LESSON PLAN AP PHYSICS 1 & 2

Unit 1: Kinematics in One Dimension

OBJECTIVES:

Big Idea 1: Objects and systems have properties such as mass and charge. Systems may have internal structure.

Enduring Understanding 1.A: The internal structure of a system determines many properties of the system.

Essential Knowledge 1.A.1: A system is an object or a collection of objects. Objects are treated as having no internal structure.

a. A collection of particles in which internal interactions change little or not at all, o0r in which changes in these interactions are irrelevant to the question addressed, can be treated as an object.

Essential Knowledge 1.A.5: Systems have properties determined by the properties and interactions of their constituent atomic and molecular substructures. In AP Physics, when the properties of the constituent parts are not important in modeling the behavior of the macroscopic system, the system itself may be referred to as an object.

Essential Knowledge 5.A.1: A system is an object or a collection of objects. The objects are treated as having no internal structure.

Big Idea 3: The interactions of an object with other objects can be described by forces.

Enduring Understanding 3.A: All forces share certain common characteristics when considered by observers in inertial reference frames. [1]

Essential Knowledge 3.A.1: An observer in a particular reference frame can describe the motion of an object using such quantitates as position, displacement, distance, velocity, speed, and acceleration.

a. Displacement, velocity, and acceleration are all vector quantities.

b. Displacement is change in position. Velocity is the rate of change of position with time. Acceleration is the rate of change of velocity with time. Changes in each property are expressed by subtracting initial values from final values.

c. A choice of reference frame determines the direction and the magnitude of each of these quantities.

Learning Objectives:

3.A.1.1: The student is able to express the motion of an object using narrative, mathematical, and graphical representations.

3.A.1.2: The student is able to design an experimental investigation of the motion of an object.

3.A.1.3: The student is able to analyze experimental data describing the motion of an object and is able to express the results of the analysis using narrative, mathematical, and graphical representations.

[1] We will cover the objectives in gray text when we get to our units on force.

Big Idea 4: Interactions between systems can result in changes in those systems.

Enduring Understanding 4.A: The acceleration of the center of mass of a system is related to the net force exerted on the system, where $\vec{a} = \frac{\vec{F}}{m}$.

Essential Knowledge 4.A.1: The linear motion of a system can be described by the displacement, velocity, and acceleration of its center of mass.

Learning Objectives:

4.A.1.1: The student is able to use representations of the center of mass of an isolated two-object system to analyze the motion of the system qualitatively and semiquantitatively.

Essential Knowledge 4.A.2: The acceleration is equal to the rate of change of velocity with time, and velocity is equal to the rate of change of position with time.

a. The acceleration of the center of mass of a system is directly proportional to the net force exerted on it by all objects interacting with the system and inversely proportional to the mass of the system.

b. Force and acceleration are both vectors, with acceleration in the same direction as the net force.

Learning Objectives:

4.A.2.1: The student is able to make predictions about the motion of a system based on the fact that acceleration is equal to the change in velocity per unit time, and velocity is equal to the change in position per unit time.

PROCEDURE:

1. Phase 1: Introduction to basic concepts
    - Notes: Roman numeral I
    - Homework 1:
        - Generate an example of an inertial reference frame and a non-inertial reference frame.
        - Problems: page 220 numbers 41 & 43
2. Phase 2: Introduction to kinematics
    - Notes: Roman numeral II
    - Lab 1: Uniform vs. Accelerated Motion
    - Homework 2: Beginning on page 52:
        - Conceptual Questions: 1-3, 6-10
        - Problems: 1, 2, 4, 12-13
        - Concepts & Calculations: 81, 83, 84 (For #84 do concept part b only. Skip concept part a and the problems.)
    - Problem packet set 1

3. Phase 3: Kinematic equations and graphical analysis
    - Notes: Roman numerals III and IV
    - Lab 2: Acceleration due to Gravity
    - Homework 3: Beginning on page 52:
        - Conceptual Questions: 11, 13, 14 (Note: Sometimes the book tells you to go to a web page before doing a problem. You don't have to do that.)
        - Problems: 19, **20****, 22, 23, 25, 41, 58 (graph shown on page 56), 59, 86, and 87 (for #87: only the Concept Questions) ****For #20**, draw graphs for position, velocity, and acceleration as functions of time. These must be accurate. Therefore you should also find the final time. Finally, identify the slopes for the velocity and the acceleration graphs.
    - Problem packet set 2

<u>LABORATORY COMPONENT</u>:
Lab 1: Uniform vs. Accelerated Motion
Lab 2: Acceleration due to Gravity