Fall 2012 Physics 231 Exam 3 **Name:**

Total points: 40. Total time: 1.5 hr. Show all your work.
You must write down your answers with units in the Ans. boxes

1. (6 pt) Determine the conservative force if its potential energy is given by:

$$U(x) = \cos(ax) + e^{-bx} \ ,$$

where a and b are constants.

Ans.

2. (4pt) As a 2.0-kg object moves from $\vec{r}_1 = \left(-7\hat{i} + 2\hat{j}\right)$ m to $\vec{r}_2 = \left(8\hat{i} + 4\hat{j}\right)$ m, the constant resultant force acting on it is equal to $\vec{F} = \left(2\hat{i} - 3\hat{j}\right)$ N. If the speed of the the object at the initial position is 4.0 m/s, what is its kinetic energy at its final position?

Ans.

3. (4 pt) In a given displacement of a particle, its kinetic energy increases by 30 J while its potential energy decreases by 10 J. Determine the work of the nonconservative forces acting on the particle during this displacement.

Ans.

4. (6 pt) A 12-kg projectile is launched directly upward with an initial vertical speed of 20 m/s. It rises to a maximum height of 18 m above the launch point. How much work ids doen by the dissipative resistive force (air resistance) on the projectile during this ascent?

Ans.

5. (6 pt) Three odd-shaped blocks of chocolate have the following masses and center-of-mass coordinates: (a) 0.300 kg; (0.200 m, 0.300 m) (b) 0.700 kg; (0.400 m, -0.100 m) (c) 0.300 kg; (-0.300 m, 0.600 m) Find the y-coordinate of the center of mass of the system of three chocolate blocks.

Ans.

6. (4 pt) You are standing on a large sheet of frictionless ice and are holding a large rock. In order to get off the ice, you throw the rock directly horizontally so it has velocity relative to the earth of 12.0 m/s. If your mass is 70.0 kg and the rock's mass is 15.0 kg, what is your speed after you throw the rock?

Ans.

7. (6 pt) A 4.0-kg object moving with a velocity of 7.0 m/s in the positive x direction strikes and sticks to a 3.0-kg object moving initially with a speed of 2.0 m/s in the opposite direction. How much kinetic energy is lost in this collision?

Ans.

8. (4 pt) A 2.0-kg block sliding on a rough horizontal surface is attached to one end of a horizontal spring (k = 250 N/m) which has its other end fixed. The block passes through the equilibrium position with a speed of 2.6 m/s and first comes to rest at a displacement of 0.20 m from equilibrium. What is the coefficient of kinetic friction between the block and the horizontal surface?

Ans.