CurriculumVisions 2E Science@School

Forces and movement

Teacher's Guide CD

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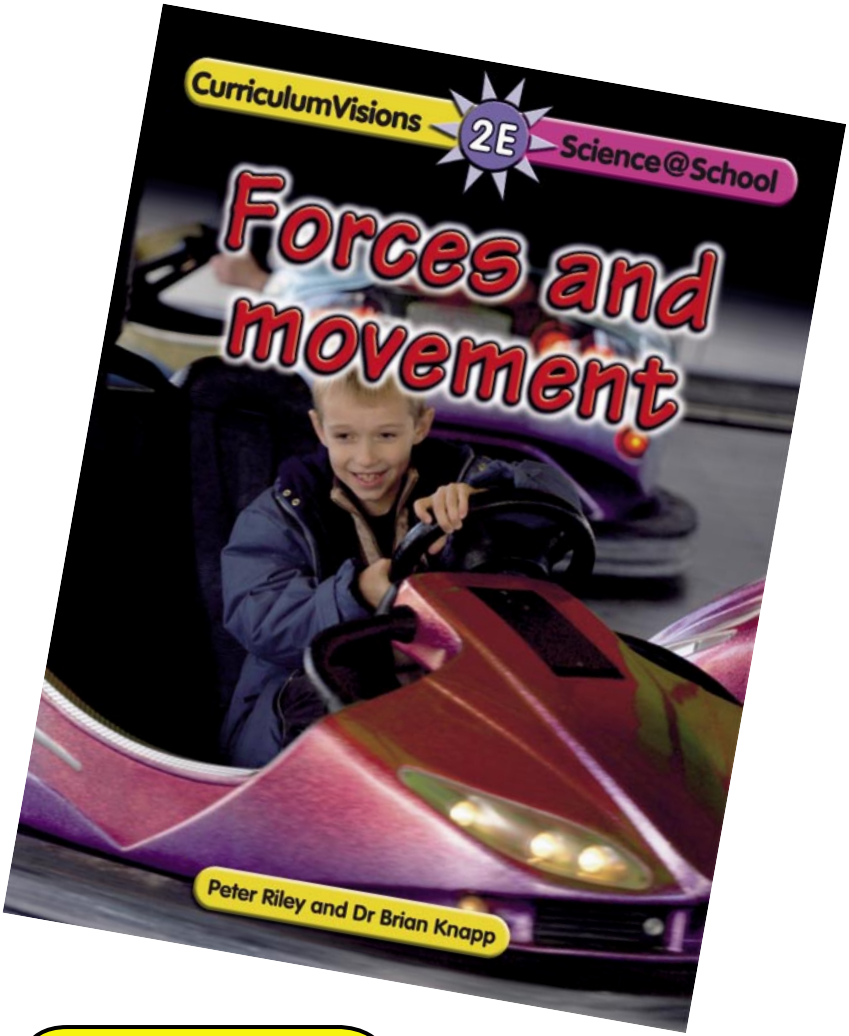

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Curriculum Visions

A CVP Teacher's Guide

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Contents

Introduction

The pupil's book

The Key stage 1 Science@School series is a series of twelve books. Each one addresses one of the QCA units in the Key Stage 1 science curriculum.

Each spread in the book addresses one or more objectives in a QCA unit by providing photographs, simple text and questions to stimulate discussion.

Each book has an illustrated glossary and a simple index for finding information.

The teacher's guide

It may be that you already have a scheme of work and wish to use the books to support it. Alternatively you could use the books, this CD ROM and the **CurriculumVisions.com** web site, which provides support material in the form of extra text (with audio option), pictures, captions, activities and demonstration videos to build a new scheme. Whichever way you choose, the notes in this teacher's guide have been set out as if you were using each page or spread as the basis for a lesson. You may follow each set of notes in their entirety to build up your lesson or take parts of the notes to fit into your scheme.

The teacher's notes contain information about practical work. You should check your school policies on practical science work and only select activities for which you are confident to take responsibility.

The book *Be Safe!* published by the ASE (ISBN 978–0–86357–324–8) provides useful guidance on carrying out science activities.

The structure of the notes

The notes for each page or spread follow the same structure, which is outlined here.

Objectives

These may be linked to the QCA objectives or build on them to enrich the topic.

Resources and preparation

Suggestions may be made for building on the visual display of the books with posters and models.

There are also pictures (aka flashcards) at the end of the notes to each lesson, which may be printed off and used as triggers to start the lesson or used in the plenary as revision. When the pictures have been used they could be displayed on a wall and others added as the subsequent lessons are completed. This will make a colourful summary of the work which could be used as a final revision resource when the book is completed.

If you are using the **CurriculumVisions.com** web site log in, go to Science, Year 2, Unit 2E Forces and movement.

There may be some suggestions for building practical work into the use of the pages in the book and these include a list of requirements (simple, readily available materials) and advice on preparing the requirements for use in the lesson.

Introduction

Starting the lesson

Each lesson begins with a short activity, which helps settle the children and focus them on the work ahead.

Activities with the page

These may be reading activities, observing and discussing the pictures or answering a question. There may also be practical activities which are designed to develop a range of practical science skills from making observations to carrying out fair tests.

Differentiation

There are suggestions for providing help and activities for children of different abilities.

Assessment

There are suggestions for assessing the children's work. There are three assessments for you to print off at the end of this guide. These are for use with lesson 4 (page 55), and after completing all the lessons (page 57), or you could use both together as an end of unit test. Guidance for the answers is given in the assessment section of the lesson notes.

Plenary

The work done in the lesson is reviewed in this section and there may be a further activity to help secure the children's knowledge.

Outcomes

These may be linked to the QCA objectives or build on them to enrich the topic.

1 Teacher's sheet 2E

Ways of moving

Objectives

- To review knowledge of pushes and pulls.
- To know that pushes and pulls are forces.
- To know there are many different ways of moving.

Resources and preparation

A model train on a few straight rails.

