4U Physics : Review Problems - Part 1

Ramps and Friction

1. A 3.0 Kg mass is on a ramp inclined up 25° to the horizontal. When released, the mass accelerates at 0.589 m/s^2.
   Find the coefficient of friction between the ramp and the mass.
2. A 65.0 kg mass is on a ramp inclined up 43° to the horizontal. The coefficient of friction between the ramp and the mass is 0.25.
   Find the acceleration of the mass down the ramp when it is released.

Projectiles

3. A 10.0 kg projectile is launched at an angle of 36.9° to the horizontal at a velocity of 7.5 m/s. The projectile is launched from a cliff edge 100.0m above the flat ground below.
   a. Find the vertical component of the velocity vector.
   b. Find the horizontal component of the velocity vector.
   c. Determine the time the projectile is in the air.
   d. How far away from the cliff face, does the projectile land on the flat plain below?
   e. What is the velocity vector that the projectile lands with? (don't forget the angle).

Centripetal Force

4. A 3.98 kg mass is spun on a string in a vertical circle that has a radius of 1.99 m at a velocity of 9.0 m/s. Use up as the positive direction.
   Find the tension in the string at the top and the bottom of the circle.
5. A 2.00 kg mass is spun on a string in a vertical circle that has a radius of 0.804 m at a velocity of 6.0 m/s. Use up as the positive direction.
   a. Find the tension in the string at the top and the bottom of the circle.
   b. Confirm your answer using the difference in the tensions.

Momentum

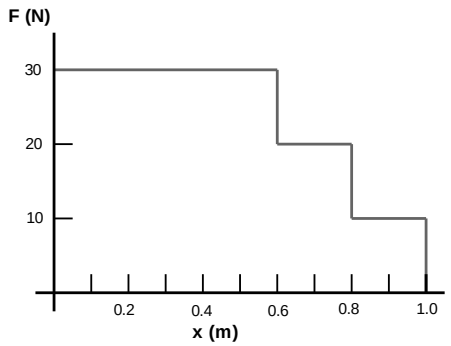
6. A stationary 6.0 kg object blows apart into three parts. The three parts move away from each other on a level plane. A 2.0kg piece moves away at 3.0 m/s [N30°W] and a 1.0 kg piece moves away a 5.0m/s [W25°N].
   a. Write the momentum statement for this situation.
   b. Determine the velocity of the third piece.

Collisions

7. A 2.0 kg cart is moving on a frictionless surface at 5.0 m/s [E] and is struck by a 4.0kg cart moving at 1 m/s [W]. Let [E] be the positive direction. This is an elastic collision. Find the velocity of each of the carts after the collision.

F-x Graphs

8. A 4.0 kg mass is travelling East at 4.47 m/s and hits a stationary 1.7kg mass. The 4.0 kg mass has a 1.0m spring front bumper with a force distance graph as shown below. Find out the minimum length that the bumper compresses down to?



ANSWERS :

1. $\mu=0.4$
2. $a=4.9\ m/s^2$
3a. $V_{vi}=4.5\ m/s$ b. $V_h=6.0\ m/s$ c. $t=5.0s$ d. $d_h=30m$ e. 45m/s[82°BH]
4. $T_{top}=123N$[down] $T_{bottom}=201N$[up]
5a. $T_{top}=70N$[down] $T_{bottom}=109N$[up] b. difference in tension = $2F_g=2(2kg)(9.8m/s^2)=39N$
6a. $m_1v_1+m_2v_2+m_3v_3=0$ b. $v_3=3.5m/s$[E44°S]
7. $V_1'=-3.0m/s$ $v_2'=3.0\ m/s$
8. $x=0.4m$