# UNIT 3: Speeding and stopping

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## ENRICHMENT ACTIVITIES

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Unit 3: Speeding and stopping

About Traffic Safety Essentials

Young people are at risk on our roads, particularly as passengers and when they begin driving. Road crashes are the single biggest killer of young Victorians aged 16-25 years. Victoria’s Road Safety Strategy 2012-2022 highlights the importance of road safety for young people, especially from the point at which they prepare for and begin to use the road as drivers. This starts just before they begin learning to drive right through to when they are fully licensed and have progressed through Victoria’s Graduated Licensing System.

Traffic Safety Essentials has been developed as the key Victorian road safety education resource for secondary schools with a focus on Year 10. It is in Year 10 that most young people become eligible for a Learner Permit, and begin the process of learning to drive a car. Traffic Safety Essentials links to AusVELS and is designed to assist secondary schools to implement a core road safety education program at Year 10. It is focused on helping young people to improve their decision making skills, develop an understanding of consequences and improve the safety of themselves and their peers.

This Year 10 classroom program takes an integrated approach to key road safety issues for young people at this critical point in their lives. It is around this time that they begin to learn to drive and also to travel more independently, often with their peers. Unfortunately young people can often be involved in tragic road crashes through poor decision making at critical times. The program takes this into account and features six units:

UNIT 1: Driving or just steering
UNIT 2 Focused or fractured
UNIT 3: Speeding and stopping
UNIT 4 Alcohol and other drugs
UNIT 5: Hoons or harassed
UNIT 6: Travel choices

All units contain a number of individual classroom activities, each of which are grouped into three sections that move students through a process, based around theories of behaviour change:

Problem recognition

Problem solving

Taking action

You can find details of other road safety education resources and programs that link with Traffic Safety Essentials at: www.roadsafetyeducation.vic.gov.au
Background to UNIT 3: Speeding and stopping

Speed is a major contributor to crashes, particularly among young drivers. Understanding the various factors involved in stopping vehicles and driver limitations is an important step towards changing driver attitudes to speed.

The science behind stopping vehicles can be used to demonstrate the various processes involved, from the physical and mechanical involving friction, momentum and kinetic energy, through to the myriad of complex human factors involved, such as reaction times, driver awareness and expectation.

While there are a range of strategies drivers can use to restrict speed, different technologies have been developed to address the issue of speed and the physical and social impacts of crashes (e.g. safety cameras). Vehicle manufacturers also use a range of technologies to reduce crash impact on vehicle occupants. Research is continuing in vehicle safety systems as governments continue to look for ways to reduce the costs of road trauma. While many technologies hold some promise, in the end it is the driver who has ultimate responsibility for the speed at which they drive.

Essential learning

As an outcome of this unit students will understand:

• that reaction times and speed are two key components affecting crash outcomes
• stopping distances are affected by a range of variables, including speed, reaction time, road conditions, distractions and driver limitations
• there are sound scientific reasons for reducing speed to lessen the chance and the impact of a crash
• the various technology solutions that are used in road design and construction, and vehicle safety to reduce crash risk, injury and property damage.
Unit 3: Speeding and stopping

Links to AusVELS

Science
Strand: Science Understanding
Physical sciences
- Energy conservation in a system can be explained by describing energy transfers and transformations (ACSSU190)
- The motion of objects can be described and predicted using the laws of physics (ACSSU229)

Strand: Science as a Human Endeavour
Use and influence of science
- Advances in science and emerging sciences and technologies can significantly affect people’s lives, including generating new career opportunities (ACSHE195)
- The values and needs of contemporary society can influence the focus of scientific research (ACSHE230)

Strand: Science Inquiry Skills
Questioning and predicting
- Formulate questions or hypotheses that can be investigated scientifically (ACSI2198)

Planning and conducting
- Plan, select and use appropriate investigation methods, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (ACSI2199)

Processing and analysing data and information
- Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSI2203)
- Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSI2204)

Communicating
- Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSI2204)

Mathematics
Strand: Number and Algebra
Linear and nonlinear relationships
- Solve problems involving linear equations, including those derived from formulas (ACMNA235)
- Solve linear equations involving simple algebraic fractions (ACMNA240)

Information and Communications Technology
Dimension: ICT for communicating
Learning Focus: Students expand their skills in locating information on websites by using general and specialised directories. They refine their searching techniques to get more precise results by using within suitable search engines, proximity operators, which specify where one term in a document must appear in relation to another term.

