Physics Practice Test

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

2c **Blackline Master**

Content Review

1. b

2. d

The inertia of an object is measured in terms of its mass, so the object with the largest mass has the largest inertia. Inertia is the resistance of a mass to a change in its state of motion. Inertia is often confused with momentum.

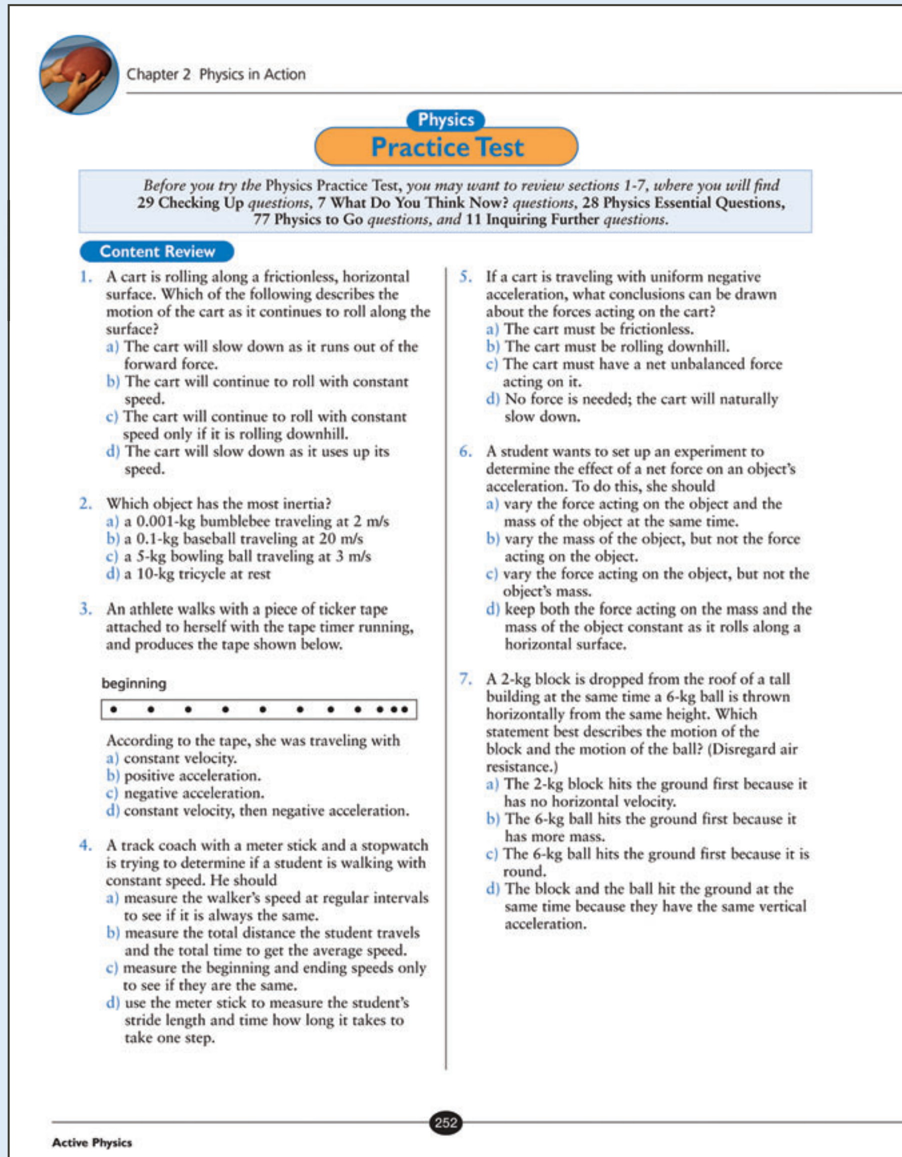
3. d

4. a

5. c

6. c

7. d



Chapter 2 Physics in Action

Physics **Practice Test**

Before you try the Physics Practice Test, *you may want to review sections 1-7, where you will find* **29 Checking Up** *questions,* **7 What Do You Think Now?** *questions,* **28 Physics Essential Questions, 77 Physics to Go** *questions, and* **11 Inquiring Further** *questions.*

Content Review

1. A cart is rolling along a frictionless, horizontal surface. Which of the following describes the motion of the cart as it continues to roll along the surface?
   a) The cart will slow down as it runs out of the forward force.
   b) The cart will continue to roll with constant speed.
   c) The cart will continue to roll with constant speed only if it is rolling downhill.
   d) The cart will slow down as it uses up its speed.

