PHY 105 Test 3 December 2, 2005 55 minutes

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Do all work in the blue book! All answers must be in MKS units unless otherwise specified. Justification must be provided for any use of a conservation law, and all systems must be described.

- 1. (12 pts) A 3.2 kg projectile is fired from ground level vertically upward at 50.0 m/s. Air drag decreases the mechanical energy by 1.0 kJ during the projectile's ascent
 - a) What is the maximum height of the projectile?
 - b) Assuming the same air-drag on the way down, with what velocity will the projectile hit the ground?
- 2. (16 pts) Two 3-kg blocks move towards a stationary 8-kg block on a frictionless table as shown. The blocks are positioned in a way that leads to a simultaneous 3-mass collision.



- a) Assuming a totally inelastic collision, what is the velocity of the joined masses after the collision?
- b) What fraction of kinetic energy is lost in the collision calculated in (a)?
- 3. (14 pts) A 2.5 kg mass moving on a frictionless table at 6 m/s overtakes a 1.1 kg mass moving at 3 m/s. The masses undergo a totally elastic collision. Determine the final velocities of each mass.



4. (8 pts) Five masses are connected on a lightweight chain. Each mass is a multiple of a standard mass *m*, and the separation between each mass is *a*. Determine the center of mass of this system. Indicate where this center of mass is on the diagram.



- 5. (10 pts) A 2.0 kg particle moving in 1-D has a momentum in the x-direction that is changing in time according to $p_x = t^3 + 2t 1$ kg m/s
 - a) How fast is the object moving at t = 0? At t = 3?
 - b) What is the average acceleration of the mass over the first 3 seconds?
 - c) Use Newton's formulation of his Second Law to determine the net force (in the x-direction) on the object as a function of time
- 6. (10 pts) A block of mass *m* is given an initial velocity down an inclined plane as shown. Because of friction, the mass stops when it reaches the bottom of the incline. Determine an expression for ΔE_{th} in terms of the parameters in the diagram and *g*.

