Name Date Class

SECTION 2 Reinforcement

Newton's Laws of Motion

Chapter 3.2 Review

Directions: *Use the equation* F = ma *to solve the following problems. Show your calculations in the spaces provided.*

1. How much force is needed to accelerate a 1000-kg car at a rate of 3 m/s²?

2. If a 70-kg swimmer pushed off a pool wall with a force of 250 N, at what rate will the swimmer accelerate from the wall?

3. A weightlifter raises a 200-kg barbell with an acceleration of 3 m/s². How much force does the weightlifter use to raise the barbell?

4. A dancer lifts his partner above his head with an acceleration of 2.5 m/s². The dancer exerts a force of 200 N. What is the mass of the partner?

Directions: *Answer the following questions on the lines provided.*

5. What does Newton's second law of motion state?

6. What two factors affect the rate of acceleration of an object?

7. If you push on a wall with a force of 200 N, with what force does the wall push back?

Interacting Forces

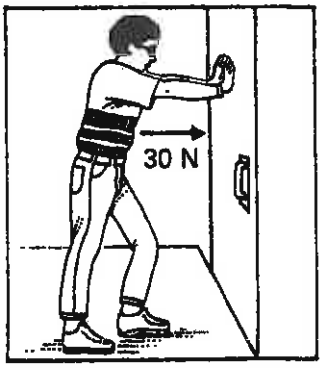
Worksheet

LESSON 4.4 ■ LEVEL 1

1. Newton's third law of motion states that when one object acts on a second object, the second object acts on the first object with _____ force.
   a. equal
   b. unequal
   c. half as much

2. a. A rocket engine works by forcing out hot, expanding _____. This creates a push against the rocket.
   b. If the rocket engine nozzle is pointed east, the rocket goes _____.

Sherman thinks the door opens the other way. He'll never get it open his way, but he's going to try his best!



2. With how much force does the door push back on Sherman?

_____

3. What force keeps Sherman from accelerating away from the door?

_____

4. Describe Sherman's movement if the floor is slippery. Explain your description.

_____

_____

5. An ice fisherman is fishing near the shore, when suddenly the ice he is standing on breaks off. Now he is floating out into the lake. The wind is still. He quickly grabs the bucket of fish he has caught. "Too bad these have to go," he thinks. "But it's either me or them!" What can he do with his bucket of fish that will help him reach the shore? Use Newton's third law of motion to explain your answer.

_____

_____

6. Use Newton's third law of motion to explain how thrusters can decrease the speed of a moving spacecraft.

_____

_____

Name Date Class

Chapter Review

Forces and Newton's Law

Part A. Vocabulary Review

Directions: *In the space at the left, write the term from the list that correctly completes each statement.*

gravity **weight** **distance** **newtons** **momentum**
terminal velocity **Newton's second law of motion** **net force**
centripetal force **Newton's third law of motion** **centripetal acceleration**
air resistance **conservation of momentum** **sliding friction** **static friction**

_____ 1. The phrase "to every action there is an equal and opposite reaction" is _____.

_____ 2. The largest velocity reached by a falling object is its _____.

_____ 3. An object at rest on the surface of the Earth is experiencing zero _____.

_____ 4. When an object moves in a circle, _____ acts to accelerate the object toward the center of that circle.

_____ 5. When a car travels around a curve in the road, _____ helps to keep the car traveling in a curved path.

_____ 6. The force exerted by air on a moving object is called _____.

_____ 7. A net force acting on an object causes the object to accelerate in the direction of the force; this is _____.

_____ 8. A property of a moving object resulting from its mass and velocity is _____.

_____ 9. According to the _____, when a bowling ball strikes the pins, the momentum lost by the bowling ball is equal to the momentum gained by the pins.

_____ 10. _____ is the force that every object in the universe exerts on every other object.

_____ 11. An object's _____ is the measure of the force of gravity on that object.

_____ 12. The amount of gravitational force between two objects depends on their masses and the _____ between them.

_____ 13. Weight is measured in units called _____, while mass is measured in units called grams and kilograms.

_____ 14. Two surfaces that are not moving past each other have _____.

_____ 15. _____ causes a box you are pushing across the floor to stop when you stop pushing.

Directed Reading for Content Mastery

Section 1 ▪ Forces
Section 2 ▪ Newton's Laws

Directions: *In the blank at the left, write the letter of the term that correctly completes each statement.*