Standard: Students apply techniques to locate more precise information from websites, including searching general and specialised directories, and applying proximity operators.
Unit 3: Speeding and stopping

**Communication**

**Dimension: Presenting**

**Learning focus:** Students experiment with communicating complex ideas in a variety of ways. They organise their information, ideas and opinions into a coherent structure, select and adjust their mode of presentation to suit purpose and audience, and make appropriate adjustments in response to an audience.

**Standard:** At Level 10, students demonstrate their understanding of the relationship between form, content and mode, and select suitable resources and technologies to effectively communicate. They use subject specific language and conventions in accordance with the purpose of their presentation to communicate complex information. They provide constructive feedback to others and use feedback and reflection in order to inform their future presentations.

**Thinking Processes**

**Learning focus:** Students begin to formulate and test hypotheses, contentions and conjectures and to collect evidence to support or reject them. They develop their skills in synthesising complex information and solving problems that include a wide range of variables. Students develop questioning techniques appropriate to the complexity of ideas they investigate, to probe into and elicit information from varying sources. They work with others to modify their initial questions and to develop further their understanding that sources of information may vary in their validity.

**Dimension: Reasoning, processing and inquiry**

**Standard:** At Level 10, students discriminate in the way they use a variety of sources. They generate questions that explore perspectives. They process and synthesise complex information and complete activities focusing on problem solving and decision making which involve a wide range and complexity of variables and solutions. They employ appropriate methodologies for creating and verifying knowledge in different disciplines. They make informed decisions based on their analysis of various perspectives and, sometimes contradictory, information.

**Interpersonal Development**

**Dimension: Working in teams**

**Learning Focus:** Students take opportunities to work in diverse teams within and beyond school, including the workplace, to complete tasks with several interrelated components. Some of these tasks are managed by the team, with limited teacher input.

**Standard:** At Level 10, students work collaboratively, negotiate roles and delegate tasks to complete complex tasks in teams. Working with the strengths of a team they achieve agreed goals within set timeframes. Students describe how they respect and build on the ideas and opinions of team members and clearly articulate or record their reflections on the effectiveness of learning in a team. They develop and implement strategies for improving their contributions to achieving the team goals.
Problem recognition: The involvement of speed in crashes – reaction time

Preparation

Students will require access to the Internet. Students will also need enough 30cm rulers for one per pair or small group. Make copies of Activity Sheet 3.1: Research reaction time using a simple experiment (page 18), Activity Sheet 3.2: Testing your reaction time (page 19) and Activity Sheet 3.3: Testing your family’s reaction time (page 20).

What to do

Discussion

Write this statement on the board:

*As speed increases so does the severity of a crash.*

Discuss what this means and ask whether students believe it to be true.

Show students the TAC advertisement *Slo-Mo* with road safety expert Dr Ian Johnston explaining the relationship between speed and stopping distance: www.youtube.com/watch?v=SuY_VHzKdjc

Brainstorm what factors, in addition to the speed of the vehicle, affect stopping distances.

A bit more info...

Which factors affect the distance in which you stop?

- Reaction time.
- Visibility.
- Mechanical movement time.
- Condition of tyres.
- Condition of and type of brakes.
- Road surface condition (wet/dry, loose surface, etc.).
- Driver awareness/alertness.
- Age of driver.

Key Factors in Stopping

![Diagram showing the relationship between travel speed, impact speed, driver reaction time, and stopping distance](attachment:diagram.png)
Unit 3: Speeding and stopping

Experiment

Have the students research reaction time using a simple experiment. Working in pairs or small groups, each will need a 30cm ruler. Demonstrate the procedure to the class.

