Orbital Mechanics Lesson Plan

Computer simulation of gravity and 3 body planetary systems

Course/Class: Physics 841	**Name:** Brandon Schmidt	**Date:** 26-Apr-10
Topic: Gravitation / Orbital mechanics	**Unit 1:** Kinematics and Dynamics	**Grade:** 12

A.Intents/Objectives/Purpose

- Address common misconceptions present in Newton's first and second law of motion.
- Address common misconceptions present in the understanding of the nature of gravity.
- Provide students with the tools necessary to measure, interpret and share data with peers.
- Provide students with the ability to qualitatively describe how objects behave in the presence of gravity and to quantitatively understand the relationship between mass, distance and the universal nature of gravity.
- To develop an understanding of a mathematical pattern by way of analogy.
- Provide a foundation for understanding the effect of gravity as it acts over a distance.
- Address and simulate Kepler's laws of planetary motion.

A. Connection to Massachusetts Introductory Physics Curriculum Framework

1. Motion and Forces

Central Concept: Newton's laws of motion and gravitation describe and predict the motion of most objects.

1.3 Create and interpret graphs of 1-dimensional motion, such as position vs. time, distance vs. time, speed vs. time, velocity vs. time, and acceleration vs. time where acceleration is constant.

1.4 Interpret and apply Newton's three laws of motion.

1.5 Use a free-body force diagram to show forces acting on a system consisting of a pair of interacting objects. For a diagram with only co-linear forces, determine the net force acting on a system and between the objects.

1.7 Describe Newton's law of universal gravitation in terms of the attraction between two objects, their masses, and the distance between them.

A. Introduction	***Displays/Resources/Materials***
• Every physics student has had a lot of experience with the force of gravity. Unfortunately, this experience is limited to the interaction between a very large object, the Earth, and much smaller objects that are very close to it. This is a very limited range of the possibilities. • Physics students can explore a variety of gravitational interactions between objects (planets). These activities are designed to be used with the Orbital Mechanics Easy Java simulation	○ EJS – Orbital Mechanics
Clarifying/Creating-Understanding/Concept-Development • Prior to working on the simulation activity, students should be familiar and proficient with kinematics, Newton's laws of motion, projectile motion, uniform circular motion, and Newton's Universal Law of gravitation.	○ Screen or board with markers
A. Solitary Practice/Homework • Complete the homework exercises for next day.	○ Workbook Physics Ch. 8 problems
A. Review/Assessment • Periodically review student understanding	○ Homework exercise solutions ○ Quizzes, and chapter and unit exams
A. Activity / Lab • Orbital Mechanics simulator exploration activity	○ EJS console ○ Student activity worksheet