

## Cricket Smart **Teacher Resource**



**CRICKET**  
AUSTRALIA

## **FORCES**

Are you a force with which to be reckoned?

Using fun and practical activities to explore the concept of forces, this unit supports the physical sciences element of the curriculum.

The unit draws on the sport of cricket to create not only a hook for the unit but also to help students understand that the study of science is applicable in everyday aspects of their lives. It does this by analysing some of the contact and non-contact forces that play a vital role in the game.

Students will be involved in a series of simple experiments and activities designed to collect data and to draw conclusions from the results. With the support of video footage from current cricketers on technical aspects of the game, the students will then be well equipped to design their own experiment and to further develop their skills of analysis.

# Teacher Resource

## Year Level 4

## Learning Area Science

# FORCES

Are you a force with which to be reckoned?

## Resource Descriptor



This unit is designed to support the physical sciences element of the science curriculum and investigate the concept of forces. It draws on the sport of cricket, Australia's largest participation sport, by analysing some of the contact and non-contact forces that play a vital role in the game. Students will be involved in a series of simple experiments and activities that will allow them to collect data and draw conclusions. To encourage deeper analysis and design skills, an experiment topic is outlined for the students to then design.

View the supporting resources for this unit of work at [www.cricketsmart.cricket.com.au](http://www.cricketsmart.cricket.com.au).

## Unit Objectives

In completing this unit, students will be expected to:

- Observe qualitatively how speed is affected by the size of a force
- Explore how non-contact forces are similar to contact forces in terms of objects pushing and pulling other objects
- Compare the effect of friction on different surfaces
- Investigate the effect of forces on the behaviour of an object through actions such as throwing, dropping, bouncing and rolling

## Major Assessment Task

Students are to write a scientific report on one of the three experiments they completed during the unit. Students should include the following information:

- **Aim:** an explanation of what the experiment was trying to find out
- **Hypothesis:** what students thought might happen in their experiment
- **Method:** the procedure students used in the experiment
- **Results:** a presentation of data, which is often presented in a results table
- **Conclusion:** what students found out during the experiment. Students link this back to their original hypothesis. Was it what they expected? What could they have done differently?

# Alignment to the Australian Curriculum

## Australian Curriculum Content Descriptions

### Science Understanding

**ACSSU076:** Forces can be exerted by one object on another through direct contact or from a distance

### Science as a Human Endeavour

**ACSHE061:** Science involves making predictions and describing patterns and relationships

**ACSHE062:** Science knowledge helps people to understand the effect of their action

### Science Inquiry Skills

**AC SIS065:** Suggest ways to plan and conduct investigations to find answers to questions

**AC SIS066:** Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate

**AC SIS068:** Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends

**AC SIS216:** Compare results with predictions, suggesting possible reasons for findings

**AC SIS069:** Reflect on the investigation; including whether a test was fair or not

**AC SIS071:** Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports

### General capabilities

- Literacy
- Numeracy
- Information and communication technology (ICT) capability
- Critical and creative thinking
- Personal and social capability
- Ethical understanding
- Intercultural understanding

### Cross-curriculum priorities

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability

## Teacher Resources

The student worksheets have increasingly complex analysis opportunities. Questions 2 and 5 (Experiment 1), 4 (Experiment 2) and all of Experiment 3 provide opportunities for critical and/or creative thinking. A variety of thinking and planning skills could be used, e.g. thinking strategies such as **Think:Pair:Share**, **Extent Barometers** and **Round Robins**.

For more information on how to use an **Extent Barometer** or **Round Robin**, scan the QR Code or use the URL.



Extent Barometer

[www.itcpublications.com.au/qr/barsau](http://www.itcpublications.com.au/qr/barsau)



Round Robin

[www.itcpublications.com.au/qr/rrtau](http://www.itcpublications.com.au/qr/rrtau)

Teachers have flexibility in using the student worksheets but the following sequence of ideas may prove helpful.

- Students can investigate some of the forces cricket players encounter in the playing of the game. Students can collect data during the course of the experiments that should allow them to propose reasons for the performance of the Australian players (or other teams' players!).
- Students can visit the Cricket Smart website ([www.cricketsmart.cricket.com.au](http://www.cricketsmart.cricket.com.au)) to listen to players discussing how they apply knowledge of forces to their batting, bowling and fielding.
- Students can discuss (in **Round Robins** or **Think:Pair:Share**) the forces involved in batting, bowling and fielding. They can organise their ideas into contact, non-contact, pushes, pulls and twists (particularly for spin bowling). Students can be encouraged to think about practice and fitness programs.
- The activities give students opportunities to propose and develop their own experiments and use higher-order thinking strategies to analyse information.
- There are separate activities for batting, bowling and fielding and the order of completion is not significant. However, the activity in which students design their own experiment is more challenging and it is suggested that this should be the final activity.
- There are many opportunities for co-operative work.
- Experiment 3 is deliberately more challenging and has been written as an extension activity. Students are required to make many of their own experimental design decisions.
- Techniques of spin bowling could be investigated in the context of physical education. They can be difficult for novices to achieve, so if there is a teacher or student able to bowl spin in a class, it may be easier to use this person as the bowler for Experiment 3.
- Spin bowling is easier to achieve using a ball with a seam. Soft cricket balls with seams are likely to be available in most primary schools.



