Chemistry Unit: Materials		
Topic	**Misconception**	**Comment**
Everyday materials Uses of everyday materials	Only fabrics are materials Only building materials are materials Only writing materials are materials	Material = the matter from which a thing is or can be made. Material is commonly synonymous with fabric/upholstery. Fabric/textile is an example of a material, but pupils need to be aware of other materials such as metal, plastic, wood, rubber, glass, rock etc.
	The word 'rock' describes an object not a material Brick is a material.	Rock is a material that is used to make objects. Pupils think that bricks are also materials as they make bigger objects as opposed to being made of rock which is the material.
	'Solid' is another word for hard	Hard is not synonymous with solid. There are solids that are soft e.g. sponge and jelly.
	An object cannot be made from more than one material.	Materials made of more than one material are called composites. When the materials are combined, they are stronger than the materials on their own.
	Dark objects cannot shine	Matt objects are dull and do not reflect as much light. Objects that are shiny are reflective, the colour of the object is not dependent on this. E.g. a 2p coin.
States of matter	Solids are hard and cannot break or change shape easily and are often in one piece	Pupils can think that when a solid is broken that the particle arrangement has changed rather than it being two parts with the same arrangement of particles.
	Substances made of very small particles like sugar or sand cannot be solids	Pupils think that because these substances can be poured that they are liquids when in fact each grain/crystal has a solid arrangement of particles but as a collective behave differently.
	Particles in liquids are further apart than in solids and they take up more space	This is a big misconception that filters into secondary science. The particles in a liquid are still all touching but can move around each other (like someone pushing through a dense crown)
	When air is pumped into balloons, they become lighter	The inflated balloon has a lower density as the mass is spread over a larger area.
	Water in different forms – steam, water, ice – are all different substances	Rather than the same particles just arranged in different ways.
	All liquids boil at the same temperature as water (100 degrees)	Different substances have different melting and boiling points due to the differing intermolecular forces between particles.
	Melting, as a change of state, is the same as dissolving	Melting is the change of state from a solid to a liquid whereas dissolving is where a soluble solid is incorporated evenly throughout a liquid (solvent).
	Steam is visible water vapour	Steam is visible due to the condensing water droplets can be seen.
Properties and changes of materials	Thermal insulators keep cold in or out	Thermal insulators reduce the rate of energy transfer (reducing how quickly it cools down).
	Thermal insulators warm things up	Thermal insulators reduce the rate of energy transfer (reducing how quickly it cools down).
	Solids dissolved in liquids have vanished and so you cannot get them back	Solutions occur when a soluble solid is evenly distributed throughout a solvent. If the solvent e.g. water, is removed the solid is left behind.
	Lit candles only melt, which is a reversible change	The candle is used up during the combustion reaction and is converted to water and carbon dioxide in an irreversible chemical reaction.
	Particles are inside matter	All matter is made up of particles - many students have the idea that if

The particle model	(if you zoomed in on an object the inside would look like particles).	they zoomed in enough on the inside of an object, they would see the particles.
	Particles in a liquid are spread out and not all touching.	Pupils think that because liquids can be poured and change shape that the particles are not touching.
	Particles in a liquid are drawn in the centre of its container.	Liquids fill to take the shape of their container so should be drawn from the bottom upwards.
	Particles in a solid do not move.	All particles have kinetic energy (unless at absolute zero -273°C)
	Gases cannot be poured.	Pupils think that because they cannot see gases that they cannot be poured. Especially since most gases are less/same density as air they tend to float and disperse in the air. A good demonstration for this is using dry ice (solid CO_2), as it sublimes the gas is denser that air and doesn't rise very far – it can also be pored so the pupils can visually see the gas moving into another container.
	Liquids can be compressed.	The particles in a liquid are too close together to compress. This misconception comes from the pupils understanding of squeezing a container and liquid escaping if it is not sealed.
	Sponge is a solid but can be compressed.	The air (gas) pockets in a sponge are what is being compressed. The solid itself cannot be compressed.
	Particle shape is limited to spheres/circles.	This is the most used model of particles and of the atoms. In reality, particles are complex and could be made of many atoms.
	Mass changes when a substance changes state.	During the change of state from liquid → gas, the gas spreads out and it lost to the surroundings which makes it appear to lose mass.
	The particles escape from the top of the liquid during boiling.	Evaporation occurs at the surface of a liquid when individual particles of enough energy to change state. Boiling is when a change of state occurs in the main body of the liquid cause a gas bubble which rises to the top of the liquid.
	Boiling and evaporation are interchangeable terms.	See above.
	All substances have an exact melting/boiling point.	Only pure substances have an exact melting and boiling point. Impure substances/mixtures melt and boiling
	Diffusion occurs in all states.	Pupils think that since all particles have kinetic energy, they can all move to spread out substances but this only occurs in liquids and gases as they have enough kinetic energy to move around.
Acids and alkalis	The metal salt produces from neutralisation can be converted back into an acid and an alkali.	This is a chemical reaction which is irreversible.
	Alkalis are safer than acids.	Both acids and alkalis can be dangerous depending on how concentrated they are.
	All acids are dangerous.	There are some acids which are not harmful e.g. citric acid (found in citrus fruits and tangfastics).
	A diluted strong acid is the same as a weak acid.	A strong acid is one where it fully dissociates in water (every molecule releases a H^+ ion) whereas a dilute acid has fewer acid molecules per unit volume.
Separating mixtures	When substances dissolve, they disappear.	See states of matter.
	All mixtures are separated using only one separating technique.	There are four main separation techniques to separate different types of mixtures. E.g. filtration separates an insoluble solid from a liquid, crystallisation separates a soluble solid from a liquid, distillation

