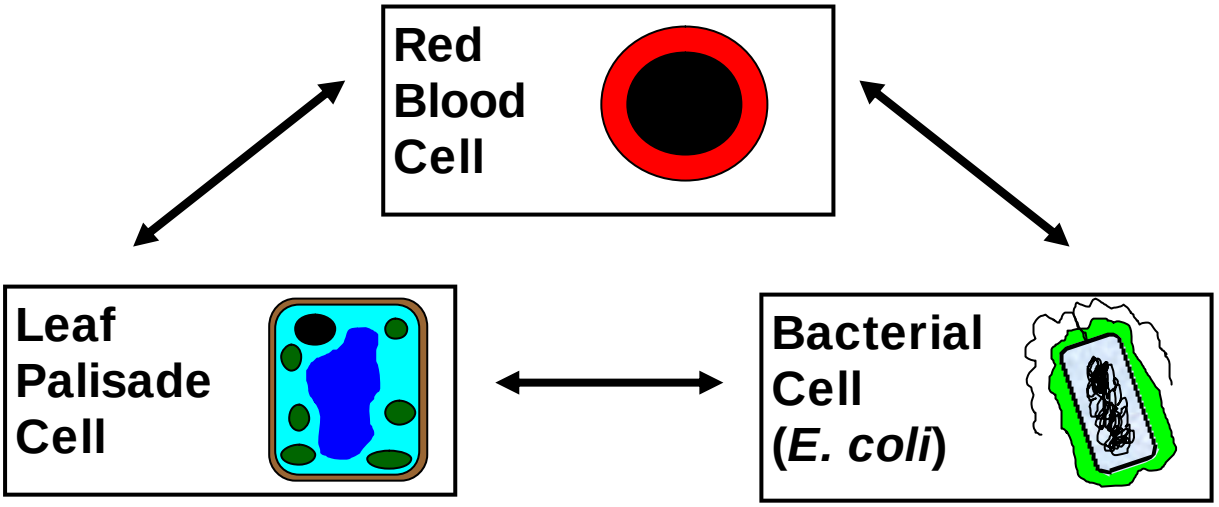
KEY IDEA: cells

Odd Cell Out

sCIENCE eNRICHMENT eXERCISES

- Look at the three types of cell below;
- Identify the odd one out;
- There are no correct answers to this problem. Find as many solutions as you can;
- Complete the table.



Odd cell out	Explanation of why the cell is the odd one out
Leaf palisade cell	*This is the only cell that has a nucleus. A red blood cell has lost its nucleus and the bacterial cell just has a string of DNA (called a bacterial chromosome)*

KEY IDEA: cells

A case against fire

sCIENCE eNRICHMENT eXERCISES

- Some fire-fighters think that fire has a life of its own;
- You have been taught about the characteristics of living things;
- Answer the questions below and build a case *against* fire being living.

- Using the 'features of living organisms' model (MRS GREN), write down the seven characteristics that *all* living things have:

- Copy and complete the following table:

Feature of living organism:	Explain how a tree fits the feature:	Explain how fire fits the feature:
Moving	*A tree moves its leaves so that they are at 90° to the Sun as it moves through the sky.*	*Fire can move from place to place if there is a fuel for it to move to.*

- Using the evidence that you have gathered, explain if there is a case for fire being described as being alive.

- Explain why the '7 features of living organisms' is only a 'good enough' model for describing what is alive (or what is not!).

- How could you modify the 'good enough' model to exclude fire?

- There is a lot of scientific debate about what is alive and what is not. Many new organisms are being found that do not fit the 'good enough' model for being alive. Use secondary sources to find out about the answers to the following questions:

Are viruses (microbes that cause disease) really alive?	Are BSE and CJD caused by a living organism?	What is a viroid and should we be worried about them?	If there is life on Mars, what should we be looking for?

KEY IDEA: cells

Microbe mayhem

sCIENCE eNRICHMENT eXERCISES

- Nav's mum watched a television program about the dangers of food poisoning in the kitchen;
- She rushed out and bought a new product from the supermarket called 'Microcide';
- Nav remembered a science lesson about problems with bacteria becoming resistant to antibiotics and antiseptics;
- You are an expert on microbes;
- Nav has written you a letter and enclosed the packaging for the 'Microcide';
- Your task is to write a letter back to him evaluating the use of these products;
- You must make sure that you answer all of his questions and give a balanced view of the use of these products.

Dear Doc,

I am really worried about this product. 'Microcide' contains antibiotics and my teacher told me that we shouldn't use too many of these because the microbes, in our kitchen, could become resistant and that would cause us loads of problems.

I am not sure what antibiotics are in 'Microcide'. I have heard of sodium hydroxide and penicillin but I'm not sure if these are antibiotics. What do all the ingredients do? What is the difference between an antibiotic and an antiseptic? Should my mum carry on using this product? Please help me...what should I do?

Nav

microcide

For external use on:
CHOPPING BOARDS
WORKSURFACES
DISHCLOTHS and SPONGES

Active Ingredients:

Ethanol (Ethyl alcohol)
Polyethylene glycol
Cetylpyridinium chloride
Tri-chloro phenol
Methyl penicillin
Chloramphenicol
Tetracycline
Sodium Hydroxide
Water

Do not consume.
For external use only.
Contains antibiotics which may cause allergic reactions.

microcide

the only good germ is a dead one!

This product is guaranteed to kill 99.9% of all known germs with its potent mix of antibiotics and antiseptics.

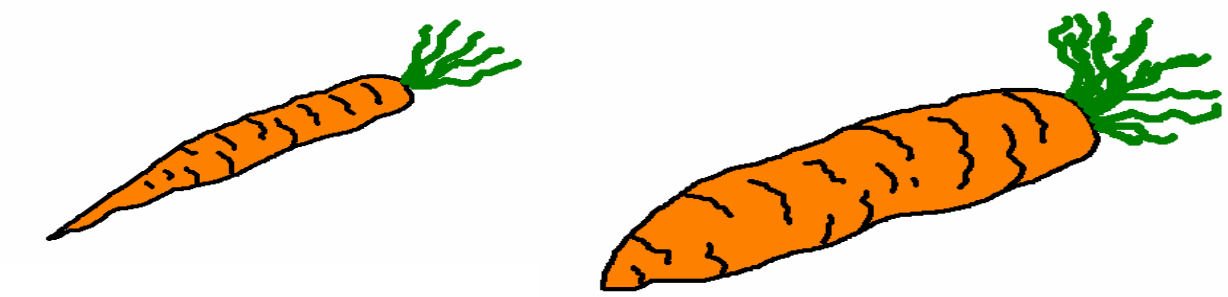
KEY IDEA: cells

Manic on organic!

sCIENCE eNRICHMENT eXERCISES

- Organic food has become very popular in the 21st century;
- Many people do not understand what is meant by organic food products;
- You will need to use some secondary sources to support this task.

- The picture below shows two types of carrot. One has been grown organically and the other has been grown as a normal intensive arable crop:



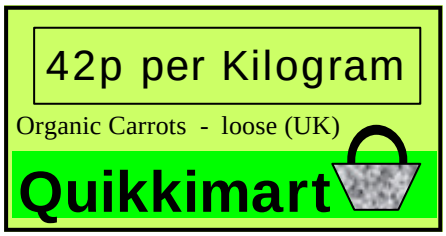
organically grown carrot

intensively grown carrot

- What is meant by the term ‘organic farming’?

- Using the carrots above, as an example, explain why the two carrots are very different.

- Look at the supermarket shelf labels below and explain the reasons for the difference:



- Explain the reasons for the following data:

Quikkimart sales year	1998	1999	2000	2001	2002
Annual sales of organic products (pounds (£))	130565	250545	567234	978556	1850003

- Is there any evidence that organic food is more healthy and environmentally friendly?

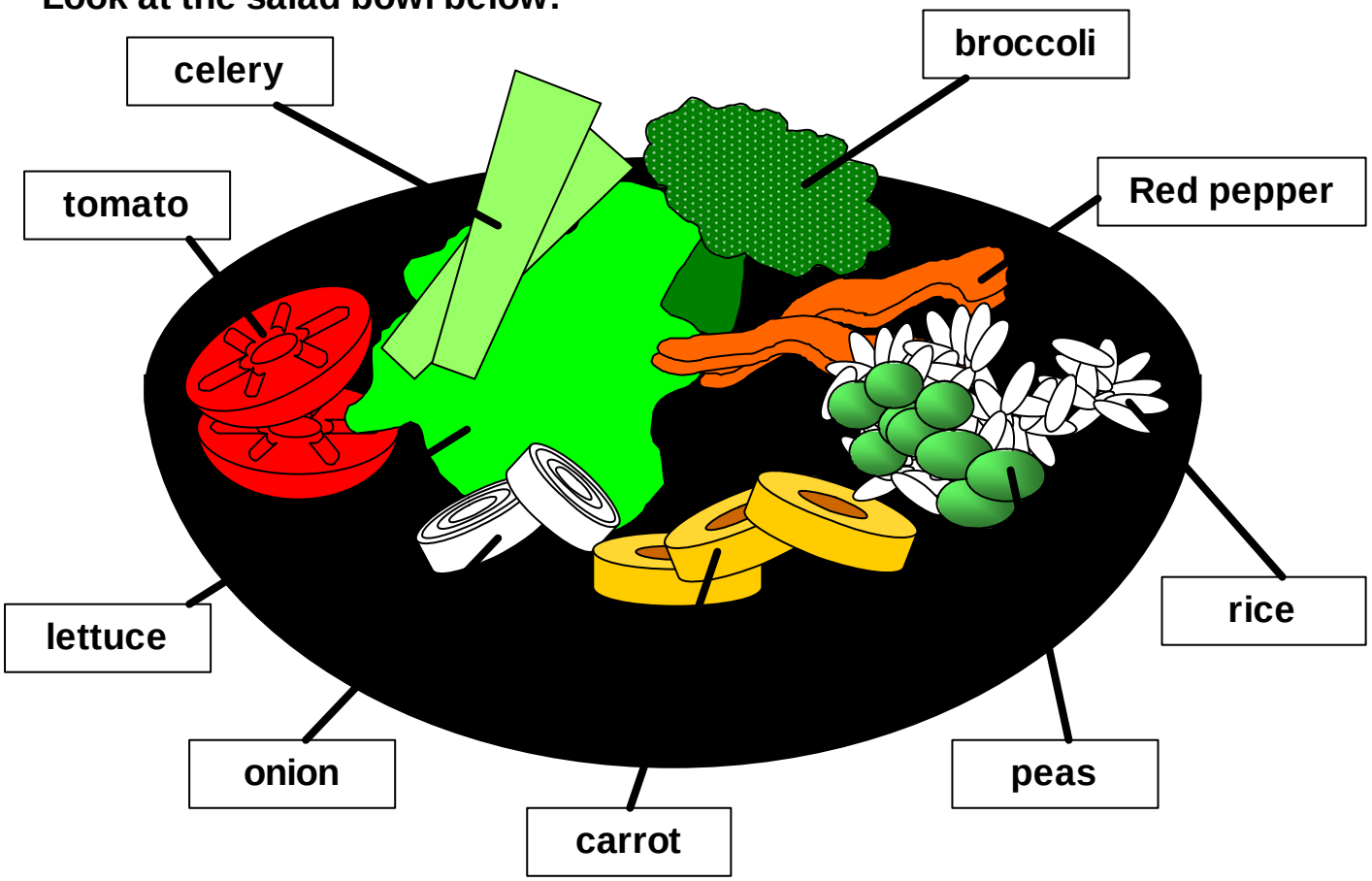
KEY IDEA: cells

Organ salad!

sCIENCE eNRICHMENT eXERCISES

- This is a research project looking at plant organs. You will need to use a range of secondary sources (including the Internet);
- There are a number of problems that you need to solve.

- Look at the salad bowl below:



- Find out which part of the plant each salad item comes from (stem, root, leaf, flower, fruit or seed.
- What is the difference between a fruit and a vegetable?
- What is the link between brussels sprouts, cauliflower, broccoli, kohlrabi and kale?
- Which of the salad bowl contents is the only fruit or vegetable that is never sold frozen, dried, pickled, canned, processed or cooked. It is only ever used fresh?
- Is it true that all vegetables are annual plants and so have to be re-grown every year?

KEY IDEA: cells

Different Christmas!

sCIENCE eNRICHMENT eXERCISES

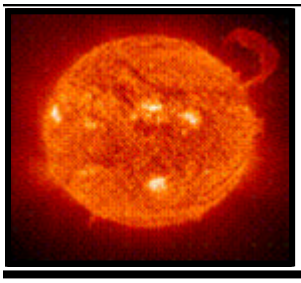
- It is now possible to have exotic fruits at any time of the year;
- Charlie wants to have strawberries for her Christmas dessert;
- She wants to grow her own, in the garden;
- She knows that it will be far too cold to grow them in her garden;
- Your task is to design a way that Charlie can grow strawberries at any time of the year;
- You must use a diagram and annotate it to explain how she can do it;
- You must explain the reasons behind your selections;
- Use the table below to record your ideas.

