Forces: Friction

Aim:	**Success Criteria:**	**Resources:**
To identify the effects of friction by investigating brakes. To investigate the effects of friction.	I can explain the effects of friction on a moving vehicle. I can investigate the effects of friction created by different materials. I can recognise and control variables in an investigation.	**Lesson Pack** Tricycles or scooters – one per group, if possible. The lesson does not require these to be ridden. Thick card cut into playing card-sized pieces Five different materials to test (e.g. carpet, vinyl flooring, tin foil, towels, bubble wrap, plastic) Stopwatch
	Key/New Words: Friction, force, brake, prediction, investigation, measure, observe, variables, results.	**Preparation:** Differentiated **Investigating Friction Activity Sheet** – per child

Prior Learning: The children will have learnt about friction in Year 3 and in Lesson 1 of this unit.

Learning Sequence

	What Is Friction? Children discuss the statements about friction and decide if they are true or false. Share the answers and explain them using the information on the **Lesson Presentation**. Can children explain how friction affects a moving vehicle?	
Whole Class	**Friction in Action:** Using the **Lesson Presentation**, discuss how brakes on a bicycle make use of the force of friction.	
	Design a Brake Pad: Explain the context of the investigation and how to carry it out, referring to the **Lesson Presentation**.	
	Reliable Results: Discuss the variables with the children, pointing out the need to keep the variables not being tested or measured the same in order to gather reliable results. Groups of children discuss how they can try to keep the controlled variables consistent. Ask the children to consider why taking repeat readings is useful. Discuss how a second reading confirms the first reading was not a fluke. Can children recognise and discuss how they will control variables in an investigation?	
	Find the Best Brake Pad: Children complete their prediction on the differentiated **Investigating Friction Activity Sheet**. They will then conduct the investigation and complete the table on the activity sheet with their results. Ideally, children will have enough time to repeat the investigation to gather a second set of readings. Once completed, the children will demonstrate which material they think makes the best brake pad, and explain their choice on the activity sheet. You may wish to film or photograph the children's demonstrations, or they could present them to the rest of the class. Ask children to look at their results and suggest further results they would like to gather. Can children investigate the effects of friction created by different materials? ★ Use key words to explain their prediction and choice of material. ★★ Write their own explanations. ★★★ Make generalisations about the properties of materials that create most friction.	
	Solve and Explain: In pairs, children discuss how to solve the problem on the **Lesson Presentation**, explaining the science behind their solution. Share children's ideas and share the example answer with the class.	

Taskit

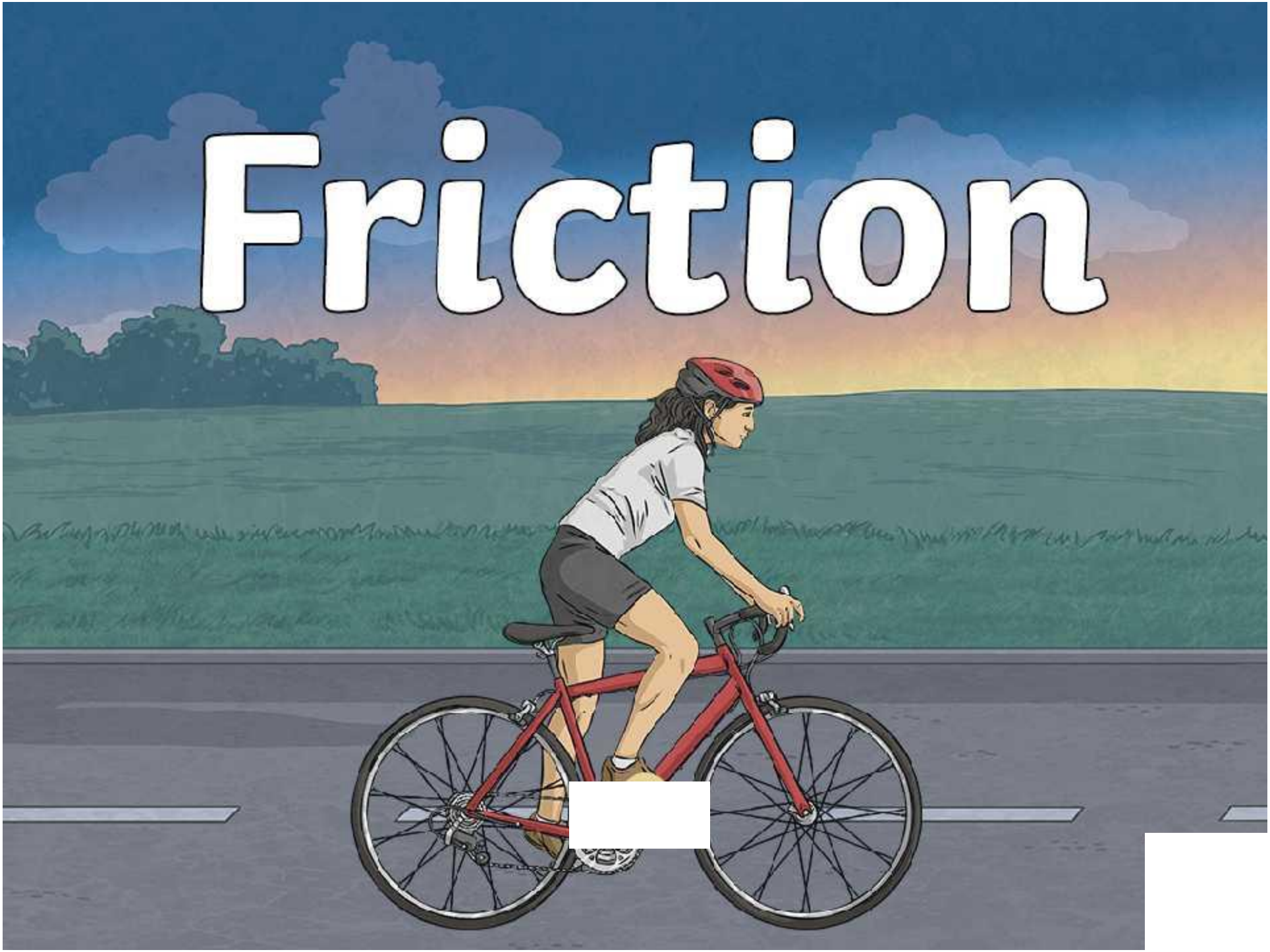
Investigateit: Can you adapt a shoe to improve its grip? Test a shoe by sliding it down ramps of different heights. Then adapt the shoe by adding different materials to it. Test it on the ramps again to see if it grips the ramps better and slides more slowly.

