Study Guide for Physics 1100 Exam #1

Note: The exam will consist of both multiple-choice questions (about 35) and short problem solving questions (about 6). There is EXTRA CREDIT embedded within the exam.

Measurement / Variables / Hypotheses

Be able to keep track of units and be able to use conversions. For example: Given: Speed = 60 mile per hour, what is this speed in meters per second? (You would be given that 1.6 km = 1 mile, and 1000 m = 1 km).

Be able to identify the independent variable, the dependent variable, and any controlled variables in an experiment that is described and be able to evaluate the validity of such an experiment.

Newton's 1st Law of Motion

Be able to cite Newton's 1st law. What is the behavior of an object when there are no net forces (pushes or pulls) on that object?

What is "inertia"?

What does it mean to be in "equilibrium?" Distinguish between static equilibrium and dynamic equilibrium.

Linear Motion

Be able to distinguish position, displacement, path, average speed, average velocity and average acceleration. Be able to calculate these.

Distinguish between instantaneous speed and instantaneous velocity.

Be able to interpret position vs. time and velocity vs. time graphs. Be able to deduce a velocity graph from a position graph.

Be able to apply $v = at$ and $d = (1/2)at^2$ in appropriate situations.

(Take the acceleration due to gravity as 10 m/s^2 downward near the Earth's surface.)

Newton's 2nd Law of Motion

Be able to sketch a force vector diagram on an object showing all the forces that act on that object.

Be able to sketch the resultant vector from the addition of 2 or more vectors.

Be able to resolve a given vector into components parallel and perpendicular to some chosen set of coordinate axes.

Be able to distinguish between mass and weight.

Newton's 3rd Law of Motion

Be able to identify action/reaction pairs of forces. Remember action/reaction pairs act on different objects. For example: Earth pulls down on apple = Action. Then the reaction is: Apple pulls up on Earth. (Does it really make a difference which one of the pair is called the "action?")

Distinguish between internal and external forces acting on a given system.

Momentum

Be able to distinguish momentum and impulse. (Impulse is a CHANGE IN momentum).

Remember that "change in (whatever)" = $\text{whatever}_{(\text{after})} - \text{whatever}_{(\text{before})}$.
The symbol for "change in" is "Δ". The symbol for momentum is "p".
Impulse = $\Delta p = \Delta(mv)$. Also, $\Delta p = F(\Delta t)$.

Be able to deduce the outcome of a collision. That is, be able to solve problems such as PROBLEMS 2, 4, 6, 8 at the end of Chapter 6 in our textbook.

Use conservation of momentum $p_{(before)} = p_{(after)}$ for a system with no external forces acting it.

Energy

Be able to compute the work done by a force ($W = F_{(\text{parallel})}$ x displacement) and the rate at which work is done (Power = W/t).

Distinguish different forms of mechanical energy:
Kinetic Energy = $(1/2)mv^2$ Gravitational Potential Energy = mgh

Be able to solve problems such as: How fast does object go at the bottom ramp given some conditions by using conservation of energy.

Rotational Motion

Be able to distinguish rotational and linear variables (like Linear Velocity and Angular Velocity).

What is rotational inertia? What keeps an object moving in a circle? What is center-of-mass? What determines the stability of an object?

Be able to solve simple balancing problems like you did (or will do) in the lab.

What is angular momentum? (Angular momentum = $I\omega$) Be able to describe the behavior of rotating objects using conservation of angular momentum.

Gravity

Be able to calculate the gravitational force between two objects whose centers are separated by some distance. Know what it means when something obeys an "inverse-square law".

What interpretation of gravity did Albert Einstein promote?

Projectile / Satellite Motion

Be able to determine the position of an object thrown at some angle near the surface of the Earth at some later time. What are the components of the object's velocity?

How do the vertical and horizontal components of velocity behave when an object is thrown at an arbitrary angle near the surface of the Earth?

What are Kepler's Laws of Planetary Motion? What do they mean?