

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

Exercises

6.1 Force Causes Acceleration (page 87)

1. When a hockey puck is struck with a hockey stick, a(n) _____ acts on the puck and the puck _____.
2. Circle the letter of the type of force that causes acceleration.

a. balanced	b. negligible
c. zero	d. unbalanced
3. The combination of forces acting on an object is known as the _____ force.
4. 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 _____.
5. Circle the letter of each statement about force and acceleration that is true.
 - a. Balanced forces cause constant acceleration.
 - b. The forces acting on an object at rest are unbalanced.
 - c. A net force acting on an object causes acceleration.
 - d. Force is not required for an object to accelerate.
6. 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.

6.2 Mass Resists Acceleration (page 87)

7. For a constant force, how does an increase in an object’s mass affect its acceleration?

8. What does it mean for two quantities to be inversely proportional to one another?

9. Circle the letter showing how mass and acceleration are related.

a. acceleration \sim mass	b. acceleration \sim 1/mass
c. acceleration \sim mass ²	d. acceleration \sim $\frac{1}{2}$ mass

6.3 Newton’s Second Law (pages 88–89)

10. Circle the letter of each quantity related by Newton’s second law.

a. mass	b. force
c. time	d. 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 _____ and the unit for mass is _____.
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.

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.

17. Circle the letter of the equation that describes Newton’s second law of motion.

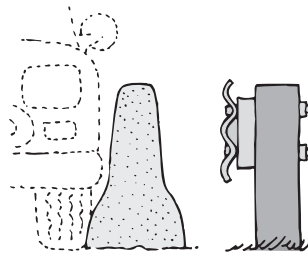
a. $a = \frac{F}{m}$	b. $F = ma^2$
c. $F = \frac{a}{m}$	d. $F = \frac{1}{2}(am)^2$

6.4 Friction (page 90–91)

18. Describe what causes friction between two solid surfaces.

19. Is the following sentence true or false? Friction does not depend on the types of materials in contact with each other. _____
20. Is the following sentence true or false? Friction depends on how much the materials in contact are pushed together. _____

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21. The figure above shows where an out-of-control car might strike a concrete road divider. In terms of friction, explain why the concrete barrier is superior to the steel barrier in the figure.

22. Substances that are liquids or gases are also called _____.

23. Is the following sentence true or false? When friction is present, an object can move with constant velocity even when an outside force is applied.

24. A _____ is a diagram in which all of the forces acting on an object are shown.

6.5 Applying Force—Pressure (pages 91–92)

25. Circle the letter of each quantity related to pressure.

- a. time
- b. force
- c. weight
- d. area

26. Circle the letter that best describes pressure.

- a. the applied force that acts on an object
- b. force per unit of area
- c. the area to which a force is applied
- d. force times surface area

27. Imagine standing on a bathroom scale on two feet and then one foot. Describe the force and pressure exerted in each case.

28. As the area a force acts on increases, the force exerted on each unit of area _____.

29. What is the equation for pressure when the force is perpendicular to the surface area?

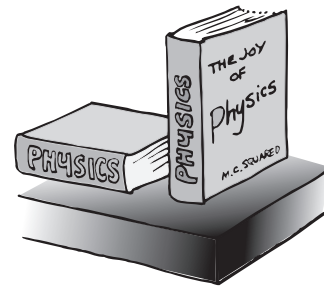
30. Circle the letter that describes the unit of pressure known as a pascal.

- a. newtons × area
- b. newton · meter
- c. newtons per square meter
- d. square meters per second

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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 _____.
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.

34. When an object is in free fall, the only force acting on the object is _____.
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.

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.

