Lesson 10.2 Newton’s first law of motion

Recommended teaching time for this lesson: 0.5 x 60 minute period

• 15 minutes of explicit teaching

• 15 minutes of suggested classroom activities

• 20 minutes homework

Getting started

Key ideas

* Newton’s first law of motion states that an object maintains its state of rest or constant velocity motion unless it is acted on by an external unbalanced force.

Curriculum links

Science understanding

* Describe the three laws of motion of classical mechanics and give examples of each.
* Solve problems using of the laws of classical mechanics and $a=\frac{F\_{net}}{m}$.

Science as a human endeavour

* Appreciate the significant contributions of scientists such as Isaac Newton and Émilie du Châtelet.
* Explore historical models and theories used to describe motion and force, and how evidence was used to build upon and improve on earlier understandings.
* Appreciate that the laws of motion proposed by Isaac Newton provided an explanation for a range of previously unexplained physical phenomena, which were confirmed by multiple experiments performed by a multitude of scientists.

Advice for teaching this lesson

Things to know before you start teaching

The amount of content in the lesson looks quite short, but should not be rushed through. Students often have conceptions about how the world works, and when discussing forces we present a model that opposes the normal view of the world. This is because humans live in a gravity field and certain forces are an everyday experience for us.

Common misconceptions

* That objects have force while they move, and that forces ‘run out’ which stops movement. Active questioning should be used to ascertain if this is the case.

Differentiation strategies

If your students would benefit from more hands on activities, some examples are included here: <https://www.youtube.com/watch?v=hwmf73Bwky8>

Try to use as many physical scenarios as possible that students can relate to in their day to day life.

Starter activity: Observations and reflections

Approximate time: 5 minutes

**Activity placement:** Place directly after Lesson overview

**Activity summary:** A thinking activity designed to draw attention to ‘common sense’ vs ‘physics explanation’ when it comes to motion and force.

Notes for the teacher

This activity is designed to have students consider the world around them like the Ancient Greeks and hopefully come to a similar conclusion.

This puts the conflict between what students might think of as natural vs a physical explanation of how motion occurs fresh into their mind.

You may like to bring a tennis ball or basketball to class for students to actually roll it.

You should come back to this activity at the end of the lesson as part of reflection and wrap up so that students can reconsider their ideas.

Instructions for students

Step 1: Describe what happens to the motion of objects for the following scenarios.

* 1. Sliding your school bag along the ground.
	2. Kicking a ball along the oval.
	3. A gust of wind blows some garbage off your table onto the ground.

Step 2: Reflect on the scenarios you have just described.

* 1. Identify any commonalities between your descriptions.

Helpful hints

* Don’t overthink it; this isn’t designed to be a trick.

Answers

1. Student answers will vary but should include that motion eventually stops.
2. Student answers will vary but should include that motion eventually stops.
3. Student answers will vary but should include that motion eventually stops.
4. The commonality is that the motion will stop.

Classroom activity: The tablecloth trick

Approximate time: 10 minutes

**Activity placement:** Place directly above “Check your learning 10.2”

**Activity summary:** Teaching students how to do the magician’s tablecloth trick while explaining the law of inertia.

Notes for the teacher

You could try this yourself if you feel brave.

Video address is <https://www.youtube.com/watch?v=PcGIUZzWoVc> if you decide to do this as a class led activity.

Instructions for students

Step 1: Watch the following video.

Tablecloth trick – Cool science experiment: <https://www.youtube.com/watch?v=PcGIUZzWoVc>

1. Explain what you observe in the video.

Helpful hints

* Make sure to use the words you have learnt in this chapter, such as inertia and Newton’s first law.
* If you listen carefully, Steve Spangler gives a good quick summary of what is happening.

Support activity

Notes for the teacher

This version gives students some scaffolded questions before the explain question.

Instructions for students

Step 1: Watch the following video.

Tablecloth trick – Cool science experiment: <https://www.youtube.com/watch?v=PcGIUZzWoVc>

1. What force is pushing the cups and plates down?
2. What property of matter resists motion?
3. Explain what you observe in the video.

Challenge activity

Notes for the teacher

This question poses a hypothetical based on an instruction given in the video.

Instructions for students

Step 1: Watch the following video.

Tablecloth Trick – Cool science experiment: <https://www.youtube.com/watch?v=PcGIUZzWoVc>

1. Explain what you observe in the video.
2. What would happen if instead of pulling the cloth down, the cloth was pulled with some upwards motion?

Answers

1. The dishes, glasses and water stay in place as they have inertia. For them to start moving they need a force to be applied to them, as per Newton’s first law of motion. They get a small application of force from the tablecloth moving underneath them; however this only creates a small amount of movement as there is not much friction between the cloth and the items.

Support activity

1. Gravity
2. Inertia
3. The dishes, glasses, and water stay in place as they have inertia. For them to start moving they need a force to be applied to them, as per Newton’s first law of motion. They get a small application of force from the tablecloth moving underneath them; however this only creates a small amount of movement as there is not much friction between the cloth and the items.

Challenge activity

1. The dishes, glasses, and water stay in place as they have inertia. For them to start moving they need a force to be applied to them, as per Newton’s first law of motion. They get a small application of force from the tablecloth moving underneath them; however this only creates a small amount of movement as there is not much friction between the cloth and the items.
2. The upwards motion would apply an upwards force to the cups/plates. Because this is in the direction of gravity – but opposite – it would amplify the small force applied by the tablecloth moving, and so likely carry the plates/cups off the table.