Makeit: Can you design and make a marble race? Stick different papers and cards across a ramp. You could try sandpaper, corrugated cardboard, foil or tissue paper. Hold one marble for each type of paper at the top of the ramp. Release the marbles and see which one reaches the bottom of the ramp first!

Science

Forces

Friction



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What Is Friction?

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your ideas with your partner you h
cl

Friction is a force.

Friction is stronger than gravity.

Friction slows moving objects down.

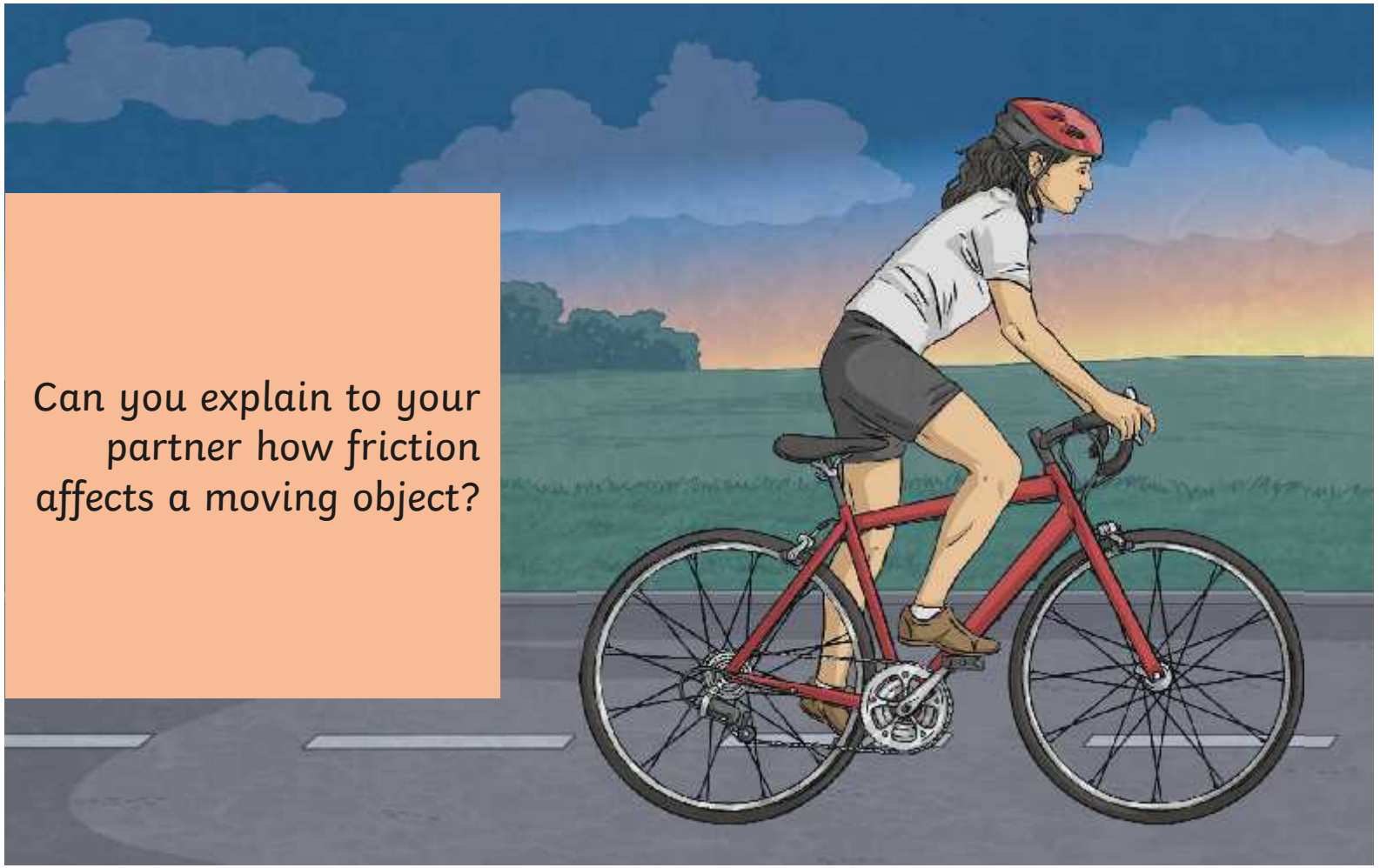
All surfaces create friction on an object moving over them.

Friction is always a useful force.

Friction produces heat.

How did you do?

