1. A blinking light of constant period is situated on a lab cart. Which diagram best represents a photograph of the light as the cart moves with constant velocity?

(1) • • • • • •

(2) • • • • • •

(3) • • • • • • •

(4) • • • • • • •

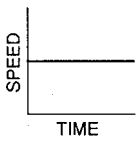
2. A baseball pitcher throws a fastball at 42 meters per second. If the batter is 18 meters from the pitcher, approximately how much time does it take for the ball to reach the batter?

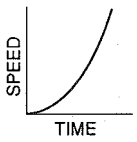
(1) 1.9 s
(2) 2.3 s
(3) 0.86 s
(4) 0.43 s

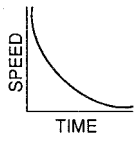
3. An object is uniformly accelerated from rest to a speed of 25 meters per second in 10 seconds. The acceleration of the object is

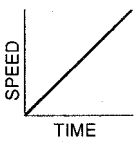
(1) 1.0 m/s^2
(2) 2.0 m/s^2
(3) 1.5 m/s^2
(4) 2.5 m/s^2

4. Which graph best represents the motion of a freely falling body near the Earth's surface?

(1) 

(3) 

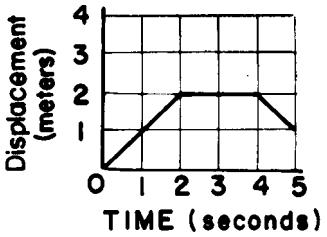
(2) 

(4) 

5. A rock dropped off a bridge takes 5 seconds to hit the water. Approximately what was the rock's velocity just before impact?

(1) 5 m/s
(2) 2 m/s
(3) 50 m/s
(4) 125 m/s

6. The graph below represents the motion of an object traveling in a straight line as a function of time. What is the average speed of the object during the first four seconds?



(1) 1 m/s
(2) 2 m/s
(3) 0.5 m/s
(4) 0 m/s

7. If the speed of a moving object is doubled, which quantity associated with the object must also double?

(1) its momentum
(2) its kinetic energy
(3) its acceleration
(4) its gravitational potential energy

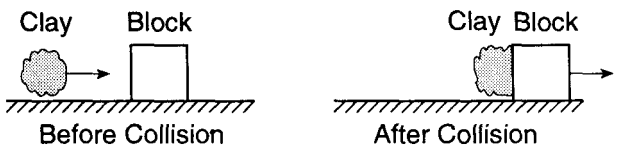
8. A 2-newton force acts on a mass. If the momentum of the mass changes by 120 kg.-meters/sec., the force acts for a time of

(1) 8 sec.
(2) 30 sec.
(3) 60 sec.
(4) 120 sec.

9. A force of 10. Newtons acts on an object for 0.010 second. What force, acting on the object for 0.050 second, would produce the same impulse?

(1) 1.0 N
(2) 2.0 N
(3) 5.0 N
(4) 10. N

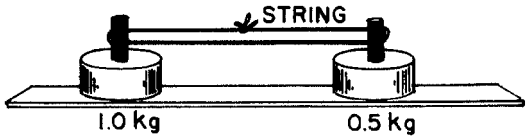
10. As shown in the diagrams below, a lump of clay travels horizontally to the right toward a block at rest on a frictionless surface. Upon collision, the clay and the block stick together and move to the right.



Compared to the total momentum of the clay and the block before the collision, the momentum of the clay-block system after the collision is

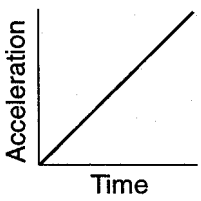
(1) less
(2) greater
(3) the same

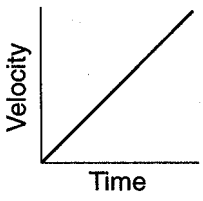
11. Two disk magnets are arranged at rest on a friction less horizontal surface as shown in the diagram below. When the string holding them together is cut, they move apart under a magnetic force of repulsion. When the 1.0-kilogram disk reaches a speed of 3.0 meters per second, what is the speed of the 0.5-kilogram disk?

