

## Chapter 6 Newton's Second Law of Motion—Force and Acceleration

**Exercises****6.1 Force Causes Acceleration (page 87)**

- When a hockey puck is struck with a hockey stick, a(n) unbalanced force acts on the puck and the puck accelerates.
- Circle the letter of the type of force that causes acceleration.
  - balanced
  - negligible
  - zero
  - unbalanced
- The combination of forces acting on an object is known as the net force.
- The acceleration of an object is directly proportional to the net force acting on it. This means that, as the net force acting on the object increases, the acceleration of the object increases.
- Circle the letter of each statement about force and acceleration that is true.
  - Balanced forces cause constant acceleration.
  - The forces acting on an object at rest are unbalanced.
  - A net force acting on an object causes acceleration.
  - Force is not required for an object to accelerate.
- Two shopping carts of equal mass are pushed by two different people. One cart accelerates three times as fast as the other cart. Describe the forces acting on each cart.

A net force acts on both carts. The net force acting on the cart that accelerates faster is three times greater than the other force.

**6.2 Mass Resists Acceleration (page 87)**

- For a constant force, how does an increase in an object's mass affect its acceleration?  
An increase in the mass will result in a decrease in the acceleration.
- What does it mean for two quantities to be inversely proportional to one another?  
When one quantity increases, the other quantity decreases.
- Circle the letter showing how mass and acceleration are related.
  - acceleration  $\sim$  mass
  - acceleration  $\sim$   $1/\text{mass}$
  - acceleration  $\sim$   $\text{mass}^2$
  - acceleration  $\sim$   $\frac{1}{2}$  mass

**6.3 Newton's Second Law (pages 88–89)**

- Circle the letter of each quantity related by Newton's second law.
  - mass
  - force
  - time
  - acceleration

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11. Circle the letter of each statement related to Newton's second law that is true.
- a. Acceleration is directly proportional to the net force.
  - b. The direction of acceleration is the same as the net force.
  - c. Acceleration is inversely proportional to mass.
  - d. Net force and mass are always equal.
12. When using the equation for Newton's second law, if force is measured in newtons, then the unit for acceleration is m/s<sup>2</sup> and the unit for mass is kg.
13. Is the following sentence true or false? The acceleration of an object is equal to the net force acting on it divided by the object's mass.  
true
14. A 100-N force is used to accelerate a large push cart across the floor. Circle the letter of the force required to accelerate the push cart twice as fast.
- a. 50 N
  - b. 100 N
  - c. 150 N
  - d. 200 N
15. An object accelerates when a net force is applied to it. Circle the letter describing the conditions that would double the object's acceleration.
- a. doubling the mass
  - b. halving the force
  - c. doubling the mass and halving the force
  - d. halving the mass
16. During a lab experiment, a net force is applied to an object and the object accelerates. The mass of the object is then doubled, and the net force applied to it also doubles. Describe the object's acceleration.  
The object accelerates at the same rate.
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17. Circle the letter of the equation that describes Newton's second law of motion.
- a.  $a = \frac{F}{m}$
  - b.  $F = ma^2$
  - c.  $F = \frac{a}{m}$
  - d.  $F = \frac{1}{2}(am)^2$

**6.4 Friction (page 90–91)**

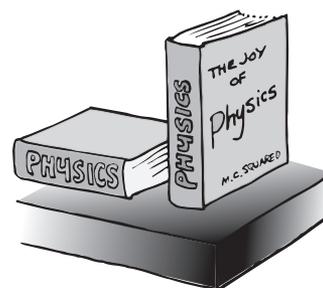
18. Describe what causes friction between two solid surfaces.  
The friction is due to irregularities in the two surfaces being pressed together. Force is needed to move one material up and over the other or to scrape the irregularities away.
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19. Is the following sentence true or false? Friction does not depend on the types of materials in contact with each other. false
20. Is the following sentence true or false? Friction depends on how much the materials in contact are pushed together. true



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31. Look at the two books resting on a shelf in the illustration shown below. Assume the two books are identical. Circle the letter of each statement about the two books that is true.

- a. Both books have the same mass.  
 b. Both books exert the same force on the shelf.  
 c. Both books exert the same pressure on the shelf.  
 d. Both books have the same weight.

**6.6 Free Fall Explained (pages 93–95)**

32. An object dropped in air that experiences no air resistance is said to be in free fall.
33. A 1-kg river rock and a 10-kg small boulder are dropped from the back of a truck at the same time. Identify which rock will strike the ground first.  
They will both strike the ground at the same time.
34. When an object is in free fall, the only force acting on the object is gravity.
35. Circle the letter of each statement about freely falling objects that is true.
- a. They all fall with the same acceleration.  
 b. The net force acting on them is their weight.  
 c. Their weight-to-mass ratios are always the same.  
 d. Their acceleration is  $g$ , the acceleration due to gravity.

**6.7 Falling and Air Resistance (pages 95–97)**

36. Identify the conditions needed for a feather and coin to fall at the same rate.  
They will fall at the same rate in a vacuum.
37. Circle the letter of each factor that affects the amount of air resistance experienced by an object.
- |                                 |                                    |
|---------------------------------|------------------------------------|
| a. time in contact with the air | b. speed of object through the air |
| c. surface area of object       | d. weight of object                |
38. Circle the letter that describes the forces that are in balance when an object reaches its terminal speed.
- |                            |                                |
|----------------------------|--------------------------------|
| a. mass and air resistance | b. air resistance and friction |
| c. friction and mass       | d. weight and air resistance   |
39. Define terminal speed and terminal velocity.  
Terminal speed is the speed at which the acceleration of a falling object is zero.  
Terminal velocity is terminal speed plus direction.