Physics Practice Test

The *Physics Practice Test* is provided as a Blackline Master in your *Teacher Resources CD*.

4-4b **Blackline Master**

Content Review

1. b

2. b

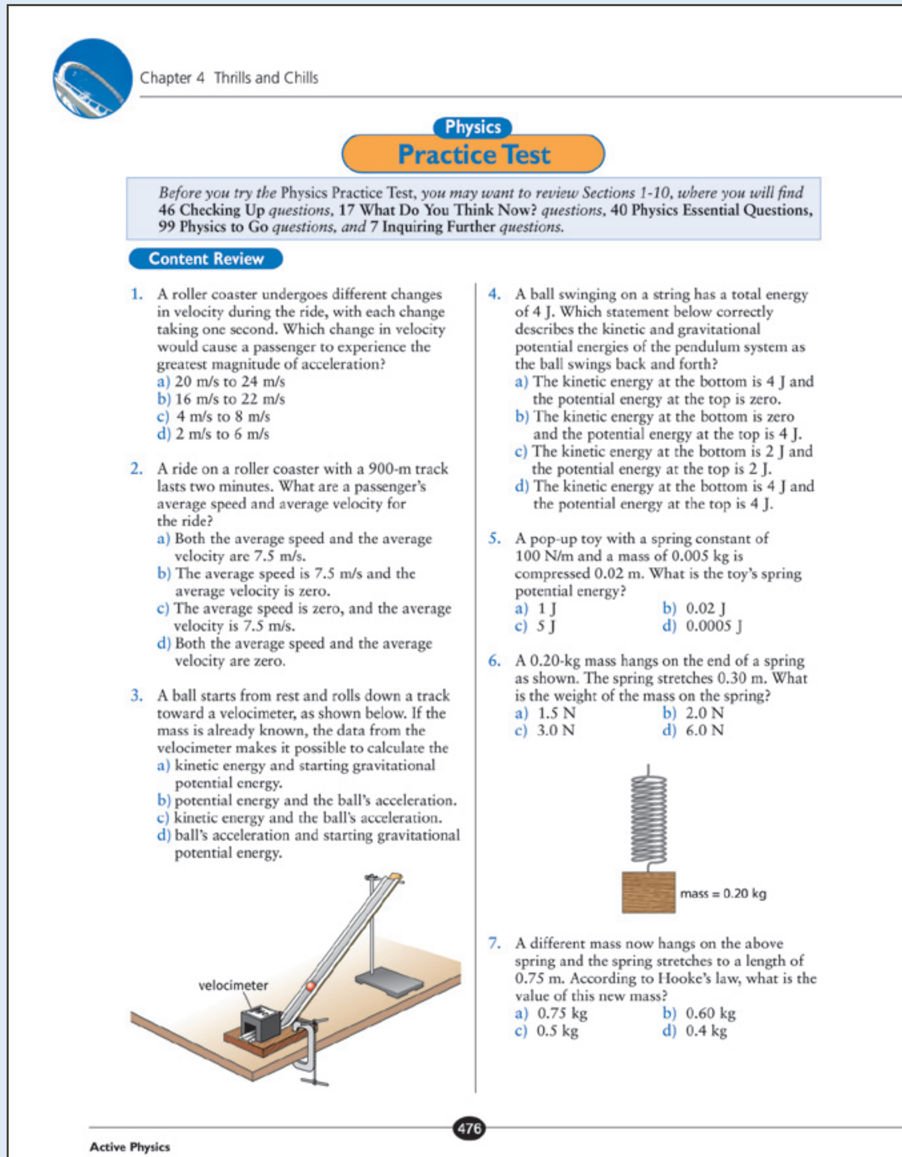
3. a

4. d

5. b

6. b

7. c



Chapter 4 Thrills and Chills

Physics

Practice Test

Before you try the Physics Practice Test, *you may want to review Sections 1-10, where you will find* **46 Checking Up** *questions,* **17 What Do You Think Now?** *questions,* **40 Physics Essential Questions, 99 Physics to Go** *questions, and* **7 Inquiring Further** *questions.*

Content Review

1. A roller coaster undergoes different changes in velocity during the ride, with each change taking one second. Which change in velocity would cause a passenger to experience the greatest magnitude of acceleration?
   a) 20 m/s to 24 m/s
   b) 16 m/s to 22 m/s
   c) 4 m/s to 8 m/s
   d) 2 m/s to 6 m/s

2. A ride on a roller coaster with a 900-m track lasts two minutes. What are a passenger's average speed and average velocity for the ride?
   a) Both the average speed and the average velocity are 7.5 m/s.
   b) The average speed is 7.5 m/s and the average velocity is zero.
   c) The average speed is zero, and the average velocity is 7.5 m/s.
   d) Both the average speed and the average velocity are zero.