Starting the lesson

Ask the children to tell you about things that people push. Look for answers about a pram or a supermarket trolley. Someone may suggest pushing open a door or that you push a ball when you kick it or pushing someone on a swing. Now ask the children to tell you about things that people or animals pull. Look for answers about pulling a door open, pulling a toy trolley, a horse pulling a cart, a dog pulling on a lead. Show the children the model train carriages on the track and hold up the engine. Ask someone to come out and attach it ready for pulling the train (at the front) and someone else to come out and attach it ready for pushing the train. Ask the children if there is a way to attach the engine so that it both pushes and pulls and look for someone to come out and attach it in the middle of the train. Ask the children if they know the scientific name for pushes and pulls and look for the word force.

Activities with pages 4 and 5

- Read the opening sentence and move on to the first paragraph and read the first three sentences. Ask the children to name ten things which are not moving.
- Read the remainder of the paragraph and ask the children to cover the second paragraph while they think of an answer. Look for an answer about pushing and pulling then read the first three sentences of the second paragraph.
- Look at the picture of the aeroplane with the children and ask them to point to the engines and count them. They should find four. Ask the children about aeroplanes and look for answers about the engines making a noise pushing the aeroplane very fast along the runway and then into the air.
- Look across at the go-kart with the children and read the caption. Ask which part of the go-kart pushes on the road and look for an answer about wheels.
- Move back to page 4 and read the last line of the second paragraph. Remind the children that humans are animals and look at the picture of the ballerina and read the caption. Ask the children to tell you about muscles and movements and look for answers about muscles pulling on bones with

tendons and the action of the biceps and triceps if they have done lesson 3 with Science@School 1E Pushes and pulls. They may also mention moving the muscles in their face to smile and frown. The children could demonstrate that when they make a stride their legs push back on the ground to move them forwards.

- Move on to look at the picture of the horses and ask the children about the different ways horses move. Look for answers about trotting and galloping which the children could mime. Ask about how other animals move and look for answers about a cat prowling, a fish swimming or a snake slithering along the ground. Look at the picture of the humming bird and ask about how other birds move. Look for an answer about eagles hovering and herons wading through water.
- Ask the children to answer the question on page 5 by making drawings of the different movements and give each drawing a caption.

Differentiation

Less confident learners could be given help by looking through other resources with them and spotting different ways of moving and writing a simple caption such as 'Running'. More confident learners could be challenged to think of their answers and write a longer caption such as 'The boy runs down the race track'.

Assessment

The children can be assessed on the presentation of their drawings and captions.

Plenary

The children can display their drawings and captions and you can make a class list of all the different ways of moving that they have identified.

Outcomes

The children:

- Know that movement is caused by pushes and pulls.
- Know that pushes and pulls are forces.
- Know there are many different ways of moving.

Changing shape

Objectives

- To know that the shapes of materials are changed by rolling, squashing, bending, twisting and stretching.
- To know that pushes and pulls are used in rolling, squashing, bending, twisting and stretching.

Resources and preparation

A few models from the plenary of lesson 5 in Science@School 2D Grouping and changing materials, or a lump of Plasticine for you to make a model at the start of the lesson. Each child will need a piece of Plasticine or modelling clay, access to a plastic knife and pencil. Each group will need a small piece of sponge, a pipe cleaner. You will need an elastic band and a bubble-making kit for class demonstrations.

Starting the lesson

Present the models made in lesson 5 of Science@School 2D Grouping and changing materials, and ask the children to describe how they were made by rolling, squashing, bending, twisting and stretching. Alternatively if the children have not made models make a simple model with them and describe how you are making it in terms of rolling, squashing, bending, twisting and stretching. Remind the children that they are studying forces now and must look for pushes and pulls in the shaping of objects.

Activities with pages 6 and 7

- Read the opening sentence with the children and ask them to demonstrate a push and a pull.
- Read the text on page 6 and then move on to the pictures and captions on the rest of the page. Look at the top left picture first and explain that a potter's wheel turns round steadily but the clay does not fall off if it is placed at the centre. Point to the fingers of the right hand pushing on the clay. Look at the lower left picture and demonstrate how the potter would push on the clay. Ask the children whether they made a push as they made their models.
- Move on to the picture on the right and demonstrate how the potter pulls up the clay and ask the children when they made a pull as they made their models.
- Look at the use of the scraper and tell the children that by pushing the scraper onto the surface as the pot spins the surface is made smooth. Tell the children that the potter had a range of tools with points and blades for adding decorative features to the pottery.
- Give each child a lump of Plasticine or modelling clay and let them make a small vase like the one on the photograph. Ask them to think about the pushes and pulls they make as they make the pot. Tell the children

that when the pot is finished, they can decorate its surface by using a plastic knife or the tip of a pencil.

- Move on to page 7 and look at the sponge and read the caption. Let the children copy the action with a small piece of sponge.
- Look at the picture and caption about the athlete and ask the children to find out more about athletes in the glossary. Give each group a pipe cleaner and let them bend it and consider whether they are pulling or pushing or making both actions.
- Look at the picture of the rubber band and caption and ask a child to demonstrate the action to the class.
- Move to the bubble picture and ask a child to demonstrate bubble blowing. As the child blows the children could shout 'push'.

Differentiation

Less confident learners may need help in understanding when they are making pushes and pulls as they make the small vase. They may need help in deciding patterns and using the plastic knife and the pencil. More confident learners may like to add handles to the vase and a lid. These additional items should also be decorated.

Assessment

The children can be assessed on the quality of their vases and the ability to identify pushes and pulls as they make them.

Plenary

Let the children display their vases. Ask the children to answer the question on page 7 then check their answer by rolling some Plasticine or modelling clay into a ball. Challenge the children to identify pushes and pulls as you squash, bend, twist and stretch it.

Outcomes

The children:

- Know that the shapes of materials are changed by rolling, squashing, bending, twisting and stretching.
- Know that pushes and pulls are used in rolling, squashing, bending, twisting and stretching.