In pairs or small groups have students work through Activity Sheet 3.1: Research reaction time using a simple experiment and use Activity Sheet 3.2: Testing your reaction time to record their results.

Have the students conduct the same experiment at home with their families (Activity Sheet 3.3: Testing your family’s reaction time). Compare students’ scores with those of parents/carers. Have the students record the results in a spreadsheet and create a graph of the results.

Website Reaction Time Tests

You may also like to use this website, which tests reaction times and gives a final result in milliseconds (1/1000 of a second):

http://cognitivelabs.com/mydna_speedtestno.htm

There is also this online experiment where students can work out the average reaction time by dividing the hits by 30 to get reaction per second:

http://faculty.washington.edu/chudler/java/dottime.html

A bit more info…

What factors affect reaction times?

- Driver distractions – mobile phones, other passengers, loud music.
- Something unexpected happening – in an experiment the subject was waiting for the particular event to happen.
- Being tired (fatigued).
- Being under the influence of alcohol or other drugs.
Discussion

Brainstorm what factors might affect reaction times when it comes to driving a car.

Ask students to predict what effect these factors might have on reaction times (i.e. increase or decrease).

Discuss what the impact of speed would be on reaction times. Note that the faster you travel the greater the distance the car travels as the driver reacts to an unexpected event (such as braking to avoid a pedestrian).

A bit more info...

Reaction Times

Many drivers cheat with their speed when driving. They think that while the speed limit is 60 km/h the police won’t pull them over if they sit on 65 km/h. So they happily let the speedo hover just above the speed limit, unaware that by so doing they are greatly magnifying their chances of crashing.

Scientists at the University of Adelaide have used crash data to estimate the relative risk of a car becoming involved in a casualty crash (a car crash in which people are killed or hospitalised) for cars travelling at or above 60 km/h. They found that the risk doubled for every 5 km/h over 60 km/h. Thus, a car travelling at 65 km/h was twice as likely to be involved in a casualty crash as one travelling at 60 km/h. For a car travelling at 70 km/h, the risk increased four times. For speeds below 60 km/h the likelihood of a fatal crash is correspondingly reduced.

Under normal driving conditions the reaction time is much greater than those in experiments where we are expecting a ruler to drop or whatever event we are testing. The reaction time for an unexpected event is usually greater by a factor of 6 or 7 or even more. So if the reaction time was 0.2 seconds to catch the ruler, the reaction time to an unexpected event would be more like 1.2 to 1.5 seconds.

Source: www.science.org.au/nova/058/058key.htm
**Problem recognition:**
The involvement of speed in crashes – stopping distances and speed

**Preparation**
Students will need to have completed the reaction time experiments. You will need a computer or laptop with access to the Internet and a data projector or interactive whiteboard. The experimental work requires use of physics trucks or model cars, modelling clay and ramps. Make copies of Activity Sheet 3.4 Design your own experiment (page 21).

**What to do**

**Calculations**

Explain to students that it is important to understand why you keep moving when a collision occurs. The key is to calculate the momentum of the vehicle. Discuss momentum by asking:

- How is momentum important in a crash?
- What do car manufacturers do to assist passengers to cope with the momentum of a vehicle in a crash?
- How does vehicle weight affect momentum?
- How does vehicle speed affect momentum?

Have the students do a range of momentum calculations for vehicles of different mass travelling at different speeds so they can understand the concept of momentum.

Discuss the results of these calculations with students by asking whether these results surprise them. Ask what can they conclude about the momentum of different vehicles at different speeds in a crash?

