Part A

Answer all questions in this part.

Directions (1–35): For *each* statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2006 Edition Reference Tables for Physical Setting/Physics.* Record your answers on your separate answer sheet.

1 Which term identifies a scalar quantity?

(1) displacement
(2) momentum
(3) velocity
(4) time

2 Two 20.-newton forces act concurrently on an object. What angle between these forces will produce a resultant force with the greatest magnitude?

(1) 0°
(2) 45°
(3) 90.°
(4) 180.°

3 A car traveling west in a straight line on a highway decreases its speed from 30.0 meters per second to 23.0 meters per second in 2.00 seconds. The car's average acceleration during this time interval is

(1) 3.5 m/s^2 east
(2) 3.5 m/s^2 west
(3) 13 m/s^2 east
(4) 13 m/s^2 west

4 In a race, a runner traveled 12 meters in 4.0 seconds as she accelerated uniformly from rest. The magnitude of the acceleration of the runner was

(1) 0.25 m/s^2
(2) 1.5 m/s^2
(3) 3.0 m/s^2
(4) 48 m/s^2

5 A projectile is launched at an angle above the ground. The horizontal component of the projectile's velocity, v_x, is initially 40. meters per second. The vertical component of the projectile's velocity, v_y, is initially 30. meters per second. What are the components of the projectile's velocity after 2.0 seconds of flight? [Neglect friction.]

(1) v_x = 40. m/s and v_y = 10. m/s
(2) v_x = 40. m/s and v_y = 30. m/s
(3) v_x = 20. m/s and v_y = 10. m/s
(4) v_x = 20. m/s and v_y = 30. m/s

6 A ball is thrown with an initial speed of 10. meters per second. At what angle above the horizontal should the ball be thrown to reach the greatest height?

(1) 0°
(2) 30.°
(3) 45°
(4) 90.°

7 Which object has the greatest inertia?

(1) a 0.010-kg bullet traveling at 90. m/s
(2) a 30.-kg child traveling at 10. m/s on her bike
(3) a 490-kg elephant walking with a speed of 1.0 m/s
(4) a 1500-kg car at rest in a parking lot

8 An 8.0-newton wooden block slides across a horizontal wooden floor at constant velocity. What is the magnitude of the force of kinetic friction between the block and the floor?

(1) 2.4 N
(2) 3.4 N
(3) 8.0 N
(4) 27 N

9 Which situation represents a person in equilibrium?

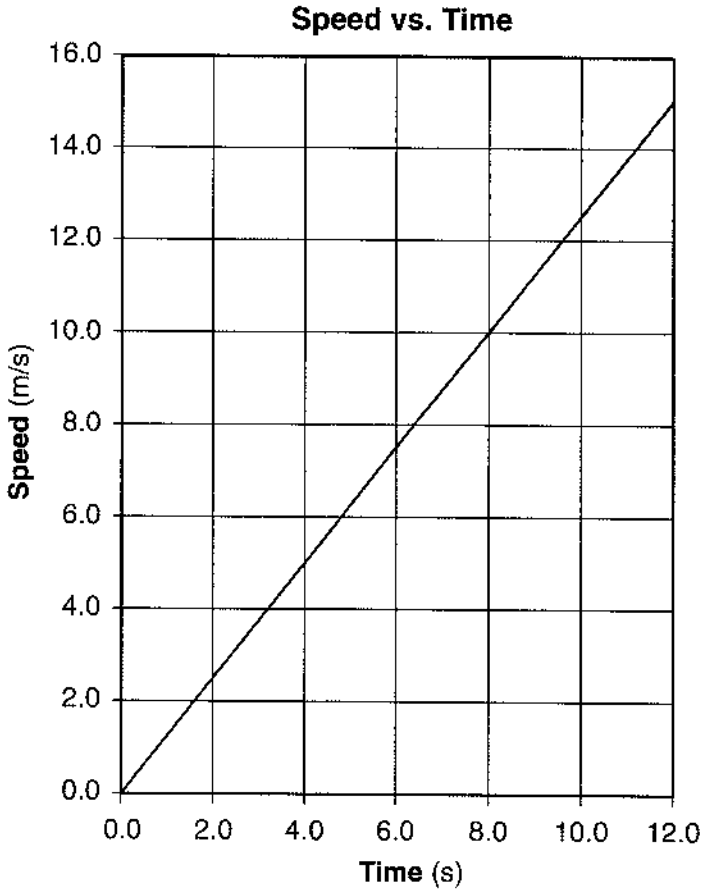
(1) a child gaining speed while sliding down a slide
(2) a woman accelerating upward in an elevator
(3) a man standing still on a bathroom scale
(4) a teenager driving around a corner in his car

10 A rock is thrown straight up into the air. At the highest point of the rock's path, the magnitude of the net force acting on the rock is

(1) less than the magnitude of the rock's weight, but greater than zero
(2) greater than the magnitude of the rock's weight
(3) the same as the magnitude of the rock's weight
(4) zero

Base your answers to questions 57 through 59 on the information and graph below.

