



Lesson Overview

The following activity guide is for use by high school students and educators looking to explore and expand on the concepts of **forces and motion** both in the classroom and at home. The guide presents an overarching challenge for students to respond to and some supporting activities to integrate cross-curricular priorities and help structure their understanding by providing depth and richness within the learning. There is an extension task to encourage students to apply their understanding to new situations and encourage further thinking.

A **force** is a push or a pull which acts on an object, resulting in a change in its movement, speed or direction of movement. An object's **motion** is the action of changing location or position. The relationship between forces, motion and energy is called mechanics. This guide will encourage students to explore Gravity and Air Resistance as forces acting on moving eggs and their relationship to impact. Students will investigate an egg's kinetic energy as it falls and how friction can be applied through air resistance to slow it down before applying these concepts to real life problems.

Lesson Intentions

- Use investigative skills to design experiments
- Investigate the laws of physics through designed experiments
- Discuss the motion of objects and the forces acting upon them using scientific language

Teachers Notes

Year 8 Outcomes:

Science Understanding

- Energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems (ACSSU155)

Science as a Human Endeavor

- Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE135)

Science Inquiry Skills

- Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSI139)
- Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSI140)
- Measure and control variables, select equipment appropriate to the task and collect data with accuracy (ACSI141)

Year 10 Outcomes:

Science Understanding

- 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)

Science Inquiry Skills

- Formulate questions or hypotheses that can be investigated scientifically (ACSI198)
- Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (ACSI199)
- Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately (ACSI200)

Main Challenge

Remote Delivery:

Design a transport solution to deliver raw eggs safely to remote communities in Australia by air. Your solution must ensure none of the eggs are broken during or after the delivery and should also consider how they will be protected from predators or air and road traffic.

Tips:

- Investigate delivery solutions for remote communities.
- Investigate the relationship between drop height and impact.
- Investigate the relationship between the egg's mass and momentum.
- Consider how your solution might be modified to accommodate more than one egg.
- Consider the fragility of eggs and investigate ways to protect the outer layer from outside forces.
- Consider how air resistance can be used as a tool in delivery solutions.
- Investigate the concept of terminal velocity.
- Take photos and record accurate measurements during your investigation.
- Present your investigation and findings using a digital medium.

Check your understanding with these questions:

1. Imagine you drop an egg to the ground with no extra force. Then you throw a second egg of the same size to the ground from the same height but with all the force you can muster. Which egg will have more air resistance acting upon it?
The thrown egg. As an object's speed increases, so does the air resistance, and therefore, friction.
2. A person drops an egg from a height of 20 metres. What forces are acting on the egg before it hits the ground?
Gravity and air resistance are acting on the egg while it falls.
3. Two eggs are dropped from the same height. Egg One has a parachute measuring 10cm x 10cm, and egg Two has a parachute measuring 20cm x 20cm. What happens?
Egg One falls faster as its parachute has a smaller surface area. Egg Two's parachute is larger, meaning that it encounters a significant amount of air resistance, slowing its fall.

Supporting Activities

Investigate how much force is needed to stop a moving egg without it breaking. Explore variable factors like speed and egg size or material of the object used to stop the egg.

Research different protective packaging options in your local supermarket. Discuss the differences in shapes, structure and material used. How might some options be improved to better protect the contents?

Explore air resistance by creating the 'perfect' paper aeroplane. Investigate which shapes, structures and folds allow the craft to stay airborne for longer. Hold a class competition to find the best plane engineers. How could this knowledge inform your decisions in the main challenge?

Extension Opportunity

Design and build a trebuchet or catapult that launches a raw egg the furthest possible distance. Hold a class competition to determine the best design. How will the success criteria for the designs be determined?