branches.		Build suitable parallel circuits and measure the current at different points to show how the current splits.

P7.2.2C	Understand that in a parallel circuit currents combine when routes/branches meet and the total current entering a junction is the same as the total amount leaving.		Opportunity for students to build suitable parallel circuits and measure the current at different points to show how the currents combine and that the total current entering a junction is the same as the total amount leaving.

VOLTAGE AND POTENTIAL DIFFERENCE

Reference	Objective	Guidance	Possible links to enquiry
P7.2.3A	Understand that a potential difference is needed to cause a flow of electrons (current) in a circuit.		
P7.2.3B	Understand that a potential difference is provided by a cell/battery/power pack and that it is related to the energy provided by the cell/battery/power pack.		
P7.2.3C	Understand that the higher the voltage, the more (negative) charges can be 'pushed' around the circuit, so the higher the current.		Build circuits containing varying numbers of cells/batteries and measure the current and potential difference.
P7.2.3D	Know that voltage and potential difference is measured in volts (V) using a voltmeter connected in parallel to the component (across the component).	Students should know the universal symbol for a voltmeter.	Build suitable circuits and measure the potential difference across various components.
P7.2.3E	Know that the potential difference across two components connected in parallel is the same.		Build a suitable circuit and measure the potential differences in order to demonstrate this.

RESISTANCE

Reference	Objective	Guidance	Possible links to enquiry
P7.2.4A	Understand that the (electrical) resistance of a component indicates how hard it is for current to flow through a component.		
P7.2.4B	Understand that components such as bulbs and resistors that make it more difficult for a current to flow through have a high resistance; components such as copper wire that are easy for a current to flow through have a low resistance.		Build circuits containing these components and measure the current.
P7.2.4C	Understand that the higher the total resistance of the components in a circuit, the smaller the current that flows.	Students should understand this concept only qualitatively.	Build suitable circuits and measure the currents in order to demonstrate this.

ELECTRICITY IN THE HOME

Reference	Objective	Guidance	Possible links to enquiry
P7.2.5A	Explain how to reduce the risks when using electrical appliances.	For example, avoid allowing water to come into contact with live electrical equipment, check plugs are undamaged and wired correctly and avoid pushing metal objects into plug sockets.	
P7.2.5B	Know the purpose of fuses and circuit breakers.		

FORCES

DIFFERENT TYPES OF FORCES

Reference	Objective	Guidance	Possible links to enquiry
P7.3.1A	Understand that forces are pushes or pulls that can change the speed of an object or the direction it is moving in, or can change the shape of something.	For example, clay could be reshaped, a swing could be pushed harder to go faster and a thrown ball could be hit and travel in a new direction.	
P7.3.1B	Understand the difference between contact forces, such as friction, upthrust, air and water resistance, and non-contact forces, such as gravity, magnetism and forces due to static electricity.		
P7.3.1C	Know and describe the use of the extension of springs in force meters to measure forces.	Include terms such as ‘elastic’ and ‘stretches’.	Use force meters to measure various forces.
P7.3.1D	Know that the unit of force is the newton (N).		
P7.3.1E	Understand the use of different-sized arrows to indicate the size and direction of action of a force.		Use correct diagrams/terms in investigations and reporting.
P7.3.1F	Explain the effects of balanced and unbalanced forces.		
P7.3.1G	When discussing objects on or near the Earth, know that the Earth’s gravitational force attracts any mass towards its centre.		

P7.3.1H	Know the difference between mass and weight.	Appreciate that an object on the Earth has weight because of gravity and know that the mass of a given object is constant.	
P7.3.1I	Know that the force of gravity on a given object is less on the Moon than on the Earth.	Appreciate that the same object will weigh less on the Moon than on the Earth.	
P7.3.1J	Understand the origin of friction, air and water resistance (drag) and upthrust, and know situations in which these forces act.	For example, wind resistance slows a parachutist, a fish experiences water resistance and the weight of a boat in water displaces water and causes upthrust.	
P7.3.1K	Know how forces of friction can be helpful and unhelpful and how they can be changed.	For example, car brakes use friction to slow a vehicle, a parachute helps to slow a fall to a safe velocity; unoiled gears or chains on a bicycle or car will experience unhelpful friction and waste energy through heat.	

PRESSURE

Reference	Objective	Guidance	Possible links to enquiry
P7.3.2A	Understand that pressure is the amount of force acting on a certain area.	Know how to carry out calculations using the formula pressure = force ÷ area.	
P7.3.2B	Know that the unit of pressure is N/m^2 or pascals (Pa).		
P7.3.2C	Know simple situations where size of pressure is important.	For example, snow shoes increase the area affected by a person's weight, causing the pressure to be lower and stopping a person from sinking into the snow.	

WAVES

TYPES OF WAVES

Reference	Objective	Guidance	Possible links to enquiry
P7.4.1A	Understand what is meant by a longitudinal wave, using sound waves as an example.		
P7.4.1B	Understand what is meant by a transverse wave, using waves on the surface of water as an example.		
P7.4.1C	Know that all waves can be reflected.		
P7.4.1D	Know what happens when waves meet and what superposition means.		

INTRODUCTION TO SOUND

Reference	Objective	Guidance	Possible links to enquiry
P7.4.2A	Understand what causes sound in terms of vibrations of objects.		
P7.4.2B	Understand the terms ‘volume’, ‘pitch’, ‘frequency’ (measured in hertz, Hz) and ‘amplitude’, and the links between them.	For example, the greater the amplitude, the louder the sound; the greater the frequency, the higher the pitch.	

