GREEN PENNIES

Age Range: 7-14

Show the class some examples of rusty articles e.g. nails. Ask them what has happened. Ask if they can recall seeing anything similar? Where? What is causing it?

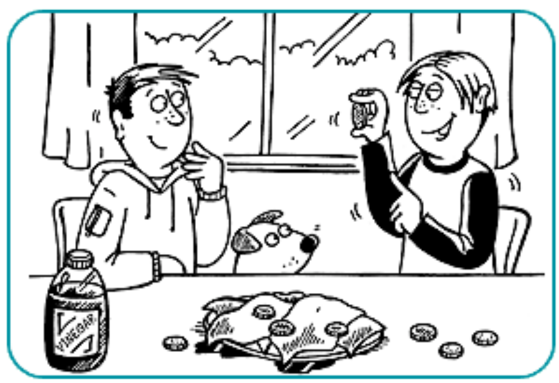
Lead the discussion around to the idea of chemical reactions.

Comment on the appearance of copper roofing e.g. on some church spires. Show pictures if possible. Discuss the green colouring. Lead into this investigation.

You will need

- A sauce
- Some paper towels
- Vinegar
- 3-5 pennies

Instructions



- Arrange the paper towels into a wad on your saucer.
- Pour enough vinegar into the saucer to cover the paper towel.
- Place the pennies on top of the wet paper towel and leave for a few hours.
- Encourage observations; look at both sides of the pennies. The tops of the pennies turn green and the bottoms of the pennies stay copper coloured.

Further Information

Vinegar is an acid that has the chemical name of 'acetic acid'. Part of this acid combines with the copper of the pennies to form a green coating that is composed of copper acetate. Oxygen must be present for this chemical reaction to occur. Oxygen comes from the air, and this is why the tops of the coins turn green but the bottoms do not.

Extension Ideas

Look at other reactions such as the rusting of steel wool in water.

This experiment came from...

The Planet Science Newsletter.

GROW YOUR OWN SALTICLE

Age Range: 7-14 with adult supervision

Teachers:
Ask the class whether they have visited any underground caves. If so, ask what they observed. If stalactites or stalagmites are mentioned then start a discussion about how they may be formed. Lead on to this experiment.

Parents:
Stalactites and stalagmites are formed when small amounts of calcium salts are dissolved as water seeps through rock. When the water evaporates, the calcium salt is left behind. Have a go at forming salticles!

You will need

- Salt
- Two small jars
- Large paper clips
- Wool or string
- A small saucer

Instructions

- Stir plenty of salt into a large glass of very hot water. Keep stirring. If all the salt dissolves, add more until it doesn't. Allow the mixture to cool, and then pour half into each jar.
- Attach a paper clip to each end of a piece of wool about 40 cm long.
- Put one end of the wool in one of the bottles, and the other end of the wool in the other bottle. Make sure the ends of the wool are in the solution.
- Now make sure that the bottom of the loop of wool between the bottles is hanging below the level of the salt solution in the bottles.
- Place a saucer under the bottom of the loop of wool. Leave for a week. And behold a salticle will appear!
- **Tip:** Make sure your wool is good and porous; it's got to act as a passageway for the salty liquid. Also, make sure the wool doesn't dry up during the week or you'll be snookeroo'd.

Further Information

The salt solution travels along the wool by capillary action. This is a physical effect by which water can travel upwards as if to defy gravity! It's due to the interactions between the water molecules and the wool which contains tiny tubes and spaces for the solution to fill. Plants take advantage of capillary action to pull water from the soil into themselves.

As the salt solution travels along the wool it starts to drip from the lowest point in the loop of wool. The water evaporates and salt crystals are left behind. In time more and more salt solution drips down and the crystals of salt grow larger. Eventually it will form a 'salticle' or stalactite.

Stalactites and stalagmites, collectively known as speleothems, form due to water seeping through rock. As the water moves through the rock, it dissolves small amounts of limestone or calcium carbonate. When the water drips from a cave ceiling, small amounts of this limestone are left behind, eventually leaving an icicle-shaped stalactite. Limestone that reaches the cave floor "piles up" and forms 'stalagmites'.

Extension Ideas

Use other salts e.g. baking soda (sodium bicarbonate).

Grow a woolly lamb:
Fold paper such as sugar paper (or other coarse grained paper) in half. Draw a sheep shape on it and cut it out. Make up a strong salt solution and put it into a Petri dish or a coffee jar lid. Place the feet of your sheep into the solution and over the next few days salt crystals will appear over the back and sides.

This experiment came from...

Science on the Shelves (University of York).
Woolly lamb by Mary-Jane Murray, from Saxton Primary School in North Yorkshire.

Remember BE SAFE!

Treat hot water with care to avoid scalding injury.

MAKE YOUR OWN THERMOMETER

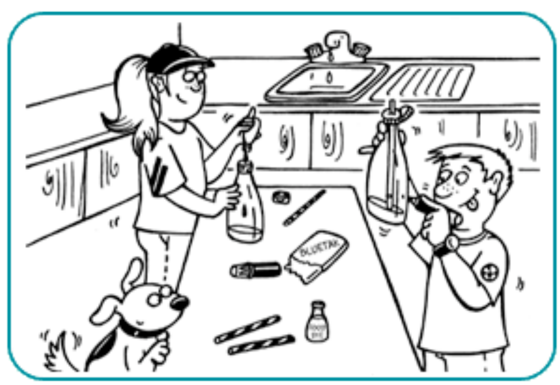
Age Range: 7-14

Want to know how a thermometer works?
Find out by making one.

