

Forces Lessons: Scope and Sequence

Lesson Number	Focus Question(s)	Main Learning Goal	Science Content Storyline
1a	What makes something start to move?	A <i>force</i> is a push or pull that causes a change in an object's motion.	An object starts to move because something is pushing or pulling it. The words <i>push</i> and <i>pull</i> imply that something is <i>being</i> pulled or pushed, and something else is <i>doing</i> the pushing or pulling. In other words, an interaction is taking place between two objects. For one object to push or pull another object, the objects need to touch.
1b	What makes something start to move?	A <i>force</i> is a push or pull that involves an interaction between two objects and causes a change in an object's motion.	An object starts to move because something is pushing or pulling it. These pushes and pulls are called <i>forces</i> . Forces cause a change in an object's motion. The words <i>push</i> and <i>pull</i> imply that something is <i>being</i> pulled or pushed, and something else is <i>doing</i> the pushing or pulling. In other words, an interaction is taking place between two objects. In most cases, two objects must touch to exert a force that causes an object to move, but <i>gravity</i> is a type of pulling force that doesn't require two objects to touch. When an object drops or falls, we can say that Earth is pulling on the object with the force of gravity.
2a/b	How can we draw the forces pushing or pulling an object when we can't see them?	The forces acting on an object have a strength and direction that can be represented using arrows of various lengths and directions.	Arrows can be used to represent the strength and direction of the forces acting on an object. The direction of an arrow represents the direction of the force, and the length of an arrow represents the strength of the force.
3a/b	Why do moving objects slow down and eventually stop?	Moving objects slow down and stop at different distances on different surfaces.	All moving objects on Earth eventually slow down and stop. The surface an object moves over determines how long it will take for the object to stop. Objects take longer to slow down and stop on smooth surfaces, but they slow down and stop more quickly on rough surfaces.
4a/b	What force makes a moving object slow down and eventually stop?	When bumps on the surfaces of two objects push against one another, they create a force called <i>friction</i> . Friction is the reason moving objects on Earth slow down and	The toy car in our investigation traveled different distances over three different surfaces. Tiny bumps on these surfaces pushed against the bumps on the surface of the car's wheels, creating a force called <i>friction</i> that acted in the opposite direction of the car's motion. The pushing force of friction caused the car to slow down and eventually stop. In a world without friction, such as outer space, objects in motion would keep moving forever in a straight line.

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5a	What happens if more than one force pushes or pulls an object?	If two forces of <i>equal</i> strength are pushing or pulling an object in opposite directions, the object won't move. If two forces of <i>unequal</i> strength are pushing or pulling an object in opposite directions, the object will move in the direction of the stronger force.	We can predict whether an object will move by figuring out the direction and strength (size) of the forces pushing or pulling it. If a student tries to push a heavy file cabinet across a carpet, the push exerts a force on the cabinet, and the frictional force between the carpet and the bottom of the cabinet pushes back in the opposite direction. If the student's push is equal to the opposing push of friction, the cabinet won't move. If the student's push is greater, or stronger, than the push of friction, the cabinet will move in the direction of the student's push. Smoother surfaces, like a tile floor, have smaller bumps that push against other surfaces with less force, so the student would be able to push the cabinet across a tile floor more easily than across a carpet. In this case, the student would apply much more force than the frictional force of the tiles pushing in the opposite direction. In summary, if two forces of <i>equal</i> strength are pushing or pulling an object in opposite directions, the object will remain at rest. If forces of <i>unequal</i> strength are pushing or pulling an object in opposite directions, the object will move in the direction of the stronger force.
5b	What happens if more than one force pushes or pulls an object?	If gravity is pulling down on an object but the object isn't moving, there must be a force of equal strength pulling up on the object. If the upward force is stronger or weaker than the force of gravity, the object will move in the direction of the stronger force.	More than one force can push or pull an object at the same time. If two forces of <i>equal</i> strength are pushing or pulling an object in opposite directions, the object won't move. But if forces of <i>unequal</i> strength are pushing or pulling an object in opposite directions, the object will move in the direction of the stronger force. Forces can push side to side, but they can also push up and down. On Earth, gravity always pulls objects toward the ground, so if an object isn't moving, something else, such as the floor, a chair, or a table, is pushing up on it with equal force. For example, when a pencil is sitting still on a desk, the force of gravity is pulling down on it, and the table is pushing up on it at the same time with equal force.
6a	How can ideas about forces help us predict the motion of objects?	Ideas about forces can help us predict the motion of objects.	A <i>force</i> is a push or pull that causes a change in motion and involves an interaction between two objects. A force can cause an object to start moving, slow down, speed up, change direction, or stop moving. <i>Friction</i> is a force that pushes in the opposite direction of an object's motion. Rougher (bumpier) surfaces generate greater friction between objects. <i>Gravity</i> is a force that consistently pulls an object toward Earth. Each of these science ideas about forces can help us predict motion in everyday

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6b	How can ideas about forces help us explain the motion of objects?	Ideas about forces can help us predict and explain the motion of objects.	<p>A <i>force</i> is a push or pull that causes a change in motion and involves an interaction between two objects. A force can cause an object to start moving, slow down, speed up, change direction, or stop moving. <i>Friction</i> is a force that pushes in the opposite direction of an object's motion. Rougher (bumpier) surfaces generate more friction between objects. <i>Gravity</i> is a force that consistently pulls an object toward Earth. Each of these science ideas about forces can help us predict and explain motion in everyday situations.</p>