PHY2020
Fall 2013, Makeup Exam
100 points total

Name: _____

UF ID: _____

Ignore air friction in all problems.

Please give complete responses to all questions including units and theoretical justification for responses.

You must show ALL of your work to receive full credit!

Useful values and formulas:

$G = 6.7 * 10^{-11}$ N m^2 / kg^2

$M_{Earth} = 5.98 * 10^{24}$ kg
$R_{Earth} = 6378$ km

1 km = 0.62 miles = 3280.8 feet
1 m = 39.37 inches
1 kg = 2.2 lbs

Moment of Inertia
Cylinder of radius r, axis through center: 1/2 m r^2
Sphere of radius r, axis through center: 2/5 m r^2
Rod of length l,   axis through center: 1/12 m l^2
Rod of length l,   axis through end: 1/3 m l^2

101 kPa = 760 mg Hg
1 atm = 101,325 Pa

ρ_{water} = 1 g/cm^3 = 1000 kg/m^3

1 cal = 4.18 Joules

c_{water} = 1.0 kcal/kg °C

Speed of sound in dry air at 68 °F = 343 m/s
Coulomb constant: 9 x 10^9 N m^2 / C^2

1. (15 pts) A tiger leaps horizontally from a 5 m high rock with a speed of 2.5 m/s.
    a. How long does it take the tiger to reach the ground?
    b. How far away from the rock will it land?

2. (20 pts) a. What is the strength and direction of the electric field felt at a point half way between the two charges shown below?

b. What is the magnitude and direction of the electric force felt by a 1.3 mC charge placed at this point?

-2 mC   +3.7 mC

14 micrometers
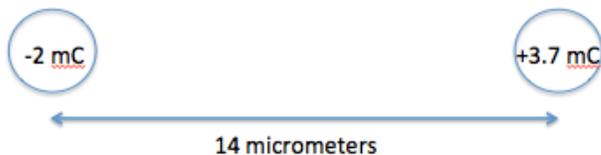
3. (8 pts) The spring in a spring gun is compressed a distance x from it's relaxed state. A ball of mass m is placed in the barrel. What will be the speed of the ball when the gun is fired?

4. (6 pts) A cricket is sitting 7 cm from the center of an album. The album is rotating at 45 rpm. What is the linear speed of the cricket?

5. (6 pts) What in the physical makeup of a material determines if the material is magnetic or non-magnetic? Explain with more than one or two words.

6. (8 pts) A person is standing stationary in a pair of high-heeled shoes. If the person weighs 150 lbs and the radius of the heel is 6 mm, find the pressure applied to the floor coming from one of the heels. You can assume all of the weight of the person is centered above the heel portion of the shoe.

7. (6 pts) How much heat is generated when a 2520 kg car, traveling at 90 km/hr, is brought to rest?

8. (8 pts) A 12 liter container holds Oxygen gas at 45 °F. How will the pressure inside the vessel change if the temperature increases to 50 °F?

9. (7 pts) Which of the following statements are true of an object moving in a circle at a constant speed? Circle all that apply.

a. The object experiences a force that has a component directed parallel to the direction of motion.

b. If the net force acting upon the object is suddenly reduced to zero, then the object would suddenly depart from its circular path and travel tangent to the circle.

c. There can be a force pushing outwards on the object as long as the net force is pointing inward.

d. The acceleration of the object is directed tangent to the circle.

e. Inertia causes objects to move in a circle.

f. Because the speed is constant, the acceleration is zero.

g. The acceleration and the net force vector are directed perpendicular to each other.

10. (10 pts) Three light bulbs are connected to a battery as shown at the right.
    a. Which adjustments could be made to the circuit that would increase the current being measured at X? Circle all that apply.
    b. What equation(s) did you use to obtain your answer?

a. remove one of the bulbs

b. increase the voltage of the battery

c. decrease the voltage of the battery

d. increase the resistance of two of the bulbs

e. increase the resistance of one of the bulbs

f. decrease the resistance of two of the bulbs
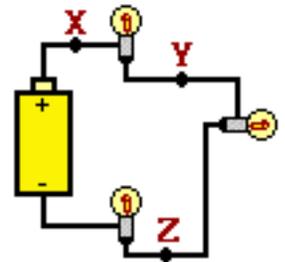
11. (6 pts) Consider Newton's second law of motion to determine which of the following statements are true. Circle all that apply.

a. If an object is accelerating to the right, the net force on the object must be directed towards the right.

b. If an object is moving to the right and slowing down, then the net force on the object is directed towards the left.

c. Accelerating objects are either slowing down or speeding up.

d. The acceleration of an object is directly dependent upon its mass and inversely dependent upon its net force.

e. An object has an acceleration of 8 m/s^2. If the net force acting upon the object is increased by a factor of 4 and the mass of the object is increased by a factor of 2, then the new acceleration would be 16 m/s^2.

f. A 10-kg object slows down from 24 m/s to a final velocity of 9 m/s in 3 seconds. The net force acting upon the object is 80 N.