

Exploring Science: Working Scientifically mapping

This document maps the iLowerSecondary science curriculum to UK Exploring Science: Working Scientifically. Scientific Enquiry is embedded in teaching throughout the course.

iLowerSecondary Year 7 Biology

Topic	iLowerSecondary Objective	Suggested Exploring Science: Working Scientifically lesson
Structure and function of living organisms: Life Processes	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.	7Aa Life processes
Structure and function of living organisms: Cells and organisation	<p>B7.1.2A Know the structure of a typical animal cell.</p> <p>B7.1.2C Understand the basic parts of a simple light microscope and their functions.</p> <p>B7.1.2D Understand the level of cellular detail that can be seen with a simple light microscope.</p> <p>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.</p>	<p>7Ad Cells</p> <p>7Ac Tissues</p> <p>7Ad Cells</p> <p>7Ad Cells</p> <p>7Ad Cells</p>

	<p>B7.1.2F Know the functions of the cell wall, cell membrane, cytoplasm, nucleus, permanent vacuole, mitochondria and chloroplasts.</p> <p>B7.1.2G Know the hierarchical organisation of multicellular organisms from cells to tissues to organs to organ systems to organisms.</p> <p>B7.1.2H Know the major organs and organ systems of the human body and describe their functions.</p> <p>B7.1.2I Apply knowledge of human organs and organ systems to other vertebrates.</p>	<p>7Ae Organ systems</p> <p>7Ab Organs and 7Ae Organ systems</p>
Plants: External structure of plants	<p>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.</p> <p>B7.2.1B Know the functions of roots, stems and leaves.</p> <p>B7.2.1C Apply knowledge of roots, stems and leaves to a variety of familiar and less familiar flowering plants.</p> <p>B7.2.1D Know the simple external features of plants living in different habitats.</p>	<p>7Ab Organs</p> <p>7Ab Organs</p> <p>7Db Adaptations</p>

<p>Humans and animals: The musculo-skeletal system</p>	<p>B7.3.1A Understand the structure and functions of the human skeleton, to include support, protection, movement and making blood cells.</p> <p>B7.3.1B Understand the function of antagonistic muscles in movement.</p> <p>B7.3.1C Explain the relationship between muscles and bones to bring about movement at the elbow and shoulder.</p> <p>B7.3.1D Compare the range of movement of a variety of human joints.</p>	<p>7Cc The skeleton</p> <p>7Cb Muscles and blood.</p> <p>7Cd Muscles and moving</p> <p>7Cd Muscles and moving</p>
<p>Organisms and their environment: Interactions between living organisms</p>	<p>B7.4.1A Understand the terms 'producer', 'primary consumer', 'secondary consumer', 'tertiary consumer' and 'decomposer'.</p> <p>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.</p>	<p>7Dd Effects on the environment</p> <p>7De Effects on the environment</p>

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iLowerSecondary Year 7 Chemistry

Topic	iLowerSecondary Objective	Suggested Exploring Science: Working Scientifically lesson
Matter: Particle model	<p>C7.1.1A Know the term 'particle'.</p> <p>C7.1.1B Know the arrangement of particles in solids, liquids and gases.</p> <p>C7.1.1C Explain the properties of solids, liquids and gases in terms of particles.</p> <p>C7.1.1D Understand changes of state in terms of arrangement, movement and energy of particles.</p> <p>C7.1.1E Describe diffusion using the particle model.</p>	<p>7Gb Particles</p> <p>7Gb Particles</p> <p>7Gb Particles, 7Ge Air pressure</p> <p>8Ib Changing state</p> <p>7Gd Diffusion</p>
Matter: Hazards and safety	<p>C7.1.2A Recognise common hazard symbols.</p> <p>C7.1.2B Understand how to work safely in a laboratory.</p>	<p>7Fa Hazards</p> <p>7Ec Working Scientifically page covers working safely – all topics encourage safe working</p>

Matter: Pure substances and mixtures	<p>C7.1.3A Know the difference between a pure substance and a mixture.</p> <p>C7.1.3B Understand dissolving in terms of particles.</p> <p>C7.1.3C Know what is meant by the terms 'solvent', 'solute', 'solution', 'saturated solution' and 'suspension'.</p> <p>C7.1.3D Know what is meant by the term 'colloid'.</p>	<p>7Ha The air we breathe</p> <p>7Eb Solutions</p> <p>7Ea Mixtures</p>
Matter: Separating mixtures	C7.1.4A Know methods of separation: filtration, evaporation, simple distillation and paper chromatography.	7Ec Evaporation, 7Ed Chromatography, 7Ed Distillation
Matter: Elements, atoms and compounds	C7.1.5A Understand the meaning of the terms 'element', 'atom', 'compound' and 'molecule'.	7Ha The air we breathe, 7Hb Earth's elements, 7Hd Making compounds
Chemical reactions: Chemical reactions introduction	<p>C7.2.1A Understand the difference between physical changes and chemical changes.</p> <p>C7.2.1B Describe reactions in terms of rearrangement of atoms to form new substance(s)/compound(s).</p> <p>C7.2.1C Understand the terms 'reactants' and 'products'.</p>	<p>7He Chemical reactions, 8Fb Chemical properties</p> <p>8Fb Chemical properties</p> <p>7He Chemical reactions</p>

