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CMST Lesson Plan

FOCUS QUESTION

Can you save your egg?

DESCRIPTION

Students will design a bungee jump that allows their egg to stop within 5 centimeters of the floor when dropped from 1.5 meters. After achieving success with their design, they will model their solution using *Interactive Physics* and then discuss and reflect upon energy and force.

PERFORMANCE INDICATORS

- Students will be able to design, execute, and evaluate in order to successfully complete an inquiry-based engineering challenge.
- Students will be able to model their design using *Interactive Physics*.
- Students will be able to explain their model in terms of energy and force.

NYS STANDARDS (from *Intermediate Level Science Core Curriculum*)

Standard 1 Students will use mathematical analysis, scientific inquiry, and engineering design to pose questions, seek answers, and develop solutions.

Standard 2 Students will access, generate, process, and transfer information, using appropriate technologies.

Standard 6 Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.

Standard 7 Students will apply the knowledge and thinking skills of mathematics, science, and technology to address real-life problems and make informed decisions.

Standard 4, Key Idea 4.1e Energy can be thought of as either kinetic energy, which is the energy of motion, or potential energy, which depends on relative position.

Standard 4, Key Idea 5.1d Force is directly related to an object's mass and acceleration. The greater the force, the greater the change in motion.

Standard 4, Key Idea 5.1e For every action, there is an equal and opposite reaction.

MATERIALS

- ❑ a variety of “bungees”: nylon stockings, rubber bands, balloons, yarn
- ❑ plastic sandwich bag
- ❑ pennies
- ❑ egg
- ❑ ruler

PROCEDURE

- 1) Get the nylon stockings, rubber bands, balloons, and yarn. Test each bungee to determine the relative elasticity, or stretchiness. Then, use any combination of these materials to make a bungee cord.
- 2) Make a test egg by filling a plastic sandwich bag with pennies until it has the same mass as a real egg. Record this mass.
- 3) Test your bungee design, dropping your test egg from 1.5 meters. Measure and record how close the test egg comes to the ground. **Your goal is to have the egg come within 5 centimeters of the ground without making contact.**
- 4) Evaluate your design. In what ways can you improve your bungee design? Change your design and record your rationale for changing your design the way that you did.
- 5) Test your new design and record how close the egg comes to the ground.
- 6) Redesign, retest, and reevaluate your design until you have met your goal.
- 7) When you have achieved success with your test egg, attempt your bungee jump with a real egg. Record what happens.
- 8) Use *Interactive Physics* to model what happened during this activity. Add a graph that shows the changes in potential and kinetic energy of the egg.

REFLECTIONS

1. Describe the changes in potential and kinetic energy that occurred before and after the bungee jump.
2. Calculate the force of the egg as it falls toward the ground. Show your work and label all numbers.
3. What would happen to the force of the egg as it falls toward the ground if a genetically-modified egg was used that had double the mass of your original egg. Show your work and label all numbers.
4. In one concise sentence, summarize the relationship between force and an object's change in motion.
5. Newton's third law of motion states that for every action there is an equal and opposite reaction. Explain this in terms of the egg bungee jump. You may add a diagram to help illustrate your words.
6. Make a Venn diagram that details the benefits and disadvantages of using a computer model as compared with the hands-on activity.

EXTENSION

Design an experiment that allows you to test the effects of changing one variable (e.g. length of bungee cord). Make a hypothesis, execute the experiment, and evaluate.

RUBRIC

Inquiry Activity	<i>Interactive Physics</i>	Forming a Conclusion	Character and Charm
Egg bungee jump is well conceived, tested, and evaluated. 5	Appropriately models actual events and accurately shows changes in potential and kinetic energy. 5	All reflection questions are thoroughly answered and supported. 5	Teamwork was evident, station was left how it was found, technology used appropriately. 5
Egg bungee jump is either not well conceived OR not well tested OR not well evaluated. 3	Either appropriately models actual events OR accurately shows changes in potential and kinetic energy. 3	Half of the reflection questions are thoroughly answered and supported. 3	Inappropriate behavior OR inappropriate use of equipment OR left a mess. 3
Design is neither well conceived, nor well tested nor well evaluated. 0	Neither appropriately models actual events nor accurately shows changes in potential and kinetic energy. 0	None of the reflection questions are thoroughly answered or supported. 0	Inappropriate behavior and inappropriate use of resources and left a mess. 0

<p>TOTAL= ___ /20 = ___%</p>