2. Which object has the most inertia?
   a) a 0.001-kg bumblebee traveling at 2 m/s
   b) a 0.1-kg baseball traveling at 20 m/s
   c) a 5-kg bowling ball traveling at 3 m/s
   d) a 10-kg tricycle at rest

3. An athlete walks with a piece of ticker tape attached to herself with the tape timer running, and produces the tape shown below.

   beginning

   According to the tape, she was traveling with
   a) constant velocity.
   b) positive acceleration.
   c) negative acceleration.
   d) constant velocity, then negative acceleration.

4. A track coach with a meter stick and a stopwatch is trying to determine if a student is walking with constant speed. He should
   a) measure the walker's speed at regular intervals to see if it is always the same.
   b) measure the total distance the student travels and the total time to get the average speed.
   c) measure the beginning and ending speeds only to see if they are the same.
   d) use the meter stick to measure the student's stride length and time how long it takes to take one step.

5. If a cart is traveling with uniform negative acceleration, what conclusions can be drawn about the forces acting on the cart?
   a) The cart must be frictionless.
   b) The cart must be rolling downhill.
   c) The cart must have a net unbalanced force acting on it.
   d) No force is needed; the cart will naturally slow down.

6. A student wants to set up an experiment to determine the effect of a net force on an object's acceleration. To do this, she should
   a) vary the force acting on the object and the mass of the object at the same time.
   b) vary the mass of the object, but not the force acting on the object.
   c) vary the force acting on the object, but not the object's mass.
   d) keep both the force acting on the mass and the mass of the object constant as it rolls along a horizontal surface.

7. A 2-kg block is dropped from the roof of a tall building at the same time a 6-kg ball is thrown horizontally from the same height. Which statement best describes the motion of the block and the motion of the ball? (Disregard air resistance.)
   a) The 2-kg block hits the ground first because it has no horizontal velocity.
   b) The 6-kg ball hits the ground first because it has more mass.
   c) The 6-kg ball hits the ground first because it is round.
   d) The block and the ball hit the ground at the same time because they have the same vertical acceleration.

252

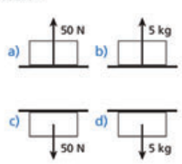
Active Physics

8. A pitching machine launches a baseball horizontally with no spin. Which of the following statements correctly describes the ball's motion in the air as the launch speed is increased?
a) The ball's acceleration increases, and the distance it falls in one second decreases.
b) The ball's acceleration remains the same, and the distance the ball falls in one second decreases.
c) The ball's acceleration remains the same, and the distance the ball falls in one second increases.
d) The ball's acceleration remains the same, and the distance the ball falls in one second remains the same.

9. A punter on a football team can kick the ball at an angle of either 30° or 80°. If he wants to maximize both the amount of time the ball spends in the air and the distance the ball travels, at which angle should he kick the ball?
a) the 30° angle because the ball goes further
b) the 80° angle because the ball goes further
c) the 30° angle because the ball spends more time in the air
d) the 80° angle because the ball spends more time in the air

10. A student is holding a book that has a weight of 20 N in his hand while sitting in a chair. The man claims that the book must be attracting Earth with a force of 20 N. His claim must be
a) false because books do not attract objects.
b) false because Earth is much larger than the book.
c) true because the book has more inertia than Earth.
d) true due to Newton's third law of action-reaction.

11. Which diagram of a 5-kg mass resting on a table correctly represents the force of the table on the mass?



12. Two students have a "tug-of-war" on a smooth gym floor. One student has a mass of 70 kg and is wearing socks, but no athletic shoes. The other student has a mass of 60 kg and is wearing athletic shoes. The student most likely to win will be
a) the 60-kg student because he can pull harder on the 70-kg student.
b) the 70-kg student because he can pull harder on the 60-kg student.
c) the 60-kg student because he experiences a greater frictional force with the floor.
d) the 70-kg student because he experiences a greater frictional force with the floor.

13. Automobiles with front-wheel drive that have the engine located over the drive wheels have better traction in snow than automobiles with rear-wheel drive. This is most likely because
a) the tires on front-wheel drive automobiles have a higher coefficient of friction than rear-wheel drive automobiles.
b) the front tires encounter the snow first.
c) the front tires have a higher normal force than the rear-wheel tires because the engine is heavier than the rear of the automobile.
d) the front wheels are used for steering.