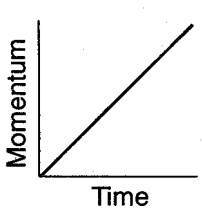


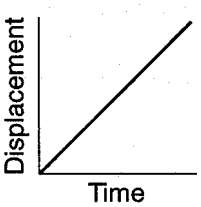
(1) 1.0 m/s
(2) 0.50 m/s
(3) 3.0 m/s
(4) 6.0 m/s

12. Which graph best represents the motion of an object that has *no* unbalanced force acting on it?

(1)


(3)


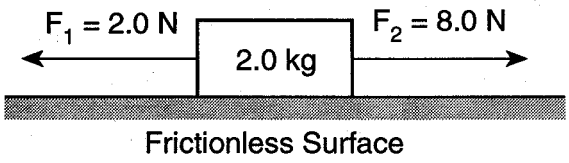
(2)


(4)


13. An 800-newton person is standing in an elevator. If the upward force of the elevator on the person is 600 Newtons, the person is

(1) at rest
(2) accelerating upward
(3) accelerating downward
(4) moving downward at constant speed

14. Two forces are applied to a 2.0-kilogram block on a frictionless horizontal surface, as shown in the diagram below.



The acceleration of the block is

(1) 5.0 m/s^2 to the right
(2) 5.0 m/s^2 to the left
(3) 3.0 m/s^2 to the right
(4) 3.0 m/s^2 to the left

15. If the Earth were twice as massive as it is now, then the gravitational force between it and the Sun would be

(1) the same
(2) twice as great
(3) half as great
(4) four times as great

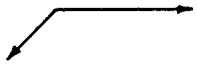
16. As a satellite is accelerated away from the Earth by a rocket, the satellite's mass

(1) decreases
(2) increases
(3) remains the same

17. A 60.-kilogram astronaut weighs 96 Newtons on the surface of the Moon. The acceleration due to gravity on the Moon is

(1) 0.0 m/s^2
(2) 1.6 m/s^2
(3) 4.9 m/s^2
(4) 9.8 m/s^2

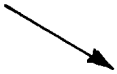
18. The diagram at the right represents two concurrent forces acting on a point. Which vector best represents their resultant?



(1) 

(3) 

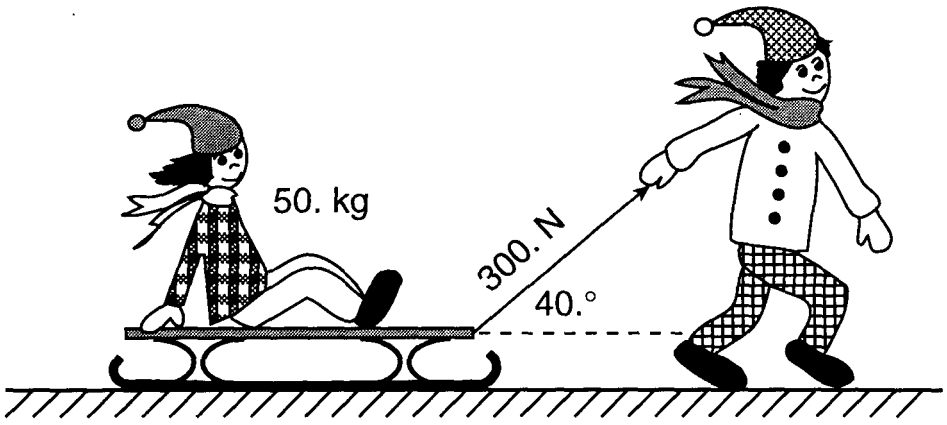
(2) 

(4) 

19. A man walks 40 meters north, then 70 meters east, and then 40 meters south. What is his displacement from the starting point?

(1) 150 meters east
(2) 150 meters west
(3) 70 meters east
(4) 70 meters west

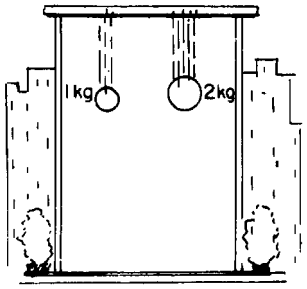
20. The diagram below shows a child pulling a 50.-kilogram friend on a sled by applying a 300.-newton force on the sled rope at an angle of 40.º with the horizontal



The vertical component of the 300.-newton force is approximately

(1) 510 N (2) 230 N (3) 190 N (4) 32 N

21. Base your answer to the following question on the diagram below which shows a 1-kilogram mass and a 2-kilogram mass being dropped from a building 100 meters high.