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**A bit more info…**

**Understanding momentum**

- Momentum is the product of the mass and the velocity of an object (e.g. a vehicle).
- Which has the most momentum, a 2000kg vehicle travelling at 54 km/h (15 m/s) or a 1200kg vehicle travelling at 108 km/h (30 m/s)?
  
  \[ p = mv \]

  \[ p = 2000 \times 15 = 30000 \text{ kgm/s} \]
  
  \[ p = 1200 \times 30 = 36000 \text{ kgm/s} \]

  Where: \( p \) = momentum, \( m \) = mass, \( v \) = speed (velocity) in metres per second (m/s)

- Do a range of kinetic (motion) energy calculations:
  
  Which has the greatest kinetic energy?

  \[ E = \frac{1}{2} mv^2 \]

  \[ E = \frac{1}{2} \times 2000 \times 15^2 = 225 \text{ Kj} \]

  \[ E = \frac{1}{2} \times 1200 \times 30^2 = 540 \text{ KJ} \]
View Crash Test Videos

Show the students some crash test videos. View some videos of front on and side on collisions of a range of vehicles. You can find a collection of crash test videos here: www.youtube.com/user/ancapcrashtests

Ask what the videos show about momentum. Discuss:

- What injuries would occupants sustain in the video from a side crash of a small car?
- What are the differences between small cars versus medium and large cars?
- Which cars fared better in a head on collision?
  - Why did they do better?
  - How can this be explained in terms of momentum and energy?
- Why does the front of a car crumple in a head on collision?
  - To what extent does the vehicle absorb energy during the collision?
  - What happens if you reduce the rate of deceleration of the vehicle? Note that a fast stop would cause more damage than a slower stop as the energy is dissipated over a much shorter time span.
- How would older cars compare with new cars that have better safety features?

Calculations

Kinetic energy is the energy possessed by an object because of its motion.

All moving objects have kinetic energy. The amount of kinetic energy depends upon the mass and speed of the object. A car has a lot of kinetic energy, especially if it is moving fast and has a lot of mass. Kinetic energy is calculated using the formula:

\[
KE = \frac{1}{2} m v^2
\]

Where:

- \( m \) = mass in kilograms
- \( v \) = velocity (speed) in metres per second

When a vehicle is involved in a crash, the kinetic energy must be absorbed or dissipated. Typically this energy is dissipated through the vehicle’s brakes, but in a crash this must be absorbed through vehicle crumple zones, energy absorbing flexible road barriers and air bags. If the human body absorbs a large amount of this energy it can result in serious injury or death.

Have students calculate the kinetic energy of a vehicle of mass 1500kg going at 60 km/h, 65 km/h, 70 km/h, 75 km/h and 80 km/h. Using a spreadsheet will make this easier.

**A bit more info...**

To convert from km/h to metres multiply by 1000 & divide by 3600
e.g. 60 km per hour = 60 x 1000 metres per hour
  = 60 x 1000 ÷ 60 × 60 metres per minute
  = 60 x 1000 ÷ 60 ÷ 60 metres per second
  = 16.7 m/s
Ask students to answer the following questions:

1. What is the percentage increase in kinetic energy from 60km/h to 65 km/h?
2. What is the percentage increase in speed from 60km/h to 65 km/h?
3. Which is the greater percentage? Why?
4. What has the greatest impact on kinetic energy, increasing vehicle speed or vehicle mass (weight)? Why?
5. What conclusions can you draw from this regarding kinetic energy and vehicle speed?
6. Is the Wipe off 5 campaign (i.e. encouraging drivers to drive slower) an effective way to reduce kinetic energy of vehicles?

**Designing an Experiment**

Have the students work in small groups to design an experiment (*Activity Sheet 3.4 Design your own experiment*) to test energy absorption in a simulated crash:

- Use ramps, physics trucks with nails stuck in front and crash into a block of modelling clay.
- Measure the distance the nail enters the modelling clay at different speeds, based on how far up the ramp they are released from and the steepness of the ramp.

Note that the speed at impact is proportional to the square root of the distance up the ramp when released.

Each group should present their findings and conclusions to the class. Their conclusions should consider issues such as what this means for vehicle construction.

