

2016 national curriculum assessments

Key stage 2

2016 teacher assessment exemplification: end of key stage 2

Science

Working at the
expected standard

April 2016



Standards
& Testing
Agency

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2016 teacher assessment exemplification: end of key stage 2

Key stage 2 (KS2) science teacher assessment (TA), using the interim teacher assessment frameworks, is statutory for 2016.

This document contains material that exemplifies the science content and working scientifically statements within the KS2 interim TA framework for 'working at the expected standard'.

Use of the exemplification materials

- Schools must use the interim TA frameworks to reach their TA judgements.
- If teachers are confident in their judgements, they do not need to refer to the exemplification materials. The exemplification materials are there to help teachers make their judgements where they want additional guidance.
- The judgement as to whether a pupil meets a statement is made across a collection of evidence and not on individual pieces.
- This document consists of pieces of work drawn from different pupils which exemplify all or part of a statement within the expected standard.
- Only a selection of the 'pupil can' statements have been exemplified in this document. These all relate to content taught in the national curriculum in year 6.
- Some of the examples in this document demonstrate how the 'pupil can' statements have been met using work produced whilst a particular topic was being taught. When making their judgements, teachers should be confident that any required knowledge and skills can be used appropriately by the pupil.

Note: you must also refer to the 'Interim teacher assessment frameworks at the end of key stage 2' on GOV.UK as they have not been fully duplicated here.

Interim teacher assessment framework at the end of key stage 2: science

Working at the expected standard

Working scientifically: this must be taught through, and clearly related to, the teaching of substantive science content in the programme of study.

- The pupil can describe and evaluate their own and other people's scientific ideas related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources.
- The pupil can ask their own questions about the scientific phenomena they are studying, and select and plan the most appropriate ways to answer these questions, or those of others, recognising and controlling variables where necessary – including observing changes over different periods of time, noticing patterns, grouping and classifying things, carrying out comparative and fair tests, and finding things out using a wide range of secondary sources of information.
- The pupil can use a range of scientific equipment to take accurate and precise measurements or readings, with repeat readings where appropriate.
- The pupil can record data and results using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- The pupil can present findings and draw conclusions in different forms, and raise further questions that could be investigated, based on their data and observations.
- The pupil can use appropriate scientific language and ideas from the national curriculum to explain, evaluate and communicate their methods and findings.

Science content:

- The pupil can name, locate and describe the functions of the main parts of the digestive, musculoskeletal, and circulatory systems, and can describe and compare different reproductive processes and life cycles, in animals.
- The pupil can describe the effects of diet, exercise, drugs and lifestyle on how their bodies function.
- The pupil can name, locate and describe the functions of the main parts of plants, including those involved in reproduction and transporting water and nutrients.
- The pupil can use the observable features of plants, animals and micro-organisms to group, classify and identify them into broad groups, using keys or in other ways.
- The pupil can construct and interpret food chains.
- The pupil can explain how environmental changes may have an impact on living things.
- The pupil can use the basic ideas of inheritance, variation and adaptation to describe how living things have changed over time and evolved; and describe how fossils are formed and provide evidence for evolution.
- The pupil can group and identify materials, including rocks, in different ways according to their properties, based on first-hand observation; and justify the use of different everyday materials for different uses, based on their properties.

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- The pupil can describe the characteristics of different states of matter and group materials on this basis; and can describe how materials change state at different temperatures, using this to explain everyday phenomena, including the water cycle.
- The pupil can identify, and describe what happens when dissolving occurs in everyday situations; and describe how to separate mixtures and solutions into their components.
- The pupil can identify, with reasons, whether changes in materials are reversible or not.
- The pupil can use the idea that light from light sources, or reflected light, travels in straight lines and enters our eyes to explain how we see objects, and the formation, shape and size of shadows.
- The pupil can use the idea that sounds are associated with vibrations, and that they require a medium to travel through, to explain how sounds are made and heard.
- The pupil can describe the relationship between the pitch of a sound and the features of its source; and between the volume of a sound, the strength of the vibrations and the distance from its source.
- The pupil can describe the effects of simple forces that involve contact (air and water resistance, friction), and others that act at a distance (magnetic forces, including those between like and unlike magnetic poles; and gravity).
- The pupil can identify simple mechanisms, including levers, gears and pulleys that increase the effect of a force.
- The pupil can use simple apparatus to construct and control a series circuit, and describe how the circuit may be affected when changes are made to it; and use recognised symbols to represent simple series circuit diagrams.
- The pupil can describe the shapes and relative movements of the sun, moon, earth and other planets in the solar system; and explain the apparent movement of the sun across the sky in terms of the earth's rotation and that this results in day and night.