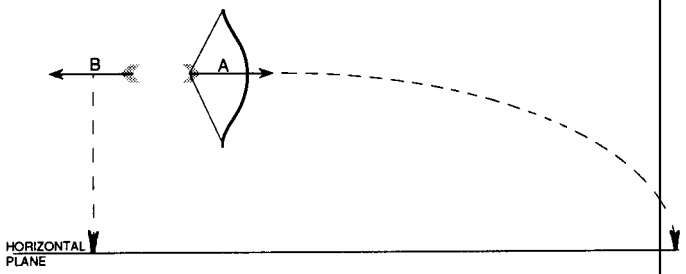
Halfway down, the acceleration is

(1) greater for the 1-kilogram mass

(2) greater for the 2-kilogram mass

(3) the same for both masses

22. Above a flat horizontal plane, an arrow, *A*, is shot horizontally from a bow at a speed of 50 meters per second, as shown in the diagram below. A second arrow, *B*, is dropped from the same height and at the same instant as *A* is fired.



Neglecting air friction, compared to the amount of time *A* takes to strike the plane, the amount of time *B* takes to strike the plane is

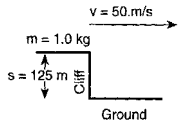
(1) less

(2) greater

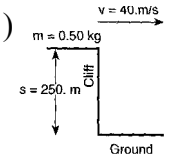
(3) the same

23. Four different balls are thrown horizontally off the top of four cliffs. In which diagram does the ball have the shortest time of flight?

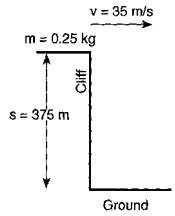
(1)



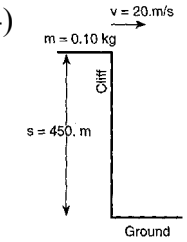
(3)



(2)



(4)



24. A bullet is fired from a rifle with a muzzle velocity of 100. meters per second at an angle of 30.° up from the horizontal. What is the magnitude of the vertical component of the muzzle velocity?

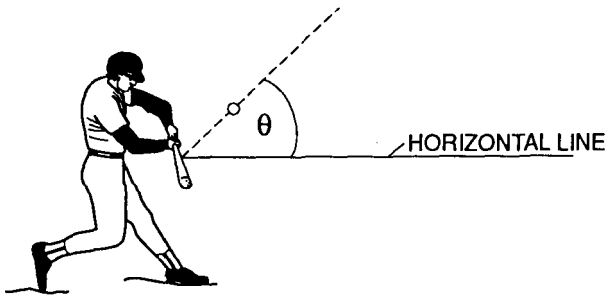
(1) 0.0 m/s

(2) 50. m/s

(3) 87. m/s

(4) 100. m/s

25. The diagram below shows a baseball being hit with a bat. Angle θ represents the angle between the horizontal and the ball's initial direction of motion.



Which value of θ would result in the ball traveling the longest horizontal distance? [Neglect air resistance.]

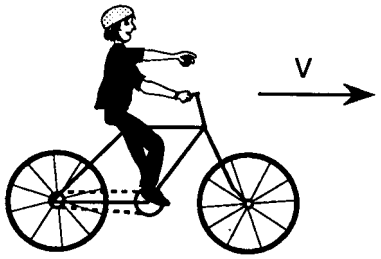
(1) 30º

(2) 45º

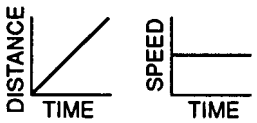
(3) 60º

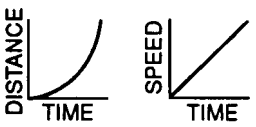
(4) 75º

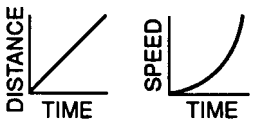
26. The diagram to the right represents a bicycle and rider traveling to the right at a constant speed. A ball is dropped from the hand of the cyclist.

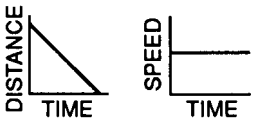


Which set of graphs best represents the horizontal motion of the ball relative to the ground? [Neglect air resistance.]

(1) 

(2) 

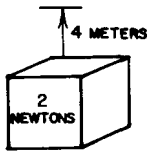
(3) 

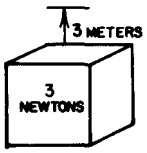
(4) 

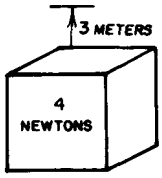
27. The work done in raising an object must result in an increase in the object's
    (1) internal energy
    (2) kinetic energy
    (3) gravitational potential energy
    (4) heat energy

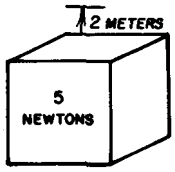
28. When gamma radiation is emitted from a nucleus, the stability of the nucleus
    (1) decreases
    (2) increases
    (3) remains the same

29. Each of the blocks in the diagrams below is lifted vertically for the distance indicated. Which block will gain the most gravitational potential energy?