3. A ball starts from rest and rolls down a track toward a velocimeter, as shown below. If the mass is already known, the data from the velocimeter makes it possible to calculate the
   a) kinetic energy and starting gravitational potential energy.
   b) potential energy and the ball's acceleration.
   c) kinetic energy and the ball's acceleration.
   d) ball's acceleration and starting gravitational potential energy.

velocimeter

4. A ball swinging on a string has a total energy of 4 J. Which statement below correctly describes the kinetic and gravitational potential energies of the pendulum system as the ball swings back and forth?
   a) The kinetic energy at the bottom is 4 J and the potential energy at the top is zero.
   b) The kinetic energy at the bottom is zero and the potential energy at the top is 4 J.
   c) The kinetic energy at the bottom is 2 J and the potential energy at the top is 2 J.
   d) The kinetic energy at the bottom is 4 J and the potential energy at the top is 4 J.

5. A pop-up toy with a spring constant of 100 N/m and a mass of 0.005 kg is compressed 0.02 m. What is the toy's spring potential energy?
   a) 1 J b) 0.02 J
   c) 5 J d) 0.0005 J

6. A 0.20-kg mass hangs on the end of a spring as shown. The spring stretches 0.30 m. What is the weight of the mass on the spring?
   a) 1.5 N b) 2.0 N
   c) 3.0 N d) 6.0 N

mass = 0.20 kg

7. A different mass now hangs on the above spring and the spring stretches to a length of 0.75 m. According to Hooke's law, what is the value of this new mass?
   a) 0.75 kg b) 0.60 kg
   c) 0.5 kg d) 0.4 kg

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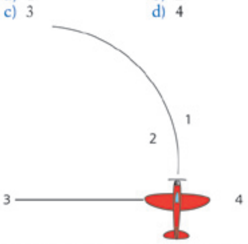
Active Physics

8\. As a mass suspended from a spring scale accelerates uniformly downward, the reading on the spring scale would be
a) lower than the weight of the mass.
b) higher than the weight of the mass.
c) equal to the weight of the mass.
d) first lower, then equal to the weight of the mass.

9\. A person with a mass of 60 kg stands on a bathroom scale in an elevator that is accelerating. If the scale reads 720 N, what is the magnitude and direction of the acceleration?
a) 7.2 m/s^2 upward
b) 2 m/s^2 upward
c) 12 m/s^2 downward
d) 9.8 m/s^2 downward

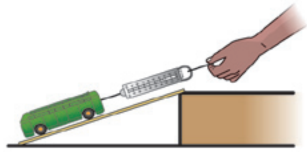
10\. A toy plane attached to a wire is flying in a horizontal circle. What point will the plane move toward if the wire breaks when the plane is in the position shown below?
a) 1 b) 2
c) 3 d) 4



11\. The centripetal force acting on the plane in the position in *Question 10* is directed toward point
a) 1 b) 2
c) 3 d) 4

12\. A diver with a mass of 50 kg runs off the end of a diving board with a kinetic energy of 200 J. If the board is 3 m above the surface of a pool, what is the diver's kinetic energy when she hits the water?
a) 350 J
b) 650 J
c) 1700 J
d) 6050 J

13\. A lab cart is being pulled up a ramp to the top of a ledge as shown below. As the angle between the ramp and the horizontal is increased, what happens to the force required and the work done?
a) The force increases and the work decreases.
b) The work increases and the force increases.
c) The force remains the same and the work increases.
d) The force increases and the work remains the same.



