

T19

- 1 Which quantity is scalar?
(1) mass (3) momentum
(2) force (4) acceleration
- 2 What is the final speed of an object that starts from rest and accelerates uniformly at 4.0 meters per second² over a distance of 8.0 meters?
(1) 8.0 m/s (3) 32 m/s
(2) 16 m/s (4) 64 m/s
- 3 The components of a 15-meters-per-second velocity at an angle of 60.° above the horizontal are
(1) 7.5 m/s vertical and 13 m/s horizontal
(2) 13 m/s vertical and 7.5 m/s horizontal
(3) 6.0 m/s vertical and 9.0 m/s horizontal
(4) 9.0 m/s vertical and 6.0 m/s horizontal
- 4 What is the time required for an object starting from rest to fall freely 500. meters near Earth's surface?
(1) 51.0 s (3) 10.1 s
(2) 25.5 s (4) 7.14 s
- 5 A baseball bat exerts a force of magnitude F on a ball. If the mass of the bat is three times the mass of the ball, the magnitude of the force of the ball on the bat is
(1) F (3) $3F$
(2) $2F$ (4) $F/3$
- 6 A 2.0-kilogram mass is located 3.0 meters above the surface of Earth. What is the magnitude of Earth's gravitational field strength at this location?
(1) 4.9 N/kg (3) 9.8 N/kg
(2) 2.0 N/kg (4) 20. N/kg
- 7 A truck, initially traveling at a speed of 22 meters per second, increases speed at a constant rate of 2.4 meters per second² for 3.2 seconds. What is the total distance traveled by the truck during this 3.2-second time interval?
(1) 12 m (3) 70. m
(2) 58 m (4) 83 m
- 8 A 750-newton person stands in an elevator that is accelerating downward. The upward force of the elevator floor on the person must be
(1) equal to 0 N (3) equal to 750 N
(2) less than 750 N (4) greater than 750 N
- 9 A 3.0-kilogram object is acted upon by an impulse having a magnitude of 15 newton•seconds. What is the magnitude of the object's change in momentum due to this impulse?
(1) 5.0 kg•m/s (3) 3.0 kg•m/s
(2) 15 kg•m/s (4) 45 kg•m/s
- 10 An air bag is used to safely decrease the momentum of a driver in a car accident. The air bag reduces the magnitude of the force acting on the driver by
(1) increasing the length of time the force acts on the driver
(2) decreasing the distance over which the force acts on the driver
(3) increasing the rate of acceleration of the driver
(4) decreasing the mass of the driver
- 11 **When a mass is placed on a spring with a spring constant of 60.0 newtons per meter, the spring is compressed 0.500 meter. How much energy is stored in the spring?**
(1) 60.0 J (3) 15.0 J
(2) 30.0 J (4) 7.50 J

12. A 15-kilogram cart is at rest on a horizontal surface. A 5-kilogram box is placed in the cart. Compared to the mass and inertia of the cart, the cart-box system has (1) more mass and more inertia (2) more mass and the same inertia (3) the same mass and more inertia (4) less mass and more inertia

13. A boy pushes his sister on a swing. What is the frequency of oscillation of his sister on the swing if the boy counts 90. complete swings in 300. seconds? (1) 0.30 Hz (2) 2.0 Hz (3) 1.5 Hz (4) 18 Hz (Use frequency formula)

14. A shopping cart slows as it moves along a level floor. Which statement describes the energies of the cart? (1) The kinetic energy increases and the gravitational potential energy remains the same. (2) The kinetic energy increases and the gravitational potential energy decreases. (3) The kinetic energy decreases and the gravitational potential energy remains the same. (4) The kinetic energy decreases and the gravitational potential energy increases.

15. The height of a 30-story building is approximately (1) 10^0 m (2) 10^1 m (3) 10^2 m (4) 10^3 m

16. A 1.0×10^3 -kilogram car travels at a constant speed of 20. meters per second around a horizontal circular track. The diameter of the track is 100 meters. The magnitude of the car's centripetal acceleration is (1) 0.20 m/s² (2) 2.0 m/s² (3) 8.0 m/s² (4) 4.0 m/s²

17. John wants to move a 400 lb. rock with a 5 ft. 9 in. crowbar. He puts the fulcrum 9 inches from the rock. How much force must he use to move the rock? (a) 30 N (b) 60 N (c) 70 N (d) 80 N (E) None

18. John, Peter and Jane weigh 80, 60 and 50 lbs respectively. John sits 3 ft., Peter sits 5 ft. and Jane sits 6 ft. from the fulcrum on the same side. How far must their 200 lb. father sit from the fulcrum in order to balance them? (a) 3.2 m (b) 4.2 (C) 5.2 (d) None

19. A bullet of mass 0.100 kg is pressed against spring of a gun ($K = 250 \text{ N/m}$). The spring is compressed 6 cm and released. Find speed of the bullet when spring reaches its normal length. (a) 4 m/s (b) 3 m/s (c) 2m/s (d) None

