FINAL. PHYS 203. Spring 2012

NAME:

SEAT NUMBER:

1. Kinematics (20 points)

A batter hits a baseball so that it leaves the bat with an initial speed $v_0 = 60.0$m/s at an initial angle $\theta = 42^o$ with the horizontal.

Find:

(a) The position of the ball and the magnitude and direction of its velocity at t=2 s. (5 points)

(b) Find the time when the ball reaches the highest point of its flight. (5 points)

(c) Find the height H and the acceleration at this point. (5 points)

(d) Find the horizontal range R. (5 points)

2. Newton's equation (20 points)

In the figure, an object of mass $m_1 = 20$ Kg moves on a surface with friction coefficient $\mu_k = 0.5$. It's connected to a mass $m_2 = 5$Kg by a massless cord that passes over a frictionless pulley. Find the acceleration of each body and the tension in the cord.

4. Fluids (20 points)

Water discharges from a horizontal pipe at the rate of $5.00 \times 10^{-3} m^3/s$. At a point in the pipe where the cross-section area is $1.00 \times 10^{-3} m^2$ the absolute pressure is 1.60×10^5 Pa. What is the cross-section area of a constriction in the pipe if the pressure there is reduced to 1.20×10^5 Pa? ($\rho_{water} = 1000$ kg/m^3).

3. Energy (20 points)

Consider the track plus a level surface as shown in the figure.

A 4 kg package is release from rest at point A and slides down on a frictionless track until it reaches point B with speed of 4.20 m/s. From point B it slides on a level surface with friction coefficient μ_k a distance of 3.00 m to point C, where it comes to rest. (a) (10 points) Calculate the height H. (b) (10 points) Calculate the coefficient of kinetic friction on the horizontal surface.

5. Temperature and heat (20 points)

A 0.500-kg block of metal with an initial temperature of 30.0°C is dropped into a container holding 1.12 kg of water at 20.0°C. If the final temperature of the block-water system is 20.4°C, what is the specific heat of the metal? Assume the container can be ignored, and that no heat is exchanged with the surroundings. [specific heat of water: $c_w = 4186$ J/(kg C)].

TEST # 3. PHYS 203. Spring 2012

NAME:

1. Springs. (35 points)

A block with mass 5.0 kg is suspended from an ideal spring having negligible mass and stretches the spring 0.20 m to its equilibrium position.

(a) (5 points) What is the force constant of the spring ? **(b) (30 points)** The spring is then stretched 0.80 m from its equilibrium position and then released with velocity zero. Calculate the velocity of the mass when the mass passes again through the equilibrium position.

3. Fluids (35 points)

Water ($\rho = 1000$ kg/m^3) enters a pipe on the ground with an inside diameter of 2 cm at a pressure of 4 x 10^5 Pa. Then a 1 cm-diameter pipe leads the water to a height of 5 m above the ground. The flow speed at the inlet is $v_1 = 1.5$ m/s

(a) (15 points) Find the flow speed at the outlet (2).

(b) (20 points) Find the pressure at the outlet (2).

4. Heat. (30 points)

(a) 20 points. Objects A and B have the same mass of 3kg. They melt when 3.0×10^4 J of heat is added to A and when 9.0×10^4 J is added to B. Determine the latent heat of fusion for the substance from which each object is made. **(b) 10 points**. Find the heat requiered to melt object A when its mass is 6Kg.

TEST # 2. PHYS 203. SPRING 2012.

NAME:

1. Energy. 35 points.

The figure shows a 1.50-kg block at rest on a ramp of height h. When the block is released, it reaches the bottom of the ramp and moves across a surface that is frictionless except for one section of width 10 cm that has a coefficient of kinetic friction $\mu_k = 0.64$. Find h such that the block's speed after crossing the rough patch is 3.50 m/s [Remember that the force of friction is $f_k = \mu_k N$, where N is the normal].

2. Momentum. 35 points.

The picture shows a collision between two pucks. Puck A has a mass of 0.025 Kg and is moving along the x axis with a velocity of 5 m/s. It makes a collision with puck B, which has a mass of 0.05kg and is initially at rest. The collision is not head-on. After the collision, the two pucks fly apart with angles shown in the figure. Find the final speed of puck A and B.

3. Rigid objects in equilibrium. 30 points.

A 5m long diving board of negligible mass is supported by two pillars. One pillar is at the end left of the diving board, the other is 1.50 m away. Find the forces exerted by the pillars when a 90-kg diver stands at the far end of the board.

TEST # 1. PHYS 203. SPRING 2012.

NAME:

1. Kinematic in 1D

You throw a ball straight up. The ball has an initial speed of 11.2 m/s when it leaves your hand.

(a) (11 points) What is the maximum height the ball reaches relative to the throwing point.

(b) (11 points) How long does it take the ball to reach this height?

(c) (6 points) What is the position of the ball at $t = 2$s?

(d) (6 points) At what height does the ball have a speed of +5m/s?

2. Kinematic in 2D

A golf ball is hit off with an initial velocity of 30 m/s at an angle of 35^o to the horizontal.

(a) (11 points) What is the maximum height reached by the ball?

(b) (11 points) What is the range?

(c) (6 points) What is the magnitude and direction of the aceleration and velocity at the maximum height?

(d) (6 points) What is the time of flight, that is, the time to reach the ground again?

3. Forces

Two blocks are connected by a string, as shown in the figure. The smooth (frictionless) inclined surface makes an angle of 35^o with the horizontal, and the block in teh incline has a mass $m_1 = 5.7$ kg. The mass of the hanging block is $m_2 = 3.2$kg.

(a) (18 points) Find the direction and magnitude of the hanging block's acceleration.

(b) (14 points) Find the tension in the rope.