14\. If the cart in the diagram above is always pulled to the top of the ramp in the same amount of time once the ramp angle is changed, what happens to the power needed to pull the cart up the ramp?
a) The power increases as the angle increases.
b) The power decreases as the angle decreases.
c) The power remains the same regardless of the angle.
d) The power decreases as the angle increases.

15\. An automobile goes over a hill that has a radius of 50 meters and collides with another vehicle. The driver claims the automobile was not airborne when it passed over the top of the hill. Knowing that the centripetal force on the automobile is provided only by the force of gravity, what else would an accident investigator need to know to determine if the driver is telling the truth?
a) the automobile's speed only
b) the automobile's speed and mass
c) the automobile's mass only
d) the automobile's speed and the height of the hill

8. a
9. b
10. a
11. c
12. c
13. d
14. a
15. a

CHAPTER 4

Critical Thinking

16.a)

Given:
$m = 0.5$ kg; $h = 0.4$ m; $g = 9.8$ m/s^2

$GPE = mgh =$
$(0.5 \text{ kg})(9.8 \text{ m/s}^2)(0.4 \text{ m}) = 2 \text{ J}$

16.b)

2 J

16.c)

$\Delta GPE = \Delta KE$ or $mgh = \frac{1}{2}mv^2$

Therefore,

$(0.5 \text{ kg})(9.8 \text{ m/s}^2)(0.4 \text{ m}) =$
$\frac{1}{2}(0.5 \text{ kg})(v^2)$

and
$v = 2.8$ m/s

16.d)

2 J

17.a)

A spring scale of appropriate reading size and a meter stick.

17.b)

Measure the length of the path along the ramp from the floor to the lab's tabletop for the different angles used. Measure the force required to pull the cart up the ramp at these different angles.

17.c)

Multiplying the force required to pull the cart up the plane by the length of the plane at the different angles. Because Work = Force times distance, the product of these numbers will always be the same if the work done is independent of the angle.

Chapter 4 Thrills and Chills

Practice Test *(continued)*

Critical Thinking

16. A cart with a mass of 0.5 kg is at the top of a ramp as shown in the diagram below.
   a) What is the cart's gravitational potential energy at the top of the ramp?
   b) If the cart is allowed to roll down the ramp freely, what would be its kinetic energy at the bottom of the ramp?
   c) What would be the cart's velocity at the bottom of the ramp?
   d) How much work would be required to pull the cart back to the top of the ramp from the bottom?

17. Design an experiment to show that the amount of work required to pull a cart to the top of a table from the floor is independent of the angle of the ramp used to pull the cart.
   a) What measuring instruments will you need?
   b) What measurements will you take?
   c) How will you use this data to prove that the angle has no effect on the work done?

18. The data below pertains to the stretch of a spring given the amount of mass hanging from it.

Mass	Stretch
0.200 kg	0.15 m
0.400 kg	0.28 m
0.600 kg	0.44 m
0.800 kg	0.59 m
1.000 kg	0.75 m
1.200 kg	0.89 m

   a) Graph the data above.
   b) Using the data, calculate the spring constant of the spring.
   c) Calculate the spring potential energy of the spring when it is stretched a distance of 0.80 m.
   d) If a 0.500-kg mass were suspended from the spring, how far would the spring stretch?

19. A 60-kg person is standing on a spring scale in an elevator. Provide answers to the following in newtons:
   a) What will the scale read when the elevator is at rest?
   b) If the elevator accelerates upward for a short period of time at 1 m/s^2, what will the scale read during the acceleration?
   c) What will the scale read if the elevator continues at constant speed upward?
   d) When coming to rest, the elevator has a negative acceleration of 1.5 m/s^2. What does the scale read now?

20. An 800-kg roller-coaster cart traveling at a constant speed of 20 m/s goes around a vertical loop with a radius of 25 meters.
   a) What is the weight of the coaster cart?
   b) What is the roller-coaster cart's centripetal acceleration?
   c) The cart now goes around the vertical loop at a different constant speed requiring a centripetal force of 10,000 newtons to travel in a circle with a radius of 25 meters. What is the magnitude and direction of the net force that the track must supply on the cart at the bottom of the loop?
   d) What is the magnitude and direction of the net force the track must supply on the cart at the top of the loop?