Design idea	Scientific reasons behind the design idea

KEY IDEA: cells

Odd One Out 1

sCIENCE
eNRICHMENT
eXERCISES



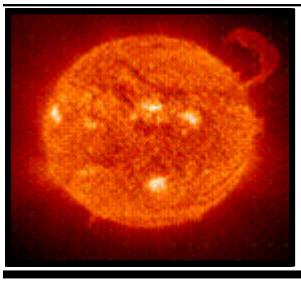
KEY IDEA: energy

Frosty the snowman

sCIENCE eNRICHMENT eXERCISES

- Year 6 students have been doing a project on insulation;
- They seem to have got a bit confused;
- Read their comments and explain who is right;
- You must evaluate each comment and explain how their science knowledge and understanding is right or wrong.

This concept cartoon is adapted from Naylor and Keogh 2000



KEY IDEA: energy

Current thinking

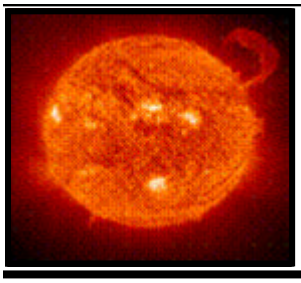
sCIENCE eNRICHMENT eXERCISES

- **Sam's teacher has described a 'good enough' model for electricity in wires;**
- **Her teacher has compared electricity to the flow of water in a river. This is called an analogy;**
- **Complete the table below to compare and contrast an electrical current and a river:**

Similarities (things that the electricity model and river analogy have in common)	Differences (things that the electricity model and river analogy do not have in common)
Rivers and electrical currents both transfer energy.	*Rivers flow at different speeds depending on the shape of the valley.*

Using the river analogy, identify which features of a river match the circuit features in the table below:

Feature of circuit	River feature	Feature of circuit	River feature
Battery or cell	The Sun	Current	
Wire		Amps	
Resistor		Voltage	
Switch		Heating and Lighting	

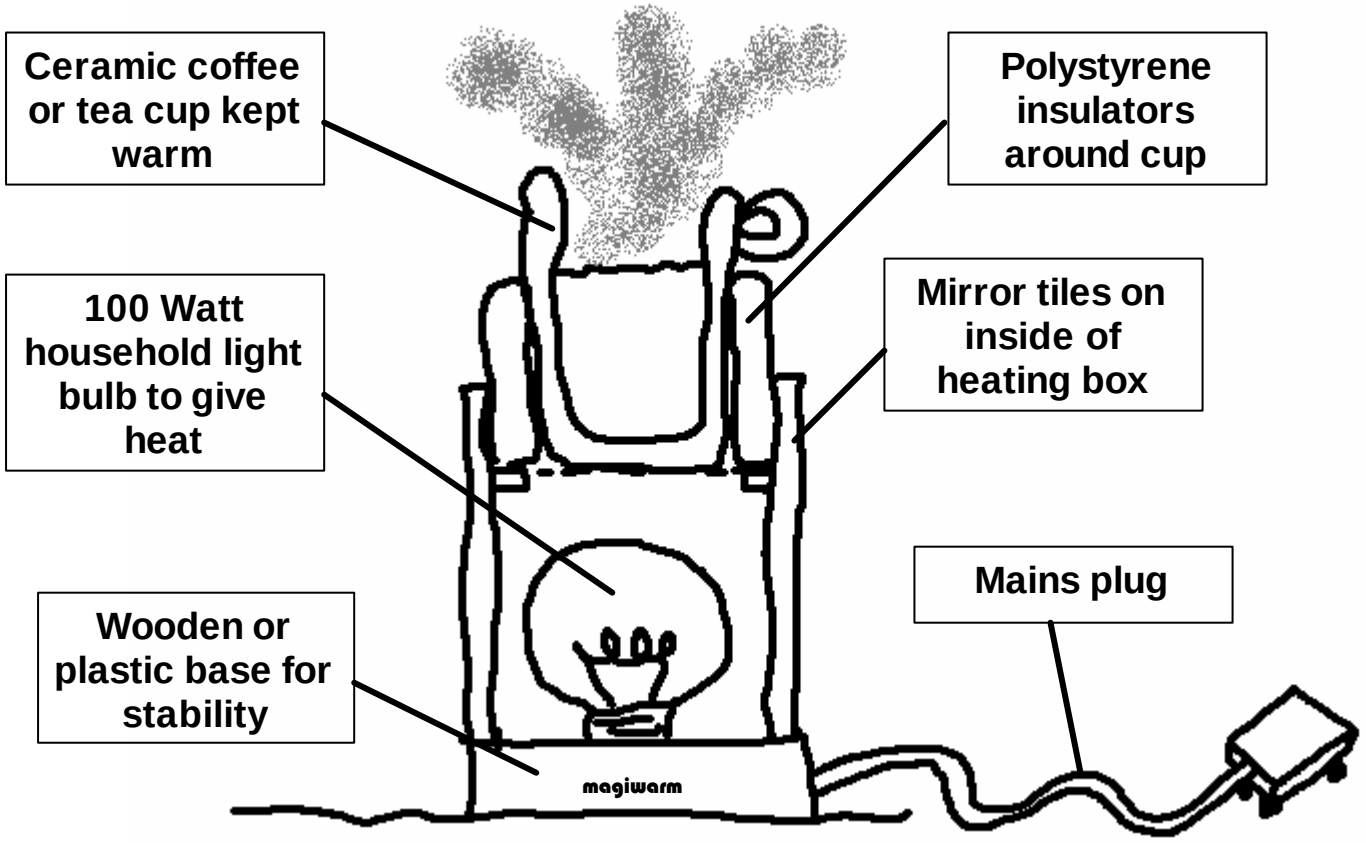


KEY IDEA: energy

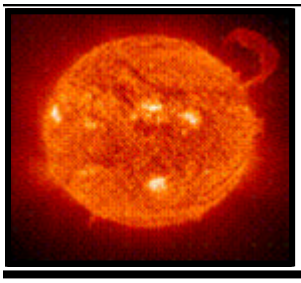
Watts going on?

sCIENCE eNRICHMENT eXERCISES

- As part of his design and technology project, Lee has designed a fantastic new invention for keeping his drinks warm. Lee has named it the MagiWarm!
- During the evaluation stage he has realised that it is very expensive to run and is thinking about a redesign to make it more economic.
- Use the information in the plan to answer the questions below:



- Explain the science behind the invention.
- Lee's friend suggests that it would be cheaper to run, if the light bulb was replaced with a strip light or an energy saving bulb. Would this be an improvement to the invention? Use your knowledge of energy transfers to help explain your ideas,
- During the evaluation phase it is found that for every kiloJoule of electrical energy supplied to the device only 150 Joules are transferred to the liquid as heating. How efficient is the Magiwarm?
- Design a more efficient way of keeping the drinks warm.



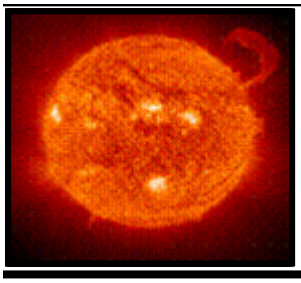
KEY IDEA: energy

To tree or not to tree?

sCIENCE eNRICHMENT eXERCISES

- Trevor lives very close to East Midlands Airport (EMA);
- He notices that they have planted lots of tall evergreen trees around the airport;
- He thinks that there is a connection.

- Explain the science behind planting trees around the runways of airports. There is more than one answer. You may want to do some research using secondary sources.
- Explain why evergreen trees (such as firs and spruces) are used.
- Describe how trees are used, in similar ways, in other places.
- Evaluate the use of trees in these ways.
- What problems might trees cause around an airport?
- Describe the uses of trees and tree products in the school.

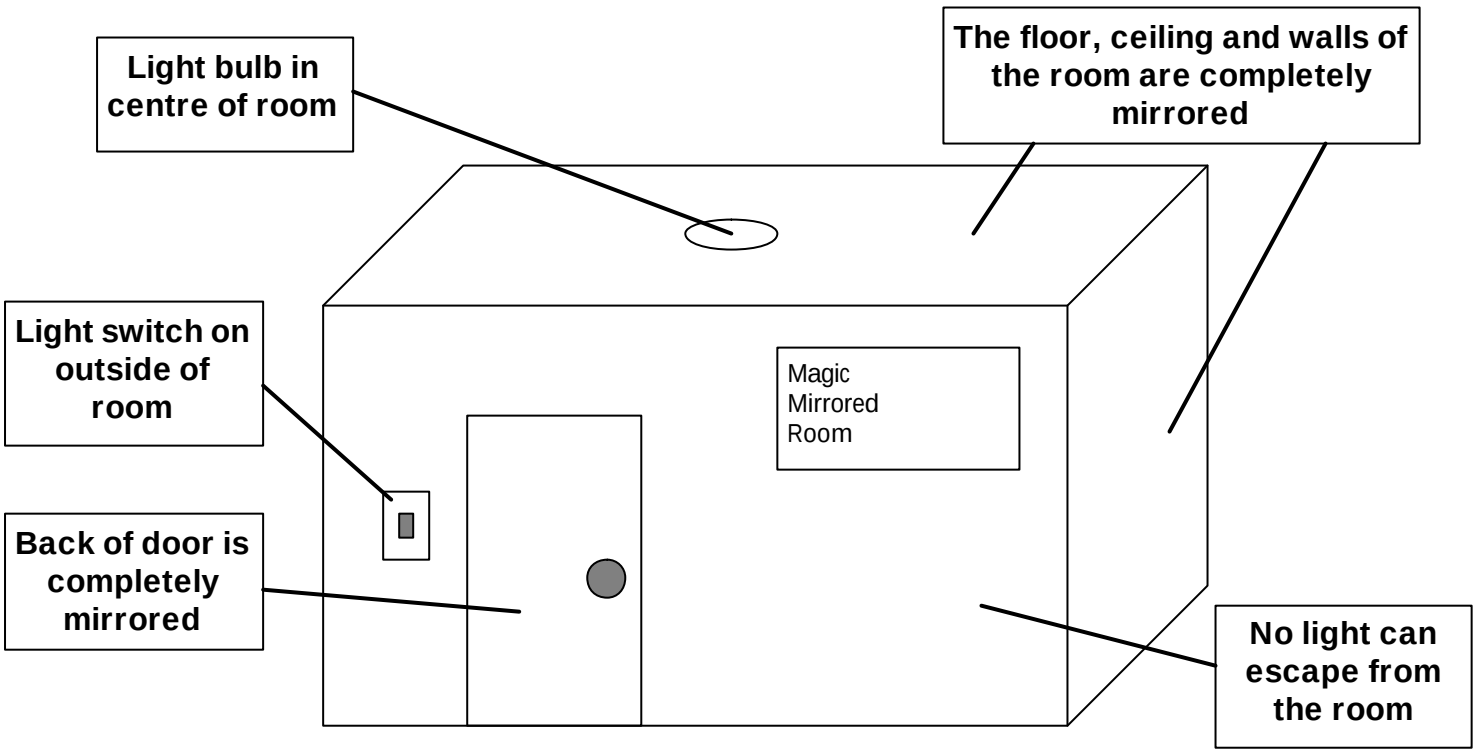


KEY IDEA: energy

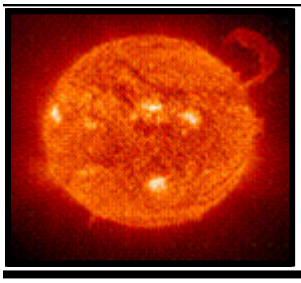
The mirrored room

sCIENCE eNRICHMENT eXERCISES

- Look at the diagram of an imaginary room below;
- Someone switches the light bulb on for 10 minutes and then turns the light off;
- Answer the questions below using science knowledge and understanding.



- Explain what will happen, inside the room, when the light is switched off.
- The light is left on for 24 hours. What happens in the room when the light is switched off?
- Explain the energy transfers that happen in the room from the moment the light is switched off.
- Where is the energy of the light bulb transferred to?
- If the room was repainted black, explain what would happen when the light was switched off.
- What would happen if more bulbs were added to the room?

