Explorify guide to embed long-term understanding of Materials

Upper primary (7-12 years)

There is a guide to how to use this outline below the table.

Learning focus – to fit with any curriculum or scheme of work	Engage and elicit - what do children already know?	Developing learning - activities from Explorify which give ideas for working scientifically and support teacher subject knowledge	Deepening learning – what connections do children make? Can they recall the scientific vocabulary correctly?
Compare and group together different kinds of rocks based on their appearance and simple physical properties	Have you ever picked up a rock you found and put it in your pocket to take home?	OOO Useful rocks - chalk, slate, granite	Big Question Why don't all rocks look the same? OOO Building with rocks - brick house, marble Taj Mahal, limestone cathedral
Know the properties of solids and liquids and be able to sort groups of solids and liquids	OOO States in the kitchen - a bar of chocolate, bread dough and vegetable oil	OOO Pouring fun - sand, water and beads being poured WGO Pouring liquids - oil, syrup and tomato ketchup moving down a slope	ZIZO Glorious Grains - sand OOO Tiny grains - sugar, salt, sand What if the sea was gloopy like ketchup?
Learn about the properties of gases	OOO Gas filled - air pumped into ball, oxygen being given to a poorly lady, carbon dioxide bubbles in a fizzy drink	OOO Inflating fun - arm bands, bubble wrap, balloon, WGO Dancing raisins - bubbles of gas in fizzy drink lifting raisins New: WGO Air in or air out? - vacuum packing and filling and emptying a balloon ZIZO Spring clean - bubbles	OOO Gas - helium balloons, bread, fizzy water OOO Is it a liquid? - shaving foam, jelly in a bowl, water with bubbles in it WGO Wet or dry - a scrunched-up piece of paper in a glass is lowered underwater.
Understand that materials change between three 'states of	OOO Wonderful water - water in different states	ZIZO Hold on tight- icicles	WGO Frozen in motion - a partly frozen waterfall What if water couldn't freeze

matter' (solid, liquid and gas) when they are heated or cooled			ZIZO White crystals - ice on a car's windscreen
Know that the process of a material changing from a solid to a liquid is called melting. Investigate melting in a range of materials	Have you ever held a piece of chocolate tightly in your hand?	Have you ever had an icecream melt?	OOO Melting materials - candle wax, melted plastic bins, molten metal ZIZO Glistening brown - butter melting on toast
Know that the process of a material changing from a liquid to a gas is called evaporation. Explore how to speed up or slow down evaporation (including with temperature)	Have you ever splashed in a puddle?	OOO Sensing evaporation - perfume, hand gel, scented candles Have you ever needed to dry something quickly? BQ How can we slow down evaporation to make sure that the wildlife can drink?	What if water didn't evaporate? LWCYH? Terrific Transformations - water being boiled ZIZO Golden wrinkles - raisins including drying on the vines
Know that the process of a material changing from a gas to a liquid is called condensation and observe it	Have you ever not been able to see yourself in the bathroom mirror?	Have you ever not been able to see yourself in the bathroom mirror?	ZIZO Shiny patterns - condensation on a metal tap OOO Where is the water? - clouds of condensation from breath of birds, boiling kettle and jet planes
Identify the part played by evaporation and condensation in the water cycle	BQ What are clouds made of?	WGO Never ending story - stages of water cycle: sun over ocean, rain over mountains, streams returning to ocean	OOO Cloud watching - cumulus, nimbostratus and cirrus Start with Art Water
Use evidence from comparative and fair tests to compare the properties of different materials (including thermal and electrical conductivity and response to magnets) and explain their uses	OOO Wonderful wheels - scooter, inline skates, bicycles Assess what the children already know and the vocabulary they use with confidence. You could provide a word bank: *hard, soft, stretchy, stiff, bendy, floppy, waterproof, absorbent, rough, smooth, shiny, dull, see-*	WGO Hot and cold - filmed using a thermal camera WGO Melting ice cubes - compares ice cubes melting on different materials MB Electrifying metals Problem solvers: Suits you	OOO What are my properties? - steel saucepan, aluminium drinks can and plastic spatula

