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Potential and Kinetic Energy with a Pendulumn

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Final integrated project / lesson plan (teams-Due: Thursday, August 12th)

Submit as hard copy AND electronically through ANGEL

Names: Jacqueline Keily, Frank Rinere, Annette Pennella
Grade level(s)/Subject taught: Special Education (inclusion model), science, and math. Grades 7-8.
Objectives: At the end of this lesson students will: 1. Understand the concept of potential and kinetic energy. 2. Interpret points on pendulum • use position to determine potential energy • Use velocity to determine kinetic energy. 3. Demonstrate an increase in vocabulary. 4. Use the appropriate formulas to determine potential energy and kinetic energy at different points on the model.

Describe the integrated Mathematical - Science Concepts or "key ideas" 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 and… Organisms maintain a dynamic equilibrium that sustains life).

Mathematical - Science Concepts to be integrated: Key idea #1 Energy and matter interact through forces that result in changes in motion. Key idea #2: potential and kinetic energy are directly related to the operation of a pendulum. Key idea #3 observations made while testing proposed explanations, when analyzed using the pendulum model, provides new insight into phenomena.

For your integrated project / lesson plan) lesson (team effort), describe how you plan on using a desired modeling software package(s) with your students AND how you might integrate or weave together the two (or more…) math and science concepts into one or more lessons. You might describe what a visitor might see walking into your classroom during this lesson. You might also describe the role of the student during the entire lesson and your role as the teacher. Please try to be specific as possible. Also, construct a tentative rubric that you might use with your students. ** see example page 5.

Prompts:

1. How will you assess the prior knowledge of the student?
2. How will you begin the lesson?
3. What are the teacher and students doing every 5-10 minutes? (Teacher Actions and Student Actions
4. Describe your thinking of how the concepts will be integrated.
5. How will you assess the learning for the lesson?
6. How will the chosen software/tool(s) be integrated into our teaching as per rubrics in this packet? (I.e. you may want to discuss a problem or describe how you might use the chosen modeling package in your plan. How does the model/tool help the concept(s) to be taught)?

Using Interactive Physics and the TI-84 calculator we plan on having our students:

1. Find potential energy and kinetic energy at different points on the model
2.Use position to determine potential energy
3.Use velocity to determine kinetic energy
4. Visualize how mass changes both kinetic and potential energy values

Formulas used:
Potential energy = MGH where m=mass, g=gravitational constant ($9.8m/s^2$) and h=height
Kinetic energy= ½ MV^2 m=mass, v=velocity

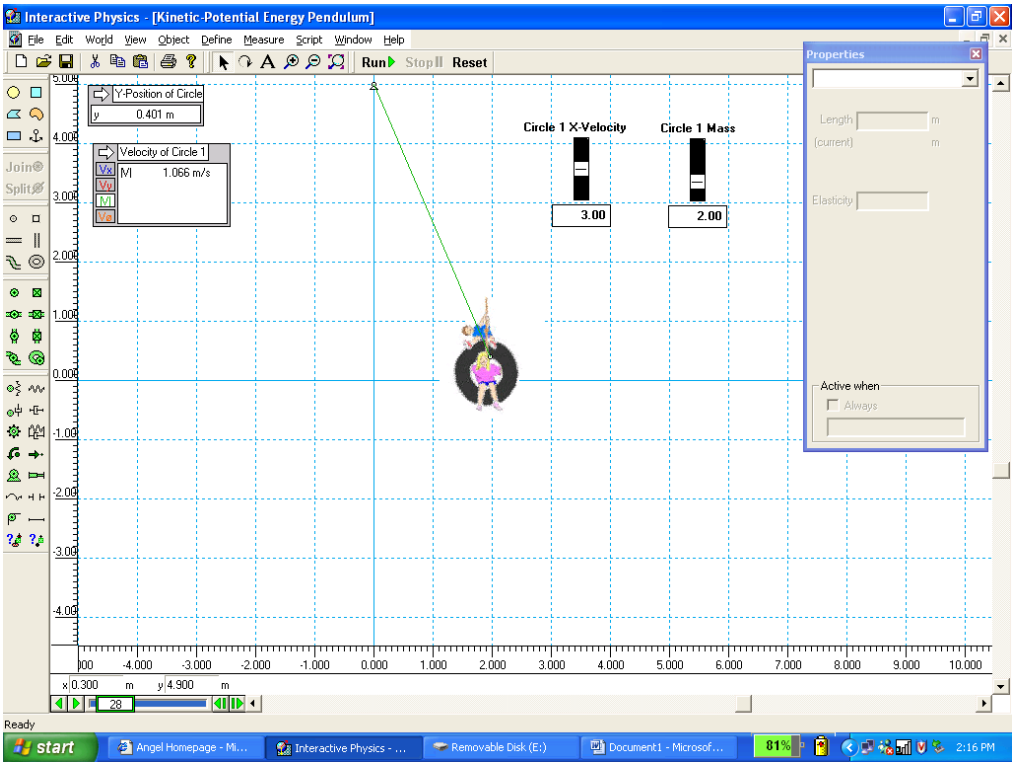
Modifications:
1. Special ed students: Calculate highest and lowest values
2.General ed students : Calculate 10-15 values

Upon entering this 7/8 science classroom you'll see many silent teacher and student work adorn the walls. At the top of the white board is the essential question: how are potential and kinetic energy related to the operation of a pendulum?
Desks are in cooperative groups of four; each student has his/her own calculator programmed and ready to begin. Ms. Keily is beginning our lesson with physics study cards and the LCD projector. We are reviewing some basic vocabulary as it relates to the upcoming lesson. The study cards application (TI-84) is projected onto the white board. For the first fifteen minutes we play a round of vocabulary fun, kids have two chances to get the definition correct before moving onto the next person. Whoever has the most correct gets a "free homework pass".

- potential energy----stored energy, a result of position
- velocity---speed and direction an object takes
- mass----amount of matter something has
- gravity-----weight depends on, mass does not

- kinetic energy---------motion

Now we are ready to break up into pairs. Each pair of kids per computer. Mr Rinere uses this transition time to set up our pendulum model, project it onto the whiteboard and illustrates how to read the data several times. Each group then runs the simulation and collects data at three (3) positions; the top of the swing, the midpoint of the swing and some point in between them. The data includes the mass of the object, the height of the object and its velocity. Data is exported to Excel and printed. At this time, Ms. Keily is circulating throughout the room assisting those students who need more assistance.



Math Mini-Lesson

Materials:

1) TI-84 Graphing Calculators
2) Data sheets for Mass or 2 kg, Mass of 4 kg.
3) Kinetic/Potential Energy Pendulum Worksheet
4) View Screen on overhead

Teacher will demonstrate how to enter the height and velocity data into the calculators. The data will be saved into lists for the different masses of 2kg and 4kg.

1) Students go to new screen. They input the data by hand and calculate the formulas of kinetic energy and potential energy, for each position (0 m height, .221 m height, and .459 m height)
2) Teacher will demonstrate this process for the students. (Students would write answers of the three specified positions, on to worksheets during student work time.
3) Math teacher will then return to data lists and demonstrate inputting the formulas for the kinetic energy and potential energy. The calculator will then work out the whole list of data to verify the relationship between that the kinetic and potential energy worked.

Students are given the last 20 minutes or so to complete their worksheets. Any thing not completed is to be done for homework and gone over tomorrow in class. Ms.Keily, Ms. Pennella, and Mr. Rinere are circulating throughout to help as needed.