14. A student whose mass is 60 kg and a bicycle with a mass of 20 kg are at rest on a horizontal road. The student exerts a force of 120 N to accelerate the bike over a distance of 48 meters. What is the velocity of the bicycle and rider at the end of the 48 meters?
a) 3 m/s
b) 6 m/s
c) 8 m/s
d) 12 m/s

15. A basketball player is able to jump to a vertical height of 1.25 m. A student calculates that the player must have left the floor with a velocity of 5 m/s. The student can prove this claim by using
a) conservation of energy.
b) the principle of friction.
c) Newton's third law of motion.
d) the principle of inertia.

253

Active Physics

8. d

9. d

10. d

11. a

12. c

13. c

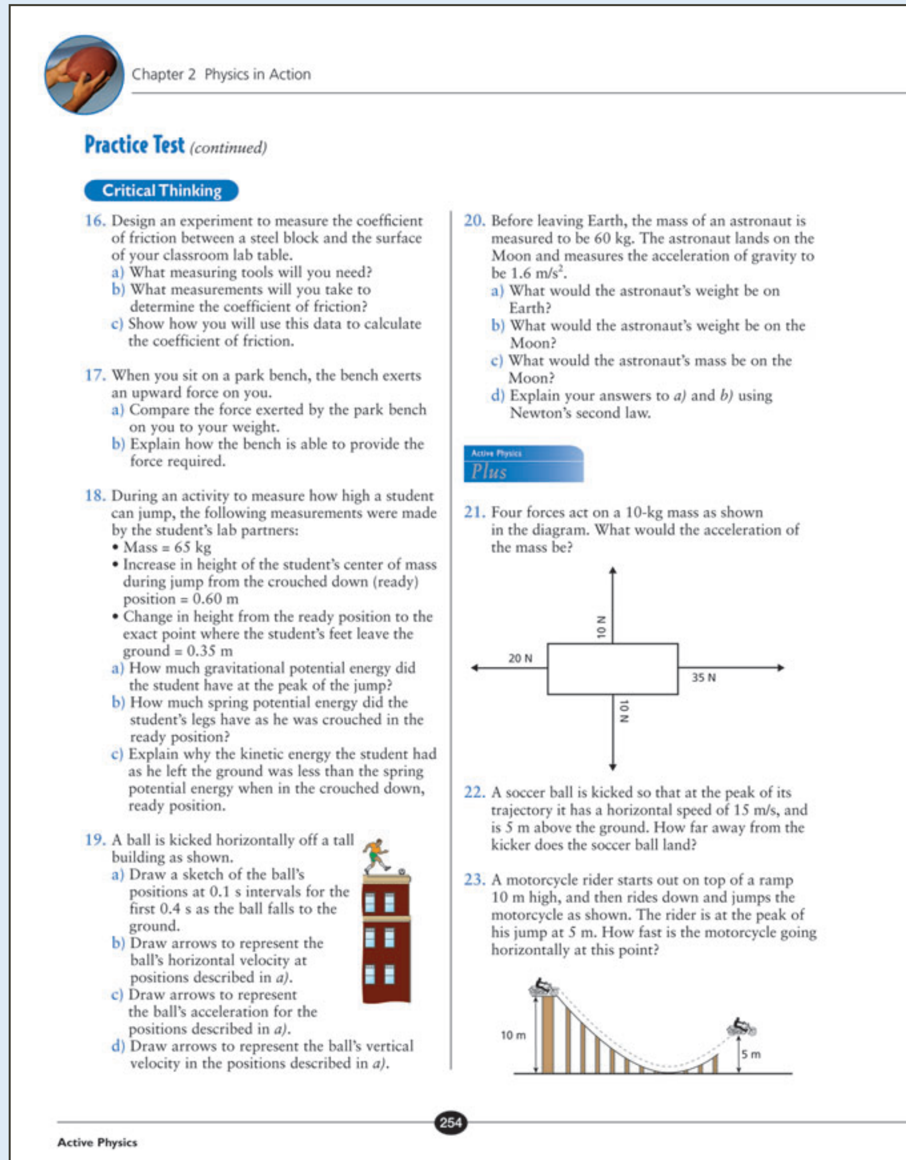
14. d

Here it is assumed that the student is riding the bicycle, so that the force the student exerts is to accelerate both the student and the bicycle together (total mass = 80 kg). Using $\Sigma F = ma$ gives $120\text{ N} = (80\text{ kg})(a)$ or $a = 1.5\text{ m/s}^2$. To find the velocity, $v^2 = 2a\Delta d$ or $v^2 = 2\left(1.5\text{ m/s}^2\right)\left(48\text{ m}\right) = 144\text{ m}^2/\text{s}^2$; therefore, $v = 12\text{ m/s}$.