Title	Changing ideas about circulation
Year group of pupil	6
Science content statement(s)	The pupil can name, locate and describe the functions of the main parts of the digestive, musculoskeletal, and circulatory systems, and can describe and compare different reproductive processes and life cycles, in animals.
Working scientifically statement(s) (if applicable)	The pupil can describe and evaluate their own and other people's scientific ideas related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources.
Context	In this activity, pupils were asked to recall facts from their studies of the human body in previous years. They drew and labelled these on the outline of the human body. The teacher then demonstrated a heart dissection and went on to ask pupils to carry out some research, using books available in the classroom, about the circulatory system. This focused on the heart, blood vessels and lungs. They were asked to present this information in a similar way so that they could compare the 2 versions.
Comment	Using information from books, the pupil has presented what they learnt about the main parts of the circulatory system (heart, blood vessels, lungs), in comparison with ideas they held before, such as the position and relative size of the heart and lungs.

This is what I knew in year 4:

Inside of me you will find:

mouth
lungs
muscle
stomach
heart
rectum
kidneys

The lungs help get rid of carbon dioxide and waste and give oxygen back to the blood.

The heart is slightly tilted to the left (we learnt from diagrams) and has 4 chambers. It pumps blood all over the body and to the lungs. We dissected a heart and saw valves.

The heart takes the blood to every organ.

An Artery takes the blood away from the heart.

Capillaries are tiny tubes which help to go to every part of the body.

Title	Features used to classify animals
Year group of pupil	6
Science content statement(s)	The pupil can use the observable features of plants, animals and micro-organisms to group, classify and identify them into broad groups, using keys or in other ways.
Working scientifically statement(s) (if applicable)	Finding things out using a wide range of secondary sources of information.
Context	In previous lessons, pupils were studying animals, plants and their habitats. In this activity, pupils were asked to use books and the internet to research, and then describe in their own words, the observable features used to classify mammals, amphibians, birds, fish, insects and reptiles.
Comment	The pupil has independently used secondary sources of information to find out the features used to classify animals as mammals, amphibians, birds, fish, insects or reptiles.

What are the main animal groups?

Amphibian: a cold-blooded vertebrate
 • eg. frogs, toads, newts, salamanders, and caecilians.

Mammal: vertebrates mean they have a backbone or a spine. eg. humans
 • Have hair on their bodies. • produce milk for their babies.

