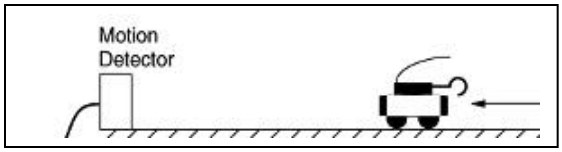
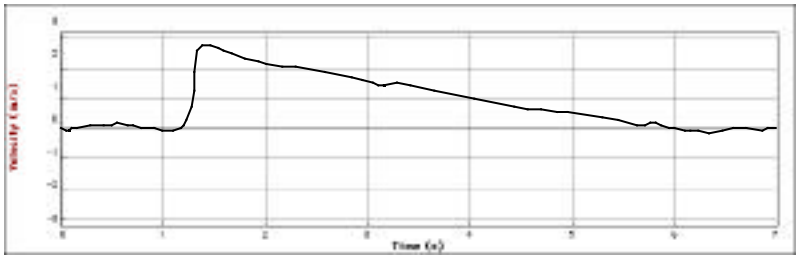
Name:_____ Posting Code _____ _____ _____

Solve the following problems in the space provided. Use the back of the page if needed. Each problem is worth 10 points. You must show your work in a logical fashion starting with the correctly applied physical principles which are on the last page. Your score will be maximized if your work is easy to follow because partial credit will be awarded.

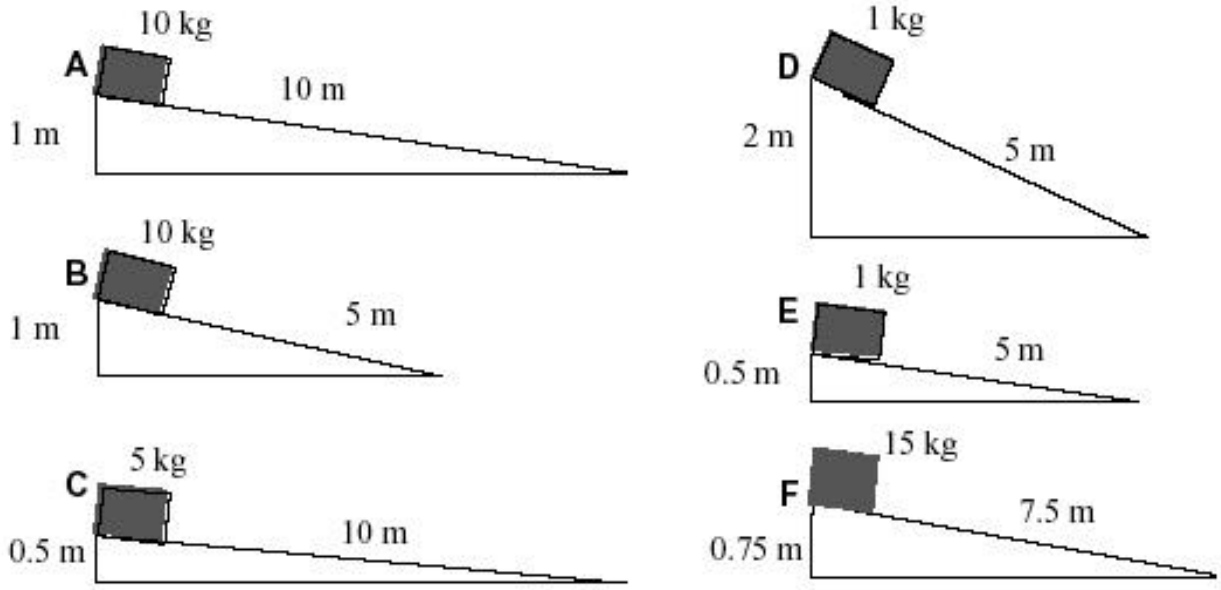
1. A coin slides off a 1.20m high horizontal counter and strikes the floor 45.0cm from the base of the counter. Find (a)the time the coin is in the air and (b)the speed that the coin left the counter.

2. A cart of mass 350g is given a push in front of a motion detector. The resulting velocity versus time graph for the cart is shown. Find (a)the frictional force and (b)the coefficient of kinetic friction.



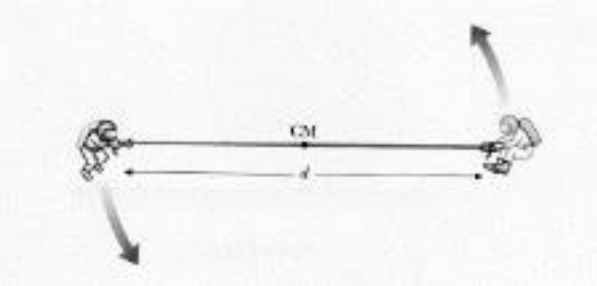


3. Rank, in order from greatest to least, the final kinetic energies of the sliding masses the instant before they reach the bottom of the incline. All surfaces are frictionless. All masses start from rest. For full credit, you must explain your reasoning.



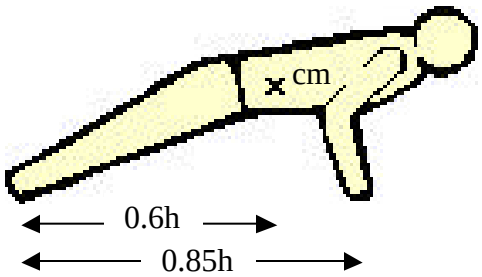
4. A billiard ball traveling at 5.00m/s collides with a stationary ball of the same mass. The incoming ball heads off at 30.0˚ to the original direction of motion while the other ball heads off at a 60.0˚ angle. Find (a)the speeds of each of the balls after the collision and (b)determine if the collision is elastic.

5. Two astronauts each have a mass of 75.0kg are initially connected by a 10.0m long rope of negligible mass. They are isolated in space and orbit their center of mass with a speed of 5.00m/s. Find (a)the acceleration of each astronaut and (b)the tension in the rope.



6. The two astronauts from problem 5 begin to pull in on the rope until they are only 5.00m apart. Find (a)their final speed, (b)their initial kinetic energy (c)their final kinetic energy and (d)the work they have done.

7. A 50.0kg athlete about to do a push-up lies horizontally with only her hands and toes touching the ground. Her center of mass is 60% of the way from her toes to her head and her hands are 85% of the way. Find (a)the force that ground exerts on her hands and (b)the force that her hands must exert on the ground.



8. A friend wants to make a pendulum with a period of 0.500s. Find (a)the length of string that she needs and (b)the mass she wants on the end.

9. Dish Network provides television signals from their satellites to homes equipped with small fixed dish antennas. Since the antennas are fixed, the satellite must be at the same point in the sky at all times, so it must orbit with the same period that the earth spins (24h). Find (a)the radius of orbit of these satellites and (b)explain why the dish antennas around Chico all point toward south.

10. Shown below are eight containers that have the same volume of the same liquid in them. Blocks of various solids are floating on top of the liquid. The blocks vary in both size and mass. Specific values for the masses labeled as M_b and volumes labeled as V_b of the blocks are given in each figure. Rank these situations, from greatest to least, on the basis of the buoyant force by the liquid on the blocks. That is, put first the situation that has the greatest buoyant force by the liquid on the block, and put last the situation that has the lowest buoyant force by the liquid on the block. Explain your reasoning for full credit.