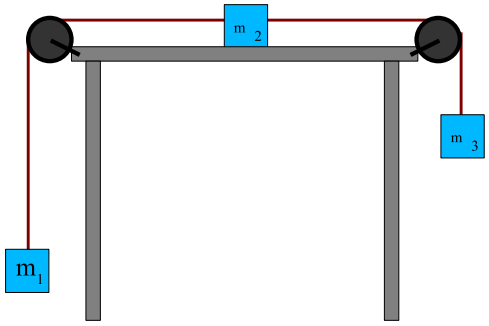
PHY 231C, INTRODUCTORY PHYSICS I, EXAM II, Oct. 13, 2003

Choose the best answer. For T/F problems, choose only ONE answer.

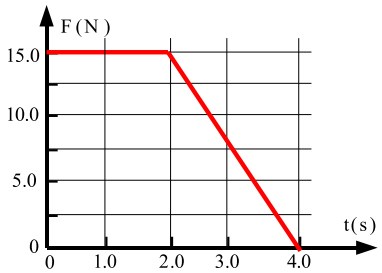


1. Consider the three masses ($m_1 = 1$ kg, $m_2 = 2$ kg, $m_3 = 3$ kg) attached by light ropes which drape over the pulleys as shown above. If m_2 slides without friction along the table, what is the magnitude of its acceleration?

   (a) 19.2 m/s^2
   (b) 9.8 m/s^2
   (c) 4.9 m/s^2
   (d) 3.27 m/s^2
   (e) 1.63 m/s^2

2. Consider the same figure from the previous problem. What is the minimum coefficient of static friction between m_2 and the table that will allow the masses to remain fixed?

   (a) 0.167
   (b) 0.333
   (c) 0.5
   (d) 1.0
   (e) 1.5

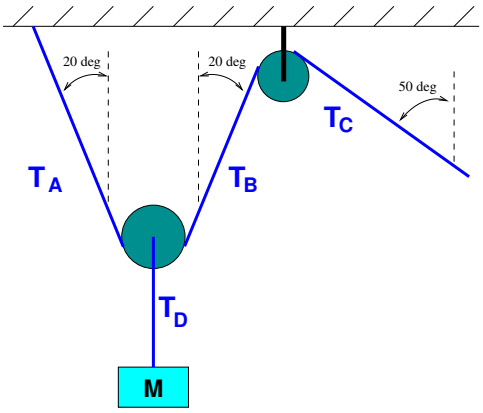


3. A particle of mass 3.0 kg has an velocity of -10 m/s at time $t = 0$. If it is acted on by the force shown above, what is its velocity at time $t = 4$ s?

   (a) -7.5 m/s
   (b) 0 m/s
   (c) 5 m/s
   (d) 10 m/s
   (e) 25 m/s

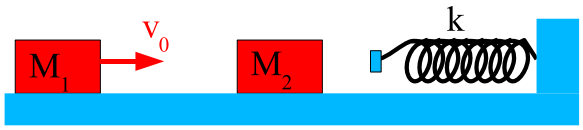
4. The rotor on a helicopter has a radius of 8.0 m and rotates at 480 revolutions per minute. What is the speed of the tip of the rotor? Give the answer as a fraction of the speed of sound, $v_{\text{sound}} = 343$ m/s.

   (a) 0.80
   (b) 1.17
   (c) 1.94
   (d) 3.10
   (e) 7.34



5. Consider the pulley system above which is holding the mass M in equilibrium. Assume each pulley is massless. Choose the ONE statement which is FALSE.

   (a) $T_D = Mg$
   (b) $T_A = T_C$
   (c) $T_A + T_B > Mg$
   (d) The force between the small pulley and the ceiling is greater than Mg.
   (e) $T_C < Mg$.



6. The mass M_1 enters from the left with velocity v_0 and strikes a mass $M_2 > M_1$ which is initially at rest. The collision between the blocks is perfectly elastic. The mass M_2 then compresses the spring an amount x. Which ONE statement is FALSE.

