LESSON PLAN

The Science of Road Crashes

STAGE
Years 5-6

DURATION
50 minutes

SUBJECT
Science, Maths

RESOURCE OVERVIEW

The stopping distance of a vehicle is made up of distance travelled while a driver reacts and begins to brake, and then the braking distance as the vehicle comes to a stop.

A common reaction time for most drivers is around 1.2 seconds before the brakes are applied, however this can vary according to factors such as driving conditions.

In this lesson, students investigate how speed, friction and reaction times influence vehicle stopping distances, and test reaction times by catching a falling ruler.

ROAD SAFETY EDUCATION VICTORIA

Resource Details

CURRICULUM ALIGNMENT

This lesson supports:

Science

- With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be based on previous experiences or general rules (VCSIS082)
- Decide which variables should be changed, measured and controlled in fair tests and accurately observe, measure and record data (VCSIS084)
- Construct and use a range of representations, including tables and graphs, to record, represent and describe observations, patterns or relationships in data (VCSIS085)
- Compare data with predictions and use as evidence in developing explanations (VCSIS086)
- Communicate ideas and processes using evidence to develop explanations of events and phenomena and to identify simple cause-and-effect relationships (VCSIS088)

Maths

- Pose questions and collect categorical or numerical data by observation or survey (VCMSP205)
- Describe and interpret different data sets in context (VCMSP207)
- Solve problems involving the comparison of lengths and areas using appropriate units (VCMMG224)

RESOURCE REQUIREMENTS

In this lesson, teacher/s will need:

- Toy car
- Ramp
- Ruler
- Base for ramp (you could use a box or a stack of books)
- Worksheet: Car stopping distances
- Ruler reaction test table

LEARNING INTENTION

In this lesson, students will:

- Identify the connections between speed, friction and reaction times on vehicle stopping distances.

SUCCESS CRITERIA

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

- Identify that speed increases stopping distance.
- Identify how surfaces with less friction can increase stopping distance.
- Identify how reaction time can affect stopping distance.
- Identify factors that can increase reaction time.

Lesson Plan

Tuning in

APPROX. 10 MINUTES

Discuss the experiment with students.

Ask students:

- What might be happening in the community that makes it important to investigate stopping distances?
- How do you think speed might change the outcome of a crash? E.g. a car needs to stop suddenly for a pedestrian. What would be the difference for the pedestrian if the car were travelling at 30km/h compared to 60km/h?

Show students the chart Stopping distances in dry conditions included below. Discuss how speed changes the outcome of a crash with a pedestrian standing 45 metres away.

Ask students to make predictions about what will happen to the stopping distance of the car under different conditions.

Main activity: Scenarios

APPROX. 30 MINUTES

Ask students to place a ramp on a flat surface and release a toy car down it under the following conditions:

- Low ramp gradient
- Medium ramp gradient
- High ramp gradient
- Smooth surface
- Rough surface (such as gravel to emulate unsealed road)
- Wet ramp and wet surface

Students should measure the distance it takes for the toy car to come to a stop (stopping distance) and record their result on the worksheet.

Ask students to share the results of their experiment. Discuss how the different conditions influenced stopping distance.

Discuss the idea of friction with students.

> *Friction is the force generated between two surfaces when they rub or move over each other. Controlling any vehicle manoeuvre such as braking, accelerating and cornering relies on frictional force between tyres and road surface. On most dry surfaces friction is high, no matter what the road surface. However, when the road is wet or icy, there is less of the two surfaces in contact with each other and, especially if the vehicle is travelling at high speed, there is less opportunity for the surfaces to be in contact with each other.*

Ask students to conduct the ruler reaction test. Students work in pairs. One student drops the ruler while the other positions their hand at the bottom of the ruler and grabs it as quickly as they can when it is dropped.

Students measure the distance they have taken to grab their ruler. They then look at the Ruler reaction test table to check what their reaction time was.

Ask students:

- How might reaction time relate to the stopping distance of a car? (The car travels a long way before the driver applies the brakes.)
- How might speed relate to the distance that a car travels before a driver reacts? (The reaction distance increases considerably as speed increases.)
- What might affect the reaction time of a driver? (Dark or foggy conditions, lack of sleep, distractions, alcohol.)

Ask students to complete the *calculating stopping distances* worksheet.

