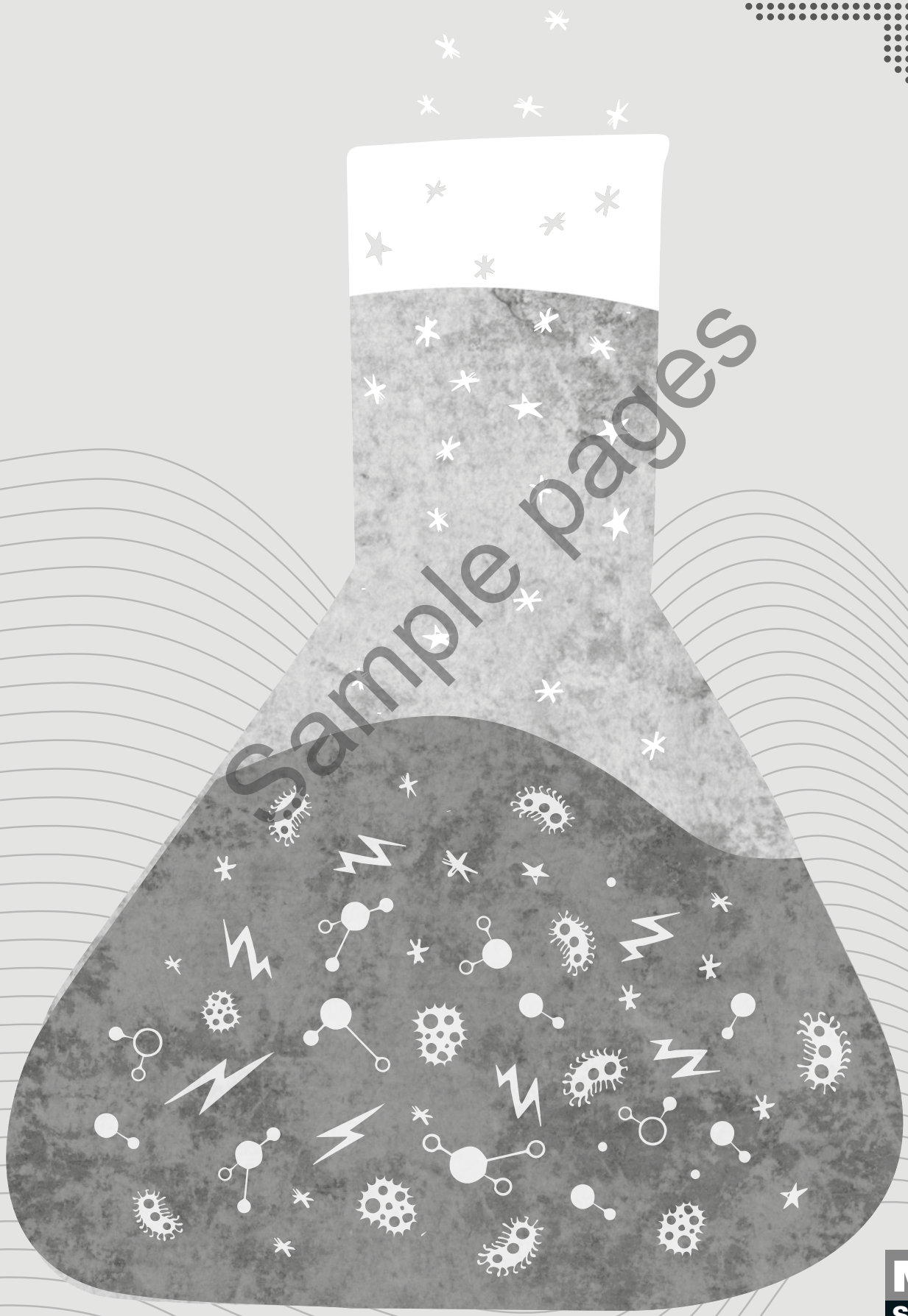
PEARSON

SCIENCE

SKILLS AND ASSESSMENT

STAGE 4



NSW STAGE 4

Contents

ISBN 978 1 4886 2614 2

Living world

Cells

Animal and plant systems

Growth and reproduction

Classification

Habitats and interactions

Chemical world

Properties of substances

Atoms, elements and compounds

Mixtures

Reversible and irreversible reactions

ISBN 978 1 4886 2614 2

How to use this book

PEARSON SCIENCE STAGE 4 NEW SOUTH WALES SKILLS AND ASSESSMENT

The *Pearson Science Stage 4 New South Wales Skills and Assessment* book provides an opportunity for you to practise, apply and extend your learning through a range of supportive and challenging activities. There are also regular opportunities for reflection and self-evaluation at the end of individual activities throughout the book.

