KS3 Physics – Properties and Uses of Materials

In this module pupils will learn about a range of different materials and what they are used for. They will explore materials using their senses and learn how to describe the properties of different materials using scientific terminology. Pupils will learn about where natural materials come from; they will link common materials to their uses and they will begin to understand why different materials are suited for different purposes. Pupils will investigate the effects of squashing, stretching, tearing, bending, melting, scratching, heating and cooling on materials; as well as investigating which materials can absorb / resist water, retain heat and conduct electricity. As students develop their understanding of materials they will learn how to group materials based on similarities and differences.

Students will 'work scientifically' to achieve these goals, learning the key features of scientific enquiry; observing over time, pattern seeking, identifying, classifying, investigating (fair tests) and researching.

RRS Articles:
This unit of work is linked to Articles of the UN Convention on the Rights of the Child.
Article 13 (freedom of expression)
Article 24 (health and health services)
Article 29 (goals of education)

	OU Progression Steps 5-6	OU Progression Steps 7-8	OU NC Step 1	OU NC Step 2
Subject specific knowledge	Knows how to use some everyday materials e.g. that sponge can be squeezed, elastic can be stretched. Knows that objects can be sorted using properties e.g. colour, size and texture. Identifies a simple difference between objects e.g. texture. Can describe materials using the terms: hard, soft, smooth, rough, hot, cold and the same as.	Knows how to comment on outcome of activity using symbols, signs, or words, with support e.g. chooses melting symbol while watching chocolate melt, says or signs "wet" or "dry" after touching wet or dry cloth, sand etc. Identifies which property they will sort materials by before starting activity. Can identify a common property in a group of objects.	Understands that heating or cooling can change the properties of a material e.g. chocolate or jelly. Knows appropriate language to describe texture. Can identify what common objects are used for. Knows one use for common materials e.g. glass is used for windows. Knows that materials can have more than one use.	Knows some similarities and differences between materials. Recognises the common materials an object is made from. Can describe and test materials that are: magnetic, transparent, floats/sinks, light/heavy, hard/soft, rigid/malleable, water resistant/ absorbent. Understands reasons why materials are used for specific purpose.

	Can states the names of materials that they have examined.	Understands where familiar materials come from, e.g. wool, paper. Explains, using simple language, the differences between two materials. Can describe materials using the terms: shiny, dull, bendy, strong, transparent, magnetic, stretchy and different from. Tests materials to identify some of their properties, e.g. puts it in water to see if it floats. Before handling material, offers word to describe how they think it will feel. Identifies a range of objects made of plastic, metal, wood and paper. Knows what some obvious everyday objects are made of e.g. windows, book, spoon. Identifies some reasons why a specific material is used for a task, e.g. paper for a parcel.	Aware of what processes maybe used on different materials: squash, stretch, tear, bend, twist, cut, melt, scratch (when in view but not touched). Identifies objects made from different materials: wood, plastic, glass, metal, water, rock, fabrics and clay. Knows what a range of measuring equipment is used for. Understands what the the terms: transparent, opaque, absorbent and waterproof mean. Understands that some objects are natural and some are man-made.	Knows more than two uses for a variety of materials e.g. glass = windows, bottles & light bulbs. Independently identifies similarities and differences between materials. Knows that some materials float and some sink. Knows that some materials can be changed into other materials e.g. wood to paper. Describes one property that makes a material suitable (or unsuitable) for a job. Knows that some materials are better at keeping things hot than others. Knows that heat can travel through objects. Describes one change caused by hot/cold. Knows that metals let electricity pass through. Suggests materials which will not let electricity through.
Subject specific skills	Selects an object by single property, e.g. find me a hard material.	Groups objects from their environment with a similar property.	States why they think an object is made from a suggested material.	Groups materials according to more than one given property.

	Can identify the "odd one out" in a collection of different materials, if very obvious. Begins to show an awareness of treating things in the same way e.g. feels and explores all objects given. Takes part in experiments to investigate which materials float / sink. Suggests what different containers could be used for. Sorts objects by a given criteria when contrasts are obvious. Identifies simple differences between materials, e.g. states if a material is dry or wet Shows anticipation when elastic is being stretched e.g. pulls back in case elastic snaps. Actively participates when exploring materials e.g. tries to bend spaghetti. Groups objects based on a given property after engaging with concrete examples.	Suggests why containers are different shapes. Finds a range of objects made from a given material e.g. paper. Takes part in an experiment to try out other materials for a task e.g. a cup made from paper. Can investigate whether some materials change shape. Shows an awareness of treating things in the same way e.g. when testing materials says that they all need to be tested. Shows understanding of vocabulary by matching action to given words or symbols e.g. does bending action when requested to bend a pipe cleaner. Predicts, verbally or using symbols, what will happen to materials when heated e.g. chocolate, ice cream. Given choice of wet or dry sand to make a sandcastle, chooses wet sand.	Makes sensible predictions when working out the best type of material for a purpose. Helps to plan an experiment to find which materials are best, e.g. at making a parachute/keeping something warm. States a simple prediction. Observes how the materials act in experiments. Works well with others to follow experiments to conclusion. Uses variety of measuring equipment in experiments to find out about properties of materials. Is able to test whether a material is magnetic, transparent, hard or soft. Can describe materials using the terms: transparent, opaque, absorbent and waterproof. Suggests a type of material that could be used to make	Suggests alternative materials for an object to be made from. Suggests ways they could test their ideas. Plans a simple experiment to test the properties of materials. Says how they will attempt to make it a fair experiment. Lists equipment they will need for their experiment. Compares the findings between different materials. Checks results against predictions. Uses simple properties of appearance and texture to group materials independently. Tests materials for floating, sinking, magnetism and transparency to identify differences. Can sequence 3 stages in making objects e.g. sheep – wool – jumper. Groups materials into "will let" and "won't let" electricity through.