You will need

- An empty small plastic squeezy mayonnaise or ketcup bottle
- A plastic straw
- Modelling clay or blutack
- Water
- Food colouring
- A marker pen

Instructions



- Fill the empty plastic bottle one quarter full of water.
- Add a few drops of food colouring to the water so you can see it better.
- Push a straw through the hole in the top of the squeezy bottle
- Make sure there is a good seal around the straw by using modelling clay or blutack.
- Blow through the straw so that the water bubbles. If you hear a hissing sound you will know that your seal is not good enough. Re-pinch the clay or blutack around the straw and make sure it is well attached to the bottle top.
- Blow bubbles through the water till it rises half way up the bottle.
- Lift your bottle so that it is at eyelevel and make a mark on the outside of the bottle that shows the level of water in the straw.
- This mark shows the level of water in the straw at room temperature.
- Now place your bottle in the fridge. What happens to the water level in the straw?
- Try placing your bottle in a warm place e.g. near a radiator. What happens to the level in the straw now?

Further Information

The thermometer works because as the temperature rises, the air inside the bottle expands and pushes the water up the straw. At cooler temperatures, the air in the bottle contracts and the water drops.

Bulb thermometers rely on the simple principle that a liquid changes its volume relative to its temperature. Liquids take up less space when they are cold and more space when they are warm. In practice water would not be a good liquid to use, as it would freeze at temperatures below 0oC. Instead other liquids that expand on heating like alcohol and mercury are used. Alcohol has a lower freezing point than water so it can measure temperatures below 0oC. Mercury has a boiling point of 357oC but due to its toxicity alcohol thermometers are usually used for medical purposes.

Digital thermometers contain a thermoresistor (or 'thermistor'). This device changes its resistance with changes in temperature. A computer or other circuit measures the resistance and converts it to a temperature which is displayed digitally.

Forehead strip thermometers use liquid crystal thermochromic ink which is formulated to change colour at different temperatures.

Extension Ideas

For more info on thermometers, have a look at How Stuff Works at:
http://home.howstuffworks.com/therm.htm

As you probably know, there are three temperature scales: Fahrenheit, Celsius and Kelvin. To find out more about the three scientists who gave their names to these scales, have a look at ENERGY QUEST at:
http://www.evergyquest.ca.gov/

This experiment came from...

The Planet Science Newsletter.

RECYLCING PLASTIC? SORTED!

Age Range: 7-14 with adult supervision

Ever wondered how all those plastic items you chuck away get sorted out for recycling? Read on ... and have a go yourself.

You will need

- A plastic milk bottle
- A yoghurt pot
- A washing up liquid bottle
- A pair of scissors
- A large of bowl of water
- A tablespoon
- Salt

Instructions

- Check the code on the bottom of the containers. There should be a number inside the recycling symbol, for example:

  Plastic milk bottle - code 2 or HDPE
  Yoghurt pot - code 6 or PS
  Washing up liquid bottle - code 1 or
PETE

- Carefully cut out three strips from each plastic container. Each strip should be about 1 cm by 4 cm. NB You might need an adult to help with this.

- Fill the bowl with water and place all the strips in it. You may want to use a spoon to make sure all of the strips are fully immersed*.

- One set of strips will float to the surface immediately. Remove these strips.

- Now add a large tablespoon of salt to the bowl and stir it up so that it dissolves.

- Another set of strips should float to the surface. Remove these strips.

- There should be one set of strips still sitting at the bottom of the bowl.

- Congratulations! You have now successfully sorted three different plastics!

- ***PS** If you can't get the PS container strips to sink in water then try adding some washing up liquid to the water. This affects the surface tension of the water and makes it 'wetter' i.e. it will wet the plastic strips better than water alone, if that makes sense...

Further Information

Each plastic container is made of a different plastic, and has its own 'density'. Density is the measure of how heavy something is for its size, in other words its mass per unit volume. Water has a density of 1 g/cm3, and anything with a density greater than this will sink in water; anything with a lower density will float. So if we have a plastic with a density less than 1 (e.g. the milk bottle) it will float in water. But what about the salt? Well, adding the salt to the water makes it more dense. That's why we float more easily in the sea than in the bath. The yoghurt pot has a density slightly greater than 1 g/cm3, so it doesn't float in tap water but it will float in salt water. The washing up liquid bottle however has a higher density still which means that it won't float in either tap or salt water. So now you know how they separate plastics for recycling!

Extension Ideas

Want to know more?
There are many different sorts of plastics and polymers, with different characteristics such as flexibility and transparency. The American Society of the Plastics Industry has produced a marking code to identify the six main types, which you can see at:
http://americanplasticscouncil.org
Checking the number on each one before recycling obviously isn't an efficient way of doing things, but because they have different densities, they can be sorted using the type of process you've just tried for yourself.
If you want to know more about the process, and about what plastics are recycled into, check out the Warwickshire Waste Wise website at:
http://www.warwickshire.gov.uk/
For more information on recycling statistics have a look at:
http://www.recoup.org/business/default.asp

This experiment came from...

