

# Materials and Earth Science

Core Lesson 1	Option lesson 1a	Core Lesson 2	Option lesson 2a	Core Lesson 3	Option lesson 3a	Core Lesson 4
1 - 1 ¼ hours	1 ½ - 2 hours	1 ¼ - 1 ½ hours	20–30 minutes plus write-up	1 ¼ hours	30-40 minutes	1 – 1 ½ hours
Applying the particle model	Sticky ice	Density	Archimedes and the Eureka moment	Earth Science	Measuring the permeability of soil	Weathering of rock
<b><u>Chemistry Objectives</u></b> Pupils explore a number of contexts that can be explained by using the particle model, in particular Brownian motion, and the increase of pressure or volume caused by increased particle movement in a gas.	<b><u>Chemistry Objectives</u></b>	<b><u>Chemistry Objectives</u></b> Pupils investigate and calculate the densities of different materials and use the particle model to explain why different materials have different densities.	<b><u>Chemistry Objectives</u></b>	<b><u>Earth Science Objectives</u></b> 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.	<b><u>Earth Science Objectives</u></b>	<b><u>Earth Science Objectives</u></b> 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.
<b><u>Key concepts and processes</u></b> Pupils use the particle model to predict the effect of temperature on particle motion. They plan and carry out a fair-testing enquiry into factors affecting gas pressure inside a sealed container, using the particle model to explain conclusions about their observations.	<b><u>Key concepts and processes</u></b> Pupils explore how ice behaves under pressure and relate what they observe to other familiar contexts, and to predictions from the particle model. They note that some questions cannot be completely answered using their existing knowledge.	<b><u>Key concepts and processes</u></b> Pupils measure the dimensions and masses of solid blocks and calculate their volumes and densities. They use a variety of measuring equipment and record, tabulate and handle their data systematically.	<b><u>Key concepts and processes</u></b> Pupils consider the story of Archimedes' 'Eureka!' moment, and carry out a problem-solving enquiry or challenge to test the purity of the material used to make a 'crown' by measuring its density.	<b><u>Key concepts and processes</u></b> 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.	<b><u>Key concepts and processes</u></b> 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.	<b><u>Key concepts and processes</u></b> 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
<b>PLTS</b> - Support conclusions using reasoned arguments and evidence, by explaining their observations using the theory of moving particles and collisions	<b>PLTS</b> - Adapt ideas as circumstances change by formulating hypotheses that might then not be supported by their evidence, and being prepared to accept that another hypothesis must be formulated	<b>PLTS</b> – Support conclusions, using reasoned arguments and evidence, by using their data for the densities of different materials to account for the materials sinking or floating behaviour	<b>PLTS</b> - Support conclusions, using reasoned arguments and evidence by using the volume data to decide whether the crown they tested contains pure 'gold' (Plasticine) or contains other material too.	<b>PLTS</b> - Support conclusions using reasoned arguments and evidence by using a model to explain the properties of different rocks	<b>PLTS</b> - 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	<b>PLTS</b> - Generate ideas and explore possibilities by using models of physical and chemical processes of weathering to explain land formations
<b>Technician's notes</b> 35 mm film canisters, shallow trays, Blu-tak, water jug, paper towels, stopwatches, effervescent tablets (vitamin C, denture tablets or antacid such as Alka Seltzer). NB Alka Seltzer tablets react readily with water but Rennies do not. Alka Seltzer contains aspirin so distribute only when required. Eye protection should be worn. Keep well away from the canisters - launch outside if possible. Stand the 'rockets' in the tray to contain most of the liquid, but ensure any spills are cleared up promptly.	<b>Technician's notes</b>	<b>Technician's notes</b> Regular blocks of different materials and other solids for floating and sinking, top-pan balances, eureka cans or 250 cm <sup>3</sup> measuring cylinders.	<b>Technician's notes</b>	<b>Technician's notes</b> Engage: soft rocks in a 250 cm <sup>3</sup> 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 <sup>3</sup> plastic beakers, measuring cylinders, eureka cans, marbles and Lego pieces (optional) Evaluation: marbles in a pot, Lego pieces	<b>Technician's notes</b>	<b>Technician's notes</b> 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 <sup>3</sup> 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.

**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 4a	Core Lesson 5	Option lesson 5a	Option lesson 5b	Core Lesson 6	Option lesson 6a	Core lesson 7
50 minutes	1 – 1 ½ hours	30 minutes + 30 minutes follow up	20-30 minutes + independent study	1 ¼ hours	20-30 minutes + independent study	1 – 1 ½ hours
Will my gravestone last?	Erosion and sedimentation	Making and testing rocks	Coastal erosion	Volcanoes and igneous rocks	Volcanic eruptions	Rock cycle
<b>Earth Science Objectives</b>	<b>Earth Science Objectives</b> 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.	<b>Earth Science Objectives</b>	<b>Earth Science Objectives</b>	<b>Earth Science Objectives</b> 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	<b>Earth Science Objectives</b>	<b>Earth Science Objectives</b> 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.
<b>Key concepts and processes</b> Pupils use photos to investigate the effects of weathering on different types of rock and how this influences the choice of building materials.	<b>Key concepts and processes</b> Pupils observe a simulation of erosion and sedimentation processes to develop understanding of the real-life processes, and describe the limitations of the model.	<b>Key concepts and processes</b> 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.	<b>Key concepts and processes</b> 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.	<b>Key concepts and processes</b> Pupils investigate models of fast and slow cooling to develop understanding of how this affects crystal size.	<b>Key concepts and processes</b> 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.	<b>Key concepts and processes</b> 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.
<b>PLTS</b> - Identify questions to answer and problems to resolve by setting and answering a question about the effects of weathering on building materials.	<b>PLTS</b> - Generate ideas and explore possibilities by modelling different conditions of erosion and sedimentation and using findings to explain sedimentary rock features	<b>PLTS</b> - Identify questions to answer and problems to resolve by setting and answering a question about the conditions needed for formation of sedimentary rocks	<b>PLTS</b> - 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	<b>PLTS</b> - Support conclusions using reasoned arguments and evidence, by using a model of cooling crystals to explain the different crystal sizes found in igneous rocks	<b>PLTS</b> - Communicate their learning in relevant ways for different audiences by targeting their report to a specific section of the community	<b>PLTS</b> - Work towards goals, showing initiative, commitment and perseverance by producing a presentation on the rock cycle
	<b>Technician's notes</b> 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.			<b>Technician's notes</b> Explore: samples of different igneous rocks e.g. obsidian (volcanic glass), basalt, granite, gabbro; hand lenses Explain: 500 cm <sup>3</sup> 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 <sup>3</sup> beakers for salol water bath, glass rods; access to freezer, kettle for warm water, sheet of coloured paper, digital microscope (optional)		<b>Technician's notes</b> Samples of different rock types (sedimentary, igneous and metamorphic), hand lenses, poster paper, pens; computers and digital cameras (both optional)
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