Chocolate Crackles and Sherbet

Teachers' Notes

By Hilary Byrne

Aim

Who can resist chocolate crackles and sherbet? Use these yummy recipes to investigate physical and chemical changes using everyday ingredients found in most kitchens.

In the first experiment (chocolate crackles), students get hands on experience of a physical change, melting. In part two (sherbet), adding liquid to a mix of dry powders gives us a chemical change which shows itself through the release of gas bubbles.

Warning: make sure that your class observe health precautions- look out for allergies and clean equipment and hands. Make sure each student has an individual packet of sherbet to avoid 'double dipping'. Clip lock bags are useful for storage and transport.

Part 1 – Chocolate crackles

Question

Discover what happens to the properties of materials when they are heated and cooled.

Plan

The experiment plan is given in the student notes.

The chocolate crackles experiment requires a heating apparatus for melting the copha, with a saucepan suggested in the student notes. A microwave could be used instead, but the melting process is not so easily visible.
If equipment is an issue, this part could be done as a demonstration. The quantities given will fill 15-20 patty cases.

Conduct

The student notes provided offer a prescriptive recipe for the students to follow.

Analysis

The analysis is qualitative rather than quantitative, consisting of commenting on observations made during the chocolate-crackle-making process.

Discussion

Physical changes are changes to the physical properties of an object, for example size or shape. In this case we are looking at melting, a change of state from solid to liquid. Physical changes can usually be reversed (at least in theory - although it may be difficult to restore a tin can to its original shape once you have trodden on it).

Physical change – melting
Melting is a "change of state" from solid to liquid. It is usually caused by heating. When a solid is heated, its temperature will rise until it reaches the melting temperature. At this point, extra heating loosens the rigid bonds between particles in the solid and it becomes a liquid.

<Further discussion>

Physical change – colour change

Something else your students may observe is that, in the final product, all the ingredients appear to be brown. Is this a physical or chemical change? It is not a chemical change as none of the ingredients has fundamentally changed – it is a physical change:

The cocoa disperses through the melted copha to give it a brown colour. It does not dissolve as the cocoa molecules do not form links to the water molecules. In theory, if you had a fine enough filter, you could filter out the cocoa particles – this is a reversible change.

The rice bubbles and coconut change colour because they are coated in the chocolate/copha/sugar mixture. This is a purely physical change, like painting something. Again, it is theoretically reversible.

What happens to the icing sugar? In a liquid like copha it does not dissolve in the same way it would in water … this is beyond the scope of years 7-10.

Conclusion

Given in the student notes.

You can extend this with any other conclusions from the discussion.

Part 2 – Sherbet

Question

Discover what happens to the properties of materials when they are mixed.

Plan / Conduct

The student notes provided offer a prescriptive recipe for the students to follow.

As noted, small variations in the measured quantities can change the taste and behaviour of the sherbet, so reasonably accurate measuring is required.

Analysis

The analysis is qualitative rather than quantitative, consisting of commenting on observations made during the sherbet-making and tasting.

<Extension>

Some further questions you could ask an advanced group:

- What was the purpose of this activity?
- What did you create?
- How could you test sherbet - what would you look for?

Discussion

When the dry ingredients are mixed, no chemical change takes place.

In a chemical change or reaction, the atoms and molecules are structurally changed from what they initially were. Chemical changes are usually difficult to reverse.

We can spot chemical changes through colour changes, solid precipitates, or gas bubbles.

Chemical change – formation of bubbles

The fizzing we see when we add liquid to the sherbet is actually lots of bubbles of gas (effervescence) and is a sign of a chemical change occurring. Students should be able to see bubbles when adding either water or vinegar to the sherbet, and feel the bubbles on their tongue.

This is an acid-base reaction. The acid is citric acid, and the base is bicarbonate of soda (aka Sodium Bicarbonate). When the dry powders are mixed, nothing much happens (the reaction is actually happening, but very, very slowly). Dissolving the substances in water lets the reaction happen much faster.

The acid and base neutralise each other, and carbon dioxide gas is formed making the bubbles.

<Investigate further>
Use universal indicator paper to find out which substance is an acid and which a base, and to check whether they neutralise each other when mixed.

<Further discussion>
Physical change – dissolving
The icing sugar dissolves in the liquid. This is a physical change, as the sugar is not chemically changed into something else.
The jelly crystals will also dissolve in water.

Physical change – colour change
Some students may note that the sherbert is coloured. This is because of the coloured jelly mixed in with it, not because we have changed the ingredients themselves.

Conclusion
Given in the student notes.
You can extend this with any other conclusions from the discussion.