Honors Physics Fall 2013 Final Exam Study Guide

DO NOT FORGET TO GO THROUGH THE WORKSHEETS AND OLD TESTS AGAIN. THEY ARE OFTEN THE BEST WAY TO PREPARE. YOU MUST BE ABLE TO DO THE PROBLEMS ON YOUR OWN.

Unit 3

Newton's Laws:

- Be able to describe each of the three laws in your own words **and understand the meaning behind your words** (i.e. how does Newton's 1st law relate to objects that are stationary, accelerating, or moving at a constant velocity?)

Breaking up forces:

- Know the method for breaking up a force (F) at an angle (θ) such as: $F_x = F\cos(\theta)$ and $F_y = F\sin(\theta)$

Balanced vs. unbalanced forces:

- Know that when all the forces balance out in a direction, the object is either stationary or traveling at a constant velocity in that direction (**and we can't know which it is!**).
- Know that if an object has unbalanced forces in any direction that the object is accelerating in that direction (**but we don't know which way it is moving**!).

Forces at an angle (dragging things across the ground):

- Remember to break up any forces at an angle.
- Remember that if an object is moving across the ground then the forces in the y-direction all balance out (i.e. $T_y + F_N = F_g$).
- You will need that F_N to calculate the friction.

Hanging Portrait Problems:

- These objects are stationary so all the horizontal forces balance and all of the vertical forces balance. So, the sum of all the upward forces must be equal in magnitude to the Fg. The sum of all the forces pulling leftward have to have the same magnitude as the sum of all the forces pulling to the right.
- Practice solving systems of equations.

Pulley Problems:

- There are two types of pulleys: a box on a ledge and an Atwood pulley system.
- Always draw free-body diagrams for each mass involved.
- Define the positive direction based on the motion of the blocks-the direction the blocks are moving is the positive direction.

- These problems often result in systems of equations where you are solving for tension and acceleration, so you must have TWO equations. This means one equation for each mass in the form of, as an example only, "3kg*a = T – 30N"

Interaction Diagrams:

- Know how to create these.
- Remember the ID's should help you draw the Free Body Diagrams.
- You should have the same number of forces on your FBD as the number of lines going into the circle in the ID.
- Know when static friction is present and when kinetic friction is present and which directions they point in for a variety of situations.
- Be able to identify 3rd law pairs—DO NOT tell me that Fg and F_N are a 3rd law pair.

Unit 4

For every part of this unit except problems that strictly use the long Fg equations, you need to identify how to write out the centripetal force (Fc) equation.

Force of gravity:

- You must know what distance to put in for the radius in this problem—it is the distance between the centers of the two objects, NOT the radius of one of the objects.
- You must know the difference between the gravitational constant (g) on the surface of a planet compared to the universal gravitational constant (G).
- You need to know which radius and mass to use when solving for (g).

Orbiting objects:

- When you need to use a velocity in an Fg question, you must set Fc = Fg (the long Fg equation).
- The r's are the same in these two equations.
- You need to know which mass to put in the Fc equation so you don't end up cancelling the wrong mass.
- Be very careful in carrying out the calculations-the radius is squared in Fg, but not in Fc.

Normal force as a centripetal force (roller coasters):

- Review setting up equations for a loop and a hill.
- Practice using these equations to solve problems.
- Make sure your answers make sense with respect to your own experiences driving in a car or riding a roller coaster.

Tension as a centripetal force:

- These are set up the same way as above by replacing F_N with T.

Static friction as a centripetal force:

- For objects running or driving in a circle, the static friction is responsible for the centripetal force. Therefore, you set Ffs = Fc.
- Remember, F_N in the Ffs equation can often be replaced by Fg, thus allowing you to cancel out the masses in Fg and Fc.