Forest Discovery Day - Messy Science

Year Group(s) KS2

Objectives:	• To learn about the different states of matter. • To understand the difference between a reversible and irreversible change. • To use fire safely in the forest.
Links to National Curriculum Programme(s) of Study:	*Science Year 4 POS:* *Group materials together according to whether they are solid, liquid or gas *Observe that some materials change state when they are heated or cooled *Measure temperature at when changes of state occur *Carry out a fair test *Make careful observations and take measurements *Science Year 5 POS:* *To know that some materials will dissolve in liquid to form a solution and describe how to recover a substance from a solution. *To demonstrate that dissolving, mixing and changes of state are reversible changes. *To explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.
Key Questions/ points:	1. To know that matter can exist in three states and that it can change between these states through heating and cooling. 2. To understand that a change is irreversible because a new substance has been made and the matter has changed chemically. 3. To work together safely in groups to carry out different investigations, including the use of fire. 4. To know the key facts about the freezing and boiling points of water. 5. To understand that changes can also be reversible and the terms for these.
Programme of Activities: **These will be the types of activities on offer. However, they may be subject to change depending on timings and the venue.** **The question of matter:** *Test prior knowledge: ask the children to go round the forest and to sort what they find in the forest into three groups: solid, liquid, gas. Regroup and take responses. Which group did you find the most of? Why is this? Relate this back to the properties.	

*How did you know whether it was a solid, liquid or gas? Discuss the properties of each. Sort statements into solid, liquid or gas.

All things small!

*What are all things made of? Discuss how everything is made of tiny, microscopic particles that we cannot see. These group together to make the things that we can see. The way they are held together determines if we have a solid, liquid or gas.

*Look at the particle diagrams: which one do you think is each? Can the children spot that the tightly packed must be solid?

*Demonstrate how it works with the children as particles.

*Play solid, liquid or gas game. Children move around and one is shouted; they need to form the particles of that.

All change!

How can we change matter?

Discuss the fact that we can change things physically: chop, crush, shred, heat, cool, sand and that this does not change the actual structure of the matter (what it is). For example, as you take off blocks off a chocolate bar, you change the shape but it is still the same chocolate. These are reversible changes.

You can also change things chemically: heat, rust, digestion, rot, combustion and this changes the matter itself by changing atoms and the bonds between them. A chemical reaction occurs and you have an irreversible change.

Breakfast time!

We will make scrambled eggs using the Trangia camping stoves and toast bread on the fire.

*Can we get the egg back the same? Emphasise not about the fact that we could not put it back in the shell but that the substance itself has been changed.

Heat actually changes the structure of the proteins within the egg.

*Can we get bread back?

Toasting is a Malliard reaction (named after the man who discovered it). It is a chemical reaction that happens when you toast, bake and fry. It is also called a browning reaction. Changes take place chemically that change the flavour and colour of the product.

*What other changes have taken place?

Wood has become ash; liquid has been burnt to create heat.

<u>An array of chemical reactions (irreversible changes):</u>

Rust formation

Children's Rust Formation Experiment - Fun Science UK (fun-science.org.uk)

Set up this investigation to see rust forming.

Rust- oxidation. Iron + water + oxygen = hydrated iron oxide.

Irreversible as a new substance has been formed. It also gives off heat as seen by the condensation- this is a byproduct of a chemical reaction.

Vinegar and bicarbonate of soda fun:

freakyhand_teachernotes_294784.pdf

What has been produced? How do you know? Can you get it back? Why not? Is there any change to the vinegar? It is another chemical reaction, creating carbon dioxide that fills the glove.

Baking soda rocket: using the chemical reaction between vinegar and baking soda to blast off a rocket! Use film cannister as rocket.

Launching Homemade Baking Soda Rockets | STEM Activity (sciencebuddies.org)

Investigating solids, liquids and gases in more detail:

Solid or liquid?

*Investigate custard as a material that can sometimes act as a solid and sometimes as a liquid. Play around with it: prod it at different speeds, pick it up, put things on it etc. Custard is a non-Newtonian liquid.

Here's an experiment you can try at home. This one is great fun and really messy! Ask an adult to get you some custard.

WATCH/LISTEN

Watch the experiment (28k 1'23")

Use the BBC Webwise guide to downloading realplayer

INTERNET LINKS

Inspire Hands-on Science Centre

CBBC Homepage

Really Wild Show

The BBC is not responsible for the content of external websites

HAVE YOUR SAY

Have you tried the experiments - were they good or do you know one that's better?

Have your say, e-mail norfolk@bbc.co.uk

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Other Science experiments:

Postcard trick

Lumpy custard

Burp in a pot

Colourful cabbage

Gooey slime ball

A-Z Norfolk Science

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What's happening?

This happens because of what custard is made of.

Custard powder is really just cornflour, colour and flavouring.

It was invented by Mr Bird after he found his wife was allergic to eggs so she could not eat egg custard.

