Physics Practice Test

Have students take the practice test to evaluate their understanding. Students should use their results in conjunction with the checklist to evaluate and review their understanding of the physics concepts. The *Physics Practice Test* is provided as a Blackline Master in your *Teacher Resources* CD.

9b **Blackline Master**

Content Review

1. a
2. d
3. b
4. d
5. c
6. d
7. c

Physics
Practice Test

Before you try the Physics Practice Test, *you may want to review Sections 1–9, where you will find* **31 Checking Up** *questions,* **16 What Do You Think Now?** *questions,* **36 Physics Essential Questions, 79 Physics to Go** *questions, and* **9 Inquiring Further** *questions.*

Content Review

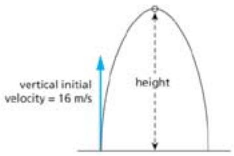
Use the following information to answer *Questions 1-8*. The acceleration due to gravity on the Moon is 1.6 m/s^2.

1. An astronaut is assigned to lift a mass of 300 kg on the Moon. What would the mass weigh on the Moon and on Earth?
   a) The mass would weigh 3000 N on Earth and 500 N on the Moon.
   b) The mass would weigh 500 N on Earth and 3000 N on the Moon.
   c) The mass would weigh 500 N on both Earth and the Moon.
   d) The mass would weigh 3000 N on both Earth and the Moon.

2. An astronaut on the Moon pushes a cart on a horizontal, frictionless track while someone on Earth pushes a cart of equal mass on a similar track with the same force. Which statement best describes the motion of the two carts?
   a) The cart on the Moon accelerates faster than the cart on Earth because it weighs less.
   b) The cart on the Moon accelerates faster because it has less inertia.
   c) The cart on the Moon accelerates faster because it has less weight and less inertia.
   d) The two carts will accelerate equally.

3. A scientist on Earth drops a golf ball on a hard, metal surface from a height of 1.5 m and the ball rebounds to a height of 0.90 m. An astronaut on the Moon drops an identical ball onto an identical surface from the same height. The rebound height of the ball on the Moon would be
   a) 0.15 m
   b) 0.90 m
   c) 5.4 m
   d) 8.1 m