Katy Hewis of Science Matters.

Remember BE SAFE!

Be careful when using scissors to cut up plastic bottles.

RUSSIAN REACTION ROULETTE

Age Range: 7-14 with adult supervision

As the name suggests, 'Russian Reaction Roulette' is a game of a chance, and one which will test participants' nerves - and knowledge of chemistry - to the max.

As with all of the more explosive events in this competition, it's being conducted outdoors, because past experience has shown that things can get messy.

This is a game for two or more participants.

You will need

- A t least 6 film canisters and lids - professionals prefer the black ones as participants can't see what's inside.
  Tip: your chemist may have spares if you ask nicely.
- Flour
- Talcum powder
- Bicarbonate of soda
- Icing sugar
- Baking powder
- A teaspoon
- An empty washing up liquid bottle
- Vinegar
- A dinner plate
- A food can e.g. beans, soup, catfood
- Several marbles

Instructions

- Into one film canister place two teaspoons of flour, into the next place two teaspoons of talcum powder and so on until all your film canisters are used.
- Put the lids on the film canisters and shuffle them around until nobody knows which is which. Umpire's note: NO CHEATING!

- Pour some vinegar into the empty washing up liquid bottle.

- Place the can in the middle of the circle of participants. Ensure the ring pull end. If there is one, is at the bottom - you want a smooth surface face up.
- Place the marbles on the top of the can.
- Place the dinner plate on top of the marbles so that it spins easily.
- Arrange the film canisters in a circle around the base of the can.
- Place the washing up liquid bottle of vinegar on its side on the dinner plate so that it acts like a pointer.
- Spin the plate.
- When the plate stops, the person at whom the vinegar bottle is pointing must pick a film canister.
- The person must take the lid off the canister and add a squirt of vinegar.
- If they are lucky nothing will happen. Otherwise suddenly a big frothy mass will spurt up and over the top of the film canister and all down the unlucky person's arm. Nice and smelly too!

Further Information

Vinegar contains a weak acid known as acetic or ethanoic acid. It will react with an alkali (or base) such as sodium bicarbonate to give off carbon dioxide gas - hence the froth. This is a chemical reaction between an acid and an alkali (base). Baking powder contains sodium bicarbonate so it too will froth and give off carbon dioxide. The marbles on the can act as ball bearings and reduce the friction between the dinner plate and the can surface - hence the plate spins easily. Try spinning the plate without marbles if you want to see the difference for yourself.

Extension Ideas

Rules for advanced rounds:
Try adding food colouring to the powders for extra yuk-factor
Have more than one 'live' canister - just to spice up the game!

This experiment came from...

Katy Hewis of Science Matters.

Remember BE SAFE!

Vinegar is irritating to the eyes. Wash affected eyes with cool water.

SHRUNKEN HEADS

Age Range: 11-14 with adult supervision

This activity can be used for Halloween fun.

Note: If you are under 16 you will need to ask an adult to supervise.

You will need

- Apple
- Apple corer
- Vegetable peeler
- Cup of lemon juice
- 1 tbsp salt
- Bowl
- Small knife

Instructions

- The first step is to core the apple and remove the skin, which will help the apple to dry quicker.
- Next, mix the lemon juice and salt in a bowl and roll the apple around in the mixture for a minute.
- Now, use the small knife to carve out holes for the eyes, nose and mouth. Remember that apples contain a lot of water so when dry they will shrink to half their size. This means you need to make the facial features big but without too much small detail, as this will be lost.
- Once again dip the apple into the lemon and salt and then place them on a baking tray.
- The quickest way to dry them is to place them inside an oven on its lowest setting and keep checking them until they are dry.
- Decorating Options:
  When the apple is nearly dry you could use a needle and thread to sew the mouth closed, or use grains of rice for teeth or raisins for eyes. Once the apple is dry you could make it a witch's hat or add wool for hair!

Further Information

The apple dries, shrinks and changes shape. Freshly cut apples turn brown when iron-containing chemicals inside apple cells react with oxygen in the air. The chemical reaction is called oxidation, and it is similar to the rusting of iron. When you soaked your apple in lemon juice, the acid in the lemon juice affects this reaction and keeps the apple from browning too much.

Although there were many headhunting cultures throughout the world, only one group was known for ancient practice of shrinking human heads (tsantsa).

They were called the Jivaro clan who lived deep in the Ecuadorian, and neighbouring Peruvian Amazon. The shrunken heads were used as trophies since it was thought the wearers harnessed the power of their hapless victims.

The shrinking process (not for the squeamish!):
After the head was severed, they peeled the skin off the face, turned it inside out and scraped it. Believing that violent death unleashed a soul bent on revenge, they carefully sewed up the lips and eyelids to trap and paralyse the spirit.

The skull and brain were sacrificed to the spirit of the anaconda while the leftovers simmered in a pot of berry-cured water. The plant used is believed to be Œhuito_. After less than 2 hours, the head would shrink to about a third of its size. Then heated pebbles were placed inside the head and shaken to shrink the skin. When the head was too small for pebbles, it was placed between hot rocks (heated by fire) and the cavity of the head filled with hot sand several times. This has the effect of melting a layer of fat inside the head, and causes the skin of the head to shrink and to turn black.

