

6. A 3000 kg elevator is initially moving up at 10 m/s. The tension in the elevator cable is $T = 15,000$ N. If the initial height of the elevator is 100 m, what is its height 3 s later?



- (1) 108 m (2) 127 m (3) 93 m (4) 82 m (5) 62 m

7. In the previous problem, a 50 kg lady stands on a scale in the elevator. What is the reading on the scale, in N?

- (1) 250 (2) 350 (3) 450 (4) 550 (5) 650

8. A 15 kg block accelerates from rest at a rate of 2 m/s^2 across a horizontal surface, due to a horizontal applied force $F = 75$ N. What is the value of the coefficient of kinetic friction?



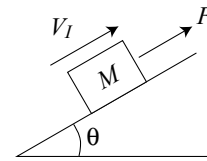
- (1) 0.3 (2) 0.45 (3) 0.6 (4) 0.75 (5) 0.9

9. A 15 kg block accelerates from rest at a rate of 2 m/s^2 across a horizontal surface, due to a horizontal applied force $F = 75$ N. How much work is done by friction during the first 10 s of motion?



- (1) -4500 J (2) -3500 J (3) $+4000$ J (4) -2000 J (5) -1000 J

10. A block of mass $M = 50$ kg is initially moving with speed 10 m/s up along an incline that makes an angle $\theta = 30^\circ$ with respect to the horizontal. An applied force $F = 200$ N acts on the block in the upward direction along the incline. The coefficient of kinetic friction is 0.6. How far along the incline does the block move before its speed drops to zero?

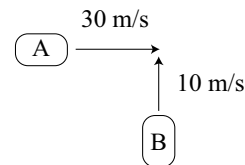


- (1) 8.3 m (2) 6.7 m (3) 3.2 m (4) 1.3 m (5) 13.8 m

11. A massive tractor/trailer and a small auto undergo an elastic collision. The tractor/trailer's mass is 50 times greater than that of the auto. Before the collision the tractor/trailer's velocity in the x direction is $+30$ m/s. After the collision the auto's velocity is $+20$ m/s. What is the auto's velocity before the collision? (Hint: Think in terms of gap closing and opening.)

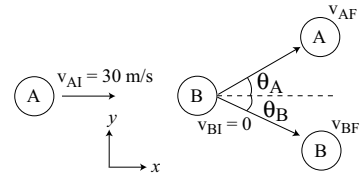
- (1) 40 m/s (2) -20 m/s (3) 20 m/s (4) 30 m/s (5) 50 m/s

12. A 2000 kg auto is initially moving with velocity 30 m/s in the positive x direction. A 3000 kg auto is initially moving with velocity 10 m/s in the positive y direction. The autos undergo a completely inelastic sticking collision. What is the kinetic energy of the two autos after the collision?



- (1) 4.5×10^5 J (2) 1.6×10^4 J (3) 2.4×10^3 J (4) 6.3×10^5 J (5) 8.8×10^4 J

13. Two equal-mass autos A and B undergo a 2-dimensional collision. Before the collision, B is at rest and A is moving along the x axis with velocity 30 m/s. After the collision, the y-component of the velocity of A is 10 m/s, and the x-component of the velocity of B is 20 m/s. What is the value of the angle θ of the final velocity of A with respect to the x axis?



- (1) 45° (2) 30° (3) 15° (4) 60° (5) 75°
14. A wheel spins up from rest to 300 rpm in 10 s. What is its angular acceleration in rad/s^2 ?
- (1) 3.14 (2) 1.21 (3) 8.39 (4) 0.64 (5) 12.42
15. A auto accelerates from rest to 30 m/s in 6 s. During this time its tires rotate through a total angle of 270 radians (no slipping). What is the radius of the tires? (Hint: consider the distance that the auto travels.)
- (1) 0.33 m (2) 0.28 m (3) 0.46 m (4) 0.21 m (5) 0.14 m
16. A satellite is in a circular orbit around planet X. The radius of its orbit is R_I and the satellite's speed is 10^4m/s . The satellite is then moved to a new orbit of radius $4R_I$. What is the satellite's speed in its new orbit?
- (1) $5 \times 10^3 \text{m/s}$ (2) $6 \times 10^4 \text{m/s}$ (3) $2.5 \times 10^3 \text{m/s}$ (4) 10^3m/s (5) 10^5m/s