	<p>C7.2.1D Know combustion as an example of a type of reaction.</p> <p>C7.2.1E Understand what is meant by a thermal decomposition reaction.</p> <p>C7.2.1F Describe the formation of carbon dioxide from the thermal decomposition of copper(II) carbonate.</p>	<p>8Ea Burning fuels</p> <p>7He Chemical reactions</p> <p>7He Chemical reactions</p>
Chemical reactions: Acids, bases and alkalis	<p>C7.2.2A Know names and occurrences of common acids, bases and alkalis.</p> <p>C7.2.2B Know how to detect acids and alkalis using indicators.</p> <p>C7.2.2C Know the pH scale as a scale from 0 to 14 of acidity and alkalinity.</p> <p>C7.2.2D Know the reaction between an acid and an alkali as neutralisation.</p> <p>C7.2.2E Know the general equation for reactions between acids and alkalis.</p> <p>C7.2.2F Know how to name salts from the names of acids and alkalis and use these in word equations.</p>	<p>7Fa Hazards, 7Fb Indicators</p> <p>7Fb Indicators</p> <p>7Fc Acidity and alkalinity</p> <p>7Fd Neutralisation</p> <p>7Fe Neutralisation in daily life</p> <p>7Fd Neutralisation</p>

<p>Periodic table: Periodic table introduction</p>	<p>C7.3.1A Know the names and chemical symbols of some common elements.</p> <p>C7.3.1B Understand how to identify an element as a metal or a non-metal from its position in the Periodic Table.</p> <p>C7.3.1C Know and describe the typical physical properties of metals and non-metals.</p> <p>C7.3.1D Relate the physical properties of metals to their uses.</p> <p>C7.3.1E Know a vertical column of elements as a 'group'.</p> <p>C7.3.1F Know a horizontal row of elements as a 'period'.</p>	<p>8Fa Dalton's atomic model</p> <p>7Hc Metals and non-metals</p> <p>7Hc Metals and non-metals, 8Ga Metal properties</p> <p>8Ga Metal properties</p> <p>8Fc Mendeleev's table</p>
<p>Earth and atmosphere: Composition of air</p>	<p>C7.4.1A Know the approximate composition of gases found in dry air.</p> <p>C7.4.1B Know uses of the gases found in air.</p>	<p>7Ha The air we breathe</p> <p>7Ha The air we breathe</p>

iLowerSecondary Year 7 Physics

Topic	iLowerSecondary Objective	Suggested Exploring Science: Working Scientifically lesson
Energy: Energy from food and fuels	<p>P7.1.1A Understand that energy is something that is needed to make things change or happen.</p> <p>P7.1.1B Know joules (J) and kilojoules (kJ) as units of energy.</p> <p>P7.1.1C Understand that the energy we need is obtained from food.</p> <p>P7.1.1D Know a simple method for comparing the amount of energy stored in foods.</p> <p>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.</p>	<p>71a Energy from food</p> <p>71a Energy from food</p> <p>71a Energy from food</p> <p>71a Energy from food</p> <p>71b Energy transfers and stores</p>
Energy: Energy transfer	<p>P7.1.2A Understand that energy can be transferred between energy stores, but no energy is created or lost.</p> <p>P7.1.2B Know ways in which energy is transferred, such as by light, heating, sound, electricity and forces.</p>	<p>71b Energy transfers and stores</p> <p>71b Energy transfers and stores</p>

	<p>P7.1.2C Explain what a fuel is and know examples.</p> <p>P7.1.2D Know what fossil fuels are and how they were formed.</p> <p>P7.1.2E Know the difference between renewable and non-renewable energy sources.</p> <p>P7.1.2F Know how some renewable energy resources can be used to generate electricity and provide heat.</p> <p>P7.1.2G Know some advantages and disadvantages of renewable energy sources.</p>	<p>71c Fuels</p> <p>71c Fuels</p> <p>71c Fuels</p> <p>71d Other energy resources</p> <p>71d Other energy resources, 71e Using resources</p>
Electricity: Electric current	<p>P7.2.1A Know electric current as a flow of negative charges or flow of electrons, which are negatively charged particles.</p> <p>P7.2.1B Know that current is measured in amperes (A) using an ammeter connected in series.</p>	<p>71b Models for circuits, 91c Current electricity</p> <p>71a Switches and current</p>

Electricity: Circuits	<p>P7.2.2A Understand that in a series circuit the current can only take one route and is the same everywhere.</p> <p>P7.2.2B Understand that in a parallel circuit there are junctions where the current splits and takes different routes/branches.</p> <p>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.</p>	<p>7Jc Series and parallel, 9Jc Current electricity</p> <p>7Jc Series and parallel, 9Jc Current electricity</p> <p>7Jc Series and parallel, 9Jc Current electricity</p>
Electricity: Voltage and potential difference	<p>P7.2.3A Understand that a potential difference is needed to cause a flow of electrons (current) in a circuit.</p> <p>P7.2.3B Understand that a potential difference is provided by a cell/battery/power pack and that it is a measure of the energy provided by the cell/battery/power pack.</p> <p>P7.2.3C Understand that the higher the voltage, the more (negative) charges can be 'pushed' around the circuit, so the higher the current.</p> <p>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).</p>	<p>7Jd Changing the current</p> <p>7Jd Changing the current</p> <p>7Jd Changing the current, 9Jc Current electricity</p> <p>7Jd Changing the current</p>

	<p>P7.2.3E Know that the voltage (potential difference) across two components connected in parallel is the same.</p>	7Jd Changing the current, 9Jc Current electricity
Electricity: Resistance	<p>P7.2.4A Understand that the (electrical) resistance of a component is a measure of how hard it is for current to flow through a component.</p> <p>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.</p> <p>P7.2.4C Understand that the higher the total resistance of the components in a circuit, the smaller the current that flows.</p>	<p>7Jd Changing the current, 9Jd Resistance</p> <p>7Jd Changing the current, 9Jd Resistance</p> <p>9Jd Resistance</p>

