Experiment Title

Changing materials

The question to ask.

What materials dissolve in water? (Do liquids and solids dissolve in water?)

The things that might affect the experiment. (Possible variables)

1. The size, shape and material of the container.
2. The quantity of water that is used.
3. The types of materials that are used.
4. The quantity of materials that are used.
5. Whether the material is solid, liquid or gas.
6. The temperature of the water.
7. Whether or not you stir the water.
8. How long you stir the water.
9. Whether the materials dissolve or not.
10. The amount of material that is added to the water each time.
11. Whether the solid material is a powder or not.

What you could do.

This is what I am going to change: The types of material we are going to use.

This is what I am going to measure or observe: Whether the materials dissolve or not.

Try to dissolve several different common materials. Try these salt, sugar, bath crystals, baking powder, powder paints, PVA glue, spangles, bicarbonate of soda, instant coffee, orange juice, flour, sand, marbles, stones, lego, plastic cubes, tea leaves chalk and chalk dust.

Make sure that the water is at the same temperature each time you try to dissolve something.

How do you know if the material has dissolved? How are you going to decide?

Possible use of the computer

The relative rates of dissolving could be put onto a spreadsheet. I have used Excel here

		Time it takes for the materials to dissolve/sec		
Materials	**Does it dissolve?**	**First time**	**Second time**	**Third time**
Salt				
Sugar				
bath crystals				
baking powder				
powder paints				
PVA glue				
sweets				
bicarbonate of soda				
instant coffee				
orange juice				
flour				
corn flour				
sand				

Figure 1 Possible use of the computer spreadsheet for results.

Evidence of achievement.

The child that realises that mixing materials can cause them to change is working at level 3 of materials and their properties. The child that realises that the dissolved material has changed but is still there is working at level 3/4 of materials and their properties

What could go wrong.

If the water is too cold or the children have added too much of the solute they may have trouble in making it all dissolve. Tell the children to add small amounts at a time. It might be interesting to ask the children whether a powder of the insoluble materials might dissolve. Give them the example of a stick of blackboard chalk and chalk powder.

Why this happens.

Some of the various materials dissolve to make a solution. Solutions are a uniform mixture of two or more materials. The solvent is usually the material that is present in the largest quantity. The substance that is in the smallest quantity is called the solute. The solute can be a solid, liquid or a gas. Carbonated soft drinks are an example of a gas (carbon dioxide) dissolved in a liquid. Oxygen is dissolved in water and this is used by fish. The molecules of the solute are evenly distributed among the molecules of the solvent.
The solution looks uniform under a microscope and the solute cannot be separated by filtration.
Some liquids can dissolve in each other in any proportions but if salt is dissolved in water there is a limit to the amount that can dissolve. The solution that will not dissolve any more solute is called a saturated solution. The amount of a solute that will dissolve is dependent on the temperature and pressure. This is why carbonated soft drinks fizz when they are opened and the pressure is released. The gas in the drink comes out of solution because of the change in pressure. Most substances increase the amount that will dissolve as the temperature increases. There are substances that will increase in solubility as the temperature falls. When a solute is added to a solvent the solvents boiling point is raised and its freezing point is lowered.

Further investigations.

Can we classify materials according to whether they dissolve or not?

Experiment Title

Changing materials (dissolving)

The question to ask.

Can we remove a material that is dissolved in water by filtering it?

The things that might affect the experiment. (Possible variables)

1. The size, shape and material of the containers.
2. Whether the material is dissolved in the water or not.
3. The quantity of water that the material is dissolved in.
4. The temperature of the water.
5. The quantity of the materials that you use.
6. Whether or not you stir the water or not.
7. How long that you stir the water.
8. The amount of material that is added each time.
9. Whether the material is a powder or not.
10. Whether or not the material can be filtered out or not.
11. Whether the water goes clear after filtering or not.
12. The size of the holes in the filter paper.
13. Whether dissolved materials can be removed from water by filtering.

