Physics and Engineering - Unit 3 - Asteroid Warning!

Unit Focus

Students will apply their knowledge of the universal law of gravitation to analyze the threat of near earth objects to our planet and/or our moon. Students will apply knowledge of computer modeling to model the behavior of a moving object to predict its future position given the presence of multiple external forces. This unit allows students to communicate complex models and complex data into a simple graph or pictorial representation for a wider audience. Students will research the challenge of detecting near earth objects (NEO) and build a system to predict if an object (comet, asteroid, etc.) will crash into the earth.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science
High School Engineering Design: 9 - 12

- Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. *HS-ETS1-2*
- Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. *HS-ETS1-4*

NGSS/NSTA Science & Engineering Practices
NGSS Science & Engineering Practices: 9-12

- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems. *SE.9-12.2.6*

Madison Public Schools Profile of a Graduate
Critical Thinking

- Analyzing: Examining information/data/evidence from multiple sources to identify possible

Transfer

T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.

Meaning

Understanding(s)	Essential Question(s)
U1 The motion of an object can be determined and/or predicted by using its position, velocity, and acceleration. **U2** Energy that is stored in an electric, magnetic, or gravitational field depends upon the position of the objects in the field. **U3** Objects in motion remain in straight-line motion at constant speed, and objects at rest remain at rest unless acted upon by unbalanced forces. (Newton's 1st law). **U4** Attractive and repulsive interactions at a distance (e.g., gravitational, magnetic, electrical and electromagnetic) can be described by using the concept of fields. **U5** The acceleration of an object depends upon its mass and the net force acting on it.	**Q1** How do the fundamental forces of the universe explain the behavior and interactions of objects? (e.g. particles, people, stars, planets) **Q2** How can position of an object in a field affect the amount of energy it has stored? **Q3** What do the results tell me? What patterns do I see or what conclusions can I draw?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 Newton's law of gravitation **K2** Velocity and acceleration are vectors **K3** An acceleration vector is the result of a net force vector and the mass of an object	**S1** Calculating the net force on an object in 2 Dimensions given positional information **S2** Predict a future position given current position, velocity and acceleration vectors

Stage 1: Desired Results - Key Understandings		
underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2) *Collaboration/Communication* • Product Creation: Effectively use a medium to communicate important information. (POG.3.2)	**K4** The velocity of an object will change if an acceleration is associated with that object **K5** 2D and 3D vectors are required to model real world objects	**S3** Create visual representations of data to communicate a concept or result **S4** Use iterators or loops in a computer simulation to simulate the passage of time **S5** Create high level parameters for computer simulations to simply future changes to a model