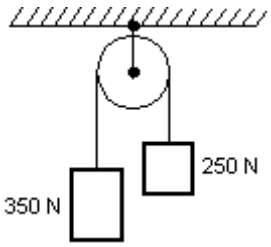
1. A 5-kg block is suspended by a rope from the ceiling of an elevator accelerates downward at 3.0 m/s^2. The tension force of the rope on the block is:
   A) 15 N, up
   B) 34 N, up
   C) 34 N, down
   D) 64 N, up
   E) 64 N, down

2. A man weighing 700 Nb is in an elevator that is accelerating upward at 4 m/s^2. The force exerted on him by the elevator floor is:
   A) 71 N
   B) 290 N
   C) 410 N
   D) 700 N
   E) 990 N

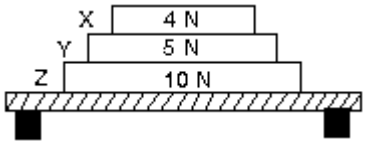
3. A 90-kg man stands in an elevator that is moving up at a constant speed of 5.0 m/s. The force exerted by him on the floor is about:
   A) zero
   B) 90 N
   C) 880 N
   D) 450 N
   E) 49 N

4. Two blocks weighing 250 N and 350 N respectively, are connected by a string that passes over a massless pulley as shown. The tension in the string is:



   A) 210 N
   B) 290 N
   C) 410 N
   D) 500 N
   E) 4900 N

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



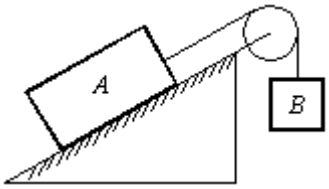
A) 0
B) 5 N
C) 9 N
D) 14 N
E) 19 N

6. A car is traveling at 15 m/s on a horizontal road. The brakes are applied and the car skids to a stop in 4.0 s. The coefficient of kinetic friction between the tires and road is:
A) 0.38
B) 0.69
C) 0.76
D) 0.92
E) 1.11

7. A 12-kg crate rests on a horizontal surface and a boy pulls on it with a force that is 30° below the horizontal. If the coefficient of static friction is 0.40, the minimum magnitude force he needs to start the crate moving is:
A) 44 N
B) 47 N
C) 54 N
D) 56 N
E) 71 N

8. A box rests on a rough board 10 meters long. When one end of the board is slowly raised to a height of 6 meters above the other end, the box begins to slide. The coefficient of static friction is:
A) 0.8
B) 0.25
C) 0.4
D) 0.6
E) 0.75

9. Block A, with a mass of 10 kg, rests on a 35° incline. The coefficient of static friction is 0.40. An attached string is parallel to the incline and passes over a massless, frictionless pulley at the top. The largest mass m_B, attached to the dangling end, for which A remains at rest is:



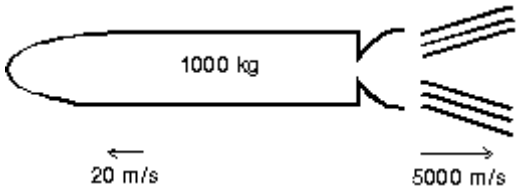
A) 2.5 kg
B) 3.5 kg
C) 5.9 kg
D) 9.0 kg
E) 10.5 kg

10. The iron ball shown is being swung in a vertical circle at the end of a 0.7-m string. How slowly, in ft/s, can the ball go through its top position without having the string go slack?

A) 1.3 m/s
B) 2.6 m/s
C) 3.9 m/s
D) 6.9 m/s
E) 9.8 m/s

11. Block A, with a mass of 4 kg, is moving with a speed of 2.0 m/s while block B, with a mass of 8 kg, is moving in the opposite direction with a speed of 3 m/s. The center of mass of the two block-system is moving with the velocity of:
A) 1.3 m/s in the same direction as A
B) 1.3 m/s in the same direction as B
C) 2.7 m/s in the same direction as A
D) 1.0 m/s in the same direction as B
E) 5.0 m/s in the same direction as A

12. A 1000-kg space probe is motionless in space. To start moving, its main engine is fired for 5 s during which time it ejects exhaust gases at 5000 m/s. At the end of this process it is moving at 20 m/s. The approximate mass of the ejected gas is:

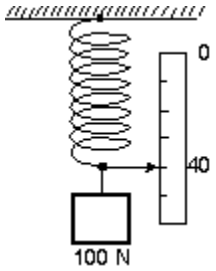


A) 0.8 kg
B) 4 kg
C) 5 kg
D) 20 kg
E) 25 kg

13. A 3.00-g bullet traveling horizontally at 400 m/s hits a 3.00-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) 1.33 m/s
B) 0.40 m/s
C) 12.0 m/s
D) 40.0 m/s
E) 160 m/s

14. A particle moves 5 m in the positive *x* direction while being acted upon by a constant force
¢ = (4 N)3 + (2 N)z – (4 N)y. The work done on the particle by this force is:
A) 20 J
B) 10 J
C) –20 J
D) 30 J
E) is impossible to calculate without knowing other forces

15. An ideal spring, with a pointer attached to its end, hangs next to a scale. With a 100-N weight attached, the pointer indicates "40" on the scale as shown. Using a 200-N weight instead results in "60" on the scale. Using an unknown weight X instead results in "30" on the scale. The weight of X is:



A) 10 N
B) 20 N
C) 30 N
D) 40 N
E) 50 N

16. A 4-kg cart starts up an incline with a speed of 3 m/s and comes to rest 2 m up the incline. The total work done on the cart is:
A) 6 J
B) 8 J
C) 12 J
D) 18 J
E) impossible to calculate without more information

17. A 1.5 kg crate falls from a height of 2.0 m onto an industrial spring scale with a spring constant of 1.5×10^5 N/m. At its greatest compression the reading on the scale is:
A) 15 N
B) 30 N
C) 1.5×10^3 N
D) 2.1×10^3 N
E) 3.0×10^3 N

18. A 0.50-kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. The total mechanical energy is 0.12 J. The greatest speed of the block is:
A) 0.15 m/s
B) 0.24 m/s
C) 0.49 m/s
D) 0.69 m/s
E) 1.46 m/s

19. A small object slides along the frictionless loop-the-loop with a diameter of 3 m. What minimum speed must it have at the top of the loop?

A) 1.9 m/s
B) 3.8 m/s
C) 5.4 m/s
D) 15 m/s
E) 29 m/s

20. The potential energy of a 0.20-kg particle moving along the x axis is given by

$U(x) = (8.0\text{J/m}^2)x^2 + (2.0\text{J/m}^4)x^4$.

When the particle is at x = 1.0 m its magnitude of its acceleration is:
A) 120 m/s^2
B) –80 m/s^2
C) 80 m/s^2
D) –40 m/s^2
E) 40 m/s^2

Answer Key

1. C
2. E
3. C
4. B
5. C
6. A
7. A
8. E
9. D
10. B
11. B
12. B
13. B
14. A
15. E
16. D
17. E
18. D
19. B
20. D