Gravity

Objectives

- To know that gravity is a force.
- To know that gravity affects us all the time throughout our lives.
- To know that gravity can be a useful and an unhelpful force.
- To know that the pull of gravity comes from the centre of the Earth.

Resources and preparation

A box of wooden blocks to make a tower, a jug of water, a sink or large bowl, a ball.

Starting the lesson

Show the children the pile of blocks and challenge the class to make a tower. Each child could come out in turn and add a block to the tower. Eventually the tower will become so tall and unsteady that it falls over. Ask the children why it happened. Remind them that things move because they are pushed or pulled and nobody pushed or pulled it. Tell the children they are going to find out by turning to page 8. If the tower fails to fall over, push its top a little but claim that your push was sideways not downwards so the children need to explain why the blocks fell down.

Activities with pages 8 and 9

- Read the opening two lines and ask the children to look up the word gravity in the glossary.
- Read the first paragraph with the children then look at the picture and read the caption. Take a jug of water and hold it high above a large bowl or sink. Tell the children that the water is stopped from falling because it is held by the sides of the jug and ask them what will happen if you tip the jug so the walls cannot hold in the water. Look for an answer about the water falling then tip the jug and let the water splash into the sink or bowl. Ask the children why raindrops fall and look for an answer about gravity.
- Read the first line of the second paragraph and let some children throw up a ball and catch it.
- Read the second line and tell the children that our muscles and bones and nerves are always working together to stop us from falling over by the pull of gravity. Take the children into the hall or other open space and ask them to spread out, put their arms out and stand on one leg. Tell the children that the eyes inform the body about the surroundings and help it stop gravity pulling us over. Ask the children to predict if it would be easier or more difficult to stand on one leg when the eyes are shut. Let them test their prediction. They

should find it is more difficult and feel their muscles pulling on their bones to keep them balancing.

- Read the last line of the second paragraph. Tell the children that the Moon and all the planets have a pull of gravity but out in space there isn't any gravity. Ask the children what would happen to them if they were in spacesuits in space and look for an answer about floating. Look at the picture and caption of the astronaut and ask the children to look up astronaut in the glossary.
- Move on to the third paragraph and then look at the two pictures and captions at the top of page 9. Ask the children when they have to work hard against gravity as they play on a slide and look for an answer about them climbing the steps. Ask the children when gravity gives them a helping hand on the slide and look for an answer about it being the force that pulls them down.
- Show the children a small Plasticine ball and ask them what will happen if you let it go. Look for an answer about falling and demonstrate that the answer is correct. Now attach one end of a piece of string to the Plasticine and ask what will happen if you let it go but hold on to the other end. Demonstrate this action and tell the children that gravity pulls the string vertical and this is important for building. If a building is not vertical it can fall over more easily. Let some of the children build a block tower again but this time overlap each block a little so that it is not vertical. The tower should fall over before it reaches the height of the tower made at the start of the lesson.
- Tell the children a string with a weight is called a plumb line and is used by builders to check that structures are vertical. Issue the string and balls of Plasticine and let the children make plumb lines and test the school walls and table legs to see if they are vertical.
- Ask the children to answer the question on page 9 and look for an answer about gravity pulling you down. Ask the children where the pull of gravity might stop and steer them towards the answer that the Earth pulls everything down to its centre.

Differentiation

Ask the children to write and draw about the topic gravity. They can select as much as they like from what they have read and done. Less confident learners may provide drawings with short captions while more confident learners could write an account and make drawings with captions to illustrate it.

Assessment

The children can be assessed on the quality of their drawings and written work.

Plenary

The children can display their work and talk about gravity being a useful force and an unhelpful force. They could finish by having one last try to get away from gravity by jumping but conclude that they have to live with gravity all their lives.

Outcomes

The children:

- Know that gravity is a force.
- Know that gravity affects us all the time throughout our lives.
- Know that gravity can be a useful and an unhelpful force.
- Know that the pull of gravity comes from the centre of the Earth.

On the move

Objectives

- To know that a push or a pull can make something move.
- To know that cars and yachts have devices to steer them.

Resources and preparation

A large toy car, model steam engine from lesson 9 Science@School 2D Grouping and changing materials. A clockwork or battery powered locomotive and carriages or tractor and trailer, a model car with front wheels that can be steered. A model boat with a rudder and a large bowl of water or sink.

Starting the lesson

Place the car on the floor and ask how it can be made to go forwards. Look for an answer about pushing it from the back and let a child try it. Ask how it can be made to go backwards and look for an answer about pushing it from the front and let a child try it. Ask how the car can be made to move forward by pulling. Look for an answer about attaching a string to the front with sticky paper and let a child try and pull it forwards. Ask how the car can be pulled backwards. The children may suggest pulling the string over the top of the car or attaching a second string to the back to pull it backwards. Let the children demonstrate either or both of these methods.

Activities with pages 10 and 11

- Read the introductory line with the children and then read the first paragraph. Remind the children of the activities in pushing and pulling the car and get them to confirm that they applied the force in the same direction that they wanted the car to move.
- Look at the photograph at the bottom of the page and read the caption. Ask the children to identify the machine the girl is riding and then ask the children about other ways children travel about on wheels. Make a list on the board. It should include scooter, bike, skateboard, rollerblade, trolley. Conduct a survey to find the most popular form of transport and let the children produce a block graph of the results.
- If you have done lesson 9 Science@School 2E Forces and movement with the children and shown them the model steam engine produce it now and remind them of how the steam pushed the wheels round and the wheels pushed on the rails to move the engine forwards. Tell the children that another name for an engine that pulls a train is a locomotive.
- Look at the picture of the train on the spread and tell the children that the locomotive is at the front of the train and its wheels are pushing it forwards on the rails. The locomotive then

pulls the rest of the carriages. Show the children the clockwork or battery powered locomotive and carriages or tractor and trailer and explain that the wheels of the locomotive or tractor push back on the ground and push the vehicle forwards (just as our feet push on the ground and push us forwards). The carriages or trailer are simply pulled along.

