Name: _____

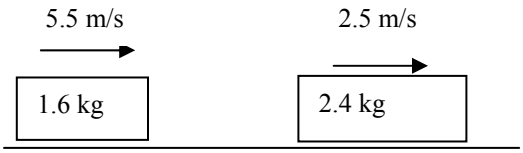
PHY 105 Test 3 November 25, 2003 60 minutes

La Salle University
Dr. R. DiDio

Do all work in the blue book!

1. (**20 pts**) An object of volume V and density ρ (less than the density of water) is suspended above the floor of a lake by a steel cable.
   a) If the cable breaks, the object shoots to the surface. Assume that it rises a distance h to the surface. Calculate the work done by gravity and the work done by the buoyant force.
   b) If the block + earth is considered the system, what is the net work done on the system as the block moves to just below the surface? Does this net work increase the total energy of the system? If so, what energy is increased (i.e. kinetic, potential, internal)

2. (**20%**) Two blocks move across a frictionless surface as shown.
   a) Calculate the final velocity of each block if an elastic collision occurs.
   b) Calculate the final velocity of both blocks if a totally inelastic collision occurs.
   c) Calculate the % kinetic energy lost in (b)



3. (**14%**) The wind at the Thule Air Base in Greenland can reach up to 115 m/s (approx. 250 mph). All barracks are secured into the permafrost with steel cables, and windows are small and round, with radii of 12 cm.
   a) Assuming atmospheric pressure when the wind is not blowing (1.01×10^5 Pa), what is the pressure just outside a window when the wind is gusting at its maximum speed?
   b) Assuming atmospheric pressure inside the barracks, what is the net outward force on a barracks window when the wind is gusting at maximum speed?

4. (**16%**) A karate expert breaks a pine board, 2.2 cm thick, with a hand chop. The hand is 540 g and strikes the top of the board with a speed of 9.5 m/s. The hand comes to rest 2.8 cm below this level.
   a) What is the time duration of the chop? (And what assumptions are you making in doing this calculation?)
   b) What is the impulse delivered to the hand by the board? (Calculate magnitude and indicate direction)
   c) What average force is applied to the board by the chop?

5. (**20 pts**) The first Goodyear blimps, built in the 1930's, had volumes of 1.84×10^5 m^3, and a mass of 193,000 kg (this mass includes skin, control cabin, engines, and cargo). The blimps were flown with He as the gas.
   a) What was the total flying weight of the blimps when filled?
   b) What is the magnitude of the buoyant force on the blimps?
   c) How much more cargo could the blimp carry if the He were replaced with Hydrogen?

$\rho_{air} = 1.21$ kg/m^3, $\rho_{He} = 0.160$ kg/m^3, $\rho_H = 0.0810$ kg/m^3