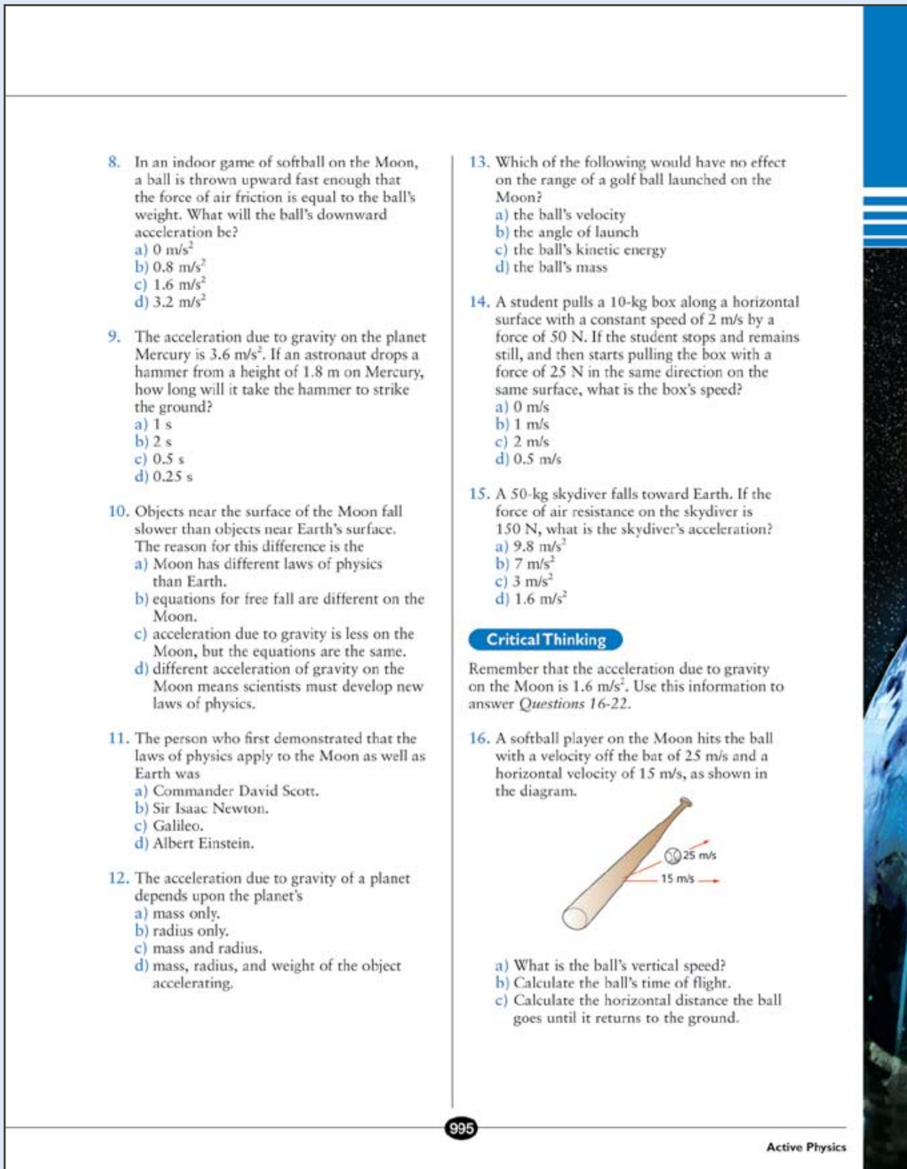
4. In a softball game on the Moon, the batter hits a "pop fly" with a vertical velocity of 16 m/s, as shown in the diagram. How long will it take for the softball to reach the peak of its rise, where its vertical velocity is zero?
   a) 1.6 s
   b) 3.2 s
   c) 5.0 s
   d) 10 s



5. For *Question 4*, what would the height of the softball be at the peak of its rise?
   a) 26 m
   b) 16 m
   c) 80 m
   d) 160 m

6. During a basketball game on the Moon, a competitor jumps to block a shot and her center of mass reaches a height of 3.2 m above the surface. If she has a mass of 65 kg, what is her gravitational potential energy at the peak of the jump?
   a) 650 J
   b) 2100 J
   c) 100 J
   d) 330 J

7. A pendulum on the Moon has a period of 2.0 s. If the length of the pendulum is doubled, what is the pendulum's period?
   a) 1 s
   b) 2 s
   c) 2.8 s
   d) 4 s



8. In an indoor game of softball on the Moon, a ball is thrown upward fast enough that the force of air friction is equal to the ball's weight. What will the ball's downward acceleration be?
   a) 0 m/s^2
   b) 0.8 m/s^2
   c) 1.6 m/s^2
   d) 3.2 m/s^2

9. The acceleration due to gravity on the planet Mercury is 3.6 m/s^2. If an astronaut drops a hammer from a height of 1.8 m on Mercury, how long will it take the hammer to strike the ground?
   a) 1 s
   b) 2 s
   c) 0.5 s
   d) 0.25 s

10. Objects near the surface of the Moon fall slower than objects near Earth's surface. The reason for this difference is the
    a) Moon has different laws of physics than Earth.
    b) equations for free fall are different on the Moon.
    c) acceleration due to gravity is less on the Moon, but the equations are the same.
    d) different acceleration of gravity on the Moon means scientists must develop new laws of physics.

11. The person who first demonstrated that the laws of physics apply to the Moon as well as Earth was
    a) Commander David Scott.
    b) Sir Isaac Newton.
    c) Galileo.
    d) Albert Einstein.

12. The acceleration due to gravity of a planet depends upon the planet's
    a) mass only.
    b) radius only.
    c) mass and radius.
    d) mass, radius, and weight of the object accelerating.

