

Chapter 10 Forces

Study Guide

1. The Nature of Force

- a. What is **Force**?
- b. **Unbalanced Forces**
 - i. **Net Force**
- c. **Balanced Forces**
 - i. *Which cause change in motion – balanced forces or unbalanced forces?*
- d. Newton's First Law of Motion
 - i. **Inertia**
 - ii. Mass

2. Force, Mass, and Acceleration

- a. Newton's Second Law of Motion
 - i. **Newton**
- b. Changes in Force and Mass

3. Friction and Gravity

- a. **Friction**
 - i. Nature of Friction
 - ii. Is Friction Useful or Not?
 - iii. Controlling Friction
 1. **Sliding Friction**
 2. **Rolling Friction**
 3. **Fluid Friction**
 4. *What are two ways to reduce friction?*
- b. **Gravity**
 - i. **Free Fall**
 - ii. **Projectile Motion**
 - iii. **Air Resistance**
 1. **Terminal Velocity**
 2. *At what rate does an object in free fall accelerate?*
 - iv. Weight
- c. Universal Gravitation

4. Action and Reaction

a. Newton's Third Law of Motion

- i. Equal but Opposite
- ii. Action-Reaction in Action
- iii. Do Action-Reaction Forces Cancel?

1. *Why don't action and reaction forces cancel each other?*

b. **Momentum**

c. Conservation of Momentum

- i. **Law of Conservation of Momentum**
- ii. Two Moving Objects
- iii. One Moving Object
- iv. Two Connected Objects

5. Orbiting Satellites

a. How do Rockets Lift off?

- i. *When a rocket is launched, what is the direction of the reaction force?*

b. What is a **Satellite**?

i. Circular Motion

1. **Centripetal Force**
2. Satellite Motion
3. Satellite Location

SECTION 10-1

REVIEW AND REINFORCE

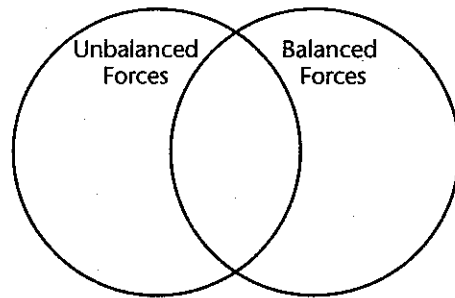
The Nature of Force

◆ Understanding Main Ideas

Write each characteristic in the correct area of the Venn diagram.

- | | |
|----------------------------------|-------------------|
| change an object's motion | push or pull |
| do not change an object's motion | have direction |
| net force = 0 | net force not = 0 |

1.



Answer the following question in the space provided.

2. Summarize Newton's first law of motion for a younger student. Give an example to show this student how the law works.

◆ Building Vocabulary

Match each term with its definition by writing the letter of the correct definition on the line beside the term.

- | | |
|----------------------------|--|
| _____ 3. inertia | a. sum of all forces acting on an object |
| _____ 4. force | b. tendency to resist a change in motion |
| _____ 5. unbalanced forces | c. push or pull |
| _____ 6. balanced forces | d. can change an object's motion |
| _____ 7. net force | e. amount of matter in an object |
| _____ 8. mass | f. will not change an object's motion |

SECTION 10-3

REVIEW AND REINFORCE

Friction and Gravity

◆ Understanding Main Ideas

Answer the following questions on a separate sheet of paper.

1. What are the two factors that affect the friction force between two surfaces?
2. What is one way you could reduce the friction between two surfaces?
3. The acceleration due to gravity of all objects in free fall is the same. Why, then, do some objects fall through the air at a different rate?
4. How does mass differ from weight?
5. What is the law of universal gravitation?

◆ Building Vocabulary

Match each term with its definition by writing the letter of the correct definition on the line beside the term.

