

# Science

## Building Curiosity One Atom at a Time

Science surrounds us. It is everywhere in our daily lives - all day, every day! We want Science to inspire students to explore the world around them and recognise and understand this. We aim to excite and enrich with the practical applications of the subject, teaching students that doing science develops our ability to ask questions, collect information, organise and test our ideas, problem-solve and apply what we learn.

Science is a platform for building confidence, developing communication skills, and making sense of the world around us.

Group	Autumn		Spring		Summer	
B	Organisms & Their Environment Proteins & Functions	Respiration	Patterns of Inheritance	Organisms Changing Through Time	Revision	Revision
C	Rates of Reaction	Exothermic & Endothermic Reactions	Acids, Bases & Salts	Electrolysis		
P	Using mains electricity safely & the power of electrical appliances	What happens when radioactive substances decay, and the uses and dangers of their emissions	Nuclear fusion and fission	Review P2.1-2.6		

Science homework is an integral part of each students learning journey. Therefore the Science department will issue regular homework.

The homework set is designed to:

- consolidate learning
- allow further research on subjects
- develop and practise essential scientific skills
- provide extra challenge and support for students

Students will be set two pieces of homework per week. One piece will be based on the current learning and the second homework will be a piece of recall work to consolidate previous topic and aid revision. Students studying separate sciences will receive three pieces of homework per week but of a shorter duration.

Homework is not expected to be completed in isolation and we actively encourage parents or any other person to help and support students while completing the tasks set. If a student is having difficulty completing homework they must bring this to the attention of their class teacher who will arrange a time suitable to go over any problem areas.

Unit	Learning Objectives/Outcomes
Organisms & Their Environment  Proteins & Functions	<ul style="list-style-type: none"> <li>• Obtain quantitative data on the distribution of organisms by random sampling using a quadrat</li> <li>• Investigate changes in populations by sampling along a transect</li> <li>• Describe and explain the structure, functions and importance of proteins</li> <li>• Describe and explain the function of enzymes and the conditions needed for their optimum performance</li> <li>• Describe and relate digestive enzymes to their functions and conditions in which they operate</li> <li>• Describe the uses of different enzymes in industry</li> <li>• Describe and explain the types of enzymes used in biological detergents in the home</li> </ul>
Respiration	<ul style="list-style-type: none"> <li>• Describe the processes which occur during respiration and summarise respiration in the form of an equation</li> <li>• Describe the changes which take place in the body during exercise and explain their effects</li> <li>• Describe and explain anaerobic respiration and the effect it has on the body</li> </ul>
Patterns of Inheritance	<ul style="list-style-type: none"> <li>• Explain mitosis and meiosis, the two main types of cell division</li> <li>• Explain why different alleles of a gene produce different characteristics and why sexual reproduction produces variation in the offspring</li> <li>• Explain how sex is inherited in humans and draw genetic diagrams to explain the effect of inheriting recessive and dominant alleles</li> <li>• Explain the inheritance of some human disorders caused by dominant and recessive alleles</li> <li>• Describe how embryos can be screened for disorders and explain the advantages and disadvantages of doing this</li> <li>• Describe cell differentiation in animals and plants and how stem cells can differentiate to form many types of specialised cell</li> </ul>

Organisms Changing Through Time	<ul style="list-style-type: none"> <li>Describe some of the ways which fossils form and how fossil records can be used in relation to evolutionary theory</li> <li>Describe and explain the causes of extinction of organisms</li> <li>Describe and explain how new species arise</li> </ul>
Rates of Reaction	<ul style="list-style-type: none"> <li>Describe why reactions occur</li> <li>Analyse rate of reactions graphs</li> <li>Describe how concentration affects rate of reaction</li> <li>Explain why concentration affects rate of reaction</li> <li>Describe how temperature affects rate of reaction</li> <li>Explain why temperature affects rate of reaction</li> <li>Describe how surface area affects rate of reaction</li> <li>Explain why surface area affects rate of reaction</li> <li>Describe the purpose of a catalyst</li> <li>Analyse data to identify catalysts</li> </ul>
Exothermic & Endothermic Reactions	<ul style="list-style-type: none"> <li>Identify an exothermic or endothermic reaction from experimental data</li> <li>Describe what exothermic and endothermic reactions are</li> </ul>
Acids, Bases & Salts	<ul style="list-style-type: none"> <li>Describe the key features of acids and bases</li> <li>Predict which salt will be made in a reaction</li> <li>Describe how to make a soluble salt (metal + base)</li> <li>Produce a sample of a soluble salt</li> <li>Describe how to make a soluble base (acid + alkali)</li> <li>Produce a sample of sodium chloride</li> <li>Describe how to make an insoluble salt</li> <li>Compare with method of soluble salt production</li> </ul>
Electrolysis	<ul style="list-style-type: none"> <li>Describe the process of electrolysis</li> <li>Predict the products of electrolysis of molten substances</li> <li>Describe the electrolysis of copper chloride solution</li> <li>Explain how the products form at each electrode</li> <li>Describe the electrolysis of aluminium oxide</li> <li>Explain how the products are formed at each electrode</li> <li>Write half equations to show the reactions</li> <li>Describe the electrolysis of sodium chloride solution</li> <li>Describe the process of electroplating</li> <li>Explain the uses of electroplating</li> </ul>
Using mains electricity safely & the power of electrical appliances	<ul style="list-style-type: none"> <li>Describe AC and DC including "mains electricity"</li> <li>Describe the structure of electrical cable and a 3-pin plug, describe how to wire a 3-pin plug and recognise wiring errors</li> <li>Explain how fuses, the earth wire and circuit breakers work. Use <math>P = E/t</math>, use <math>P = IV</math>, calculate the size of fuse needed, use <math>E = VQ</math>, use <math>Q = It</math> and rearrange the equations</li> </ul>

