Problem Set #6 2D Kinematics and Forces
Due Thursday Oct. 10 (A/B)/Friday Oct. 11 (C/D)

Name:_____

I worked with:

Equations:

Position (constant velocity)	$s(t) = s_0 + v_0 t$
Position:	$s(t) = s_0 + v_0 t + \frac{1}{2} at^2$
Average Velocity:	$v_{avg} = \frac{s_2 - s_1}{t_2 - t_1}$
Velocity:	$v(t) = v_0 + at$
Final Velocity (time):	$v_f = v_0 + at_f$
Final Velocity (position):	$v_f^2 = v_0^2 + 2a\Delta s$
Acceleration:	$a = \frac{v_2 - v_1}{t_2 - t_1}$
Force:	$F = ma$
Acceleration due to gravity:	$9.8\ m/s^2$
Universal Gravitation:	$F = \frac{GMm}{r^2}$
Gravitational Constant:	$G = 6.67 \times 10^{-11}$
Avogadro's Number:	6.022×10^{23}

1. A 10-kg box is pushed horizontally from rest across a frictionless surface for 5 seconds by a Force (F_A) of 20-N.
    a. Draw a free-body diagram of the box **and** determine its acceleration **and** final velocity.
    b. Draw a position vs time, velocity versus time, and an acceleration vs. time graph for this scenario.

2. A 2 Kg box is put on the surface of an inclined plane at 27 ° with the horizontal. The surface of the inclined plane is assumed to be frictionless.
    a. Draw a free body diagram of the box on the inclined plane and label all forces acting on the box.
    b. Determine the acceleration a of the box down the plane.
    c. Determine the magnitude of the force exerted by the inclined plane on the box.

3. A projectile is fired at a 45º angle with an initial velocity of 50 m/s. Ignore air resistance.
    a. What is the maximum height the projectile will reach
    b. How long will it take to hit the ground?

4. (Honors) A projectile can be fired at a maximum velocity of 40 m/s. There is a small hoop suspended 15 m above the ground.
    a. At what angle must the projectile be fired so that the peak of the projectile's movement is at the same position as the hoop?
    b. How much time will it take for the projectile to reach the hoop?
    c. How far from the launch site will the projectile land
    d. What will its total speed be upon landing?