LESSON PLAN

Safer Vehicles Save Lives

STAGE
Years 9-10

DURATION
45 minutes

SUBJECT
Science

RESOURCE OVERVIEW

Vehicle safety features are so important that if everyone drove a five-star safety rated vehicle, road trauma could be reduced by up to half.

In this lesson, students are introduced to different types of vehicle safety features. They explore how safety features can help avoid crashes or protect road users who are involved in a crash, and then consider which features they'd like to see in vehicles of the future, and why.

Some students may find the video confronting. Please ensure suitable support is available for them.

ROAD SAFETY EDUCATION VICTORIA

Resource Details

CURRICULUM ALIGNMENT

This activity supports:

The values and needs of contemporary society can influence the focus of scientific research (VCSSU116)

The description and explanation of the motion of objects involves the interaction of forces and the exchange of energy and can be described and predicted using the laws of physics (VCSSU133)

RESOURCE REQUIREMENTS

In this lesson, teacher/s will need:

- A computer and projector, and/or digital whiteboard to show the opening video
- Crash test: old versus new cars video (https://www.youtube.com/watch?v=xidhx_f-ouU)
- **Resource 1:** What makes cars safe, to be displayed on the digital whiteboard or blown up to a size that can be seen by all students
  Answers - Resource 1
- Copies of the following resources for each group
  Resource 2: Safety features worksheet
  Answers - Resource 2
- **Resource 3:** Safety features explained
- **Resource 4:** Crash analysis worksheet
  Sample answers - Resource 4

If students undertake additional research, they will need access to internet-enabled devices

LEARNING INTENTION

In this lesson, students will:

- Gain an understanding of the importance of safety features in cars.

SUCCESS CRITERIA

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

- Describe vehicle safety features designed to protect vehicle occupants and other road users in a crash.
- Offer an informed opinion on why car manufacturers are making safer cars.

Lesson Plan

Tuning in

APPROX. 10 MINUTES

Explain that this lesson is about safety features of vehicles, and talk about why they have improved over the years.

Show students the video Crash test: old versus new cars (https://www.youtube.com/watch?v=xidhx_f-ouU). This video shows a crash where a 1998 (grey) and a 2015 (white) Corolla, each travelling at 64 km/h, hit head-on. The crash was conducted by an independent organisation called ANCAP (Australasian New Car Assessment Program). As the video has no commentary, you may need to watch it a few times so you can explain what's happening.

Ask students what makes the newer car safer. While both cars had seatbelts, safety features in the 2015 Corolla that were not present in the 1998 Corolla were:

Seven airbags

Electronic stability control (ESC)

Anti-lock brake system (ABS)

Rear view camera

You may like to show the video twice so the students can focus on the safety features. Point out that a 2015 Corolla wouldn't have had all the safety features that are now common in new cars.

Ask students why they think car manufacturers are producing safer vehicles. Introduce the idea that the community's values may have changed – we now expect manufacturers to produce safer vehicles.

Main activity: Safety features & crashes

APPROX. 30 MINUTES

Show Resource 1: What makes cars safe (digital whiteboard or large hardcopy). As a class, brainstorm what makes a car safer and write on the resource. You may need to prompt students by asking what features there are inside (e.g. seatbelts) and outside (anti-lock brakes – ABS) a vehicle to keep the driver and passengers safe as well as what might keep other road users safer (e.g. bike riders and pedestrians). (You can use the information in Resource 2 to suggest safety features. Not all safety features shown in Resource 2 need to be covered.)

Extension: Students may research safety features. More information can be found at https://howsafeisyourcar.com.au/safety-features and https://www.ancap.com.au/understanding-safety-features.

Students work in groups for the remainder of this activity.

Handout Resource 2: Safety features worksheet and Resource 3: Safety features explained. Explain that safety features can be separated into two groups:

- **Crash avoidance features** - help you avoid a crash
- **Injury protection features** - help protect drivers, passengers and other road users who are involved in vehicle crashes.

Using Resource 3, each group should complete Resource 2.

Ask students to share their answers.

Handout Resource 4: Crash analysis worksheet). Each group should identify how crash avoidance or crash prevention features may have prevented each crash or reduced the likelihood of injury.

