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Using Interactive Physics to Explore Conservation of Energy

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Lesson Plan 3

Using Interactive Physics to Explore Conservation of Energy and the Accompanying Graphs

You should submit this form in addition to any computer generated files/documents/models to your group folder on Angel. Please create a .zip file and upload the group of files as a single archive.

Name: Fayne Winter
Grade level(s)/Subject taught: 7th Grade Math
Objectives: Students will gain experience in critically looking at graphs and peripheral information in order to read and understand the information the graph is relaying to them. Students will gain an understanding that Energy is Conserved, that Total Energy is the sum of all the energies involved in a situation and as one energy decreases, another increases, therefore conserving energy.

1. *Write* the Mathematical Concept or "key idea" that modeling will be used to teach: (e.g. Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships)

Modeling/Multiple Representations – to interpret data presented graphically with little background information provided. To critically examine graphical information and analyze what the graph is communicating.

and/or…

1b. *Write* the Science Concept or "key idea" that modeling will be used to teach: (e.g. Organisms maintain a dynamic equilibrium that sustains life).

Standard 4 – Energy exists in many forms, even when these forms change, energy is conserved.

Materials: Pencils, paper, calculators, Interactive Physics

- **Using _Interactive Physics__ I plan on having my students…**
  (software / modeling package(s)

Warm-Up: Students will look at 3 different graphs representing different data. They will describe what is happening in the graphs and what kind of information the graphs are communicating to them. Two of the graphs will contain labels and information to draw from. One of the graphs will simply be a line which students will create a situation that could be modeled by the graph.

Mini-Lesson: What are the different parts of a graph?
How do you read graphs?
If a line increases and decreases, what does that tell you?
What does a straight line tell you?

What is Kinetic Energy? Gravitational Energy? Spring Energy? Total Energy?
What does: KE, PEs, PEg, ME mean?
What does Conservation mean?

Students will answer the above questions using prior knowledge of graphs as well as by using the graphs they worked with in their Warm Up. Students will also be given definitions for the types of Energy.

Work Time:

Activity 1

In Interactive Physics, students will observe what is happening in the activity "Conservation of Energy". This activity consists of a ball bouncing from a spring and a graph with labels of types of energy but no numerical labels. In addition, there are 4 lines on the graph, one each for Kinetic, Gravitational, Spring, and Total Energies. Students will need to observe the graph, the bouncing ball and what is happening and come up with a prediction of what the activity, and namely the graphical information, is telling them about what is happening.

Activity 2

When students complete activity 1, they will go on to the Interactive Physics activity, "Energy Of Oscillating Spring". In this activity, numerical measurements are supplied in the graph, the graph is just like the one in activity 1, including the use of a spring, and there are equations showing the changing energy levels, yet the conservation of Total Energy remaining the same. Students will expand their predictions and understanding of what the graphs and activities are telling them in relation to energy levels. Here they should notice the different levels of the different lines on the graph and observe that when one energy decreases, ie. PE, then another energy increases, ie. KE. Students should be able to come up with concrete explanations for what is occurring in the graph and explain that to the group, including the idea of Conservation of Energy.

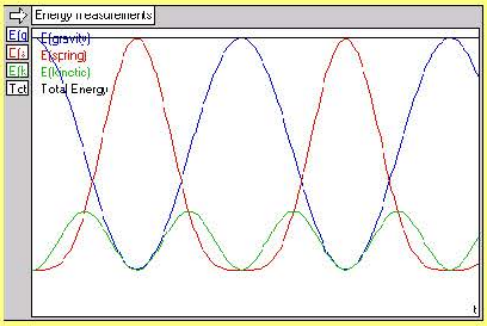
Create presentation for class.

Closing: Students will present their understandings to the classroom describing the graphs and what is occurring at different positions of "Bob" as he bounces from the spring.

Conservation of Energy

1. Press Run
2. Observe that the total energy of the system is conserved

The total energy of a body on a spring is the sum of the gravitational energy, the spring energy, and the kinetic energy.



1. Set Bob's mass and the spring constant
2. Press Run and observe the energy measurements and notice that total energy (ME) is conserved
3. Repeat steps 1 and 2 with different input values

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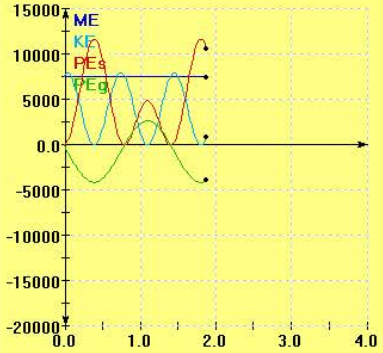
Energy Measurements (J)



$ME = KE + PE_s + PE_g =$ 7500.0 J

$KE = \frac{1}{2} m v^2 =$ 862.9 J

$PE_s = \frac{1}{2} k y^2 =$ 10537.2 J

$PE_g = m g y =$ -3900.1 J

Bob's Mass (kg) Spring Constant k (N/m)