SOUND WAVES

Reference	Objective	Guidance	Possible links to enquiry
P7.4.3A	Know how sound travels through a medium.	Compare the speed of sound in air, water and solids.	Carry out an investigation to measure and compare the speed of sound in various media using microphones and a data logger, if available.
P7.4.3B	Know how moving vibrations form a wave.		Carry out an experiment using an overturned speaker and uncooked rice grains to demonstrate sound causing wave-form vibrations.

SOUND DETECTION

Reference	Objective	Guidance	Possible links to enquiry
P7.4.4A	Know how animals use ears to detect sound.		
P7.4.4B	Know how a microphone converts sound into electrical signals.		
P7.4.4C	Know that sound waves transfer energy, and describe ways in which sound is used.	For example, communication, ultrasound and sonar.	

YEAR 8

BIOLOGY

STRUCTURE AND FUNCTION OF LIVING ORGANISMS

LIFE PROCESSES

Reference	Objective	Guidance	Possible links to enquiry
B8.1.1A	Know the difference between breathing and respiration.		
B8.1.1B	Know the difference between excretion and defaecation.		

CELLS AND ORGANISATION

Reference	Objective	Guidance	Possible links to enquiry
B8.1.2A	Explain how cells may have adaptations for particular functions, using cilia and microvilli as examples.		
B8.1.2B	Identify the slime capsule, cell wall, cell membrane, flagella, nucleoid and plasmids in a generalised bacterial cell.		
B8.1.2C	Explain the functions of the slime capsule, cell wall, cell membrane, flagella, nucleoid and plasmids in a generalised bacterial cell.		
B8.1.2D	Know the similarities and differences between generalised plant, animal and bacterial cells.		View suitable examples using a microscope, note down/record similarities and differences and report on these.

MOVEMENT OF MOLECULES

Reference	Objective	Guidance	Possible links to enquiry
B8.1.3A	Know the process of diffusion and relate this to the movement of substances in and out of cells.		
B8.1.3B	Understand the concept of a diffusion gradient.	Know that particles diffuse from areas of high concentration to areas of low concentration; particles move down the diffusion gradient.	

PLANTS

TRANSPORT OF WATER AND MINERALS

Reference	Objective	Guidance	Possible links to enquiry
B8.2.1A	Know how water and minerals are absorbed and transported in flowering plants.		Revise this with a practical experiment following the movement of dyed water through a plant.
B8.2.1B	Explain why plants need minerals, using nitrate and magnesium ions as examples.		

FERTILISERS

Reference	Objective	Guidance	Possible links to enquiry
B8.2.2A	Explain how fertilisers can increase crop yield.		
B8.2.2B	Know the advantages and disadvantages of natural and artificial fertilisers.	For example, artificial fertilisers may be cheaper and more effective at providing specific nutrients but may contaminate water, require frequent reapplying and cause acid formation; natural fertilisers may provide a wider range of nutrients, be less affected by rain, and be less polluting but may be more expensive and slower to act.	

HUMANS AND ANIMALS

THE DIGESTIVE SYSTEM

Reference	Objective	Guidance	Possible links to enquiry
B8.3.1A	Know the main components of the digestive system and their functions.	Include teeth, salivary glands, oesophagus, stomach, pancreas and small/large intestine.	
B8.3.1B	Know the components of a balanced diet.	These include carbohydrates, proteins, lipids (fats and oils), minerals, vitamins, dietary fibre and water.	

B8.3.1C	Know the difference between starvation and malnutrition and the effects of nutritional deficiencies.		
B8.3.1D	Know how energy requirements vary with age and activity levels.	For example, an athlete who is training every day will need more energy than a typical person of the same age; the amount of energy required increases as children grow; the amount of energy required begins to decrease again from around 50 years of age.	
B8.3.1E	Know that different foods have different energy values.		Perform a practical investigation to estimate and compare the amount of energy available in different foods by burning them and measuring the temperature change.

BREATHING AND RESPIRATION

Reference	Objective	Guidance	Possible links to enquiry
B8.3.2A	Recognise the main components of the respiratory system and their functions.	Include trachea, bronchi, bronchioles and alveoli.	
B8.3.2B	Explain the role of cartilage in keeping airways open.		
B8.3.2C	Know and describe the mechanism of breathing to move air in and out of the lungs.	Movements of the ribs, rib muscles and diaphragm allow air into and out of the lungs. Air passes between the lungs and the outside of the body through the windpipe, called the trachea. The trachea divides into two bronchi, with one bronchus for each lung.	
B8.3.2D	Understand the term ‘gas exchange’.		
B8.3.2E	Describe the effects of smoking.	Include the effects on the respiratory system and wider health risks.	
B8.3.2F	Understand the term ‘aerobic respiration’ and correctly use the terms ‘breathing’ and ‘respiration’.		

ORGANISMS AND THEIR ENVIRONMENT

INTERACTIONS BETWEEN LIVING ORGANISMS

Reference	Objective	Guidance	Possible links to enquiry
B8.4.1A	Know how to draw and interpret pyramids of number.	Show the numbers of each living organism in a food chain, for example, tree – caterpillars – small birds – single raptor.	Gather data on the local environment and present and interpret the data.
B8.4.1B	Know how to interpret food chains and food webs in terms of energy flow.	Know that energy flows from each food to each feeder.	
B8.4.1C	Explain ways in which energy is lost between trophic levels.	Know that energy is used as heat and for life processes (e.g. movement), and that faeces and remains are passed to decomposers.	

INTERACTIONS WITH THE ENVIRONMENT

Reference	Objective	Guidance	Possible links to enquiry
B8.4.2A	Explain how toxic materials can accumulate along food chains.	For example, mercury or DDT are persistent and cumulative. They do not break down, meaning the apex predator will get lots and lots of small amounts.	