<p>Electricity: Electricity in the home</p>	<p>P7.2.5A Explain how to reduce the risks when using electrical appliances.</p> <p>P7.2.5B Know the purpose of fuses and circuit breakers.</p>	<p>7Je Using electricity</p> <p>7Je Using electricity</p>
<p>Forces: Different types of force</p>	<p>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.</p> <p>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.</p> <p>P7.3.1C Know and describe the use of the extension of springs in force meters to measure forces.</p> <p>P7.3.1D Know that the unit of force is the newton (N).</p>	<p>7Ka Forces</p> <p>7Ka Forces</p> <p>7Ka Forces</p> <p>7Ka Forces</p>

	<p>P7.3.1E Understand the use of different-sized arrows to indicate the size and direction of action of a force.</p> <p>P7.3.1F Explain the effects of balanced and unbalanced forces.</p> <p>P7.3.1G When discussing objects on or near the Earth, know gravity (gravitational field strength, g) as a force that always pulls things towards the centre of the Earth.</p> <p>P7.3.1H Know the difference between mass and weight.</p> <p>P7.3.1I Know that the force of gravity on a given object is less on the Moon than on the Earth.</p> <p>P7.3.1J Understand the origin of friction, air and water resistance (drag) and upthrust, and know situations in which these forces act.</p> <p>P7.3.1K Know how forces of friction can be helpful and unhelpful and how they can be changed.</p>	<p>7Ka Forces</p> <p>7Ke Balanced and unbalanced</p> <p>7Ka Forces, 8Ld Gravity in space</p> <p>7Ka Forces, 8Ld Gravity in space</p> <p>8Ld Gravity in space</p> <p>7Kc Friction, 8Id Floating and sinking</p> <p>7Kc Friction</p>
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Forces: Pressure	<p>P7.3.2A Understand that pressure is the amount of force acting on a certain area.</p> <p>P7.3.2B Know that the unit of pressure is N/m² or pascals (Pa).</p> <p>P7.3.2C Know simple situations where size of pressure is important.</p>	<p>7Kd Pressure</p> <p>7Kd Pressure</p> <p>7Kd Pressure</p>
Waves: Types of waves	<p>P7.4.1A Understand what is meant by a longitudinal wave, using sound waves as an example.</p> <p>P7.4.1B Understand what is meant by a transverse wave, using waves on the surface of water as an example.</p> <p>P7.4.1C Know that all waves can be reflected.</p> <p>P7.4.1D Know what happens when waves meet and what superposition means.</p>	<p>7Le Comparing waves</p> <p>7Le Comparing waves</p> <p>7Le Comparing waves</p> <p>7Le Comparing waves</p>
Waves: Introduction to sound	<p>P7.4.2A Understand what causes sound in terms of vibrations of objects.</p> <p>P7.4.2B Understand the terms 'volume', 'pitch', 'frequency' (measured in hertz, Hz) and 'amplitude', and the links between them.</p>	<p>7La Animal sounds</p> <p>7La Animal sounds, 7Lb Moving sounds</p>

Waves: Sound waves	<p>P7.4.3A Know how sound travels through a medium.</p> <p>P7.4.3B Know how moving vibrations form a wave.</p>	<p>7Lb Moving sounds</p> <p>7Lb Moving sounds</p>
Waves: Sound detection	<p>P7.4.4A Know how animals use ears to detect sound.</p> <p>P7.4.4B Know how a microphone converts sound into electrical signals.</p> <p>P7.4.4C Know that sound waves transfer energy, and describe ways in which sound is used.</p>	<p>7Lc Detecting sounds</p> <p>7Lc Detecting sounds</p> <p>7Ld Using sounds</p>

iLowerSecondary Year 8 Biology

Topic	iLowerSecondary Objective	Suggested Exploring Science Working Scientifically lesson
Structure and function of living organisms: Life Processes	<p>B8.1.1A Know the difference between breathing and respiration.</p> <p>B8.1.1b Know the difference between excretion and defaecation.</p>	<p>7Ca Muscles and breathing</p> <p>8Ad Digestion covers egestion, 7Aa Life processes</p>
Structure and function of living organisms: Cells and organisation	<p>B8.1.2A Explain how cells may have adaptations for particular functions, using cilia and microvilli as examples.</p> <p>B8.1.2B Identify the slime capsule, cell wall, cell membrane, flagella, nucleoid and plasmids in a generalised bacterial cell.</p> <p>B8.1.2C Explain the functions of the slime capsule, cell wall, cell membrane, flagella, nucleoid and plasmids in a generalised bacterial cell.</p> <p>B8.1.2D Know the similarities and differences between generalised plant, animal and bacterial cells.</p>	<p>8Cb Gas exchange system, 8Ae Absorption</p> <p>8Dc Bacteria</p> <p>8Dc Bacteria</p> <p>7Ad Cells, 8Dc Bacteria</p>
Structure and function of living organisms:	B8.1.3A Know the process of diffusion and relate this to the movement of substances in and out of	8Ae Absorption, 9De In and out

Movement of molecules	<p>cells.</p> <p>B8.1.3B Understand the concept of a diffusion gradient.</p>	
Plants: Transport of water and minerals	<p>B8.2.1A Know how water and minerals are absorbed and transported in flowering plants.</p> <p>B8.2.1B Explain why plants need minerals, using nitrate and magnesium ions as examples.</p>	<p>7Ae Organ systems, 9Bb Plant adaptations</p> <p>9Bb Plant adaptations, 9Bc Plant Products, 9Bd Growing crops</p>
Plants: Fertilisers	<p>B8.2.2A Explain how fertilisers can increase crop yield.</p> <p>B8.2.2B Know the advantages and disadvantages of natural and artificial fertilisers.</p>	9Bd Growing crops
Humans and animals: The digestive system	<p>B8.3.1A Know the main components of the digestive system and their functions.</p> <p>B8.3.1B Know the components of a balanced diet.</p> <p>B8.3.1C Know the difference between starvation and malnutrition and the effects of nutritional deficiencies.</p> <p>B8.3.1D Know how energy requirements vary with age and activity levels.</p>	<p>8Ad Digestion</p> <p>8Ac Balanced diets</p> <p>8Ac Balanced diets</p> <p>8Ab Uses of nutrients</p>