- Ask the children to answer the question on page 11 and look for an answer about the train slowing down and stopping.
- Move on to the picture of the car and read the caption with the children. Let the children watch as a child sets the wheels on the car to make it go round in a circle. Let another child set the wheels for the car to go in the opposite direction. The children could set up an obstacle course for the car to go round and take turns at trying to steer it round.
- Move on to the picture of the yacht and read the caption. Ask the children to find out more about the rudder in the glossary. Show the children the rudder on the model boat and then ask one of them to set it to turn right. Set the boat going and note its direction. Let a child set the rudder to turn the boat to the left and set the boat going again.

Differentiation

Less confident learners may need help in transferring the data on the board to a block graph. More confident learners could write instructions on how to ride a bicycle, a scooter or travel safely on a skateboard or roller boots. The notes should include advice on how to change direction.

Assessment

The children can be assessed on the presentation of their graphs and the clarity of their instructions. There is an assessment sheet at the end of the guide (page 55).

Answer guidance

1. The trolley goes in the same direction that you are pushing.
2. They go in the same direction as the engine.
3. You pull on the right handle bar and push on the left handle bar.
4. The pushing force of the wind.
5. A rudder.
6. The arrow points backwards where the wheel and ground meet.
7. The arrow points backwards where the foot and ground meet.

Plenary

The children could talk about their travels on a scooter, bike, skateboard and roller blades. The tales will invariably feature mishaps!

Outcomes

The children:

- Know that a push or a pull can make something move.
- Know that cars and yachts have devices to steer them.

Going faster

Objectives

- To know that more effort has to be made to go faster.

Resources and preparation

A large toy car with a long piece of string attached to it. Access to the hall.

Starting the lesson

Take the children in the hall and show them the toy car and string. Ask a child to pull it along steadily. Ask the class what needs to be done to make the car suddenly go faster. Look for an answer about tugging harder on the string and let the child try it a few times. Point out that each time the child has to make more effort in pulling to make the car go faster. Tell the children that they are going to look at how they can go faster.

Activities with pages 12 and 13

- Read the two introductory lines with the children. Explain that a car has an accelerator pedal. When it is pressed it sends more fuel to the engine so the engine can work harder and move the car faster.
- Read the first line of the paragraph and remind the children how more effort had to be made to make the car go faster. Tell them that when it speeded up it was accelerating.
- Read the rest of the paragraph with the children and take them in the hall again. Ask them to walk slowly and count the steps as they take them. Ask them to run by making little steps and keep counting. Ask them what they noticed when they accelerated and look for an answer about making the steps quicker. Tell them to walk slowly again and then tell them to run by making longer steps. Ask them what they noticed and look for answers about taking fewer steps but still moving faster.
- Look at the picture of the cyclists and read the caption. In the plenary to the last lesson the children were invited to talk about their travels on bicycles and it may be appropriate to remind them of it.
- Move on to the picture of the swimmers. If there is space in the classroom ask the children to spread out and mime a swimmer's arm movements as they swim slowly and then quickly.
- Let the children look at the photograph at the top of page 13 and read the caption. Let them find space to arrange themselves into rowing crews with four rowers and a cox (coxwain). The cox faces the rowers and gets them to row their oars at the same pace then speeds up or slows down. The three rowers behind the one facing the cox should follow the

pace of the first rower. The children could practise rowing slowly, speeding up and slowing down again.

- Ask the children to answer the question on page 13 and look for an answer about jumping faster than everybody else.

Differentiation

In lesson 2 of Science@School 1E Pushes and pulls the children worked out and performed a series of movements. This work can be extended here by letting the children consider their movements in the context of putting in more effort to move fast. Let the children work out a sequence of movements, which involves walking slowly, running with little steps, running with longer steps. They can change from slow to fast then slow and fast again and perhaps put in a jump or hop before moving slowly again. Less confident learners may need more help in working out a sequence and concentrate on doing a short sequence very well and incorporating the waving of the arms. More confident learners can make a more elaborate sequence.

Assessment

The children can be assessed on their application to the task of making and practising a sequence of movements and their performance. If the children do the rowing activity they could be assessed on how they work as a team.