This resource is split into the four strands of the syllabus: Physical world, Earth and space, Living world and Chemical world. Each strand consists of four main sections:

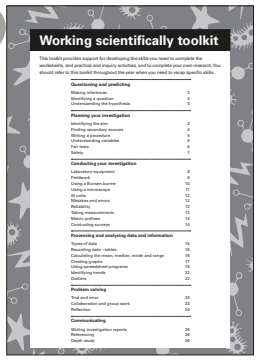
- worksheets
- practical activities
- inquiry activities
- depth study.

Explore how to use this book below.

Working scientifically toolkit

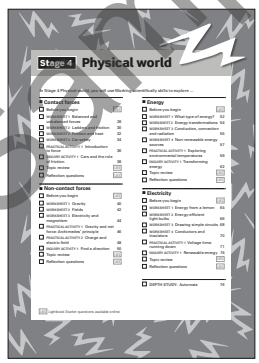
The **Working scientifically toolkit** supports development of the skills and techniques you need to complete the worksheets, practical activities, inquiry activities, and depth studies. You can refer back to the toolkit at any time, to remind yourself of a specific skill.

Try yourself boxes can be found throughout the toolkit. They are to check your understanding, and to provide you with the chance to practise what you have just learnt.



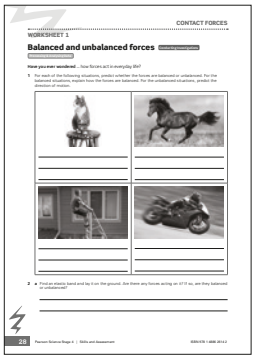
Strand opener

Each book is split into the four strands of the syllabus, with the strand opener acting as a checklist of all the activities available, both within the book and online on *Lightbook Starter*. Tick each activity off once you've completed it!



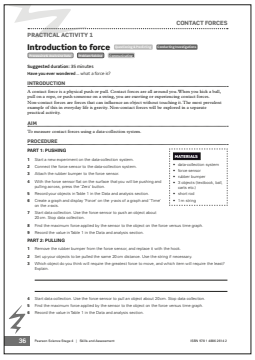
Worksheets

The worksheets feature questions that allow you to practise and apply the Working scientifically skills; for example, interpreting data from a table, plotting data on a graph or communicating your understanding of scientific concepts.



Practical activities

Practical activities offer you the chance to complete practical work related to the various topics in your skills and assessment book. You will have the chance to design and conduct experiments, record results, analyse data, and prepare evidence-based conclusions. You will also need to complete risk assessments for your activities, to ensure you understand how to conduct experiments safely. An icon will appear to indicate where a SPARKlab alternative practical is available.



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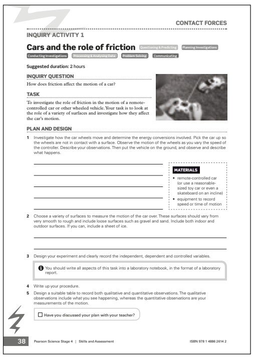
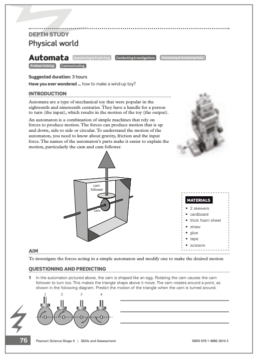
Inquiry activities



The inquiry activities are a bit different from the practical activities. In practical activities you are usually provided with a procedure and specific steps to follow. Inquiry activities are open-ended questions that encourage you to plan, design and create your own solution to a problem. They also provide you with a chance to improve and reflect on your idea or investigation. These problems require you to use prior content knowledge along with the skills you will have learnt from the toolkit.

Depth study



This is where your skills and content knowledge all come together. Each strand contains one depth study. The depth studies apply a mixture of the content and skills you have learnt to a larger, real-world investigation that you need to solve.

In each depth study, you will demonstrate your understanding of a range of different Working scientifically skills, showing how important each type of skill is in thinking like a scientist.