Have groups of students design and conduct a momentum experiment using physics trucks or model cars, ramps and rubber stoppers as passengers. Measure how far the passenger is sent forward for different speeds. Students should consider:

- Why is this relevant to car crashes?
- What is done to stop passengers continuing to move in head on collisions?
- What do the car manufacturers do to reduce passengers moving forward at high speeds?
- What else could be done?

**Present Findings**

Each group should present their findings and conclusions to the class.
Unit 3: Speeding and stopping

Problem recognition:
Forces, friction and stopping distances

Preparation

Students will need access to computers and spreadsheet software for calculations. Make copies of Activity Sheet 3.5: Stopping in time - Dry conditions (page 22) and Activity Sheet 3.6: Stopping in time - Wet conditions (page 23).

What to do

Calculations using spreadsheets

Have students use spreadsheet software to calculate stopping distance (sum of reaction distance and braking distance) by:

- Using their own reaction times (multiply these by 6, to allow for a realistic estimate of reaction time when driving a car) and the speed of the vehicle in metres per second (m/s) from the previous activity.
- Making a table of the speed versus stopping distances for 60, 70 and 100 km/h including reaction times using their data.
- Using the formula:  \[ d = \frac{v^2}{2ug} \]

Where:
- \( d \) = stopping distance
- \( v \) = speed (velocity) in m/s
- \( g \) = 9.8 (gravitational constant)
- \( \mu \) = friction coefficient

This friction coefficient is a value between 0.8 for new tyres and good road to 0.4 for poor tyres and poor road. It can even be lower for black ice, snow, hail or heavy rain. Use 0.6 for an average car.

Students’ tables should look like this:

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<th>A</th>
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<th>C</th>
<th>D</th>
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<th>G</th>
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<tbody>
<tr>
<td>1</td>
<td>Reaction Time</td>
<td>Speed</td>
<td>Friction Coefficient</td>
<td>Reaction Distance</td>
<td>Braking Distance</td>
<td>Stopping Distance</td>
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<td>2</td>
<td>(milliseconds)</td>
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<td>3</td>
<td>180</td>
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Unit 3: Speeding and stopping

Further Investigations

Measure the distances in front of your school for each of these different speeds. Mark out where drivers would have to respond to students crossing the road at the various speeds you determined. Have students stand at the various points. Do this for various values of the friction coefficient.

- What do you think are the implications for your findings?
- Why are good tyres and brakes important? Explain in terms of friction.
- What is the effect if the road is wet?

Discuss with students:

- Which type of tyres (type of tread, not brand of tyre) racing cars use in dry and wet conditions? Which have the best stopping distance in each type of condition? Why?
- At what speed is impact from a car more likely to be fatal for a pedestrian? (Research has shown that at speeds above 30 km/h the likelihood of survival for a pedestrian is severely reduced. A person hit by a car travelling at 40 km/h has a 25 per cent chance of being killed. Increase the speed to 60 km/h and the crash becomes barely survivable with the pedestrian having an 85 per cent chance of being killed. [Source Monash University Accident Research Centre Report 229])

Have students in small groups discuss and work through the questions on Activity Sheet 3.5: Stopping in time - Dry conditions and Activity Sheet 3.6: Stopping in time - Wet conditions.

Sharing the Findings

Discuss and share the answers from each group.

Have students in small groups prepare items for the school newsletter based on their findings, which explain to parents/carers the importance of travelling at low speeds, especially around schools. Suggest they link the presence of low speed zones with the likelihood that there will be vulnerable road users in the area - e.g. pedestrians, especially children or older people, and cyclists.
Preparation

Students will need access to computers and the Internet to conduct research.

What to do

Discuss

Point out to students that while there is a great deal of effort put into engineering cars and roads to improve safety, they need to note that it is estimated that in about 90% of crashes, human factors play a part. This is often due to carelessness or risk taking.

Discuss what measures are taken to address the human factor in crashes.

Brainstorm

Brainstorm different engineering measures or technologies on the roads that are used to restrict or detect driver speeds.

