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Warm-Up | Newton's Laws of Motion

Lesson Question

Lesson Goals

Explore Newton's three _____.

Relate Newton's first law to the concept of _____.

Apply Newton's second law to solve _____.

Identify _____ that involve Newton's third law.

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Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

relate	to show or explain a [ ] between two concepts
inertia	the property of matter that [ ] change in motion
Newton's first law of motion	an object at [ ] stays at rest, and an object in [ ] stays in motion, unless acted on by an [ ] force
Newton's second law of motion	the total [ ] acting on an object is equal to [ ] times [ ] ($F = ma$)
Newton's third law of motion	for every [ ], there is an equal and opposite [ ]

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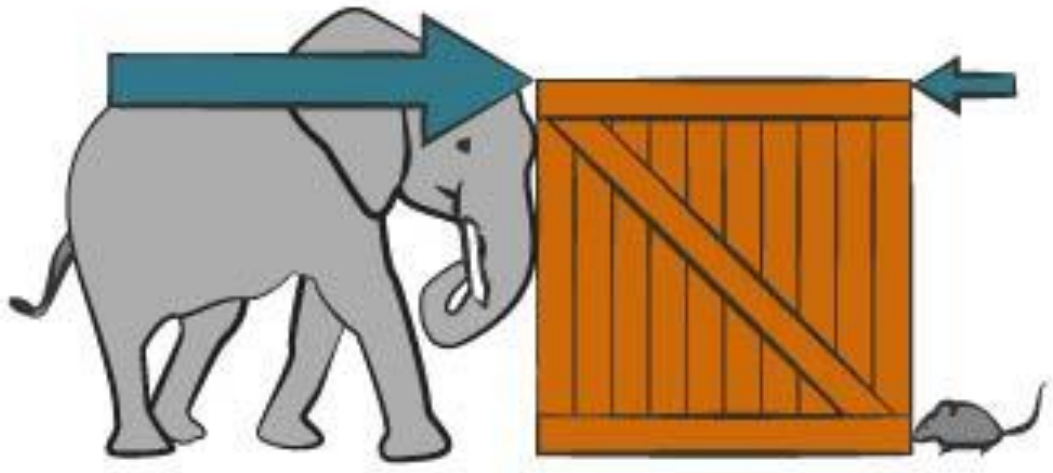
Forces

- _____ forces do not cause a change in motion.
- _____ forces cause a change in motion.
- _____ is the overall force acting on an object.

Circle the situation that shows balanced forces. Put a box around the situation that shows unbalanced forces.





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Isaac Newton (1643–1727)

PROFILE

- Performed many _____ involving light (optics)
- _____ works on mathematics, history, and theology
- Published his most significant _____, *Philosophiae Naturalis Principia Mathematica*, in 1687

Newton's First Law

- Newton's _____ of motion states that an object at rest stays at rest, and an object in motion stays in motion, unless acted on by an _____ force.
- This is also known as the law of _____.
- Inertia is the natural tendency of objects to _____ in motion.

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Newton's First Law

EXAMPLE

- Let's use this nice and neatly set up table in order to demonstrate the concept of [ ]. What will happen if I were to take the two ends of this tablecloth and pull really quickly? Why do these objects not fly off the table with the tablecloth?

- The objects have [ ]—there is substance to them. The mass of an object is also a [ ] of its inertia. It is also how much [ ] would be required for the objects to be moved.

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Newton's Second Law

- Newton's [ ] of motion states that the total [ ] acting on an object is equal to [ ] times [ ].

$$F = ma$$

$F =$ [ ] $= \text{N} = \text{kg} \times \text{m/s}^2$

$m =$ [ ] (kg)

$a =$ [ ] (m/s^2)

- The equation is written in three ways:
  - $F = ma$
  - $m = F/a$
  - $a = F/m$

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Application of Newton's Second Law: Calculate Force

REAL-WORLD CONNECTION

Calculate the force needed to accelerate an object to 4.3 m/s^2. The object has a mass of 2.2 kg. Round the answer to the nearest tenth.

Given:

- $a = 4.3\ \text{m/s}^2$
- $m = 2.2\ \text{kg}$

Unknown: F

Equation to use: $F = ma$

Solve:

- $F = (2.2\ \text{kg})(4.3\ \text{m/s}^2)$
- $F = 9.46\ =$ [ ]

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Application of Newton's Second Law: Calculate Acceleration

REAL-WORLD CONNECTION

Calculate the acceleration of a moving object, given that the object is 500 g and has a force of 6.5 N.

Given:

- $m = 500\ \text{g} = 0.5\ \text{kg}$
- $F = 6.5\ \text{N}$

Unknown: a

Equation to use: $a = F/m$

Solve:

- $a = F/m$
- $a = (6.5\ \text{N})/(0.5\ \text{kg})$
- $a =$ ☐

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NASA Deep Impact Mission: Parts of the Spacecraft

CAREER CONNECTION

- Scientists at NASA study the forces involved with _____ and acceleration for a mission.
- This mission was to study a comet's materials that are ejected in a collision.
- The spacecraft has two parts:
  - the impact craft collides with a comet
  - the support craft collects data

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NASA Deep Impact Mission: The Collision

CAREER CONNECTION

- Scientists carefully calculated the _____ of the craft to ensure ample force in the collision.
- Scientists used Newton's second law in the calculations.

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Newton's Third Law

- Newton's _____ of motion states that for every action, there is an _____ and _____ reaction.
- Considered action/reaction _____
  - The skate pushing _____ is the _____ force.
  - The ice pushing _____ is the _____ force.

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Real-World Applications of Newton's Third Law

REAL-WORLD CONNECTION

The action reaction forces:

[ ] hands:

- The action and reaction forces are felt independently based on the point of view of the observer.
  - Active force:
    - The baby feels the pressure of the dad's hand pushing down on its hand.
  - Reactive forces:
    - The dad can feel the baby's hand resist.
- Helium [ ] :
  - Active force:
    - The gases inside are pushing outward.
  - Reactive forces:
    - The balloon elastic is pushing back on the gases.

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Summary | Newton's Laws of Motion

Lesson Question

How do Newton's laws describe the motion of an object?

Answer

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Review: Key Concepts

Law of motion	Description
[ ] law of motion	An object at rest stays at rest, and an object in motion stays in motion, unless acted on by an [ ] force.
Second law of motion	The total [ ] acting on an object is equal to [ ] times [ ].
Third law of motion	For every [ ], there is an equal and opposite [ ].

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Summary | Newton's Laws of Motion

Use this space to write any questions or thoughts about this lesson.

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