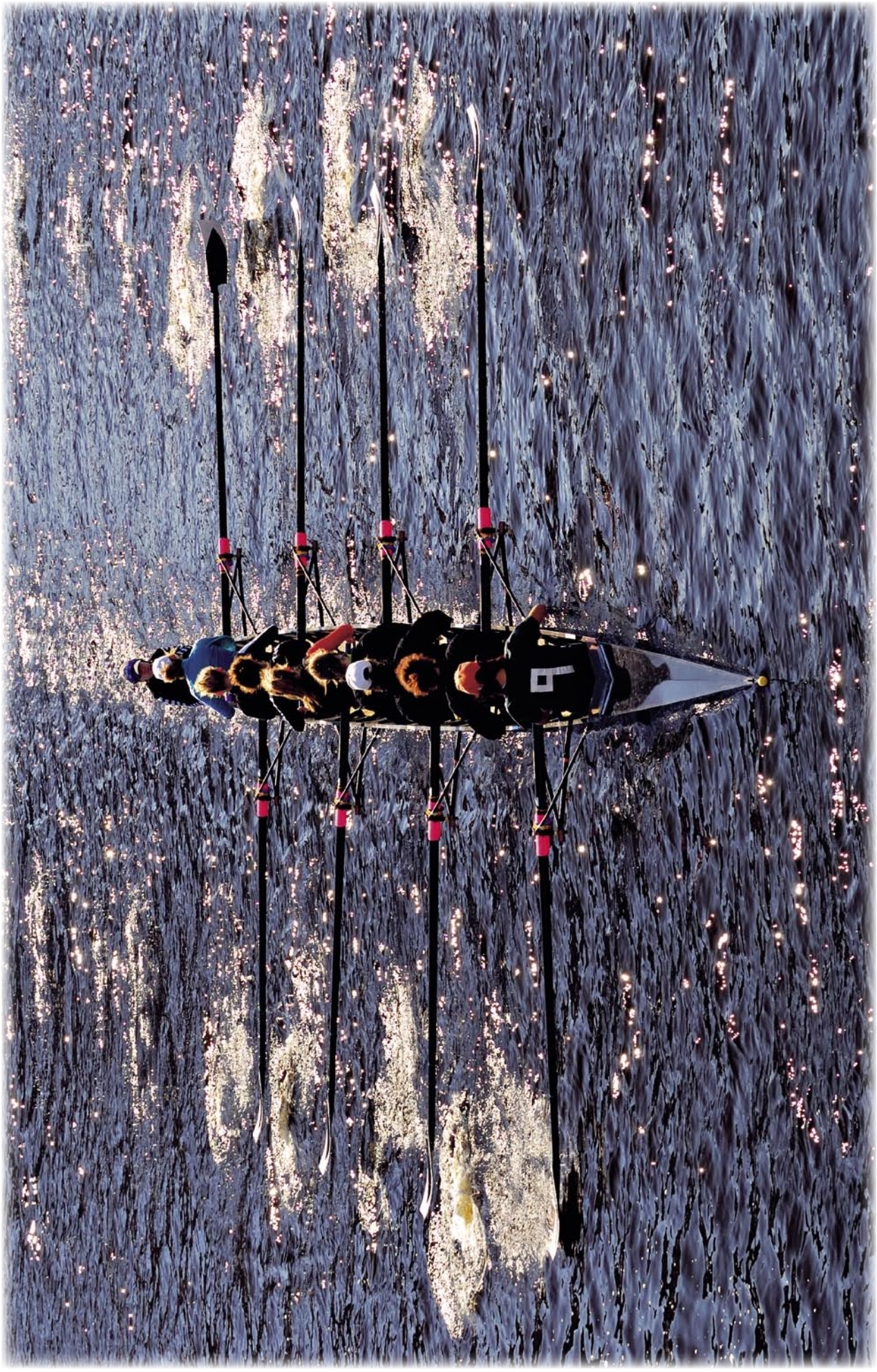
Plenary

The children could perform their running and walking sequences and demonstrate how they work as a team in a rowing crew.

Outcomes

The children:

- Know that more effort has to be made to go faster.



Friction

Objectives

- To know that friction is a force.
- To know that friction can be either a push or a pull.
- To know that when surfaces rub together heat is generated.

Resources and preparation

Rubbers, each group will need two flat pieces of wood, a wooden block and a jug of water. You will need a match box.

Starting the lesson

Ask the children to lay their books flat on the tables and put a rubber in the middle of them. Ask them to lift one end of the book very slowly and notice that the rubber stays in place. Tell the children that the force that is making the rubber grip the book is called friction and they are going to find out more about it.

Activities with pages 14 and 15

- Read the introductory sentences with the children but do not let them go to the glossary until the end of the lesson and use the activity for reviewing the meaning.
- Read the first paragraph, stand up and ask what would happen if friction could be switched off and it had been switched off in the classroom. Look for the children saying that you would slide about, fall over and crash into a wall or table. Anything you knocked would keep on moving and as the class laughed and wriggled in their seats they would slide onto the floor and slide about like they would at a skating rink.
- Read the first two sentences of the second paragraph with the children and ask them to tell you about gravity or return to page 8 and review it.
- Read the last line with the children and tell them that when they tilted the block in the model snow experiment or the rubber on their book gravity was pulling at the block or the rubber but friction was holding them in place. Let the children put their rubbers back on their books and tip the books slowly again until the rubber slides. Tell the children that as gravity tries to pull the rubber down the book, friction pulls in the other direction and holds it in place. Tell them that as the book is tipped the pull of gravity on the rubber increases until it is stronger than the pull of friction and the rubber moves.
- Tell the children that there is something unusual about friction and ask them to put their rubbers on the table and push very gently from one side. They should find that the rubbers do not move. Explain that as their fingers try to push the rubber so friction pushes back and keeps the

rubber in place. The unusual thing about friction is that it can be a push or a pull and this depends on whether an object is being pushed or pulled.

- Read the third paragraph with the children and then move on to the photograph and its caption. Ask the children how they could see if there was less friction on a wet surface than a dry one. Steer them to think of having two pieces of wood and two wooden blocks. One piece of wood should be covered in water and the second should be kept dry. The wooden block should be placed on the dry piece of wood and one end raised until the block starts to slide. The height of the raised end should be measured. Alternatively the tilted wood with its block could be photographed. The experiment should be repeated with the wet piece of wood. Let the children try this activity
- Move on to page 15, look at the top picture and read the caption. Ask the children if they can remember studying slippiness and snow before and steer them to their work on conifers in lesson 9 of Science@School 2C Variation. Remind them that the leaves were waxy to reduce friction so the snow fell off and its weight did not break the twigs. Explain that here the snowboarder polishes the board to move faster over the snow.
- Move onto the picture of the snow clearing machine and say that the chains on the tyres make the tyre surface rougher so the machine does not slip. Take a wood block, place it on the book and raise one end until the block moves. Show the children a matchbox with its sandpaper and place it sandpaper side down on the book. Ask them what should happen as you raise one end and look for a prediction about the book being tipped higher because the force of friction will be greater. Test their prediction.
- Look at the pictures of the matches with the children and read the captions. Tell the children that they can do a safer experiment than use matches to show that heat is produced when surfaces are rubbed and get them to rub their hands together and feel the warmth.
- Let the children look up friction in the glossary.

Differentiation

The children should write an account of the experiment. Less confident children could draw a sequence of pictures and give each one a caption. More confident children could write down the items they used, draw a picture of the set up and write about what happened.

Assessment

The children could be assessed on the presentation of their accounts of the experiment.

Plenary

The children could display the accounts of their experiments and then get them to look at the question on page 15 and ask them how they could answer it. Look for an answer about going round school sliding their feet on carpets, tiles and tarmac then let them try it.