Icons and features

The **skills icons** show you which of the Working scientifically skills you are using to complete that activity.

Questioning & Predicting | Planning Investigations

Conducting Investigations | Processing & Analysing Data

Problem Solving | Communicating

The **safety icon** highlights hazards that may cause harm. Be sure to prepare a risk assessment for these activities and show it to your teacher.

Highlight boxes identify important information such as formulae or prompts.

Vocab boxes provide you with definitions for key words.

Hint boxes provide hints and tips.

SPARKLab icons direct you to where an alternative, online practical activity is available.

Check-in boxes allow you to check your risk assessment or procedure with a teacher before starting. Make sure you tick these boxes!

Materials boxes show you all the materials you need to complete an activity. Sometimes they might include a safety icon that highlights any substances or materials that require you to take care when preparing or using them.

LIGHTBOOK STARTER

LS **Lightbook**Starter

Lightbook Starter LBS, our digital formative assessment tool, works alongside the skills and assessment book. Test your knowledge before starting the activities in the skills and assessment book with the 'before you begin' questions on Lightbook Starter. Then, after you've completed a topic, do the topic review and reflection questions on Lightbook Starter to review what you've learnt. The progress tracker records your results and helps you monitor your learning.

Rate my learning

At the end of each activity, you can rate your learning for that activity. Colour in the circle that represents how you felt doing each activity. This way, you will be able to see what areas you need to work on to improve.

RATE MY LEARNING ○ Not confident ○ Somewhat confident ○ Mostly confident ○ Very confident

Teacher support material

Comprehensive answers and fully worked solutions for the toolkit plus all worksheets, practical activities, inquiry activities and depth studies are provided on the **Pearson Places website.**

Stage 4 Physical world

In Stage 4 Physical world, you will use Working scientifically skills to explore ...

■ Contact forces

■ Non-contact forces

■ Energy

■ Electricity

LBS Lightbook Starter questions available online

WORKSHEET 1

Balanced and unbalanced forces

Conducting Investigations

Processing & Analysing Data

Have you ever wondered ... how forces act in everyday life?

1 For each of the following situations, predict whether the forces are balanced or unbalanced. For the balanced situations, explain how the forces are balanced. For the unbalanced situations, predict the direction of motion.

2 **a** Find an elastic band and lay it on the ground. Are there any forces acting on it? If so, are they balanced or unbalanced?

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b Stretch the elastic band as far as you can. Describe what you have to do to hold the elastic band still.

c Is this situation balanced or unbalanced? _____

d Draw a diagram of the stretched elastic band and the forces involved.

e What happens when you let the elastic band go?

f Are the forces now balanced or unbalanced? How do you know?

TAKE THIS FURTHER

3 Create a poster outlining three examples of both balanced and unbalanced forces. Include graphics and definitions. Structure your poster to teach someone who does not know how balanced and unbalanced forces work.

RATE MY LEARNING ○ Not confident ○ Somewhat confident ○ Mostly confident ○ Very confident

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WORKSHEET 2

Ladders and friction

Questioning & Predicting | Conducting Investigations | Processing & Analysing Data

Have you ever wondered ... how ladders stay upright against walls?

To investigate the roles of forces and friction in the use of ladders, use a lightweight ruler to simulate a ladder and test the effect of various floor surfaces.

1 Use a smooth wall, and a variety of smooth and rough floor surfaces, including gravel or sand. Write your chosen surfaces into the following table. Conduct the experiment and write your observations in the table. Complete the table by determining whether the forces are balanced or unbalanced.

Floor surface	**Observation** **For example, the ruler slips.**	**Balanced/unbalanced forces**

2 Identify the independent, dependent and controlled variables.

3 Explain your observations in terms of friction and balanced or unbalanced forces.

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4 Choose one type of surface and vary the angle of lean against the wall. Does this make a difference? Explain why.

TAKE THIS FURTHER

5 Would the force balance change if a stepladder was used, or a ladder twice the length? Discuss with your group and present your predictions to the class.