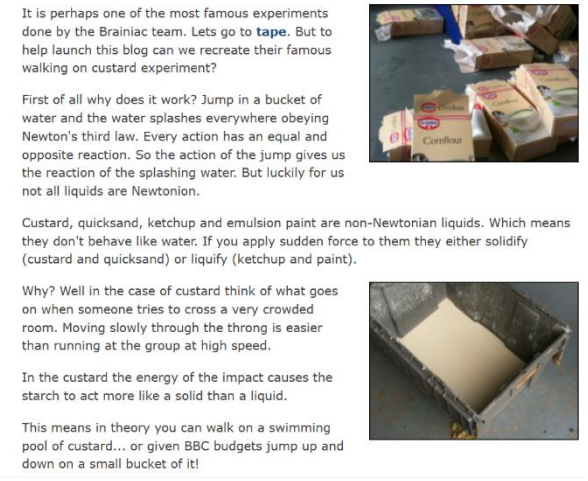
The custard can go from being like a solid ball...

Cornflour is very finely ground flour. One of the strange results of the fine grinding is that the particles made will link together if you put a bit of pressure on them, but will immediately separate when the pressure stops.

As long as you keep squeezing, those links join together and the custard stays in a ball.

In the same way, the pressure of the spoon handle causes a clean cut to form in the custard, but as soon as it passes, the custard becomes liquid again.

...to all stringy like this in seconds.



It is perhaps one of the most famous experiments done by the Brainiac team. Lets go to **tape**. But to help launch this blog can we recreate their famous walking on custard experiment?

First of all why does it work? Jump in a bucket of water and the water splashes everywhere obeying Newton's third law. Every action has an equal and opposite reaction. So the action of the jump gives us the reaction of the splashing water. But luckily for us not all liquids are Newtonion.

Custard, quicksand, ketchup and emulsion paint are non-Newtonian liquids. Which means they don't behave like water. If you apply sudden force to them they either solidify (custard and quicksand) or liquify (ketchup and paint).

Why? Well in the case of custard think of what goes on when someone tries to cross a very crowded room. Moving slowly through the throng is easier than running at the group at high speed.

In the custard the energy of the impact causes the starch to act more like a solid than a liquid.

This means in theory you can walk on a swimming pool of custard... or given BBC budgets jump up and down on a small bucket of it!

Explain that gases are often invisible and we just see the effects of them. We are going to look at some activities to see their effect.

Dancing raisins:

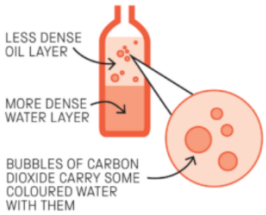
To perform the activity, fill the glass 3/4 full of the clear soda. Then, add the raisins. Watch what happens.

The science behind this experiment: Students will see the raisins "dancing" in the soda. The raisins will fall to the bottom of the glass and then float back up to the top. They will then fall again. What is happening in the carbonation gas from the soda adheres to the raisin. This causes the raisins to float to the top. Once the bubble pops at the surface, the raisin then falls to the bottom again.

Lava lamp:

Use water, oil, food colouring and fizzy vitamin tablet to create own lava lamp.
The water and oil don't mix. Can pupils see how the oil floats on the water?

WHAT'S THE SCIENCE?



This lava lamp effect works for two reasons. The first is that oil and water don't mix. This is because water molecules are attracted to each other but not to oil. The other reason is because of density, which is how compact a substance is. Water is denser than oil, so the oil layer stays on top.

The vitamin tablet falls through the oil, and when it reacts with the water it produces bubbles of carbon dioxide gas. This gas floats to the surface because it is less dense than both the water and the oil, carrying some coloured water with it. When the bubbles pop, the gas is released, and the denser water sinks back down again.

Water: the only substance that can occur naturally in all three states on our planet!
*Investigation of water in its three states. Emphasise that as it changes between states all the changes are reversible as water has not changed its structure.
Start with ice block. Measure the temperature of it. Place on tray over Trangia and heat. Watch as it melts and keep observing the temperature. What temperature is it when it is all melted? Continue heating. What happens? (Draw out that it bubbles and then steam comes off.) What temperature does this happen at? After it's boiled, take it off the heat. Will the water refreeze? Discuss where the water vapour has gone and what might happen to it.
Key knowledge and vocabulary:
*freeze point is 0 degrees
*Boiling point is 100 degrees (after each of these points water can no longer exist in its liquid form)
*melt, freeze, evaporate, condense
Have process up in trees to refer to with arrows on for the processes which cause the change of state. Also include hot and cold to show the effect of temperature and how this relates to the process.

Ice-cream making!
*What happens when we add salt to ice? Give children some ice and salt to try. What happens? Why do they think this is?
Salt lowers the freezing point of water- that is why it is added to roads in cold weather so the ice will melt or not form.
*Creating ice-cream!! Use the knowledge from above to create own ice-cream! Decorate and eat! The salt will lower the temperature of the ice in the bag causing the cream to freeze.
States of Matter Science Experiments - Teaching Muse

Cleaning rock salt using reversible changes
*Give the children rock salt and normal salt: what is the difference? How could we clean the rock salt?
*Draw out that we could use dissolving as only the salt will dissolve and not the dirt. How do we know something has dissolved? The liquid is clear. It can be got back through evaporation though.
*Use dissolving and then filtering to get the dirt out. Then evaporate. When we evaporate the water, how could we get it back? Demonstrate with clingfilm.
*Why does this process involve reversible changes?
(It is all mixed up but you can get back component parts: water to water vapour and back- change of state; rock salt: dissolving, filtering and evaporating)

Is all chocolate equal?
*Do all types of chocolate melt at the same point?
*How could we carry out a fair test to check out this question? Gather ideas. Children to then investigate. Put results up. What can we conclude?

Plenary:
*Quick quiz to recap on the key concepts covered in the day.