

Reactions and Earth Science

Core Lesson 1	Option lesson 1a	Core lesson 2	Option lesson 2a	Core Lesson 3	Option lesson 3a	Option lesson 3b
1 ¼ hours	20-30 minutes + independent study	1 – 1 ½ hours	50 minutes	1 – 1 ½ hours	20-30 minutes + independent study	30 minutes + 30 minutes follow up
Earth Science	Measuring the permeability of soil	Weathering of rock	Will my gravestone last?	Erosion and sedimentation	Landforms	Making and testing rocks
Earth Science Objectives Pupils are introduced to the idea that earth science is the study of how the natural processes of the Earth form sediments, rocks and landforms. They learn how to observe, compare and classify rocks in order to define a rock, and about some differences between rocks in terms of properties.	Earth Science Objectives	Earth Science Objectives Pupils are introduced to the idea that rocks change and that physical, chemical and biological weathering are responsible for this. The physical processes of freeze-thaw and differential expansion and the chemical process of acid attack are considered.	Earth Science Objectives	Earth Science Objectives Pupils observe features caused by the erosion (removal and transportation) and sedimentation of weathered material, and realise that sedimentary rocks are formed when transported sediments are laid down. They appreciate that sedimentary rocks are formed in layers with the oldest layer at the bottom.	Earth Science Objectives	Earth Science Objectives
Key concepts and processes Pupils develop process skills of observation, comparing, classifying, inferring and predicting. They use evidence from observations and a simple marbles analogy to develop an explanation for the properties of different rocks.	Key concepts and processes Pupils investigate the permeability of different soils by timing how long it takes a certain volume of water to run through the soil, relating this to the size and shape of the soil particles, the spaces/pores between the particles (porosity) and the degree of saturation /water content of the soil.	Key concepts and processes Pupils use a model rock to come to an understanding of real-life weathering processes. They analyse trends in results to draw conclusions, and critically evaluate whether there is sufficient evidence from their data	Key concepts and processes Pupils use photos to investigate the effects of weathering on different types of rock and how this influences the choice of building materials.	Key concepts and processes Pupils observe a simulation of erosion and sedimentation processes to develop understanding of the real-life processes, and describe the limitations of the model.	Key concepts and processes Pupils find out about the weathering, erosion and deposition processes involved in the formation of a real-life local or foreign land formation of personal interest and present their case study using terminology appropriate to a chosen audience, optionally using ICT.	Key concepts and processes Pupils try making rocks from loose sediment and learn that in order for sediments to become rock the grains have to become bound together with cement. They devise a range of methods to test the strength and resistance to weathering of their rocks.
PLTS - Support conclusions using reasoned arguments and evidence by using a model to explain the properties of different rocks	PLTS - Identify questions to answer and problems to resolve, by setting and answering a question to determine, compare and account for the permeability of different soils	PLTS - Generate ideas and explore possibilities by using models of physical and chemical processes of weathering to explain land formations	PLTS - Identify questions to answer and problems to resolve by setting and answering a question about the effects of weathering on building materials.	PLTS - Generate ideas and explore possibilities by modelling different conditions of erosion and sedimentation and using findings to explain sedimentary rock features	PLTS - Communicate their learning in relevant ways for different audiences by producing an annotated diagram or presentation explaining how a named geographic feature was formed	PLTS - Identify questions to answer and problems to resolve by setting and answering a question about the conditions needed for formation of sedimentary rocks
Technician's notes Engage: soft rocks in a 250 cm ³ container Explore and Extend: examples of coarse-grained sedimentary rocks (e.g. sandstone, limestone) and igneous rocks (e.g. granite, gabbro); hand lenses, metal spoons, digital balance (weighing to 0.1g), paper towels, 250 cm ³ plastic beakers, measuring cylinders, eureka cans, marbles and Lego pieces (optional) Evaluation: marbles in a pot, Lego pieces		Technician's notes Effervescent tablets (vitamin C, denture tablets or antacid such as Alka Seltzer). NB Alka Seltzer tablets react readily with water but Rennies do not; dilute hydrochloric acid, 250 cm ³ glass beakers, water baths to warm the water or acid to different temperatures; thermometers, stopwatches, balance; chipped and powdered limestone (optional); access to a freezer (optional) Alka Seltzer contains aspirin so distribute only when required.		Technician's notes 1 m length of guttering (square section type) with two end pieces; wooden blocks to support gutter; sand, gravel and fine silt to place in gutter; rubber tubing to connect to a lab tap; washing up bowl or similar; access to sink with tap; coffee jar with lid, sand, gravel, silt Wet floors can be slippery. Clean up any spills at once. The mixture of sand, gravel and stones can block the sink waste, so place bowl in sink to catch any sediment washed over the end of the gutter.		