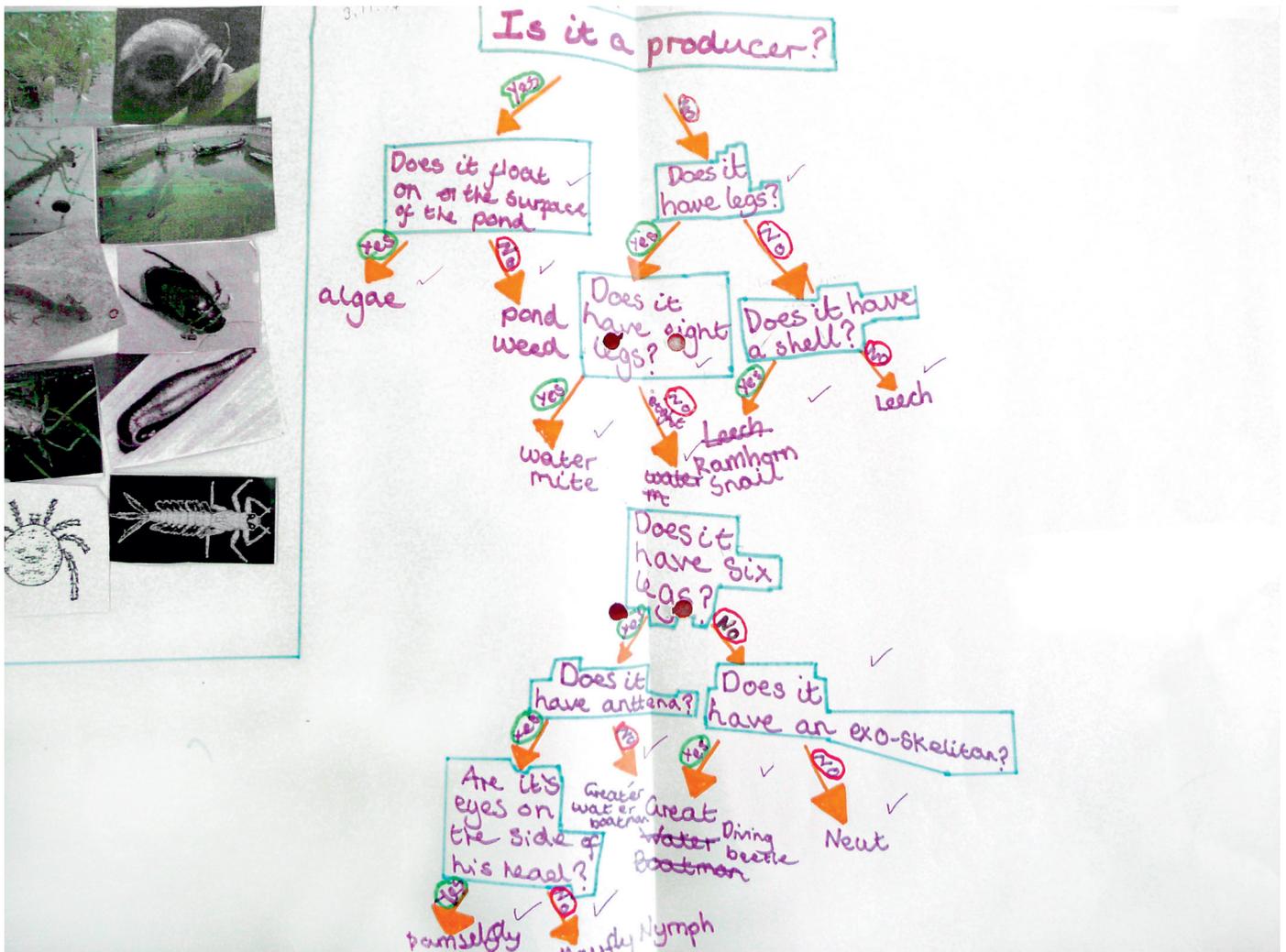
Reptile: vertebrates (have a backbone),
 • lay eggs eg. Comodo dragon, snake
 • cold-blooded

Insects:

- Insects have two antennae.
- Insects have three pairs of legs
- Spiders aren't insects. - why? because a spider has 8 legs and 2 pairs of legs and a unised ^{6 legs} egg.
- Most insects have been hatched from an egg.
- The number of insect species is believed to be between 6 and 10 million

Vertebrates: are animals with have a backbone or a spine

Title	Making a classification key – pond animals
Year group of pupil	6
Science content statement(s)	The pupil can use the observable features of plants, animals and micro-organisms to group, classify and identify them into broad groups, using keys or in other ways.
Working scientifically statement(s) (if applicable)	The pupil can record data and results using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
Context	In previous lessons, pupils had conducted fieldwork at a local RSPB Nature Reserve, including pond dipping. They used classification keys to identify and name animals they found in the pond, looking at their observable features. Based on their fieldwork experience, pupils were asked to create their own classification key in this activity to identify animals found in the pond habitat. They were told to generate their own yes/no questions in order to categorise the animals.
Comment	The pupil uses observational evidence to devise clear and appropriate questions which lead to single answers. From this they then create a classification key to sort and identify a range of pond animals.