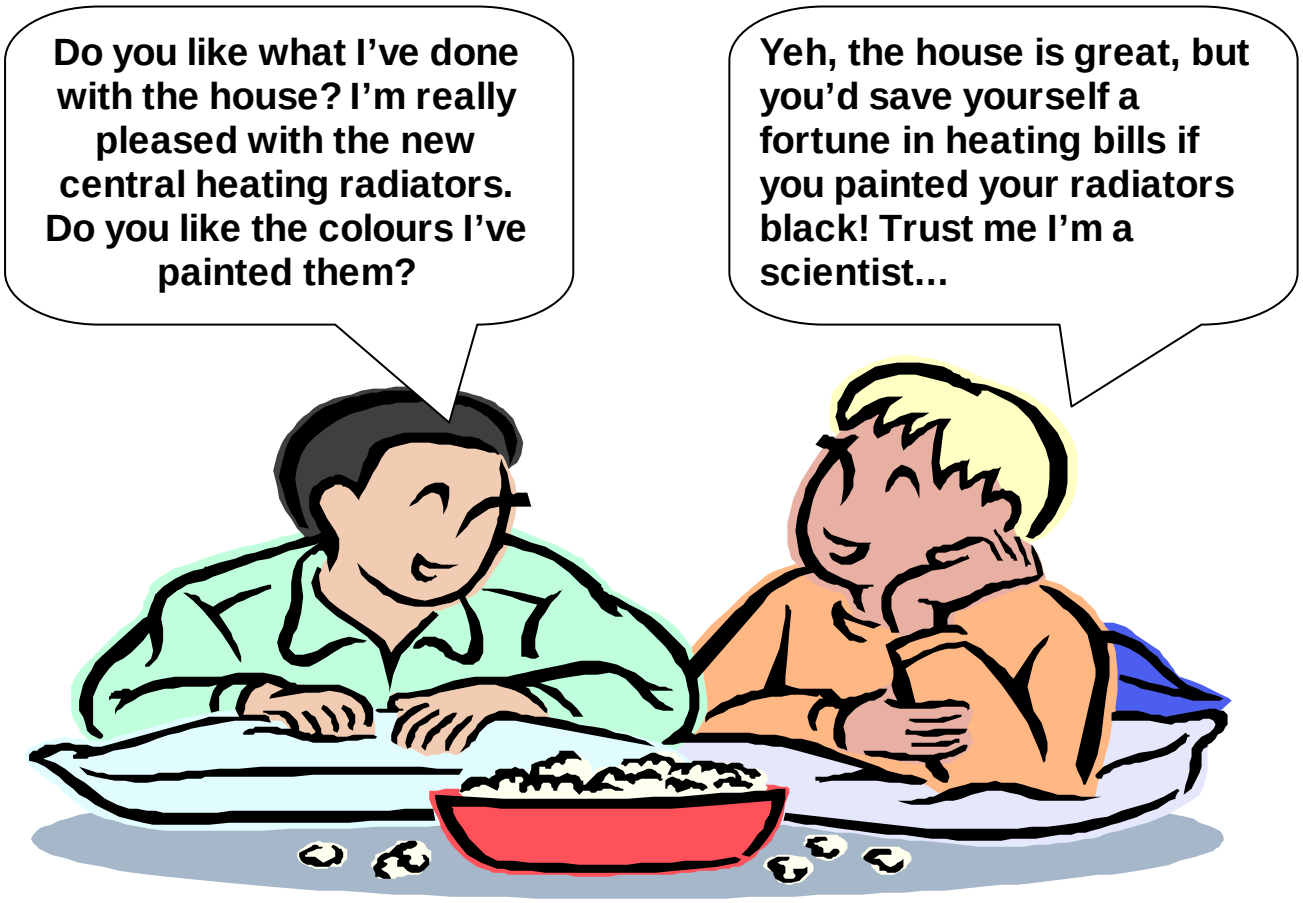


KEY IDEA: energy

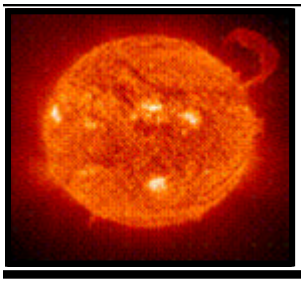
Designer radiators

sCIENCE eNRICHMENT eXERCISES

- Alex is a big fan of home improvement programmes like changing rooms;
- He has decided to modernise his front room. He has painted some of his radiators white and some silver.
- He invites his best friend (who is a scientist) round to a house warming party.



- Using your science knowledge and understanding (about heat transfer) to explain if Alex's scientist friend is right.
- Why do you think that all radiators are painted white and not black?
- Why do people who live in very hot countries tend to paint their houses white?
- People think that polar bears have white fur but this isn't true. The hairs that make up their fur are actually hollow cylinders. Their skin is black. Explain how this adaptation keeps polar bears' body temperatures above that of the environment.



KEY IDEA: energy

Odd Transfer Out

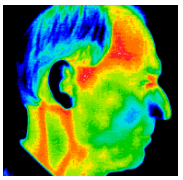
sCIENCE eNRICHMENT eXERCISES

- **Look at the three types of heat transfer below;**
- **Identify the odd one out;**
- **There are no correct answers to this problem. Find as many solutions as you can;**
- **Complete the table.**

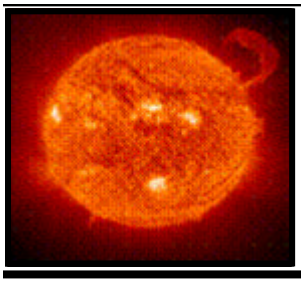
Conduction

Convection

Radiation



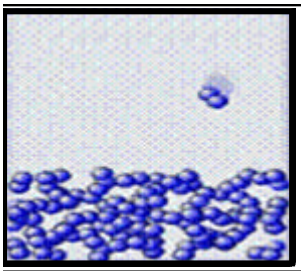
Odd transfer out	Explanation of why the transfer is the odd one out



KEY IDEA: energy

Odd One Out 1

sCIENCE eNRICHMENT eXERCISES

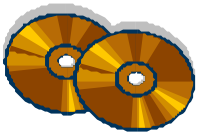
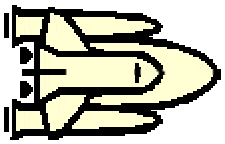
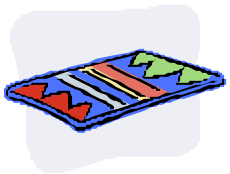
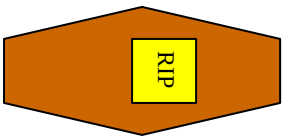


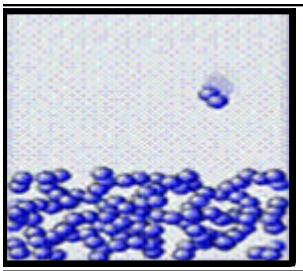
KEY IDEA: particles

Odd objects

sCIENCE eNRICHMENT eXERCISES

- This is a PMI exercise;
- This means that you have to identify the positives, the minuses and the interesting things about an object;
- Look at the objects below and do a PMI analysis for each;
- Try to come up with as many as possible.

Object	Made of	Positives	Minuses	Interesting
	Brittle toffee DVDs	• Cheap • Can eat after • Light • Appeal to children	• Get sticky • Wont last long • Very brittle • Not water-resistant	• In movies they use sugar glass for windows and bottles as it is safer
	Glass umbrella			
	Stainless steel house			
	Plastic space shuttle			
	Grass rug			
	Wooden coffee mug			
	Cardboard coffin			



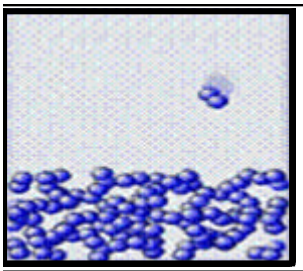
KEY IDEA: particles

Sandy solution

sCIENCE eNRICHMENT eXERCISES

- Bob has been marooned on a desert island;
- He has found three suitcases washed up on the beach;
- Your task is to solve Bob's problems by flowcharting the methods he could use. He can only use the objects listed below;
- There is more than one solution to each problem—be creative!

Problem One	In case 3 it has been a disaster. Bob needs to separate the peanuts, the sugar, the sand and the glass from each other so that he can make a cup of tea. Explain how Bob can separate each item out so that it can be used or thrown away.
Problem Two	In the summer, the little stream on the island begins to dry up. Bob gets worried that he will run out of fresh water. How can he turn seawater (salty) into fresh water (no salt)? Remember sea water will kill Boris if he drinks it.
Problem Three	Wine is a mixture of alcohol and water. Boris wants the alcohol out of the wine to help stop his mosquito bites getting infected. Wine is too dilute to have antiseptic properties.

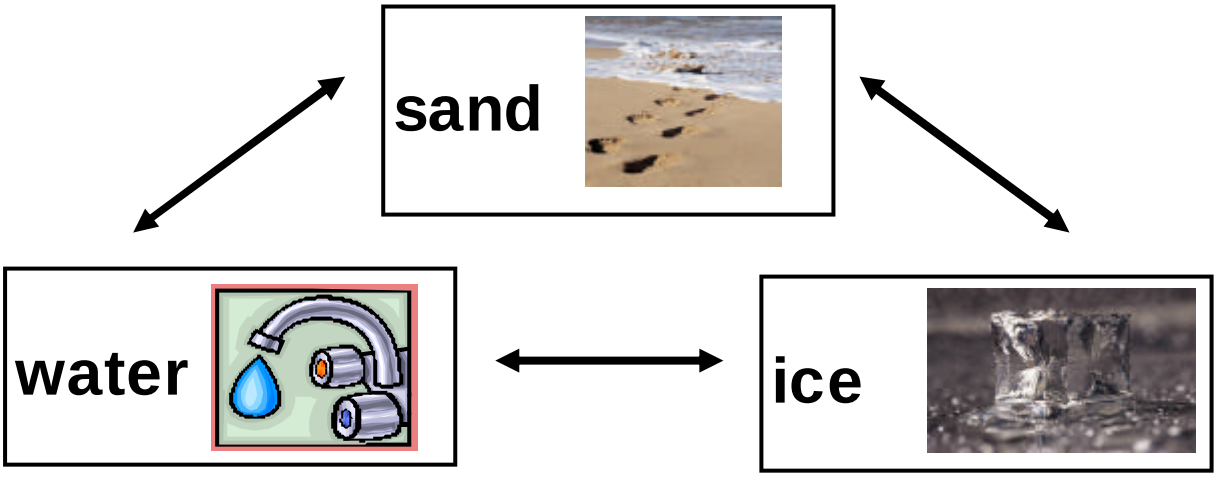


KEY IDEA: particles

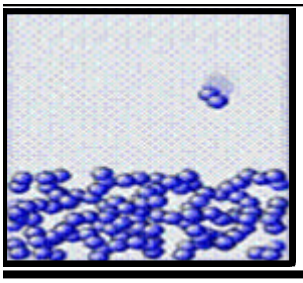
Material Madness

sCIENCE eNRICHMENT eXERCISES

- **Look at the three types of material below;**
- **Identify the odd one out;**
- **There are no correct answers to this problem. Find as many solutions as you can;**
- **Complete the table.**



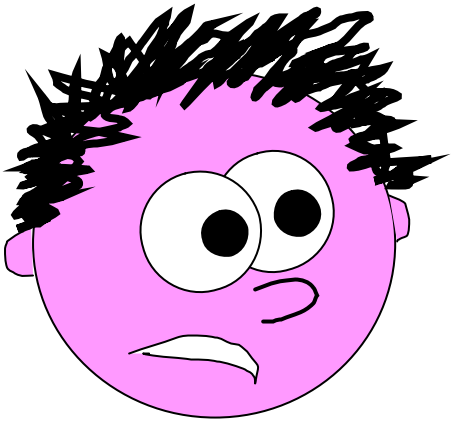
Odd one out	Explanation of why the material is the odd one out
Water	*Water is a liquid at room temperature, the others are both solids.*

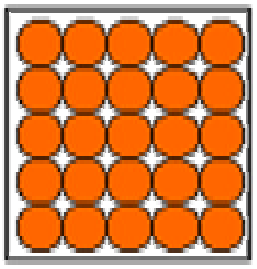


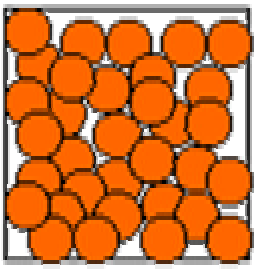
KEY IDEA: particles

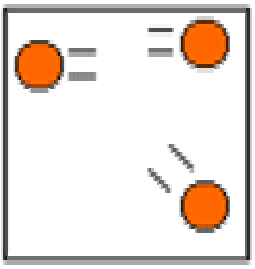
Particle puzzlers!

sCIENCE eNRICHMENT eXERCISES





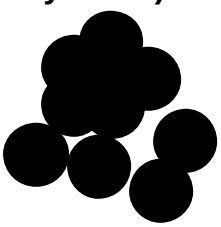




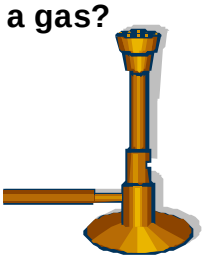
- Lee has some scientific problems;
- His teacher has described a ‘good enough’ model of what the particles look like in a solid, a liquid and a gas;
- Lee thinks that these models are not ‘good enough’ to explain his ideas;
- Evaluate Lee’s ideas against the model for particles. Is he right?

Lee’s particle puzzlers!

There can’t be any gaps between the particles in a liquid because you can’t compress them. If you could then car brakes (which are hydraulic systems) wouldn’t work!



If the particles in a solid move less when you cool them, can you cool them beyond when they stop moving? What happens when you carry on heating a gas?