Outcomes

The children:

- Know that friction is a force.
- Know that friction can be either a push or a pull.
- Know that when surfaces rub together heat is generated.

7 Teacher's sheet 2E

Going slower

Objectives

- To know that if a pushing or pulling force is removed an object will slow down and stop.
- To know that friction makes things slow down and stop.

Resources and preparation

Wooden blocks, bicycle, trolley with a wooden block or model person in it towards the back. (The idea is to stop the trolley suddenly so the object moves forwards in the trolley.) Cylindrical pencils.

Starting the lesson

Give each child a wooden block and tell them to put it on the cover of their book. Ask the children to push the block along the cover a short way and then stop pushing. Ask them what happens to the block. Look for an answer about the block stopping. Tell the children that the block moves because they push on it and ask them if there could be another force at work. Remind the children that when objects slide down slopes the pull of gravity is greater than friction and tell the children that when they push the block their pushing force is greater than the friction between the block and the book. Explain that when they stop pushing there is only friction pushing on the block and this stops the block moving.

Activities with pages 16 and 17

- Read the opening sentence with the children and remind them that the block on the book went slower and stopped the moment they stopped pushing it.
- Read the first paragraph and refer back to the block and book to reinforce the link between friction and slowing down and stopping.
- Read the second paragraph and ask the children to look up brakes in the glossary. If the children have done lesson 7 with Science@School 1E Pushes and pulls they may have seen the bicycle and you could remind them of it. Alternatively you could bring in a bicycle, raise a wheel and set it spinning and then apply the brakes. If the children have bicycles let them tell you about how they ride it and use the brakes.
- Finish off your work on bicycles by looking at the picture on page 17 and talk about how the brake rubs against the rim of the wheel and the friction force slows the wheel and stops it turning.
- Look at the top right hand picture and ask children to tell you about going down slides. Ask them if they have ever slowed themselves down by doing the same as the child in the picture. Tell the children that the friction between the hands and the

slide is stronger than the friction between the clothes and the slide and this increase in friction slows you down when you use your hands.

- Look at the picture of the child in the car seat and read the caption. Tell the children that we all need to use car seats because something odd happens when things stop quickly. Show the children the trolley with the wooden block in it or model person. Pull the trolley to increase its speed without making the object slide about in the trolley and then let it stop suddenly by pulling back on the string or letting it run into an object. Ask the children what they saw. They should see that the object shoots to the front of the trolley or even falls out of it.
- Tell the children that once an object is moving it will keep going even if the pushing or pulling force is removed. (This property of matter is called inertia but the children do not need to know this.) In the case of the trolley and object when the trolley stops suddenly due to an impact force the object keeps moving on the trolley until it too suffers an impact force. A similar thing happens with people in cars who are not belted up and the impact forces they receive can be fatal.
- Look at the photograph of the roller blades and read the caption with the children. Tell them that there is friction between curved and flat surfaces just as there is between two flat surfaces and ask them to compare the friction in the following way. Let them put a block and a cylindrical pencil on the book and tip the end nearest the block. The pencil should roll away almost immediately but the block will only slide when the book is tilted higher.

Differentiation

Less confident learners may need to repeat exercises about the ideas in this topic to make their knowledge secure. More confident learners could be challenged to predict what would happen if they put a finger gently on the block on a book and tipped the book (the book can be tipped higher before the block moves) and then challenged to predict what would happen if they pressed harder on the moving block (it would stop). They could compare these observations with the action of bicycle brakes and conclude that extra pressure on the surfaces increases friction.

Assessment

The children could be questioned on friction and slowing and stopping to assess the security of their knowledge.

Plenary

Remind the children of the time they pretended to be a rowing crew and ask them to answer the question on page 17. Point out that there is friction between the sides of the boat and the water. Look for an answer about rowing more slowly or stopping rowing to remove the push. Some children may say

that holding the oars steady in the water slows the boat down. This is true but is due to increasing the surface area of the boat plus oars pushing through the water and increasing a force acting on the boat, called water resistance.

Outcomes

The children:

- Know that if a pushing or pulling force is removed an object will slow down and stop.
- Know that friction makes things slow down and stop.

Toy cars

Objectives

- To follow instructions to carry out an investigation.
- To make accurate measurements.
- To make a prediction and test it.
- To know that gravity and friction are forces at work when a car moves down a ramp and across a flat surface.

Resources and preparation

A selection of toy cars and lorries, small wooden planks for ramps, wooden blocks, rulers. More confident learners could use dominoes instead of blocks.

Starting the lesson

Sit a few children on the carpet and give them a toy car. Tell them you want to see which car goes furthest when it is given a gentle push. Ask them to give their cars a gentle push and let the other children describe what happens. They should see that the cars move different distances. Ask the children if they can be sure that the car that travelled the furthest really can move further than the others when given a push. Look for an answer about the children pushing with different strengths and ask the children how they could devise an experiment in which all the cars were pulled by the same force. Steer them towards the use of gravity pulling down a ramp.

Activities with pages 18 and 19

- Read the opening sentence with the children and tell them that they are going to investigate movement with a ramp, a car and the pull of gravity.
- Read the title and first two lines of the investigation. Make sure of the link between ramp and slope by asking the children to look up ramp in the glossary. Set up a car on a ramp with blocks.
- Read the first line of point 1 and move across to page 19 and look at the picture with the children. Move back to point 1 and read the next two lines and follow the instruction. You may like to set up the ramp on the floor with a particularly free-wheeling vehicle.
- Read point 2 and look across at the picture on page 19 and follow the instruction.
- Let the children try points 1 and 2 for themselves.
- Tell the children to make a table with two columns. The left column heading is 'Number of blocks' and the right column heading is 'Distance travelled (cm)'.
- Read point 3 with the children and discuss the most orderly way of performing the experiment. Look for a strategy of starting with a ramp propped up by one block, then two, then three, and so on. Let the children

carry out this part of the investigation and fill in their table.