		separates two or more liquids of different boiling points and chromatography separates a mixture of solutes.
	Evaporation and boiling are the same thing.	See particle model.
	Filtration can separate solutions.	The dissolved solid in a solution is too small to be separated with filter paper as it is evenly dispersed throughout the solvent.
	A solution is a single substance.	A solution is a mixture containing a solute and a solvent evenly distributed.
	Boiling points increase as a substance is heated.	The boiling point of a substance is fixed.
	The boiling/condensation point is different e.g., if it boils at 100°C, it must condense at 99°C.	The temperature that a substance changes state from liquid → gas is the same as the reverse change from gas → liquid (similarly with solid → liquid) it just depends on which way the temperature is changing on what state you end up with.
	Water flows through the condenser and not around it.	In a Liebig condenser the condensing tube is surrounded by another tube where the water flows around.
The Periodic Table	The periodic table was constructed using the atomic structure of the elements.	Scientists did not know the structure of the atom whilst the Periodic Table was being developed. They used observations of the physical and chemical properties of the elements to categorise them.
	The term salt refers only to table salt, NaCl.	A salt is the chemical term used for a compound formed when the hydrogen of an acid is replaced by a metal.
	Group 1 elements are the most reactive.	Group 1 are highly reactive, but group 7 are also very reactive – this misconception stems from the fact the group 7 are non-metals so less dangerous (fluorine is the most reactive element).
	The Periodic Table is in order of increasing atomic weight.	This was how it was developed but after the development of the model of the atom and the discovery of protons and how these link to the chemical properties of the element, we now order the elements by increasing atomic number (number of protons).
	Group 7 elements are less dangerous than group 1.	group 7 are also very reactive – this misconception stems from the fact the group 7 are non-metals so less dangerous (fluorine is the most reactive element).
	Group 7 are most reactive at the bottom of the group.	Group 7 get less reactive as you go down the group as the out electron shell gets further from the nucleus.
	All the elements on the Periodic Table are metals	The majority of elements are metals, some are classed as semi metals and the rest are non-metals.
Metals and non-metals	All metals are magnetic.	Only iron, nickel and cobalt are magnetic.
	All non-metals are gases.	Many are gases as they tend to have low boiling points but there are a number which are liquid, and some are solid.
	All non-metals are poor electrical conductors.	Carbon in the form of graphite can conduct electricity and is often used as electrode due to its low reactivity.
	Only metals are strong.	Carbon in the form of diamond and graphene has very high tensile strength.
	All metals are shiny.	Diamonds are shiny as are polished rocks.
Elements	Elements are always monatomic.	Many gases are diatomic (form molecule pairs) to achieve a full
	All gases are colourless	Group 7 gases are coloured.
Chemical reactions	All chemical reactions are irreversible	There are a number of chemical reactions where the products can react to form the reactants again.
	Endothermic reactions get colder because they lose energy.	Endothermic reactions get cooler because they absorb energy from the surroundings.

	Exothermic reactions get hotter because the gain energy	Exothermic reactions get cooler because they release energy to the surroundings.