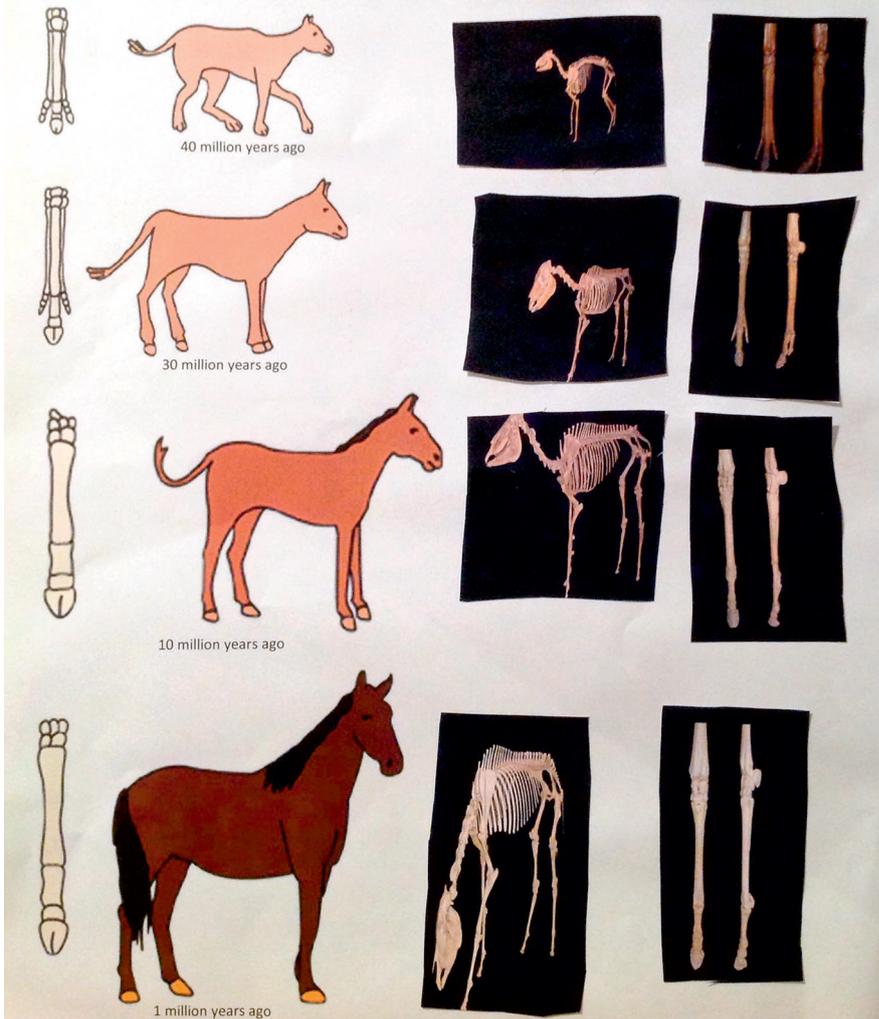


Title	Fossil horses
Year group of pupil	6
Science content statement(s)	The pupil can use the basic ideas of inheritance, variation and adaptation to describe how living things have changed over time and evolved; and describe how fossils are formed and provide evidence for evolution.
Working scientifically statement(s) (if applicable)	Not applicable.
Context	In previous activities, pupils were introduced to the idea of evolution as a change over time, and were asked to think about where any evidence might come from to support the idea. Having discussed what they can remember about fossil formation, they were provided with a worksheet with images of horses and their fossils, together with the written prompt, and asked to describe what it might tell us about horse evolution.
Comment	The pupil describes, in simple terms, the evidence that the fossils provide about the way a horse's body shape has changed over time.

Fossils and what they tell us!

Can you match the horse fossils to the correct diagram of what horses probably looked like millions of years ago?
Use what you notice about the differences between the fossils to describe what they tell us about how horses have changed over time?