The face was rubbed with charcoal and berries to keep it moisturized, so it wouldn't crack. After one night of smoking over a fire, the hair was carefully trimmed and the head was ready for the celebration.

Much less disgusting to use apples!

For information on the Hobbit-sized human visit the Science Museum, London's website at: http://www.sciencemuseum.org.uk/antenna/flores/

This experiment came from...

The Planet Science Newsletter.

Remember BE SAFE!

Be careful when using sharp knives. Ask an adult to help.

SIMPLY NUTS

Age Range: 5-14

Q: What are the chances of picking out a Brazil nut when you plunge your hand into a jar of mixed nuts without looking?

A: Considerably better if you tap the jar on the table a few times first. But why ..?

You will need

- A jar of mixed nuts
- A tabletop
- A hand

Instructions

- Unscrew the lid of the jar and see which nuts are on the surface. There's sure to be at least one Brazil nut.
- Push the Brazil nut(s) down below the surface.
- Screw the lid back on and give it a gentle thump on the table a few times.
- Now look inside again. Aha!! How did that happen?

Further Information

The Brazil nut(s) are larger than the other nuts in the jar. As you tap the jar the Brazils move upwards which allows the other smaller nuts to fall beneath it and take up the space it leaves.

Since the Brazil nut is fairly smooth, the friction between it and the other nuts is low which makes it easier for other nuts to slip beneath it.

As you continue to shake the jar the Brazil nut will gradually move upwards until it is finally sitting on the surface. Cunning eh?

Extension Ideas

You can also try this trick with a jar of rice and a marble or small rubber ball.

This experiment came from...

The Planet Science Newsletter.

SKY IN A JAR

Age Range: 7-14

Why is the sky blue and sunsets red?

Consider possible responses. Introduce the fact that white light is sompposed of all the colours of the spectrum.

You will need

- A clear, straight-sided drinking glass, or a clear plastic or glass jar
- Water
- Milk
- Mesauring spoons
- A torch
- A darkened room

Instructions

- Fill the glass or jar about 2/3 full of water, about 250–400ml.
- Add 1/2 to 1 teaspoon of milk and stir.
- Take the glass and torch into a darkened room.
- Hold the torch above the surface of the water and observe the water in the glass from the side. It should have a slight bluish tint.
- Now, hold the torch to the side of the glass and look through the water directly at the light. The water should have a slightly reddish tint.
- Put the torch under the glass and look down into the water from the top. It should have a deeper reddish tint.

Further Information

The small 'particles' of milk suspended in the water scatter the light from the torch, in the same way that dust particles and molecules in the air scatter sunlight.

Sunlight is a mixture of all the colours of the rainbow (the spectrum), and different colours of light are scattered by different amounts when they encounter stuff like dust particles. Light at the bluer end of the rainbow has a shorter wavelength; it's scattered most easily. The red end of the rainbow represents light that's less easily scattered since it has a longer wavelength.

When the light shines in at the top of the glass, the water looks blue because you see blue light scattered to the side. This is like the midday sky. However, when you look through the water directly at the light, it appears red because more of the blue was sent elsewhere by scattering. In the same way, at sunset light from the sun has to travel through much more atmosphere than when the sun is overhead. Blue light and all the other colours are scattered around (and diluted) so much by all this atmosphere that only red, orange and yellow light remain visible.

This experiment came from...

The Planet Science Newsletter.

SOLAR SYSTEM BISCUITS

Age Range: 7-14 with adult supervision

Tasty snacks with a science theme!

If the Orionoids have left you hungry for more then these biscuits make ideal treats for any sky-gazing nights you might be planning. Of course, you don't have to be into astronomy to enjoy making these biscuits, and what better way to introduce your budding astronomers to the Solar System than to make edible versions of the planets!

You will need

- 175g plain flour
- 100g butter or margarine
- 50g caster sugar
- Four different sized biscuit cutters
- Items to decorate - colouring icing, hundreds & thousands and liquorice.

Instructions

- Pre-heat the oven to 150°C/300°F Gas 2
- Cream the butter or margarine and caster sugar together until they are light and fluffy. Stir in the flour and, once mixed, knead the dough together until it forms a ball. Add a sprinkle of flour if the dough is sticky.
- Roll out the dough on a lightly floured surface until it is about 5mm thick.
- Use the smallest biscuit cutter to cut three biscuits from the dough (Pluto, Mercury and Mars).
- Use the next-size-up biscuit cutter to make two biscuits (Venus and Earth).
- Use the next larger biscuit cutter to make another two biscuits (Neptune and Uranus).
- Use the largest biscuit cutter to cut the last two biscuits (Saturn and Jupiter).
- Place the biscuits on a baking tray and bake in the centre of the oven for 25 minutes or until golden brown.
- Let the biscuits cool before decorating.
  Note: Keep track of the planets as you cut them out so you can decorate them correctly after they are cooked.