15. a

CHAPTER 2

Critical Thinking


Chapter 2 Physics in Action

Practice Test *(continued)*

Critical Thinking

16. Design an experiment to measure the coefficient of friction between a steel block and the surface of your classroom lab table.
   a) What measuring tools will you need?
   b) What measurements will you take to determine the coefficient of friction?
   c) Show how you will use this data to calculate the coefficient of friction.

17. When you sit on a park bench, the bench exerts an upward force on you.
   a) Compare the force exerted by the park bench on you to your weight.
   b) Explain how the bench is able to provide the force required.

18. During an activity to measure how high a student can jump, the following measurements were made by the student's lab partners:
   - Mass = 65 kg
   - Increase in height of the student's center of mass during jump from the crouched down (ready) position = 0.60 m
   - Change in height from the ready position to the exact point where the student's feet leave the ground = 0.35 m

   a) How much gravitational potential energy did the student have at the peak of the jump?
   b) How much spring potential energy did the student's legs have as he was crouched in the ready position?
   c) Explain why the kinetic energy the student had as he left the ground was less than the spring potential energy when in the crouched down, ready position.

19. A ball is kicked horizontally off a tall building as shown.
   a) Draw a sketch of the ball's positions at 0.1 s intervals for the first 0.4 s as the ball falls to the ground.
   b) Draw arrows to represent the ball's horizontal velocity at positions described in *a)*.
   c) Draw arrows to represent the ball's acceleration for the positions described in *a)*.
   d) Draw arrows to represent the ball's vertical velocity in the positions described in *a)*.

20. Before leaving Earth, the mass of an astronaut is measured to be 60 kg. The astronaut lands on the Moon and measures the acceleration of gravity to be 1.6 m/s^2.
   a) What would the astronaut's weight be on Earth?
   b) What would the astronaut's weight be on the Moon?
   c) What would the astronaut's mass be on the Moon?
   d) Explain your answers to *a)* and *b)* using Newton's second law.

Active Physics *Plus*

21. Four forces act on a 10-kg mass as shown in the diagram. What would the acceleration of the mass be?

22. A soccer ball is kicked so that at the peak of its trajectory it has a horizontal speed of 15 m/s, and is 5 m above the ground. How far away from the kicker does the soccer ball land?

23. A motorcycle rider starts out on top of a ramp 10 m high, and then rides down and jumps the motorcycle as shown. The rider is at the peak of his jump at 5 m. How fast is the motorcycle going horizontally at this point?

254

Active Physics

16.a)

The coefficient of friction between the steel block and the table surface could be determined by pulling the block along the surface with constant velocity by a horizontal pull parallel to the table's surface, using a spring scale. The materials you would need include a spring scale, a balance to measure the weight of the steel block if the spring scale did not work, and a method to attach the spring scale to the steel block, such as a string.

16.b)

The measurements you would need to take would include the weight of the steel block, and the reading on the spring scale when the block is sliding across the table with constant velocity.

16.c)

The coefficient of friction could be determined using the formula μ = frictional force/normal force.

17.a)

The upward force supplied by the park bench is exactly equal to your weight.

17.b)

When a force is applied to the bench, the bench flexes like a spring until it reaches a point where the spring-like force it is exerting upward just balances the force of your weight downward. The bench then stops bending and stays in that position until the force is removed, and it returns to its original, un-flexed position.

18.a)

$$GPE = mg\Delta h = (65\text{ kg})(10\text{ m/s}^2) \times (0.6\text{ m}) = 390\text{ J}$$

18.b)

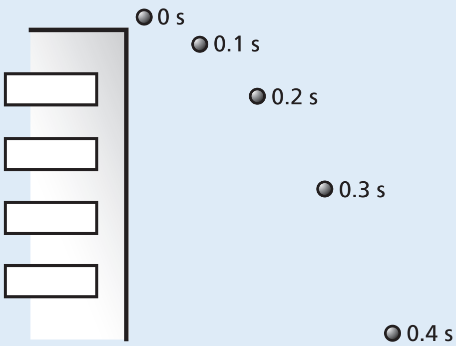
$$SPE = GPE_{\text{peak}} - GPE_{\text{ready}} = mgh = (65\text{ kg})(10\text{ m/s}^2)(0.6\text{ m}) = 390\text{ J}$$

18.c)

The spring potential energy in the legs is greater than the student's kinetic energy when he leaves the ground because some of the spring potential energy has gone into the energy needed to raise the student's center of mass to the lift-off position.