CHEMISTRY

MATTER

IDENTIFICATION OF PURE SUBSTANCES

Reference	Objective	Guidance	Possible links to enquiry
C8.1.1A	Understand that a pure substance has a fixed melting and boiling point.	For example, the melting point of pure iron is 1536 °C and its boiling point is about 3000 °C; the melting point of pure oxygen is –183 °C and its boiling point is –218.8 °C.	
C8.1.1B	Know a physical test to show whether a sample of water is pure.		Practically carry out this test and investigate a range of water for purity.
C8.1.1C	Understand that a mixture may melt or boil over a range of temperatures.	Students should know that mixtures have variable composition whereas compounds do not.	Melt a suitable mixture and follow the temperature as it melts, and then plot this on a graph and interpret the results.
C8.1.1D	Know what is meant by an ‘alloy’ and know some examples.	For example, steel, brass and bronze.	
C8.1.1E	Relate properties of alloys to uses.	For example, an alloy that is light and strong may be used in aircraft construction; a malleable alloy may be suitable for jewellery or decorative purposes.	

ELEMENTS, ATOMS AND COMPOUNDS

Reference	Objective	Guidance	Possible links to enquiry
C8.1.2A	Know Dalton's atomic model.		
C8.1.2B	Know common chemical symbols and common chemical formulae.	Know, for example, common components of air, O, N, Ar, and other common elements including H, He, C, Si, Na, Mg, K, Ca, Fe and Cu. Know common formulae, including salt (NaCl) and limestone ($CaCO_3$).	
C8.1.2C	Understand that chemical formulae show the ratio of elements in a compound and be able to use these formulae.		

CHEMICAL REACTIONS

REACTIONS INVOLVING OXYGEN

Reference	Objective	Guidance	Possible links to enquiry
C8.2.1A	Describe the combustion of elements in oxygen, including magnesium, hydrogen and sulphur.		Watch teacher-led experiments, take notes, plan own versions of the experiments, and carry these out.
C8.2.1B	Understand the term 'oxidation' as gain of oxygen.		
C8.2.1C	Know the chemical properties of metal and non-metal oxides with respect to acidity/alkalinity.		Carry out experiments to produce some of these and then test their pH.

MORE ON COMBUSTION

Reference	Objective	Guidance	Possible links to enquiry
C8.2.2A	Know about an experiment to show the products of combustion of a hydrocarbon.	For example, a burning candle.	Plan and carry out an experiment, passing the released gases through limewater to show one of the products.

C8.2.2B	Know about a test for the presence of water using anhydrous copper(II) sulphate.		Plan and carry out this experiment to demonstrate that the white solid turns blue in the presence of water. Take measurements and write up results.
C8.2.2C	Know about a test for the presence of carbon dioxide using limewater.	This section revises the work done in Year 7.	Plan and carry out this experiment to demonstrate that limewater turns cloudy white in the presence of CO_2. Take measurements and write up results.
C8.2.2D	Understand the fire triangle.	Know that fuel, heat and oxygen are all needed for most fires.	
C8.2.2E	Know how air pollution may be caused by the combustion of sulphur and the complete/ incomplete combustion of carbon in fossil fuels.	For example, formation of CO, soot, CO_2 and SO_2.	
C8.2.2F	Know the environmental problems caused by air pollution and ways of reducing them.	For example, the greenhouse effect and global warming/ climate change.	

REACTIONS OF METALS

Reference	Objective	Guidance	Possible links to enquiry
C8.2.3A	Know the reactions of some metals with oxygen and know what is meant by ‘corrosion’.	For example, potassium, sodium, lithium and magnesium.	Learn about observations by observing the reactions of some metals with oxygen.
C8.2.3B	Know experiments to find the conditions needed for rusting of iron.		Plan and carry out these experiments.
C8.2.3C	Know simple methods of preventing rusting by barrier methods and galvanising.	For example, use of paint, oil and grease.	
C8.2.3D	Describe the reactions of some metals with water.	For example, potassium, sodium, lithium and calcium; introduce idea of reactivity series.	Plan and carry out these experiments.
C8.2.3E	Describe the reaction of dilute acid with some metals such as magnesium to produce a salt plus hydrogen.		Plan and carry out these experiments.
C8.2.3F	Know how to test for hydrogen gas.		Plan and carry out these experiments.

PERIODIC TABLE

BRIEF HISTORY OF PERIODIC TABLE

Reference	Objective	Guidance	Possible links to enquiry
C8.3.1A	Know the principles behind Mendeleev's Periodic Table.	Know that he arranged them so that groups of elements with similar properties fell into vertical columns in his table, leaving gaps that he thought would be filled later.	
C8.3.1B	Know how the modern Periodic Table is organised.	Know that atomic number has replaced atomic mass.	

TRENDS IN PERIODIC TABLE

Reference	Objective	Guidance	Possible links to enquiry
C8.3.2A	Identify and describe trends in physical properties of elements in the Periodic Table.	For example, melting points in Group 1.	
C8.3.2B	Identify and describe trends in chemical properties of elements in the Periodic Table.	For example, reactivity down Group 1, acid/base nature of oxides across a period.	

EARTH AND ATMOSPHERE

EARTH'S STRUCTURE

Reference	Objective	Guidance	Possible links to enquiry
C8.4.1A	Know and describe the main parts of the structure of the Earth.	The main parts are the outer core, inner core, mantle and crust.	

TYPES OF ROCKS

Reference	Objective	Guidance	Possible links to enquiry
C8.4.2A	Describe the formation of igneous, sedimentary and metamorphic rocks and the links between them in the rock cycle.	Know examples of each type and their uses related to properties.	
C8.4.2B	Know what is meant by 'weathering' and 'erosion' of rocks.		