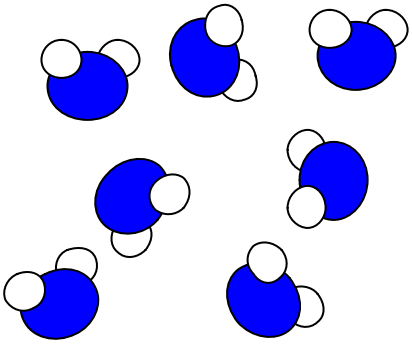


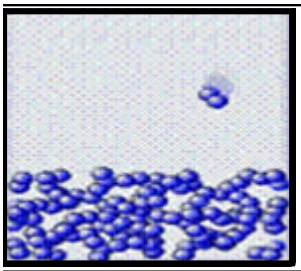
What is the difference between ice at 0°C and water at 0°C?

What would a fizzy pop look like in our particle model? Lemonade contains dissolved carbon dioxide.

How come ice floats in water if it is a solid? If its particles are closer together, it should be more dense and so it should sink!

What’s between the particles in a gas like steam?



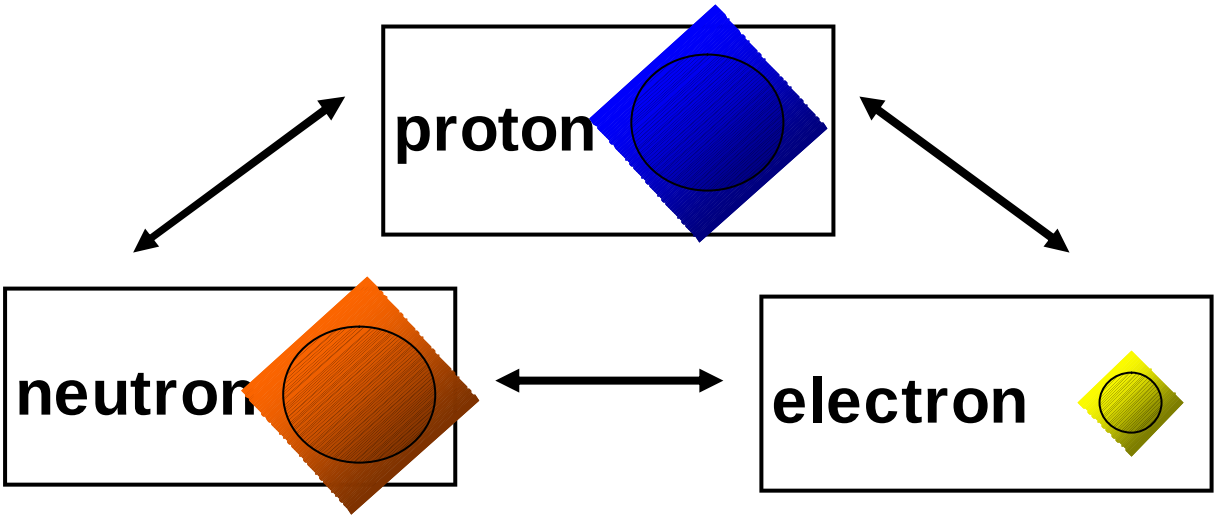


KEY IDEA: particles

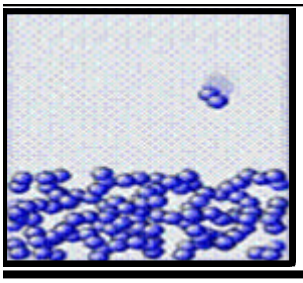
Atomic pattern?

sCIENCE eNRICHMENT eXERCISES

- **Look at the three types of sub-atomic particle below;**
- **Identify the odd one out;**
- **There are no correct answers to this problem. Find as many solutions as you can;**
- **Complete the table.**



Odd one out	Explanation of why the sub-atomic particle is the odd one out
electron	*This is a negative particle. The proton is positive and the neutron does not have a charge.*



KEY IDEA: particles

What a state to be in!

sCIENCE eNRICHMENT eXERCISES

- **Whenever we draw 'good enough' particle models we always forget to write down the temperature that they are drawn at;**
- **The temperature of a material is very important in working out what state the material will be in;**
- **A data table showing melting and boiling points for some materials is given;**
- **Use your scientific knowledge to answer the problems below:**

Name of material	Element or Compound	Melting point (°C) *Solid to liquid*	Boiling point (°C) *Liquid to gas*
Aluminium	Element	660	2470
Hydrogen	Element	-259	-252
Mercury	Element	-39	357
Water	Compound	0	100
Salt	Compound	801	1413
Alcohol	Compound	-117	79

What state will the materials in the data table be on the Earth?

Average daily temperature on Earth is:

18°C

What state will the materials in the data table be on Mercury?

Average daily temperature on Mercury is:

305°C

What state will the materials in the data table be on Venus?

Average daily temperature on Venus is:

459°C

What state will the materials in the data table be on Mars?

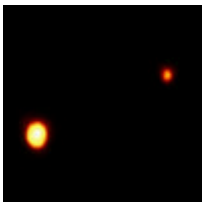
Average daily temperature on Mars is:

-80°C

What state will the materials in the data table be on Saturn?

Average daily temperature on Saturn is:

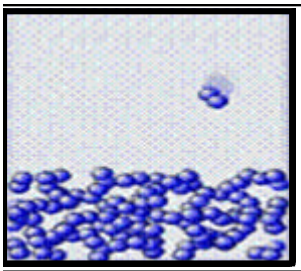
-176°C



What state will the materials in the data table be on Pluto?

Average daily temperature on Pluto is:

-265°C



KEY IDEA: particles

Solution to a solution

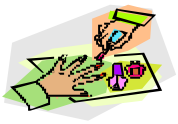
sCIENCE eNRICHMENT eXERCISES

- We use solvents and solutions every day;
- You will probably need to use some secondary sources;
- Using your scientific knowledge of solvents and solutions, solve the problems below:

- Fill in the correct spaces in the table below:

Name of solution	Solute(s)	Solvent
Sea water		
Coffee with sugar		
Sugar free fizzy pop		
Ink		

- Explain the following observations using scientific answers:

	Water will not remove chewing gum from clothes or the carpet but *trichloroethane* solvent will.
	Nail varnish is designed to be insoluble in water but will dissolve in *acetone* solvent.
	Children's felt-tip pens are made with water soluble ink. Most pen inks are insoluble in water.

- Look at the labels on the following products and work out what the solvent, solute(s) and solutions are called:

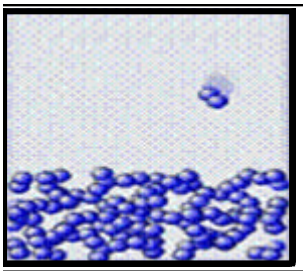
INGREDIENTS

Orange juice from concentrate (50%), sugar, water, citric acid, flavourings, preservatives (potassium sorbate and sodium metabisulphite.

Ingredients:

Ethanol (Alcohol), Butane, Isobutane, Propane, Aqua, Perfume, Isopropyl myristate, Triclosan.

Active Ingredients:
Sodium Monofluorophosphate 0.76% w/w (1000ppm)
Sodium Fluoride 0.1% w/w (500 ppm)
Other Ingredients:
Dicalcium phosphate dehydrate, sorbitol, carboxymethyl cellulose, sodium lauryl sulphate, sodium saccharin, sodium benzoate, spearmint flavour, aqua purified.



KEY IDEA: particles

Cryptic clues

sCIENCE eNRICHMENT eXERCISES

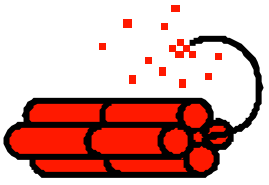
- Read the following paragraphs;
- Each paragraph describes something related to the topic of particles;
- Each clue is in a cryptic form;
- You must be able to explain how you came to your answer!

I can be dangerous and destructive if I am not handled properly. Water and I don't get on very well and our meetings always get heated. I indicate my presence by turning red. What am I?

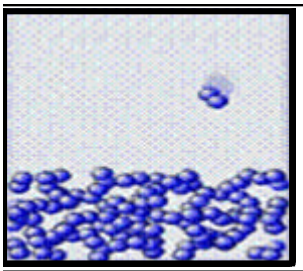
I am very impatient and like to get a move on. Although my presence is important for things to change quickly, I myself stay the same. Living things have a version of me. I can be found exhausted on cars! What am I?

I could write my own story because I took the place of the lead. Am I 12 or 14? When I bond to myself strongly, I could be a girls best friend. I have dated mummies and dinosaurs! What am I?

My friends are K and P. I am responsible for most of the atmosphere in an argument but you can see straight through me. My life goes in cycles and I'm explosive in the right proportions. What am I?



Red Cabbage or Blue?
It depends on you!
You'll see me in the paper.

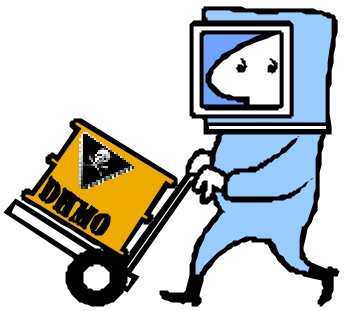


KEY IDEA: particles

Ban dihydrogen monoxide!

sCIENCE eNRICHMENT eXERCISES

- **Read the information about the compound below;**
- **Your task is to evaluate the evidence and decide whether or not dihydrogen monoxide should be banned;**
- **Present your ideas in the form of a letter to your local environmental health department. You will find the address in the telephone directory.**



Dihydrogen monoxide (DHMO) is a colourless, odourless and tasteless chemical compound. It is also called hydrogen hydroxide, hydronium hydroxide, or, more simply, hydric acid. Every year, over 3000 people are killed in the United Kingdom; Most of these deaths are caused by accidental inhalation of DHMO. Prolonged exposure to the solid form of DHMO causes irreparable tissue damage. Symptoms of DHMO ingestion can include excessive sweating and urination. The kidneys, skin and lungs try to excrete the toxin. Other symptoms include nausea, vomiting and body electrolyte imbalance. For those who have become dependent, DHMO withdrawal means certain death.

DHMO is a major component of acid rain. It is also thought that DHMO contributes to global warming. In all forms, DHMO accelerates the corrosion, oxidation and rusting of many metals. DHMO has been linked to at least 30% of all electrical failures and is a major contributing factor in decreasing the effectiveness of car brake systems. DHMO has even been found in the tumours that have been removed from cancer patients. A recent research paper has shown that DHMO could be involved in killer tornadoes and flooding across the world.

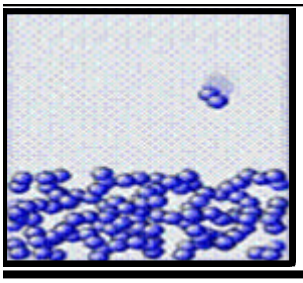
Contamination of the Earth by DHMO is reaching epidemic proportions. Quantities of DHMO have been found in almost every stream, lake and reservoir in the UK today. The pollution is global and traces of DHMO contaminant have been found in the Antarctica ice. Scientists have also found that DHMO is entering food chains and they believe that DHMO is becoming the number one environmental pollutant of the 21st century. Studies have shown that even after careful washing, food and produce that has been contaminated, still contain dangerous amounts of the toxin.

Despite the dangers, DHMO is used as an industrial solvent and coolant. DHMO is used in nuclear power stations and was largely responsible for the 1986 Chernobyl nuclear disaster. It is used as a fire retardant, an additive to 'junk-food' products, as a performance enhancer in sports, in many forms of cruel animal research, in the distribution of pesticides and in the manufacture of chemical and biological weapons.

Companies dump waste DHMO into rivers and the ocean. Nothing can be done to stop them because this practice is still legal in the UK. The impact on wildlife is extreme and we cannot afford to ignore this issue any longer.

The British Government has refused to ban the production, distribution, or use of this damaging chemical due to its 'importance to the economic health of this nation'. In fact, the navy and other military organisations are conducting experiments with DHMO. One such project (Project O) has been set up to design a device to control and use DHMO during conflict situations. Hundreds of military research facilities receive tonnes of DHMO through a highly sophisticated underground distribution network. Many store huge quantities for later use. It is thought that Saddam Hussein was stockpiling DHMO for use against the rest of the world.

It is not too late to prevent further contamination. Whenever you are dealing with any product or food that you suspect may be contaminated with DHMO, exercise caution. Low levels of DHMO contamination are unavoidable. Remember, don't panic. Write to your local MP…..We must act now!



KEY IDEA: particles

Odd One Out 1

sCIENCE
eNRICHMENT
eXERCISES

KEY IDEA: forces

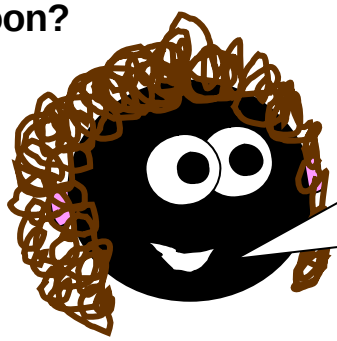
Where's the sun gone?

sCIENCE eNRICHMENT eXERCISES

- In this activity you will be looking at eclipses;
- There are two types of eclipse: a solar eclipse and a lunar eclipse;
- Solar eclipses are quite common but lunar eclipses happen much more often;
- Use your science knowledge to solve the problems.