Now for the decoration:

- Mercury has a rocky surface and is orange-red in colour, so use coloured icing and hundreds and thousands to decorate this biscuit.
- Venus is covered with thick, yellow clouds so you will need yellow icing.
- Earth is an obvious one! Decorate with green and blue icing and a sprinkle of icing sugar to resemble the clouds.
- Decorate your Mars biscuit with red icing.
- Jupiter is a giant ball of yellow, orange and red gas arranged in stripes. Use stripes of coloured icing decorate with a red sweet in the middle to resemble Jupiter's Great Red Spot.
- Saturn looks yellow because of its foggy atmosphere and is famous for its rings, so use yellow icing and lay a few pieces of liquorice on the biscuit to resemble its rings.
- Uranus looks green so decorate with green icing.
- Neptune is blue with faint stripes so decorate with blue icing and make faint stripes with sprinkles of icing sugar.
- Finally for Pluto, sprinkle a little icing sugar on the top of the biscuit to resemble this icy, rocky planet.
- Now all you have to do is arrange the biscuits in the correct planetary order and serve.

Extension Ideas

Remember the order of the planets by using the mnemonic:

My **V**ery **E**asy **M**ethod **J**ust **S**hows **U**s **N**ine **P**lanets

Mercury-Venus-Earth-Mars-Jupiter-Saturn-Uranus-Neptune-Pluto

This experiment came from...

The Planet Science Newsletter.

Remember BE SAFE!

Adhere to the guidelines for Food and Hygiene (Be Safe! 3rd edition section 6). Take care when using cookers and handling hot baking trays.

SPINNING JUICE

Age Range: 7-14 with adult supervision

You will need

- An empty 1 litre fruit juice carton
- A piece of string
- A pair of scissors
- A washing up bowl
- Water

Instructions

- Poke a hole in the bottom left hand corner of each of the four faces of a 1 litre juice carton. (Get an adult to do this, it can be a bit tricky - and stabby)

- Poke an extra hole in the top flap of the carton and tie a string through it.

- Knot the string, so that you can hang the carton from it.

- Pour some water into the washing up bowl so that it's about one quarter full.

- Place the carton into the bowl of water.

- Pour water into the carton until it is full to the top. (The reason you put water in the bowl previously is so that you can fill the carton up with out it shooting straight out of the holes.)

- Now lift the carton out of the water by the string and watch what happens! The carton will be, in the words of Kylie Minogue, "spinning around" …

Further Information

Newton's Third Law states that every action has an equal and opposite reaction. Water shoots out the holes, and pushes back on the carton with equal force. A turbine is formed as the energy of the moving liquid is converted into rotational energy. Consequently the carton spins. This effect was first noted by Hero of Alexandria, although possibly not using a juice carton.

Hero (or Heron) (roughly A.D. 10 to roughly A.D. 70) was a Greek engineer and geometer. His most famous invention was the first documented steam engine, the 'aeolipile'. Steam was generated in a separate boiler and fed into a sphere through a hollow spindle. The steam left the sphere via two narrow, angled nozzles and the reaction to the jets of steam leaving these nozzles made the sphere spin.

Extension Ideas

To see an animation of Hero's Aeolipile, there's a good little animation here:
http://www.geocities.com/Athens/Acropolis/

This experiment came from...

The Planet Science Newsletter.

Remember BE SAFE!

Be careful when using scissors to puncture holes.

THE AIR POWERED CAR

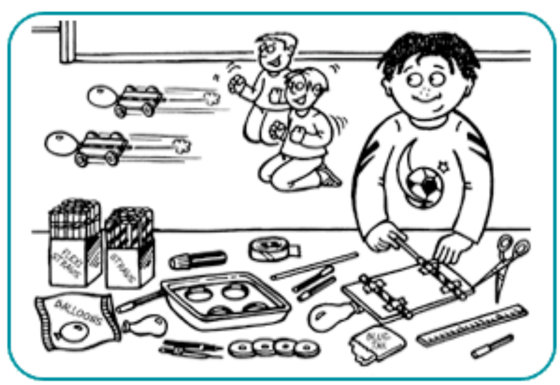
Age Range: 7-14 with adult supervision

Here's an activity which is good fun to try on your own, but can also provide the basis for a Wacky Races style challenge if you have more than one team involved...

You will need

- A piece of strong card - A5 size (approx. 15cm x 21cm)
- Styrofoam trays (1 large or several small)
- A ruler
- A compass
- A maker pen
- A balloon
- Sticky tape
- Scissors
- 1 flexi-straw
- 2 'normal' straws
- 2 thin dowelling rods (approx. 2cm longer than the straws)
- Blutack
- Felt pens etc to decorate - optional

Instructions



- Draw four circles 7.5cm in diameter on the flat surface of the styrofoam tray and cut them out.
- Make a small hole in the centre of each circle. These are your four wheels.
- Inflate the balloon a few times to stretch it. Slip the end of the balloon over the end of the flexi-straw (nearest its bend).
- Secure the end of the balloon to the straw with tape and seal it tight so that the balloon can be inflated by blowing through the straw.
- Tape the straw lengthways along the middle of the A5 piece of card.
- Flip the card upside down and place the two 'normal' straws across the card 5cm from each end. Stick them down.

- Push the dowelling rods through these two straws. The rods should stick out the ends of the straws. Push the wheels onto the end of each dowelling rod. Secure the wheels to the rod with blutack. Flip the car back over. Blow through the flexi-straw to inflate the balloon. When the balloon is full, pinch the straw to hold in the air.