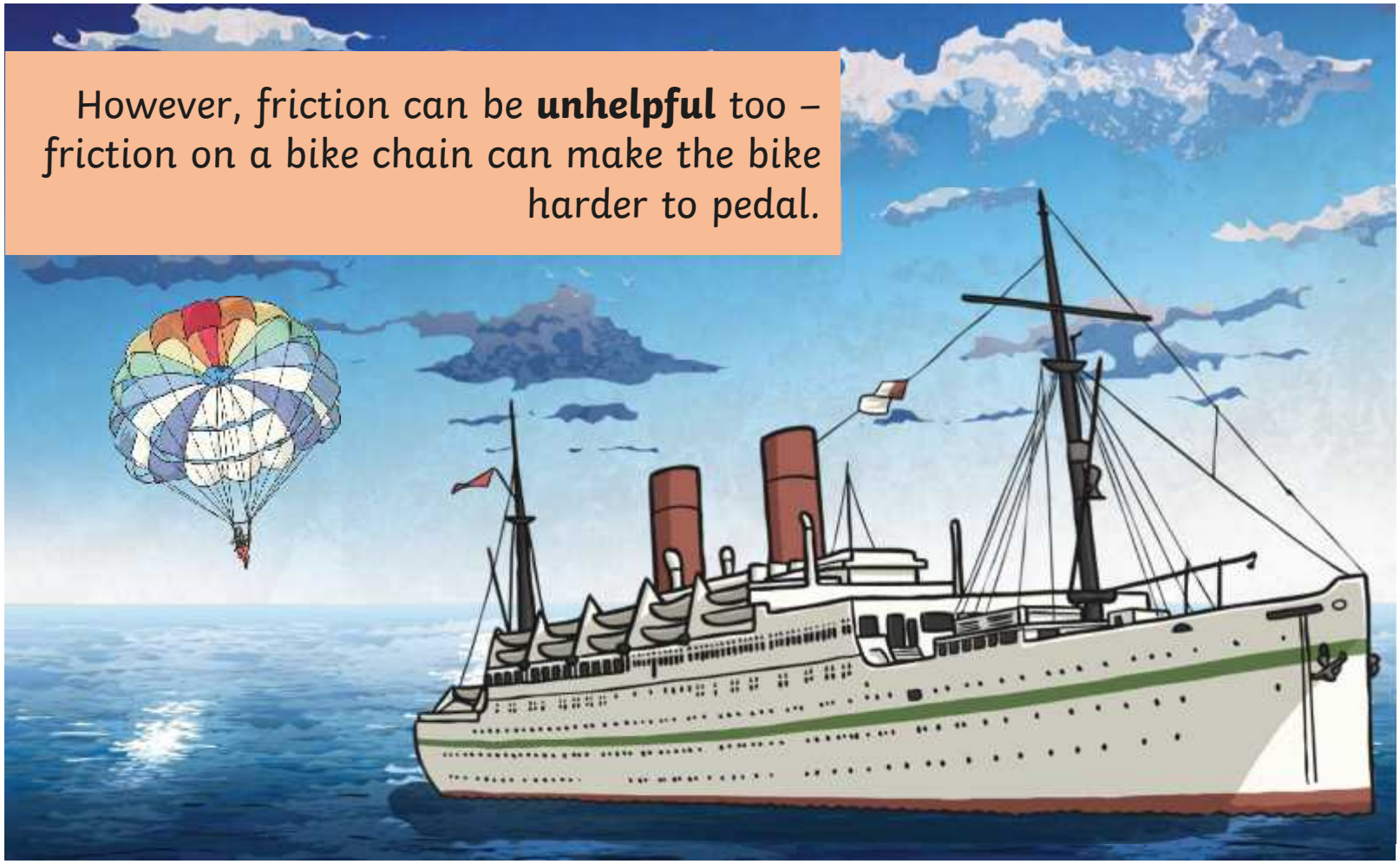
What Is Friction?



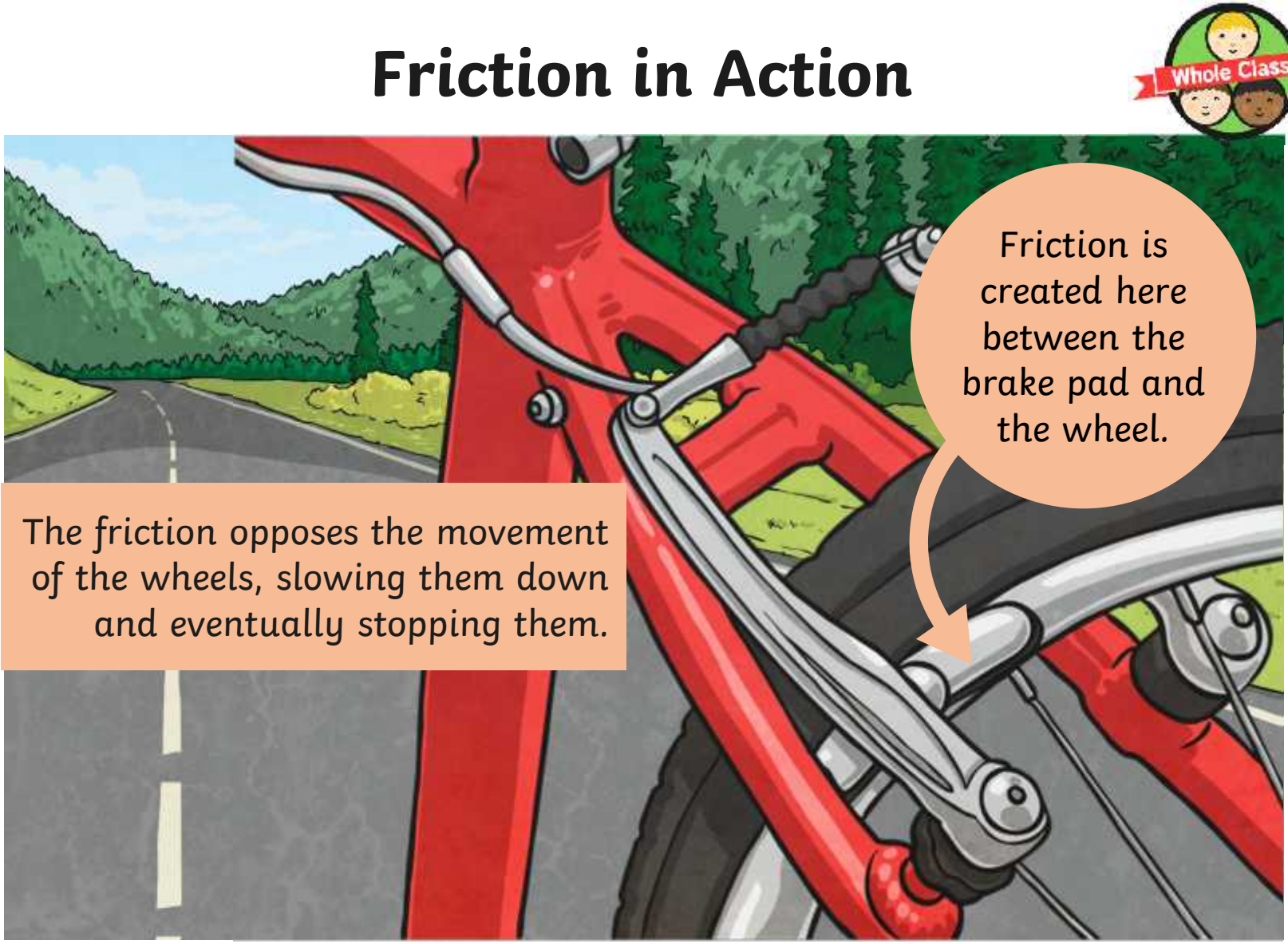
Can you explain to your partner how friction affects a moving object?

