As You View the Power Point

- Write down the highlighted information.
- You will have an assessment over the information.

1

Force

- An object will speed up, slow down, or turn only if something is pushing or pulling on it.

1

Force

- A **force** is a push or a pu
- A force can be exerted in different ways.
- For instance, a paper clip can be moved by the force a magnet exerts, the pull of Earth's gravity, or the force you exert when you pick it up.
- These are all examples of forces acting on the paper clip.

1

Combining Forces

- The combination of all the forces acting on an object is the **net force**.

- When more than one force is acting on an object, the net force determines the motion of the object.

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Combining Forces

- If two forces are in opposite directions, then the net force is the difference between the two forces, and it is in the direction of the larger force.

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Balanced and Unbalanced Forces

- If you and your friend push on a door with the same force in opposite directions, the door does not move.

1

Balanced and Unbalanced Forces

- Two or more forces exerted on an object are **balanced forces** if their effects cancel each other and they do not cause a change in the object's motion.

- If the forces on an object are balanced, the net force is zero.

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Balanced and Unbalanced Forces

- If the forces are **unbalanced forces**, their effects don't cancel each other.
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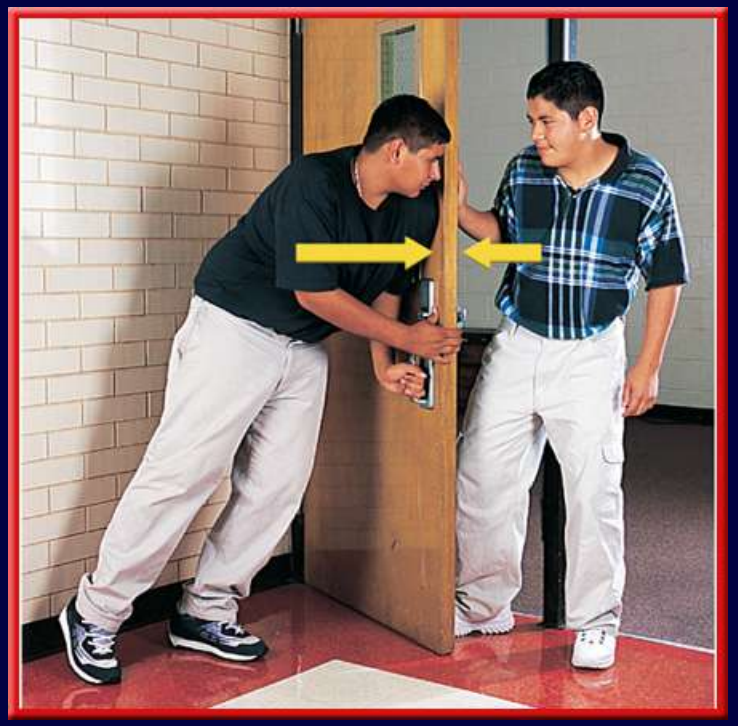

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Newton's First Law of Motion

- An object at rest remains at rest unless an unbalanced force acts on it and causes it to move.

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Newton's First Law of Motion

- Galileo Galilei, who lived from 1564 to 1642, was one of the first to understand that a force doesn't need to be constantly applied to an object to keep it moving.
- Galileo's ideas helped Isaac Newton to better understand the nature of motion.

1

Newton's First Law of Motion

- Newton was able to explain the motion of objects in three rules called Newton's laws of motion.
- According to **Newton's first law of motion**, if the net force acting on an object is zero, the object remains at rest, or if the object is already moving, continues to move in a straight line with constant speed.

1

Friction

- Every day you see moving objects come to a stop.
- The force that brings nearly everything to a stop is **friction**, which is the force that acts to resist sliding between two touching surfaces.

1

Opposing Sliding

- Friction always will slow an object down.

1

Static Friction

- The type of friction that prevents an object from moving when a force is applied is called static friction.
- Static friction is caused by the attraction between the atoms on the two surfaces that are in contact.

1

Static Friction

- Usually, as the surface gets rougher and the object gets heavier, the force of static friction will be larger.

- To move the object, you have to exert a force large enough to break the bonds holding two surfaces together.

1

Sliding Friction

- Sliding friction slows down an object that slides. You have to keep pushing to overcome the force of sliding friction.

1

Rolling Friction

- Another type of friction, rolling friction, is needed to make a wheel or tire turn.
- Rolling friction keeps the tire from slipping on the ground.

Complete Launch Lab

Page 309 in the textbook

1

Question 1

You try and push a desk across the floor one direction but a friend is trying to push it the opposite direction. As a result, the desk doesn't move. This is an example of what kind of forces?

1

A. balanced forces
B. opposite forces
C. parallel forces
D. unbalanced forces

1

Answer

The answer is A. When forces are balanced, the net force is zero.

1

Question 2

What happens any time there are unbalanced forces acting on an object—that is, any time the net force is not zero?

Answer

Any time the net force is not zero, the object moves.

1

Question 3

Explain Newton's first law of motion.

Answer

The first law says that when the net force acting on an object is zero an object already in motion will tend to stay in motion and one at rest will tend to stay at rest.