- The picture on the right shows an annular solar eclipse in Africa. You can see the different phases of the eclipse. How do you think scientists got this image?
- What's the difference between a total, partial and annular solar eclipse?
- Why do the Sun and the Moon look about the same size in the sky even though the sun is about 400 times bigger than the Moon?

megan



If I visited another planet in another Solar System, would they have total solar eclipses like the Earth?

- Answer Megan's question using your scientific knowledge of total solar eclipses.
- Copy and complete the following table to compare and contrast a solar and a lunar eclipse:

Things that a solar and lunar eclipse have in common	Things that are different in a solar and lunar eclipse

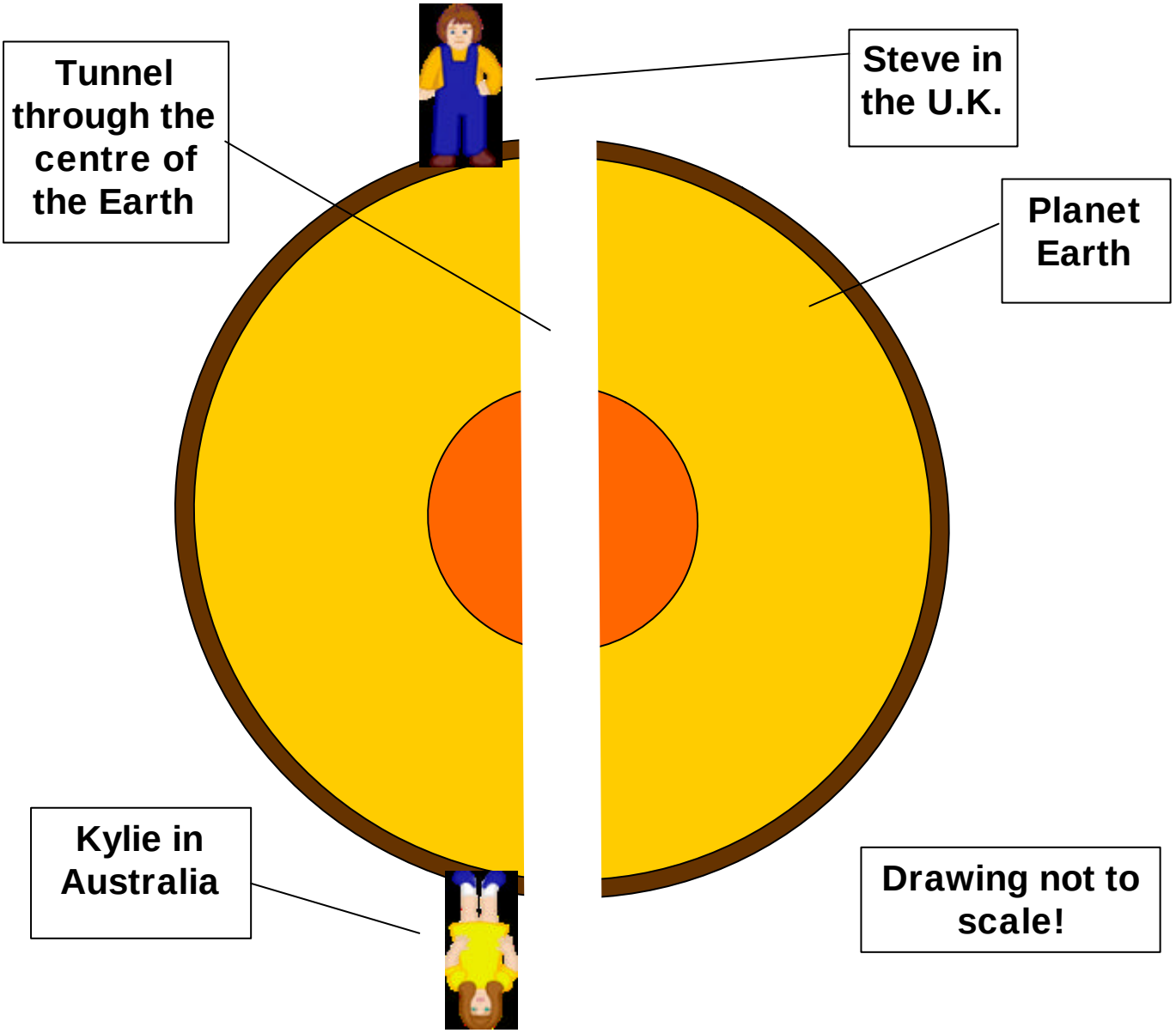
- Find out how ancient civilisations (such as the Egyptians and Chinese) explained solar eclipses.

KEY IDEA: forces

The fall guy!

sCIENCE eNRICHMENT eXERCISES

- Sometimes our model of the world causes us problems when we look at odd situations;
- Look at the picture of the Earth below and answer the questions below:



- Describe what, a non-scientist would say, happened if both Steve and Kylie jumped into the tunnel at the same time. Ignore the fact that it is very hot in the centre of the Earth.
- Explain what would really happen when Steve and Kylie jumped. How does this problem help to explain the idea of 'centre of gravity'?
- Which way is up and which way is down on the model above?

KEY IDEA: forces

All in a spin…

sCIENCE eNRICHMENT eXERCISES

If the Earth is spinning then why don't we get dizzy?

If the Earth is going around the Sun then why can't we feel it?

- **Lee has got all confused. His teacher has taught him about the Earth and Solar System but it has all got jumbled up;**
- **Write a letter to Lee explaining why he does not get dizzy and why we can't feel the Earth moving.**
- **Make sure that you use scientific terms.**

- **The picture on the right was taken (at night) using a very long exposure. This means that the camera shutter stays open for a long time (in this case it was for 2 hours).**
- **What has caused the patterns in the sky?**

- **Find out the following facts from secondary sources:**

  How fast does the Earth spin?
  How fast does the Earth move around the Sun?
  How fast does the Solar System move through the Milky Way?

KEY IDEA: forces

Parachute competition

sCIENCE eNRICHMENT eXERCISES

- Your task is to judge your local primary school's annual science competition;
- The competition is to design and build the best parachute;
- The school has sent you some information to help you decide the winner for the best parachute.

Success criteria:

- Write a letter to the headteacher (Mrs. Jones) thanking her for asking you to be a judge. In your letter explain which observations were helpful and which were not;
- You should also explain how you came to your decision about which group is the winner;
- You should include a suggestion for a more organised way that the results could be recorded before they are sent to you;
- Write a set of rules for next year's competition so that it is a fair test and make it easier to judge the winning team.

Swannington Primary School parachute competition 2003 results:

Team 1: Sarah and Lana The parachute was dropped from the playground climbing frame and took 3 seconds to hit the ground. The parachute was a square with sides of 10 cm and made of graph paper.	**Team 2: Bonnie and Megan** The parachute was made from a cotton shirt and was a circle drawn around a large plate. The weight was an action man figure and it took 1.5 seconds to hit the ground.	**Team 3: Lee and Bailey** This parachute was dropped from the top of the stairs. It took 5 seconds to hit the ground. The parachute was an oblong square with sides of 75 cm. It was made of newspaper.
Team 4: Ellie and Cassie The parachute was a sheet of graph paper with sides of 25 cm and 20 cm. The weight on the parachute was a blob of plasticene. It was dropped from 2 metres. It took 2.67 seconds to hit the ground.	**Team 5: Maddy and Ron** The parachute was a circle of plastic carrier bag with a radius of 30 cm. A mass of 2.5 Newtons was used. The parachute was dropped from the top of the stairs (a height of 3.5 metres). The fall took 5.25 seconds. A small hole was cut in the centre of the parachute.	**Team 6: Mike and Paul** This team used a triangle shaped parachute cut out of a nylon bed sheet. The team used a 5g ball of plasticene. The team dropped the parachute from the top of the slide in the playground. It took about 4 seconds to fall.

KEY IDEA: forces

A world without friction

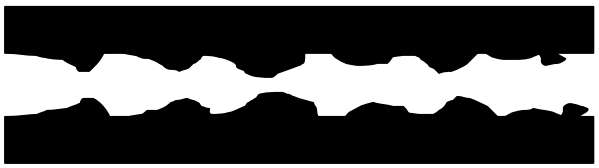
sCIENCE eNRICHMENT eXERCISES

- **Friction is a very important force. Without friction, life would be very difficult.**
- **Friction is very useful but it can also be a problem!**
- **Complete the table below making sure that you give examples.**

Ways that friction is very useful to us	Ways that friction is not useful to us
In the brakes of cars when the pads grip onto the discs.	***When roads get very icy or wet there is less grip and so there are more accidents***

- **Using the ideas from above, write a story about a day in your life if the force of friction suddenly disappeared;**
- **Try to split the story up into episodes.**

- **Scientists had a model for friction. This model is in a lot of textbooks. It is now thought to be very wrong. The model says that friction is caused by microscopic bumps on the surfaces of objects:**



high friction

low friction

- **What is the new model?**

KEY IDEA: forces

Moon Olympics 2200

sCIENCE eNRICHMENT eXERCISES

- This is a PMI exercise;
- This means that you have to identify the positives, the minuses and the interesting things about an issue;
- Look at the issue below and do a PMI analysis of it;
- Try to come up with as many as possible.

- Look at the television schedule on the right. It is taken from a TV guide in 2200;
- Read through it and think about how the Olympics might be affected by being staged on the Moon;
- The Olympics are being staged in a colony on the Moon. This is like a giant dome.
- Fill in the PMI analysis form below.

ITV46

SKY 2246 NTL 2246/2 Moon 46

1.30 Granderstand

An afternoon of live coverage from the 2200 Moon Olympics 1456665
1.35, 3.50 High Jump
2.10, 4.15 Long Jump
2.25, 4.30 Men's 100m hurdles heats
4.40 Javelin
5.00 Women's 100m hurdles final
5.25 Men's Weightlifting final
5.40 Football Final (Eurasia vs USA)
7.15 Golf

- Following programmes may run late

Positives	Minuses	Interesting

KEY IDEA: forces

Solve me if you can!

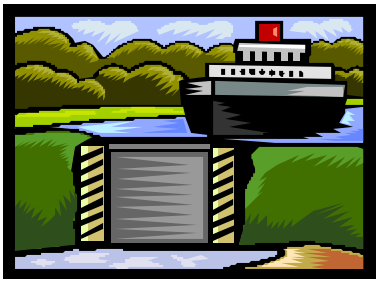
sCIENCE eNRICHMENT eXERCISES

- There are four problems below;
- These are very difficult scientific problems;
- To solve them you must use your common sense and science ideas;
- You must make sure that you explain how you came to your answers.

Bob works for a pet shop. He has been asked to transport twenty parrots to a shop in France. As he is about to go through the Eurotunnel he is stopped and his van is put on a large set of very accurate scales. The parrots are all sitting on their perches. Suddenly, a train roars past and blows its horn. All the parrots fly off their perches and they start flying around the van. Does the total weight of the van and parrots change?

It was little Dee's birthday. She was six years old. She had a great party at McRonalds. She was really pleased that she got loads of presents and loads of helium balloons. When the party was finished, they went home in the car. Her dad put all the balloons in the back of the car. When her dad started accelerating forward, the helium balloons moved from the back into the front of the car! Explain why this happens.

Sarah has just bought a brand new car. It is a convertible. She picks up her best friend Louise and they go off for a drive. As they are going down the motorway, Louise throws a golf ball straight up in the air. Draw a diagram to show what will happen to the golf ball. Where will it land? Make sure that you label all of the forces on the diagram.



Rosie and Jim have a business transporting scrap iron down the canals. They have their own canal barge. One day, they get stuck in the locks. Jim thinks that they are too heavy so he decides to unload some of the iron. If Jim throws the iron off the boat, into the lock water, what happens to the level of the water in the lock?