Active Physics *Plus*

21. A pop-up toy with a spring constant of 50 newtons/meter and a mass of 0.005 kg is compressed 0.04 meter, and then released. If all the spring potential energy is converted to gravitational potential energy, how high will the toy pop up?

22. A roller-coaster cart with a mass of 300 kg goes around a vertical loop that has a 10-meter radius. The maximum normal force exerted by the rail during the loop is 9700 newtons. What is the cart's speed at this point?

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Active Physics

18.a)

A graph of the force in newtons on the vertical axis versus stretch in meters on the horizontal axis should yield a straight line.

18.b)

Given:
$m = 1.200$ kg; $x = 0.89$ m;
$g = 9.8$ m/s^2

The spring constant of the graph should be calculated from the slope of the line.

$F = kx$, therefore,
$k = F/x$ gives $k = mg/x =$
$(1.2 \text{ kg})(9.8 \text{ m/s}^2)/(0.89 \text{ m}) =$
13 N/m

18.c)

Given:
$x = 0.8$ m

The spring potential energy is given by
$SPE = \frac{1}{2}kx^2 =$
$\frac{1}{2}(13 \text{ N/m})(0.8 \text{ m})^2 = 4.2 \text{ J}$

18.d)

The stretch of the spring may either be done from interpolation of the graph or by using $F = kx$ and solving for $x = F/k$. This gives $x = (0.5 \text{ kg})(9.8 \text{ m/s}^2)/(13 \text{ N/m})$ or $x = 0.38$ m.

19.a)

Using $g = 10 \text{ m/s}^2$ for this problem, the spring scales reads the person's weight $= (60 \text{ kg})(10 \text{ m/s}^2) = 600 \text{ N}$.

19.b)

Given:

$a = 1 \text{ m/s}^2$

Accelerating upward, the spring scale must provide a net upward force above the force of the weight. Using $F = ma$ gives $F = (60 \text{ kg})(1 \text{ m/s}^2) = 60 \text{ N}$. Thus, the total force is 660 N.

19.c)

At constant velocity upward the scale reads the weight = 600 N.

19.d)

Given:

$a = -1.5 \text{ m/s}^2$

Using $F = ma$ gives

$(60 \text{ kg})(-1.5 \text{ m/s}^2) = -90 \text{ N}$.

When added to the weight of +600 N the net upward force is 510 N.

20.a)

Given:

$m = 800$ kg; $v = 20$ m/s; $r = 25$ m

Using $g = 10 \text{ m/s}^2$ for this problem,

$$W = mg = (800 \text{ kg})(10 \text{ m/s}^2) = 8000 \text{ N}$$

20.b)

Using $a_c = v^2/r = (20 \text{ m/s})^2/(25 \text{ m}) = 16 \text{ m/s}^2$.

20.c)

At the bottom of the loop, the track must supply an upward force equal to the weight of the cart plus the centripetal force needed to navigate the loop, or 10,000 N + 8000 N = 18,000 N upward.

20.d)

At the top of the loop, gravity supplies a force of 8000 N downward, so the track only must supply 2000 N downward to provide the required centripetal force of 10,000 N.

21. Active Physics *Plus*

Given:

$k = 50$ N/m; $m = 0.005$ kg;
$x = 0.04$ m; $g = 9.8 \text{ m/s}^2$

$$mgh = \tfrac{1}{2}kx^2$$

$$h = \frac{kx^2}{2mg} = \frac{(50 \text{ N/m})(0.04 \text{ m})^2}{2(0.005 \text{ kg})(9.8 \text{ m/s}^2)} = 0.8 \text{ m}$$

22. Active Physics *Plus*

Given:

$m = 300$ kg; $r = 10$ m;
$F_N = 9700$ N; $g = 9.8 \text{ m/s}^2$

$$F_c = F_N - W = 9700 \text{ N} - (300 \text{ kg})(9.8 \text{ m/s}^2) = 6760 \text{ N}$$

$$F_c = ma_c = m\frac{v^2}{r}$$

$$v = \sqrt{\frac{F_c r}{m}} = \sqrt{\frac{(6760 \text{ N})(10 \text{ m})}{300 \text{ kg}}} = 15 \text{ m/s}$$