- Move on to point 4 and ask the children to make a prediction and test it.
- Move on to page 19 and read the 'How does it work section?' The friction between the axles and their mountings is the force that slows the car down on the smooth ramp and table but you do not need to explain this to the children.

Differentiation

Less confident learners may need help in measuring and always putting the car at the top of the ramp. More confident learners could use dominoes instead of blocks and make more measurements.

Assessment

The children can be assessed on their ability to follow the instructions, make measurements, make and fill in the table and draw conclusions.

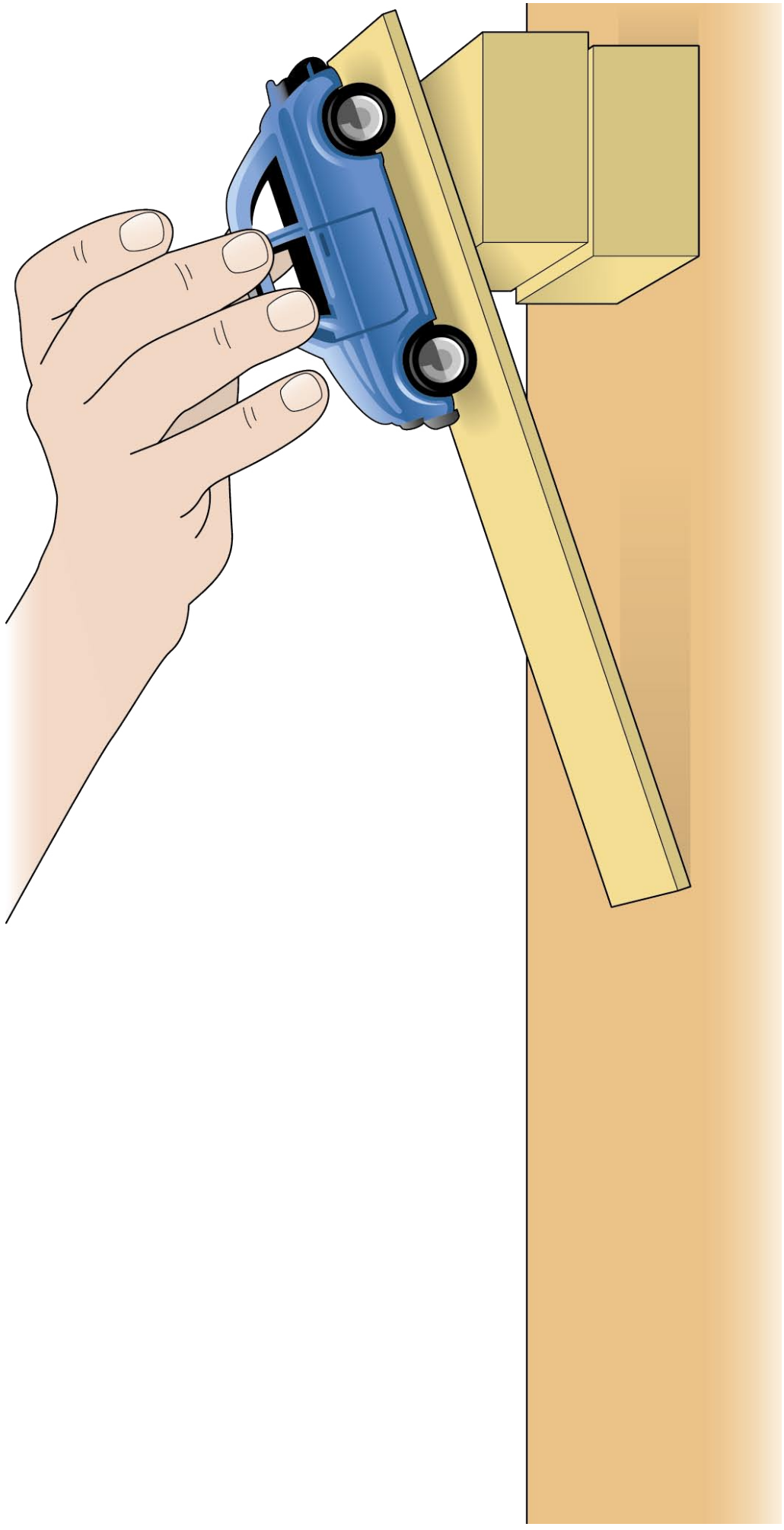
Plenary

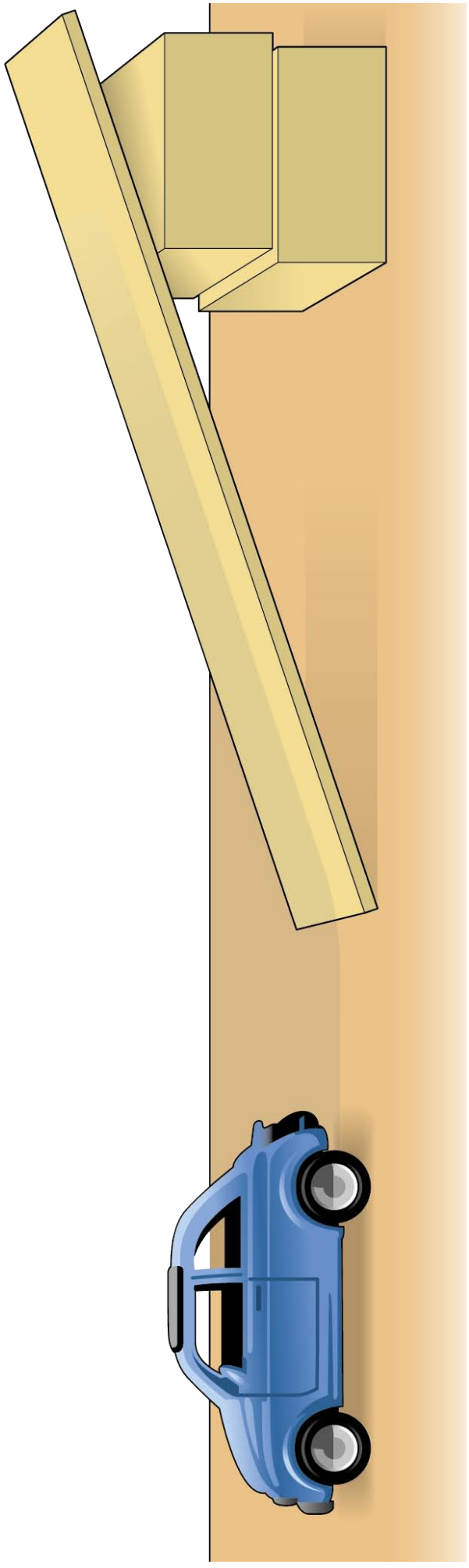
Let the children compare their results. They should be able to find out which car can travel the furthest distance and list the other cars in the order of the distance travelled. Ask the children to answer the question on page 19. Look for a response about the car travelling a shorter distance because the table cloth is rougher than the table top and friction will be increased. Let the children test their prediction.