	B8.3.1E Know that different foods have different energy values.	8Aa Nutrients
Humans and animals: Breathing and respiration	<p>B8.3.2A Recognise the main components of the respiratory system and their functions.</p> <p>B8.3.2B Explain the role of cartilage in keeping airways open.</p> <p>B8.3.2C Know and describe the mechanism of breathing to move air in and out of the lungs.</p> <p>B8.3.2D Understand the term 'gas exchange'.</p> <p>B8.3.2E Describe the effects of smoking.</p> <p>B8.3.2F Understand the term 'aerobic respiration' and correctly use the terms 'breathing' and 'respiration'.</p>	<p>7Ca Muscles and breathing</p> <p>7Ca Muscles and breathing</p> <p>7Ca Muscles and breathing</p> <p>7Ca Muscles and breathing</p> <p>8Cc Getting oxygen</p> <p>7Ca Muscles and breathing, 8Ca Aerobic respiration</p>
Organisms and their environment: Interactions between living organisms	<p>B8.4.1A Know how to draw and interpret pyramids of number.</p> <p>B8.4.1B Know how to interpret food chains and food webs in terms of energy flow.</p>	<p>7De Transfers in food chains</p> <p>7Dd Effects on the environment, 7De Transfers in food chains</p>

	B8.4.1C Explain ways in which energy is lost between trophic levels.	7De Transfers in food chains
Organisms and their environment: Interactions with the environment	B8.4.2A Explain how toxic materials can accumulate along food chains.	7De Transfers in food chains

iLowerSecondary Year 8 Chemistry

Topic	iLowerSecondary Objective	Suggested Exploring Science Working Scientifically lesson
Matter: Identification of pure substances	C8.1.1A Understand that a pure substance has a fixed melting and boiling point.	8De Pure metals and alloys
	C8.1.1B Know a physical test to show whether a sample of water is pure.	
	C8.1.1C Understand that a mixture may melt or boil over a range of temperatures.	8De Pure metals and alloys
	C8.1.1D Know what is meant by an 'alloy' and know some examples.	8De Pure metals and alloys
	C8.1.1E Relate properties of alloys to uses.	8De Pure metals and alloys
Matter: Elements, atoms and compounds	C8.1.2A Know Dalton's atomic model.	8Fa Dalton's atomic model
	C8.1.2B Know common chemical symbols and common chemical formulae.	8Fa Dalton's atomic model
	C8.1.2C Understand that chemical formulae show the ratio of elements in a compound and be able to use these formulae.	8Fb Chemical properties

Chemical reactions: Reactions involving oxygen	<p>C8.2.1A Describe the combustion of elements in oxygen, including magnesium, hydrogen and sulphur.</p> <p>C8.2.1B Understand the term 'oxidation' as gain of oxygen.</p> <p>C8.2.1C Know the chemical properties of metal and non-metal oxides with respect to acidity/alkalinity.</p>	<p>8Ea Air pollution [covers reaction of hydrogen and oxygen], 8Eb Oxidation [covers reaction of magnesium with oxygen], 8Ed Air pollution [covers reactions of non-metals with oxygen]</p> <p>8Eb Oxidation</p> <p>8Fe Chemical trends</p>
Chemical reactions: More on combustion	<p>C8.2.2A Know about an experiment to show the products of combustion of a hydrocarbon.</p> <p>C8.2.2B Know about a test for the presence of water using anhydrous copper(II) sulphate.</p> <p>C8.2.2C Know about a test for the presence of carbon dioxide using limewater.</p> <p>C8.2.2D Understand the fire triangle.</p> <p>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.</p> <p>C8.2.2F Know the environmental problems caused by air pollution and ways of reducing them.</p>	<p>8Ea Burning fuels</p> <p>8Ea Burning fuels</p> <p>8Ea Burning fuels</p> <p>8Ec Fire safety</p> <p>8Ed Air pollution</p> <p>8Ed Air pollution</p>

Chemical reactions: Reactions of metals	C8.2.3A Know the reactions of some metals with oxygen and know what is meant by 'corrosion'.	8Gb Corrosion
	C8.2.3B Know experiments to find the conditions needed for rusting of iron.	8Gb Corrosion
	C8.2.3C Know simple methods of preventing rusting by barrier methods and galvanising.	8Gb Corrosion
	C8.2.3D Describe the reactions of some metals with water.	8Gc Metals and water
	C8.2.3E Describe the reaction of dilute acid with some metals such as magnesium to produce a salt plus hydrogen.	8Gd Metals and acids
	C8.2.3F Know how to test for hydrogen gas.	8Gc Metals and water
Periodic table: Brief history of the periodic table	C8.3.1A Know the principles behind Mendeleev's Periodic Table.	8Fc Mendeleev's table
	C8.3.1B Know how the modern Periodic Table is organised.	8Fc Mendeleev's table
Periodic table: Trends in the periodic table	C8.3.2A Identify and describe trends in physical properties of elements in the Periodic Table.	8Fd Physical trends
	C8.3.2B Identify and describe trends in chemical properties of elements in the Periodic Table.	8Fc Chemical trends