What you could do.

This is what I am going to change: Whether I use coffee beans, instant coffee or ground coffee.

This is what I am going to measure or observe: Whether I can filter out the coffee from the water.

Try to dissolve a similar weight of coffee beans, instant coffee, and ground coffee in like amounts of cold water. Which ones seem to have dissolved? Now filter all of the mixtures with the same kind of filter paper and see if you can separate out the coffee from the water. How can you tell if you are successful? How many time should you do this to make it fair?

Possible use of the computer

A spreadsheet could be used to see if there is any loss in weight from the materials added to the water. Remember to dry the coffee before you weigh it. You will have to weigh the filter paper too because you will not be able to remove all the coffee when you want to weigh it.

	Weight in grams		
	Before experiment	**After the experiment**	**Change in weight**
Coffee beans			
Instant coffee			
Ground coffee			

Figure 1 Possible use of the spreadsheet.

Evidence of achievement.

The children that realise that mixing materials can cause them to change is working towards level three of materials and their properties. The child that realises that insoluble solids can be separated from liquids by filtering is working towards level 3/4 of materials and their properties. The child that realises that some solids can dissolve in water to give solutions and that others do not is working towards level 3/4 of materials and their properties.

What could go wrong?

If the water is too cold or the children have added too much of the solute they may have trouble in making it all dissolve. Tell the children to add small amounts at a time. Make sure that the children dry their filter papers. To save time would it be possible to put the filter paper between two paper towels to dry? This may cause loss of some of the ground coffee but practicalities and time constraints may conspire to take this as an option.

Why this happens.

The materials are dissolved to make a solution. Solutions are a uniform mixture of two or more materials. The solvent is usually the material that is present in the largest quantity. The substance that is in the smallest quantity is called the solute. The solute can be a solid, liquid or a gas. Carbonated soft drinks are an example of a gas (carbon dioxide) dissolved in a liquid. The molecules of the solute are evenly distributed among the molecules of the solvent. The solution looks uniform under a microscope and the solute cannot be separated by filtration.

Some liquids can dissolve in each other in any proportions but if salt is dissolved in water there is a limit to the amount that can dissolve. The solution that will not dissolve any more solute is called a saturated solution. The amount of a solute that will dissolve is dependent on the temperature and pressure. This is why carbonated soft drinks fizz when they are opened and the pressure is released. The gas in the drink comes out of solution because of the change in pressure. Most substances increase the amount that will dissolve as the temperature increases. There are substances that will increase in solubility as the temperature falls. When a solute is added to a solvent the solvents boiling point is raised and its freezing point is lowered.

Further investigations.

See if the temperature of the water or the size of the grains of coffee have any effect on the way it dissolves. Remember to list all of your variables before you start the investigation.

Experiment Title

Changing materials (dissolving)

The question to ask.

Does the size of the grains alter the way that materials dissolve?

The things that might affect the experiment. (Possible variables)

1. The size, shape and material of the containers.
2. The size, type and shape of the sugar grains.
3. The quantity of water that is used.
4. The temperature of the water that is used.
5. The quantity of the sugars that are used.
6. Whether or not you stir the water or not.
7. How long that you stir the water.
8. The amount of sugar that you add.
9. The size of the grains of the sugars.
10. The time they take to dissolve.

What you could do.

This is what I am going to change: The size of the sugar grains.

This is what I am going to measure or observe: How long they take to dissolve.

Get several types of sugar like granulated, caster, coffee sugar crystals, demarara, icing etc. and add a measured weight of each to a separate measured quantity of water at a similar temperature. Stir each for a measured number of times and observe the time that each of the sugars takes to dissolve. Does the grain size have any effect on the rate that the sugar dissolves?

Possible use of the computer

The time taken for each of the types of sugar could be put onto a spreadsheet and then a graph of the results could be obtained.

