Audit feedback: materials

Task 1

The activity produced these results.

✓ = Dissolves. ✗ = Does not dissolve

	Salt	Sugar	Sand	Sawdust
Oil	✗	✗	✗	✗
Water	✓	✓	✗	✗

Insoluble solids – **sand, sawdust**

Solutes – **salt, sugar**

Solvents – **water**

Solutions – **salt solution, sugar solution**

Commentary on Task 1

Insoluble means that it does not dissolve (in this case, sand and sawdust do not dissolve in water or oil). Salt and sugar are insoluble in oil, although soluble in water.

Solute is the material that dissolves in the liquid (in this case salt and sugar can dissolve).

Solvent is the liquid that does the dissolving (in this case only the water).

Solution is the mixture produced when material dissolves in a liquid (in this case salt solution and sugar solution).

Health & Safety In primary classrooms the most appropriate oil that should be used in contexts like these is cooking oil. Engine oils carry a health risk.

Materials (continued)

Task 2

Process		Description		Example	
Evaporation	A	Used to separate a liquid from an insoluble solid.	D	Water and alcohol	E
Sieving	B	Used to separate liquids of different boiling points that are mixed together.	E	Soil and water	D
Dissolving	C	Used to separate solid particles of different sizes through an appropriate mesh.	B	Sugar and water	A
Filtering	D	Used to separate liquid mixtures according to the distance they move across absorbent paper.	F	Sand and sugar	C
Distillation	E	Used to separate an insoluble solid from a soluble solid.	C	Yellow and blue inks	F
Chromatography	F	Used to separate a solid from the liquid in which it is dissolved.	A	Sand and stones	B

Commentary on Task 2

Task 2-a

The water evaporates, but the sugar does not; the sugar remains behind.

Task 2-b

Small grains of sand pass through the sieve, and pebbles are held by the mesh.

Task 2-c

Sugar dissolves in the water, but the sand does not dissolve and sinks to the bottom. (The sand could then be removed by filtering.)

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Materials (continued)

Task 2-d

The water passes through the filter paper but the soil does not dissolve and is held in the filter paper (it acts rather like a fine meshed sieve).

Task 2-e

On warming to about 80°C the alcohol boils and the vapour is collected; as water does not boil at this temperature its evaporation rate is much slower and it remains behind.

Task 2-f

The yellow and blue pigments move different distances across the paper and so yellow and blue appear as separate colours.

Materials (continued)

Task 3

1	Usually flows downwards and spreads out	L
2	Retains its shape	S
3	Capable of moving freely and unaided in all directions	G
4	Volume and shape are not fixed	G
5	Volume and shape are fixed	S
6	Volume is fixed but shape is variable	L
7	Can easily be compressed	G
8	Very light for its volume	G

Commentary on Task 3

1 When there is no container to constrain it, a liquid can flow downwards or spread out under the effect of gravity (although, when in a container, such as a pipe, a liquid can be made to flow in any direction). Gases that are heavier than air will also flow downwards.

2 Liquids and gases readily change their shape.

3 Gases can spread out in all directions to fill the space available.

4 Gases easily expand or contract, changing volume to fill their container.

5 Solids cannot be compressed. Even when the shape is changed the volume remains the same.

6 Although you can change the shape of a liquid it cannot be compressed into a smaller volume.

7 Only a gas can be easily compressed.

8 Gases have much lower densities than solids or liquids.

Materials (continued)

Task 4-a

The sugar does "go into" the tea, but children by the end of Key Stage 2 should use the correct terminology: "dissolves". The fact that the tea is hot helps.

Melting is the correct term for turning a solid into a liquid by heating.

Task 4-b

The main misunderstanding is in thinking that this is an example of melting. The mixing of the sugar into the tea is an example of dissolving. The sugar does not reach a high enough temperature to melt.

Task 4-c

Although the child has found out that sugar is composed of particles called molecules, the idea has not been understood. The child mistakenly attributes molecules with the bulk properties of the sugar. Molecules do not themselves melt; melting involves a rearrangement of the molecules.