13. Which of the following would have no effect on the range of a golf ball launched on the Moon?
    a) the ball's velocity
    b) the angle of launch
    c) the ball's kinetic energy
    d) the ball's mass

14. A student pulls a 10-kg box along a horizontal surface with a constant speed of 2 m/s by a force of 50 N. If the student stops and remains still, and then starts pulling the box with a force of 25 N in the same direction on the same surface, what is the box's speed?
    a) 0 m/s
    b) 1 m/s
    c) 2 m/s
    d) 0.5 m/s

15. A 50-kg skydiver falls toward Earth. If the force of air resistance on the skydiver is 150 N, what is the skydiver's acceleration?
    a) 9.8 m/s^2
    b) 7 m/s^2
    c) 3 m/s^2
    d) 1.6 m/s^2

Critical Thinking

Remember that the acceleration due to gravity on the Moon is 1.6 m/s^2. Use this information to answer *Questions 16-22.*

16. A softball player on the Moon hits the ball with a velocity off the bat of 25 m/s and a horizontal velocity of 15 m/s, as shown in the diagram.

    a) What is the ball's vertical speed?
    b) Calculate the ball's time of flight.
    c) Calculate the horizontal distance the ball goes until it returns to the ground.

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Active Physics

8. d

9. a

10. c

11. a

12. c

13. d

14. a

15. b

Critical Thinking

16 a)

Given:

$v_0 = 25$ m/s; $v_{0x} = 15$ m/s

Using the Pythagorean Theorem

$v_0^2 = v_{0x}^2 + v_{0y}^2$

$v_{0y} = \sqrt{v_0^2 - v_{0x}^2} =$

$\sqrt{(25 \text{ m/s})^2 - (15 \text{ m/s})^2} = 20$ m/s

16.b)

$$t_{\text{total}} = \frac{2v_{0y}}{g} = \frac{2(20 \text{ m/s})}{1.6 \text{ m/s}^2} = 25 \text{ s}$$

16.c)

Using $d = v_{0x}t =$

(15 m/s)(25 s) = 375 m

CHAPTER 9

17.a)

Given:
$m = 80$ kg; $\Delta h = 5$ m

$GPE = mg\Delta h =$
$80 \text{ kg}(1.6 \text{ m/s}^2)(5 \text{ m}) = 640 \text{ J}$

17.b)

$KE = GPE = 640$ J

17.c)

$KE = \frac{1}{2}mv^2$
$640 \text{ J} = \frac{1}{2}(80 \text{ kg})v^2$
$v = 4$ m/s

17.d)

$d = \frac{1}{2}at^2$
$5 \text{ m} = \frac{1}{2}(1.6 \text{ m/s}^2)(t^2)$
$t = 2.5$ s

18.a)

Given:
$m = 0.200$ kg; $L = 2$ m

$T = 2\pi\sqrt{(L/g)} =$
$2\pi\sqrt{(2 \text{ m})/(1.6 \text{ m/s}^2)} = 7 \text{ s}$

18.b)