KEY IDEA: forces

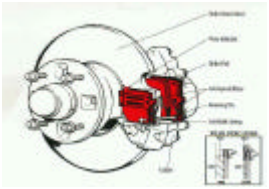
Odd Force Out

sCIENCE eNRICHMENT eXERCISES

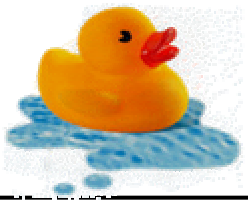
- **Look at the three types of force below;**
- **Identify the odd one out;**
- **There are no correct answers to this problem. Find as many solutions as you can;**
- **Complete the table.**

Weight

Friction



Upthrust



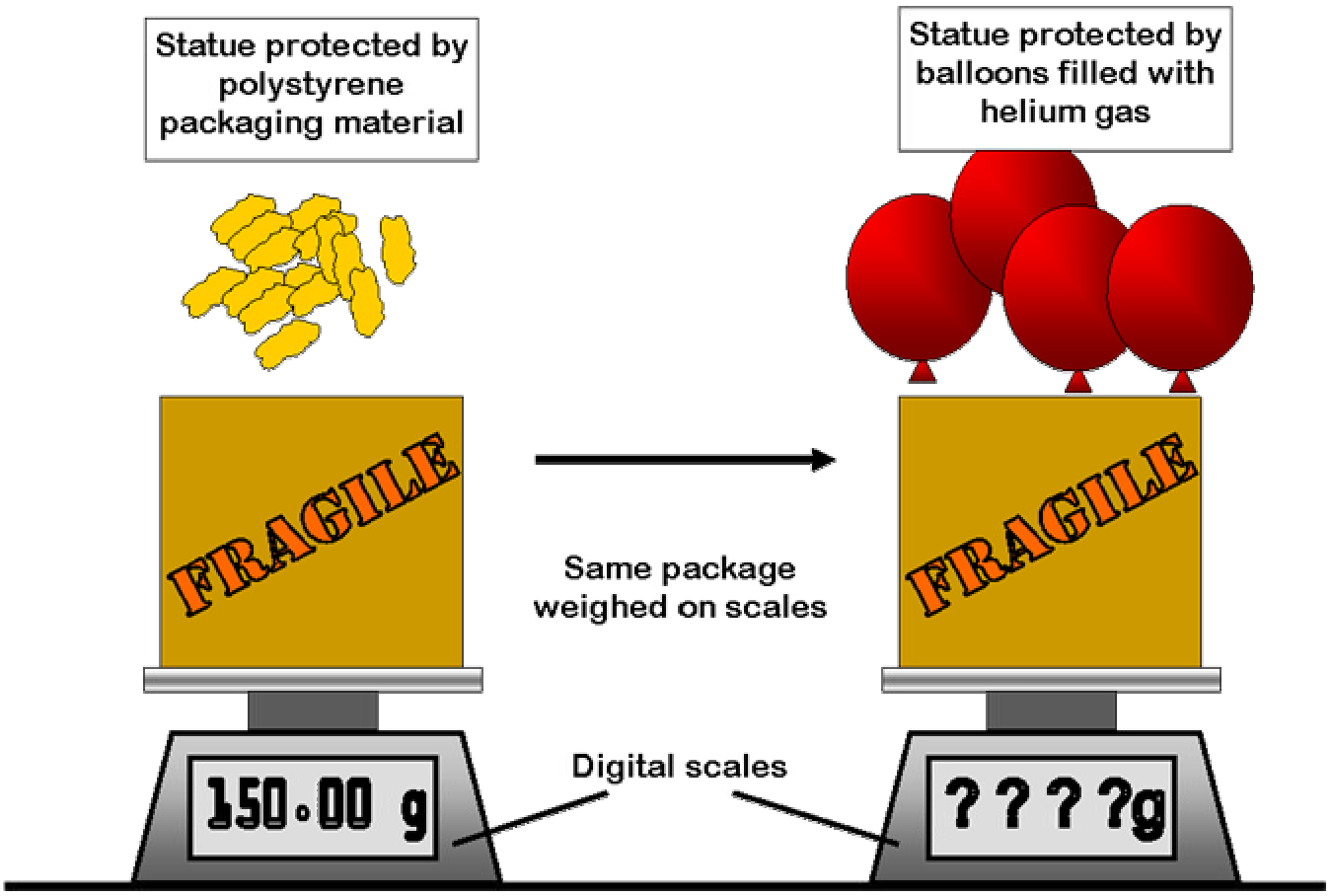
Odd force out	Explanation of why the force is the odd one out

KEY IDEA: forces

Balloon bother

sCIENCE eNRICHMENT eXERCISES

- **Bob wants to send a priceless statue to Australia;**
- **He has to send it by air mail;**
- **The cost is based on the weight of the package;**
- **Look at the picture below and then have a go at the teasers!**



- **What do you think will be the reading on the scales with the helium balloons?**
- **Explain why you have come to this answer.**
- **What is the difference between weight and mass?**
- **The plane stops off at Singapore on its way to Australia. All the cargo is taken off the plane and reweighed. Will there be any difference between the weight in London and the weight in Singapore? Explain your answer.**
- **An inventor develops helium filled bubble wrap. He claims it will save airline companies millions of pounds. Evaluate the use of helium bubble wrap.**
- **Hydrogen is a cheaper gas than helium to manufacture. Why is hydrogen cheaper to produce. Evaluate the use of hydrogen in bubble wrap.**

KEY IDEA: interdependence

Habitat theme park

sCIENCE eNRICHMENT eXERCISES

- You are a theme park designer.
- You have been asked to design a theme park based on animal habitats and ecosystems.
- The park has five areas: a desert, an arctic, a river, an ocean and a rainforest.
- Your plan should be in the form of an A3 annotated diagram;
- Read the success criteria below to find out what you must and could do:

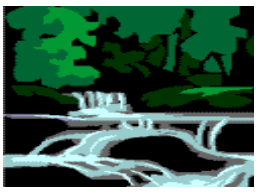
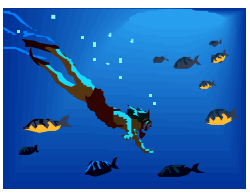
Success criteria:

You must:

- Use secondary sources to research habitats and theme parks;
- Prepare an A3 design for the theme park. It should be annotated to explain the different themed areas;
- Devise a name for your park;
- Explain in detail the conditions for each habitat;
- Name the types of animals and plants found in each habitat.
- Explain why schools could use the theme park to help them with their studies;

You could:

- Design a major ride for each area;
- Build a model of your theme park;
- Produce a leaflet to give to visitors when they arrive at the park to tell them about the attractions;
- Design a worksheet that students could use in your park.

				
ArcticLand	**RiverLand**	**OceanLand**	**DesertLand**	**ForestLand**

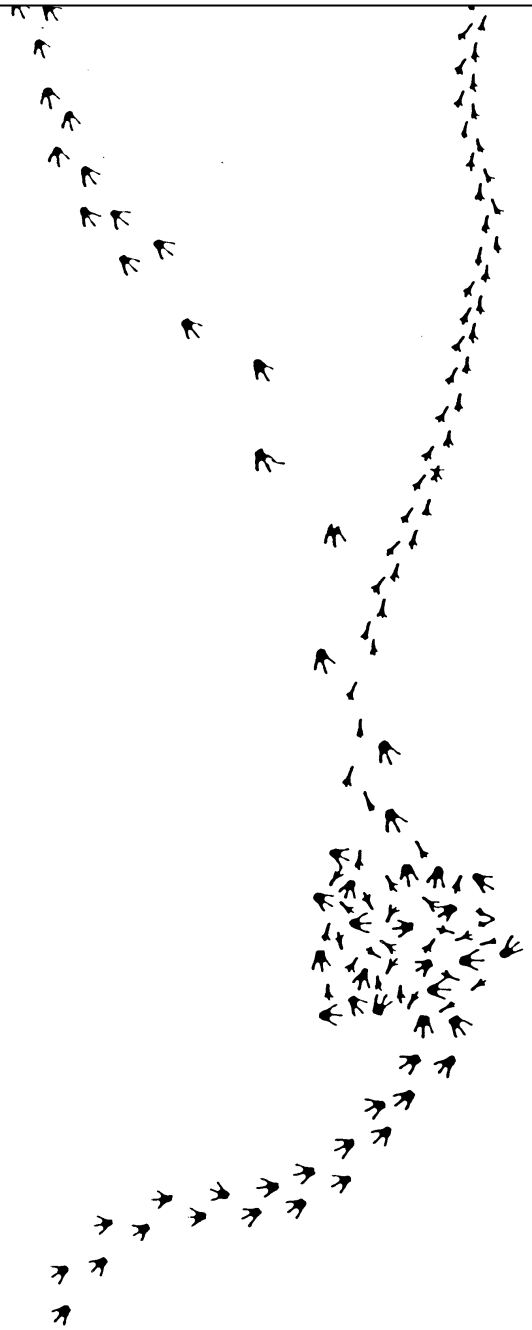
KEY IDEA: interdependence

Tricky tracks

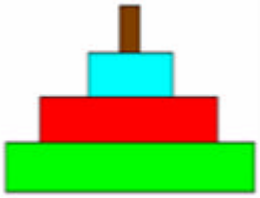
sCIENCE eNRICHMENT eXERCISES

Success Criteria:

- I can identify the pattern in a series of animal tracks;
- I can describe more than one pattern in a series of tracks;
- I can explain each step in my thought process;
- I can discuss my pattern with another person.



What do you think the tracks actually show?



KEY IDEA: interdependence

Dodgy relationships

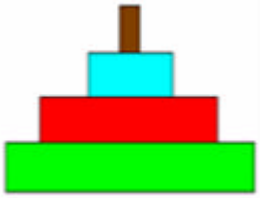
sCIENCE eNRICHMENT eXERCISES

- Most people can only remember one relationship between living organisms. This relationship is predator—prey;
- There are many more types of relationship that exist in nature;
- In this exercise you will be looking at organism relationships and making analogies with those of human relationships;
- You will need to research the following relationships:

  parasite-host mutualism commensalisms symbiotics competition

- Complete the table below:

	Biological Relationship	Key Features	Human relationships
	**Predator-Prey**	• • • •	**Bully-victim**
	**Parasite-Host**	• • • •	**Teenager-Parent**
	**Mutualism**	• • • •	
	**Commensalism**	• • • •	**Teacher-Pupil**
	**Symbiotic**	• • • •	
	**Competition**	• • • •	

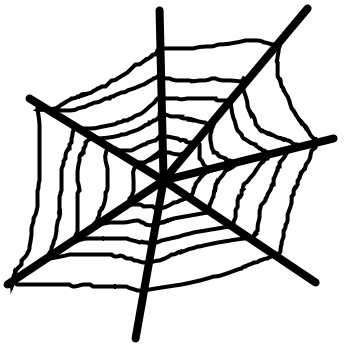


KEY IDEA: interdependence

Arctic food web

sCIENCE eNRICHMENT eXERCISES

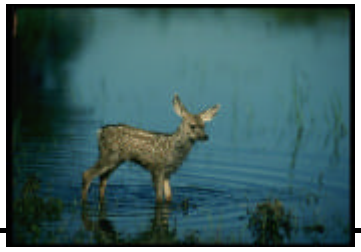
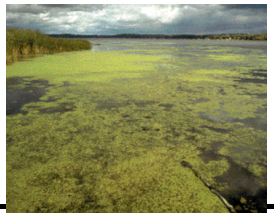
- In this exercise you are going to be building a food web;
- A food chain is built up of lots of food chains that inter-link;
- The list below shows some of the food chains in an arctic ecosystem;
- You will need a large sheet of paper, a marker pen and the organism cards.

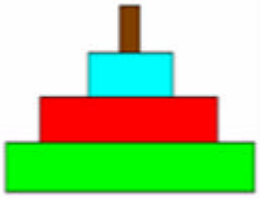


Moss ⇨ Snowshoe Hare ⇨ Arctic Fox
Moss ⇨ Snowshoe Hare ⇨ Arctic Lynx
Lichen ⇨ Lemming ⇨ Snowy Owl
Lichen ⇨ Vole ⇨ Eagle
Moss ⇨ Deer ⇨ Arctic Lynx
Algae ⇨ Squid ⇨ Seal ⇨ Polar Bear
Algae ⇨ Cod ⇨ Seal ⇨ Polar Bear
Moss ⇨ Lemming ⇨ Arctic Lynx
Lichen ⇨ Vole ⇨ Snowy Owl
Algae ⇨ Cod ⇨ Human
Algae ⇨ Cod ⇨ Eagle
Lichen ⇨ Deer ⇨ Arctic Lynx

Describe and explain what would happen to the food web if:

- Britain, Norway and Russia continue to fish Cod, even though their numbers are very low;
- Russia continues to dump pesticides and radioactive material in the Arctic Ocean;
- A severe winter kills off 50% of the Arctic Lynxes.

Moss 	Snowshoe Hare 
Arctic Lynx 	Arctic Fox 
Lichen 	Lemming 
Snowy Owl 	Vole 
Deer 	Eagle 
Algae 	Squid 
Seal 	Polar Bear 
Cod 	Human 



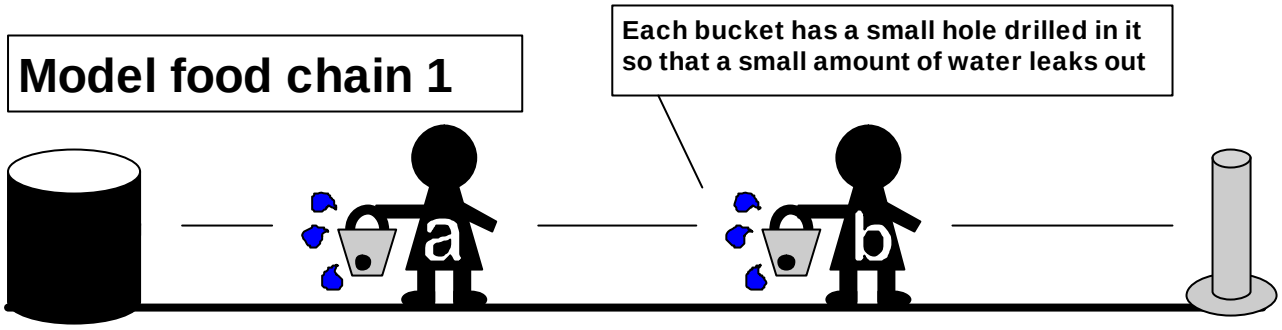
KEY IDEA: interdependence

There's a hole in my bucket

sCIENCE eNRICHMENT eXERCISES

- Mr Sheldon models food chains using buckets of water and labels;
- He makes the food chains different lengths by adding in more people;
- Look at the diagrams below and then answer the questions.

