What's in Stuff

QUT Extreme Science

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Glossary

Acid	Something that has a sour taste, and is corrosive, with a pH below 7
Base	The opposite of an acid, with a bitter taste, and a pH above 7
Chemical	A compound which has a specific molecular composition, produced by or used in a chemical process (e.g. water H_2O)
Chemical change	A usually irreversible chemical reaction where the atoms of the substances are rearranged, and the chemical properties of the substances change, resulting in the formation of at least one new substance
Neutral	A substance that is neither an acid nor a base
Physical change	A usually reversible change to the physical properties of a substance, such as size or shape (e.g. ice melting into water, dissolving salt in water)

Definitions adapted from www.dictionary.com

Objectives

- Learn to predict the result of an experiment based on prior knowledge
- Learn to carry out a 'fair test' and what makes a test fair (reinforced through 'Fair Test' add-on)
- Learn to identify the difference between a physical change and a chemical change
- Learn to explain why a result came about
- Learn to compare your results with your predictions
- Learn to describe and share observations in small groups and as a class

Equipment list

Activity 1: Glue with Moo

- Cups
- Spoons
- Bottles labelled 'waste'
- Bottles labelled 'vinegar'
- Bottles labelled 'water'
- Containers labelled 'bicarb'
- Funnels
- Milk powder
- Vinegar
- Sodium bicarbonate (bicarb soda)
- Chux cloths

Activity 2: What Makes Sherbet Fizz?

- Testing trays
- 4 containers of icing sugar
- 4 containers of jelly crystals
- 4 containers of sodium bicarbonate and
- 4 containers of citric acid
- 4 dropper bottles labelled 'water'
- Paddlepop sticks

Safety notes for students

- Students should not eat any of the items they are conducting experiments with (this will be reinforced by the presenter)

Safety notes for QUT ambassadors

- Instruct the students that they are not to eat any of the testing materials
- Make sure that spills are cleaned up to prevent any slips or falls
- Make sure any power cords used are kept out of the way of the students

Background

It is important to understand the difference between chemical and physical changes. The two types are based on studying chemical reactions and states of matter. Some changes are obvious, but there are some basic ideas you can use. Physical changes are about energy and states of matter. Chemical changes happen on a molecular level.

The starting and ending materials of a physical change are the same, even though they may look different. When you step on a can and crush it, you have forced a physical change. The shape of the object has changed. It wasn't a change in the state of matter, but something changed. When you melt an ice cube you have also forced a physical change (adding energy). That example caused a change in the state of matter. You can cause physical changes with forces like motion, temperature, and pressure.

Chemical changes happen on a much smaller scale. There may be clues that a chemical reaction took place, such as light, heat, color change, gas production, odor, or sound. While some experiments show obvious chemical changes such as a colour change, most chemical changes happen between molecules and are unseen. When iron (Fe) rusts you can see it happen over a long period of time. The actual molecules have changed their structure (the iron oxidized). Melting a sugar cube is a physical change because the substance is still sugar. However, burning a sugar cube is a chemical change as the energy of the fire has broken down the chemical bonds[1].

[1] http://www.chem4kids.com/files/matter_chemphys.html

http://chemistry.about.com/od/lecturenotesl3/a/chemphyschanges.htm

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Workshop activities

Activity 1: Glue with Moo

The students make casein glue from milk. The milk is curdled with vinegar, then after removing the liquid using a chux cloth, bicarb soda is added. Steps are shown below:

1. Add 2 teaspoons of vinegar to the cup of milk and stir
2. Put the funnel into the bottle marked 'waste'
3. Lay a chux cloth over the funnel and push down to make a well
4. Pour the milk and vinegar into the funnel containing the chux cloth
5. Remove the chux cloth and gently squeeze the cloth to get rid of as much liquid as possible
6. Scrape up the curds from the chux cloth and put them back into the cup
7. Add ¼ teaspoon of bicarb soda to the curds and mix
8. Add water if needed (it should be like clag glue)
9. Test the glue on the corner of your worksheet

Activity 2: What Makes Sherbet Fizz?

In this activity, the students test the ingredients of sherbet to see which ones cause the fizzing. To do this, they are given a diagram of the experiment layout (see below) showing them how to set up the experiment. After laying out the ingredients into the testing tray, they add water to watch for a reaction. The ingredients are also tested on their own as a 'control' (i.e. we know they that should not fizz – so we can make sure our test is working).