After about 10 minutes, ask students to share their answers.

Reflecting activity

APPROX. 5 MINUTES

Ask each group to discuss how cars could be made safer in the future and then to share one of the safety features they want to see in future vehicles.

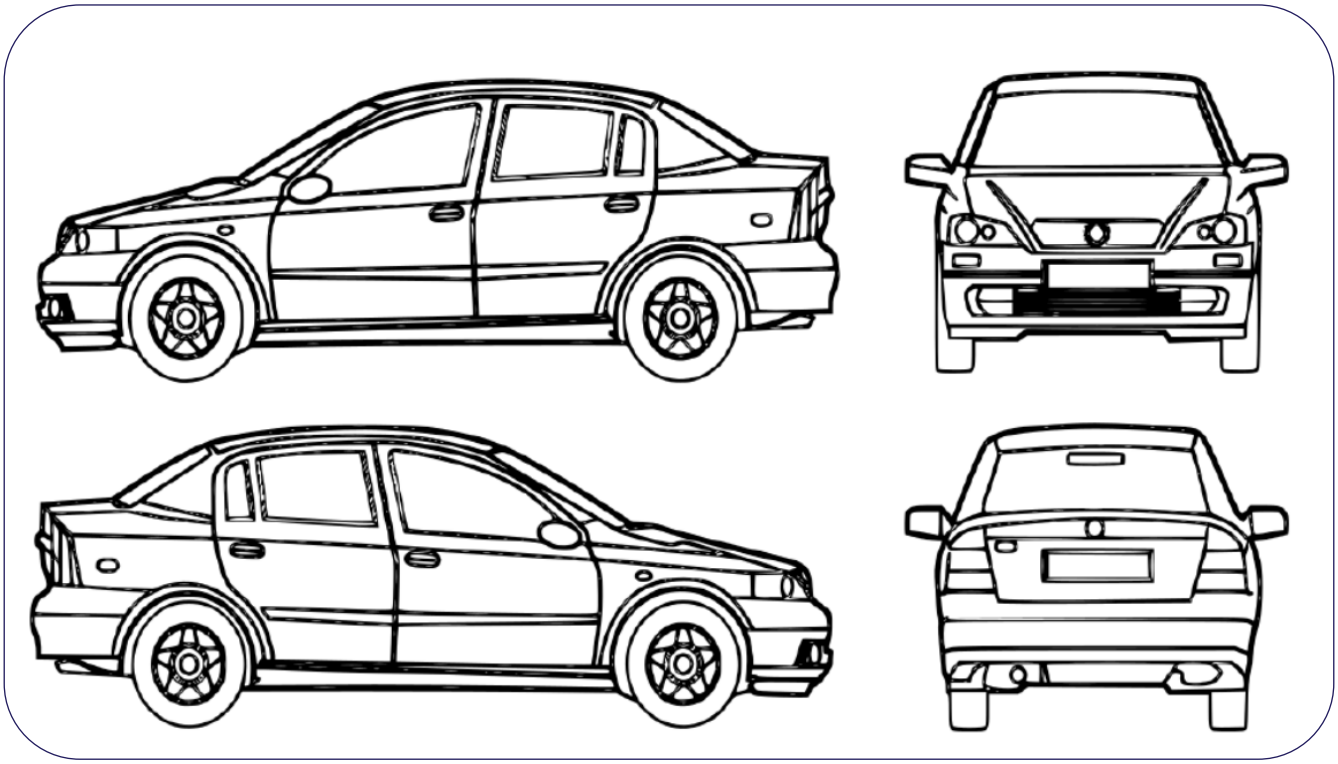
Ask students:

- whether they think community values are causing car manufacturers to make cars safer
- why they think car manufacturers are making safer cars
- one thing they have learn in the lesson about vehicle safety.

Finish by telling students that howsafeisyourcar.com.au is the first place they should go when they are planning to buy a car. It will help them choose the safest car they can afford.