	Uses senses to engage with a variety of materials for squashiness, bendiness, twistability and stretchiness. Independently explores changes in materials when they are heated, cooled or made wet. Investigates what happens when water freezes. Selects pictures of things they think will melt. Is able to simply comment on and record their observations. Predicts a change in the property of a material.	Can record results simply on paper. Shows understanding of topic specific vocabulary e.g. with verbal prompt shows squashing action with playdough. Groups objects based on observed differences e.g. foods before and after heating. Selects a named material from a mixed group, not always correctly.	an object based on what they have found out. Draws a material and labels with examples of its properties. Can demonstrate how to change shape of a material e.g. screwing up a piece of paper. Records their results in tables drawn by the teacher. Initiates using a range of senses to explore materials. Is able to use a magnet to identify a difference in materials. Identify objects are natural and objects that are man-made.	
Personal development	**Problem solving** Investigations and matching exercises **Communication skills** Working as pairs in investigations, asking and answering questions **Self-belief** Learning new skills, practising them and demonstrating them. **Self-management** Working with new equipment **Teamwork** Working as groups to solve problems or find out new information			

Suggested activities	Exploring and differentiating: • Explore the squashiness of wide variety of materials, e.g. sponges, playdough, salt pastry, balloons, clay, pillows, scrunched up paper, drinks cans, soft fruit/veg, slime, foam balls, wet cloths, squeegee mops. • Explore which materials bend and which do not bend. Don't: biscuits, raw spaghetti, twigs, celery, stones, pencils, carrots. Do: paper, foil, straws, pipe cleaners, wire, playdough, slinkies, cooked spaghetti. • Explore twistability of materials, e.g. wet cloth, pastry, pasta, wire, paper, wool, hair, rubber band, blue-tack. • Explore stretchiness of materials e.g. elastic, balloons, springs, tyre inner tubes, some fabrics, play-dough, blue-tack, bandages, hair-ties, socks. • Sort soaps according to smell – could also try washing up liquids. • Put samples e.g. herbs, banana, apple etc into small pots with a muslin lid held in place by an elastic band, pupils match samples into the same and different. Materials and properties: • Pupils names simple properties of materials using a feely bag. • Sort everyday objects by identity e.g. spoons, candles, cars. • Group everyday objects by single property, e.g. hard, wet, shiny. • Regroup same objects by a different property, to explore similarities and differences. • Identify objects by 2 properties e.g. find a hard, shiny thing from group given. • Begin to name materials, as part of grouping activity e.g. metal, plastic, wood, paper, rock, glass. Go round school to identify examples. • Using catalogues to find objects made from plastic, metal, etc and make a collage. • Find materials outside in a scavenger hunt using given criteria, e.g. rough, wet, smooth… • Guessing games to work out the type of material using properties given. • Make a collection of different fabrics. When are they used/ worn? Why? • Look at everyday objects and relate property to use e.g. why are windows made of glass, not wood? • Play materials 'snap' – pupils select two objects that are the same in some way and explain their choice. • Have displays with particular themes e.g. made of plastic, fabric, stretchy things and so on. Using materials: • Observe and discuss objects that have same use but made from different materials e.g. cups, spoons, plates, packaging. • Questions like "why don't we have chocolate furniture? Wooden clothes? Stone tyres? Rubber bridges?" to promote discussion. • Why are balloons rubber, toys plastic, scissors metal etc? • Look at things used to wash up (cloths, scourers, brushes, sponges). Why are they used? • Compare different balls for different uses – rounders, golf, squash, table tennis etc. • Look at materials used on a bike. Discuss why they are used.

	Changing properties: • Heat a variety of materials and observe changes – spaghetti, chocolate, ice-cubes, jelly, water, wax, cheese, bread, butter,), popcorn, marshmallows. • Heat plastic disposable cup in microwave and observe changes (cup collapses, becomes a flat circle of hard plastic. Pierce while still warm to make hole for hanging, make mobiles or jewellery). • Cool prepared jelly mix in fridge until it sets. • Freeze water in ice-cube moulds, plastic gloves, plastic containers. Add objects to see what happens. • Make thick custard mix, using custard powder and observe thickening as it cools. • Add water to: sand, plaster of Paris, natural sponge, salt, sugar, loo-paper, powder paint, cornflour, flour (make dough) to look at a range of changes. • Use sequenced drawings to ask 'what was it like before? and before that? And before that?' • Sort according to 'materials that have been changed' and 'materials that haven't been changed'. • Ask questions like – "Do you think this has always looked like this?" "What should it have looked like before?" • Look at clothes – which things are made from natural materials and which from man-made. • Compare natural and man-made objects • Consider what we get from farm animals. • Compare two natural objects – list all the ways they differ and are the same. Possible investigations: • Investigated the difference between bread and toast using all of the senses. • Which shopping bag holds the most before breaking? What material is it made out of? • Which is the best material for absorbing water from the table? • Which material is best for writing on? • Explore floating and sinking – which materials float and which sink? Predict first. • Explore magnetic/non-magnetic objects. Can they find magnets in use in the home/classroom? • Examine what birds' nests are made from – which materials are better for holding the eggs? Keeping them warm?
Online resources Twinkl CLEAPPS for risk assessments BBC bitesize for video resources.	
Evidencing Work All work / evidence sheets need to be printed off, annotated by staff, self-assessed by pupils and stored in student folders.	