  YOU ARE NOW READY TO RACE!

- Set the car on a smooth surface, with the wheels on the ground (obviously!) and release the straw...

Further Information

The car is propelled along the floor by escaping air. The air travels backwards out of the straw, which causes the car to move in the opposite direction. You can think of this movement as being like what happens when you swim: you push water backwards with your arms but you yourself move forward.

This is a demonstration of Newton's Third Law of Motion, and technologists employ the same principle to launch rockets into space. Gas and fire explode downwards out of the end of the rocket, causing the body of the rocket to take off in the opposite direction, i.e. up, up and away...

Extension Ideas

How far does your car go? Can you think of any design improvements? How about customising the cars?
Now challenge your friends to a race...

This experiment came from...

The Planet Science Newsletter.

Remember BE SAFE!

Children under 8 yrs should not inflate balloons as they can be a chocking hazard.
Take care when using scissors.

THE BIG DRIPPER

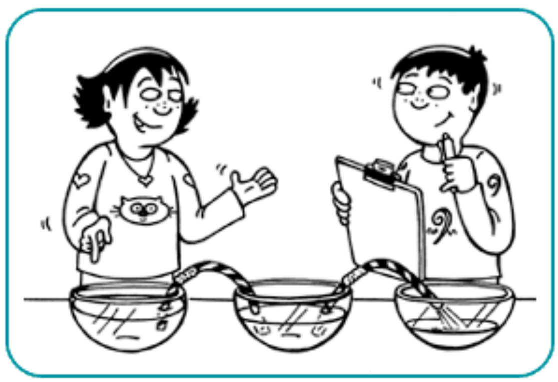
Age Range: 11-14

Challenge the class to move water from one bowl to another without pouring it and without making the bowls higher or lower.

You will need

- Plastic 'bendy' drinking straws
- Small clear bowls or yoghurt pots
- Food colouring
- Water
- Washing-up bowl

Instructions



- In one small bowl add a few drops of food colouring and fill nearly to the brim with water. This is Bowl 1.
- Fill another small bowl a quarter full with water and place it next to the first. This is Bowl 2.
- Half fill the washing-up bowl with water.
- Immerse the straw completely in the washing up bowl so that it fills with water. You may have to jiggle or squash it to force out any air bubbles but take care not to split it.
- Whilst still in the washing up bowl, fold back the two ends of the straw and pinch them tight so that you can take the straw out of the water without letting any air in.
- Put one end of the straw under the surface of the water in Bowl 1. Make sure that it is completely in the water before you release it and no air gets in.
- Arch the straw and place the other end of the straw under the surface of the water in Bowl 2. Make sure that it is completely in the water before you release it and no air gets in.

- Do you see how the coloured water is now draining into Bowl 2? Amazing eh? If not, then you may have air in the straw and you need to repeat steps 4 and 5.
- Once Bowl 1 is draining into Bowl 2, take an empty bowl and add a few drops of a different food colouring and fill it with a small amount of water. This is Bowl 3.
- Connect Bowls 2 and 3 with a water-filled straw as before. Now Bowl 3 should start filling up.
- Continue adding more bowls and straws, as you wish, to make your very own water roller coaster.

Further Information

As you can see, the water has to travel uphill through the straw and down the other side to flow into the next bowl. The fluid is behaving just like the carriages joined together in a roller coaster. This is an effect known as siphoning.

In a conventional siphon a quantity of liquid can be moved from one container to another using a flexible tube. E.g. emptying a fish tank by submerging a length of plastic tubing in it and then sealing one end with a finger and placing it in a bucket on the floor. The bucket is at a lower level than the tank and so the water is siphoned out.

Two things define a siphon:
1. The inlet is higher than the outlet
2. A portion of the siphon tube is higher than the inlet.

Find out more about how siphons work with these two links:
http://www.science-projects.com/WaterCoaster.htm
http://www.pump-flo.com/

But in our water roller coaster all the bowls are on the same level. How does the siphon effect work now? Well the bowls themselves are all on the same level but the levels of water in the bowls are different. In Bowl 1 we have the greatest height of water and this drains into Bowl 2 which has a greater height of water than Bowl 3 and so on. Have you noticed what happens when the levels of liquid equal out? The siphon stops. But it all starts again when you add more water to Bowl 1.

The siphon works because there is a pressure difference at the inlet and outlet ends of the straw. The greater height of water in Bowl 1 means a greater pressure forcing water up the straw towards the lower level water. When it reaches the high point of the straw arch, gravity can then pull the water downwards. Imagine the carriages on the roller coaster as they go over the peaks of the slopes. The combination of these two effects means that the water flows through the straw until both levels of water are equal in the bowls and hence the pressure at the inlet and outlet are the same.

Extension Ideas

Try placing Bowl 2 at a lower level than Bowl 1? Does the water flow faster or slower?

Arrange your bowls in steps with the fullest bowl at the top. Can you move the water from the top bowl to the bottom bowl using straws?

Arrange a colourful water feature by placing different food colourings in different bowls. Remember that the colours will mix!

Scale up and use buckets and washing up bowls with lengths of plastic tubing.

Talk about larging it!

This experiment came from...

Katy Hewis of Science Matters.

THE BLUBBER GLOVE

Age Range: 7-14

Here's an activity that lets you find out for yourself how whales, seals and penguins all manage to stay warm in the cold.