Earth and atmosphere: Earth's structure	C8.4.1A Know and describe the main parts of the structure of the Earth.	8Hb Igneous and metamorphic
Earth and atmosphere: Types of rocks	<p>C8.4.2A Describe the formation of igneous, sedimentary and metamorphic rocks and the links between them in the rock cycle.</p> <p>C8.4.2B Know what is meant by 'weathering' and 'erosion' of rocks.</p> <p>C8.4.2C Know what is meant by a 'mineral' and an 'ore'.</p> <p>C8.4.2D Understand that ores are sources of metals and that there is a limited supply on Earth.</p> <p>C8.4.2E Know environmental problems associated with obtaining ores.</p> <p>C8.4.2F Know reasons for recycling.</p>	<p>8Hb Igneous and metamorphic, 8Hd Sedimentary rocks</p> <p>8Hc Weathering and erosion</p> <p>8Ha Rocks and their uses (covers mineral), 8He Materials in the Earth (covers ore)</p> <p>8He Materials in the Earth</p> <p>8He Materials in the Earth</p> <p>8He Materials in the Earth</p>
Earth and atmosphere: Oxygen in air	C8.4.3A Know experiments to find the approximate percentage of oxygen in air using iron and copper.	

iLowerSecondary Year 8 Physics

Topic	iLowerSecondary Objective	Suggested Exploring Science Working Scientifically lesson
Energy: Energy transfer	<p>P8.1.1A Understand the difference between thermal (heat) energy and temperature.</p> <p>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.</p> <p>P8.1.1C Understand that a temperature difference between two objects leads to thermal energy transfer from the hotter to the cooler one.</p> <p>P8.1.1D Know how energy can be transferred through conduction, radiation and convection.</p>	<p>8Ka Temperature changes</p> <p>9La Differences covers specific heat capacity</p> <p>8Ka Temperature changes, 9La Differences</p> <p>8Ka Temperature changes, 8Kb Transferring energy</p>
Energy: Conservation of energy	<p>P8.1.2A Understand the law of conservation of energy.</p> <p>P8.1.2B Understand the use of Sankey diagrams to show energy transfers.</p> <p>P8.1.2C Understand and use the term 'efficiency'.</p> <p>P8.1.2D Understand how our energy use is calculated and charged for in energy bills.</p>	<p>7Ib Energy transfers and stores</p> <p>8Kd Power and efficiency</p> <p>8Kd Power and efficiency</p> <p>8Ke Paying for energy</p>

	P8.1.2E Know ways of reducing energy use and costs.	8Ke Paying for energy
Energy: States of matter	P8.1.3A Explain the properties of the three states of matter in terms of particles.	8la The particle model
	P8.1.3B Explain expansion, contraction and changes in density in terms of particles.	8la The particle model
Energy: Changes in state	P8.1.4A Know changes in state in terms of particles.	8lb Changing state
	P8.1.4B Know that the temperature stays constant during changes in state.	8lb Changing state
	P8.1.4C Know the anomalous property of water around its freezing point.	8lb Changing state
Earth and space: Models of the solar system	P8.2.1A Know Ptolemy's geocentric model and Copernicus' heliocentric model of the Solar System.	8La Gathering the evidence
	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.	8La Gathering the evidence
	P8.2.1C Know some evidence for the shape of the Earth.	8La Gathering the evidence 8La Gathering the evidence

	<p>P8.2.1D Know the names of the eight planets in the Solar System in order of increasing distance from the Sun.</p>	
Earth and space: Beyond our Solar System	<p>P8.2.2A Understand that our Sun is a star and that a galaxy is a large collection of billions of stars.</p> <p>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.</p> <p>P8.2.2C Understand that a light year is the distance travelled by light in a year.</p>	<p>8Le Beyond the Solar System</p> <p>8Le Beyond the Solar System</p> <p>8Le Beyond the Solar System</p>
Forces: More on pressure	<p>P8.3.1A Explain pressure and its effects in terms of particles.</p> <p>P8.3.1B Know and describe how pressure in liquids and gases changes with depth or height.</p>	<p>8lc Pressure in fluids</p> <p>8lc Pressure in fluids</p>

<p>Forces: More on types of forces</p>	<p>P8.3.2A Explain why some objects float using forces of weight and upthrust.</p> <p>P8.3.2B Explain whether an object will sink or float in terms of density.</p> <p>P8.3.2C Know that air resistance and water resistance are types of drag.</p> <p>P8.3.2D Describe the causes of drag and how drag forces can be increased and decreased.</p>	<p>8ld Floating and sinking</p> <p>8ld Floating and sinking</p> <p>8le Drag</p> <p>8le Drag</p>
<p>Forces: More on gravity</p>	<p>P8.3.3A Know that the greater the mass of an object, the stronger the gravitational force it exerts.</p> <p>P8.3.3B Know how to use the formula weight = mass (m) \times 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.</p> <p>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.</p> <p>P8.3.3D Know that the gravitational force (force of gravity) is weaker if objects are further apart.</p> <p>P8.3.3E Describe the effect of gravity in making the Earth spherical.</p>	<p>8Ld Gravity in space, 9Ja Force fields</p> <p>8Ld Gravity in space, 9Ja Force fields</p> <p>8Ld Gravity in space, 9Ja Force fields</p> <p>8Ld Gravity in space, 9Ja Force fields</p> <p>8Ld Gravity in space</p>

