Australian Government
Civil Aviation Safety Authority

KNOW YOUR DRONE

DRONE SAFETY SECONDARY LESSON IDEA

Falling out of the sky

Safety focus: exploring why drone rules exist; learning how to fly a drone safely.

Curriculum focus: exploring energy transformations, balanced and unbalanced forces.

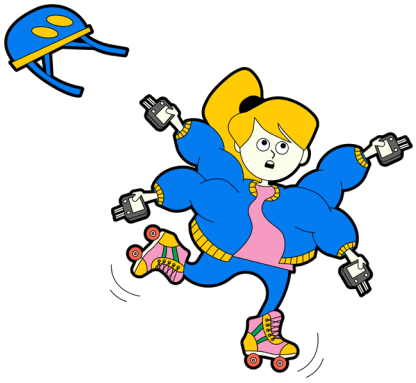
This lesson forms a useful investigation to apply recently learned knowledge about energy transformations and the motion of objects. It provides a real-world context for applying these concepts, assessing students' understanding and building their science inquiry skills.

This lesson would take around 90 minutes, including an initial design of a promotional piece in the final activity. A second lesson (or more) would be required for students to complete the whole promotional piece.

Relevant CASA safety rules

Incorporate the following messages and rules.

- Rule 1 Stay low: you must not fly your drone higher than 120 m (400 ft) above ground level.
- Rule 2 Don't be a space invader: You must keep your drone at least 30 m away from other people.
- Rule 5 Steer clear: do not fly over or above people or in a populous area.
- Rule 7 No go zone: if your drone weighs more than 250 grams, you must fly at least 5.5 km away from a controlled airport.
- Rule 8 Don't be a hazard: you must not operate your drone in a way that creates a hazard to another aircraft, person or property.



Possible curriculum links:

Year 10 Science

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).

Science as a human endeavour: Use and influence of science

- People use scientific knowledge to evaluate whether they accept claims, explanations or predictions, and advances in science can affect people's lives, including generating new career opportunities (ACSHE194).

Science inquiry skills: Planning and conducting; Communicating

- Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately (ACSIS200).
- Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS204).
- Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (ACSIS208).

You must check the rules that apply before you fly a drone at school. For the latest requirements, visit: casa.gov.au/drones-at-school

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Lesson outline

Learning phase	Task	Relevant rule
Tuning in (10 min)	Share this statement regarding drone safety with the class: 'Drones have surpassed helicopters to become the second most common aircraft involved in accidents over the past five years, Australian Transport Safety Bureau statistics show.' (https://www.atsb.gov.au/publications/2020/ar-2020-014/) Discuss with the class whether they have heard of any safety incidents involving drones. They may have heard about the Darling Harbour incident in Sydney, which happened on January 15 2021. Share a news article about this incident, or distribute a range of news articles about drone safety accidents or near misses. Also supply students with the drone safety rules, without introduction. Ask students to read through the news article in small groups, and identify which of the drone safety rules are important in considering what happened in the incident. Students share findings with the class.	All
Finding out (10 min)	Overarching questions to share with the class: Why are the specific distances in the rules important? Why are the rules slightly different for different weights of drone? Are there any other questions the class would like to investigate? Build on this list based on earlier class discussions. Think-pair-share activity: Ask students to identify what aspects of drone motion could be measured to answer these questions, and how they would be measured. Students should come up with some combination of the following: position, velocity, mass, forces acting (including weight), energy transformations. Guide the discussion to have students review what they know about these concepts and how they might be applied in this context.	
Sorting out (20 min)	Introduce the idea that the key to how a drone moves depends upon the forces acting on it. In small groups, discuss and draw force vectors for forces at play in different drone-related scenarios: • when stationary on the ground • when stationary in the air (hovering) • moving (in controlled flight) • moving (in free fall). Students share their findings with the class. Consider perhaps using a class gallery of force diagrams to discuss differences, either using sheets of butcher paper or online collaborative drawing tools.	

