

Name: ____ (Answers) _____

PHYS 2211 – Exam 2
March 5, 2008

*Please solve all five problems below. You must **show all your work** to get full credit. You may use a calculator and a 3" x 5" index card for reference. A cell phone may not be used as a calculator. Exam duration: 55 min.*

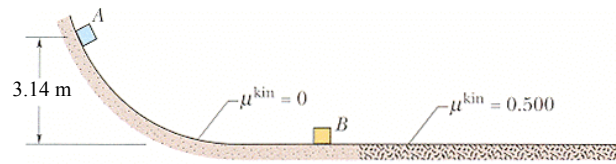
1. A proton with a speed of 550 m/s collides elastically with another proton initially at rest. The projectile and target protons then move along perpendicular paths, with the projectile path at 30° from the original direction.
- (a) What is the speed of the target proton after the collision?
 - (b) What is the speed of the projectile proton after the collision?

[(a) 275 m/s, (b) 476 m/s]

2. A 1200 kg automobile starts from rest on a horizontal road and gains a speed of 75 km/h in 35 s.
- (a) What is the kinetic energy of the auto at the end of the 35 s?
 - (b) What is the average power required of the car during the 35 s interval?
 - (c) What is the instantaneous power at the end of the 35 s interval, assuming that the acceleration was constant?

[(a) 2.6×10^5 J, (b) 7440 W, (c) 14833 W]

3. In the figure below, block A of mass m_A slides from rest along a frictionless ramp from a height of 3.14 m and then collides with stationary block B, which has mass $m_B = 5.80 m_A$. After the collision, block B slides into a region where the coefficient of kinetic friction is 0.500 and comes to a stop in distance d within that region.



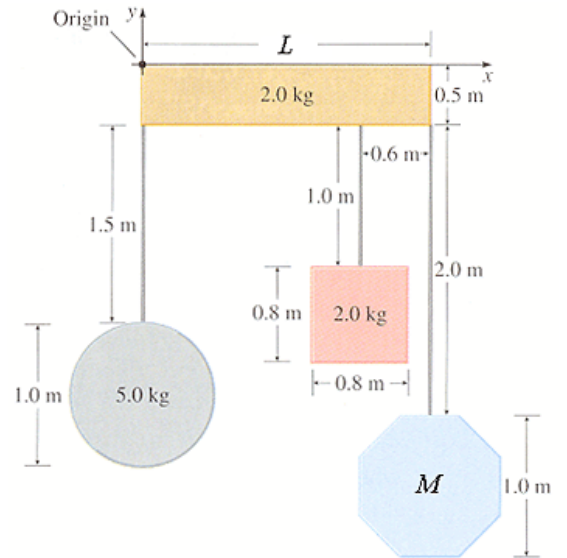
(a) What is d if the collision is elastic?

[(a) 0.543 m]

(b) What is d if the collision is completely inelastic?

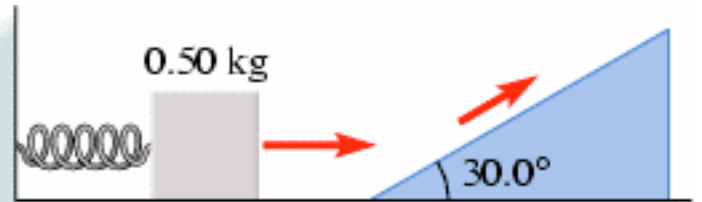
[(b) 0.136 m]

4. Belinda needs to find the center of mass of a sculpture she has made so that it will hang in a gallery correctly. The sculpture is all in one plane and consists of various shaped uniform objects with masses and sizes as shown. The length of the rectangle is $L = 1.6$ m and the mass of the octagon is $M = 2$ kg. Where is the center of mass of this sculpture? Assume the thin rods connecting the larger pieces have no mass and place the reference frame origin at the top left corner of the sculpture.



$[X_{\text{com}} = 0.618 \text{ m}, Y_{\text{com}} = -2.07 \text{ m}]$

5. A spring with $k = 10.0$ N/m is at the base of a frictionless 30.0° inclined plane. A 0.50 kg object is pressed against the spring, compressing it 0.1 m from its equilibrium position. The object is then released. If the object is not attached to the spring, how far up the incline does it travel before coming to rest and then sliding back down?



$[0.0204 \text{ m}]$