C8.4.2C	Know what is meant by a ‘mineral’ and an ‘ore’.		
C8.4.2D	Understand that ores are sources of metals and that there is a limited supply on Earth.		
C8.4.2E	Know environmental problems associated with obtaining ores.	For example, erosion, air and water pollution.	
C8.4.2F	Know reasons for recycling.	For example, to reduce pollution caused by waste and to reduce the impact of producing brand new goods.	

OXYGEN IN AIR

Reference	Objective	Guidance	Possible links to enquiry
C8.4.3A	Know experiments to find the approximate percentage of oxygen in air using iron and copper.		

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PHYSICS

ENERGY

ENERGY TRANSFER

Reference	Objective	Guidance	Possible links to enquiry
P8.1.1A	Understand the difference between thermal (heat) energy and temperature.		
P8.1.1B	Understand that the amount of thermal energy stored in an object depends on its mass, its temperature and what it is made from.		
P8.1.1C	Understand that a temperature difference between two objects leads to thermal energy transfer from the hotter to the cooler one.		
P8.1.1D	Know how energy can be transferred through conduction, radiation and convection.	For example, a cold pan of water on a stove, a radiator heating a room and metal left out on a sunny day.	

CONSERVATION OF ENERGY

Reference	Objective	Guidance	Possible links to enquiry
P8.1.2A	Understand the law of conservation of energy.	Know that in an isolated system, energy is conserved.	
P8.1.2B	Understand the use of Sankey diagrams to show energy transfers.		
P8.1.2C	Understand and use the term ‘efficiency’.	Use the formula: efficiency = (useful energy output ÷ total energy output) × 100.	
P8.1.2D	Understand how our energy use is calculated and charged for in energy bills.	Use the unit kilowatt-hour (kWh).	
P8.1.2E	Know ways of reducing energy use and costs.	For example, turning off electrical items when not in direct use, insulating a house properly, wearing appropriate clothing instead of using heating or air conditioning.	

STATES OF MATTER

Reference	Objective	Guidance	Possible links to enquiry
P8.1.3A	Explain the properties of the three states of matter in terms of particles.	This section continues and consolidates learning from Year 7 Chemistry.	
P8.1.3B	Explain expansion, contraction and changes in density in terms of particles.	Include experiments to calculate density and use of the formula density = mass ÷ volume.	Carry out experiments to calculate the density of suitable objects.

CHANGES IN STATE

Reference	Objective	Guidance	Possible links to enquiry
P8.1.4A	Know changes in state in terms of particles.		
P8.1.4B	Know that the temperature stays constant during changes in state.		Follow the temperature changes as a beaker of ice is heated to melting point and then to boiling point.
P8.1.4C	Know the anomalous property of water around its freezing point.	Water is at its maximum density at 4 °C.	

EARTH AND SPACE

MODELS OF THE SOLAR SYSTEM

Reference	Objective	Guidance	Possible links to enquiry
P8.2.1A	Know Ptolemy's geocentric model and Copernicus' heliocentric model of the Solar System.	Students should be able to explain why people believe(d) in each of these.	Research these ideas, weigh up the evidence for each model and be able to explain why people believe(d) in each of them.
P8.2.1B	Understand how knowledge of the modern Solar System has been developed through the use of telescopes on Earth and in space, space probes, photography and the detection of electromagnetic waves.		

P8.2.1C	Know some evidence for the shape of the Earth.	For example, pictures from space; Earth casts a circular shadow on the Moon during lunar eclipses.	
P8.2.1D	Know the names of the eight planets in the Solar System in order of increasing distance from the Sun.	Students should also know that from 2006, Pluto was no longer classified as a planet.	

BEYOND OUR SOLAR SYSTEM

Reference	Objective	Guidance	Possible links to enquiry
P8.2.2A	Understand that our Sun is a star and that a galaxy is a large collection of billions of stars.		
P8.2.2B	Understand that our Solar System is in the Milky Way galaxy and that the Universe is a large collection of billions of galaxies.		
P8.2.2C	Understand that a light year is the distance travelled by light in a year.		

FORCES

MORE ON PRESSURE

Reference	Objective	Guidance	Possible links to enquiry
P8.3.1A	Explain pressure and its effects in terms of particles.		
P8.3.1B	Know and describe how pressure in liquids and gases changes with depth or height.		Plan and carry out an experiment, for example, an experiment with holes in a bucket or large water container – the water from holes further down (i.e. more water/mass above it) comes out further and faster due to more pressure on it at that point.

MORE ON TYPES OF FORCES

Reference	Objective	Guidance	Possible links to enquiry
P8.3.2A	Explain why some objects float using forces of weight and upthrust.		
P8.3.2B	Explain whether an object will sink or float in terms of density.		
P8.3.2C	Know that air resistance and water resistance are types of drag.		
P8.3.2D	Describe the causes of drag and how drag forces can be increased and decreased.		Plan, carry out and write up an investigation into different ways of increasing/decreasing drag forces.

MORE ON GRAVITY

Reference	Objective	Guidance	Possible links to enquiry
P8.3.3A	Know that the greater the mass of an object, the stronger the gravitational force it exerts.		
P8.3.3B	Know how to use the formula weight = mass (m) × gravitational field strength (g), and know that the approximate value of the gravitational field strength (g) on the surface of the Earth is 10 N/kg.	Know that gravitational field strength (g) is smaller on the moon's surface than on the Earth's surface.	
P8.3.3C	Know that the gravitational force of Earth acting on an object decreases as the object moves further away from the centre of the Earth.		
P8.3.3D	Know that the gravitational force between two objects decreases as the objects move further apart.		
P8.3.3E	Describe how gravity makes the Earth spherical		
P8.3.3F	Know that gravitational force causes moons to orbit planets and causes the planets to orbit the Sun.		
P8.3.3G	Know that gravitational force causes artificial satellites to orbit the Earth and causes comets to orbit the Sun.		
P8.3.3H	Understand the terms 'natural satellite' and 'artificial satellite'.		
P8.3.3I	Know some uses of artificial satellites.	For example, to support mapping or television signals.	