What happens when radioactive substances decay, and the uses and dangers of their emissions	<ul style="list-style-type: none"> <li>Describe the orbital model of an atom, describe how evidence from the Rutherford scattering experiment has contributed to the model of the atom and calculate the number of electrons protons and neutrons in an atom</li> <li>Define the terms "isotope" and "radiation", name and describe the three types of ionizing radiation and state the properties and dangers of ionizing radiation</li> <li>Describe the origins of background radiation and describe the effect of alpha and beta decay on radioactive nuclei</li> <li>Define half-life, calculate half-life and use half-life to determine level of radioactivity</li> <li>Describe uses of radiation, link uses of radiation to the properties of radiation and evaluation the hazards associated with using radioactive materials</li> </ul>
Nuclear fusion and fission	<ul style="list-style-type: none"> <li>Describe how a nuclear reactor works (fission) and explain, with a labelled diagram how a chain reaction occurs</li> <li>Describe how a star releases energy (fusion)</li> </ul>

## Science (Triple Award)

Group	Autumn		Spring		Summer	
B	Movement of molecules in and out of cells	Transport systems in plants and animals	Homeostasis Humans and their environment	Review	Revision	Revision
C	Periodic Table Water	Energy Transfers Chemical Analysis	Ammonia Production Organic Chemistry	Review		
P	Medical Applications of Physics	Using physics to make things work	Keeping things moving	Review		

Unit	Learning Objectives/Outcomes
Movement of molecules in and out of cells	<ul style="list-style-type: none"> <li>• Describe and explain the process of osmosis.</li> <li>• Describe and explain the differences between active transport and osmosis?</li> <li>• Explain how substances can move across cell membranes and the function of sports drinks.</li> <li>• Explain how alveoli and villi are adapted for their functions.</li> <li>• Mechanism of ventilation of the lungs.</li> <li>• Explain how different parts of a plant have been adapted for exchanging certain substances.</li> </ul>
Transport systems in plants and animals	<ul style="list-style-type: none"> <li>• Identify different parts of the heart and describe and explain the circulatory system.</li> <li>• Describe the structure of different types of blood vessels and relate them to their functions.</li> <li>• Explain the functions of different parts of the blood.</li> <li>• Evaluate methods of treating heart disease.</li> <li>• Describe the movement of water, mineral ions and sugars through a plant.</li> </ul>
Homeostasis	<ul style="list-style-type: none"> <li>• Describe how the body controls the maintenance of balance in the internal conditions of the body through homeostasis.</li> <li>• Describe and explain how the kidneys produce urine.</li> <li>• Describe and explain how a person suffering from kidney failure may be treated with dialysis.</li> <li>• Describe and explain how a kidney transplant is carried out, including the advantages and disadvantages of such a procedure.</li> <li>• Describe and explain ways that the body monitors and controls core body temperature.</li> <li>• Describe and explain the ways that the body monitors and controls blood sugar concentration.</li> <li>• Describe, explain and evaluate the different modern methods of treating diabetes.</li> </ul>
Humans and their environment	<ul style="list-style-type: none"> <li>• Describe and explain the consequences of increasing amounts of waste being produced by the human population.</li> <li>• Describe and explain the effects of tropical deforestation and destruction of areas of peat.</li> <li>• Describe and explain the consequences of increased carbon dioxide and methane levels in the atmosphere.</li> <li>• Describe and explain how biofuels are produced and how they are used.</li> <li>• Explain how biogas is produced on a small scale and how it is used.</li> <li>• Describe and explain how the fungus <i>Fusarium</i> is useful for producing mycoprotein, a protein-rich food suitable for vegetarians.</li> <li>• Describe and evaluate the methods and solutions being employed to provide water and food to a global population.</li> <li>• Describe and explain why biomass and energy decrease at each stage in a food chain and the implications for improving the efficiency of food production.</li> </ul>