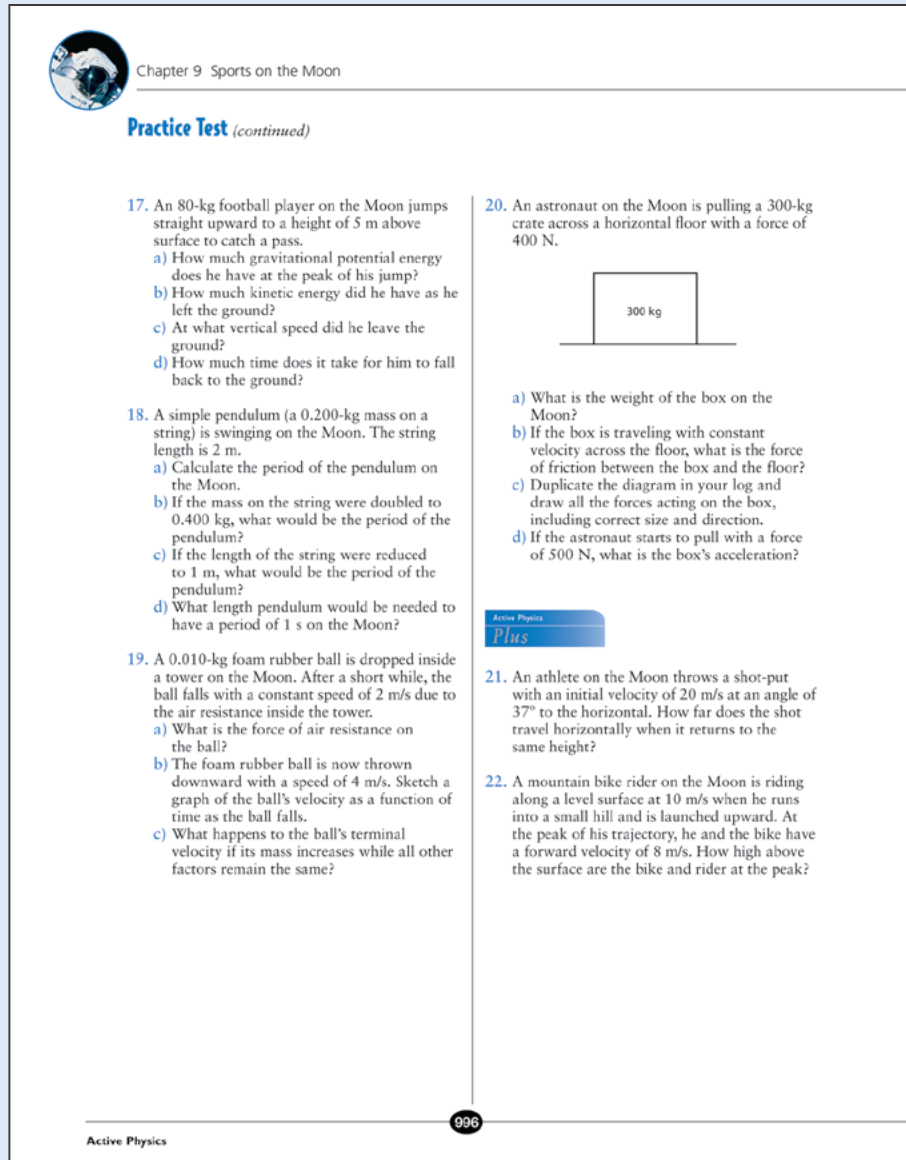
Mass has no effect on the period of a pendulum, so the period remains the same.

18.c)

$T = 2\pi\sqrt{(L/g)} =$
$2\pi\sqrt{(1 \text{ m})/(1.6 \text{ m/s}^2)} = 5 \text{ s}$

18.d)

$T = 2\pi\sqrt{L/g}$
$1 \text{ s} = 2\pi\sqrt{L/(1.6 \text{ m/s}^2)}$
$L = 0.04$ m



Chapter 9 Sports on the Moon

Practice Test *(continued)*

17. An 80-kg football player on the Moon jumps straight upward to a height of 5 m above surface to catch a pass.
a) How much gravitational potential energy does he have at the peak of his jump?
b) How much kinetic energy did he have as he left the ground?
c) At what vertical speed did he leave the ground?
d) How much time does it take for him to fall back to the ground?

18. A simple pendulum (a 0.200-kg mass on a string) is swinging on the Moon. The string length is 2 m.
a) Calculate the period of the pendulum on the Moon.
b) If the mass on the string were doubled to 0.400 kg, what would be the period of the pendulum?
c) If the length of the string were reduced to 1 m, what would be the period of the pendulum?
d) What length pendulum would be needed to have a period of 1 s on the Moon?

19. A 0.010-kg foam rubber ball is dropped inside a tower on the Moon. After a short while, the ball falls with a constant speed of 2 m/s due to the air resistance inside the tower.
a) What is the force of air resistance on the ball?
b) The foam rubber ball is now thrown downward with a speed of 4 m/s. Sketch a graph of the ball's velocity as a function of time as the ball falls.
c) What happens to the ball's terminal velocity if its mass increases while all other factors remain the same?