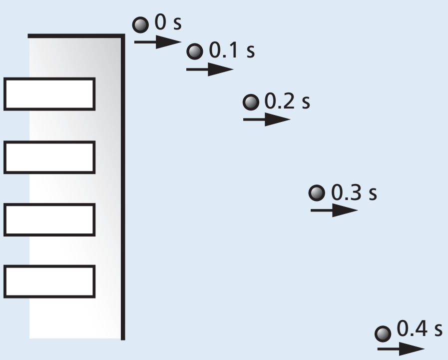
19.a)

Diagram should be similar to what is shown below:



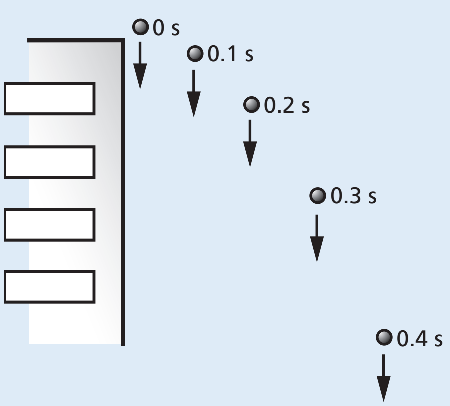
19.b)

Diagram should look similar to the one shown below, showing all equal length, horizontal arrows.



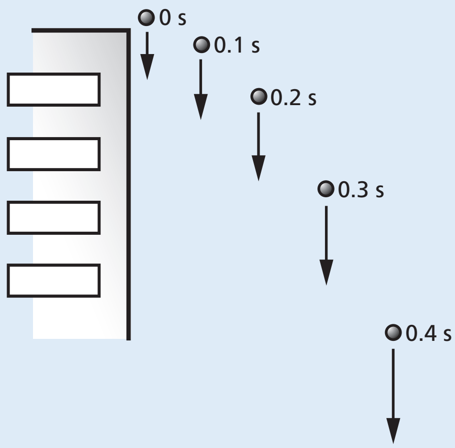
19.c)

Diagram should look similar to the one at right with all equal length vertical arrows.



19.d)

Diagram should look similar to the one at right with arrows increasing uniformly in length.



20.a)

Astronaut's weight on Earth, $W = mg_{\text{earth}} = (60\text{ kg})(9.8\text{ m/s}^2) =$ 590 N

20.b)

Astronaut's weight on the Moon, $W = mg_{\text{moon}} = (60\text{ kg})(1.6\text{ m/s}^2) =$ 96 N

20.c)

Astronaut's mass on the Moon is still 60 kg.

20.d)

Newton's second law says the acceleration of an object is equal to the net force applied divided by the object's mass. To make a falling object accelerate at the acceleration of gravity, the force the planet attracts the mass with must be equal to the weight.

21. Active Physics *Plus*

The two forces acting vertically (toward the top or bottom of the page) are each 10 N and cancel each other. The two forces acting in horizontally yield a net force of 15 N. Using the formula $\Sigma F = ma$ and assuming that acceleration to the right is positive gives $35\text{ N} - 20\text{ N} = (10\text{ kg})(a)$ or $a = 1.5\text{ m/s}^2$.

22. Active Physics *Plus*

The time for the ball to fall back to the ground is the same time as required to reach the peak. Because horizontal velocity has no effect on time of fall, use $d = \frac{1}{2}at^2$ to find out how long it takes to fall from the peak height of 5 m.

Therefore, $5\text{ m} = \frac{1}{2}(10\text{ m/s}^2)(t^2)$ or $t = 1$ s. The total time of flight is 2 s. The horizontal distance traveled, $d_x = v_x t = (15\text{ m/s})(2\text{ s}) = 30\text{ m}$.

23. Active Physics *Plus*

Using conservation of energy, the *GPE* at the top of the ramp must be equal to the sum of the *GPE* and the *KE*. So, $GPE_{\text{peak}} = GPE_{\text{jump}} + KE_{\text{jump}}$. Solving for the velocity gives $mgh_{\text{peak}} = mgh_{\text{jump}} + \frac{1}{2}mv^2_{\text{jump}}$. After canceling the mass, the equation becomes $gh_{\text{peak}} = gh_{\text{jump}} + \frac{1}{2}v^2_{\text{jump}}$. Substituting in the values and solving for v, gives

$(10\text{ m/s}^2)(10\text{ m}) =$

$(10\text{ m/s}^2)(5\text{ m}) + \frac{1}{2}(v^2)$ or

$\frac{1}{2}v^2 = 50\text{ m}^2/\text{s}^2$ or $v = 10\text{ m/s}$.