Model food chain 1



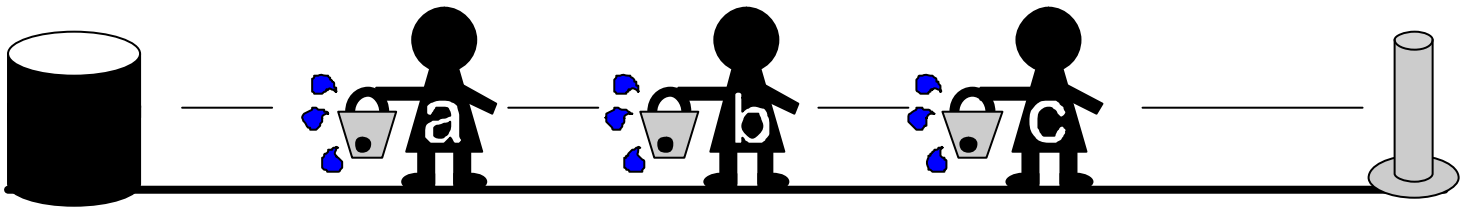
Store of water

First person fills bucket and runs to next person

First person fills bucket of second person

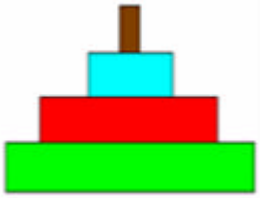
Second person runs to cylinder and tips in water

Model food chain 2



This is the same model as above but there is an extra person in the chain

- What does the model water store represent in a food chain?
- In this model of a food chain, what does the water represent?
- What does the hole in the bucket represent?
- Mr Sheldon says that the holes in b and c should be bigger than the holes in A. Why is this?
- In which model, 1 or 2, will the volume of water, in the measuring cylinder, be greatest after 5 minutes?
- Which person letter represents the producer, a herbivore and a carnivore?
- Write food chains that match model 1 and model 2.
- Predict what will happen if you continue to add more people into the chain.
- In model food chain B, there was 20 litres of water in the store at the start. After five minutes there was only 3 litres left. After five minutes there was only 4 litres in the measuring cylinder. How efficient was the water transfer?
- What would you expect the efficiency of model food chain A to be, more or less?



KEY IDEA: interdependence

Chain pain

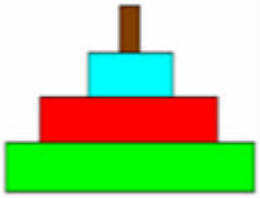
sCIENCE eNRICHMENT eXERCISES

- Look at the food chains below;
- Match the food chains to the statements;
- You must explain your choices.

a	Seaweed ➔ Human
b	Mushroom ➔ Human
c	Potato ➔ Pig ➔ Human
d	Algae ➔ Cod ➔ Seal ➔ Human
e	Corn ➔ Pig ➔ Human ➔ Tapeworm
f	Grass ➔ Deer ➔ Human
g	Plant Plankton ➔ Animal Plankton ➔ Krill ➔ Cod ➔ Human

Food chain letter	Statement about food chain
	Humans are most likely to accumulate heavy metals if the sea is polluted.
	This is the most efficient food chain.
	Humans are most likely to compete with a wolf.
	There is no producer in this food chain.
	A parasite is found in this food chain.
	Humans are tertiary consumers in this food chain.
	A decomposer is found in this food chain.

- Using food chains b,d,e and g construct a food web;
- Draw pyramids of numbers for all of the food chains above.



KEY IDEA: interdependence

Dirty detergents

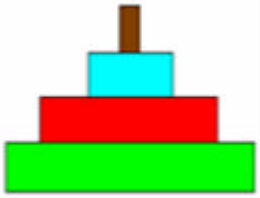
sCIENCE eNRICHMENT eXERCISES

- Last year (2002) 650,000 tonnes of detergents were flushed into rivers in the United Kingdom;
- Most detergents contain phosphates which stop the formation of scum on clothes;
- Some detergents contain enzymes which break down stains such as fats, blood, grass, food and juice stains;
- The use of phosphates, in detergents, is banned in Holland and Switzerland because cadmium (a heavy metal) is a waste product of phosphate manufacture;
- In the UK, there are no controls over phosphate production and a lot of cadmium gets into our water supply;
- A safer substance, called zeolite, can be used instead of phosphate;
- When phosphates get into water, they can be used by algae and act as a fertiliser;
- Rivers and lakes can become over-fertile and cause a dense blanket growth of algae on the surface of the water.

The composition of some detergents and information about their manufacture is shown in the table below (+ means yes, - means no):

Name	Crude oil used in manufacture?	Phosphates present?	Enzymes present?	Plant oils used in manufacture
Ariel	+	+	+	-
Bold	+	+	+	-
Ecover	-	-	-	+
Daz	+	+	+	-
Lux	-	-	-	-
Persil	-	+	+	-
Asda Auto	+	-	-	-
Tesco Auto	+	-	+	-

- Name one detergent that would be banned in Holland;
- Name one detergent that would work in boiling water. Explain your answer;
- Explain why the process of producing phosphate could be harmful to the environment;
- The production of which detergent uses a replaceable resource?
- Explain how a dense blanket of floating algae might affect the environment where the algae live;
- If you wanted to sell a detergent to countries like Holland, explain how you could avoid environmental pollution and still stop scum forming on clothes.



KEY IDEA: interdependence

Flower clocks

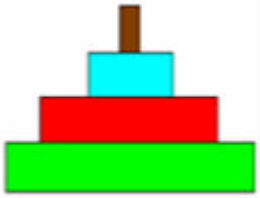
sCIENCE eNRICHMENT eXERCISES

- A hundred years ago, people planted ‘flower clocks’ in their gardens;
- The clocks used the opening and closing of the flowers to keep time:

Name of plant	Opens or closes flowers?	Time
Spotted cat’s ear	opens	6am
African marigold	opens	7am
Mouse-ear hawkweed	opens	8am
Marigold (calendula)	opens	9am
Nipple-wort	closes	10am
Star of Bethlehem	opens	11am
Passion flower	opens	12 noon
Childing pink	closes	1pm
Scarlet pimpernel	closes	2pm
Hawkbit	closes	3pm
Small bindweed	closes	4pm
White water lily	close	5pm
Evening primrose	opens	6pm

- Evaluate the use of a flower clock for keeping time.
- Why do flowers open and close?

- Your task is to design a flower calendar. This is different from a flower clock because you are looking at what times of year plants begin to flower;
- You will need to find out which plants flower in each of the 12 months;
- You will need to present your flower calendar as an A3 annotated diagram.
- You will need to evaluate the use of your calendar, giving its benefits and disadvantages.
- Think about the layout of your calendar. What materials are you going to use? How are you going to make it easy to maintain? Should you use annual or perennial plants?
- Explain why different plants open their flowers at different times of the year.

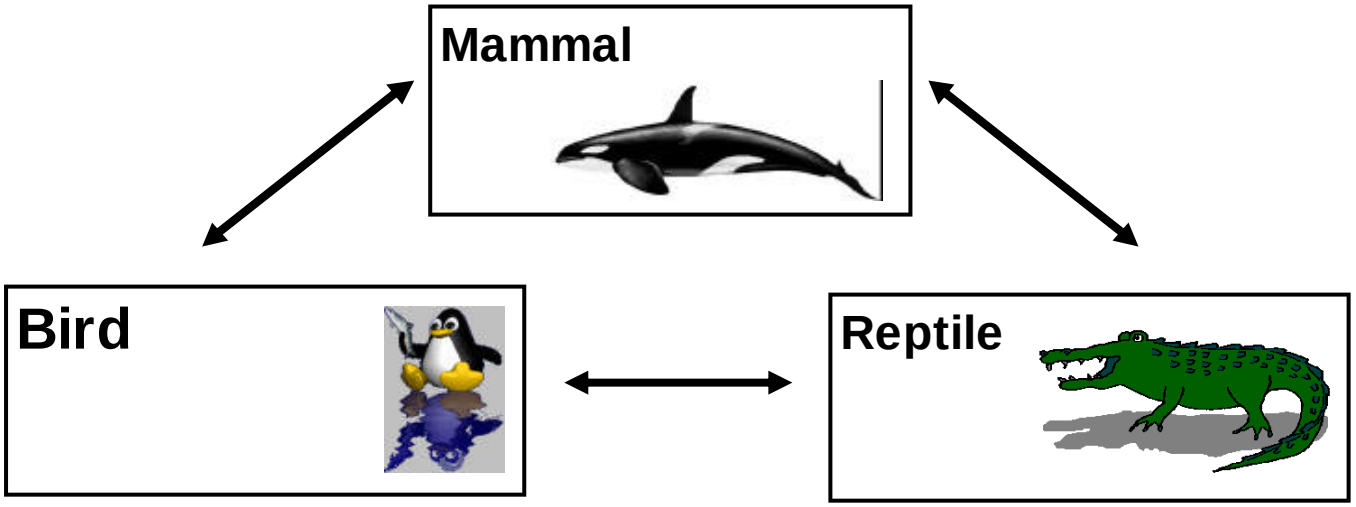


KEY IDEA: interdependence

Odd Vertebrate Out

sCIENCE eNRICHMENT eXERCISES

- Look at the three types of vertebrate below;
- Identify the odd one out;
- There are no correct answers to this problem. Find as many solutions as you can;
- Complete the table.



Odd vertebrate out	Explanation of why the vertebrate is the odd one out

KEY IDEAS: enquiry

Accuracy?

sCIENCE eNRICHMENT eXERCISES

- **Does being accurate really matter?**
- **Read the situations and then answer the questions.**

Measuring out orange squash to make a drink of orange.	**A doctor weighing a patient during a health check.**
Timing a qualifying lap on a Grand Prix circuit.	**A midwife weighing a premature baby.**
Going for a 4km jog each morning to keep yourself fit.	**Training for an 800m running race.**
Timing a 100m sprint final at the Olympics.	**The body temperature of a child with a fever.**
A doctor measuring out a drug to inject into a patient.	**Measuring the air temperature outside to decide whether to wear a coat or not.**
A builder measuring out sand, cement, gravel and water to make concrete.	**You are building an Olympic swimming pool and you need to measure the length of the pool to be 50 metres.**
A group of soldiers need to find their base. They need to measure the distance and direction.	**Measuring out the ingredients to make a birthday cake.**

- **Sort the situations above into two groups. The first group requires accurate measurements. In the second group a rough estimation is good enough.**
- **For each of the situations that require accurate measurements, decide if there is more than one variable that needs to be accurately measured. Record your answers in a table, like the one below:**

Situation needing measuring	Variable 1	Variable 2
100 metre sprint	Time	Distance (100m)

- **For each of the accurate situations decide how accurate each reading must be? Use the code A=accurate to 1 unit, B=accurate to 1/10 of a unit, C=accurate to 1/100 of a unit and D=accurate to 1/1000 of a unit. Add these letters to your table.**
- **Name the type of instrument that you would use to make the measurements.**

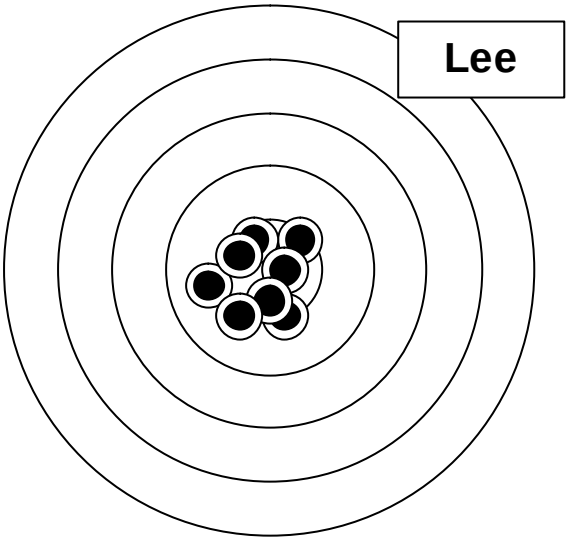
Adapted from the Royal Society for Chemistry (RSC)

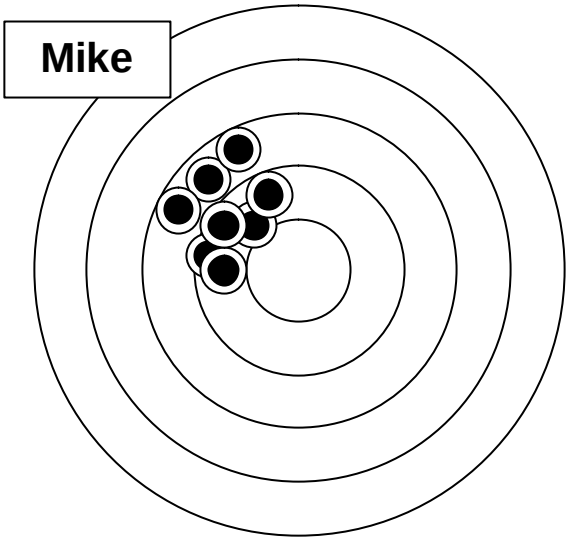
KEY IDEAS: enquiry

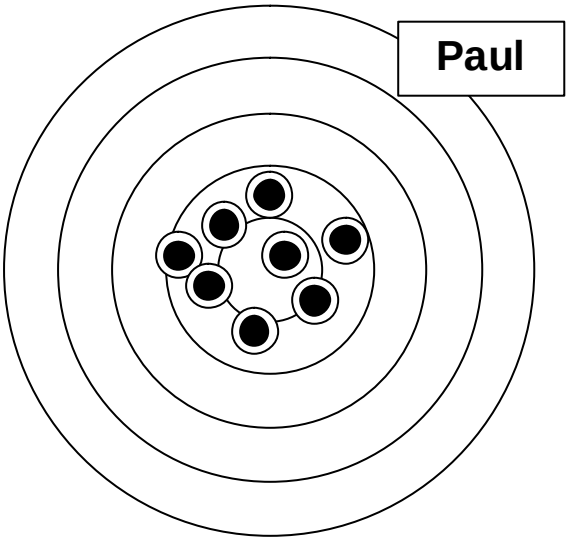
Archery Accuracy!