Commentary on Task 4

Task 4-a

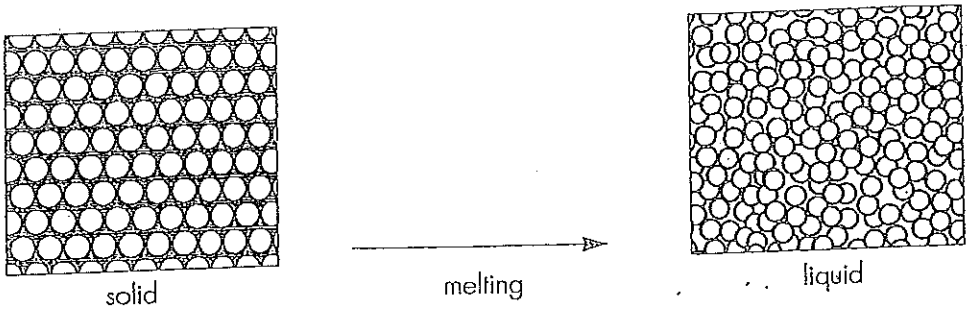
Although melting is the term that describes the change from a solid to a liquid, it is wrongly applied to sugar in tea. When sugar is added to tea it is dissolving that occurs. Dissolving involves the mixing of different substances; melting involves only one material.

Task 4-b

When the sugar dissolves, the molecules mix intimately with those of the water but it does not require the sugar to reach its melting point; it can take place in cool tea. Solid sugar must reach a temperature of 185°C in order to turn into liquid sugar, whereas the tea will only be at about 80°C.

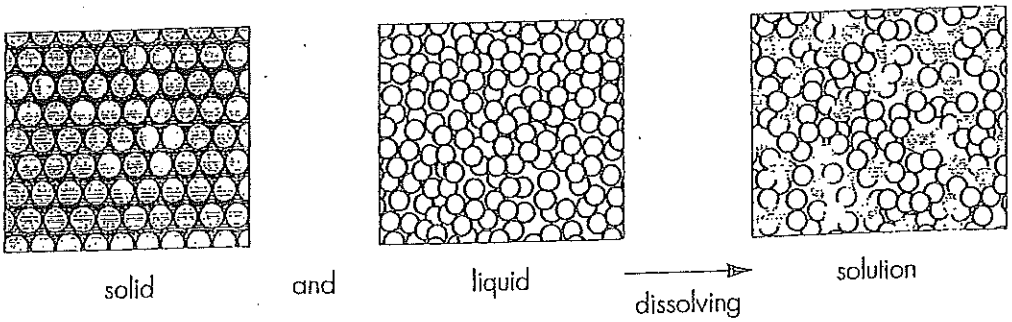
Task 4-c

When melting occurs the regular arrangement of molecules in the solid is lost and the molecules become mobile. One way of representing it is:



Materials (continued)

Dissolving is the intimate mixing of the sugar molecules with the water molecules in the cup of tea. One way of representing it is:



Materials (continued)

Task 5-a

Change	Chemical	Physical
A match burning.	✓	
A tooth decaying.	✓	
An ice cube melting.		✓
Glass breaking.		✓

Task 5-b

Which two of these statements about a barbecue describe physical changes?

Some of the food is cooked.	
A delicious smell is produced.	
The barbecue is resting on the patio.	
The charcoal burns away.	
The grill expands when it is hot.	✓
A lot of smoke is given off.	
The barbecue cools down again afterwards.	✓

Task 5-c

The key characteristic of a chemical change is that a new substance is formed. In a physical change, no new substance is formed; only the state or shape is changed. The other characteristic you may have identified is that chemical changes are usually much more difficult to reverse than physical changes. Physical changes can often be reversed by a simple temperature change, eg boiling (reversed by cooling down) or freezing (reversed by melting).

Materials (continued)

Commentary on Task 5

Task 5-a

Glass breaking and an ice cube melting are both physical changes. No new substance is formed, but the material has changed its shape (to smaller pieces of glass) or its state (ice turning from a solid to a liquid). Broken glass can be melted down and re-used. Again no new substance is formed; only its shape is changed.

A match igniting and a tooth decaying are chemical changes. These are more profound changes, in which new substances are produced.

The decaying tooth cannot be reversed into a new tooth. The smoke and ash produced by a burning match cannot be reversed back to a new match again.

Task 5-b

The metal grill expands when it is hot. As it cools down it returns to its original size; therefore, it is a physical change.

(The cooking of food, the production of a delicious smell, the charcoal burning away and the production of smoke are all examples of chemical changes; new substances are produced.)

Task 5-c

A chemical change is a more profound change to a material than a physical change. There is a significant change at the molecular level in which particles interact (sometimes breaking up into simpler materials, sometimes combining together to form more complex substances). In a physical change the molecules remain unchanged; hence, no new substance is formed. Many chemical changes can be reversed, but this is nearly always more difficult than reversing a physical change.