Resource Worksheets & Answers

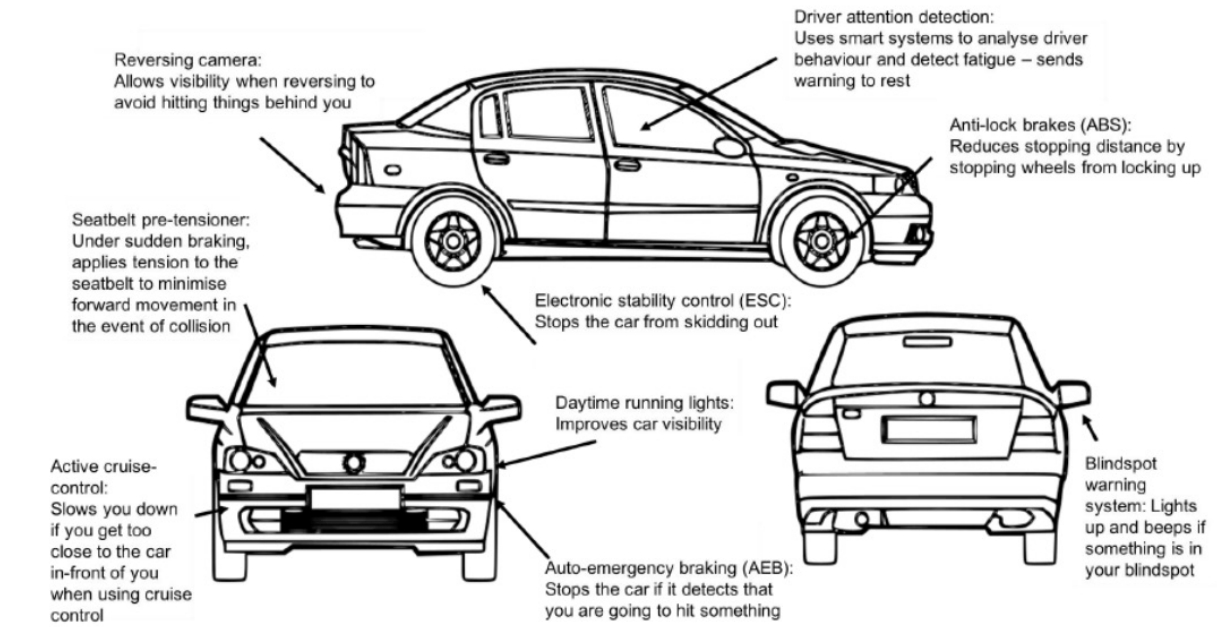
Resource 1: What makes cars safe worksheet



Resource Worksheets & Answers

Answers — Resource 1: What makes cars safe worksheet

Note for teachers: the below image is a sample of what a filled-in student template may look like. This is not a comprehensive list of features. For a detailed list and explanation of safety features, visit: www.howsafeisyourcar.com.au/Safety-Features/Safety-Features-List/



Resource 2: Safety features worksheet

Directions: Correctly categorise each safety feature as either a crash avoidance feature (which makes a crash less likely) or an injury protection feature (which reduces injury in a crash).

Write the feature in the appropriate column of the table below.

SEAT BELTS | ACTIVE CRUISE CONTROL | HEAD RESTS | LANE-KEEP ASSIST

ANTI-LOCK BRAKE SYSTEM (ABS) | CRUMPLE ZONES | BLIND SPOT WARNINGS

ELECTRONIC STABILITY CONTROL (ESC) | INTELLIGENT SPEED ADAPTATION (ISA)

PEDESTRIAN FRIENDLY BONNET | AUTO EMERGENCY BRAKING (AEB)

SIDE-IMPACT PROTECTION SYSTEM | DESIGN | AIRBAGS

DESIGN DRIVER FATIGUE MONITORING

CRASH AVOIDANCE FEATURES (Features that make a crash less likely)	INJURY PROTECTION FEATURES (Features that reduce injury to road users in a crash)