	Dissolving time in seconds			
Types of sugar used	**First time**	**Second time**	**Third time**	**Average time**
Granulated sugar				
Caster sugar				
Coffee crystal sugar				
Icing sugar				
Demarara sugar				
Preserving sugar				

Figure 1 Possible use of a spreadsheet to record results and obtain a graph.

Evidence of achievement.

The children that realise that mixing materials can cause them to change are working towards level 4 of materials and their properties. The children that can recognise that the size of the grain will affect the rate of dissolving is working towards level 5 of materials and their properties.

What could go wrong.

There are sugars that contain additives and these will alter the dissolving rate of some of them. This needs to be brought to the children's attention so that strange results can be explained.

Why this happens.

The smaller the grain the larger the surface area to volume ratio. The larger the surface area of the sugar the quicker it will dissolve. The larger the relative surface area to volume ratio the more molecules of sugar that are in contact with the water and can be released into the water.

Further investigations.

Try this with different types of salt. You could use preserving salt and table salt.

Experiment Title

Separating mixtures of materials (dissolving)

The question to ask.

Does the temperature of the water change how much salt can dissolve in water?

The things that might affect the experiment. (Possible variables)

1. The size, shape and material of the containers.
2. The amount of salt that is used.
3. The amount of water that is used.
4. The rate at which the salt is added.
5. Whether the water is stirred.
6. The time that the water is stirred.
7. The temperature of the water.
8. The weight of the salt that has been dissolved in the water.

What you could do.

This is what I am going to change: The temperature of the water.

This is what I am going to measure or observe: The weight of salt that will dissolve in the water.

Get equal volumes of hot and cold water. Measure out equal amounts of salt and add them to the water and stir until the salt dissolves. Continue to add measured weights of salt to the water until no more will dissolve. Find the weight of two filter papers. Filter out the remaining salt. Dry the filter papers and weigh them. Take the weight of the filter papers away from the total weight to find the weight of the salt left. Take this amount from the weight of the salt added to the water to see how much salt dissolved.

Possible use of the computer.

The difference in weights could be calculated on a spreadsheet. Formula can be put into the spreadsheet to automatically do the calculations.

	Weight in grams				
Temperature of the water	**Amount of salt added**	**Weight of the filter paper**	**Weight of the filter paper and salt**	**Weight of salt**	**Weight of salt that has dissolved**
Cold					
Hot					

Figure 1 Possible use of a spreadsheet to get the results of the dissolving experiment.

Evidence of achievement.

The child that realises that there is a limit to the mass of solid that can dissolve in a given amount of water and that this limit is different for different solids is working towards level 4 of materials and their properties.

What could go wrong.

There should be quite a difference in the temperatures of the water so that the resolution is quite large. With a smaller difference in temperature the resolution will be smaller and the difference that the children will be able to see will be that much smaller.

Why this happens.

The materials are dissolved to make a solution. Solutions are a uniform mixture of two or more materials. The solvent is usually the material that is present in the largest quantity. The substance that is in the smallest quantity is called the solute. The solute can be a solid, liquid or a gas. Carbonated soft drinks are an example of a gas (carbon dioxide) dissolved in a liquid. The molecules of the solute are evenly distributed among the molecules of the solvent. The solution looks uniform under a microscope and the solute cannot be separated by filtration.

Some liquids can dissolve in each other in any proportions but if salt is dissolved in water there is a limit to the amount that can dissolve. The solution that will not dissolve any more solute is called a saturated solution. The amount of a solute that will dissolve is dependent on the temperature and pressure. This is why carbonated soft drinks fizz when they are opened and the pressure is released. The gas in the drink comes out of solution because of the change in pressure. Most substances increase the amount that will dissolve as the temperature increases. There are substances that will increase in solubility as the temperature falls. When a solute is added to a solvent the solvents boiling point is raised and its freezing point is lowered.

Further investigations.

Are there any other ways in which you can speed up dissolving? Can you speed up dissolving by stirring?