What Is Friction?

However, friction can be **unhelpful** too – friction on a bike chain can make the bike harder to pedal.



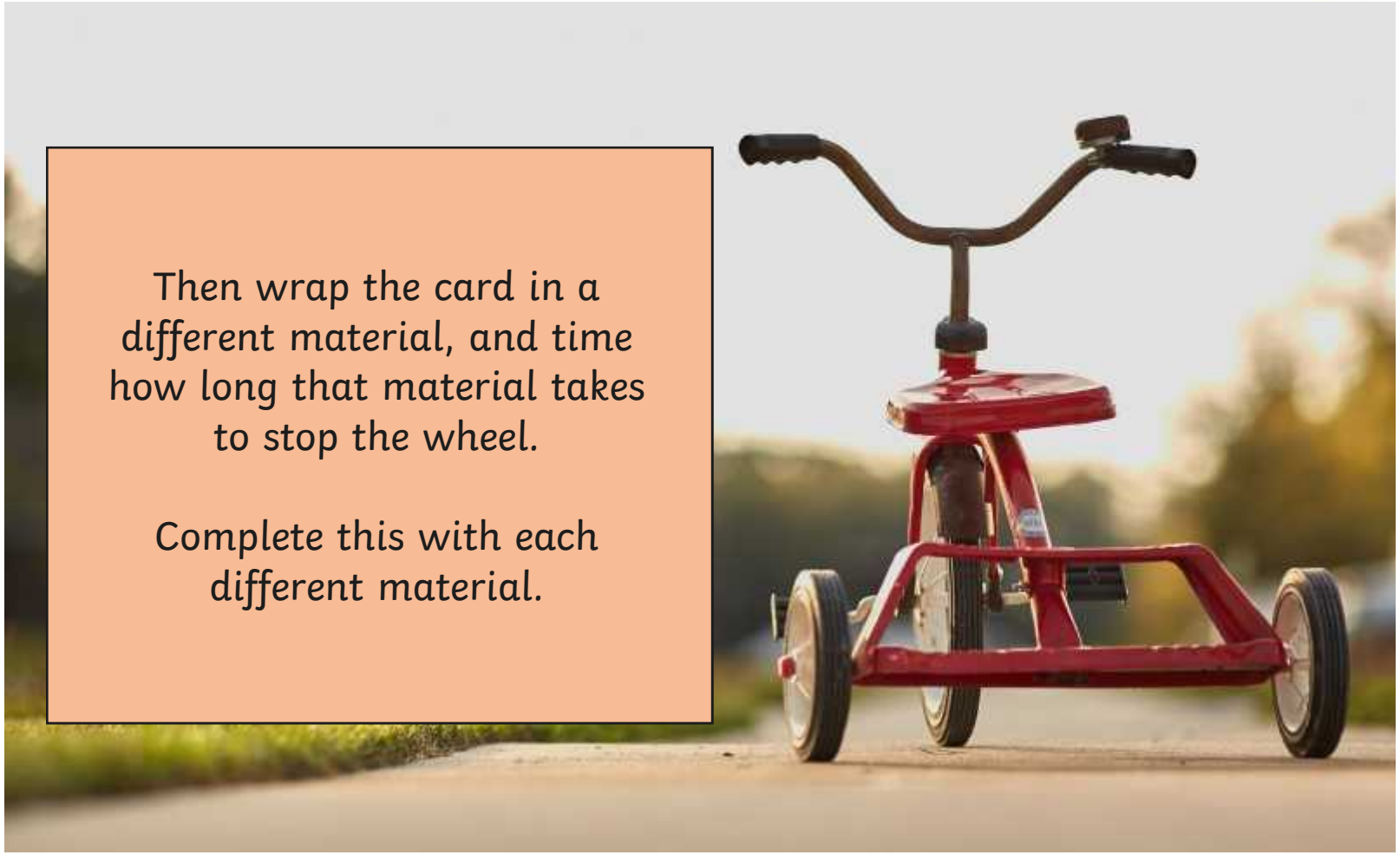
Friction in Action



Design a Brake Pad

You will need to test different materials and demonstrate the best choice.

