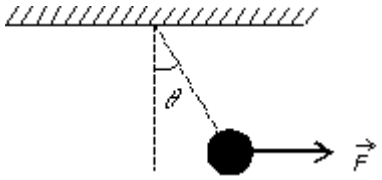
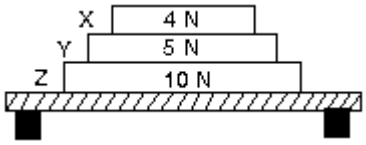
1. A 1000-kg elevator is descending (moving downward) and its speed is increasing at 4 m/s^2. The tension in the elevator cable is:
   A) 6800 N
   B) 1000 N
   C) 5800 N
   D) 9800 N
   E) none of these

2. A 3-N pendulum bob is held at an angle θ from the vertical by a 4-N horizontal force F as shown. The tension in the string supporting the pendulum bob (in newtons) is:



   A) cos θ
   B) 2/cos θ
   C) 5
   D) 1
   E) none of these

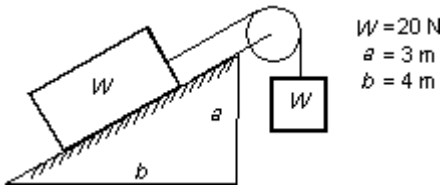
3. Three books (X, Y, and Z) rest on a table. The weight of each book is indicated. The force of book Y on book X is:



   A) 0
   B) 5 N
   C) 9 N
   D) 14 N
   E) none of these

4. A crate resting on a rough horizontal floor is to be moved horizontally. The coefficient of static friction is 0.24. To start the crate moving with the weakest possible applied force, in what direction above the horizontal should the force be applied?
   A) 13.50
   B) 25.6°
   C) 20.4°
   D) 17.9°
   E) none of these

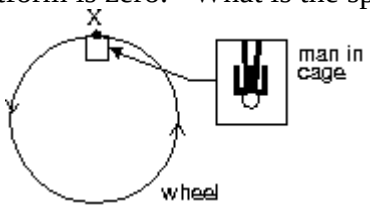
5. Two blocks of equal weight (20 N each) are indicated in the figure. The block on the ramp is accelerating up the ramp at a rate of 3.34 m/s^2. The tension (in N) is the string is:



A) 14.78
B) 20.38
C) 13.18
D) 16.90
E) none of these

6. An object is moving at the end of a string in a horizontal circular path. The tension in the string is 2000 N. If the mass of the object is halved, the speed tripled and the radius doubled, the new tension (in N) in the string will be:
A) 9,000
B) 18,000
C) 2,000
D) 4,500
E) none of these

7. A giant wheel, 25 m in radius, is fitted with a cage and platform on which a man can stand. The wheel rotates at such a speed that when the cage is at X (as shown) the force exerted by the man on the platform is zero. What is the speed of the man?



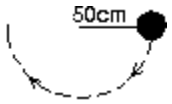
A) 11.43 m/s
B) 15.65 m/s
C) 28.55 m/s
D) 80.87 m/s
E) none of these

8. One end of a 1.6-m string is fixed, the other end is attached to a 2.0-kg stone. The stone swings in a vertical circle, passing the bottom point at 4.0 m/s. The tension force of the string (in newtons) at this point is about:
   A) 19.2
   B) 23.4
   C) 29.8
   D) 39.6
   E) none of these

9. A 0.60-kg particle moves along the x axis. Its potential energy is given by $U(x) = 5x^2$, where U is in joules and x is in meters. If the particle has a speed of 3.0 m/s when it is at $x = 1.2$ m, its speed when it is at the origin is:
   A) 5.74 m/s
   B) 2.51 m/s
   C) 3.87 m/s
   D) 7.92 m/s
   E) none of these

10. A 0.50-kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. When the spring is 0.04 m longer than its equilibrium length, the speed of the block is 0.60 m/s. The greatest speed of the block is:
   A) 0.23 m/s
   B) 0.32 m/s
   C) 0.55 m/s
   D) 0.78 m/s
   E) 0.93 m/s

11. The string in the figure is 50 cm long. When the ball is released from rest, it swings along the dotted arc. How fast is it going at the lowest point in its swing?



   A) 2.0 m/s
   B) 2.2 m/s
   C) 3.1 m/s
   D) 4.4 m/s
   E) 6.0 m/s

12. The potential energy of a body of mass m is given by $U = -mgx + 1/2kx^2$. The corresponding force is:
    A) $-mgx^2/2 + kx^3/6$
    B) $mgx^2/2 - kx^3/6$
    C) $-mg + kx/2$
    D) $-mg + kx$
    E) $mg - kx$

13. A 0.04-kg ball is released from rest 100 m above the surface of the Earth. Just before it hits the surface its speed is 24 m/s. How much heat energy did the ball and the air acquire, in joules?
    A) 19.9
    B) 22.6
    C) 27.7
    D) 45.5
    E) none of these

14. A man is marooned at rest on level frictionless ice. In desperation, he hurls his shoe to the right at 15 m/s. If the man's mass is 73.5 kg and the shoe's mass is 0.4 kg, the man moves to the left at a speed of approximately:
    A) 0.2 m/s
    B) 0.3 m/s
    C) 0.6 m/s
    D) 1.1 m/s
    E) none of these

15. A 4.21-g bullet traveling horizontally at 400 m/s hits a 2.45-kg wooden block, which is initially at rest on a smooth horizontal table. The bullet buries itself in the block without passing through. The speed of the block after the collision is:
    A) 0.33 m/s
    B) 0.40 m/s
    C) 0.69 m/s
    D) 0.86 m/s
    E) none of these

16. Blocks A and B are moving toward each other along the *x* axis. A has a mass of 2.0 kg and a velocity of 50 m/s, while B has a mass of 4.0 kg and a velocity of –25 m/s. They suffer an elastic collision and move off along the *x* axis. The kinetic energy transferred from B to A during the collision is:
    A) 0
    B) 100 J
    C) 500 J
    D) 750 J
    E) 1000 J

17. The momentum of a an object at t = 0 s is 2.0 kg-m/s. At that moment, a time-varying force given by $F(t) = 2t^2\ln(t + 1)$, where t is in seconds, and F is in newtons, begins to act on the object. What will be the momentum (in kg-m/s) of the object when t = 1.2 seconds?
    A) 7.4
    B) 5.1
    C) 6.2
    D) 2.7
    E) none of these

18. A 1200-kg car is traveling at 11 m/s along a horizontal road when the brakes are applied. The car skids to a stop in 4.0 s. How much work (in joules) was done on the car in this time?
    A) 4.8×10^4 J
    B) 5.9×10^4 J
    C) 1.2×10^5 J
    D) 7.3×10^4 J
    E) none of these

19. A 40-N force pulls at an angle of 38 degrees above the horizontal on a 12-kg block that slides over a horizontal surface. The coefficient of kinetic friction is 0.22. What is the acceleration of the block, in m/s^2?
    A) 0.75
    B) 0.92
    C) 1.21
    D) 1.45
    E) none of these

20. A 4-kg object is at rest at x = 0. At that time, a force $F(x) = 3x^2 e^x$ begins to act on the object, where F is measure in newtons, and x is in meters. What will be the object's speed (in m/s) when x = 1.4 m?
    A) 2.01
    B) 6.54
    C) 8.45
    D) 4.58
    E) none of these