Physics

Final Exam Review Sheet 2ⁿᵈ Trimester

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. Electric Forces and Fields
  • atomic particles and properties
  • interaction of charge
  • conductors and insulators
  • methods of charging
  • Coulomb's law
  • electric field theory
  • electric potential energy
  • voltage (potential difference)
  •*ACTIVITY: The Van de Graff Generator
  *LAB: Mapping an electric field

IX. DC Circuits
  • voltage and current
  • alternating and direct current
  • series and parallel circuits
  • electrical resistance
  • using Ohm's law
  • measuring voltage and current in simple circuits
  • drawing circuit diagrams

• applying Kirchhoff's laws to simple circuits
*LAB: Building and Analyzing Series and
Parallel Circuits

VIII. Special Relativity
• *inertial reference frames* and *events*
• the postulates of relativity
• Consequences 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*

PROBLEM REVIEW:

1.) A 5000 kg space ship flies by Earth at 0.87c. How much time will go by on Earth if 50.0 minutes pass on the astronaut's watch? If a person on Earth measures the moving ship to be 125m, how long will it be to a person on board? How massive will the ship appear to an observer in a ship moving in the opposite direction at 0.80c?

2.) A skier starts at the top of hill A with a speed of 5.0 m/s. The skier coasts down the hill and up hill B. The crest of the second hill is roughly circular with a radius of 40.0 m. Neglecting friction and air resistance what must be the height, h, of the first hill so that the skier just loses contact with the second hill as she passes over it (see diagram below)?
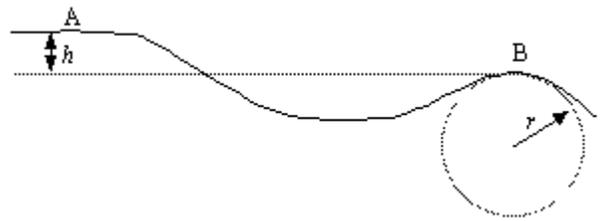
3.) A small sphere of mass 8.0 g and charge +0.60 µC is hung on a thread. A charge of -0.90 µC is placed 15 cm directly to the right of the first charge. Determine the tension in the thread and the angle that the thread will make with the vertical.
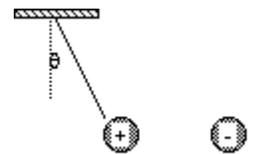
4.) Three charges are fixed to the corners of a rectangle as in the diagram at right. Determine the magnitude of a 4th charge at the open corner so that it experiences *no horizontal force*.
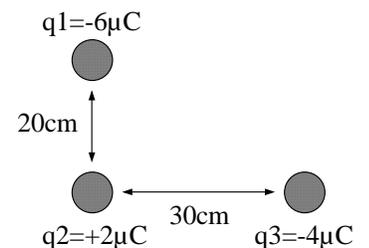
5.) A ball of mass 250g and velocity +5.0 m/s collides head on with a ball of mass 800g and velocity -3.0 m/s. If the collision is elastic and no net external forces act on the system, find the final velocity of each ball.

6.) Determine the current in each branch of the circuit at right and the voltage drops across each resistors.
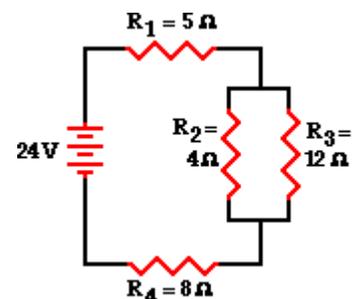
7.) Determine the banking angle for a plane to maneuver a turn of radius 1.75 mi at a speed of 655 mph. What would the vertical lift be at that point? Would the plane be rising or falling?