MAGNETISM

Reference	Objective	Guidance	Possible links to enquiry
P8.3.4A	Know that a bar magnet has a north(-seeking) pole and a south(-seeking) pole.		
P8.3.4B	Know that a compass is a magnet that points north.		
P8.3.4C	Know that like poles repel each other and opposite poles attract each other.		
P8.3.4D	Know that the magnetic field is the space around a magnet in which the magnetic force has an effect.		
P8.3.4E	Know how to find the shape of the magnetic field around a magnet.		Plan and carry out an experiment to find the shape of the magnetic field around a bar magnet.

P8.3.4F	Know about the Earth's magnetic field and how compasses are affected by it.		

WAVES

LIGHT

Reference	Objective	Guidance	Possible links to enquiry
P8.4.1A	Know that light is a way of transferring energy from one place to another.		
P8.4.1B	Know that light waves are transverse waves.	That is, the wave vibrates at right angles to the direction of travel.	
P8.4.1C	Know some differences between light and sound waves.	For example, speed and what they travel through.	
P8.4.1D	Understand that when light rays meet an opaque object some are reflected and some are absorbed.		
P8.4.1E	Understand the difference between the terms 'transparent' and 'translucent'.		

REFLECTION OF LIGHT

Reference	Objective	Guidance	Possible links to enquiry
P8.4.2A	Understand the use of ray diagrams and the terms 'incident ray', 'reflected ray', 'normal', 'angle of incidence' and 'angle of reflection'.		
P8.4.2B	Know an experiment to show that, when light hits a mirror, the angle of incidence equals the angle of reflection.	Include applications, e.g. a simple periscope; how to see around a corner.	Plan and carry out an experiment, for example, using a torch and a reflective surface. Shine the torch at a set angle, so light bounces onto a non-reflective surface. Mark the impact of the light and measure the angle.
P8.4.2C	Know how an image is formed in a plane mirror.	Use ray diagrams to describe how the image is formed.	

P8.4.2D	Know the properties of an image formed in a plane mirror.		
P8.4.2E	Know what happens when light hits a rough, opaque surface.		

REFRACTION OF LIGHT

Reference	Objective	Guidance	Possible links to enquiry
P9.4.3A	Know that refraction is the change of direction of light that happens when light passes from one transparent material to another.	Know that it only takes place at the 'interface', i.e. where the two materials meet; examples include from air to glass or water.	
P9.4.3B	Know that light travels more slowly in materials such as glass and water than it does in air.		
P9.4.3C	Know that when light travels from air to (more dense) materials such as glass and water, the light bends towards the normal (and vice versa).	Consider simple examples, such as looking at objects at the bottom of a pool of water.	Carry out experiments that demonstrate refraction, e.g. using ray boxes and glass blocks.

Pearson

YEAR 9

BIOLOGY

STRUCTURE AND FUNCTION OF LIVING ORGANISMS

LIFE PROCESSES

Reference	Objective	Guidance	Possible links to enquiry
B9.1.1A	Know the basic structure of viruses and understand that viruses are obligate parasites causing harm to the cells of living things.		
B9.1.1B	Know how a virus reproduces and use this to explain why viruses may not be classed as living organisms.	Viruses are acellular particles (meaning they are not made up of living cells like plants and animals are), consisting of a central core of either DNA or RNA.	
B9.1.1C	Know that plant and animal cells respire to produce ATP to provide energy for cells.	Reinforce respiration being opposite to photosynthesis (and clarify plants not 'breathing'). Detailed knowledge of ATP is not required.	Use a hydrogen carbonate indicator to investigate the effect of light on respiration of a leaf – three tubes, one wrapped in foil to block light, one open and one as control with indicator solution only.
B9.1.1D	Know how to model aerobic and anaerobic respiration using a word equation and a balanced symbol equation for aerobic respiration only.	carbon dioxide + water (+ energy) → glucose + oxygen $6CO_2 + 6H_2O$ (+ energy) → $C_6H_{12}O_6 + 6O_2$	

PATHOGENS

Reference	Objective	Guidance	Possible links to enquiry
B9.1.2A	Know the difference between the terms 'pathogen' and 'parasite'.		
B9.1.2B	Understand that, in addition to viruses, some bacteria, some fungi and some protocists cause disease.	Bacterial – tuberculosis; fungal – ringworm; protocist – malaria.	
B9.1.2C	Understand that antibiotics are effective against bacteria but not against viruses.		

B9.1.2D	Know the problems associated with overuse of antibiotics in humans and farmed animals.	For example: Antibiotic resistance can affect anyone, of any age, in any country. Antibiotic resistance occurs naturally, but misuse of antibiotics in humans and animals is accelerating the process. A growing number of infections, such as pneumonia, tuberculosis, gonorrhoea and salmonellosis, are becoming harder to treat as the antibiotics used to treat them become less effective. Antibiotic resistance leads to longer hospital stays, higher medical costs and increased mortality.	
B9.1.2E	Understand how vaccination helps to prevent the spread of disease in communities.	For example, polio, MMR (measles, mumps, rubella), DTP (diphtheria, tetanus, pertussis), hepatitis B, varicella (chicken pox).	

