

**APP**  
AF2, AF3

**PoS**  
1.2a, 1.2b,  
2.2a, 3.1b,  
4c

**Framework**  
1.1a3.1, 1.1b,  
1.1c, 1.2f, 4.2

## Resources

Worksheets 21.1, 21.2 and Data sheet 21.1.

Equipment:

poster paper

coloured pens or pencils

Alternative outcome: access to computer with spreadsheet and word processing or DTP package, internet access

Websites you may find useful:

**Shiny side up** information and advice aimed at reducing motorcycle accidents.

**Department for Transport** road casualties for 2007. The data on Data sheet 21.1 is from Article 4, linked on the right hand side.

### Transport accident commission

Australian site with safety advice and information for motorcyclists.

## Task overview

Pupils produce publicity material aimed at improving road safety and reducing injuries for motorcyclists.

## Key concepts

forces, new materials

## Outcomes

Poster with accompanying explanatory leaflet  
Alternative outcome: a set of web pages.

## Timing

1 lesson

## Levels 3–5

In January 2009, motorcycle riders in Nigeria made international news by being caught riding with dried pumpkin shells on their heads, to try to get around new laws requiring the wearing of helmets. Show the pupils one of these news articles (search using Nigeria pumpkin helmet), and elicit ideas about why helmets are compulsory, how they work, and why people might not want to wear them.

Pupils then use Worksheet 21.1 *Motorcycle safety 1* and the data on Data sheet 21.1 *Motorcycle safety* to help them to produce safety posters and leaflets, or web pages, to persuade riders to ride and dress more safely.

Pupils will be aided by access to the Level Descriptions Sheet. Assessment by you, or by pupils themselves, can be done by using Level ladder 21.1. Pupils could work together in groups, perhaps with one pupil working on a poster for a crash site, another working on leaflets to be given out to motorcyclists in a supermarket car park nearby and another working on a supporting website for the campaign. This would allow three pupils of very different ability levels to work together, and would help pupils to achieve the group work targets in AF3.

## Levels 5–8

As above, but pupils should include some statistics about the causes of accidents, and may produce biased graphs or charts if they think this will help to get their point across. Pupils aiming at higher levels will need to do some internet research to supplement the information provided. They should note their sources and whether or not they think the sources may be biased. They should also explain how and why they manipulated any data, if they did so.

Pupils will be aided by access to the Level Descriptions Sheet. Assessment by you, or by pupils themselves, can be done by using Level ladder 21.2.

Motorcycles are much cheaper to buy than cars, and many people also think they are more fun. But they are also more dangerous.

‘Fatality rates per passenger are highest for motorcyclists, regardless of whether this is measured on a per kilometre, per journey or per hour basis – around 40 to 60 times greater than the equivalent rate for car users.’

Department for Transport website

In the UK riders must wear a helmet by law, and this helps to prevent head injuries in a crash.

Riders can also protect themselves by wearing proper protective clothing that will protect their skin. Some protective clothing includes body armour to protect vulnerable parts of the body.

However, drivers of other vehicles can often be the problem. In a study in California, researchers found that in most collisions involving a motorcycle and another vehicle, the driver had not seen the bike, or had not seen it in time to prevent the collision.

**BEWARE  
BIKES!**



*A poster is often displayed at known motorcycle crash sites.*

## What you need to do

The local council wants to run a campaign to improve safety on the roads. The council wants a poster to display at a common crash site, a leaflet to give out to motorcyclists visiting a local supermarket and a website to support the campaign. Work in a group to produce a poster and leaflet, or to make a website, to help to improve road safety for motorcyclists. You could concentrate on one area such as explaining:

- why riders should stick to speed limits and make sure they don't go around bends too fast
- how they can help to reduce their injuries if they do crash by wearing suitable clothing
- how they can help other road users to see them.

Your poster should be eye-catching and colourful. The leaflet that goes with it should explain some of the science behind your recommendations.

You should think about including some of these things:

- tables, charts or graphs to show the different causes of motorcycle accidents
- an explanation of why stopping distance changes with speed and road conditions
- *how* helmets or protective clothing can protect a rider.

## You may find these words helpful

body armour, braking distance, deceleration, force, friction, protective clothing, stopping distance, thinking distance

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‘Fatality rates per passenger are highest for motorcyclists, regardless of whether this is measured on a per kilometre, per journey or per hour basis – around 40 to 60 times greater than the equivalent rate for car users.’

Department for Transport website

Motorcycle riders can improve safety by making sure they know how to ride their bike safely, don't ride when they have been drinking, and wear the correct protective clothing. In the UK riders must wear a helmet by law, and this helps to prevent head injuries in a crash. Riders can also protect themselves by wearing proper protective clothing that will protect their skin. Some protective clothing includes body armour to protect vulnerable parts of the body.

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## What you need to do

The local council wants to run a campaign to improve safety on the roads. The council wants a poster to display at a common crash site and a leaflet to give out to motorcyclists visiting a local supermarket. They would also need a website to support the campaign. These should include some information about the causes of motorcycle accidents to grab attention, but should also *explain* one or more of these things:

- why speed limits matter
- why getting proper training will improve safety
- how to make sure car and lorry drivers can see them
- how they can reduce their injuries if they do crash.