RATE MY LEARNING ○ Not confident ○ Somewhat confident ○ Mostly confident ○ Very confident

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WORKSHEET 3

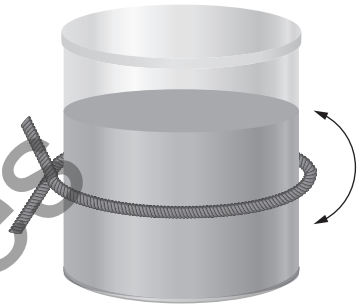
Friction and heat

Conducting Investigations | Processing & Analysing Data

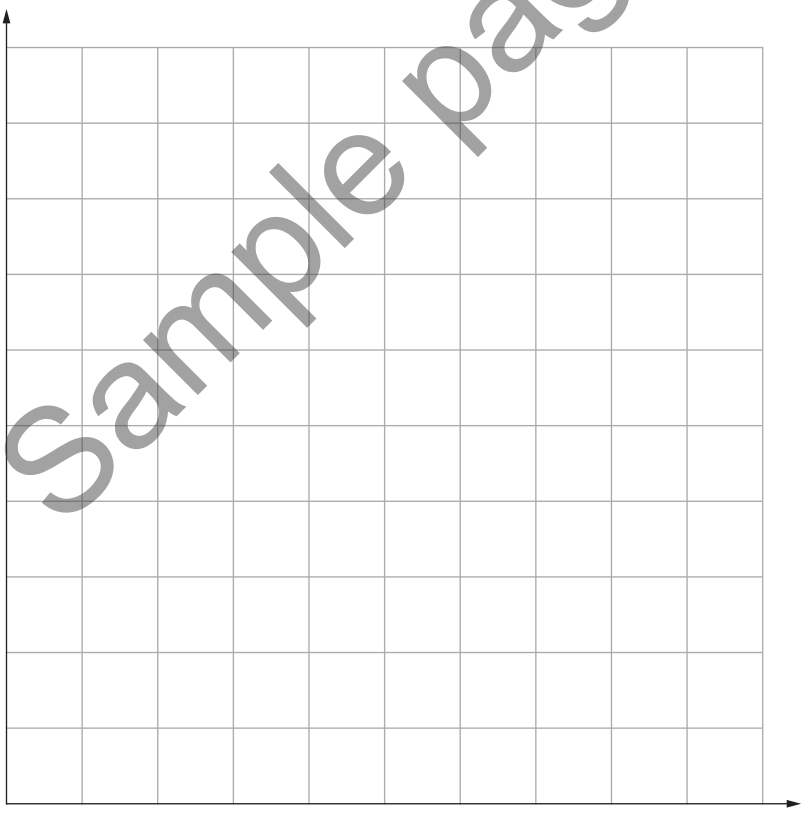
Have you ever wondered ... why you rub your hands together when they are cold?

1 Rub your hands together very fast. Describe what you notice.

2 **a** If you have access to a temperature sensor, set up the scenario shown here. Put water into a tin can, such as a small baked-bean can, to approximately two-thirds full. Then wrap some rope or string around the tin, and rapidly rub it back and forth. Record the temperature over time and paste a copy of the graph below.



Alternatively, rub your hands together very fast and get a partner to record the temperature changes with a thermometer over time. Create a graph of the temperature versus time in the space below.



b Describe and explain your observations.

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3 **a** Observe the temperature of a motorised appliance, such as a drill or a vacuum cleaner, before and after turning it on.

Before turning on: _____

After turning on: _____

b Explain your observations.

_____

_____

_____

_____

TAKE THIS FURTHER

4 Identify some positive and negative effects of friction in everyday actions.

Positive	Negative

RATE MY LEARNING ○ Not confident ○ Somewhat confident ○ Mostly confident ○ Very confident

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WORKSHEET 4

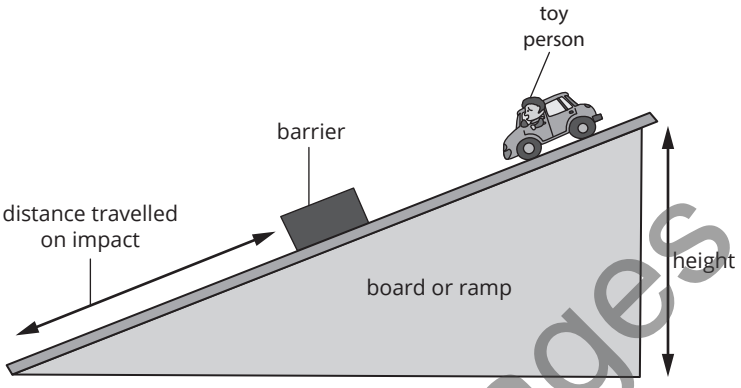
Car safety

Questioning & Predicting | Processing & Analysing Data | Problem Solving | Communicating

Have you ever wondered ... about the science behind seatbelts?