It's gross, but it works...

You will need

- Four waterproof plastic bags, big enough to get your hand in, eg freezer bags
- Parcel tape
- A big bowl of ice and water - good and ch-ch-chilly
- A few packs of solid vegetable fat, at room temperature
- A spoon (unless you really want to get your hands dirty!)

Instructions

- Cut the tops off two of the plastic bags if they have any handles or flaps and place one inside the other.
- Start to fill the gap between the bags with vegetable fat. Mmmmmm - nice!
- Once the gap is filled with about 2cm of fat all around, seal the gap between the bags with parcel tape leaving the inner bag open so you can put your hand in it. You've now made yuor blubber glove.
- Put one hand inside the blubber glove. Sqodge the fat around as necessary as to cover your hand completely.
- Put your other hand inside the the two other plastic bags. Now dip both hands into the icy water. Which one do you have to pull out first? Don't leave either in there too long as they will start to hurt!

Further Information

You should notice that you can keep your blubber-gloved hand in the bowl of ice much longer than the hand protected only by the plastic bags.

This is because the fat acts as an insulator, keeping the heat inside and not letting it pass through to the icy water.

In the wild, many sea animals have a thick layer of blubber to protect them from the cold.

This experiment came from...

The Planet Science Newsletter.

THE STRANGE CASE OF THE WEIGHTY BALLOON

Age Range: 7-14 with adult supervision

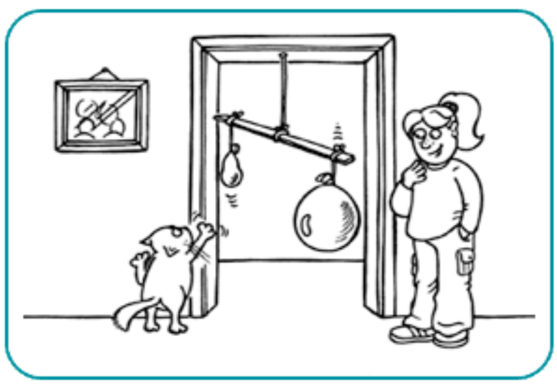
Is it really possible to be as 'light as air'?

Quite a compliment you might think, but is air really that light?
Here's an experiment to help you investigate...

You will need

- A metre rule (or long straight uniform stick)
- String
- Sticky tape / drawing pins
- 2 big balloons

Instructions



- First set up the balance. Tie one end of a piece of string around the centre of the metre rule and attach the other end of the string to the ceiling, or a doorway, with a drawing pin or sticky tape.

- Now move the loop of string until your metre rule balances - this should be around the 50cm mark.

- Once it's balanced, use a bit of tape to stick the string loop in place around the rule.

- Take an uninflated balloon and tie a piece of string firmly around its neck and loop it about 5cm from one end of the metre rule. This will completely unbalance the metre rule, but don't worry about that at this stage.

- Take you second uninflated balloon and tie a piece of string VERY LOOSELY around its neck and make a loop over the other end of the metre rule.

- Move each of these balloons along the rule slightly until it's nicely balanced again. Stick your string loops to the metre rule with sticky tape.

- Carefully untie the second balloon, blow it up and tie it so it stays inflated. Now re-tie it in its place. You will notice that the balance has tipped. After all that work, how come it no longer balances? Any guesses?

Further Information

The inflated balloon actually weighs more than the flat balloon. This is because air has a weight! When we fill the balloon with air it pulls on the balance and tips it over, very, very slightly.

The smaller the balloon the harder it will be to see the change, so make sure you fill the balloon up as much as possible.

Extension Ideas

Read more about this, and why helium balloons float at:
http://science.howstuffworks.com/helium1.htm

Another approach to the experiment would be to balance two inflated balloons on the metre rule. Once balanced, pop one of the balloons with a pin and see what happens.

This experiment came from...

The Planet Science Newsletter.

Remember BE SAFE!

Children under 8yrs should not inflate balloons as they can be a choking hazard.

WARM HEARTS

Age Range: 11-14 with adult supervision

From the Planet Science Diner, here's a science activity that's a dessert as well.

What a top combination!

You will need

- A carton of ice cream (not soft scoop)
- Some of your favourite jam
- A microwave oven
- A freezer or freezer compartment in the fridge
- A knife, and spoons of various sizes

Instructions

- Wash your hands. Then, carve an ice cream ball out of your block a few inches in diameter. With the knife, cut it in half and hollowout the centre. (Be careful not to hurt your fingers by freezing them if you touch the ice cream).

- Place a spoonful of jam in the hollow. Reform the ball by attaching the two halves together again. Make as many balls as you need.

- Place them on a plate and pop them into the freezer for at least half an hour or so. They will need to be rock solid for the next step.

- When you are ready to serve them, remove them from the freezer and microwave each one individually on full power for about 10-15 seconds. You'll be able to see exactly how much time is right in the microwave by trial and error on the first couple of balls. (Do not be tempted to try and microwave them all at once).

- Serve immediately. The ice cream should be deliciously cold - but the jam may become very hot so warn your guests not to burn their tongues.

