Chemical versus Physical Change

Overall Objective: By the end of the session pupils should understand the difference between a physical and chemical change and have a basic understanding of the states of matter.

Achievement Objective: Material world

Level 1 and 2

Properties and changes of matter: Observe, describe, and compare physical and chemical properties of common materials and changes that occur when materials are mixed, heated, or cooled.

Chemistry and society: Find out about the uses of common materials and relate these to their observed properties.

Level 3

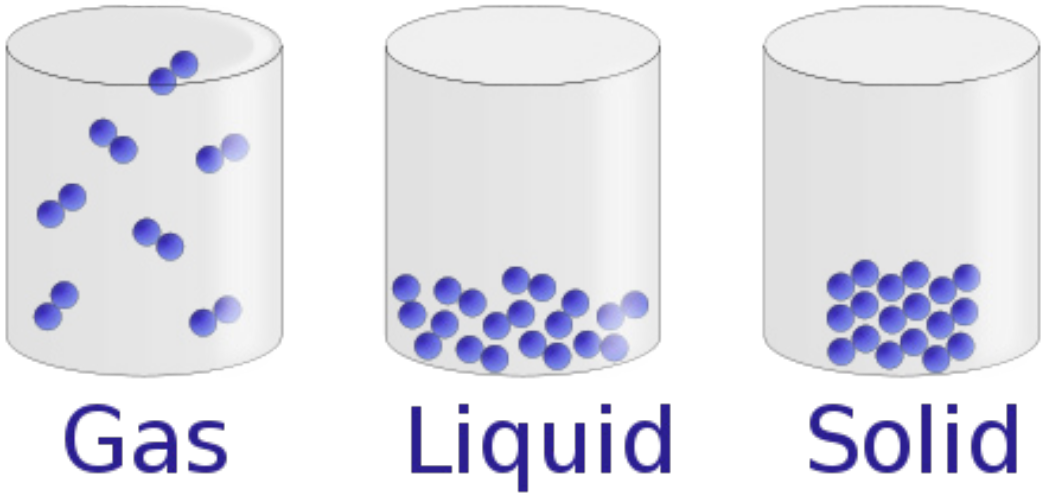
Properties and changes of matter: Group materials in different ways, based on the observations and measurements of the characteristic chemical and physical properties of a range of different materials. Compare chemical and physical changes.

Chemistry and society: Relate the observed, characteristic chemical and physical properties of a range of different materials to technological uses and natural processes.

Pre-knowledge activities

In this topic we will be looking at the difference between physical and chemical changes. Physical and chemical changes are all about particles (Molecules for older children). The best way for you to understand the difference between physical and chemical change is to understand how these particles act.

Take a look at what the particles look like in the gas, liquid and solid state. They are the same particles but they have been rearranged.



The children can act this out as role play to get a better understanding. You can use a small inflatable paddling pool or mask out a square on the floor. Gather a group of children and ask them to bunch together really tightly and not move, explain this is how particles in solids act. Now ask the same group to hold hands but move about in the space, this is how liquid particles act. Finally ask them to all move around freely in the space without holding hands, this is how gas particles act. Solids have a definite shape, liquids take on the shape of the container.

Online learning see 3 States of Matter - Solid, Liquid, Gases
Animation Lesson go to: https://www.youtube.com/watch?v=PjZSMu2SXt4

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What is the difference between a physical and chemical change?

A physical change is a change in which no new particles are formed; a chemical change normally results in the formation of one or more new particles/substances. A physical change is reversible, a chemical change is not normally reversible (there are exception).

Understanding physical change If we had an ice-cube and were melting it with a rise in temperature is this a chemical or physical change? Are the particles the same or have we created new particles? Think back to the pre-knowldege activity involving the particles in the state of matter activity solid, liquid gas. Give each group an ice-cube. How can you add change to this? ie put in the Sun, rub in our hands. (See activity outline and recording sheet below)

Information : *When you melt an ice cube, you have forced a physical change by adding energy in the form of heating/warming. If we freeze it we can return it back to ice. It retains all the same properties it had when it was previously a solid. Finally if we heat up the liquid even more the particles can move around freely as they become steam. They are the same particles but we have changed the way the move /act, so the particles of the substance are rearranged.*

Other physical change activities.
Place a lump of butter on warm toast or in the Sun. The butter will slowly melt changing it from a solid to a liquid. No new substance has been created but the particles have been rearranged, so this is an example of physical change.

Introduction demonstration (or get the children in small groups) using a toaster with bread

If I heat bread and make toast, is this a physical or chemical change?

The heat has caused a chemical change in the bread, we cannot restore the bread to the way it was before it was toasted. The particles of the substance are broken apart, have joined together to form new particles.