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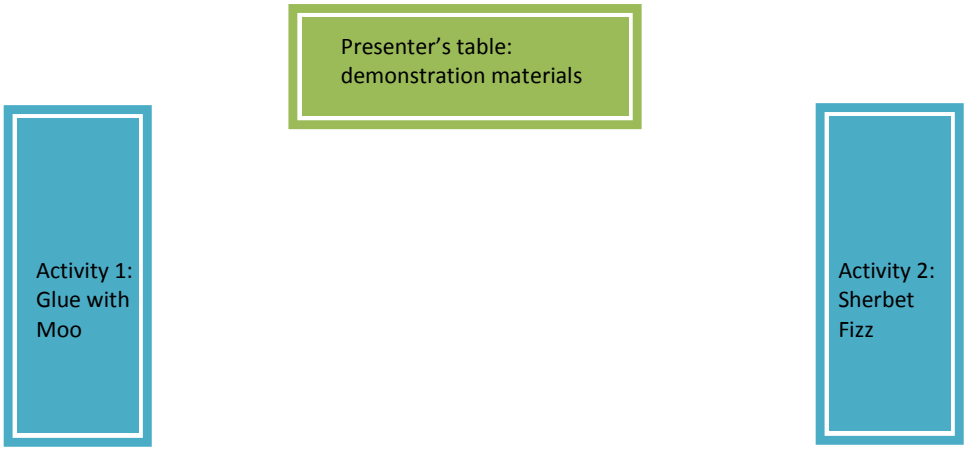
Rundown of the workshop

Time	Activities
0-15	Introduction and demonstrations
15-20	Explain activities, split class in half for activities
20-30	Activity round 1
30-40	Activity round 2
40-50	Discuss results

Two large tables are required for the two activities, as there will be a large number of students (10-15) at each activity. However, they need to be on the same table so that the presenter can guide them through the activities. A third table will be required for the demonstrations at the beginning of the workshop. A good example is shown in the diagram below. Photos of the set up are also shown.



Glue with moo

Sherbet fizz

Sherbet is made during the workshop for the student to take home. Check with the teacher at the beginning of the class to see if there are any students who cannot have sherbet. Sherbet can be made by the teachers during the activities, or at the end using student volunteers to help (with students' help, it takes about 5 minutes).

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Script

The introduction takes around 15 minutes. Dialogue is in italics.

Check with the teacher prior to the workshop to see if the children can eat the sherbet. If the class has been well prepared the children will do most of the talking and you will just need to guide them with your questioning. All of the italicised text below is your dialogue, but hopefully the children will come up with most of the answers.

Today's Extreme science workshop is all about chemistry.Who can give me some examples of chemicals? If they can't think of many examples, tell them to think about things in their laundry and kitchen cupboards.

Are chemicals good or bad? Try and get kids to see that chemicals are all around us and may be good or bad depending on the context, i.e. the vitamins in our food are chemicals and they are very important for our health, but pesticides or herbicides on our foods can be harmful.

Clean your hands with anti-bacterial gel. Start the Fairy Floss machine with the sugar in it so that it has time to melt the sugar.

We will also be investigating the difference between a physical change and a chemical change.

Who thinks they can explain what a physical change is? A physical change is when you change the appearance of something without creating something totally new- examples are ice melting into water, although you have changed the state of the substance you have not created anything new. Squashing a loaf of bread is another example of a physical change.

Who can explain what a chemical change is? A chemical change occurs when you combine two or more chemicals and these chemicals combine to create a new chemical. Generally we see "evidence" that a chemical change has occurred. This evidence is often bubbles which we can see or heat which we can feel. Most chemical reactions are difficult to reverse or undo.

There are lots of processes in life where we have both physical and chemical changes happening at the same time! Sometimes we might even have several physical changes and several chemical changes happening at once.

Demonstrations:

pH test – cabbage water (if you are short on time skip this part but it's good to show the students)

A property that chemicals have is called 'pH' – has anyone heard this term before? If no one replies yes, then ask the class who has a pool or a fish tank. *So have you ever seen your parents do a test on the water to make sure it's ok to swim in? This is a pH test. It measures whether something is an acid, a base (otherwise known as alkali) or neutral. Have you heard of those words before?*

A base is the opposite of an acid. The pH scale goes from 1 to 14. 7 is neutral. Anything below 7 is an acid – the further away from 7 (so the lower the number) then the more acidic the substance is. For example, strong hydrochloric acid can be pH 1, vinegar is usually around pH 4. Anything above 7 on the pH scale is a base – again the further away you go from 7, the more basic it is. So something like caustic soda has a very high pH of 14, whilst ammonia that you use for cleaning has a pH of about 11. To test what the pH of a liquid or substance is, we use something called a 'pH indicator'. Today we are going to use purple cabbage water. I made this at home – just chop up some purple (or red) cabbage, put it in a jar, and pour hot water over it – the colour of the cabbage comes out into the water and looks like this! (Show the indicator to the class.) *When it is added to an acid, it turns pink. When it is added to a base, it turns blue-green. What do you think will happen if you add it to a*

neutral liquid? That's right, it stays the same colour. This test can't tell us exactly what the pH is, but it tells us if the liquid we are testing is acidic, basic or neutral. Demonstrate the test in a testing tray with water, vinegar and bicarb soda (mixed into water).