Answers — Resource 2: Safety features worksheet

CRASH AVOIDANCE FEATURES (Features that make a crash less likely)	INJURY PROTECTION FEATURES (Features that reduce injury to road users in a crash)
ANTI-LOCK BRAKE SYSTEM (ABS)	SEAT BELTS
ELECTRONIC STABILITY CONTROL (ESC)	AIRBAGS
LANE-KEEP ASSIST	HEAD RESTS
ACTIVE CRUISE CONTROL	SIDE-IMPACT PROTECTION SYSTEM
BLIND SPOT WARNINGS	CRUMPLE ZONES
DESIGN DRIVER FATIGUE MONITORING	PEDESTRIAN FRIENDLY BONNET
AUTO EMERGENCY BRAKING (AEB)	DESIGN
INTELLIGENT SPEED ADAPTATION (ISA)	

Resource 3: Safety features explained

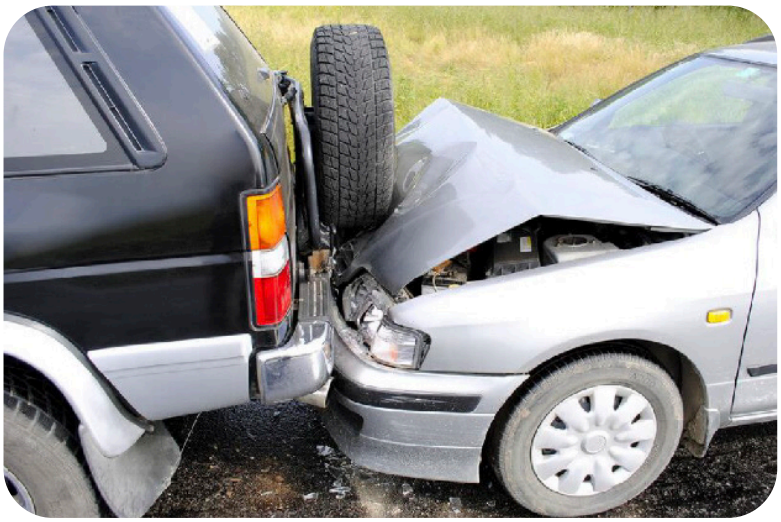
SAFETY FEATURES	DESCRIPTION
Anti-lock brake System (ABS)	Detects panic braking when sudden and forceful movement is applied to the brake pedal. When the system recognises sudden braking, it will add additional pressure to the brake. This allows the wheels on a motor vehicle to maintain tractive contact with the road surface according to driver inputs while braking, preventing the wheels from locking up (ceasing rotation) and avoiding uncontrolled skidding.
Seatbelts	For drivers and front-seat passengers, using a lap and shoulder belt reduces the risk of fatal injury by 60 percent in an SUV, van or ute and by 45 percent in a car.
Airbags	Airbags provide crucial cushioning for people during a crash.
Electronic Stability Control (ESC)	ESC is an extension of antilock brake technology that helps drivers maintain control of their vehicles on curves and slippery roads, and hence prevent skidding. ESC becomes active when a driver loses control of their car.
Head Rests	Attached to the top of a seat this safety feature reduces whiplash or serious neck and spinal injury.
Lane-Keep Assist	Technology that detects if a car is drifting in its lane. It provides alerts and warnings to help avoid or mitigate a crash. Some versions will proactively steer the car back into the lane.
Active Cruise Control	Improved cruise control that includes warnings or assistance such as automatic braking to adjust the vehicle speed by detecting the distance and speed of the preceding vehicle and maintains an appropriate following distance.
Side-Impact Protection System	By having a reinforced energy absorbing honeycomb materials inside the doors, force is widely distributed across the vehicle. Resulting in less directional force being applied to a specific area.
Crumple Zones	Crumple zones absorb the energy from the impact of a crash. By absorbing the energy, the crumpling prevents the energy traveling through the car.
Pedestrian Friendly Bonnet Design	These features reduce injury to the pedestrians whilst maintaining structural integrity.

Resource 3: Safety features explained (cont.)