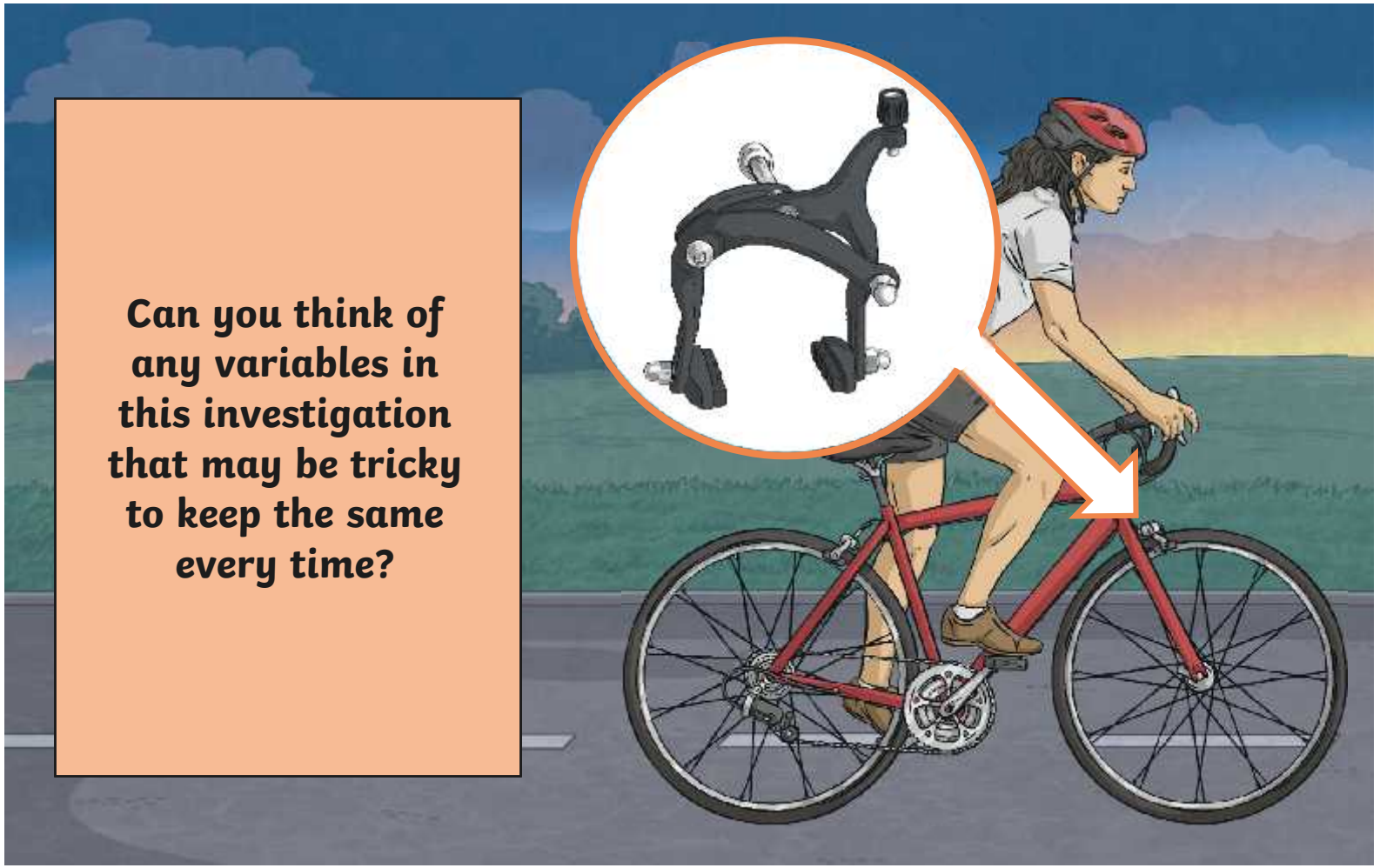
Design a Brake Pad



Then wrap the card in a different material, and time how long that material takes to stop the wheel.