3

Action and Reaction

- Newton's third law describes something else that happens when one object exerts a force on another object.
- According to **Newton's third law of motion**, forces always act in equal but opposite pairs.

3

Action and Reaction

- Another way of saying this is for every action, there is an equal but opposite reaction.
- This means that when you push on a wall, the wall pushes back on you with a force equal in strength to the force you exerted.

3

Action and Reaction Forces Don't Cancel

- The forces exerted by two objects on each other are often called and action-reaction force pair.
- Either force can be considered the action force or the reaction force.
- Action and reaction force pairs don't cancel because they act on different objects.

3

Action and Reaction Forces Don't Cancel

- You constantly use action-reaction force pairs as you move about.
- When you jump, you push down on the ground.
- The ground then pushes up on you. It is this upward force that pushes you into the air.

3

Large and Small Objects

- When you walk forward, you push backward on the ground.
- Your shoe pushes Earth backward, and Earth pushes your shoe forward.

3

Large and Small Objects

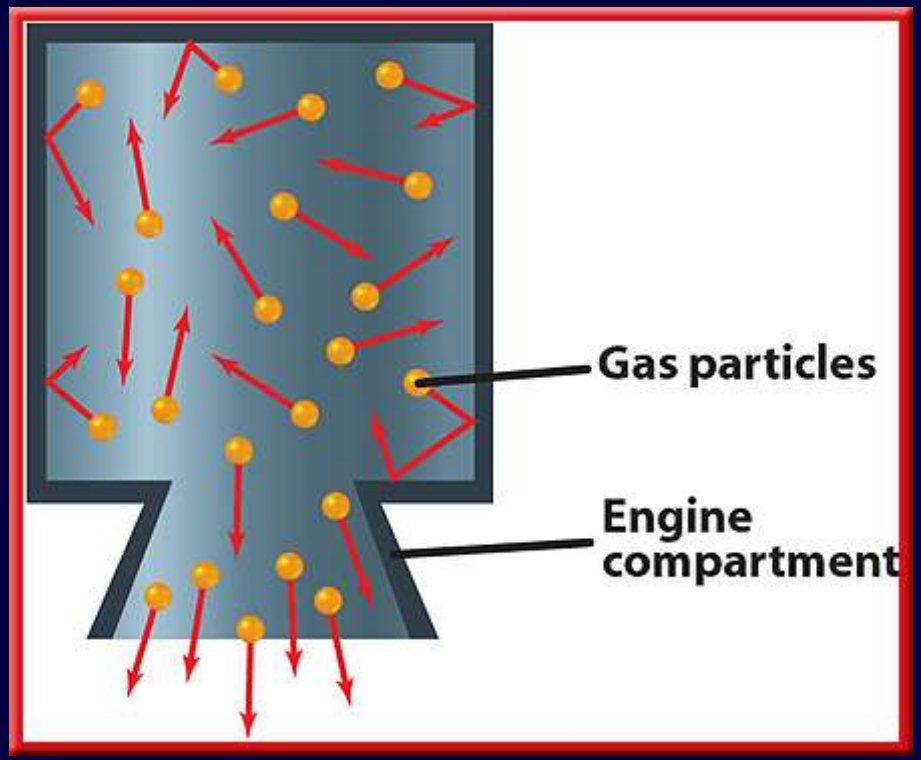
- Earth has so much mass compared to you that it does not move noticeably when you push it.

- If you step on something that has less mass than you do, like a skateboard, you can see it being pushed back.

3

A Rocket Launch

- When the rocket fuel is ignited, a hot gas is produced.
- As the gas molecules collide with the inside engine walls, the walls exert a force that pushes them out of the bottom of the engine.



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A Rocket Launch

- This downward push is the action force.
- The reaction force is the upward push on the rocket engine by the gas molecules.
- This is the thrust that propels the rocket upward.

3

Free Fall and Weightlessness

- Now suppose you were standing on a scale in an elevator that is falling.
- A falling object is in free fall when the only force acting on the force is gravity.
- You and the scale are both in free fall.

3

Free Fall and Weightlessness

- Because the only force acting on you is gravity, the scale no longer is pushing up on you.
- According to Newton's third law, you no longer push down on the scale.

3

Free Fall and Weightlessness

- So the scale pointer stays at zero and you seem to be weightless.
- Weightlessness is the condition that occurs in free fall when the weight of an object seems to be zero.

3

Weightlessness in Orbit

- When the space shuttle orbits Earth, the shuttle and all the objects in it are in free fall.
- They are falling in a curved path around Earth, instead of falling straight downward.
- As a result, objects in the shuttle appear to be weightless.

3

Question 1

Explain Newton's third law of motion.

Answer

The third law says that forces always act in equal but opposite pairs. For every action, there is an equal and opposite reaction.

3

Question 2

If they are “equal but opposite,” why don’t action-reaction pairs cancel?

Answer

Action-reaction pairs don’t cancel because they act on different objects, not on the same object. Equal and opposite forces acting on the same object would cancel.

3

Question 3

Every time you jump into the air, you push on Earth. Why doesn't the Earth ever seem to move as a result?

Answer

Earth is so much more massive than you are that the force you exert on it, and the effect it has, is negligible.

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