A car crash is simulated using a toy vehicle to investigate what happens to a person who is restrained by a seatbelt and a person who is unrestrained.

The simplest way to get the vehicle to a specific speed is to use a ramp and adjust the angle or height. Let the vehicle go at the top of the ramp. Once it hits the barrier, the unrestrained toy is thrown forwards. An example set-up is shown below.



1 Predict what will happen to the speed of the car as the height of the ramp is increased.

2 The results of the experiment are recorded in the following table.

Angle (°)	Height (cm)	Distance of travel (cm)			Average distance travelled (cm)
		Trial 1	Trial 2	Trial 3	
5	9.5	3	3	1	2.3
6	12	12	15	13	
8	17	25	17	20.5	
10	21	40	62	49	
12	25	64	57	84	

To calculate the average of a data set, add all of the values and then divide by the number of data values. For example, in the first row of the table (for the angle 5°), the distances travelled were 3 cm, 3 cm and 1 cm.

Step 1: First add these values together: 3 + 3 + 1 = 7 cm.

Step 2: Divide by the number of data values, in this case 3. So, 7 ÷ 3 = 2.3 cm. So 2.3 cm is the average distance travelled for the 5° angle. This has been filled out for you in the table.

Complete the table by calculating the average distance travelled for each angle.

3 What are the independent and dependent variables of this investigation?

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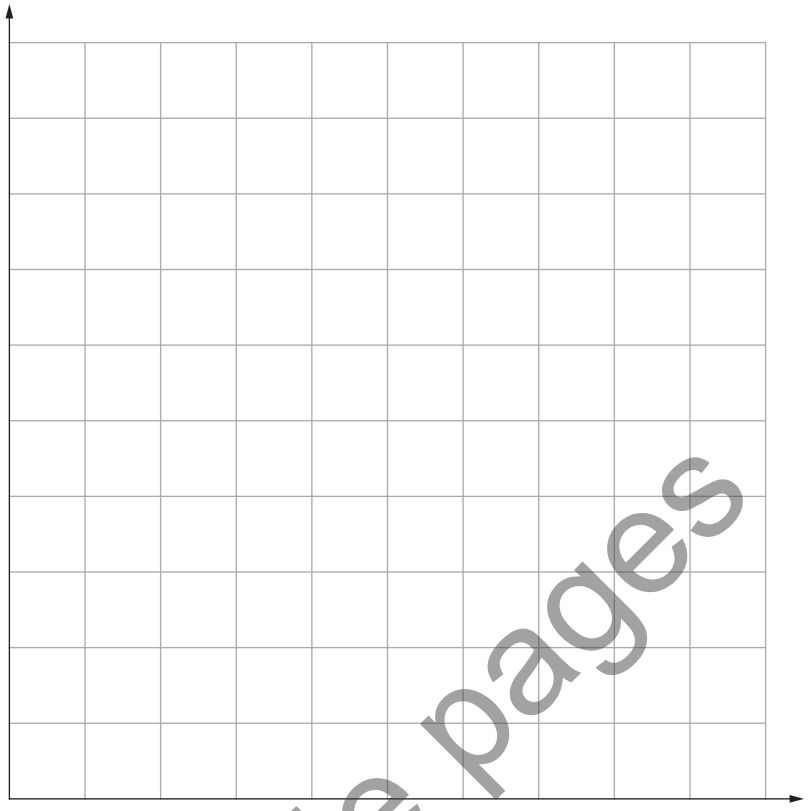
4 Plot the height (cm) against the average distance. Give your graph a title.



5 Can you think of a way to improve this experiment?

6 Describe to a family member the importance of using a seatbelt to restrain people in a car. Your explanation should include a description of the forces involved.

TAKE THIS FURTHER

7 Research and outline the function of another safety device in cars that helps to reduce the force in a collision.

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PRACTICAL ACTIVITY 1

Introduction to force

Questioning & Predicting | Conducting Investigations | Processing & Analysing Data | Problem Solving | Communicating

Suggested duration: 35 minutes

Have you ever wondered ... what a force is?

INTRODUCTION

A contact force is a physical push or pull. Contact forces are all around you. When you kick a ball, pull on a rope, or push someone on a swing, you are exerting or experiencing contact forces. Non-contact forces are forces that can influence an object without touching it. The most prevalent example of this in everyday life is gravity. Non-contact forces will be explored in a separate practical activity.