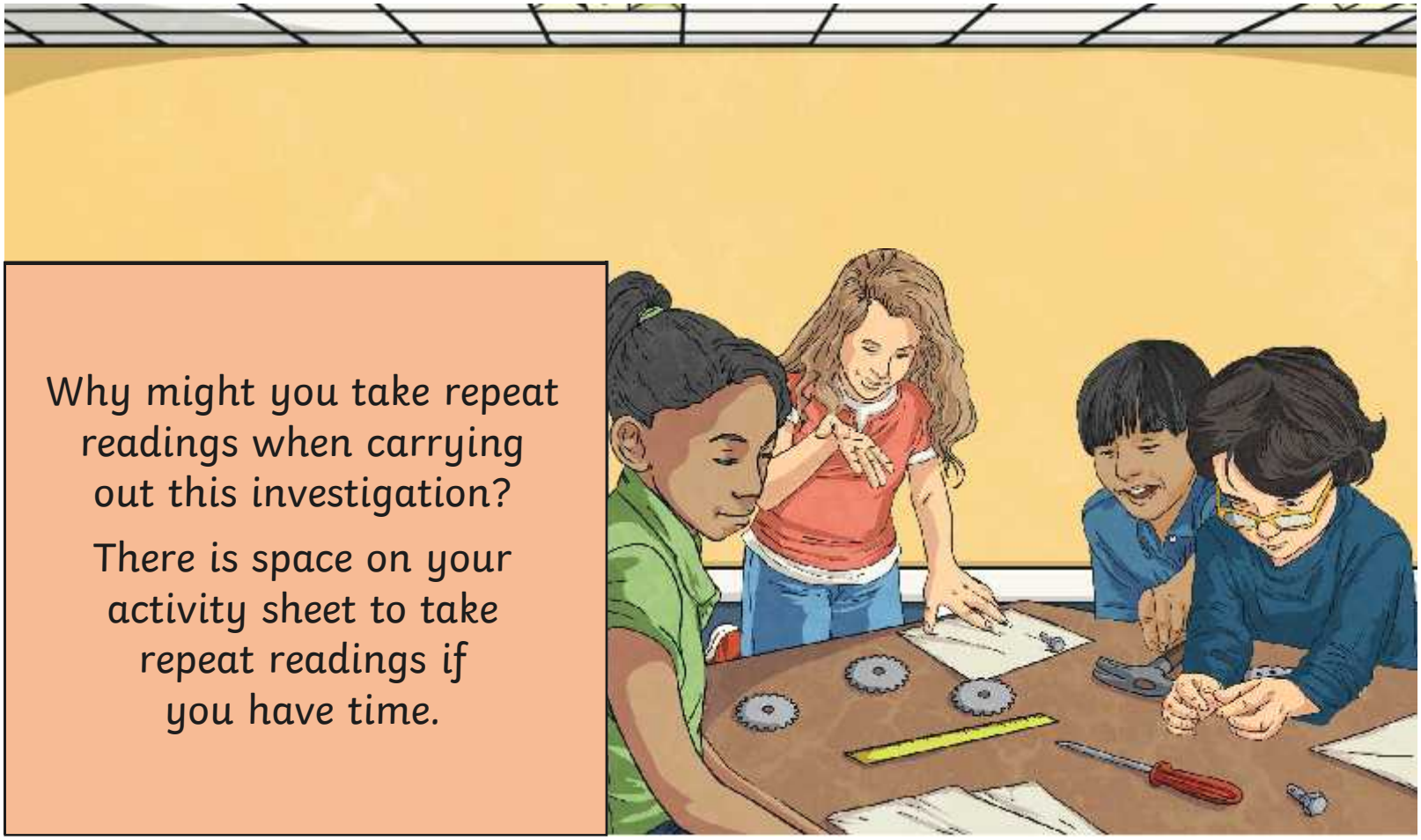
Complete this with each different material.

Reliable Results



Can you think of any variables in this investigation that may be tricky to keep the same every time?

Reliable Results



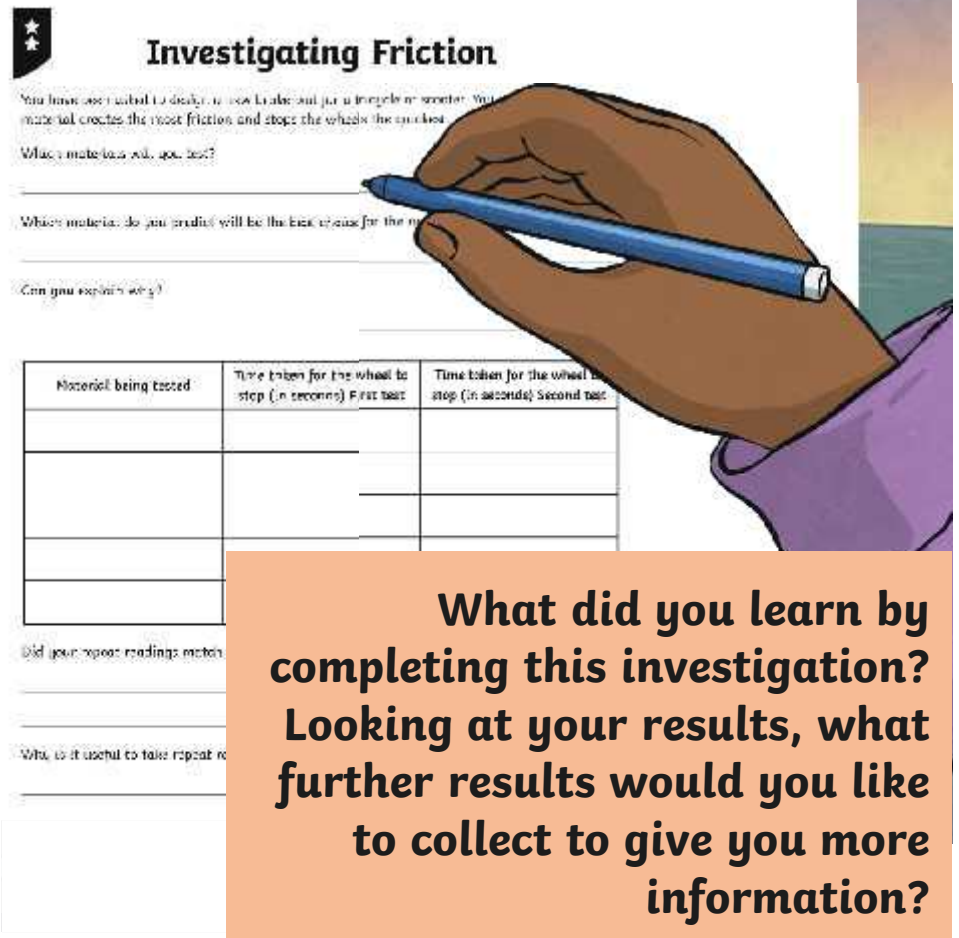
Why might you take repeat readings when carrying out this investigation?

There is space on your activity sheet to take repeat readings if you have time.