The graph below shows the relationship between speed and elapsed time for a car moving in a straight line.



57 Determine the magnitude of the acceleration of the car. [1]

58–59 Calculate the total distance the car traveled during the time interval 4.0 seconds to 8.0 seconds. [Show all work, including the equation and substitution with units.] [2]

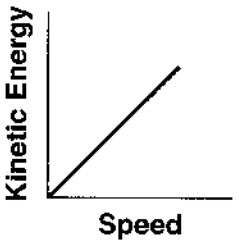
Base your answers to questions 63 through 65 on the information below.

A 28-gram rubber stopper is attached to a string and whirled clockwise in a horizontal circle with a radius of 0.80 meter. The diagram in your answer booklet represents the motion of the rubber stopper. The stopper maintains a constant speed of 2.5 meters per second.

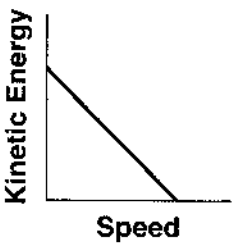
63–64 Calculate the magnitude of the centripetal acceleration of the stopper. [Show all work, including the equation and substitution with units.] [2]

65 On the diagram *in your answer booklet*, draw an arrow showing the direction of the centripetal force acting on the stopper when it is at the position shown. [1]

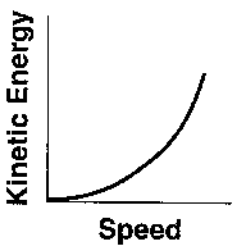
45 Which graph represents the relationship between the kinetic energy and the speed of a freely falling object?



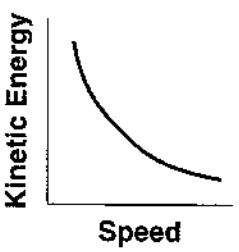
(1)



(2)



(3)



(4)

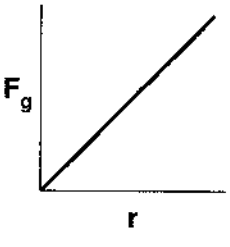
39 If a motor lifts a 400.-kilogram mass a vertical distance of 10. meters in 8.0 seconds, the *minimum* power generated by the motor is

(1) 3.2×10^2 W
(2) 5.0×10^2 W
(3) 4.9×10^3 W
(4) 3.2×10^4 W

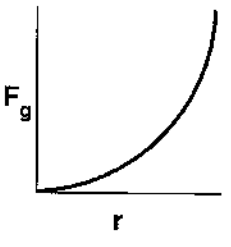
40 A 4.0-kilogram object is accelerated at 3.0 meters per second^2 north by an unbalanced force. The same unbalanced force acting on a 2.0-kilogram object will accelerate this object toward the north at

(1) 12 m/s^2
(2) 6.0 m/s^2
(3) 3.0 m/s^2
(4) 1.5 m/s^2

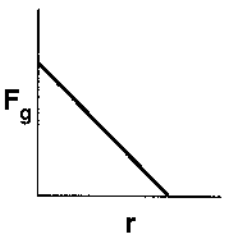
41 Which graph represents the relationship between the magnitude of the gravitational force, F_g, between two masses and the distance, r, between the centers of the masses?



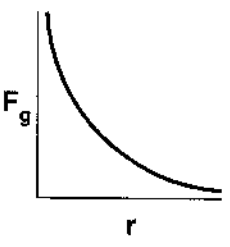
(1)



(2)

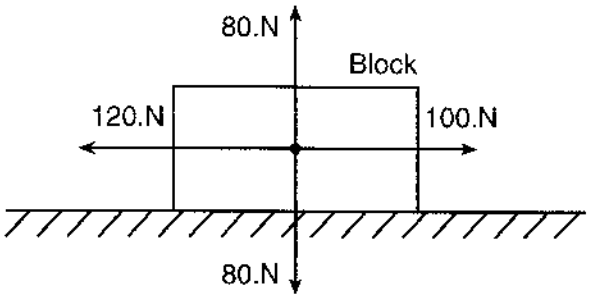


(3)



(4)

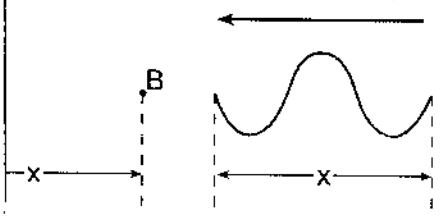
38 Four forces act concurrently on a block on a horizontal surface as shown in the diagram below.