AIM

To measure contact forces using a data-collection system.

PROCEDURE

PART 1: PUSHING

MATERIALS

- data-collection system
- force sensor
- rubber bumper
- 3 objects (textbook, ball, carts etc.)
- short rod
- 1 m string

1. Start a new experiment on the data-collection system.
2. Connect the force sensor to the data-collection system.
3. Attach the rubber bumper to the force sensor.
4. With the force sensor flat on the surface that you will be pushing and pulling across, press the 'Zero' button.
5. Record your objects in Table 1 in the Data and analysis section.
6. Create a graph and display 'Force' on the *y*-axis of a graph and 'Time' on the *x*-axis.
7. Start data collection. Use the force sensor to push an object about 20 cm. Stop data collection.
8. Find the maximum force applied by the sensor to the object on the force versus time graph.
9. Record the value in Table 1 in the Data and analysis section.

PART 2: PULLING

1. Remove the rubber bumper from the force sensor, and replace it with the hook.
2. Set up your objects to be pulled the same 20 cm distance. Use the string if necessary.
3. Which object do you think will require the greatest force to move, and which item will require the least? Explain.

_____

_____

4. Start data collection. Use the force sensor to pull an object about 20 cm. Stop data collection.
5. Find the maximum force applied by the sensor to the object on the force versus time graph.
6. Record the value in Table 1 in the Data and analysis section.

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DATA AND ANALYSIS

Table 1 Objects and forces

Object	Maximum push force (newtons)	Maximum pull force (newtons)

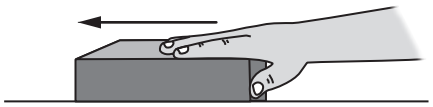
1 From Part 1: Describe the relationship between the contact of the force sensor and the object, the force plot, and the motion that resulted from the applied force.

2 From Part 2: Describe the relationship between the contact of the force sensor and the object, the force plot, and the motion that resulted from the applied force.

CONCLUSION

3 Discuss what you think a force is with your classmates.

4 If you push a book across a table, what are the forces on the book? Draw the forces on the diagram below.



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INQUIRY ACTIVITY 1

Cars and the role of friction

Questioning & Predicting | Planning Investigations | Conducting Investigations | Processing & Analysing Data | Problem Solving | Communicating

Suggested duration: 2 hours

INQUIRY QUESTION

How does friction affect the motion of a car?

TASK

To investigate the role of friction in the motion of a remote-controlled car or other wheeled vehicle. Your task is to look at the role of a variety of surfaces and investigate how they affect the car's motion.

PLAN AND DESIGN

1 Investigate how the car wheels move and determine the energy conversions involved. Pick the car up so the wheels are not in contact with a surface. Observe the motion of the wheels as you vary the speed of the controller. Describe your observations. Then put the vehicle on the ground, and observe and describe what happens.

MATERIALS

- remote-controlled car (or use a reasonable-sized toy car or even a skateboard on an incline)
- equipment to record speed or time of motion

2 Choose a variety of surfaces to measure the motion of the car over. These surfaces should vary from very smooth to rough and include loose surfaces such as gravel and sand. Include both indoor and outdoor surfaces. If you can, include a sheet of ice.

3 Design your experiment and clearly record the independent, dependent and controlled variables.

> You should write all aspects of this task into a laboratory notebook, in the format of a laboratory report.

4 Write up your procedure.

5 Design a suitable table to record both qualitative and quantitative observations. The qualitative observations include what you see happening, whereas the quantitative observations are your measurements of the motion.

☐ Have you discussed your plan with your teacher?

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CREATE

6 Conduct your experiment, remembering to take three identical measurements for each surface. You may have to do more if you have difficulties when taking the measurements.

If you have to modify your procedure during this part of the experiment, this is normal scientific practice. Just make a note in your lab book about how you changed the procedure.

IMPROVE

7 Describe the difficulties you had with this experiment.

8 How could the experiment be improved?

REFLECT

9 Describe what you notice about your data in terms of the size and type of the friction on the surfaces and how this affects the car's motion. Can you group your observations and make some general statements about them?

10 Use your experiment to help explain the different design features of tyres on off-road vehicles, such as mountain bikes and four-wheel drives, and tyres on vehicles and bikes used in cities.

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