MOVEMENT OF MOLECULES

Reference	Objective	Guidance	Possible links to enquiry
B9.1.3A	Explain how temperature and concentration affect rate of diffusion.		Place a Petri dish of cold water on top of graph paper. Add 1 cm^3 of food dye. 1.5 min later, record the area of spread. Carry out twice more to calculate average. Repeat with warm and then hot water. Graph results and compare them.

B9.1.3B	Know how to calculate and compare surface area : volume ratios.	Use a video and explanation of the limits of surface area : volume on cell growth.	Calculate and compare the surface area to volume ratios of cubes, look at effect of scaling them up and down and produce a general statement to fit.

PLANTS

PHOTOSYNTHESIS AND CROP YIELD

Reference	Objective	Guidance	Possible links to enquiry
B9.2.1A	Know the structure of a leaf and explain how it is adapted for photosynthesis.	Large surface area, thin, network of veins, stomata.	Investigate how leaves are essentially different in northern, darker regions in comparison to sunnier, tropical regions.
B9.2.1B	Know how to model photosynthesis using a word equation and a balanced symbol equation.	carbon dioxide + water (+ light energy) → glucose + oxygen $6CO_2 + 6H_2O$ (+ light energy) → $C_6H_{12}O_6 + 6O_2$	
B9.2.1C	Explain how light intensity and carbon dioxide concentration affect rate of photosynthesis.		Conduct an experiment to measure the rate of photosynthesis by counting the number of bubbles rising from pondweed.
B9.2.1D	Explain how crop yield may be affected by changes in abiotic factors.		
B9.2.1E	Know how selective breeding can lead to new plant varieties.		Investigate how rice is adapted by human intervention to provide vitamin A to populations in need. Discuss disease-resistant wheat.

HUMANS AND ANIMALS

THE CIRCULATORY SYSTEM

Reference	Objective	Guidance	Possible links to enquiry
B9.3.1A	Know the difference between single and double circulatory systems.		
B9.3.1B	Know the main components of the circulatory system and their functions.	Include heart, arteries, veins, capillaries, lungs, brain and liver.	

B9.3.1C	Explain the differences in pressure and rate of flow in arteries, veins and capillaries.		
B9.3.1D	Know the effect of exercise on heart rate and explain why these changes are important.		
B9.3.1E	Understand how to measure average pulse rate by counting beats per minute.		Investigate own average pulse rates by counting beats per minute – this is an opportunity to reinforce ideas about fair testing.
B9.3.1F	Know how to interpret line graphs showing how pulse rate changes with exercise.		Obtain and present evidence of how pulse rate changes with exercise by measuring the average pulse rate before and after exercise and plotting suitable line graphs.
B9.3.1G	Explain how lifestyle factors may contribute to cardiovascular disease.		

ORGANISMS AND THEIR ENVIRONMENT

INTERACTIONS BETWEEN LIVING ORGANISMS

Reference	Objective	Guidance	Possible links to enquiry
B9.4.1A	Know, draw and interpret pyramids of biomass.	Understand that pyramids of biomass are a more accurate indication of how much energy is passed on.	For example: oak tree – caterpillar – blue tit – sparrowhawk; data-handling opportunity – explore the energy transfer to next trophic level using a cow as consumer of the primary producer (grass, leaf matter, etc.).
B9.4.1B	Understand the terms ‘species’, ‘population’, ‘community’, ‘habitat’ and ‘ecosystem’.		
B9.4.1C	Know the difference between inter- and intra-specific competition.		
B9.4.1D	Know how to interpret data on population numbers.	Use a pyramid of numbers to illustrate population size within a food chain.	Translate a pyramid of numbers to a graphical presentation of potential population numbers, e.g. a bar graph where the top of the pyramid is a bird of prey with a value of 1.
B9.4.1E	Explain why population numbers fluctuate, including predator–prey relationships.	Factors also include size of ecosystem, food, competition, reproduction, diseases, migration and human activity.	

B9.4.1F	Know about predator–prey interactions in order to interpret data.	For example, ladybird and aphid, Canadian lynx and snowshoe hare.	Research and present data for population changes of the Canadian lynx. Use this to predict and add to the graph the related population fluctuations of the snowshoe hare.

INTERACTIONS WITH THE ENVIRONMENT

Reference	Objective	Guidance	Possible links to enquiry
B9.4.2A	Know the role of decomposers in recycling carbon in an ecosystem.		
B9.4.2B	Know examples of production of carbon dioxide by human activity and discuss the impact of these on the climate.	Deforestation and cement production, as well as the burning of fossil fuels at all stages of industrial processes and transportation.	Find out whether the introduction of renewable sources of energy has reduced the impact humans are having on the climate. Have signs of global warming slowed? Students could also research levels of carbon dioxide production by different countries and the potential reasons for these differences.

CHEMISTRY

MATTER

MODEL OF AN ATOM

Reference	Objective	Guidance	Possible links to enquiry
C9.1.1A	Know the structure of an atom in terms of the positions of sub-atomic particles.		
C9.1.1B	Know the relative charges of protons, neutrons and electrons.		
C9.1.1C	Understand and use the terms ‘atomic (proton) number’ and ‘mass number’.		

CHEMICAL REACTIONS

FORMULAE AND EQUATIONS

Reference	Objective	Guidance	Possible links to enquiry
C9.2.1A	Understand how to represent simple chemical reactions using formulae and equations, including state symbols.		
C9.2.1B	Understand the conservation of mass in chemical reactions.		Measure out 5 cm^3 of potassium iodide and then the same of lead nitrate. Measure the total mass of two beakers with contents. Combine the contents of the beakers. Observe reaction taking place. Place both beakers (with one containing all the liquid) onto a pan balance. Observe that the original mass is retained, allowing for a small margin of error. Opportunity to discuss repeatability.

