

Chapter 10 Forces

Chapter 10 Level A

The Nature of Force

Use Target Reading Skills

Sample graphic organizer:

Recall Clues and

Questions

Notes

What is a force?

What are the SI units
for force?

Force—a push or pull

- A vector quantity
- Describes magnitude and direction
- Arrows show direction and strength of force

SI unit called newton (N)

Summary Statement:

A force is described by its magnitude and by the direction in which it acts.

What is net force?

What are unbalanced
forces?

What are balanced
forces?

Net force

- Combination of all forces acting on object
- Acts in direction of greater force
- Is zero if opposing forces are equal

Unbalanced forces

- Occur when net force acts on an object
- Cause a change in an object's velocity

Balanced forces

- Occur when equal forces act on an object in different directions
- Have no net force

Summary Statement:

When an object is subject to two or more forces at once, the result is the combination, or cumulative effect, of all the forces.

© Pearson Education, Inc. All rights reserved.

- 1.** a push or a pull
- 2.** exerting

3. a, c
4. newton
5. net force
6. added
7. positive, negative
8. speed up, slow down, or change direction
9. true
10. balanced forces
11. false
12. net force

Friction, Gravity, and Elastic Forces

Use Target Reading Skills

Friction

Effect on Motion

Opposes Motion

Depends on

Types of surfaces; how hard they push together

Measured in

Newtons

Gravity

Effect on Motion

Pulls objects together

Depends on

Mass and Distance

Measured in

Newtons

1. true
2. Friction is a force that two surfaces exert on each other when they rub against each other.
3. opposite
4. the types of surfaces involved and how hard the surfaces push together
5. Even surfaces that seem smooth have irregular bumps that you could see with a microscope, so friction occurs even with smoothlooking objects.
6. There is very little friction between a sled or skis and the snow because the snow is relatively smooth. Also, the snow may be partially melted, and fluid friction is much easier to overcome.
7. Fluid friction; Sliding friction; Rolling friction; Static friction
8. sliding friction
9. rolling friction
10. The oil keeps the machine parts from making direct contact, and there is fluid friction between the parts instead of sliding friction.
11. gravity
12. true
13. The force of gravity acts between all objects in the universe.
14. mass and the distance between the objects
15. Weight is the force of gravity on a person or object at the surface of a planet.
16. Weight is a measure of the force of gravity

on an object, while mass is a measure of the amount of matter that makes up an object.

17. newtons

18. false

19. An object is in free fall when the only force acting on the object is gravity.

20. 9.8 m/s²

21. air resistance

22. true

23. projectile

24. false

25. Students should show an arrow pointing downward, labeled gravity, and a shorter arrow, labeled air resistance, pointing upward.

26. elastic

27. true

28. Compression is an elastic force that squeezes or pushes matter together.

29. tension

Newton's First and Second Laws

Use Target Reading Skills

I. The First Law of Motion

A. Inertia

B. Inertia Depends on Mass

II. The Second Law of Motion

A. Changes in Force and Mass

B. Determining Acceleration

1. force

2. Newton's first law of motion states that an object will remain at rest or moving at a constant velocity unless it is acted upon by an unbalanced force.

3. Inertia is an object's resistance to a change in its motion.

4. the law of inertia

5. mass

6. Acceleration depends on the net force acting on the object and on the object's mass.

7.

8. b, c

9. Net Force = Mass _ Acceleration

10. increase the force acting on it, decrease the mass of the object

Acceleration Net force

Mass

© Pearson Education, Inc. All rights reserved.

Newton's Third Law

Use Target Reading Skills

Sample graphic organizer:

1. If one object exerts a force on another object, then the second object exerts a force of

equal strength in the opposite direction on the first object.

2. action force

3. reaction force

4. equal, opposite

5. Forces can be added together only if they are acting on the same object. When one person hits a ball, the action force is exerted on the ball, while the equal reaction force is exerted back on the person. Therefore, the equal forces in this situation cannot be added together and do not cancel each other.

6. momentum

7. Momentum = Mass \times Velocity

8. kilogram-meters per second, kg·m/s

9. The law of conservation of momentum states that, in the absence of outside forces, the total momentum of objects that interact does not change.

10. The result of the collision is that the first train car stops and the second train car moves forward at 10 m/s. In that case, the momentum of the first train car is transferred to the second train car, so momentum is conserved.

Rockets and Satellites

Use Target Reading Skills

Sample Main Idea:

Satellites in orbit around Earth continuously fall toward Earth, but because Earth is curved, they travel around it.

Sample Details:

Gravity pulls satellites toward Earth.

At a certain velocity, the path of a projectile

Recall Clues and

Questions

Notes

What is Newton's third law of motion?

IF . . . one object exerts a force on another object

THEN the second object exerts a force of equal strength in the opposite direction on the first object.

Example: When you jump on the ground, the ground pushes back on you.

Summary Statement: For every action there is an equal and opposite reaction.

You can't always detect the motion, such as Earth's pull on a dropped object.

What is momentum? • A characteristic of a moving object that

depends on mass and velocity

- Momentum =

Mass \times Velocity

- Greater momentum of object = harder to change velocity

Summary Statement:

Momentum is a characteristic of a moving object and is affected by the object's mass and velocity.

What is conservation of momentum?

- Refers to conditions that exist before and after event

- Momentum conserved after event is same amount that existed before event

Summary Statement:

Law of conservation of momentum: The total momentum of any group of objects remains the same, or is conserved, unless outside forces (such as friction) act on the objects.

© Pearson Education, Inc. All rights reserved.

98

matches the curve of Earth.

A satellite moves ahead due to inertia.

1. Newton's third law of motion

2. A downward action force is caused as the rocket expels exhaust gases.

3. The gases forced out of the rocket exert a reaction force equal in magnitude but opposite in direction on the rocket.

4. Students should draw two equal-sized arrows: an arrow labeled "action force" pointing downward and an arrow labeled "reaction force" pointing upward.

5. greater

6. satellite

7. direction

8. a centripetal force

9. gravitational force, or gravity

10. true

11. The satellite does not fall into Earth because Earth is curved. As a result, the satellite falls around Earth rather than into it.

12. around

13. A satellite continues to move due to its

inertia.

14. gravity