Ask students what treatments, interventions or technologies have been used near the school to slow down traffic.

In small groups, ask students to discuss what else could be used at the front of schools or kindergartens to make them safer. Share the responses with the whole class.

Discussion

As a class discuss specific initiatives designed to encourage drivers not to speed in Victoria.
Small Group Internet Research

In small groups have students investigate specific initiatives designed to encourage drivers not to speed in Victoria, other states in Australia and other countries.

Present Findings

Have each group present their findings either as a slideshow presentation, website or poster display.

Discuss how effective the class believes the different types of measures to restrict speeding would be and which they believe are most effective.

Internet Research

Ask students to use the Internet to research new technologies that car manufacturers are developing and installing to make their cars safer. They should relate this to concepts explored earlier, such as momentum and kinetic energy. This could be set as a homework assignment.

Have students share their findings with the rest of the class.

A bit more info...

Examples of technologies used to make cars safer:

- reversing sensors
- backing cameras
- eye movement detectors (to detect a driver falling asleep)
- speed governors for habitual speeders
- speed warning signals
- on-road speed detection that causes cars to slow down
- pop-up roll bars (convertibles)
- front Underrun Protection Device (trucks)
- side Underrun Protection Rails (trucks)
- airbags in different positions in the cabin
- new seatbelt technology
- collapsible steering columns
- thickness of the windscreen glass
- Electronic Stability Control (ESC)
- ABS (anti-skid brakes)
- alcohol ignition interlocks.
Taking action: Understanding the issues with speed

Preparation

Make copies of the information about the demerit points system for drivers in Victoria. This can be obtained from the VicRoads website: [www.vicroads.vic.gov.au/Home/Licences/DemeritsAndOffences](http://www.vicroads.vic.gov.au/Home/Licences/DemeritsAndOffences)

What to do

Discussion

Brainstorm and discuss the main things that limit stopping distances in vehicles. Consider human factors and mechanical and physical limitations.

Ask what factors restrict speed.

Small Group Work

Provide students with details of the demerit points system for drivers in Victoria.

In small groups students should review the information on the demerit points system and discuss:

- How does the points system work?
- Are the demerit points or penalties different for different types of drivers?
  e.g. P plate drivers
- Are there situations where there is automatic loss of licence (suspension or cancellation)? What are these?

Discussion

Share the conclusions reached by each of the groups and seek some consensus on the following questions:

- Is the demerit points system fair? Why or why not?
- Is it effective in restricting speeding?
- What would you do to change or improve it?

A bit more info...

Examples of human factors:
- awareness – anticipation, defensive driving
- reaction time (drugs, alcohol, fatigue)
- distractions
- peer pressure.

Examples of mechanical and physical limitations:
- friction from tyres and the road surface
- speed (velocity)
- vehicle manufacture
- vehicle weight (mass).

Examples of factors restricting speed:
- police enforcement
- car limitations, such as performance (most cars today are easily capable of excessive speed)
- speed limits.
### ENRICHMENT ACTIVITIES

- Students research the process of what must happen when a driver sees an object and then decides to brake. What pathway does the nervous system use and what parts of the body and nervous system are involved in the process from seeing the object to actually deciding to and then hitting the brakes?


- Stimulate a discussion about speed using this video demonstrating the difference between travelling at 50 km/h and 40 km/h when a pedestrian steps out in front of a car: [www.rta.nsw.gov.au/roadsafety/speedandspeedcameras/40kmhcbdspeedlimit/index.html](http://www.rta.nsw.gov.au/roadsafety/speedandspeedcameras/40kmhcbdspeedlimit/index.html)

- Students investigate specific initiatives designed to encourage drivers not to speed in Victoria, other states in Australia and other countries. Students present their findings as a poster or slideshow presentation.

ACTIVITY SHEET 3.1  RESEARCH REACTION TIME USING A SIMPLE EXPERIMENT

Work in pairs or small groups. Each pair or group will need a 30cm ruler.