(1) 

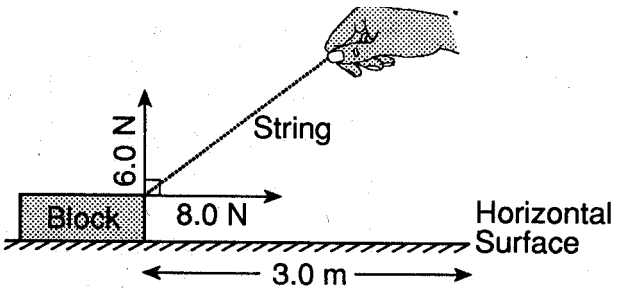
(3) 

(2) 

(4) 

30. A girl rides an escalator that moves her upward at constant speed. As the girl rises, how do her gravitational potential energy and kinetic energy change?
    (1) Gravitational potential energy decreases and kinetic energy decreases.
    (2) Gravitational potential energy decreases and kinetic energy remains the same.
    (3) Gravitational potential energy increases and kinetic energy decreases.
    (4) Gravitational potential energy increases and kinetic energy remains the same.

31. A student pulls a block 3.0 meters along a horizontal surface at constant velocity. The diagram below shows the components of the force exerted on the block by the student.

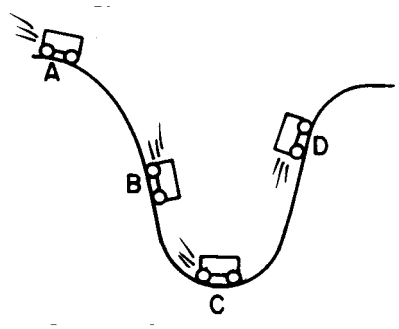


How much work is done against friction?
    (1) 18 J
    (2) 24 J
    (3) 30. J
    (4) 42 J

32. An electrical heater raises the temperature of a measured quantity of water. The water absorbs 6,000 joules of energy from the heater in 30.0 seconds. What is the minimum power supplied to the heater?

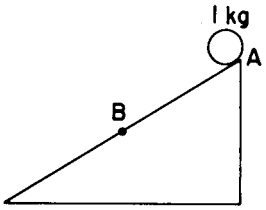
(1) 5.00×10^2 W
(2) 2.00×10^2 W
(3) 1.80×10^5 W
(4) 2.00×10^3 W

33. The diagram below shows a cart at four positions as it moves along a frictionless track. At which positions is the sum of the potential energy and kinetic energy of the cart the same?



(1) *A* and *B* , only
(2) *B* and *C*, only
(3) *C* and *D*, only
(4) all positions, *A* through *D*

34. In the accompanying diagram, a 1.0-kilogram sphere at point *A* has a potential energy of 5.0 joules.



What is the potential energy of the sphere at point *B*, halfway down the incline?

(1) 0.0 J
(2) 2.5 J
(3) 3.0 J
(4) 5.0 J

35. If the velocity of a moving object is doubled, the object's kinetic energy is

(1) unchanged
(2) halved
(3) doubled
(4) quadrupled

36. When the speed of an object is halved, its kinetic energy is

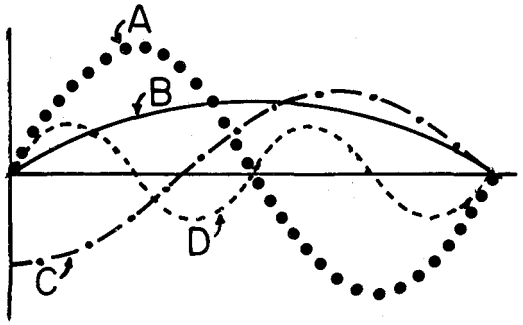
(1) quartered
(2) halved
(3) the same
(4) doubled

37. In the diagram below, the distance between points *A* and *B* on a wave is 0.10 meter.

This wave must have

(1) an amplitude of 0.10 m
(2) an amplitude of 0.20 m
(3) a wavelength of 0.10 m
(4) a wavelength of 0.20 m

38. In the diagram below, which wave has the largest amplitude?

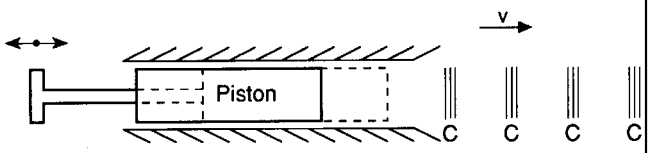


(1) *A*
(2) *B*
(3) *C*
(4) *D*

39. When a transverse wave is moving through a medium, what is the action of the particles of the medium?

(1) They travel through the medium with the wave.
(2) They vibrate in a direction parallel to the direction in which the wave is moving.
(3) They vibrate in a direction perpendicular to the direction in which the wave is moving.
(4) They remain at rest.