	<p>P8.3.3F Know that gravitational force causes moons to orbit planets and causes the planets to orbit the Sun.</p> <p>P8.3.3G Know that gravitational force causes artificial satellites to orbit the Earth and causes comets to orbit the Sun.</p> <p>P8.3.3H Understand the terms ‘natural satellite’ and ‘artificial satellite’.</p> <p>P8.3.3I Know some uses of artificial satellites.</p>	<p>8Ld Gravity in space</p> <p>8Ld Gravity in space</p>
Forces: Magnetism	<p>P8.3.4A Know that a bar magnet has a north(-seeking) pole and a south(-seeking) pole.</p> <p>P8.3.4B Know that a compass is a magnet that points north.</p> <p>P8.3.4C Know that like poles repel each other and opposite poles attract each other.</p> <p>P8.3.4D Know that the magnetic field is the space around a magnet in which the magnetic force has an effect.</p> <p>P8.3.4E Know how to find the shape of the magnetic field around a magnet.</p> <p>P8.3.4F Know about the Earth’s magnetic field and how compasses are affected by it.</p>	<p>8Lc Magnetic Earth, 9Ja Force fields</p> <p>8Lc Magnetic Earth, 9Ja Force fields</p> <p>8Lc Magnetic Earth, 9Ja Force fields</p> <p>8Lc Magnetic Earth, 9Ja Force fields</p> <p>8Lc Magnetic Earth, 9Ja Force fields</p>

Waves: Light	<p>P8.4.1A Know that light is a way of transferring energy from one place to another.</p> <p>P8.4.1B Know that light waves are transverse waves.</p> <p>P8.4.1C Know some differences between light and sound waves.</p> <p>P8.4.1D Understand that when light rays meet an opaque object some are reflected and some are absorbed.</p> <p>P8.4.1E Understand the difference between the terms 'transparent' and 'translucent'.</p>	<p>8Ja Light on the move</p> <p>8Ja Light on the move</p> <p>8Ja Light on the move</p> <p>8Ja Light on the move</p> <p>8Ja Light on the move</p>
Waves: Reflection of light	<p>P8.4.2A Understand the use of ray diagrams and the terms 'incident ray', 'reflected ray', 'normal', 'angle of incidence' and 'angle of reflection'.</p> <p>P8.4.2B Know an experiment to show that, when light hits a mirror, the angle of incidence equals the angle of reflection.</p> <p>P8.4.2C Know how an image is formed in a plane mirror.</p> <p>P8.4.2D Know the properties of an image formed in a plane mirror.</p>	<p>8Jb Reflection</p> <p>8Jb Reflection</p> <p>8Jb Reflection</p> <p>8Jb Reflection</p>

	P8.4.2E Know what happens when light hits a rough, opaque surface.	8jb Reflection
Waves: Refraction of light	<p>P9.4.3A Know that refraction is the change of direction of light that happens when light passes from one transparent material to another.</p> <p>P9.4.3B Know that light travels more slowly in materials such as glass and water than it does in air.</p> <p>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).</p>	<p>8jc Refraction</p> <p>8jc Refraction</p> <p>8jc Refraction</p>

iLowerSecondary Year 9 Biology

Topic	iLowerSecondary Objective	Suggested Exploring Science Working Scientifically lesson
Structure and function of living organisms: Life Processes	<p>B9.1.1A Know the basic structure of viruses and understand that viruses are obligate parasites causing harm to the cells of living things.</p> <p>B9.1.1B Know how a virus reproduces and use this to explain why viruses may not be classed as living organisms.</p> <p>B9.1.1C Know that plant and animal cells respire to produce ATP to provide energy for cells.</p> <p>B9.1.1D Know how to model respiration using a word equation and a balanced symbol equation for aerobic respiration only.</p>	<p>9Da Diseases</p> <p>8Da Unicellular or multicellular, 9Da Diseases</p> <p>8Ca Aerobic respiration</p> <p>8Ca Aerobic respiration</p>
Structure and function of living organisms: Pathogens	<p>B9.1.2A Know the difference between the terms 'pathogen' and 'parasite'.</p> <p>B9.1.2B Understand that, in addition to viruses, some bacteria, some fungi and some protocists cause disease.</p> <p>B9.1.2C Understand that antibiotics are effective against bacteria but not against viruses.</p>	<p>9Da Diseases covers pathogens</p> <p>9Da Diseases</p> <p>9Dc Testing Medicines</p>

	<p>B9.1.2D Know the problems associated with overuse of antibiotics in humans and farmed animals.</p> <p>B9.1.2E Understand how vaccination helps to prevent the spread of disease in communities.</p>	
Structure and function of living organisms: Movement of molecules	<p>B9.1.3A Explain how temperature and concentration affect rate of diffusion.</p> <p>B9.1.3B Know how to calculate and compare surface area: volume ratios.</p>	<p>8Ae Absorption</p> <p>9De In and out</p>
Plants: Photosynthesis and crop yields	<p>B9.2.1A Know the structure of a leaf and explain how it is adapted for photosynthesis.</p> <p>B9.2.1B Know how to model photosynthesis using a word equation and a balanced symbol equation.</p> <p>B9.2.1C Explain how light intensity and carbon dioxide concentration affect rate of photosynthesis.</p> <p>B9.2.1D Explain how crop yield may be affected by changes in abiotic factors.</p> <p>B9.2.1E Know how selective breeding can lead to</p>	<p>9Bb Plant adaptations</p> <p>9Ba Plant growth</p> <p>9Ba Plant growth</p> <p>9Bd Growing crops</p> <p>9Bd Growing crops</p>