Outcomes

The children:

- Can follow instructions to carry out an investigation.
- Can make accurate measurements.
- Can make a prediction and test it.
- Know that gravity and friction are forces at work when a car moves down a ramp and across a flat surface.





Weight

Objectives

- To know that it is the pull of gravity that gives things their weight.
- To know how weighing machines work.

Resources and preparation

A see-saw type kitchen scales with weights. (The scales and its support should be made before the lesson for the children to use, or one could be made with supervision by more confident learners.) The support can be made from a retort stand, boss and clamp loaned from a secondary school science department or purchased from a primary science supplier. A piece of wood into which the hook can be screwed can be held in the clamp of the retort stand. Alternatively the elastic band could be suspended from a horizontal cylindrical rod held between two tall cardboard boxes on a table. The scale could be attached to the thin side of a cereal packet and placed near the pointer. The string can be attached to the pan with sticky paper if small weights are going to be used.

Starting the lesson

Show the children the kitchen scales and an orange. Pass the orange round and ask the children if they think it is light or heavy. They should write down their answer on a small piece of paper and not let anyone look at it. Collect in the papers and arrange them into piles for heavy or light. Tell the children that people need to know more about weight than whether something is light or heavy and say that scales are used to measure weights. Put the orange in the scale pan and add weights to the second pan until the scales balance. Take out the weights and add them together to get the total weight of the orange. Pass round another fruit such as a melon and ask the children to predict its weight. They should write down their prediction together with their name and not let anyone see. Collect in their prediction and arrange them in order from lightest to heaviest weight. Weigh the melon and identify the person with the most accurate prediction. Ask the children to identify the force that pulls down the fruit and weights in the kitchen scales.

Activities with pages 20 and 21

- Read the opening sentence and compare it with the children's answer at the end of the start to the lesson. Let the children look up weight in the glossary.
- Read the first paragraph and review the information with the activities at the start of the lesson.
- Read the second paragraph and remind the children of how the orange and the melon pushed down on their hands.

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- Look at the picture of the weight and compare it with the weights on your kitchen scales. Let the children look up scales in the glossary.
- Look at the pictures of the spring scales. Tell the children that as the weight of the person squashes the spring in the bathroom scales the scale moves across the window to record the weight. Say that as the weight of the fruit squashes the spring in the kitchen scale a pointer moves across the scale to record the weight.
- Move on to page 21 and look at the question. Read through the investigation test slowly and assemble the scale.

Differentiation

Less confident learners may need extra examples to secure their link between gravity and weight. More confident learners could with supervision assemble the scales by threading the string through a paperclip straightened for them and sticking the string to the pan with sticky paper. They could attach the elastic band and attach it to the hook already screwed into the wood and held in the stand or onto the rod held between two cardboard boxes.

Assessment

The children could be assessed on the accuracy of their predictions. There is an assessment sheet for use when the book is completed. It is at the end of the guide (page 57).

Answers guidance

1. Push
2. Push
3. Pull
4. Gravity
5. Friction
6. There is less friction.
7. Friction slows it down and stops it.
8. Friction
9. The pulling force of gravity.
10. Scales

Plenary

Demonstrate how the scale works and let children find small objects to weigh. They should predict the mark on the scale to which the elastic will stretch when their weight is put in the pan.

Outcomes

The children:

- Know that it is the pull of gravity that gives things their weight.
- Know how weighing machines work.

Assessment

Name: .....

On the move

1. What happens when you push a shopping trolley?

   .....

2. What happens to the carriages on a train when the engine pulls them?

   .....

3. How do you make a bicycle turn right?

   .....

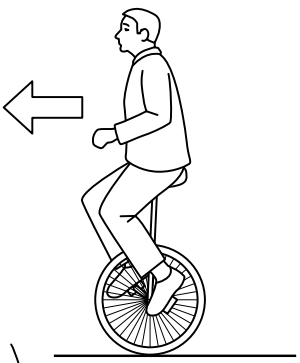
4. What force moves a yacht along?

   .....

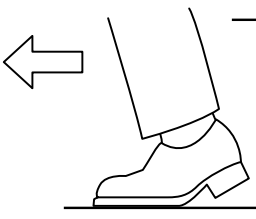
5. What is used to make a yacht change directions?

   .....

6. Which way does the wheel push on the ground to make the unicyclist go forward?
   Draw an arrow.



7. Which way does the foot push to make the person go forward.
   Draw an arrow.



Assessment

Name: .....

Forces and movement

1. **What force do you use to squeeze a sponge?**

   .....

2. **What force do you use to blow a bubble?**

   .....

3. **What force do you use to stretch an elastic band?**

   .....

4. **What force pulls things down towards the centre of the Earth?**

   .....

5. **What force occurs when two surfaces rub together?**

   .....

6. **Why are wet floors more slippery than dry floors?**

   .....

7. **Why does a ball stop rolling after you kick it?**

   .....

8. **What is the force that acts when you put on the brakes on a moving bicycle?**

   .....

9. **What gives everything its weight?**

   .....

10. **What is used to measure weight?**

    .....