SAFETY FEATURES	DESCRIPTION
Blind Spot Warnings	Alarm that alerts the driver if there is something in their blind spot.
Driver Fatigue Monitoring	Technology that provides warnings when it detects a driver falling asleep. This may help avoid or mitigate a crash.
Auto emergency braking (AEB)	AEB is a feature that alerts a driver to an imminent crash and helps them use the maximum braking capacity of the vehicle. AEB will independently brake if the situation becomes critical and no human response is made. AEB comes in three categories: 1. Low speed system – works on city streets to detect other vehicles in front of the driver's car to prevent crashes and non-life-threatening injuries such as whiplash 2. Higher speed system – scans up to 200 metres ahead using long range radar at higher speeds 3. Pedestrian system – detects pedestrian movement in relation to the path of the vehicle to determine the risk of collision.
Intelligent Speed Adaptation (ISA)	ISA assists drivers to stick to the speed limit. Technology using a GPS is linked to a speed zone database that allows the vehicle to "know" its location and the speed limit on that road. The ISA system provides visual and auditory feedback to the driver if the vehicle exceeds the speed limit.

Resource 4: Crash analysis worksheet

Directions: Look at the following four images of crashes and read the accompanying descriptions. For each image, based on the picture and description, record **what crash avoidance features** may have stopped the crash, and **what injury protection features** may have reduced injury for those involved.

CRASH IMAGE	DESCRIPTION
	This image shows a rear-end crash, one of the most common types of crashes for young drivers. In this case, the black 4WD was forced to stop suddenly, and the silver car travelling behind it failed to stop in time. As you can see, the silver car ran into the back of the 4WD and has significant damage.

SAFETY FEATURES

What crash avoidance features may have stopped this crash?

What injury protection features may have reduced injury to those involved?

Resource 4: Crash analysis worksheet

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CRASH IMAGE	DESCRIPTION
	This image shows a car about to pull in in front of the truck. The driver of the silver car didn't check their mirrors before moving across and, seconds later, collided with the truck. The driver of the silver car didn't leave enough space in front of the truck and the truck hit the rear of the silver car.

SAFETY FEATURES

What crash avoidance features may have stopped this crash?

What injury protection features may have reduced injury to those involved?

Resource 4: Crash analysis worksheet

Directions: Look at the following four images of crashes and read the accompanying descriptions. For each image, based on the picture and description, record **what crash avoidance features** may have stopped the crash, and **what injury protection features** may have reduced injury for those involved.

CRASH IMAGE	DESCRIPTION
	TIn this image, a driver skids in foggy/wet conditions and slides across to the other side of the road into oncoming traffic. The driver was travelling too fast for the conditions, and this contributed to losing control of their car.

SAFETY FEATURES

What crash avoidance features may have stopped this crash?

What injury protection features may have reduced injury to those involved?

Resource 4: Crash analysis worksheet

Directions: Look at the following four images of crashes and read the accompanying descriptions. For each image, based on the picture and description, record **what crash avoidance features** may have stopped the crash, and **what injury protection features** may have reduced injury for those involved.

CRASH IMAGE	DESCRIPTION
	This image shows a cyclist moments before a driver opens their car door and causes them to crash. It shows that even when you're stationary, or a passenger, you can still cause a crash and need to take care. It also demonstrates additional risks for other types of road users.

Note: Look at the direction the driver is facing. If they had used the *Dutch reach* when opening the door, their eyes could be drawn to the potential hazards around them.

Dutch reach:

- *When opening a car door, use the hand furthest away from the car handle.*
- *By doing this the passenger/driver are forced to turn their body towards the door, allowing them to easily look over their shoulder and check for other road users.*

SAFETY FEATURES
What crash avoidance features may have stopped this crash? **What injury protection features may have reduced injury to those involved?**

Sample answers - Resource 4: Crash analysis

Directions: Look at the following four images of crashes and read the accompanying descriptions. For each image, based on the picture and description, record **what crash avoidance features** may have stopped the crash, and **what injury protection features** may have reduced injury for those involved.