20. An astronaut on the Moon is pulling a 300-kg crate across a horizontal floor with a force of 400 N.

a) What is the weight of the box on the Moon?
b) If the box is traveling with constant velocity across the floor, what is the force of friction between the box and the floor?
c) Duplicate the diagram in your log and draw all the forces acting on the box, including correct size and direction.
d) If the astronaut starts to pull with a force of 500 N, what is the box's acceleration?

Active Physics Plus

21. An athlete on the Moon throws a shot-put with an initial velocity of 20 m/s at an angle of 37° to the horizontal. How far does the shot travel horizontally when it returns to the same height?

22. A mountain bike rider on the Moon is riding along a level surface at 10 m/s when he runs into a small hill and is launched upward. At the peak of his trajectory, he and the bike have a forward velocity of 8 m/s. How high above the surface are the bike and rider at the peak?

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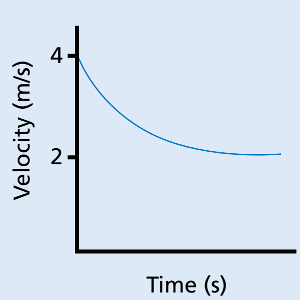
Active Physics

19.a)

Given:
$m = 0.010$ kg; $v = 2$ m/s

Constant velocity means $\sum F = 0$, so
$F_{air} = mg =$
$(0.010 \text{ kg})(1.6 \text{ m/s}^2) = 0.016 \text{ N}$

19.b)



19.c)

The terminal velocity will increase when the mass increases if all other factors are constant.

20.a)

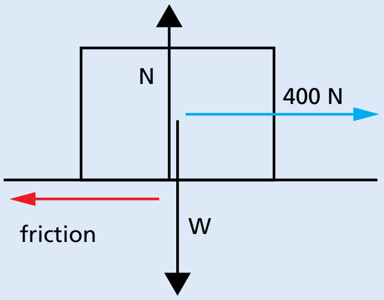
Given:
$m = 300$ kg; $F = 400$ N

$W = mg =$
$300 \text{ kg}\left(1.6 \text{ m/s}^2\right) = 480 \text{ N}$

20.b)

Constant velocity means $\sum F = 0$,
Force of friction =
applied force of 400 N

20.c)



20.d)

$\sum F = ma$
$500 \text{ N} - 400 \text{ N} = (300 \text{ kg})a$
$a = 0.33 \text{ m/s}^2$

21. Active Physics Plus

Given:
$v_0 = 20$ m/s; $\theta = 37°$

$$R = \frac{2v_{0x}v_{0y}}{g} = \frac{2v^2 \cos\theta \sin\theta}{g} =$$
$$\frac{2(20 \text{ m/s})^2 \cos(37°)\sin(37°)}{1.6 \text{ m/s}^2} = 240 \text{ m}$$

22. Active Physics Plus

Given:
$v_0 = 10$ m/s; $v_x = 8$ m/s

$v_x = v_0 \cos\theta$
$$\theta = \cos^{-1}\left(\frac{v_x}{v_0}\right) = \cos^{-1}\left(\frac{8 \text{ m/s}}{10 \text{ m/s}}\right) =$$
36.87° launch angle

vertical launch velocity
$v_{0y} = v_0 \sin\theta =$
$(10 \text{ m/s})\sin(36.87°) = 6 \text{ m/s}$

$$t_{max} = t = \frac{v_{0y}}{g} = \frac{6 \text{ m/s}}{1.6 \text{ m/s}^2} = 3.75 \text{ s}$$

$d = v_{0y}t - \frac{1}{2}gt^2 =$
$\left(6 \text{ m/s}\right)\left(3.75 \text{ s}\right) -$
$\frac{1}{2}\left(1.6 \text{ m/s}^2\right)\left(3.75 \text{ s}\right)^2 = 11 \text{ m}$

CHAPTER 9