As a result of these forces, the block

(1) moves at constant speed to the right
(2) moves at constant speed to the left
(3) accelerates to the right
(4) accelerates to the left

ward each other at equal speed in a uniform medium.

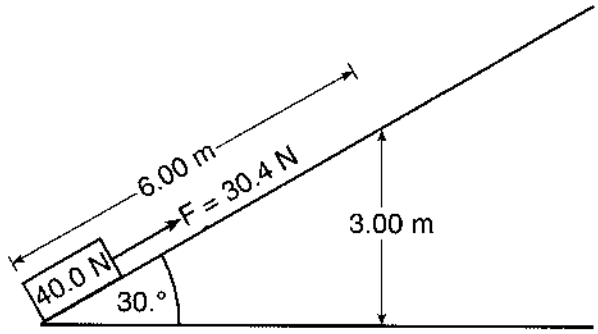


nts *A* and *B*, they will undergo

(3) destructive interference
(4) constructive interference

Base your answers to questions 81 through 85 on the information and diagram below.

A 30.4-newton force is used to slide a 40.0-newton crate a distance of 6.00 meters at constant speed along an incline to a vertical height of 3.00 meters.



81 Determine the total work done by the 30.4-newton force in sliding the crate along the incline. [1]

82–83 Calculate the total increase in the gravitational potential energy of the crate after it has slid 6.00 meters along the incline. [Show all work, including the equation and substitution with units.] [2]

84 State what happens to the kinetic energy of the crate as it slides along the incline. [1]

85 State what happens to the internal energy of the crate as it slides along the incline. [1]

Base your answers to questions 70 through 75 on the information below.

A girl rides her bicycle 1.40 kilometers west, 0.70 kilometer south, and 0.30 kilometer east in 12 minutes. The vector diagram in your answer booklet represents the girl's first two displacements in sequence from point *P*. The scale used in the diagram is 1.0 centimeter = 0.20 kilometer.

70–71 On the vector diagram *in your answer booklet*, using a ruler and a protractor, construct the following vectors:

- Starting at the arrowhead of the second displacement vector, draw a vector to represent the 0.30 kilometer east displacement. Label the vector with its magnitude. [1]
- Draw the vector representing the resultant displacement of the girl for the entire bicycle trip *and* label the vector *R*. [1]

72–73 Calculate the girl's average speed for the entire bicycle trip. [Show all work, including the equation and substitution with units.] [2]

74 Determine the magnitude of the girl's resultant displacement for the entire bicycle trip, in kilometers. [1]

75 Determine the measure of the angle, in degrees, between the resultant and the 1.40-kilometer displacement vector. [1]

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13 At a certain location, a gravitational force with a magnitude of 350 newtons acts on a 70.-kilogram astronaut. What is the magnitude of the gravitational field strength at this location?

(1) 0.20 kg/N
(2) 5.0 N/kg
(3) 9.8 m/s^2
(4) 25 000 N•kg

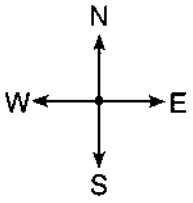
14 A spring gains 2.34 joules of elastic potential energy as it is compressed 0.250 meter from its equilibrium position. What is the spring constant of this spring?

(1) 9.36 N/m
(2) 18.7 N/m
(3) 37.4 N/m
(4) 74.9 N/m

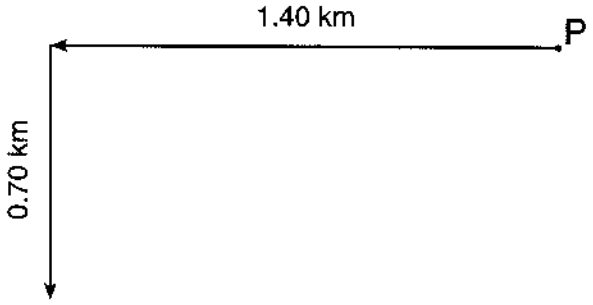
15 When a teacher shines light on a photocell attached to a fan, the blades of the fan turn. The brighter the light shone on the photocell, the faster the blades turn. Which energy conversion is illustrated by this demonstration?

(1) light → thermal → mechanical
(2) light → nuclear → thermal
(3) light → electrical → mechanical
(4) light → mechanical → chemical

70–71



Scale
1.0 cm = 0.20 km



72–73

74 _____ **km**

75 _____ °