MORE REACTIONS OF ACIDS

Reference	Objective	Guidance	Possible links to enquiry
C9.2.2A	Know the reaction between dilute acids and metal oxides and the method of producing a pure, dry salt sample.	acid + metal oxide → salt + water	Add the base (metal oxides) to a warm acid until no more will dissolve. Filter the mixture to remove the excess base, and then evaporate the water in the filtrate to leave the salt behind.

C9.2.2B	Know the reaction between dilute acids and metal carbonates and the method of producing a pure, dry salt sample.	acid + metal carbonate → salt + water + carbon dioxide	Complete a supervised experiment using reagents: magnesium carbonate, a white solid, and dilute sulphuric acid react to produce magnesium sulphate. Colourless magnesium sulphate heptahydrate crystals are obtained from this solution.

ENERGY CHANGES IN REACTIONS

Reference	Objective	Guidance	Possible links to enquiry
C9.2.3A	Know about exothermic and endothermic chemical reactions (qualitative).		Learn about observations by carrying out suitable exothermic and endothermic reactions (such as burning or the reaction between water and calcium oxide for exothermic and the reaction between ethanoic acid and sodium carbonate for endothermic) and measure the temperature changes involved.

REACTIVITY SERIES

Reference	Objective	Guidance	Possible links to enquiry
C9.2.4A	Know how metals can be placed in a reactivity series using reactions of metals with oxygen and with water.		Make observations when metals are placed in water, order them according to rate of reaction and compare this to a prepared reactivity series.
C9.2.4B	Know how metals can be placed in a reactivity series using reactions of metals with dilute hydrochloric and sulphuric acid.	Reactivity series can include any elements – metals could be magnesium, aluminium, zinc, iron or copper (not an exhaustive list).	
C9.2.4C	Explain the use of carbon in obtaining metals from metal oxides.		
C9.2.4D	Understand the position of carbon in the reactivity series.		
C9.2.4E	Understand the term ‘reduction’ as loss of oxygen.		
C9.2.4F	Understand the term ‘redox reaction’ as one in which oxidation and reduction occur simultaneously.	For example, fire, rusting of metals, browning of fruit, respiration and photosynthesis.	

C9.2.4G	Understand what is meant by a displacement reaction.	When a more reactive halogen is added to a solution, it will replace the less reactive halogen, for example, adding chlorine to sodium bromide.	
C9.2.4H	Know how metals can be arranged in a reactivity series based on their displacement reactions between metals and metal oxides.	The more reactive a metal, the more likely it is to form a compound. The more reactive a metal, the more stable its compound. The more reactive a metal, the more difficult it is to extract from its compounds. These factors will determine position in a reactivity series.	Explore: aluminium + iron(III) oxide → iron + aluminium oxide.
C9.2.4I	Understand how metals can be arranged in a reactivity series based on their displacement reactions between metals and aqueous solutions of metal salts.		
C9.2.4J	Understand that the method of extraction of a metal from its ore depends on the position of that metal in the reactivity series.	For example, reactive metals such as aluminium are extracted by electrolysis, while a less reactive metal such as iron may be extracted by reduction with carbon or carbon monoxide.	Order a selection of metals according to their ease of extraction; potassium, sodium, calcium, magnesium and aluminium all require use of electrolysis to be extracted.
C9.2.4K	Understand the use of carbon as a reducing agent in the blast furnace to obtain iron from iron oxide and the need to use electrolysis to obtain aluminium from aluminium oxide.	Carbon is a good reducing agent, especially at higher temperatures, because it is a non-metal, and it combines with oxygen and forms gaseous non-metallic oxides.	

RATE OF REACTION

Reference	Objective	Guidance	Possible links to enquiry
C9.2.5A	Know the effect of changing the temperature on the rate of reaction.		Plot a graph to illustrate the changing reaction rate when heat is introduced to sodium thiosulphate and hydrochloric acid.
C9.2.5B	Know the effect of changing the size of the solid particles on the rate of reaction.		Explore the risks associated with flour explosions.
C9.2.5C	Know the meaning of the term ‘catalyst’.		

PERIODIC TABLE

ARRANGEMENT OF ELEMENTS

Reference	Objective	Guidance	Possible links to enquiry
C9.3.1A	Know that elements are arranged in order of atomic number.		
C9.3.1B	Know that elements are arranged in groups and periods.		

GROUP 1

Reference	Objective	Guidance	Possible links to enquiry
C9.3.2A	Know the reactions of Group 1 metals with water.	Group 1 elements react vigorously with water to produce an alkaline metal hydroxide and hydrogen gas.	Watch a teacher demonstration with lithium, potassium or sodium. Document and order reactions.
C9.3.2B	Know how trends in reactions can be predicted using the Periodic Table.	For example, Group 1.	

EARTH AND ATMOSPHERE

MATERIALS MADE FROM SUBSTANCES IN THE EARTH

Reference	Objective	Guidance	Possible links to enquiry
C9.4.1A	Know the names of some common ceramic materials and their properties.	For example, porcelain, pottery and glass.	
C9.4.1B	Know how uses of some common ceramic materials are related to their properties.		
C9.4.1C	Understand that polymers are formed by many small molecules joining together in chains.	No formulae or structures are required.	
C9.4.1D	Know that rubber is a natural polymer.		
C9.4.1E	Know the names of some common polymers and their properties.	For example, poly(ethene), poly(chloroethene) (PVC) and rubber.	
C9.4.1F	Know how uses of some common polymers are related to their properties.		
C9.4.1G	Understand that composite materials are made by combining two or more materials and that they have some of the properties of each.		
C9.4.1H	Know the names of some composite materials and relate their properties to their uses.	For example, concrete, MDF and GRP.	
C9.4.1I	Understand that making and using some materials can cause environmental problems and appreciate ways of reducing them, including recycling.		
C9.4.1J	Understand the term ‘biodegradable’.		