Do the following:

1. One person holds the ruler near the 30cm mark and lets it hang vertically.
2. The test subject places their thumb and index finger either side of the 0cm mark ready to catch it when it falls. Their fingers shouldn’t touch the ruler, but should be very close.
3. Without warning the person holding the ruler lets go and the subject tries to catch the ruler as soon as possible. To prevent guessing, vary the time before letting go of the ruler.
4. The level (in cm) just above the subject’s first finger where the ruler was caught is recorded.
5. The same person should be tested 5 times and then the mean (average) of their results calculated (add all five numbers together and then divide by five).

Use the table below on the left to convert the mean scores into milliseconds (1/1000th of a second). Then rate the performance using the table below on the right.

<table>
<thead>
<tr>
<th>Catch Distance (cm)</th>
<th>Reaction Time (milliseconds)</th>
<th>Catch Distance (cm)</th>
<th>Reaction Time (milliseconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>16</td>
<td>180</td>
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<tr>
<td>2</td>
<td>60</td>
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<td>185</td>
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<td>174</td>
<td>30</td>
<td>250</td>
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<table>
<thead>
<tr>
<th>Reaction Time (milliseconds)</th>
<th>Rating</th>
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<tbody>
<tr>
<td>0-50</td>
<td>Very fast</td>
</tr>
<tr>
<td>51-130</td>
<td>Fast</td>
</tr>
<tr>
<td>131-175</td>
<td>Very good</td>
</tr>
<tr>
<td>176-200</td>
<td>Good</td>
</tr>
<tr>
<td>201-240</td>
<td>Average</td>
</tr>
<tr>
<td>241-250</td>
<td>Fair</td>
</tr>
<tr>
<td>251+</td>
<td>A little slow</td>
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Try some variations on the experiment and see if you can predict the results.

- Try the experiment in dim light. Does the reaction time increase, decrease or stay the same? Can you explain your results?
- Compare boys with girls. On average, are the boys or girls faster?
- Compare different ages by testing some younger students. Who is fastest?...The older students or younger students?
- Compare the scores after some time for practice. Does reaction time improve with practice?
- Does performance vary if you are tired? In what way?
ACTIVITY SHEET 3.2  TESTING YOUR REACTION TIME

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Reaction Time</th>
</tr>
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<tbody>
<tr>
<td>e.g. bright light</td>
<td>Attempt 1</td>
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</tbody>
</table>

Conclusions:
ACTIVITY SHEET 3.3 TESTING YOUR FAMILY’S REACTION TIME

Title:

Equipment:

Aim:

Method:

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Name of family member</th>
<th>Reaction Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. bright light</td>
<td></td>
<td>Attempt 1</td>
</tr>
<tr>
<td></td>
<td></td>
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Conclusions:
### ACTIVITY SHEET 3.4  DESIGN YOUR OWN EXPERIMENT

<table>
<thead>
<tr>
<th>Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment:</td>
</tr>
<tr>
<td>Aim:</td>
</tr>
<tr>
<td>Method:</td>
</tr>
</tbody>
</table>

**Predicted outcome:**

**Results:**

**Conclusions:**
ACTIVITY SHEET 3.5  STopping IN Time

DRY CONDITIONS

The road is dry. You have a modern vehicle with good brakes and tyres. A child runs on to the road 45 metres ahead of you while you are travelling in a 60 km/h zone. You brake hard.

Use the chart to help you answer the questions below.

Will you stop in time?

What if you were going at 65 km/h?
ACTIVITY SHEET 3.6  STOPPING IN TIME

WET CONDITIONS

The road is wet. You have a modern vehicle with good brakes and tyres. A child runs on to the road 45 metres ahead of you while you are travelling in a 60 km/h zone. You brake hard.

Use the chart to help you answer the questions below.

Will you stop in time?

What speed do you need to be doing to avoid hitting a child?

If someone is hit at more than 32 km/h it is often fatal. What speed do you need to be doing in the wet to avoid a collision in this scenario?