40. The diagram below shows a piston being moved back and forth to generate a wave. The piston produces a compression, *C*, every 0.50 second.



The frequency of this wave is

(1) 1.0 Hz
(2) 2.0 Hz
(3) 5.0×10^{-1} Hz
(4) 3.3×10^{2} Hz

41. The frequency of a light wave is 5.0×10^{14} hertz. What is the period of the wave?

(1) 1.7×10^{6} s
(2) 2.0×10^{-15} s
(3) 6.0×10^{-7} s
(4) 5.0×10^{-14} s

42. As the period of a wave decreases, the wave's frequency

(1) decreases
(2) increases
(3) remains the same

43. As a wave enters a medium of higher refractive index, its wavelength

(1) decreases
(2) increases
(3) remains the same

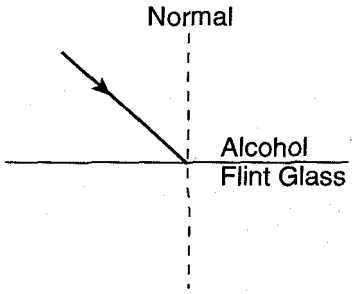
44. Periodic waves with a wavelength of 0.05 meter move with a speed of 0.30 meter per second. When the waves enter a dispersive medium, they travel at 0.15 meter per second. What is the wavelength of the waves in the dispersive medium?

(1) 20. m
(2) 1.8 m
(3) 0.05 m
(4) 0.025 m

45. As a ray of monochromatic light enters a block of flint glass from air, its speed

(1) decreases
(2) increases
(3) remains the same

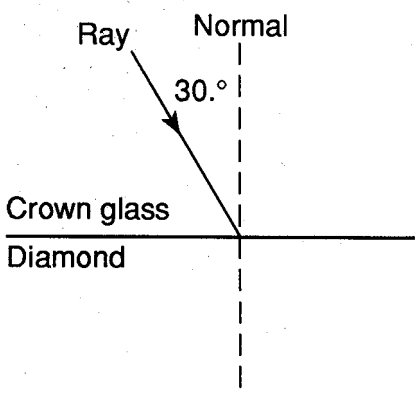
46. The diagram below shows a ray of monochromatic light incident on an alcohol-flint glass interface.



What occurs as the light travels from alcohol into flint glass?

(1) The speed of the light decreases and the ray bends toward the normal.
(2) The speed of the light decreases and the ray bends away from the normal.
(3) The speed of the light increases and the ray bends toward the normal.
(4) The speed of the light increases and the ray bends away from the normal.

47.

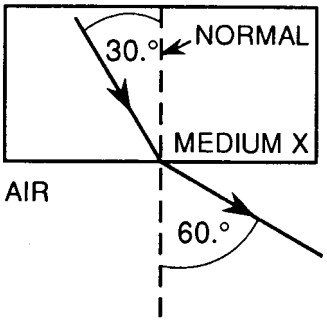


A ray of light ($\lambda = 5.9 \times 10^{-7}$ meter) traveling in crown glass is incident on a diamond interface at an angle of 30.°, as shown in the diagram above.

The angle of refraction for the light ray is closest to

(1) 12°
(2) 18°
(3) 30°
(4) 53°

48. The diagram below shows a ray of light passing from medium *X* into air.



What is the absolute index of refraction of medium *X*?

(1) 0.50
(2) 2.0
(3) 1.7
(4) 0.58

Mid-Year Review

Answer Key

1. 3
2. 4
3. 4
4. 4
5. 3
6. 3
7. 1
8. 3
9. 2
10. 3
11. 4
12. 4
13. 3
14. 3
15. 2
16. 3
17. 2
18. 4
19. 3
20. 3
21. 3
22. 3
23. 1
24. 2
25. 2
26. 1
27. 3
28. 2
29. 2
30. 4
31. 2
32. 2
33. 4
34. 2
35. 4
36. 1
37. 4
38. 1
39. 3
40. 2
41. 2
42. 2
43. 1
44. 4
45. 1
46. 1
47. 2
48. 3