Horses were much different years and years ago. 40 million years ago horses had 3 small toes at the side of their feet and 1 big one in the middle. They were much smaller than horses today. Over time horses have got more similar to horses today. Horses have grown bigger and have now only got 1 toe instead of 3.



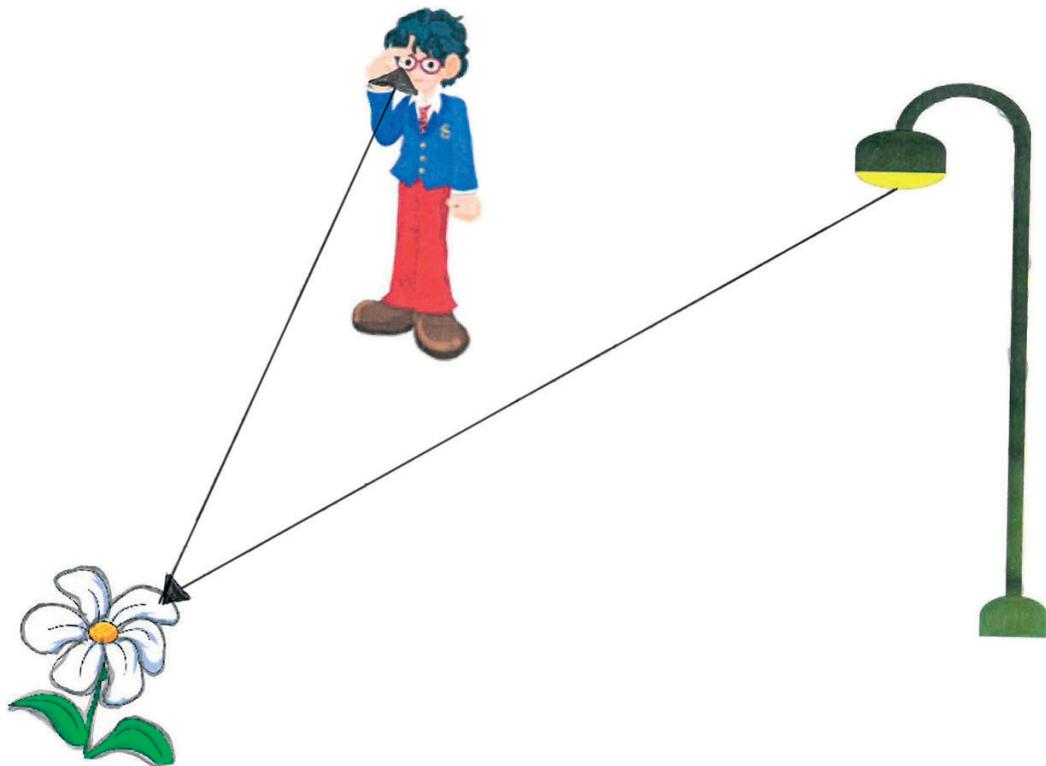
Horses were much different years and years ago. 40 million years ago horses had 2 small toes at the sides of their feet and 1 big one in the middle. They were much smaller than horses today. Over time, horses have got more similar to horses today. Horses have grown bigger and have now only got 1 toe instead of 3.

Title	Dissolving explanation
Year group of pupil	6
Science content statement(s)	The pupil can identify, and describe what happens when dissolving occurs in everyday situations; and describe how to separate mixtures and solutions into their components.
Working scientifically statement(s) (if applicable)	The pupil can use appropriate scientific language and ideas from the national curriculum to explain, evaluate and communicate their methods and findings.
Context	<p>In previous lessons, pupils had carried out practical work which involved dissolving different amounts of sugar in a fixed volume of water and measuring how the mass changed. They focused in particular on accurate measuring and looking out for patterns.</p> <p>Having reviewed a variety of non-fiction science books, pupils were encouraged to bring all their ideas together in this activity and use scientific vocabulary to explain dissolving, as if they were writing for a non-fiction science book.</p>
Comment	The pupil describes the process of dissolving. They have used appropriate scientific vocabulary throughout. The pupil worked on a computer.

What is dissolving?

