Physics Final Exam Review (First Semester)

I. Simple Motion

A. Explain the difference between displacement and distance. Explain how it is possible to travel a distance, while having no displacement.
B. What is the difference between a vector and scalar quantity? Give an example of each.
C. How would you calculate an object's average speed? Average velocity? Do they have to have the same magnitude?
D. How is an object's average velocity different than its instantaneous velocity?
E. Explain in words what acceleration is measuring.
F. If an object has a negative acceleration, what conclusion can we make about the object?
G. What is meant when it is said that an object is in free fall?

II. Motion Graphs

A. The slope of a displacement time graph tells us …..
B. The slope of a velocity time graph tells us …
C. Sketch a displacement time graph that shows an object accelerating in the positive direction, then maintaining a constant positive velocity, and finally decelerating until it comes to rest.
D. Sketch the same situation as a velocity time graph.
E. How would you find the instantaneous velocity on a displacement time graph?

III. Projectile Motion

A. Describe the horizontal and vertical components of the velocity of a horizontally launched projectile from launch to landing.
B. Describe the horizontal and vertical components of the velocity of a projectile launched at an angle. (from launch to landing)
C. If an object is launched at an angle and lands at the same level as launch, then what assumptions can we make about the object's motion?

IV. Force

A. Forces are responsible for _____.
B. Define net force. Describe how you would determine the net force on an object if multiple forces were applied to the object.
C. Summarize Newton's 3 Laws of Motion into your own words. Be able to give an example of each.
D. Define inertia. Which of Newton's laws is inertia associated with?
E. If an object has a net force of 0, then …..
F. How are weight and mass different from one another? List the SI units for both.
G. When is a normal force present? What direction is it?
H. How would you calculate the normal force on an inclined surface?
I. A high coefficient of friction means what? How do you calculate the coefficient?

V. Impulse-Momentum

A. The impulse momentum theorem states …
B. How can a small force create a large change in momentum?
C. State the difference between elastic and perfectly inelastic collisions.
D. If a moving object collides with a stationary object and they move together in the same direction, then what may you conclude about their velocity?

VI. Work and Energy

A. When is work done?
B. State the work-kinetic energy theorem.
C. Explain how an object's potential and kinetic energy can change, but still follow the law of conservation of energy.
D. How does changing the mass affect an object's kinetic energy? Changing the velocity?
E. Describe potential energy and the factors that affect it.
F. Sketch the first two hills of a rollercoaster. Describe the energy transformations that take place starting from the top of the first hill, assuming no external forces are present.
G. How would the values differ if we considered friction?

VII: Problems

1. A car has an initial velocity of 17.8 m/s and comes to rest in 5.0 s. Find the average acceleration of the car.

2. A horizontally launched projectile has an initial velocity of 10 m/s. The projectile is launched 2.0 m above the ground. Calculate the following: the time it takes to hit the ground, the horizontal distance it travels, and the vertical velocity just before impact. (Hint: there are keys to include since it is horizontally launched)

3. A 2.0 kg book slides across a table. The coefficient of friction between the book and the surface is 0.25. Find the acceleration of the book. (DRAW A FREE BODY DIAGRAM TO ASSIST)

4. Repeat the problem if the book starts at rest at the top of a 15^{o} incline.

5. A 10 kg object is pulled across the floor with a force of 50 N. The object moves a total distance of 7.0 meters. Calculate the work done by the applied force and the frictional force if the coefficient of friction is 0.20. (FBD)

6. How much power was necessary to do the above work in 10 seconds?

7. A rollercoaster's first hill has a height of 100 m. The total mass of the rollercoaster is 1500 kg. A) Calculate the speed of the rollercoaster at the bottom of the first hill (neglect friction). B) What is the net work done on the rollercoaster? C) The second hill is 25 m high. Calculate the speed of the rollercoaster at this point.

8. A 5 kg object moves 8 m/s to the right. A second object, mass 3 kg, moves 6 m/s to the left. When the objects collide they stick together and move as one. Calculate the combined mass's speed and direction.

9. Use the same set up as #7. However, now the objects do not stick together after the collision. The 5 kg object continues to move in its original direction with a speed of 1 m/s after the collision. Calculate the speed and direction of the 3 kg object after the collision