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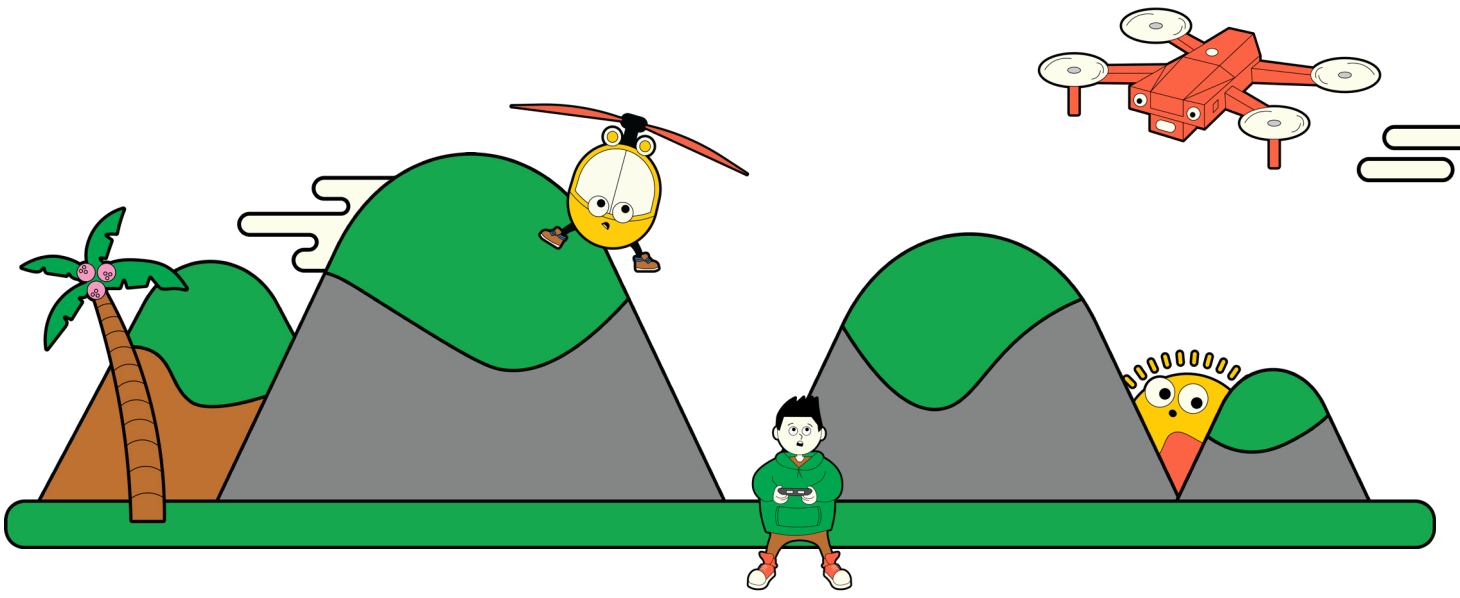
Learning phase	Task	Relevant rule
Going further (30 min)	Using free fall formula or an online calculator, ask students to investigate how long it takes a hovering drone to fall: • 30 m • 120 m. Students should calculate the velocity when a drone hits the ground for three different masses to see how much energy the drone has when it hits (250 g, 1 kg, 7 kg). Extension: introduce terminal velocity and have students estimate (with reasoning) the terminal velocity for drones of different masses/designs.	1, 2 ,5, 7, 8
Reflect and act (20 min)	As individuals or in collaborative groups, ask students to select one or two of the drone safety rules and design a promotional piece to explain this rule to younger students, including their scientific explanation for why the rule exists. This could be a poster series, a cartoon advertisement, a short video ad, or similar, depending upon how much time can be allocated and the context of the learning. Explain to students that they will need to demonstrate that they understand the energy and motion involved, how it applies to the drone safety aspect they have chosen, and that they can communicate this at the right level for their intended audience.	



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