



LESSON PLAN

Importance of Bicycle Helmets



STAGE
Years 7 - 8



DURATION
45 minutes



SUBJECT
Science



RESOURCE OVERVIEW

Cycling is a key way to travel sustainably while keeping active and fit. However, it's essential that children understand how to be safe as a cyclist, including the importance of wearing a bicycle helmet.

In this lesson, students investigate how bike helmets protect a cyclist's head in a crash through energy transfer and transformation.

This lesson links directly with the Bike Ed program resources available for Years 7 - 8 Health and PE <https://www.vicroads.vic.gov.au/safety-and-road-rules/road-safety-education/primary-schools/bike-ed-program>

Some students may have experienced trauma as a result of a road crash. Please ensure suitable support is available for them.

Resource Details



CURRICULUM ALIGNMENT

This activity supports:

Science Understanding

Physical sciences

- Energy appears in different forms including movement (kinetic energy), heat, light, chemical energy and potential energy; devices can change energy from one form to another (VCSSU104)

Science Inquiry Skills

Planning and conducting

- Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (VCSIS108)

Analysing and evaluating

- Use scientific knowledge and findings from investigations to identify relationships, evaluate claims and draw conclusions (VCSIS111)

RESOURCE REQUIREMENTS

In this lesson, teacher/s will need:

- Projector, sound system and laptop or interactive whiteboard for playing YouTube videos
- Pieces of bike helmet inner foam cut to about 100mm x 100mm (use an old helmet or purchase a cheaper brand)
- Several hammers, or just one if only you are demonstrating

LEARNING INTENTION

In this lesson, students will:

- Develop an understanding of the science behind how a bike helmet helps to manage the kinetic energy involved in a crash to reduce head injuries.

SUCCESS CRITERIA

By the end of this lesson, students should be able to:

- Describe how a bike helmet is designed to reduce head injuries through managing the kinetic energy in a crash.
- Describe how a bike helmet uses energy transfer and transformation to reduce head injuries.
- Carry out a simple experiment to demonstrate how a bike helmet manages the kinetic energy involved in a crash.

Lesson Plan



Tuning in

APPROX. 10 MINUTES

Play the video Always wear a helmet from VicRoads: <https://www.youtube.com/watch?v=jO4ahwa6hf0&t=30s>

Explain that a bicycle helmet is designed to protect your skull and brain in a crash. If your skull is injured, then the brain is at risk of serious injury. In a crash, your brain moves about and can knock against the skull and facial bones. This may cause the brain to swell and even bleed, which is very serious, or may result in concussion. Concussion can lead to effects such as headaches, dizziness, tiredness, problems with concentrating and performing complex tasks. These symptoms may last for a few days or can indicate a more serious brain injury.

Explain that research shows that wearing a bicycle helmet reduces the risk of head injury by up to 74%.

Ask what the laws are in Victoria for wearing bike helmets.

Explain that only approved bike helmets that are the right size and fitted correctly can be worn.

All bike and scooter riders are required to wear an approved bike helmet in Victoria. Mandatory bike helmet laws were introduced in July 1990. This applies when riding:

- On roads and road-related areas
- On bike and shared paths
- In bike lanes
- In recreational parks
- In car parks
- On footpaths

Main activity:

APPROX. 30 MINUTES

Standards and testing for bike helmets

- Explain that helmets are designed to meet a set of standards so they will protect the rider in a crash. Each helmet design is put through a series of tests to ensure that it meets these standards before it is approved for sale and use. Point out that bike helmets approved in Australia have to meet higher standards than anywhere else in the world at present.
- Play the video from the Global Cycling Network that explains helmet safety standards and testing: https://www.youtube.com/watch?v=S_CYpjKVx-w

The science behind how bike helmets work in a crash

Based on what they have seen in the video, ask students to explain the science of how a bike helmet works to protect your head in a crash.

Explain that when you ride a bicycle, your physical energy as you pedal is converted into the bicycle's kinetic energy, as well as some heat energy. The faster you travel, the greater the kinetic energy. In a crash this kinetic energy is both transferred and transformed.

Explain the science of how a bike helmet works in a crash in terms of energy transfer and transformation.

- Energy transfer: In a bike or scooter crash, the movement (kinetic energy) of the rider as they hit the ground is concentrated on the point of impact. The ground exerts so much force it stops the forward motion of the rider in a fraction of a second (where an opposing force stops the motion of an object, it is due to the law of conservation of energy). If a rider without a helmet hits their head, then within a fraction of a second the

force exerted as they hit the ground is all taken by the skull and brain. The human head is not designed to withstand such force.

A bike helmet is made up of an outer shell and foam inner layer. These work together to better manage the force as you hit the ground. As the foam inner compresses, it allows your head to come to a stop much slower (laboratory tests indicate about 6x slower) than an unprotected head hitting the ground. This drastically reduces the acceleration. Since force is equal to mass times acceleration, it drastically reduces the force and reduces the extent of injury to the head. The shape of the helmet also helps to spread the point of impact more widely than an unprotected head.

- Energy transformation: As the foam crushes and deforms, it also converts some of the movement (kinetic energy) into heat. This again reduces the force on the head inside the helmet.

How helmets work investigation

Carry out this brief experiment either with students working in small groups or you demonstrating to the class.

Requirements:

- Pieces of bike helmet inner foam cut to about 100mm x 100mm (use an old helmet or purchase a cheaper brand)
- Several hammers (or just one if only you are demonstrating)

Method:

- Use a section of bike helmet inner foam to explore how the helmet reduces acceleration. Using a hammer, hit a smooth hard surface (e.g. timber or concrete) with a downward movement (kinetic energy). Note that as the hammer hits the surface the opposing force from the surface can be felt in the handle.
- Place a section of bike helmet inner foam on the same surface. Using the same amount of downward movement (kinetic energy), strike the section of bike helmet foam. Ask students to note:
 - How there was a reduction in the how much of the opposing force from the surface is felt via the hammer handle.

That it took a little longer for the hammer head to come to a stop.

Whether the hammer head and the spot where the hammer hit the foam feel a little warm to touch. It may be possible to detect a small amount of heat (from energy transformation).

As an extension activity students could produce a diagram or simple animation that describes the energy transfer and transformation that occurs with a bike helmet in a crash. This could include tips of correctly fitting a helmet from the Bike Ed Helmet Fit Guide – available from Bike Ed resources: <https://www.vicroads.vic.gov.au/safety-and-road-rules/road-safety-education/primary-schools/school-program-resources>.

If you want to explore helmet standards and testing further, then these videos from the Global Cycling Network will be useful:

How Bell helmets are tested

<https://www.youtube.com/watch?v=oBDTCSoi47E>

How a MIPS (Multi-directional Impact Protection System) helmet is designed to protect the head:

https://www.youtube.com/watch?v=X_vtcOIMYRw

Reflecting activity

APPROX. 5 MINUTES

In small groups, ask students to consider the findings, discuss their conclusions and think about what these mean for them and others when it comes to wearing a bike helmet.

Ask each student group to share what they discussed with the class.



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