## Scientific Controls and Experimental Design

The appropriate design of experiments is readily demonstrated in this series of experiments. The fairness of the experimental method is subject to the students applying appropriate controls in all the experiments. Introduce students to the idea of a standard to compare their results, changing one variable at a time. Question students frequently about how these experiments provide information (data) that informs their answers to many questions.

## Experiment Organisation and Procedures

### Experiment 1 – Fielding



#### Aim

In this experiment students will investigate their ability to throw the cricket ball at cricket stumps. Students will investigate three things:

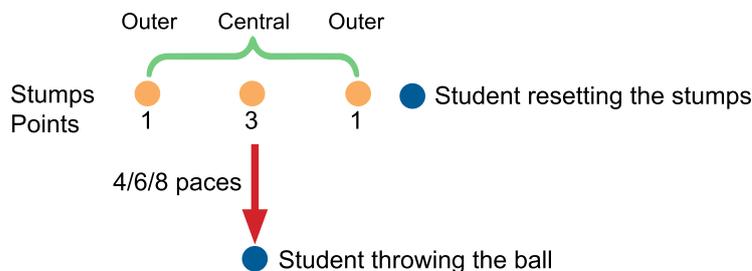
- The type of throw that generates the most force
- The type of throw that is most accurate
- If practise improves their ability to throw the ball

#### Equipment Needed:

- 3 cricket stumps per group
- 5 balls (can be soft) per group
- 1 stopwatch per group

#### Procedure

- Ensure students understand the meaning of underarm, overarm and sidearm throws. See the glossary, or direct students to the video on the Cricket Smart website ([www.cricketsmart.cricket.com.au](http://www.cricketsmart.cricket.com.au)) to learn more about these three types of throws
- Divide students into groups of four or five
- Provide each group with the required equipment
- Assist students to set up the stumps as per the diagram below. There are three stumps. The central stump is worth three points per hit while the two outer stumps are worth one point each. Ensure that stumps are a ball width apart



- Instruct students to complete the experiment and fill out the designated sections for Experiment 1 in the 'Student Resource for Forces'

- While one student throws the balls a second student can record the time it takes to complete the five throws using the stopwatch provided. Another student can stand by the stumps to reset them if they fall, and another can write the thrower's data in the table provided in the 'Student Resource for Forces'

## Experiment 2 – Batting



### Aim

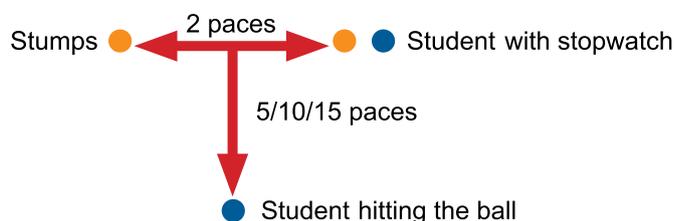
In this experiment students will investigate the importance of a back-lift when hitting a cricket ball. They will also investigate their ability to place the ball as they hit it harder. Placing the ball means that students need to try and make the ball travel between the two stumps that will be set up for this experiment.

### Equipment Needed:

- 2 stumps per group
- 1 ball (can be soft) per group
- 1 stopwatch per group
- 1 cricket bat per group

## Procedure

- Ensure students understand the meaning of back-lift. Refer to the glossary or direct students to the video on the Cricket Smart website ([www.cricketSMART.cricket.com.au](http://www.cricketSMART.cricket.com.au)) to learn what back-lift is and how this affects the movement of the ball
- Divide students into groups of four or five
- Provide each group with the required equipment
- Assist students to set up the stumps as per the diagram
- Instruct students to complete the experiment and fill out the designated sections for Experiment 2 in the 'Student Resource for Forces'
- While one student hits the ball a second student can record the time it takes for the ball to reach the stumps using the stopwatch provided. Another student can measure the distance the ball travels and another can write the required data in the table provided in the 'Student Resource for Forces'
- To differentiate this exercise, direct more able students to complete the experiment using a back-lift of more than 90°



## Experiment 3 – Bowling (Extension Activity)



Students are responsible for designing this experiment. They will have to decide on the procedure and how they will record their results.

### Aim

The aim of this experiment is for students to explore twist forces. Students will decide which grip on the cricket ball assists them the most when bowling spin.

A cricket ball has a seam. Spinning a cricket ball (off spin) involves gripping the ball with your first and middle fingers apart. Using a right to left (for a left handed player a left to right) twist of your fingers you can make a ball hit the pitch and then change direction.

Further information on spin bowling is available in the glossary and also in the video on the Cricket Smart website ([www.cricketsmart.cricket.com.au](http://www.cricketsmart.cricket.com.au)). This video provides a great overview on how to spin bowl from scratch, the ideal positioning of fingers on the ball and how much run up is required when bowling.