Find the Best Brake Pad

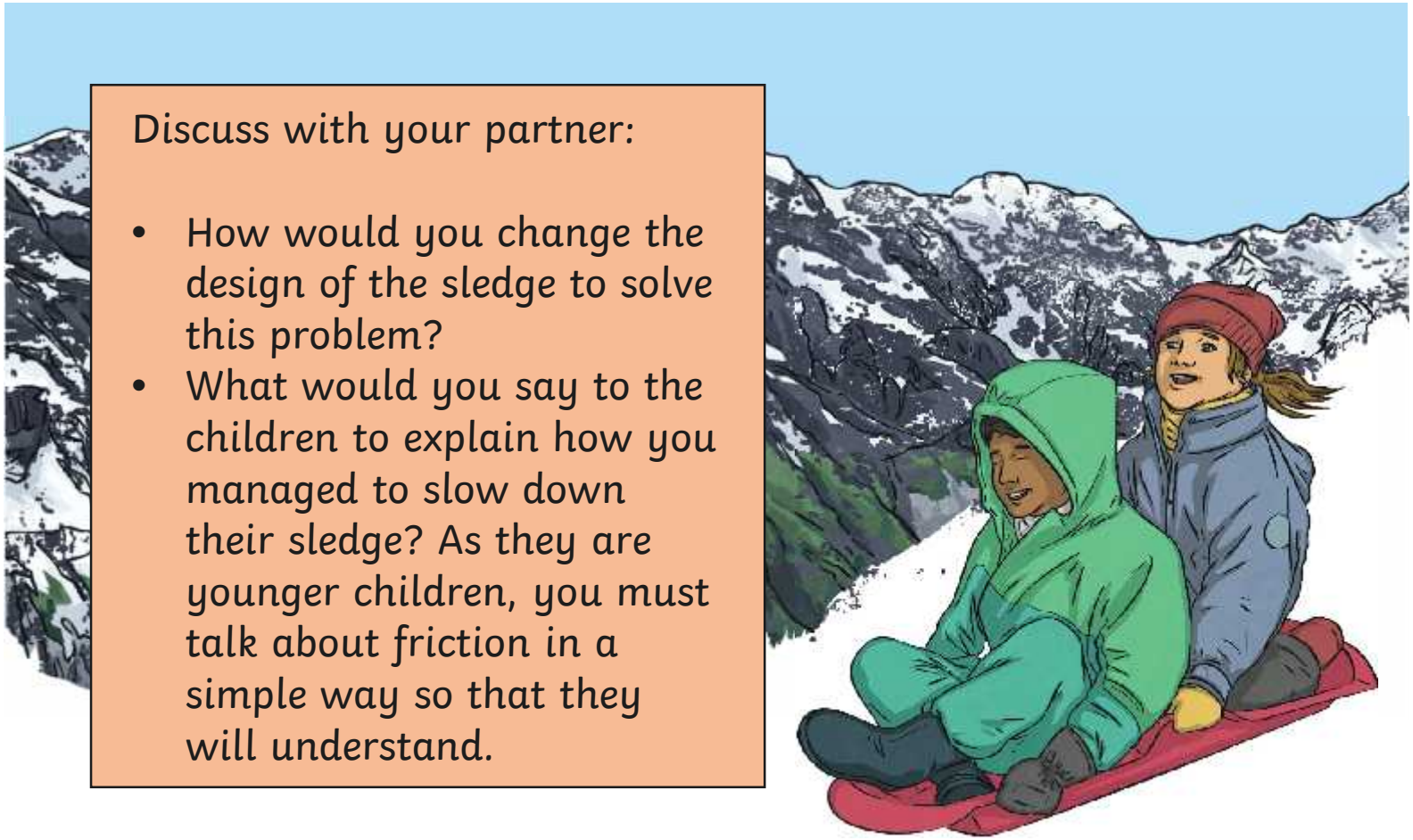
Now that you have tested the different materials, you should know which material is the best choice for the new brake pad. The company want to see a demonstration of the best material in action.

Use your **Investigating Friction Activity Sheet** to write an explanation of your choice, and then take turns to demonstrate to the class how the best brake pad material works.



What did you learn by completing this investigation? Looking at your results, what further results would you like to collect to give you more information?

Solve and Explain



Discuss with your partner:

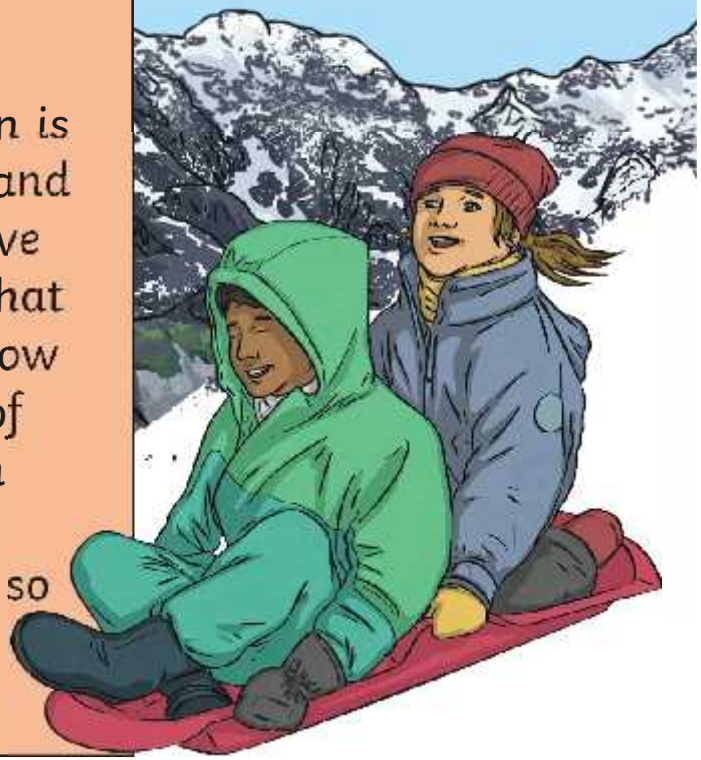
- How would you change the design of the sledge to solve this problem?
- What would you say to the children to explain how you managed to slow down their sledge? As they are younger children, you must talk about friction in a simple way so that they will understand.