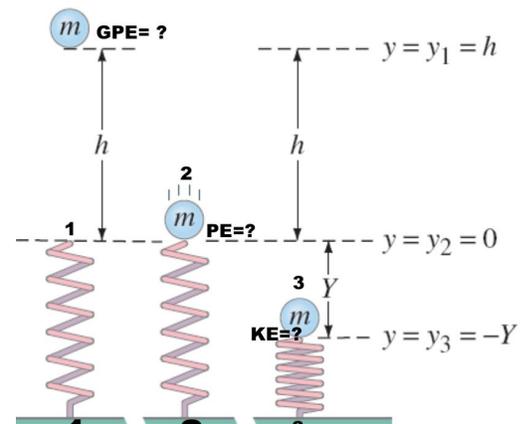
Use Spring's $X = 0$ as Reference frame for problems (20-23). Use the diagram to the right:

20. A ball of mass $m = 2.60 \text{ kg}$, starting from rest, falls a vertical distance $h = 55.0 \text{ cm}$ before striking a vertical coiled spring, which it compresses an amount $Y = 15.0 \text{ cm}$. (See the diagram to the right). What is the GPE on the Scenario 1 (a) mgh (b) $\frac{1}{2} kx^2$ (C) $\frac{1}{2} mv^2$ (d) 0 (e) None

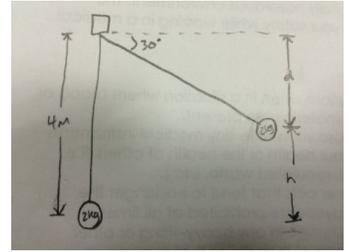
21. A ball of mass $m = 2.60 \text{ kg}$, starting from rest, falls a vertical distance $h = 55.0 \text{ cm}$ before striking a vertical coiled spring, which it compresses an amount $Y = 15.0 \text{ cm}$. What is the PE_s on the Scenario 2 (a) mgh (b) $\frac{1}{2} kx^2$ (C) $\frac{1}{2} mv^2$ (d) 0 (e) None

22. A ball of mass $m = 2.60 \text{ kg}$, starting from rest, falls a vertical distance $h = 55.0 \text{ cm}$ before striking a vertical coiled spring, which it compresses an amount $Y = 15.0 \text{ cm}$. What is the KE on the Scenario 3 (a) mgh (b) $\frac{1}{2} kx^2$ (C) $\frac{1}{2} mv^2$ (d) 0 (e) None

23. A ball of mass $m = 2.60 \text{ kg}$, starting from rest, falls a vertical distance $h = 55.0 \text{ cm}$ before striking a vertical coiled spring, which it compresses an amount $Y = 15.0 \text{ cm}$. Determine the spring stiffness constant of the spring. (a) 1500 N/m (2) 1580 N/m (C) 1580 N (d) 1580 M



24. A ball of mass 2kg is attached to a string of length 4m, forming a pendulum. If the string is raised to have an angle of 30 degrees below the horizontal and released, what is the velocity of the ball as it passes through its lowest point? Hint: you can set $GPE_{Top} = KE_{Bottom}$ (But you need to find, in order to solve for the velocity, initial height of the ball by using $H = L - L\cos\theta$) (a) 5.3 m/s (b) 6.3 m/s (c) 7.3 m/s (d) None



25.

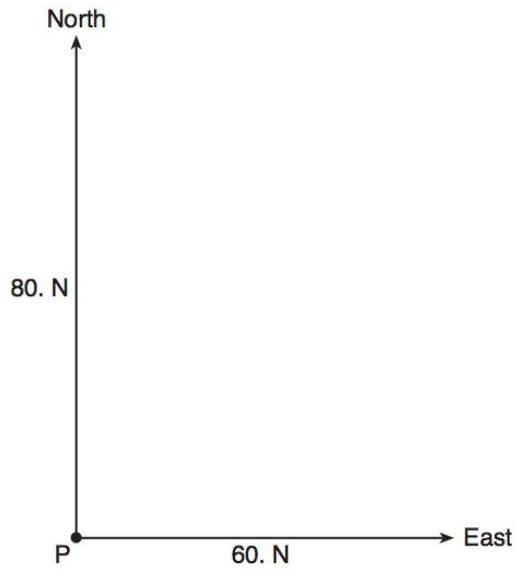
<p>Which graph best represents an object in equilibrium moving in a straight line?</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <p>(1)</p> </div> <div style="width: 50%;"> <p>(3)</p> </div> <div style="width: 50%;"> <p>(2)</p> </div> <div style="width: 50%;"> <p>(4)</p> </div> </div>	<p>Extra Credit (20 Points)</p> <p>Base your answers to questions 51 through 54 on the information below and the scaled vector diagram in your answer booklet:</p> <p>Two forces, a 60.-newton force east and an 80.-newton force north, act concurrently on an object located at point P, as shown.</p> <p>51. Using a ruler, determine the scale used in the vector diagram.</p> <p>52. Draw the resultant force vector to scale on the diagram in your answer booklet. Label the vector "R."</p> <p>53. Determine the magnitude of the resultant force, R.</p> <p>54. Determine the measure of the angle, in degrees, between north and the resultant force, R</p>
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Record your answers for Part B-2 and Part C in this booklet.

Part B-2

51 1.0 cm = _____ N

52



53 _____ N

54 _____ °

NOTE: Total possible points= 120. However, you can earn maximum of 110 points in T19.