teachers guide

Introduction to force

Forces 1:

Components

 NAME	DESCRIPTION	AUDIENCE
Introduction to force teachers guide	This guide suggests teaching strategies to engage students' interest in learning about forces and their effects on objects.	teachers
Use the force video	A 'Lego-mation' movie shows different forces in action.	students
Thinking about forces presentation	Questions about scenarios shown in the video promote class discussion about forces.	students
Newton explained background sheet	This background sheet for teachers summarises Newton's laws of motion and describes some common misconceptions held by students.	teachers

Purpose

This resource is intended to **Engage** students' interest in learning about forces and their effects on objects.

Outcomes

Students understand that:

- forces may change the position or motion of an object;
- forces have strength (magnitude) and direction; and
- forces may act through contact with objects or at a distance.

Activity summary

ACTIVITY	POSSIBLE STRATEGY
Teacher introduces the topic of forces and what they can do to objects, through questions such as:	whole class
• What forces can you name? (gravity, magnetism, friction)	
• What can forces do to objects? (change their position, speed or shape)	
 Do forces always have these effects on objects? (No – some forces don't seem to have any effect on some objects) 	
Teacher explains that students will investigate what forces can do to objects and why.	
Teacher shows 'Lego-mation' video, Use the force.	teacher and whole class
Students are asked to think about forces that are acting in each scenario included in the video.	
Teacher-led discussion and summary of forces depicted in the video and their effects on objects. The presentation, Thinking about forces, contains questions to prompt discussion.	whiteboard summary
Teacher asks students to call out what they want to know more about. Responses may include:	Teacher uses these responses to select appropriate exploratory activities.
• How do forces affect the motion of objects?	
How do forces balance each other?	

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Teacher notes

This resource helps develop students' understanding of Newton's laws of motion. A summary of these laws is included in the background sheet, Newton explained.

The 'Lego-mation' video, *Use the force*, is designed to engage students' interest in forces and motion, and to elicit their prior knowledge and misconceptions about forces. It is recommended that students view the video all the way through, before examining it in detail to identify forces and their effects in some or all of the scenarios.

The presentation, *Thinking about forces*, contains a series of still shots taken from the video to encourage class discussion. Teachers should decide which, and how many, scenarios to discuss. The following information is provided to assist with the discussion.

	Scenario 1	Magnetic force 1
	Description	Luke's magnet pushes Vader's magnet away. Vader's magnet slides
B	Description	and stops.
	Question	Why did Vader's magnet move away from Luke's?
	Answer	It moved away because Luke's magnet repelled it. Magnetic force between like poles (N and N, or S and S) causes magnets to repel one another.
slide 2	Notes	Magnetism is a force that can act at a distance or through contact. Friction only acts between objects in contact.
	Question	Why did Vader's magnet stop moving?
	Answer	Friction between the magnet and table stopped his magnet from sliding further.
	Notes	Vader's magnet stopped sliding when the friction force balanced the magnetic force.
	Scenario 2	Magnetic force 2
	Description	The stormtrooper pushes Luke's magnet towards Vader's. Vader's magnet slides and sticks to Luke's. Luke and Vader fall off.
	Question	What made the magnets slide towards each other?
	Answer	Magnetic force between opposite poles attracts the magnets to each other.
slide 3	Notes	When magnets are closer together, attraction is stronger. When magnetic force is greater than friction the magnets slide towards each other.
	Scenario 3	Magnetic force 3
	Description	The stormtrooper hands Vader a paper clip, which is attached to the ground by a rope. Suddenly Vader is yanked upwards, suspended below a magnet hanging from a crane.
	Question	What is holding Vader and the paper clip up?
	Answer	Magnetic force holds Vader and the paperclip up.
Alterna Coloresta	Question	What other forces are acting on Vader?
slide 4	Answer	Gravity and tension in the rope are acting on Vader, preventing him from reaching the magnet.
	Notes	Vader and the paper clip remain suspended below the magnet as long as the upward magnetic force balances the downward forces of gravity and tension.
	Scenario 4	Electrostatic force
	Description	The stormtrooper and Luke hold a charged rod close to a pile of paper. Small pieces of paper jump up and stick to the rod.
and the second second	Question	What forces are acting on the pieces of paper?
	Answer	Electrostatic force makes the paper move toward the rod. Gravity is acting on the pieces, pulling them back down.
slide 5	Notes	When the rod is rubbed it gains (or loses) electrons and becomes electrostatically charged. The charged rod attracts the pieces of paper. The electrostatic force is stronger than gravity, so the pieces of paper move toward the rod. Eventually, charges on paper and rod leak away and the electrostatic force decreases until it is weaker than gravity. At this point the pieces of paper fall to the floor.



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slide 11 (downwards) and air resistance (upwards). Air resistance depends on surface area. The flat sheet has a bigger surface area, which means there's more air resistance, so it falls slower. Notes If the experiment was repeated in a vacuum, both pieces of paper		Questions	
surface area, which means there's more air resistance, so it falls slower. Notes If the experiment was repeated in a vacuum, both pieces of paper		Answer	
	slide 11		
		Notes	



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Technical requirements

The teachers guide requires Adobe Reader (version 5 or later), which is a free download from www.adobe. com. QuickTime version 7 or later is required to view the video. This is a free download from www.apple. com/quicktime. A high-quality MP4 version of the video with subtitles is also available on CD-ROM or download from the SPICE website.

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Associated SPICE resources

Forces 1: Introduction to force may be used in conjunction with related SPICE resources to address the broader topic of forces and motion.

DESCRIPTION	LEARNING PURPOSE
Forces (overview)	
This learning pathway shows how a number of SPICE resources can be used to teach concepts of balanced forces, unbalanced forces and motion.	
Forces 1: Introduction to force	Engage
A video stimulates students' interest in learning about forces and motion, and elicits prior knowledge and misconceptions.	
Forces 2: Investigating forces	Explore
Practical activities provide opportunities for students to explore effects of forces on the motion of objects, including those falling in Earth's gravity.	
Forces 3: Balanced and unbalanced forces	Explain
An interactive learning object enables students to explain and predict effects of balanced and unbalanced forces on objects.	
Forces 4: Forces in the human body	Elaborate
Students apply their understanding of forces and motion to new contexts, such as: forces in the human body or designing and testing the effectiveness of a safety capsule to protect passengers in motor vehicle collisions.	



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