Solve and Explain

What would you do?

I would use a strong glue to attach a carpet to the bottom of the sledge.

I would tell the children that friction is a force that acts between the snow and the bottom of the sledge as they move across each other. I would explain that the sledge glides quickly over the snow because the smooth plastic bottom of the sledge does not cause very much friction. However, the rough carpet causes more friction with the snow, so the sledge would move more slowly with carpet glued to the bottom.



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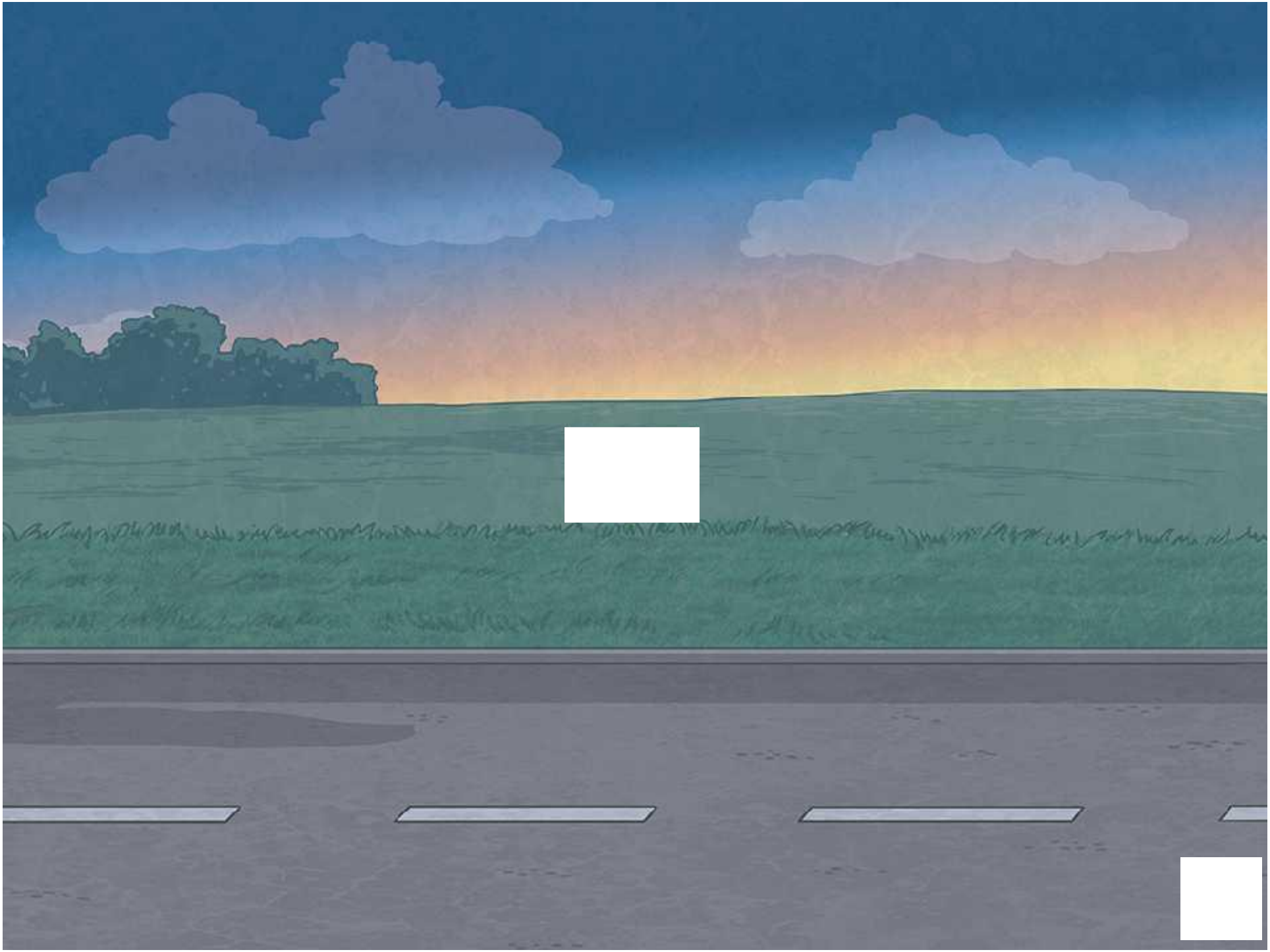

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Investigating Friction

You have been asked to design a new brake pad for a tricycle or scooter. You will find out which material creates the most friction and stops the wheels the quickest.

Which materials will you test?

Which material do you predict will be the best choice for the new brake pad?

Can you explain why?

Material being tested	Time taken for the wheel to stop (in seconds) First test	Time taken for the wheel to stop (in seconds) Second test

Did your repeat readings match up to your first readings? If not, why do you think this was?

Why is it useful to take repeat readings?

(Remember that the material that stops the wheel in the shortest time has most friction.)

The company would like to see a demonstration of the best material in action. Stick a photo or draw a picture of your demonstration of the best choice for the new brake pad in the box.

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Can you explain why this material is the best choice for the new brake pad?

_____

_____

_____

Use these words in your explanation

friction	brake	slow	stop	wheel	speed
rough	smooth	surface	force	push	back

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Can you explain why this material is the best choice for the new brake pad?

If this material is not available, what properties should the company look for in another material?

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