_____ 1. Forces that are _____ result in a net force of zero.

a. balanced **b.** unbalanced

_____ 2. Any push or a pull that can change an objects motion is _____.

a. a force **b.** inertia

_____ 3. The amount of gravitational force between two objects depends on their _____.

a. color and intensity **b.** mass and distance

_____ 4. Weight is measured in units called _____.

a. newtons **b.** kilograms

_____ 5. Mass is measured in units called _____.

a. newtons and kilonewtons **b.** grams and kilograms

Directions: *Fill in the blanks using the terms listed below.*

downward	**reaction**	**net unbalanced**
opposite	**inertia**	**acceleration**

Newton's First Law

6. Defined as: an object at rest will remain at rest unless acted upon by a _____ force.

7. _____ the tendency of an object to resist any change in its motion.

Newton's Second Law

8. Defined as: net force acting on an object causes the object to accelerate in the direction of the net force; $F = mass \times$ _____.

9. An object that is shot or thrown follows a _____ path because of the force of gravity pulling it.

Newton's Third Law

10. Defined as: to every action force there is an equal and _____ reaction force.

11. The backward "kick" of a rifle that is fired is an example of a(n) _____ force.

Name Date Class

Chapter Test A

Forces and Newton's Laws

I. Testing Concepts

Directions: *In the blank at the left, write the letter of the term that best completes each statement or answers the question.*

_____ 1. _____ is the force that opposes the sliding motion of two surfaces that are touching each other.
a. Friction **b.** Inertia **c.** Static **d.** Gravity

_____ 2. _____ is a force that opposes the motion of objects that move through the air.
a. Air resistance **b.** Gravity **c.** Static friction **d.** Rolling friction

_____ 3. Gravity is always _____.
a. attractive **b.** repulsive **c.** both a and b **d.** neither a nor b

_____ 4. The gravitational force exerted on an object is called the object's _____.
a. mass **b.** weight **c.** volume **d.** charge

_____ 5. Acceleration toward the center of a curved path is called _____ acceleration.
a. gravitational **b.** inertial **c.** centripetal **d.** curved

_____ 6. The sum of all the forces acting on an object is called the _____ force.
a. net **b.** gravitational **c.** final **d.** inertial

Directions: *Identify each statement as* **true** *or* **false**. *If the statement is false, change the underlined word(s) to make it true.*

_____ 7. The momentum of an object is the <u>sum</u> of its mass and its velocity.

_____

_____ 8. A baseball hurled by a powerful pitcher has greater <u>acceleration</u> than one lobbed gently.

_____

_____ 9. The acceleration of an object depends on its <u>volume</u> as well as the force exerted on it.

_____

_____ 10. $a = F_{net}/\underline{v}$

_____

_____ 11. If the net force on a moving object is 0, it will continue to move <u>in a curve</u> with a constant speed.

_____

_____ 12. The amount of friction between two surfaces depends on <u>the kinds of surfaces</u> and the force pressing the surfaces together.

_____

SECTION 3 Enrichment

$F = ma$ and Football

Coach Rogers had 6 positions to fill on his football team. In order to be considered for a particular position, the players had to meet certain physical criteria, Table 1. Coach Rogers had obtained data on each player that he planned to use in assigning players to positions, Table 2. Determine each player's mass from his weight. Assume $a = 9.8\ m/s^2$. Use your knowledge of Newton's laws to assign the players to the positions for which they are best suited.

Table 1

Position	Description/Criteria
Line	Stops other players from crossing the scrimmage line. Requires great strength in a short distance.
Back	Runs with a football. Requires speed and agility.
End	May block as a lineman or act as a pass receiver. Requires both speed and strength.

Table 2

Player	Weight	Mass	Time/36–m dash	Speed at finish line
Allen	833 N		4.51 s	16.0 m/s
Terry	735 N		4.40 s	16.4 m/s
Frank	911 N		4.82 s	15.0 m/s
Dave	825 N		4.71 s	15.3 m/s
Bob	1010 N		4.90 s	14.7 m/s
Carlos	931 N		4.60 s	15.7 m/s

Assuming mass indicates strength, select two players for each position. Assign each player to a position. Explain your selection in terms of Newton's laws.

Table 3

Position	Player	Reasoning

Assuming their accelerations remained the same, how many kilograms would Dave have to gain to exert the same force at the finish line as Allen? (Hint: Determine a for each boy using $v = v_0 + at$, where $v_0 = 0$ because the players started from a rest position. Then use $F = ma$ to solve for m.)