When we say dissolving we mean when a solute (solid) mixes with a solvent (liquid) and makes a solution. Imagine some sugar crystals weigh 5 grams, and water weighs 100 grams when you dissolve them, they're going to weigh 105 grams together. The mass will not change unless you add any other solutes or solvents.

Title	How we see
Year group of pupil	6
Science content statement(s)	The pupil can use the idea that light from light sources, or reflected light, travels in straight lines and enters our eyes to explain how we see objects, and the formation, shape and size of shadows.
Working scientifically statement(s) (if applicable)	The pupil can record data and results using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
Context	In previous lessons, pupils learnt that light travels in straight lines and about how we see objects, with pupils spending time exploring with torches and objects to experience and describe the phenomena. In this activity, pupils were asked to show their understanding by drawing a diagram, and then explain in their own words, what is happening.
Comment	The pupil has drawn the light travelling in a straight line from the source to the flower and reflected the light from the flower to the boy's eyes, to explain how he can see it.



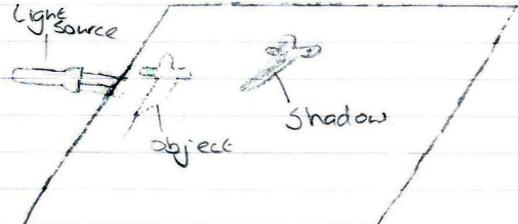
The boy ^{can see} ~~sees~~ the flower because the light ~~from the~~ light source travels to the flower then reflects off the flower to the boy's eyes.

The light travels to the flower then reflects off it to the boy's eyes.

Title	Shadows
Year group of pupil	6
Science content statement(s)	The pupil can use the idea that light from light sources, or reflected light, travels in straight lines and enters our eyes to explain how we see objects, and the formation, shape and size of shadows.
Working scientifically statement(s) (if applicable)	Noticing patterns.
Context	In previous lessons, pupils investigated how light travels in straight lines, in addition to learning about how we see objects when light is reflected into our eyes. In this activity, pupils made shadow puppets and were given time to explore the way that they work. They were then asked the following questions: 'How can you change the size of the shadow?', 'Why has this happened?' and 'Can you see a pattern?' Pupils drew diagrams and explained their answers in their own words.
Comment	The pupil explains how shadows are formed when light is blocked by an opaque material. They also identify how to change the shape and size of shadows with an explanation of why this occurs, referring to light source, object and respective distances.

Shadows are created by light and an object. You shine the light at the object. block the light object will stop the light and it will create a shadow. ✓
think of a better word than stop

1.a) Yes you can change the shadow's size
 1.b) You can do this by moving ^{it} closer and further away.
 b) * the object closer ^{and further away} the light source.
 1.c)



The closer the object to the light source the bigger the shadow. ✓
 The further the object the smaller the shadow.

1.d) Yes you can change shape of the shadow by rotating it. ✓

Pupil: The object will stop the light and will create a shadow

Teacher: Think of a better word than stop

Pupil: block

You can do this by moving it closer and further.

The object closer and further to the light source.

Title	Shoe friction investigation
Year group of pupil	6
Science content statement(s)	The pupil can describe the effects of simple forces that involve contact (air and water resistance, friction), and others that act at a distance (magnetic forces, including those between like and unlike magnetic poles; and gravity).
Working scientifically statement(s) (if applicable)	<p>Carrying out comparative and fair tests.</p> <p>The pupil can use a range of scientific equipment to take accurate and precise measurements or readings, with repeat readings where appropriate.</p> <p>The pupil can present findings and draw conclusions in different forms, and raise further questions that could be investigated, based on their data and observations.</p>
Context	<p>In previous lessons, pupils identified different types of forces and considered some of the effects that forces can have. They learnt that friction is a contact force that slows down moving objects, and acts in the opposite direction to motion.</p> <p>In this activity, pupils were challenged to plan an enquiry to find out which surfaces involve the most friction using the resources that were provided. Some decided to use newton meters to measure forces, but in this example they tip a ramp to find the angle at which a shoe would move.</p>
Comment	The pupil collects measurements, repeatedly checking for reliability, all in the context of fair testing. They calculate the average angle at which the slope needs to be for the shoe to slide and then use this data to organise the surface materials into order of increasing friction. They go on to draw a conclusion, explaining which material has the least and most friction, and using scientific ideas about materials to begin to explain why. They predict that the materials must have different surfaces, e.g. rough and smooth, identifying a prediction that they could go on to test.