Your task is to design a poster and leaflet or to make a set of web pages. These should be eye-catching and colourful. You can include some of the information from Data sheet 21.1 if you wish.

For legal reasons, the council also needs a set of notes explaining where you obtained your information and whether or not you think the sources may be biased. If you have modified the information you use, you should explain how and why you did this.

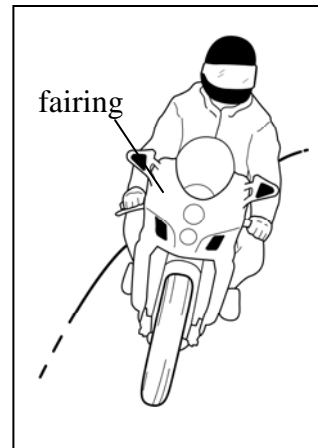
You can find more information by using these search terms:

- motorcycle safety
- motorcycle accident statistics.

This sheet provides some statistics about motorcycle accidents.

Research on motorcycle accidents in California showed that:

- 92% of riders involved in accidents had only been taught to ride motorcycles by friends or family members
- compared to the numbers on the road, there were fewer accidents involving bikes with fairings – it is thought that this is because a fairing makes a bike more visible
- the use of correct protective clothing, boots and gloves significantly reduces cuts and scrapes to the skin.



Over 60% of motorcycle accidents in the UK where the rider was killed or severely injured involved collision with a car.

### Some of the factors contributing to accidents in the UK, 2007

(based on figures available on the Department for Transport website)

Factor		Number
<b>Road</b>	Road surface slippery or needing mending	2091
	Poor road layout or signs	498
	Objects in the road	11
<b>Vehicle defects</b>	All types	246
<b>Breaking the rules</b>	Disobeying road signs	427
	Exceeding speed limit	1096
	Going too fast for conditions	1509
	Following too close	751
<b>Driver/rider error</b>	Poor turn	2391
	Failed to look properly	3062
	Failed to judge other persons path/speed	2407
	Sudden braking	1206
	Swerved or loss of control	3458
<b>Driver/rider</b>	Drinking	457
	Drugs	44
	Tired	35
	Distracted	151
	Driving aggressively, carelessly or in a hurry	2743
	Learner/inexperienced driver	1919
<b>Vision affected</b>	Could not see due to trees, other vehicles, buildings, etc.	670
	Dazzling sun	143
	Rain, sleet, snow or fog	140
	Vehicles with no contributory factor	7225
	<b>Number of vehicles</b>	<b>20 342</b>

#### Notes:

Not all contributing factors have been listed.

Not all accidents are included.

The number of factors add up to more than the number of vehicles, as accidents may have been caused by more than one factor.

**DRAFT**

You can assess yourself on two strands: AF2 and AF3.

	<b>AF2</b> <b>Understanding the applications and implications of science</b>	<b>AF3</b> <b>Communicating and collaborating in science</b>
<b>3</b>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> shown that I understand why motorcycle protective clothing or other safety features are needed.</p> <p><b>b</b> said how a scientific idea can be used, such as teaching riders about friction so that they can brake safely or teaching them about friction so that they understand the importance of protective clothing.</p> <p><b>c</b> said how scientific ideas affect our lives, such as science being used to help to develop safer motorcycles and clothing.</p> <p style="text-align: right;"><input type="checkbox"/></p>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> shown data about motorcycle accidents in more than one way, such as a table, bar chart, pictogram.</p> <p><b>b</b> used scientific words and ideas when showing why protective clothing or obeying the speed limit are good ideas, e.g. friction, braking distance.</p> <p><b>c</b> said how it was useful to work in a group in this task.</p> <p style="text-align: right;"><input type="checkbox"/></p>

	<b>AF2</b> <b>Understanding the applications and implications of science</b>	<b>AF3</b> <b>Communicating and collaborating in science</b>
<b>4</b>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> described some advantages and disadvantages of wearing motorcycle helmets and protective clothing.</p> <p><b>b</b> pointed out that light coloured clothing reflects more light, which makes it easier to see.</p> <p><b>c</b> said that people designing motorcycles or protective clothing need to understand friction and forces, or that they need to understand chemistry to help them to invent new materials.</p> <p style="text-align: right;"><input type="checkbox"/></p>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> chosen a good way to present data so that readers understand it and it makes an impact.</p> <p><b>b</b> used scientific words and ideas <i>correctly</i> when explaining simple scientific ideas, e.g. contact force, stopping distance.</p> <p><b>c</b> used standard ways of presenting certain types of information, e.g. putting units after measurements, using shorthand ways of writing units (you probably won't have covered this).</p> <p style="text-align: right;"><input type="checkbox"/></p>