	through, not see-through, opaque, transparent, translucent, reflective, non-reflective, flexible, rigid	Mystery Bag: Attracting objects	
Understand the process of dissolving and identify some soluble and insoluble materials. Investigate conditions that will increase the quantity of substance that can be dissolved or the speed of dissolving	Have you ever tasted sugar in your cereal milk?	BQ How can we speed up dissolving?	OOO Hot drinks for cold days - coffee, hot chocolate, tea WGO Brilliantly bouncy egg - observe an egg after soaking it in vinegar OOO Delicious drinks - hot chocolate, fizzy drinks, tea
Know that dissolving, mixing and changes of state are reversible changes. Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating	ZIZO All mixed up - muesli Have you ever watched water being drained from rice or pasta?	PS Clean up the beach MS Dangerous flood water	OOO Filters or sieves - tea bag, face masks, fishing net ZIZO Stringy patterns - a tea bag
Explain that some changes result in the formation of new materials, and that this kind of change is usually irreversible e.g. burning, rusting, cooking and the action of acid on bicarbonate of soda	Have you ever burnt your toast?	WGO Balloon surprise - sodium bicarbonate and vinegar react ZIZO Bright spark - a match ZIZO Red and flaky - rust WGO Baking cookies	LWCYH? Feeling hot, hot, hot - frying food and burning wood ZIZO Craggy crevices? - rock cakes WGO 321 lift off - sodium bicarbonate and vinegar react Who is Eunice Newton Foote? The woman who first discovered that carbon dioxide trapped heat WGO Shaking sensations - butter
Understand some of the processes used to make natural resources of the planet useful	ZIZO Glowing depths - coal	Have you ever warmed yourself by a real fire?	LWCYH? Rock my world - quarry and mining OOO Take your turn - water wheel, windmill, wind turbine What if we didn't use transport to get to school?

			OOO Green power - wind turbines, solar farm, heat pump
Learn how waste can be reduced, reused or recycled	BQ Where does our rubbish go?	Have you ever put something in the recycling bin?	What if we didn't plant trees? What if there was no plastic?

How to use this outline

The **learning focus** column gives one possible outline (and order) of how you could teach this unit using Explorify resources to support you, but you can easily use your current scheme of work and select the relevant Explorify activities to enhance your current planning. It is for the teacher to decide how much time to devote to each learning focus.

The **Elicit and engage** column lists the Explorify activities you could use to find out what your children already know about the learning focus. It will enable you to assess what vocabulary and knowledge they have retained from previous science units. You can use these at the beginning of a lesson, in a spare 15 minutes before the lesson, or sometimes they might be appropriate at the end of a lesson.

The **Possible activities** column guides you to Explorify activities that will support your main teaching. Here you will want to look at the **Background science**, if you need to double check your own understanding, and the **Take it further** section of the Explorify activity for the ideas you can incorporate into your lesson.

The final column guides you to Explorify activities that will support your children in **Deepening their learning** and building those long-term memories that will help them remember and build connections between scientific ideas and concepts. **Retrieval practice** is 'bringing the information to mind from memory' (Weinstein et al 2019 p85[1]). Cognitive psychology research suggests that every time we draw on a memory, we increase its strength and longevity. Children should have to put some effort into retrieving that memory, this helps strengthen it, but at the same time it needs to be low stakes as too much anxiety interferes with memory function. We think Explorify Odd One Out activities are ideal for this, when enhanced with some additional questions after the initial activity, because it gets the children talking, making connections, comparing/contrasting and justifying their choices.

You could use the **Deepening Learning** Explorify activities at: the beginning of the lesson after you have taught a new concept; later in the week in a spare 15 minutes; further into the unit or even after the unit. We would encourage you to experiment and see what works for your class. As teachers, we have all experienced teaching children something and then, when you mention it a few weeks later, the children look at you blankly and don't remember. It is hardly surprising that children do not remember if they do not regularly revisit the ideas. As teachers, we have all experienced CPD sessions where we have quickly forgotten a lot of the content.

[1] Weinstein, Y., Sumeracki, M. and Caviglioli, O. (2019) Understanding how we learn: A visual guide. Abingdon and New York: Routledge