Assessment: During each lesson each student should assess their own level using the pupil speak level ladders and show their partner where the evidence is for that level. They should record this in the grid at the front of the book. The member of staff should then assess the level of a maximum of 2 students work each lesson. At the end of each lesson there will be an end of topic test to check the content level.

Homework: For each topic there is a task booklet that students should use for homework.

Option lesson 3c	Core Lesson 4	Option lesson 4a	Core Lesson 5	Option lesson 5a	Core Lesson 6	Option lesson 6a
20-30 minutes + independent study	1 ¼ hours	20-30 minutes + independent study	1 – 1 ½ hours	40-50 minutes	1 hour	30-40 minutes +
Coastal erosion	Volcanoes and igneous rocks	Volcanic eruptions	Rock cycle	Theories of the earth	Reactions of Acids	Neutralisation reactions
Earth Science Objectives	Earth Science Objectives Pupils are introduced to the idea that igneous rocks are formed when magma (partially molten rock) cools. They learn that the rate of cooling affects crystal size and therefore that igneous rocks formed at different depths will have different crystal sizes	Earth Science Objectives	Earth Science Objectives Pupils understand the processes that lead to the formation of metamorphic rock. They use the rock cycle as a model to explain the cyclical nature of rock-forming processes and the timescales over which they operate.	Earth Science Objectives	Chemistry Objectives Pupils describe and identify patterns in the characteristic reactions of acids with metals and carbonates. They use word equations and chemical symbols to describe the reactions. During this work they use and learn the chemical tests for hydrogen and carbon dioxide	Chemistry Objectives
Key concepts and processes Pupils carry out a research enquiry to learn about the conditions that lead to coastal erosion and explore how the application of scientific ideas across disciplines can lead to measures to combat such erosion.	Key concepts and processes Pupils investigate models of fast and slow cooling to develop understanding of how this affects crystal size.	Key concepts and processes Pupils investigate volcanic eruptions in greater detail and produce a presentation targeted, for example at scientists or at residents in volcanic areas, to explain volcanic processes and also the application of science in protecting people against the effects of volcanic eruptions.	Key concepts and processes Pupils use data from secondary sources and their own observations to identify different rocks and to link the rocks and the processes that formed them. They communicate ideas using flowchart diagrams and possibly using ICT.	Key concepts and processes Pupils recognise that both evidence (e.g. from fossils and radioactive dating) and creative thinking (e.g. the new idea that geological processes could operate cyclically) have contributed to the development of scientific ideas about rock formation processes and the age of the Earth. They appreciate that a lack of evidence can give rise to inappropriate theories.	Key concepts and processes Pupils assess risk and take steps to carry out practical work safely.	Key concepts and processes Pupils assess risk and take steps to carry out their practical work safely, selecting appropriate equipment to measure solution volumes precisely. They describe and identify a pattern in the characteristic reaction of an acid with an alkali to form a salt plus water. They use word equations and possibly chemical symbols to describe the reactions.
PLTS - Identify questions to answer and problems to resolve by setting and answering a question about how coastal or soil erosion occur and how this is being addressed	PLTS - Support conclusions using reasoned arguments and evidence, by using a model of cooling crystals to explain the different crystal sizes found in igneous rocks	PLTS - Communicate their learning in relevant ways for different audiences by targeting their report to a specific section of the community	PLTS - Work towards goals, showing initiative, commitment and perseverance by producing a presentation on the rock cycle	PLTS - Question their own and others' assumptions by considering historical ideas about how rocks formed, and what assumptions in these ideas might be proved or disproved	PLTS - Anticipate, take and manage risks by planning how to experiment safely when using acids	PLTS - Take responsibility, showing confidence in themselves and their contribution by participating confidently and safely in group use of burettes
	Technician's notes Explore: samples of different igneous rocks e.g. obsidian (volcanic glass), basalt, granite, gabbro; hand lenses Explain: 500 cm ³ glass beaker, Bunsen burner, heatproof mat, tripod, gauze, safety screen, red candle wax (previously melted and poured into the base of the beaker), clean sand in a layer about 1cm deep above the wax Extend: glass microscope slides; salol (phenyl salicylate, irritant); boiling tubes, 250cm ³ beakers for salol water bath, glass rods; access to freezer, kettle for warm water, sheet of coloured paper, digital microscope (optional)		Technician's notes Samples of different rock types (sedimentary, igneous and metamorphic), hand lenses, poster paper, pens; computers and digital cameras (both optional)		Technician's notes Engage and explore: 1M hydrochloric acid; zinc foil, magnesium ribbon, iron nails, copper, sandpaper, test tubes, splints, test tube racks Extend: 0.5M hydrochloric acid, selection of carbonates in labelled bottles, spatulas, limewater, test tubes, conical flasks, delivery tubes, test tube racks; eye protection	