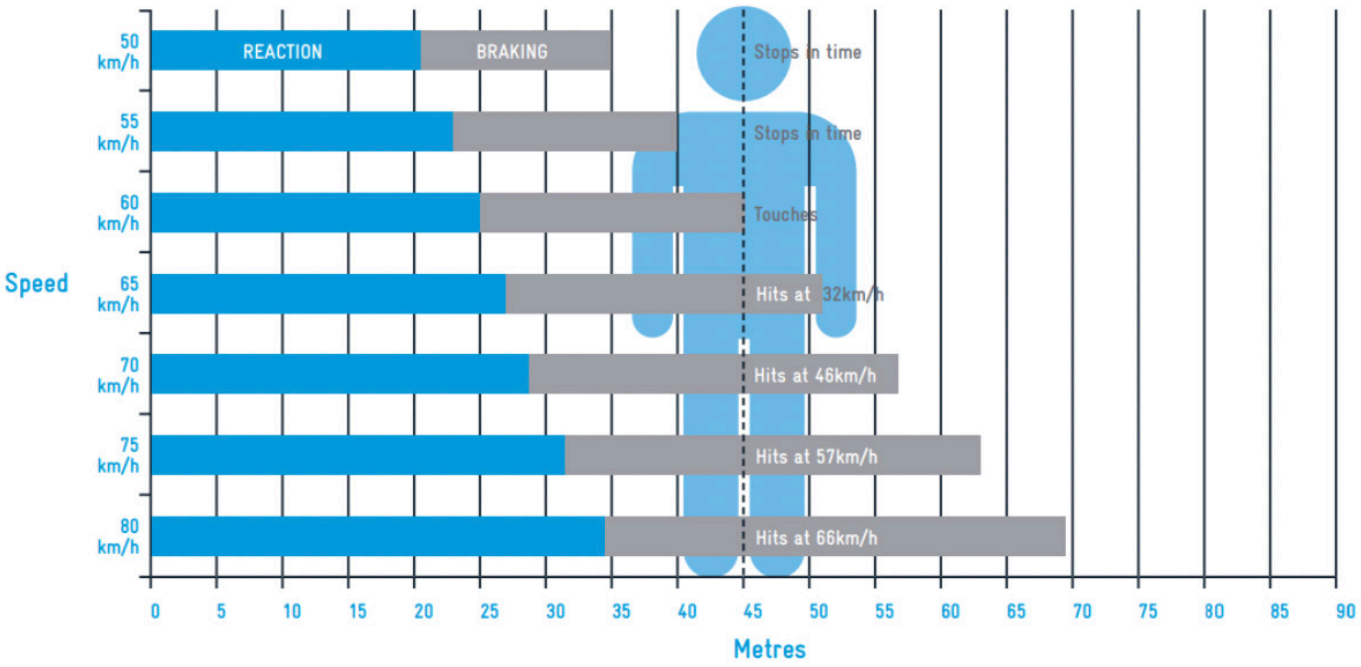
Reflecting activity

APPROX. 10 MINUTES

Ask students what recommendations they would make to drivers after completing this experiment.

Resource Worksheet

Resource 1: Stopping Distances In Dry Conditions



Resource 2: Experiment - Car Stopping Distances

Materials:

- Toy car
- Ramp
- Ruler
- Base for ramp
  (you could use a box or a stack of books)

Instructions:

1. Set up the ramp and ground surface.
2. Measure the stopping distance
   (distance from the end of the ramp to the front of the car)
3. Record the stopping distance in the table.

Stopping distance

Ramp	Ground surface	Stopping distance
Steep angle	Smooth	
Medium angle	Smooth	
Low angle	Smooth	
Medium angle	Rough	
Medium angle	Wet	

Resource Worksheet

Resource 3: Ruler Reaction Test

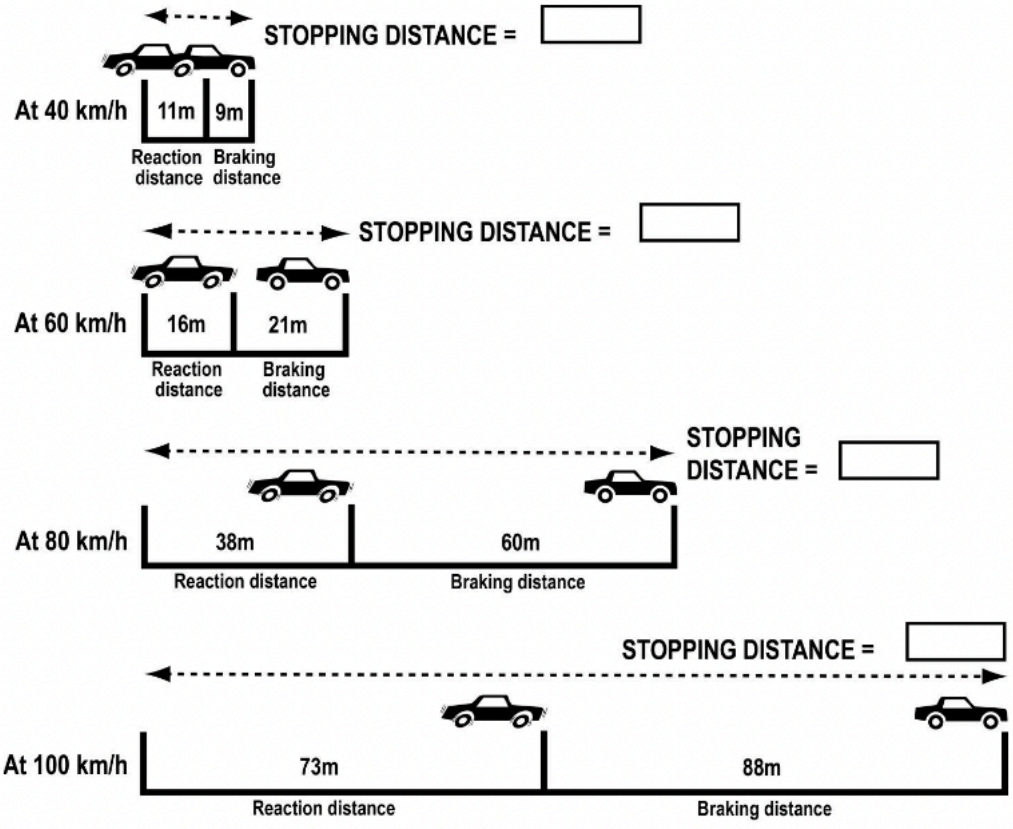
RULER DISTANCE (CM)	REACTION TIME (SECONDS)
5 cm	0.1 sec
10 cm	0.14 sec
15 cm	0.18 sec
20 cm	0.2 sec
25 cm	0.23 sec
30 cm	0.25 sec

Resource 4: Calculating Stopping Distances

Reaction distance
The distance that a vehicle continues to travel while the driver thinks about and processes the information required to stop the vehicle.

Braking distance
The distance that the vehicle continues to travel once the brakes are applied.

Stopping distance
The total distance that a vehicle travels to come to a complete stop from the time the driver first decides to stop, including the reaction distance and the braking distance.



www.roadsafetyeducation.vic.gov.au