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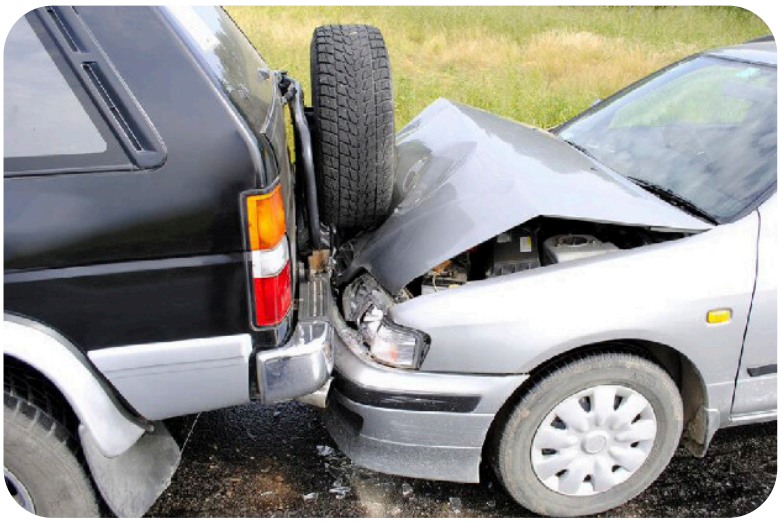	This image shows a rear-end crash, one of the most common types of crashes for young drivers. In this case, the black 4WD was forced to stop suddenly, and the silver car travelling behind it failed to stop in time. As you can see, the silver car ran into the back of the 4WD and has significant damage.

SAFETY FEATURES

What crash avoidance features may have stopped this crash?

- ABS (to increase stopping distance)
- Active cruise control (which if activated could have automatically slowed the silver car)
- Automatic Emergency Braking (AEB) (which could have notified the driver of an impending collision)
- Driver-attention detection in case of distraction or fatigue
- Active braking (which could have automatically slowed the silver car)
- Intelligent Speed Adaptation (ISA) (ensures the car doesn't exceed the speed limit)

What injury protection features may have reduced injury to those involved?

- Seat belts (to prevent the driver being thrown forwards
- Airbag (to protect the driver's head)
- Crumple zones (to absorb the force of a serious crash)
- Head rests (reduce whiplash injuries)

Sample answers - Resource 4: Crash analysis

Directions: Look at the following four images of crashes and read the accompanying descriptions. For each image, based on the picture and description, record **what crash avoidance features** may have stopped the crash, and **what injury protection features** may have reduced injury for those involved.

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SAFETY FEATURES

What crash avoidance features may have stopped this crash?

- Lane-Keep Assist (to help keep the silver car in the correct lane)
- Blind spot indicators (to remind the driver of the silver car that there was something in their blind spot)
- Indicator (to signal to the truck that they were changing lanes)

What injury protection features may have reduced injury to those involved?

- Seat belts
- Airbag (to prevent injury to the drivers' head and side of body)
- Side impact protection system (preventing the driver's body coming into contact with the side of the car)

Sample answers - Resource 4: Crash analysis

Directions: Look at the following four images of crashes and read the accompanying descriptions. For each image, based on the picture and description, record **what crash avoidance features** may have stopped the crash, and **what injury protection features** may have reduced injury for those involved.

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SAFETY FEATURES

What crash avoidance features may have stopped this crash?

- ESC (to help the driver keep control of the car and avoid skidding)
- ABS (so if the driver tried to slow down the car wouldn't skid)
- Active suspension (to help keep the car stay stable and in-control)
- Good tyres (to help maintain grip and decrease the likelihood of losing control)

What injury protection features may have reduced injury to those involved?

- Seat belts (to ensure the driver is not thrown around the inside car)
- Airbags (to protect the driver's head and body)

Sample answers - Resource 4: Crash analysis

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Dutch reach:

- *When opening a car door, use the hand furthest away from the car handle.*
- *By doing this the passenger/driver are forced to turn their body towards the door, allowing them to easily look over their shoulder and check for other road users.*

SAFETY FEATURES

What crash avoidance features may have stopped this crash?

- Side mirrors (to help the passenger see what is coming behind them)
- A rider reminder device which drivers can put on the inside of their car door handle (the textured feel of the device acts as a reminder to check for riders before opening the car door)
- Using the "Dutch reach" method of opening the door (allowing the passenger/driver to check for other road users before opening the door)
- Blind spot indicator (to remind both passenger and driver that things are coming from behind)
- Bell (for the cyclist)
- High visibility clothing (for the cyclist)

What injury protection features may have reduced injury to those involved?

- Helmet (for the cyclist)

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