Physics

Final Exam Review Sheet

I. Introductory Topics

- significant digits
- *order of magnitude* estimation
- algebra review
- problem solving methodology
- *dimensional analysis*
- systems of units/unit conversions
- graphing
- right triangle trigonometry

*ACTIVITY: Measurement Using the Tools of the Lab

*LAB: Direct and Indirect Measurement

II. Vectors

- *head to tail method* of addition
- resolving a vector into components
- *component method* of addition

*LAB: The Vector Nature of Forces

III. Kinematics in 1D and 2D

- *displacement*, *velocity*, *acceleration*
- graphs of distance vs. time and velocity vs. time
- equations of kinematics in one and two dimensions
  - -draw a picture
  - -choose a positive direction
  - -make a chart to organize givens
  - -choose an equation and solve
  - -check your answer for sensibility
- projectile motion problems
- *relative speed* and *relative velocity*

*Activity: Measuring Speed and Acceleration (tape timers)

*Activity: Graphs of Speed and Acceleration With a PASCO Interface

*LAB: Target Practice with a Projectile Launcher

IV. Newton's Laws

- the **Law of inertia**, **Law of acceleration**, **Law of force-counter force**
- the Law of **Universal Gravitation**
- weight, *tension*, and normal forces
- *static* and *kinetic* frictional forces
- equilibrium applications - $\sum F = 0$
  - -draw a picture
  - -choose a positive direction
  - -write $\sum F = 0$ in each direction
  - -get as many equations as needed and solve
  - -check your answer for sensibility
- non-equilibrium applications - $\sum F = ma$
  - -draw a picture
  - -choose a positive direction
  - -write $\sum F = ma$ in each direction
  - -get as many equations as needed and solve
  - -check your answer for sensibility

*LAB: Newton's Laws With Dynamics Carts

V. Uniform Circular Motion

- define U.C.M.
- *revolution* and *rotation*
- finding the speed of an orbiting body
- calculating **centripetal force** and **centripetal acceleration**
- *centripetal* vs. *centrifugal*
- calculating the maximum speed around banked and unbanked turns
- solving problems with satellites in circular orbits
- finding *critical velocity*
- *synchronous* orbits and their periods
- solving problems with *artificial gravity* and *apparent weightlessness*
- problems involving vertical circles and *critical velocity.*
- problem-solving - $\sum F = mv^2/r$
  - -draw a picture
  - -choose a positive direction
  - -write $\sum F = mv^2/r$ in each direction
  - -get as many equations as needed and solve
  - -check your answer for sensibility
- vertical circles

•LAB: *Road Rally*…From Space

VI. Work and Energy

- *work* and energy
- kinetic energy
- gravitational and elastic potential energy
- the **Work-Energy theorem**
- the **Law of Conservation of Energy**
- problem-solving with conservation of energy
  - -draw a picture
  - -choose a zero for GPE
  - -write $E_0=E$
  - -determine which types of energy are present
  - -fill in the energy equation and solve
  - -check your answer for sensibility
- *power* is the rate of doing work
- work done by a variable force

*ACTIVITY: Energy of a Pendulum
*ACTIVITY: Simple Machines: Pulleys
*LAB: Conservation of Energy in a Spring-Mass System

VII. Impulse and Momentum

- *impulse* and *momentum*
- the **Impulse-Momentum Theorem**
  - *follow through* and air bags
- the **Law of Conservation of Momentum**
  - -draw a picture
  - -choose a positive direction
  - -write $p_0=p$
  - -fill in the momentum equation and solve
  - -check your answer for sensibility
- *elastic* and *inelastic* collisions
- collisions in one dimension
- collisions involving bouncing
- collisions in two dimensions
- center of mass

*ACTIVITY: The Incredible Egg Drop
*LAB: Collisions with Dynamics Carts

VIII. Special Relativity

- *inertial reference frames* and *events*
- the postulates of relativity
- Consequencese of relativity:
  - -simultaneity
  - -time dilation
  - -length contraction
  - -"mass" increase
  - -the *twin paradox*
- the equivalence of mass and energy
- relativistic energy and momentum
- relativistic velocity addition

*ACTIVITY: *Modeling the "big bang"*
**LAB: Hubble's Law*