Which surface gives the best friction?

Aim

My aim is to find out which surface gives the best friction.

Prediction

I predict that the carpet will give the best friction.

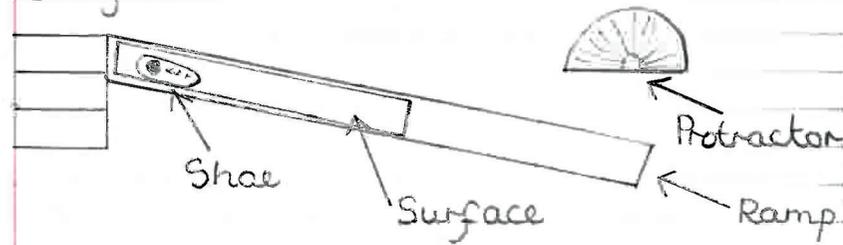
I think this because the Carpet looks rough and it can hold the grip of the slippy shoe.

Method

- In this investigation I will be changing the surface of a ramp to see how it affects friction.
- I will use carpet, lino, wood, corrugated card and a bin bag.
- I will be measuring the angle of the ramp.

- I will keep the shoe same.

Diagram



Results

Surface	Angle 1	Angle 2	Angle 3
Wood	35°	35°	30°
Carpet	43°	40°	45°
Lino	42°	43°	41°
Bin Bag	30°	37°	29°
Corrugated card	41°	40°	43°

	Surface	Average
Biggest →	Carpet	44°
	Lino	42°
	Corrugated card	41°
Smallest →	Wood	33°
	Bin Bag	32°

Conclusion

I have found out that Carpet had the biggest friction and the Bin bag had the smallest friction.



My prediction was right because I predicted carpet would have the largest friction and the carpet had the hold of the grip of the shoe so the carpet was the best surface.

I think the bin bag had the smallest friction because it was slippery and you could easily slide through the surface. The bin bag cannot get the hold of the grip of the shoe which tells me that it isn't suitable for slippery shoes.

The surfaces reacted differently to the shoe. I think this is because the material was different and the roughness and the softness of the surface must be different.

Title	Resistance in liquids investigation
Year group of pupil	6
Science content statement(s)	The pupil can describe the effects of simple forces that involve contact (air and water resistance, friction), and others that act at a distance (magnetic forces, including those between like and unlike magnetic poles; and gravity).
Working scientifically statement(s) (if applicable)	Carrying out comparative and fair tests. The pupil can use a range of scientific equipment to take accurate and precise measurements or readings, with repeat readings where appropriate.
Context	In previous lessons, pupils talked about landing a probe on a planet and were discussing how the forces on the probe might be different if the planet was made of different substances. The class decided to plan an enquiry to explore this and find out if different liquids create different drag forces. In this activity, pupils were challenged to plan and carry out an enquiry, using the resources on their table, to find out whether different liquids provided different drag forces.
Comment	The pupil identifies the variables to carry out a fair test in order to compare the drag force (friction) of different liquids. They ensure they have accurate measurements, checking these repeatedly for reliability and then calculating the mean average. They use their measurements to put the liquids into order of friction, and their conclusion is consistent with the data. They begin to use scientific ideas to justify their observations, e.g. by thinking about the possible reason for the differences in the drag force in the liquids. However, the attempted use of the idea of molecules is above what would be expected at key stage 2.