- | | |
|-----------------------------|---|
| _____ 6. friction | a. the force that accelerates objects toward Earth |
| _____ 7. rolling friction | b. the kind of friction that exists between oil and a door hinge |
| _____ 8. sliding friction | c. the general term for the force that one surface exerts on another when they rub against each other |
| _____ 9. fluid friction | d. the kind of friction that slows a falling object |
| _____ 10. free fall | e. the state that exists when the only force acting on an object is gravity |
| _____ 11. gravity | f. the kind of friction that results when you rub sandpaper against wood |
| _____ 12. terminal velocity | g. a measure of the force of gravity on an object |
| _____ 13. air resistance | h. the kind of friction that results when a wheel turns on a surface |
| _____ 14. weight | i. a falling object reaches this when forces of gravity and air resistance are balanced |

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SECTION 10-4

REVIEW AND REINFORCE

Action and Reaction

◆ Understanding Main Ideas

Answer the following questions in the spaces provided.

1. What does it mean to say that momentum is *conserved*?

2. How does the diagram illustrate Newton's third law of motion? In your answer, compare the force of the foot kicking the soccer ball with the force of the soccer ball on the foot.



3. Could an elephant have the same momentum as a golf ball? Explain.

4. What is the momentum of a 20-kg dog running at a speed of 8 m/s?

5. Suppose you have two toy cars. Each has a mass of 0.04 kg. The cars have tape on their bumpers that will cause them to couple together. One car is stopped on the track. The other car, traveling at a velocity of 4 m/s, hits the first car. What is the momentum of the coupled cars?

◆ Building Vocabulary

Answer the following questions in the spaces provided.

7. What is momentum?

8. Explain the law of conservation of momentum.

SECTION 10-5

REVIEW AND REINFORCE

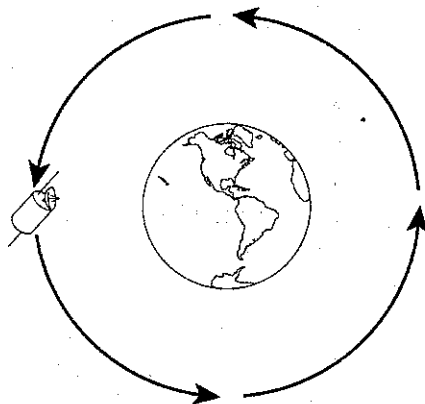
Orbiting Satellites

◆ Understanding Main Ideas

Answer the following questions in the spaces provided.

1. Which law of motion is used to explain how a rocket takes off?

2. Draw an arrow representing centripetal force in the diagram below.



◆ Building Vocabulary Skills

Answer the following questions in the spaces provided.

3. What is a satellite?

4. What is the centripetal force acting on the moon? How would the motion of the moon change if there were no centripetal force acting on it?

Name: _____

Class: _____

Choose the letter of the correct answer.

1. The force that one surface exerts on another when the two rub against each other is called
[A] inertia. [B] gravity. [C] friction. [D] acceleration.
2. Forces can be added together only if they are
[A] substantial. [B] balanced forces.
[C] acting on the same object. [D] unaffected by gravity.
3. Two figure skaters that push off from each other will move at the same speed if
[A] there is no air resistance. [B] they have the same mass.
[C] they push with the same force. [D] the ice does not cause any friction.
4. Which of the following is an example of increasing friction intentionally?
[A] waxing skis [B] throwing sand on an icy driveway
[C] oiling a squeaky door [D] adding grease to gears on a bike
5. The momentum of an object is in the same direction as its
[A] velocity. [B] inertia. [C] acceleration. [D] force.
6. The amount of matter in an object is called its
[A] balance. [B] force. [C] weight. [D] mass.
7. Air resistance is a type of
[A] acceleration. [B] velocity. [C] motion. [D] friction.
8. How can you increase the momentum of an object?
[A] by decreasing its acceleration [B] by increasing its friction
[C] by decreasing its velocity [D] by increasing its mass
9. An object that travels around another object in space is called a
[A] rocket. [B] mass. [C] projectile. [D] satellite.

Choose the letter of the correct answer.