Other chemical change activities:
Half fill a plastic bottle with vinegar, add a tablespoon of baking soda into a balloon. Pull the open end of the balloon over the lip of the bottle, so it is sealed and no air can escape. Tip the balloon up to release the baking soda into the vinegar. Watch as the balloon inflates. Discuss: Is this a physical or chemical change? Has a new particle been created? Yes, a gas (carbon dioxide) has been created by combining the two substances. This is a chemical change.

Chemical changes can create either a change in colour or an odour or a gas or a formation of a new substance eg. a solid.

For online learning games go to:
http://www.bbc.co.uk/schools/scienceclips/ages/10_11/rev_irrev_changes.shtml.

Some references for educators:

http://chemwiki.ucdavis.edu/Analytical_Chemistry/Qualitative_Analysis/Chemical_Change_vs._Physical_Change

http://www.learner.org/courses/essential/physicalsci/session4/closer1.html

Activities

What you need: Ice, plastic plate, kettle or saucepan, freezer, oven.
In groups give out an ice-cube on a plastic plate. Let the children decide how they are going to change it. They need to raise the temperature to get it to melt. When it becomes a liquid ask them if this is a physical or chemical change? Are the particles in the water the same particles as in the ice or have they created new particles? (The particles are the same they have just rearranged themselves). Now ask how the liquid can be changed again ie to a solid or gas. The children may want to change it back to an ice-cube or decide to heat it up in the microwave or on the hob (**Adult supervision will be required for all heating of liquids).** Encourage the children to try different ways to change the liquid ie freeze it, heat it up and boil it. Ask the children to record their activities on the sheet attached. Gather the group together at the end and discuss whether the action they carried out caused a physical or chemical change. Did the action result in new particles? No, it was a physical change, the particles were always the same but for each process that was carried out, the particles became rearranged.

What you need: apples, scissors, peeler, knife, graters, potato masher, saucepan or microwavable dish.

In groups give out a couple of apples and let the children select their resources to change the apple. The children are challenged to change the appearance of the apples and record these down ie chopping, peeling, slicing, grating, heating. Afterwards, have each group share a few of their examples with the whole class. Was a new chemical made? Did the process create new particles or have they just be rearranged or stayed the same. Then challenge the groups to think of how apples can go through chemical changes.
Follow up with looking at a sliced piece of apple with it's skin on, that has been left out on the table. Ask the children to record down what has happened and why they think this has happened (use the attached recording sheet). Then open up a discussion on why the apple has gone brown. Why do they think it has changed colour? Has it all gone brown? Even the skin? Is this a physical or chemical change? What about if you eat the apple? Eating an apple is both chemical and physical. By biting and chewing the apple you are causing a physical change in the apples general structure. But as the enzymes break it down and you swallow the apple and stomach acid breaks it down even more, you are creating a chemical change.

Explanation

Apples turn brown when exposed to air because of an oxidation process that goes on when the inside of the apple gets exposed to the air (which contains oxygen and water molecules). The skin on the apple would normally protect it form this process. The browning when the apples was cut happened because this action damage the cells in the fruit, allowing oxygen in the air to react with the enzyme and other chemicals in the apple.

Extension

How quickly does the apple slice turn brown in room temperature? Record the time. Would the time be the same if you place the apple slice in the refrigerator?
(The process is greatly slowed down and it may take several days before it turns brown).
How long will it take if you place it in the hot oven?
(Much faster than if you left it exposed to air at room temperature.)

Further work

What would happen if you left the apple out for a few weeks? Would this be a physical of chemical change? How will the apple change? What will it look like?
What would happen if we put a slice of apple in different substances? Would this speed up or slow down the oxidisation process or chemical change? Try putting a slice of apple in a cup of oil, vinegar, water and record time/ test the results.

Chemical Versus Physical Change

What is the difference between a physical and chemical change?
A physical change is a change in which no new substance is formed, the particles are the same but have been rearranged. A chemical change results in the formation of one or more new particles.

In your group find as many ways as possible to change the ice.

How did your group change the ice?	Was it a chemical change? (tick or cross)	Was it a physical change? (tick or cross)

In your group find as many ways as possible to change the apple.

How did your group change the apple?	Was it a chemical change? (tick or cross)	Was it a physical change? (tick or cross)
eg : We cut it		
Left out on the table		
Put in a hot oven *(Adult supervision)*		
Put in the fridge		

Time and record how long the process of oxidisation took. *(The apple turning brown)*

The apple left on the table.....

The apple put in a hot oven.....

The apple put in the fridge.....

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Do you know the difference?

Now that you have completed some experiments and tests you can see if you can tell the difference between a chemical or physical change.

Look at the process and picture on the left. Is is it a physical or chemical change, or both? Complete the chart below by ticking under the correct box.

Process	Chemical Change	Physical Change
Burning wood 		
Crushing a can 		
Mouldy bread 		
Melting ice block 		
Apple browning 		
Frying an egg 		
Melting Ice 		
Baked bread rising 		
Burnt paper 		

Can you describe what happens in a physical change?

Can you describe what happens in a chemical change?

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