### Equipment Needed:

- Cricket balls
- Other equipment as required by the experiment design



## Examples of NAPLAN-style Questions (optional)

The teacher can supplement the worksheets with some NAPLAN-style test items based on this unit of work. Examples include the following.

1. Identify the incorrectly spelled word in the following sentence and write the corrected word in the box provided.

The batter applied a strong force to the ball as she hit it to the boundary.

[SPELLING TEST]

2. Insert the word from the choices below to best fill the gap in this sentence.

The fieldsman picked up the ball, turned and threw the ball \_\_\_\_\_ the wickets.

A) up      B) towards      C) between      D) from

[GRAMMAR AND PUNCTUATION TEST]

3. Write a narrative based on a recent game of cricket you have played in or seen played. Perhaps from a real (or imaginary) player's perspective or the story of the final (real or imagined). There are many potential contexts for the narrative.

OR

Write a persuasive essay in response to:

*"Argue whether all young people should play cricket".*

[WRITING TEST]

To help to develop test familiarisation, a simple stimulus sheet could be developed for the persuasive task using images (optional, since the 2014 NAPLAN writing test stimulus did not include images) and the same prompts that have been used on past NAPLAN writing test papers.

4. Which of these units could be used to measure the mass of a cricket bat?

A) metres      B) hours      C) kilograms      D) litres

There are 16 players in an Australian touring squad. Eleven players play in a match. How many players will be rested during a match?

A) 3      B) 4      C) 5      D) 26

[NUMERACY TEST]

## Glossary

Term	Meaning
<b>back-lift</b>	The extent to which a batter raises the bat before striking the ball. Generally, the further it is raised, the greater the force with which the ball is struck.
<b>batter</b>	A cricketer whose prime responsibility in the team is the scoring of runs. An opening batter is one of the two batters to start the innings.
<b>bowler</b>	A cricketer whose prime responsibility in the team is bowling the ball to the opposition's batters. Bowlers are classified according to the way they bowl, for example spin bowlers and pace bowlers. Each ball bowled is called a delivery.
<b>fielder</b>	The ten players who are not bowling serve as fielders.
<b>flight</b>	The path the ball takes after it leaves the bowler's hand.
<b>forces</b>	Forces are pushes, pulls and twists that can cause a change of speed, of direction, and shape. They are classified as contact, between a bat, an arm or the ball, for example, or non-contact, gravity, static electricity and magnetism, for example.
<b>grip on the ball</b>	The way the bowler holds the ball before releasing it.
<b>over</b>	An over is a set of six deliveries, usually made by the same bowler.
<b>overarm throw</b>	A throwing action when the throwing hand is above the shoulder and releases the ball during a downward motion.
<b>placing the ball</b>	When batting, this is the process of directing the cricket ball. The aim is to avoid hitting the ball directly to a fielder.
<b>scientific (experimental) control</b>	The process of keeping all but one of the variables in an experiment unchanged so that the effect of a particular change in a single variable is observed.
<b>sidearm throw</b>	The thrower uses a side motion to release the ball along an almost horizontal axis between the shoulder and the hip.
<b>spin</b>	In bowling, spin is the art of releasing the cricket ball so that it spins through the air and changes direction when it hits the ground (wicket). This makes the path of the ball less predictable for the batter and more difficult to strike. Off spin is where the ball rotates from right to left. Leg spin is when the ball rotates from left to right (for right handed bowlers).
<b>standard</b>	In an experiment, the standard is the result achieved under the initial set of experimental conditions. It is used for comparing the result achieved, as the experimental variables are changed.
<b>stumps</b>	Three vertical posts, which together form a wicket at either end of a cricket pitch. Each stump is 71.1cm high and approximately 3.5cm in diameter.
<b>underarm throw</b>	A throwing action where the throwing hand passes below your hip.
<b>wicket</b>	This word has several meanings. It can be the cricket pitch used for batting. The fall of a wicket is a term to describe when a batter is out. Finally, it can be one of the three stumps, with a set of three stumps referred to as the wickets.

While the glossary is provided mainly for teacher information, some of the words in this list could be introduced as spelling and/or vocabulary activities for students.



The **Milo T20 Blast School Cup** is a fast, fun T20 competition that captures all the excitement of the KFC T20 Big Bash League and is perfect activity to get the students involved in.



Why not get your students involved in more **Cricket Fun!**

**Become your school's Ambassador and:**

- \* Be the contact person for cricket in your school
- \* Assist in arranging opportunities for your school to be involved in clinics and competitions
- \* Distribute information about upcoming cricket programs



Visit [community.cricket.com.au/schools](http://community.cricket.com.au/schools) to register now!

**CRICKET**  
AUSTRALIA



**CRICKET**  
AUSTRALIA

[COMMUNITY.CRICKET.COM.AU/CRICKETSMART](http://COMMUNITY.CRICKET.COM.AU/CRICKETSMART)

**itc**<sup>®</sup>  
publications