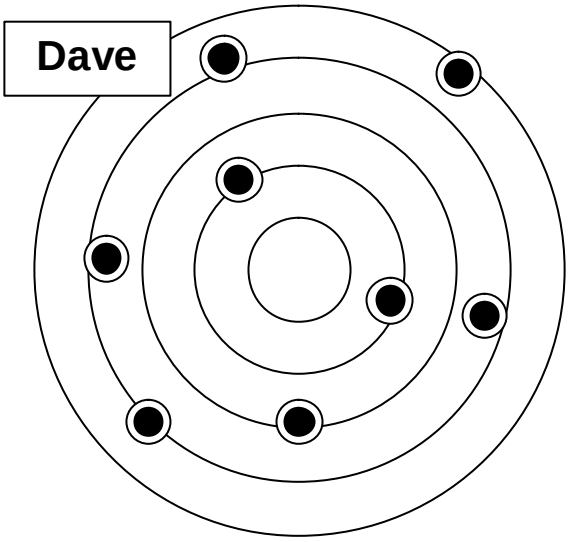
sCIENCE eNRICHMENT eXERCISES

- Lee, Mike, Paul and Dave decide to do some archery;
- In the last game they set the target as the bulls eye;
- Each person is allowed 8 arrows;
- The results of the game are shown below:









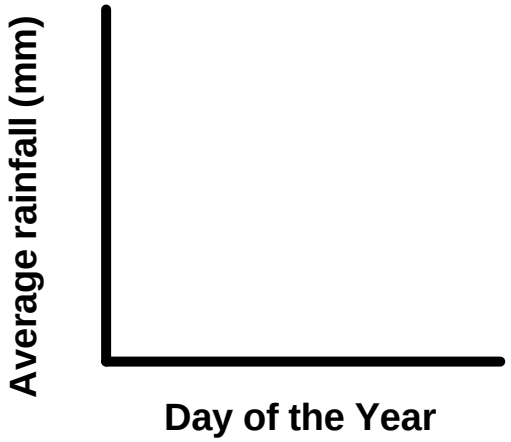
- Who won the archery competition?
- What did the players choose as their reference value?
- Whose game would you describe as:
  (a) Precise but not accurate?
  (b) Not precise but accurate?
  (c) Precise and accurate?
  (d) Not precise and not accurate?
- What is the difference between accuracy and reliability?

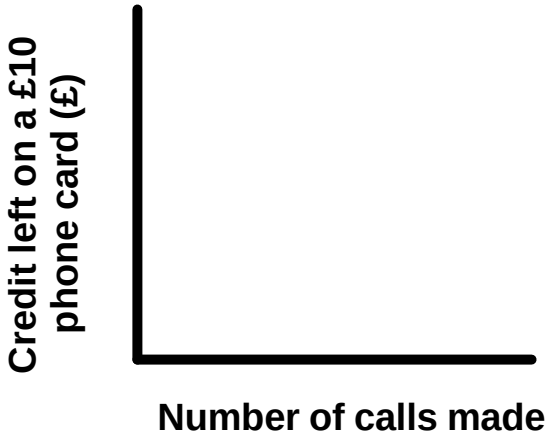
KEY IDEAS: enquiry

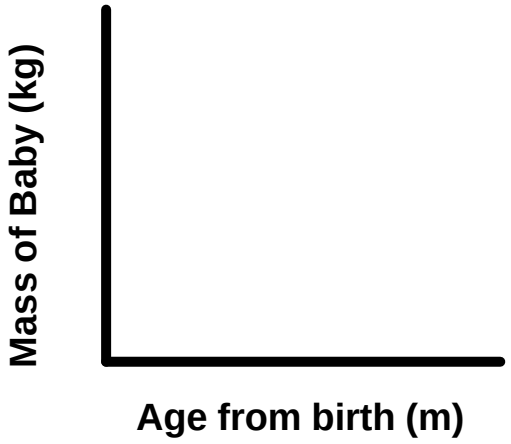
Graph shapes

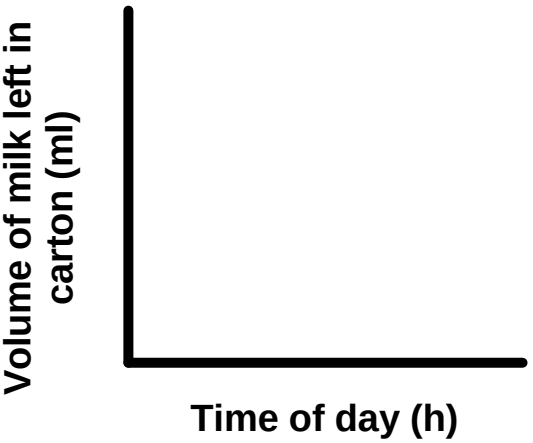
sCIENCE eNRICHMENT eXERCISES

- **Draw the correct line, curve or bars on the graphs below;**
- **If you can put data labels on the x or y axes then do it.**

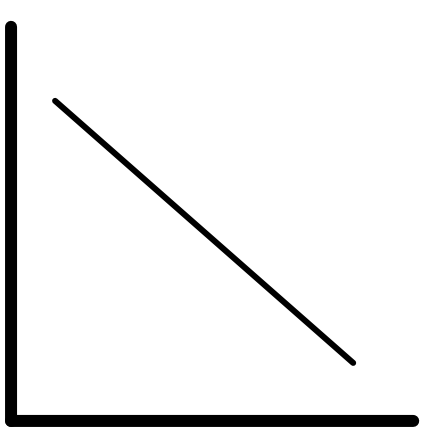


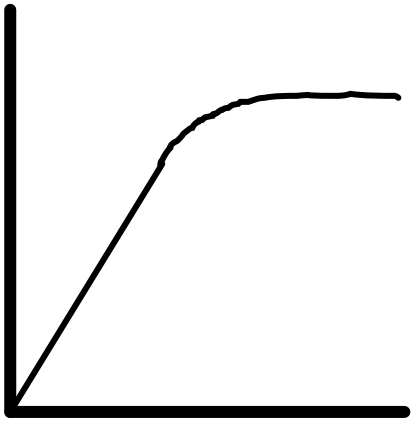


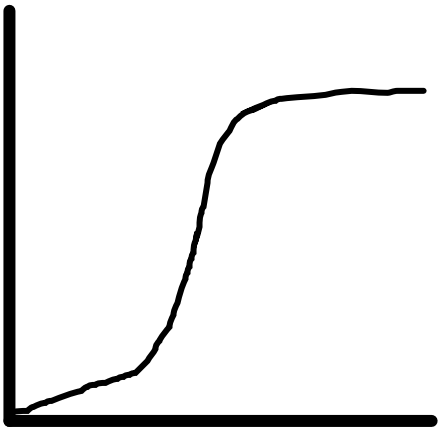




- **Label the x and y axes on the graphs below:**







science enrichment exercises

From: "The Far Side" by Gary Larson

A collection of exercises to support the teaching and learning of more able students. These tasks are based on the 5 key ideas and scientific enquiry.

Lee Sheldon

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KEY IDEAS: enquiry

Trundle wheel

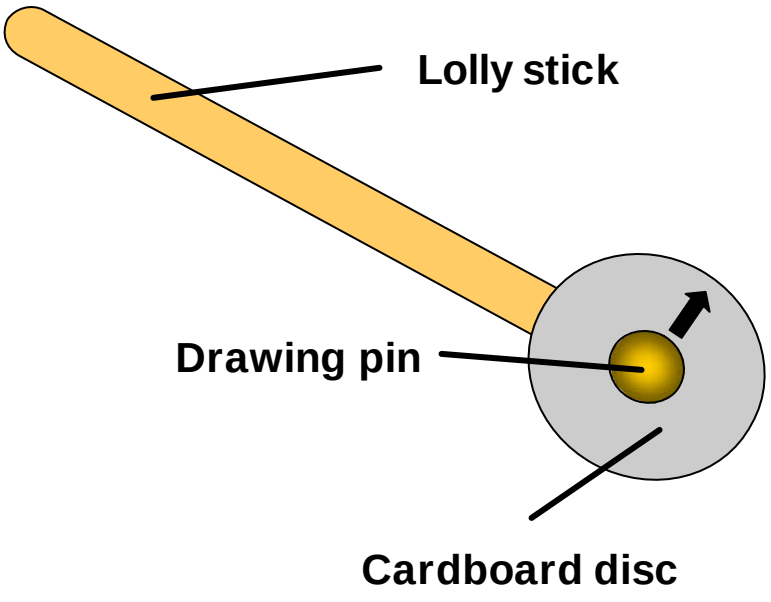
sCIENCE eNRICHMENT eXERCISES

- You will need a collection of cylindrical objects such as empty tins, rolls of sellotape, cans and coffee cups;
- You will also need a ruler and a piece of string;
- Make sure that you have a good range of sizes;
- Read the instructions below very carefully:

1	Measure the distance across the top of one of the cylindrical objects (its diameter). Measure in centimetres and millimetres. For example, you might find that the diameter was 6 cm plus 5mm. You should write this down as 6.5 cm.
2	Measure the distance round the object (its circumference) with a piece of string. Use a ruler to find the circumference. Measure in centimetres and millimetres.
3	Put your results into a table, like the one below:
4	Make sure that you record at least 10 objects. Plot a graph of diameter (x-axis) against circumference (y-axis). When you have plotted all of the points, draw a line (or curve) of best fit
5	What pattern does the graph show?

Object	Diameter (cm)	Circumference (cm)
Baked Bean Tin	5.4	17

- Try to use your graph to solve this problem:
- You wanted to make a trundle wheel, like the one on the right, to measure distances.
- The wheel must make one full turn every 10 cm.
- What would the diameter of the wheel have to be?

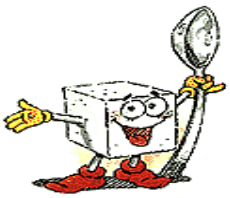
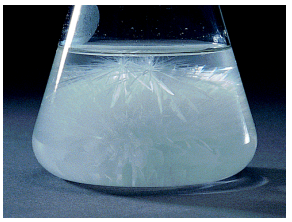
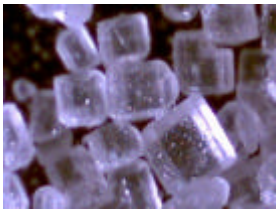


KEY IDEAS: enquiry

Evidence or not?

sCIENCE eNRICHMENT eXERCISES

- **All scientists must be able to recognise evidence. Scientists must be able to identify the difference between evidence and irrelevant facts or opinion. Look at the statements below and then decide if the statements provided are evidence for the statement or irrelevant facts or opinion.**
- **The statement is 'What evidence is there to support the idea that dissolved substances are present when they have disappeared?'**

When you dissolve sugar in water you can still taste the sugar even though you can't see it 	**The hotter the temperature the quicker it takes for sugar to dissolve** 	**You can only add a certain amount of solute before it will not dissolve any further. The solution becomes saturated** 
Sea water contains about 27g of salt for every litre 	**If you remove the solvent from the solution then the dissolved substance comes back** 	**When you are dissolving sugar in water stirring makes the sugar dissolve more quickly** 
If you dissolve a coloured substance in a clear solvent the colour can still be seen 	**You cannot remove a solute from a solvent with a filter** 	**Some substances are insoluble** 
You can obtain crystals of copper sulphate from a copper sulphate solution by evaporation 	**There are many different solvents and solutes** 	**A cup of tea with three sugars in it tastes very sweet!**