	<ul style="list-style-type: none"> <li>• Explain how the efficiency of food production can be improved by restricting energy loss from food animals.</li> <li>• Describe and explain conservation measures which can be taken to reverse the trend of declining fish stocks in the oceans.</li> </ul>
Periodic Table	<ul style="list-style-type: none"> <li>• Describe the theories of arranging the early periodic table (Newlands and Mendeleev)</li> <li>• Explain the issues with Newlands table</li> <li>• Explain why Mendeleev's theory was accepted over Newlands</li> <li>• Describe how the modern periodic table is arranged</li> <li>• Link electron arrangement to position in periodic table</li> <li>• Describe how the group 1 metals react with water</li> <li>• Describe the trend of group 1 metals</li> <li>• Explain why the reactivity changes</li> <li>• Describe the properties of transition metals</li> <li>• Compare the properties of transition metals with group 1 metals</li> <li>• Describe the properties of Group 7 elements</li> <li>• Describe the trends down group 7</li> <li>• Describe the trends of Group 7 elements</li> <li>• Explain why the reactivity changes down the group</li> </ul>
Water	<ul style="list-style-type: none"> <li>• Describe what causes hard water</li> <li>• Discuss the pros and cons of hard water</li> <li>• Describe an experiment to determine the hardness of water</li> <li>• Collect and analyse results</li> <li>• Describe methods to soften hard water</li> <li>• Evaluate the effectiveness of each method</li> <li>• Describe how to purify water for drinking</li> </ul>
Energy Transfers	<ul style="list-style-type: none"> <li>• Describe the key features of an energy level diagram</li> <li>• Interpret energy level diagrams</li> <li>• Describe how to measure the amount of energy transferred in combustion reactions</li> <li>• Collect and analyse data from experiment</li> <li>• Explain how different fuels release different amounts of energy</li> <li>• Calculate the theoretical energy transferred in a chemical reaction</li> </ul>
Chemical Analysis	<ul style="list-style-type: none"> <li>• Describe how to carry out a flame test</li> <li>• Explain the results of flame tests and how they can be used</li> <li>• Describe how analytical methods can be used to identify the metal ion in a compound</li> <li>• Describe how to test for halide compounds</li> <li>• Describe how to test for sulphate compounds</li> <li>• Use analytical methods to identify an unknown substance</li> <li>• Calculate the end point in a titration reaction</li> <li>• Evaluate the effectiveness of different indicators in titrations</li> <li>• Calculate the concentration of an unknown chemical using titration methods</li> </ul>
Ammonia Production	<ul style="list-style-type: none"> <li>• Describe the Haber process</li> <li>• Explain the conditions needed to produce the highest yield in the Haber process</li> </ul>

	<ul style="list-style-type: none"> <li>• Explain when an equilibrium is reached</li> <li>• Explain when an equilibrium is reached</li> <li>• Explain the optimum conditions for the Haber process</li> </ul>
Organic Chemistry	<ul style="list-style-type: none"> <li>• Describe the chemical features and reactions of alcohols</li> <li>• Describe the chemical features and reactions of carboxylic acids</li> <li>• Compare reactions of carboxylic acids with other acids</li> <li>• Identify the key features of esters</li> <li>• Describe the formation of esters</li> </ul>
Medical Applications of Physics	<ul style="list-style-type: none"> <li>• Explain the properties of X-rays and how they can be used in conjunction with photographic film or CCDs to make images or CT-scans of hidden objects.</li> <li>• Describe the differences between sound and ultrasound waves and explain how ultrasound can be used to measure the distance to objects or boundaries between media.</li> <li>• Explain some ways in which ultrasound and X-rays are used in medical diagnosis and treatment.</li> <li>• Compare the advantages and disadvantages of using ultrasound, X-rays and CT scanning in medicine. Compare benefits to risks.</li> <li>• Explain refraction, including some of its effects and how the refractive index of a material can be measured. (H) Snell's Law</li> <li>• Construct ray diagrams to show the nature of the image formed by objects at different distances from converging lenses.</li> <li>• Explain the use of converging lenses as magnifying glasses, and draw ray diagrams to show the nature of the image. Construct a ray diagram to show the virtual image produced by a concave lens.</li> <li>• Explain the structure of the eye and compare it to a camera.</li> <li>• Explain the causes of long and short sight and how these can be corrected using lenses.</li> <li>• Explain how total internal reflection occurs and how it is used in optical fibres and how lasers can be used in medicine.</li> </ul>
Using physics to make things work	<ul style="list-style-type: none"> <li>• Describe and explain how levers can be used and work out the force magnification achieved by a lever. Calculate the moment of a force and apply this idea to balanced objects.</li> <li>• Explain how to find the centre of mass of a thin irregular sheet and identify the centre of mass in symmetrical objects. Explain what stability means and the factors that affect the stability of objects, as well as evaluating the stability of various objects.</li> <li>• Describe and explain the relationship between the time period and frequency of a pendulum, and investigate the factors that affect the period of a pendulum.</li> <li>• Describe centripetal force and explain the factors that affect it.</li> <li>• Describe and explain pressure in liquids and how this can be used in hydraulics systems.</li> </ul>
Keeping things moving	<ul style="list-style-type: none"> <li>• Explain how magnetic fields can be produced by electrical currents and give some applications of electromagnets.</li> <li>• Describe the motor effect and how it is used in electric motors.</li> <li>• Describe the structure of a transformer and explain how transformers work. Use equations linking current, potential difference and power</li> </ul>

and explain the usefulness of switch mode transformers.

- A step-up transformer increases the potential difference while a step-down transformer decreases it
- The National Grid uses transformers to save electrical energy
- Learn how to calculate the change in potential difference produced by a transformer.