10. A leaf flutters instead of dropping straight to the ground when it falls from a tree because it experiences
[A] rolling friction. [B] inertia. [C] terminal velocity. [D] air resistance.
11. According to Newton's third law of motion, when a hammer strikes and exerts force on a nail, the nail
[A] moves at a constant speed. [B] exerts an equal force back on the hammer.
[C] creates a friction with the hammer.
[D] disappears into the wood.
12. Weight = mass x
[A] air resistance. [B] force due to balanced forces.
[C] acceleration due to gravity. [D] inertia due to force.
13. When the only force acting on a falling object is gravity, the object is said to be
[A] decelerating. [B] in free fall. [C] a projectile. [D] stationary.
14. If you were on the moon, your weight would be roughly what fraction of your weight on Earth?
[A] one sixth [B] one third [C] one fifth [D] one fourth

Fill in the word or phrase that best completes the statement(s).

15. A measure of an object's _____ is a measure of the object's inertia.
16. The overall force on an object after all the forces are added together is called the _____ force.
17. A person traveling in a car that stops suddenly keeps moving forward because of _____.
18. If the action force of a bat striking a ball accelerates the ball in one direction, the reaction force accelerates the bat in the _____ direction.

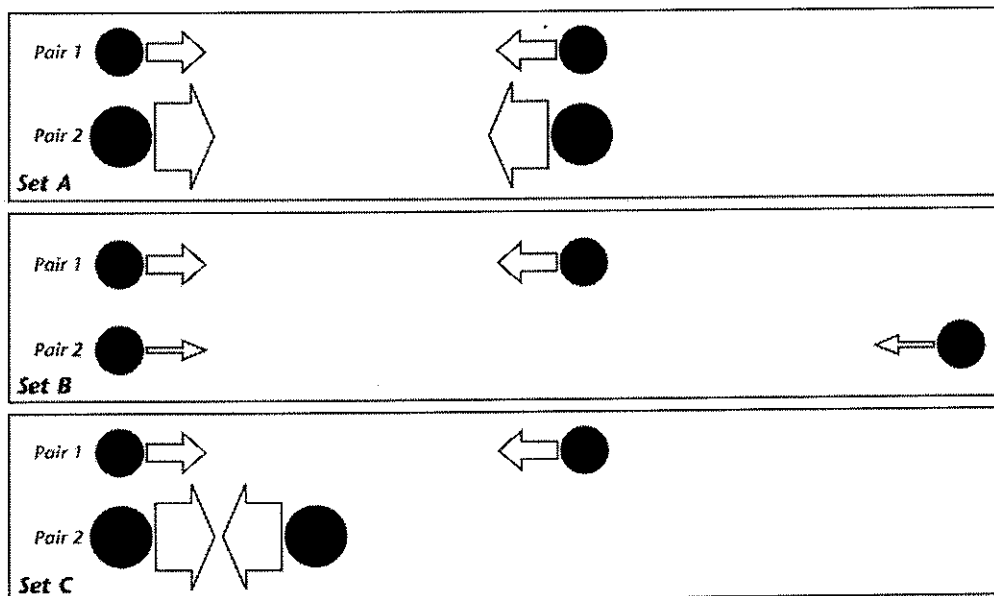
If the statement is true, write true. If it is false, change the underlined word or words to make the statement true.

19. The force that keeps a satellite in Earth orbit is always directed away from the center of Earth.

If the statement is true, write true. If it is false, change the underlined word or words to make the statement true.

20. Newton's third law of motion explains that forces act alone.
21. The force of gravity decreases as the masses of objects increase.
22. The property of matter that resists a change in motion is called inertia.
23. According to Newton's second law of motion, force equals mass times weight.

Use the diagram to answer the question(s).



Assume that all of the objects in this diagram are solid and made of the same material.

24. In Set A, is the gravitational force greater between the objects in pair 1 or pair 2? Explain why.
25. Compare the size and direction of the gravitational force exerted by each object in pair 1 of Set A.
26. In Set C, explain the difference between the magnitudes of the gravitational forces between the two pairs of objects.
27. In Set A, what would you have to do to the objects to make the gravitational forces between the objects in pair 2 the same as the forces between the objects in pair 1?