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PHYSICS

ENERGY

MORE ON ENERGY STORES AND TRANSFERS

Reference	Objective	Guidance	Possible links to enquiry
P9.1.1A	Know examples of energy stored as gravitational potential energy being transferred to other energy stores.	For example, a car parked on a slope when the parking brake fails, or a rock up on a mountain.	
P9.1.1B	Know examples of energy stored as elastic potential energy (strain energy) being transferred to other energy stores.	For example, a rubber band when stretched and released returning to its original shape, a trampoline, and an arrow drawn in a bow.	
P9.1.1C	Know an example of energy stored as nuclear energy being transferred.	For example, the splitting of an atom to release its nuclear energy.	

ELECTRICITY

MORE ON RESISTANCE, CURRENT AND VOLTAGE

Reference	Objective	Guidance	Possible links to enquiry
P9.2.1A	Know what is meant by 'electrical resistance' and that it is measured in ohms (Ω).		
P9.2.1B	Know and describe the factors that affect resistance including length and thickness of wires.		
P9.2.1C	Know the relationship: voltage (V) = current (I) × resistance (R) and perform calculations using it.		Build suitable circuits, measure voltage and current and calculate resistance.

STATIC ELECTRICITY

Reference	Objective	Guidance	Possible links to enquiry
P9.2.2A	Know the structure of an atom in terms of the central nucleus containing positively charged protons (and neutral neutrons) with negatively charged electrons moving around it.	This section builds on work from Chemistry Year 9.	

P9.2.2B	Understand how different insulating materials can be given different charges when rubbed with a cloth.	Use acetate and polythene rods as examples.	Explore the effect of electrical charge by rubbing a perspex rod with a silk cloth. After each period of 'charging', place the rod over shredded paper, next to running water and over lower arm hair or head hair to observe the effect.
P9.2.2C	Know that a charge of static electricity can build up when different materials rub together and that static electricity can cause small electric shocks.		
P9.2.2D	Know that when a charged object comes near to another object, they will either attract or repel each other. If the charges are the same they repel; if the charges are opposite they attract.		

ELECTROMAGNETS

Reference	Objective	Guidance	Possible links to enquiry
P9.2.3A	Know that a wire with an electric current flowing through it creates a magnetic field around it.		
P9.2.3B	Know that when the wire is wrapped into a coil the magnetic field produced is similar to that of a bar magnet.		
P9.2.3C	Know how the strength of the magnetic field of an electromagnet can be changed.		

FORCES

FORCES AND MOTION

Reference	Objective	Guidance	Possible links to enquiry
P9.3.1A	Understand the relationship between forces (balanced and unbalanced) on an object and its motion.		
P9.3.1B	Understand the idea of a resultant force.		
P9.3.1C	Understand how to perform simple calculations of resultant forces.		
P9.3.1D	Know that moving objects have a maximum speed.		
P9.3.1E	Understand the concept of terminal velocity of a falling object.	For example, a parachutist.	
P9.3.1F	Understand the idea of speed and average speed.		
P9.3.1G	Know that there are various units for speed and understand how to interconvert between them.	For example, convert km/h into m/s.	
P9.3.1H	Understand how to use the formula: average speed = distance travelled ÷ time taken.		

P9.3.1I	Understand how to construct and interpret distance–time graphs, describing patterns or relationships.	Include evaluating the gradient to calculate speed.	Construct a graph (using data if needed) and write a commentary on indications of speed at different points of a journey.
P9.3.1J	Understand how to construct and interpret speed–time graphs, describing patterns or relationships.	Include evaluating the gradient to calculate acceleration.	Practise interpreting graphs and making predictions about the speed of travel according to a gradient where the value of the *y*-axis is unknown. Add in values for the *y*-axis and complete data to see if predictions were accurate.
P9.3.1K	Understand simple examples of the idea of relative speed.	For example, two cars moving in same direction at 30 km/s and 20 km/s – relative velocity of +10 km/s.	

TURNING FORCES

Reference	Objective	Guidance	Possible links to enquiry
P9.3.2A	Know how a simple lever operates.		
P9.3.2B	Know the use of the terms 'pivot'/'fulcrum', 'effort' and 'load'.		
P9.3.2C	Know about the application of the principle of levers to simple situations, including the human arm.		
P9.3.2D	Know that a 'moment' is the turning effect of a force.		
P9.3.2E	Understand how to calculate the moment of a force and know the unit is Nm.	moment of force = force applied × perpendicular distance from the fixed axis $M = F \times d$	
P9.3.2F	Understand how to use moments to find out if something will balance or not.	Moments must be equal for the object to be balanced; use the formula to find moment for opposing forces.	
P9.3.2G	Know how ramps and pulleys allow less force to be used to move an object.		
P9.3.2H	Know that 'work' is the amount of energy transferred when something is moved (from one place to another) using a force.		
P9.3.2I	Know that work, like energy, is measured in joules (J).		
P9.3.2J	Understand how to calculate the amount of work done using the formula: work = force × distance moved (in the direction of the force).	Force is measured in newtons (N) and distance in metres (m).	

STRETCHING FORCES

Reference	Objective	Guidance	Possible links to enquiry
P9.3.3A	Know that adding a mass to a spring affects its extension.	Students should be able to describe Hooke's law.	Set up an experiment using a spring, a mass holder and a ruler. Add 10 g mass to the holder and record the spring length. Add another 10 g mass and record the new spring length. Subtract the previous spring length from the new length to calculate extension. Continue until 100 g is reached.