	new plant varieties.	
Humans and animals: The circulatory system	<p>B9.3.1A Know the difference between single and double circulatory systems.</p> <p>B9.3.1B Know the main components of the circulatory system and their functions.</p> <p>B9.3.1C Explain the differences in pressure and rate of flow in arteries, veins and capillaries.</p> <p>B9.3.1D Know the effect of exercise on heart rate and explain why these changes are important.</p> <p>B9.3.1E Understand how to measure average pulse rate by counting beats per minute.</p> <p>B9.3.1F Know how to interpret line graphs showing how pulse rate changes with exercise.</p> <p>B9.3.1G Explain how lifestyle factors may contribute to cardiovascular disease.</p>	<p>7Ae Organ systems</p> <p>7Cb Muscles and blood</p> <p>8Cc Getting oxygen</p> <p>8Cc Getting oxygen</p> <p>8Cc Getting oxygen</p> <p>8Cc Getting oxygen</p>
Organisms and their environment: Interactions	<p>B9.4.1A Know, draw and interpret pyramids of biomass.</p> <p>B9.4.1B Understand the terms 'species',</p>	<p>7De Transfers in food chains</p> <p>7Da Variation, 7Db Adaptations</p>

between living organisms	<p>'population', 'community', 'habitat' and 'ecosystem'.</p> <p>B9.4.1C Know the difference between inter- and intra-specific competition.</p> <p>B9.4.1D Know how to interpret data on population numbers.</p> <p>B9.4.1E Explain why population numbers fluctuate, including predator-prey relationships.</p> <p>B9.4.1F Know about predator-prey interactions in order to interpret data.</p>	<p>7Dd Effects on the environment</p> <p>7Dd Effects on the environment</p> <p>7Dd Effects on the environment</p>
Organisms and their environment: Interactions with the environment	<p>B9.4.2A Know the role of decomposers in recycling carbon in an ecosystem.</p> <p>B9.4.2B Know examples of production of carbon dioxide by human activity and discuss the impact of these on the climate.</p>	<p>8De Decomposers and carbon, 9Be Farming problems</p> <p>9Be Farming problems</p>

iLowerSecondary Year 9 Chemistry

Topic	iLowerSecondary Objective	Suggested Exploring Science Working Scientifically lesson
Matter: Model of an atom	<p>C9.1.1A Know the structure of an atom in terms of the positions of sub-atomic particles.</p> <p>C9.1.1B Know the relative charges of protons, neutrons and electrons.</p> <p>C9.1.1C Understand and use the terms 'atomic number' and 'mass number'.</p>	9Gb Chemical Reactions
Chemical reactions: Formulae and equations	<p>C9.2.1A Understand how to represent simple chemical reactions using formulae and equations, including state symbols.</p> <p>C9.2.1B Understand the conservation of mass in chemical reactions.</p>	<p>9Hd Chemical equations [Also in extension material in 8Eb Oxidation and 8Gd Metal and acids.]</p> <p>8Eb Oxidation, 9Hd Chemical equations</p>
Chemical reactions: More reactions of acids	<p>C9.2.2A Know the reaction between dilute acids and metal oxides and the method of producing a pure, dry salt sample.</p> <p>C9.2.2B Know the reaction between dilute acids and metal carbonates and the method of producing a pure, dry salt sample.</p>	9Gc Properties of different materials, 8Fe Chemical trends, 8Ga Metal properties

Chemical reactions: Energy changes in reactions	C9.2.3A Know about exothermic and endothermic chemical reactions (qualitative).	9Fc Energy and reactions [Extension material can be found in 9Hb Energy transfers.]
Chemical reactions: Reactivity series	<p>C9.2.4A Know how metals can be placed in a reactivity series using reactions of metals with oxygen and with water.</p> <p>C9.2.4B Know how metals can be placed in a reactivity series using reactions of metals with dilute hydrochloric and sulphuric acid.</p> <p>C9.2.4C Explain the use of carbon in obtaining metals from metal oxides.</p> <p>C9.2.4D Understand the position of carbon in the reactivity series.</p> <p>C9.2.4E Understand the term 'reduction' as loss of oxygen.</p> <p>C9.2.4F Understand the term 'redox reaction' as one in which oxidation and reduction occur simultaneously.</p> <p>C9.2.4G Understand what is meant by a displacement reaction.</p>	<p>8Gc Metals and water</p> <p>8Gd Metals and acids</p> <p>8He Materials in the Earth, 9Fe Extracting metals</p> <p>9Fe Extracting metals</p> <p>9Fe Extracting metals</p> <p>9Fd Displacement</p>

	<p>C9.2.4H Know how metals can be arranged in a reactivity series based on their displacement reactions between metals and metal oxides.</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>9Fd Displacement</p> <p>8He Materials in the Earth</p> <p>9Fe Extracting metals</p>
Chemical reactions: Rate of reaction	<p>C9.2.5A Know the effect of changing the temperature on the rate of reaction.</p> <p>C9.2.5B Know the effect of changing the size of the solid particles on the rate of reaction.</p> <p>C9.2.5C Know the meaning of the term 'catalyst'.</p>	<p>9Hc Rates of reaction [Covered in an extension worksheet.]</p> <p>9Hc Rates of reaction</p> <p>8Ga Metal properties</p>
Periodic table: Arrangement of elements	<p>C9.3.1A Know that elements are arranged in order of atomic number.</p> <p>C9.3.1B Know that elements are arranged in groups and periods.</p>	<p>8Fc Mendeleev's table</p>

Periodic table: Group 1	<p>C9.3.2A Know the reactions of Group 1 metals with water.</p> <p>C9.3.2B Know how trends in reactions can be predicted using the Periodic Table.</p>	<p>8Fc Mendeleev's table</p> <p>8Fd Physical trends, 8Fc Chemical trends</p>
Earth and atmosphere: Materials made from substances in the Earth	<p>C9.4.1A Know the names of some common ceramic materials and their properties.</p> <p>C9.4.1B Know how uses of some common ceramic materials are related to their properties.</p> <p>C9.4.1C Understand that polymers are formed by many small molecules joining together in chains.</p> <p>C9.4.1D Know that rubber is a natural polymer.</p> <p>C9.4.1E Know the names of some common polymers and their properties.</p> <p>C9.4.1F Know how uses of some common polymers are related to their properties.</p> <p>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.</p>	<p>9Ea About ceramics</p> <p>9Ea About ceramics</p> <p>9Eb Polymers</p> <p>9Eb Polymers</p> <p>9Eb Polymers</p> <p>9Eb Polymers</p> <p>9Ec Composites</p>