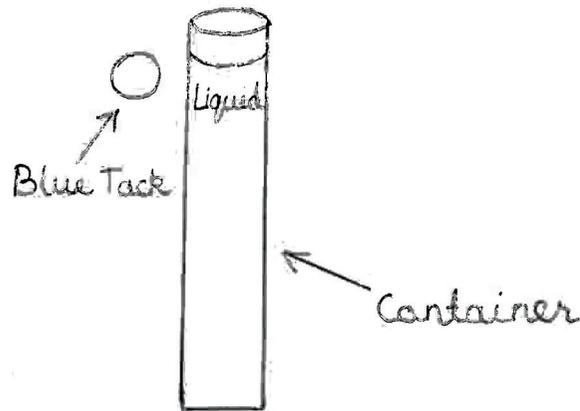
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Which liquid causes the most friction (drag)?

The variable I will change is the liquid.

The variable I will measure is the time.

The variables I will keep the same to make it a fair test is the amount of liquid and the blue tack ✓



1. First, pour the liquid into the container.
2. Put the blue tack in the liquid and time it with a stop watch - until the blue tack sinks at the bottom of the container.
3. Continue the same method for the other 3 liquids. ✓✓

The variable I will change is the liquid.

The variable I will measure is the time.

The variables I will keep the same to make it a fair test is the amount of liquid and the blue tack.

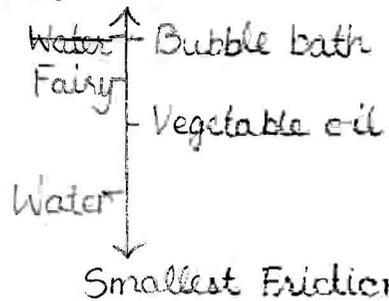
1. First, pour the liquid into the container.
2. Put the blue tack in the liquid and time it with a stop watch - until the blue tack sinks at the bottom of the container.
3. Continue the same method for the other 3 liquids.

Results

Liquid	Test 1	Test 2	Test 3	Average
Fairy	32 sec	32 sec	31 sec	31.2
Bubble Bath	1.26 min	1.29 min	1:37 sec	1.3
Water	1 sec	1 sec	1 sec	1
Vegetable oil	3 sec	3 sec	5 sec	3.2

Conclusion

Biggest Friction



I think this because the molecules hold each other tightly whereas the ~~was~~ molecules of the water are just touching each other.

Think to thinkConclusion

I found out that it took the bubble bath longer to for the blue tack to fall in the bubble bath. I think this is because of the molecules in the bubble that stick together. It took the bubble bath had the biggest friction. Whereas the water had the smallest friction.

I found that it took the bubble bath longer for the blue tack to fall in the bubble bath.

The bubble bath had the bigger friction whereas the water had the smallest friction.

Title	Circuit diagrams
Year group of pupil	6
Science content statement(s)	The pupil can use simple apparatus to construct and control a series circuit, and describe how the circuit may be affected when changes are made to it; and use recognised symbols to represent simple series circuit diagrams.
Working scientifically statement(s) (if applicable)	Noticing patterns, the pupil can record data and results using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
Context	In previous lessons, pupils shared their own ideas about electricity. In this activity, they were given simple apparatus and asked to construct a series circuit, before drawing a circuit diagram to represent it. They were challenged to draw further diagrams with different components and constructions, and to describe how the circuit is affected.
Comment	The pupil has constructed circuits and then represented the circuits in diagrams, using correct symbols. They have successfully identified a pattern in the relationship between voltage and bulb brightness.

You need a circuit to work it!

<u>Circuit Diagram</u>	<u>What I notice</u>
	<p>The lamp is ^{quite} bright. I used a cell that it is 1.5v and a lamp joint with crocodile clips.</p>
	<p>I added an extra cell so I've got 3v. With a lamp. The lamp went really bright with a larger amount of voltage.</p>
	<p>I added a motor to the circuit and the lamp went dimmer where the power was also going to the motor as well as the lamp.</p>
	<p>I added a buzzer and a switch and tried turning it on and off. (opening and closing) and the buzzer worked when the switch was closed.</p>

The larger the voltage the brighter the bulb.



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2016 teacher assessment exemplification: end of key stage 2 science
PDF version product code: STA/16/7615/e ISBN: 978-1-78644-199-7

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