	<b>AF2</b> <b>Understanding the applications and implications of science</b>	<b>AF3</b> <b>Communicating and collaborating in science</b>
<b>5</b>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> pointed out that the government is in favour of compulsory wearing of helmets, but that some riders do not like them and do not like being told what to do.</p> <p><b>b</b> said that motorcycle helmets and protective clothing help to protect riders from head injuries, but banks and shopkeepers do not like them as a rider with a helmet on cannot be identified on CCTV.</p> <p><b>c</b> stated that some people think that improved safety features on motorcycles or cars just encourage people to take more risks.</p> <p><b>d</b> described how ideas about forces and changes of shape and speed can be used to help design helmets and other protective clothing, or how a knowledge of polymers and chemistry can help scientists to invent new materials such as Kevlar<sup>®</sup> which are used in helmets.</p> <p style="text-align: right;"><input type="checkbox"/></p>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> told the difference between an opinion, such as 'wearing a helmet is uncomfortable', and scientific evidence, such as 'analysis of accident statistics shows that wearing helmets can save lives'.</p> <p><b>b</b> summarised the data provided on the causes of accidents so that it is easier for people to understand it, by producing a bar chart or pie chart.</p> <p><b>c</b> used words such as thinking time, deceleration and force correctly when explaining how helmets work, or why the government sets speed limits.</p> <p><b>d</b> explained why testing new safety clothing involves a team of people, such as accident investigators who know what happens in accidents, people to simulate accidents and measure the results, etc.</p> <p style="text-align: right;"><input type="checkbox"/></p>

DRAFT

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<b>6</b>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> explained that some people choose to ignore information about safe speed limits or the wearing of protective clothing, whereas others follow safety advice.</p> <p><b>b</b> explained how designing better protective clothing can help protect</p>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> said whether I have presented the information in my leaflet in a balanced way (and if not, explained why not).</p> <p><b>b</b> explained why I have shown information in a qualitative (no numbers) or quantitative (with numbers) way on my leaflets or web pages.</p>

<p>riders if they can afford to buy it, but can also help businesses that make and sell the clothing.</p> <p><b>c</b> explained how the discovery of some new materials has led scientists to develop more new materials with different properties.</p> <p><b>d</b> described how a knowledge of the body as well as materials is necessary for developers of protective clothing, so they can produce effective designs.</p> <p style="text-align: right;"><input type="checkbox"/></p>	<p><b>c</b> explained that the data I used were secondary data, as they were gathered by someone else.</p> <p style="text-align: right;"><input type="checkbox"/></p>
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	<b>AF2</b> <b>Understanding the applications and implications of science</b>	<b>AF3</b> <b>Communicating and collaborating in science</b>
<p><b>7</b></p>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> suggested ways in which scientific developments may be influenced by non-scientists, e.g. riders generally prefer to buy lighter helmets, which leads to research to find lighter materials/methods of construction.</p> <p><b>b</b> explained how scientific developments can change everyone's views around the world (you probably won't have covered this).</p> <p><b>c</b> discussed some of the different arguments for and against various safety measures, such as the compulsory wearing of motorcycle helmets, including their costs, whether it is right or wrong to make people do certain things, and their effects on people's lives.</p> <p><b>d</b> explained how creative thinking creates new ideas for future research, e.g. how the use of airbags in cars is now being tried in motorcycle protective clothing or how thinking about how an insect skeleton works has led to new ideas on creating exoskeletons for motorbike riders.</p> <p style="text-align: right;"><input type="checkbox"/></p>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> explained how the information in my leaflet could be altered or presented in such a way that it is biased, and explain why I have or have not chosen to do this.</p> <p><b>b</b> used symbols, flow diagrams and different kinds of graphs to represent ideas (you probably won't have covered this).</p> <p><b>c</b> explained how the design and development of protective clothing or other safety features involves scientists with knowledge of the human body, materials and forces.</p> <p style="text-align: right;"><input type="checkbox"/></p>

	<b>AF2</b> <b>Understanding the applications and implications of science</b>	<b>AF3</b> <b>Communicating and collaborating in science</b>
<b>8</b>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> explained that one way to reduce deaths and injuries on the roads would be to ban motorcycles altogether, or to fit devices that stopped people exceeding speed limits, but that these would be seen as reducing people's freedom, so we need to try to educate people to help them to keep safe instead.</p> <p><b>b</b> said whether, in general terms, new technologies such as more effective brakes and protective clothing have had good or bad effects on society, and justified my opinion.</p> <p><b>c</b> explained how certain scientific developments have had unexpected consequences, such as the introduction of seat belt laws in cars not leading to a decrease in death and injury because people feel safer when wearing seat belts and so are likely to take more risks.</p> <p><b>d</b> said whether I think the development of protective clothing and safety devices is a good or a bad thing, and given reasons for why I think this, considering the costs, how fairly the developments treat people and the effects the developments have on peoples' lives.</p> <p style="text-align: right;"><input type="checkbox"/></p>	<p><i>To reach this level I could have:</i></p> <p><b>a</b> looked at information from different sources and identified areas in which the information is biased, misleading or lacking in evidence.</p> <p><b>b</b> presented well-structured arguments persuading people to ride safely and use protective clothing, while taking account of some people's viewpoints about 'personal freedom.'</p> <p><b>c</b> suggested what skills might be needed to solve scientific problems or develop new technologies (you probably won't have covered this).</p> <p style="text-align: right;"><input type="checkbox"/></p>