	<p>C9.4.1H Know the names of some composite materials and relate their properties to their uses.</p> <p>C9.4.1I Understand that making and using some materials can cause environmental problems and appreciate ways of reducing them, including recycling.</p> <p>C9.4.1J Understand the term 'biodegradable'.</p>	<p>9Ec Composites</p> <p>9Ed Problems with materials, 9Ee Recycling materials</p> <p>9Ed Problems with materials</p>
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iLowerSecondary Year 9 Physics

Topic	iLowerSecondary Objective	Suggested Exploring Science Working Scientifically lesson
Energy: More on energy stores and transfers	<p>P9.1.1A Know examples of energy stored as gravitational potential energy being transferred to other energy stores.</p> <p>P9.1.1B Know examples of energy stored as elastic potential energy (strain energy) being transferred to other energy stores.</p> <p>P9.1.1C Know an example of energy stored as nuclear energy being transferred.</p>	<p>7Ib Energy transfers and stores, 9Lb Fields</p> <p>7Ib Energy transfers and stores</p> <p>7Ib Energy transfers and stores, 7Ic Fuels, 7Ie Using resources</p>
Electricity: More on resistance, current and voltage	<p>P9.2.1A Know what is meant by 'electrical resistance' and that it is measured in ohms (Ω).</p>	<p>9Jd Resistance</p> <p>9Jd Resistance</p>

	<p>P9.2.1B Know and describe the factors that affect resistance including length and thickness of wires.</p> <p>P9.2.1C Know the relationship: voltage (V) = current (I) × resistance (R) and perform calculations using it.</p>	9Jd Resistance
Electricity: Static electricity	<p>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.</p> <p>P9.2.2B Understand how different insulating materials can be given different charges when rubbed with a cloth.</p> <p>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.</p> <p>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.</p>	<p>9Jb Static electricity</p> <p>9Jb Static electricity</p> <p>9Jb Static electricity</p> <p>9Jb Static electricity</p>

Electricity: Electromagnets	<p>P9.2.3A Know that a wire with an electric current flowing through it creates a magnetic field around it.</p> <p>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.</p> <p>P9.2.3C Know how the strength of the magnetic field of an electromagnet can be changed.</p>	<p>9Je Electromagnets</p> <p>9Je Electromagnets</p> <p>9Je Electromagnets</p>
Forces: Force and motion	<p>P9.3.1A Understand the relationship between forces (balanced and unbalanced) on an object and its motion.</p> <p>P9.3.1B Understand the idea of a resultant force.</p> <p>P9.3.1C Understand how to perform simple calculations of resultant forces.</p> <p>P9.3.1D Know that moving objects have a maximum speed.</p> <p>P9.3.1E Understand the concept of terminal velocity of a falling object.</p> <p>P9.3.1F Understand the idea of speed and mean (average) speed.</p> <p>P9.3.1G Know that there are various units for speed and understand how to interconvert between them.</p>	<p>7Ke Balanced and unbalanced forces, 9la Forces and movement</p> <p>9la Forces and movement</p> <p>9la Forces and movement</p> <p>8le Drag, 9la Forces and movement</p> <p>9lc Speed</p> <p>9lc Speed</p>

	<p>P9.3.1H Understand how to use the formula: mean (average) speed = distance travelled ÷ time taken.</p> <p>P9.3.1I Understand how to construct and interpret distance–time graphs, describing patterns or relationships.</p> <p>P9.3.1J Understand how to construct and interpret speed–time graphs, describing patterns or relationships.</p> <p>P9.3.1K Understand simple examples of the idea of relative speed.</p>	<p>9Ic Speed</p> <p>9Ic Speed</p> <p>9Ic Speed</p>
Forces: Turning forces	<p>P9.3.2A Know how a simple lever operates.</p> <p>P9.3.2B Know the use of the terms ‘pivot’/ ‘fulcrum’, ‘effort’ and ‘load’.</p> <p>P9.3.2C Know about the application of the principle of levers to simple situations, including the human arm.</p> <p>P9.3.2D Know that a ‘moment’ is the turning effect of a force.</p> <p>P9.3.2E Understand how to calculate the moment of a force and know the unit is Nm.</p>	<p>9Id Turning forces</p> <p>9Id Turning forces</p> <p>9Id Turning forces</p> <p>9Id Turning forces</p> <p>9Id Turning forces</p>

	<p>P9.3.2F Understand how to use moments to find out if something will balance or not.</p> <p>P9.3.2G Know how ramps and pulleys allow less force to be used to move an object.</p> <p>P9.3.2H Know that 'work' is the amount of energy transferred when something is moved (from one place to another) using a force.</p> <p>P9.3.2I Know that work, like energy, is measured in joules (J).</p> <p>P9.3.2J Understand how to calculate the amount of work done using the formula: $\text{work} = \text{force} \times \text{distance moved (in the direction of the force)}$.</p>	<p>9le More machines</p> <p>9le More machines</p> <p>9le More machines</p> <p>9le More machines</p>
Forces: Stretching forces	<p>P9.3.3A Know that adding a mass to a spring affects its extension.</p>	<p>7Kb Springs</p>