Further Information

Microwave ovens work by heating (or 'exciting') the water molecules in the food you put in there. But because water in the form of ice is not easily excited by the microwave energy, the ice cream does not melt immediately. However, the jam in the centre of the ice cream is made up of mostly liquid water and sugar molecule. These do absorb the energy quickly, and as the microwaves penetrate through the food to a depth of a few centimetres, the waves can reach the jam and warm it faster than the ice cream can melt. So although it's cold on the outside it has a warm heart. Awwww.

NB: Nothing wrong in using classic vanilla ice cream and raspberry jam, but you might also like to branch out and invent your own combos (eg. chocolate ice cream with black cherry jam centres, mmmm).

Extension Ideas

For loads more fun recipes you can make in the microwave, have a look in our online larder at:
http://www.planet-science.com/outthere/diner/microwave/index.html

And if you want to play with our interactive microwave oven and find out a bit more about how it works (and what you can and can't cook in it) click through to 'Microwhizz Oven' on the following page:
http://www.planet-science.com/outtther/diner/microwave/index.html

This experiment came from...

The Planet Science Diner.

Remember BE SAFE!

Frozen items can cause injury to the skin, take care when handling. Jam can become extremely hot when heated so take care to avoid scalding injuries.

WATCHING THE (WATER) CLOCK

Age Range: 7-14 with adult supervision

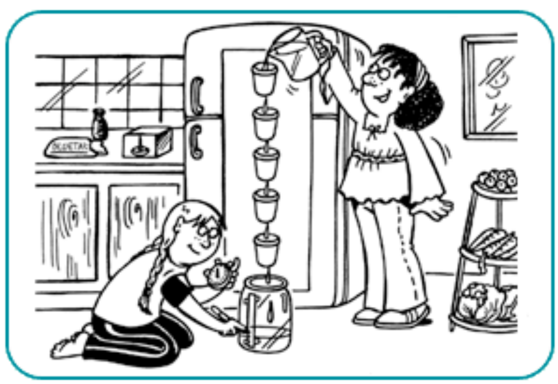
What did we do before mechanical clocks were invented?

Here's a different way to message the passage of time...

You will need

- A large sheet of heavy cardboard (at least 30cm x 75cm)
- A piece of blutack
- 5 paper polystyrene cups
- 5 drawing pins
- A large clear glass jar
- An old tea towel or cloth
- A stopwatch or timer
- Food colouring
- A jug
- A strip of paper
- Sellotape
- A marker pen

Instructions



- Use a drawing pin to punch a hole in the bottom of each cup. Tack the five cups to the cardboard, one underanother at intervals.
- Make sure the piece of cardboard is propped up vertically. You may want to use blutack to fix it against a cupboard or fridge door.
- Tape the strip of paper vertically on the glass jar, and put the jar beneath the bottom cup.
- Put an old tea towel under the jar in case of spillage.

- For a test run, fill the top cup with water from the jug and make sure the water drips smoothly through each cup. Now pour out the water from the test run.

- Add a little food colouring to a jug of water. This will make the water easier to see. Fill the top cup again. Use a timer and, at the end of every five minutes, mark the water level on the paper taped to the jar.

- When all the water has dripped into the jar, you'll be able to use this "clock" to keep track of time.

- For example, start your water clock again and use the five-minute marks to time how long it takes to do your homework, practice playing an instrument, or setting the table.

Further Information

Water clocks were among the earliest time keeping devices. It's believed that the ancient Greeks began using water clocks, called clepsydras ('water thieves') around 325 BC. A clepsydra was made of two containers of water, one higher than the other. Water travelled from the higher container to the lower container through a connecting tube. The containers had marks around their sides showing the water level, which indicated the time.

While these clocks weren't totally reliable, they worked indoors, at night, on cloudy days, so they were much more useful than the sundial, which was the only other clock in use at the time. Water clocks were common across the Middle East, and were still being used in North Africa during the early part of the twentieth century.

Extension Ideas

To find out more about early clocks and water clocks, have a look at The National Institute of Standards and Technology Physics Laboratory at:
http://plysics.nist.gov/GenInt/Time/early.html

This experiment came from...

This experiment was taken from the National Geographic Kids website at:
http://www.nationalgeographic.com/ngkids/trythis/

Remember BE SAFE!

Be careful when using drawing pins as they are sharp.

WATER GREAT TRICK!

Age Range: 7-14

The aim of the game is to take advantage of Newton's First Law of Motion; the one that states that if you have the correct props and have practised sufficiently, you can wow your way into the group memory of both friends and strangers, at very low cost indeed.

You will need

- A paper napkin
- A plastic cup, filled with water
- A table - preferably outside
- Time to practise, practise, practise in private - DEFINITELY outside!

Instructions

- Drape the napkin over the edge of the table.
- Place the cup on one corner of then napkin, only a few cms from the edge.
- Now, focus your mind, calm your nerves, and pull the napkin quickly away from under the cup.

Further Information

What should happen: The cup remains where it is and still full of water, due to inertia. The napkin meanwhile is liberated, and can be waved at the audience.
What may happen: Water goes everywhere - this is why you need to practise alone. The trick is pull the napkin as FAST AS YOU POSSIBLY CAN!
What may also happen: Your one works, but all your little cousins decide to have a try too with less successful results. This is why outdoors is best!

This experiment came from...

The Planet Science Newsletter.