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Core Lesson 6	Option lesson 6a	Option lesson 6b	Option lesson 6c
	30-40 minutes	20-30 minutes +	30-40 minutes
Atoms and molecules in reactions	Decomposition reactions	Phlogiston and oxygen	Reactions, reactions
Chemistry Objectives Pupils carry out an experiment to show that the mass of the product when something is burned can be greater than the mass of the original substance. They explain chemical reactions in terms of the rearrangement of the atoms and use the particle rearrangement model to explain why mass is conserved in chemical reactions.	Chemistry Objectives	Chemistry Objectives	Chemistry Objectives
Key concepts and processes Pupils communicate ideas about reactions using atom diagrams, word equations and chemical symbols. They describe the strengths and limitations of the atom model.	Key concepts and processes Pupils heat a metal carbonate so that it decomposes into a metal oxide and carbon dioxide, and use particle diagrams to explain the rearrangement of the atoms in the reaction. They use word equations and possibly chemical symbols to describe the reaction and deduce a pattern in the reactions for thermal decomposition of carbonates.	Key concepts and processes Pupils heat the experiments that Antoine Lavoisier performed to refute the phlogiston theory and to provide the evidence for combustion as a reaction with oxygen from the air. They recognise that theories change when they are not supported by evidence and that scientists may question previously held ideas and build on one another's results.	Key concepts and processes Pupils carry out a number of simple experiments and observe the reactions, noting that new substances form. They write word equations for the reactions and explain the formation of new compounds through the arrangement of atoms.
PLTS - Support conclusions using reasoned arguments, by drawing conclusions that are consistent with the evidence and using their knowledge of particles to explain these	PLTS - Support conclusions using reasoned arguments, by identifying the compounds created using chemical tests and theoretical models (atom diagrams) to support the conclusions	PLTS - Explore issues, events or problems from different perspectives by evaluating experiments that challenged the phlogiston theory	PLTS -
Technician's notes Engage: deflagrating spoons, sulphur powder, gas jars of oxygen, fume cupboard, Bunsen burner, heatproof mat; Lego (different colours and sizes) or Molymod Extend: top-pan balance reading to 0.01 g, pieces of magnesium ribbon about 30 cm in length (0.3g) crucibles and lids, tongs, Bunsen burners, tripods, pipe-clay triangles, heatproof mats Evaluate: copper carbonate, spatula, crucible; effervescent tablet, top-pan balance reading to 0.01 g, plastic drinks bottle with cap Sulphur dioxide is toxic. Sulphur should only be burned in a fume cupboard.			

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