Physical change – Fairy floss

Who knows what this is? Yep it is a fairy floss maker. Who can tell me how you make fairy floss? Wait for responses from students. *Firstl,y normal white sugar with a bit of colouring is added to the machine. Then the machine heats the sugar until it melts. This changes the sugar from a solid to a liquid. The liquid sugar is whizzing around inside the spinning head of the machine. There are tiny holes inside the spinning head and the liquid sugar is thrown out of these holes. When the liquid sugar hits the air it cools and turns back to a solid. The sugar has been changed from little crystals to long strands of cobweb but it is still sugar. We haven't made anything new so this is an example of a physical change. What do you feel on your tongue when you eat fairy floss? You can feel the sugar crystals that we first started with. They feel gritty on your tongue.* Give the fairy floss to the teacher.

Chemical change – glow stick

Who knows what this is? Hold up glow stick. *Okay now who can tell me how a glow stick works? Inside the glowstick are 2 chemicals kept separate by a plastic barrier. When you crack the glowstick you break the barrier and allow the 2 chemicals to mix. These 2 chemicals get together and make a new chemical. What is the evidence that a chemical change has occurred? Yep that's right! It glows.*

Today we are going to do 2 activities which I will explain after I hand these worksheets around. Could you please put your name on the top near the QUT logo. Once everyone has a sheet briefly explain how to do each of the activities. If you have noticed recurring problems with student understanding of the activity/ies, you may choose to make reference of that in this section. Tell the students to keep the sheets away from the tables during the activities or they get very sticky.

The first activity *is making glue from milk. Read the instructions and follow them carefully – otherwise your glue might not work! We will test the glue after you've made it by putting a small drop on the corner of your worksheet, and folding it over. When it dries it should be stuck!*

The second activity *is testing sherbet to see what makes it fizz. Sherbet is made from 4 ingredients, but only 2 of these cause the fizzing. You need to find which 2 they are. You'll be using a testing tray that looks like this* (show them a tray). *There is a diagram on your table of the different combinations of ingredients for you to test – follow it so that you know which test is which in your testing tray. Once you measure out all the ingredients into your testing trays, you will add some water and look for fizzing. We will also be testing the 4 ingredients separately – this is known as a control test.* (You can explain this if you think that the students will understand –this depends on the age group).

Important notes: *Although all the ingredients you will be using are edible, our ingredients are not clean so there is to be absolutely no tasting! Also, it is also really important that you clean up your area before you move on. Now I'll ask your teacher to organise your class into groups of……*

There are 8 set ups and pairs are optimal. Do a quick calculation to figure out if you need any groups of 3 and then get everyone else paired up. Check with the teacher to make sure they are happy for the kids to choose their own groups.

On completion of the activities get the children together for a wrap-up.

Okay, what happened when you added the vinegar to the milk? Yep, it went lumpy. Do you think this is an example of a chemical or a physical change? It is both a physical and a chemical change! We didn't make anything new, but we can't reverse the change either. Milk always has tiny lumps in it and adding the vinegar made all the tiny lumps stick together in a big lump. The lumpy bits are called curds and the yellow liquid stuff is called ***whey*** *just like in little Miss Muffet.*

The glue that you made is real glue, called ***casein glue****. The lumpy stuff can also be shaped and dried and used as a plastic. This is what plastic buttons were originally made from.*

Next, sherbet fizz: Which ingredients gave sherbet its fizz? Citric acid and bicarb soda. Is this a physical or chemical change? It's a chemical change as we have made something new. What evidence do we have that we made something new? We saw bubbles which are caused because when we mix bicarb and citric acid they combine to produce carbon dioxide gas which causes the fizzing that we see.

This completes the workshop. Thank the children for coming and make sure they have all their belongings including their workshop, their glue experiment and sherbet bags (if applicable).

Worksheet

On the following page is the worksheet used in the activity.

Acknowledgements

This document was compiled by Phillipa Perrott and Maria Barrett.

QUT Extreme Science

Sherbet Fizz

What ingredients cause the fizz in sherbet? _____

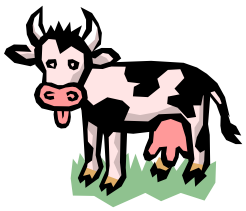
Is this a chemical or physical change? How do you know? _____

_____

_____

It is not all 4 ingredients that make the sherbet fizz. Why then do you think the other ingredients are used to make sherbet?_____

_____



Glue With Moo

What happened when you added the vinegar to the milk? _____

_____

Do you think this is a physical or a chemical change? Why? _____

_____

Test glue here

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