   (a) Immediately after the collision the mass M_1 will move to the left.
   (b) The kinetic energy of M_2 immediately AFTER the collision is less than the kinetic energy of M_1 BEFORE the collision.
   (c) The magnitude of the momentum of M_2 immediately AFTER the collision is greater than the magnitude of the momentum of M_1 BEFORE the collision.
   (d) The magnitude of the momentum of M_1 immediately AFTER the collision is less than the magnitude of the momentum of M_1 BEFORE the collision.
   (e) The maximum energy stored in the spring equals the initial kinetic energy of M_1.

7. Consider twins named Bert and Ernie who are visiting a planet name Beta Sesame. Bert is at a distance R from the star standing on the planet's highest mountaintop, while Ernie is located a distance $2R$ in a spaceship moving in a stationary circular orbit. Assume the planet is not rotating. Which ONE statement is TRUE?

   (a) Ernie's acceleration is zero.

   (b) If Ernie were to step on a bathroom scale in the spaceship, the scale would register zero.

   (c) The gravitational force experienced by Ernie acts parallel to his velocity.

   (d) The gravitational attraction from Alpha Sesame acts with twice the force on Bert than on Ernie.

   (e) If Bert were to hitch a ride on another spaceship orbiting the planet at a radius of R, Bert's spaceship would circle the planet in exactly the same time as Ernie's spaceship.

8. Bert and Ernie are both in stationary circular orbits about the star Alpha Sesame. Bert's orbit is at radius R while Ernie's orbit is at a radius $4R$. Which ONE statement is TRUE?

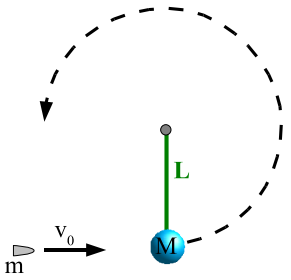
   (a) The period of Ernie's orbit equals the period of Bert's orbit.

   (b) The period of Ernie's orbit is twice the period of Bert's orbit.

   (c) The period of Ernie's orbit is 4 times the period of Bert's orbit.

   (d) The period of Ernie's orbit is 8 times the period of Bert's orbit

   (e) The period of Ernie's orbit is 16 times the period of Bert's orbit.



9. A bullet of mass $m = 15$ g moving with an initial velocity v_0 is shot into a pendulum bob of mass $M = 75$ g. The bullet becomes lodged into the bob. The pendulum bob is suspended by a light stiff rod of length $L = 2.45$ m. What is the minimum value of v_0 such that the pendulum bob will barely swing through a complete vertical circle?

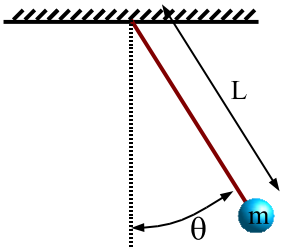
   (a) 58.8 m/s

   (b) 124.6 m/s

   (c) 356.3 m/s

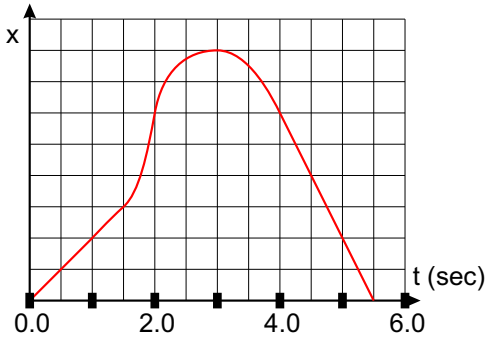
   (d) 485.0 m/s

   (e) 611.9 m/s



10. Consider the conical pendulum above, a mass on the end of a string, with the other end of the string fixed to the ceiling. Given the proper push, this pendulum can swing in a circle at an angle θ of 40° with respect to the vertical, maintaining the same height throughout its motion. If the mass of the penduulum is $m = 4.0$ kg, and the length of the string is $L = 0.64$ m, what is the speed of the mass as it swings?

    (a) 0.0543 m/s
    (b) 1.84 m/s
    (c) 26.8 m/s
    (d) 37.3 m/s
    (e) 111.2 m/s



11. Consider the graph of position vs. time above. Which statement is false?

    (a) For $0 < t < 3$ s, the velocity is positive.
    (b) At $t = 3$ s, the acceleration is negative.
    (c) For $4 < t < 5.5$ s, the acceleration is zero.
    (d) At $t = 3$ s, the velocity is zero
    (e) For all times shown on the graph, the acceleration is zero or less than zero.