PACT - Day 3

created with taskstream

Author: Stephen Herr
Date created: 04/04/2012 2:44 PM PDT ; **Date modified:** 04/11/2012 8:45 PM PDT

BASIC INFORMATION

Date(s) Taught

3/14/2012

Content Area

Science

Grade/Level

Grade 9

Topic(s)

- Energy conservation
- Gravitational Potential Energy
- Elastic Potential Energy

Agenda

9:14–9:20 Teacher explains the activity to the class.

9:21–9:26 Equipment is distributed to students. Students wheel out computer carts, plug them in, and turn them on.

9:27– 10:12 Students calculate the spring constant of their spring. They create a simplified equation that models how much a particular spring will stretch when a mass is attached to it and dropped.

10:05 – 10:15 Students test the accuracy of their model at the front of the classroom under the supervision of the teacher. Students shut down the computers, return the computer carts, and return the lab equipment.

10:15 – 10:16 The teacher reminds students that they must come in at lunch or sometime after school to complete the activity if they did not finish.

STANDARDS AND OBJECTIVES

California Content & ELD Standards

Display: ○ Collapse All ◉ Expand All

- **CA- California K-12 Academic Content Standards**
  - **Subject:** Science
    - **Grade:** Grades Nine Through TwelveStandards that all students are expected to achieve in the course of their studies are unmarked. Standards that all students should have the opportunity to learn are marked with an asterisk (*).
      - **Area:** Physics
        - **Sub-Strand:** Conservation of Energy and Momentum
          - **Concept 2:** The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept:
            - **Standard b:** Students know how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy) = mgh (h is the change in the elevation).

Standard c: Students know how to solve problems involving conservation of energy in simple systems, such as falling objects.

Standard h: Students know how to solve problems involving conservation of energy in simple systems with various sources of potential energy, such as capacitors and springs.

Area: Investigation and Experimentation

Sub-Strand 1: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:

Standard a: Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.

Standard b: Identify and communicate sources of unavoidable experimental error.

Standard c: Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.

Standard d: Formulate explanations by using logic and evidence.

Standard j: Recognize the issues of statistical variability and the need for controlled tests.

Standard n: Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).

Learning Objective(s) for Content

Given 45 minutes of class time and the appropriate materials, students will be able to create an model that that predicts the maximum distance a spring will stretch when a known mass is attached to it and dropped. This model will incorporates experimentally collected data and students knowledge of conservation of energy, elastic potential energy in a spring, and gravitational potential energy and must accurately predict the behavior of the system to level of accuracy shown in the grading rubric and detailed in the sequence of activities.

Learning Objective(s) for Academic Language

- Students will create several graphs based on data collected in this activity. All students will appropriately plot, format, and label the graphs and find an equation of the best-fit line.
- Students will interpret their graphs to determine the quality of their collected data. Students will recognize the issues of statistical variability and the need to control the conditions of their tests. The quality of student data will be evaluated on whether their model accurately predict the behavior of the system to level of accuracy shown in the grading rubric and detailed in the sequence of activities.

Prerequisite Knowledge and Skills

Students already can:

- Find the spring constant of a linear Hookean spring.
- Model the elastic potential energy stored in a spring
- Use a ruler to measure distances.
- Draw an energy flow diagram.
- Students know how to solve problems involving conservation of energy in simple systems, such as falling objects.
- Algebraically solve for a particular variable of interests.
- Work collaboratively with their lab groups

Students already understand

- Newton's Laws of Motion
- 1^{st} law of thermodynamics
- Hook's law
- Energy Conservation

LEARNING ACTIVITIES, ASSESSMENT, AND RESOURCES

Sequence of Activities

Teacher activities

- The teacher will explain the objective of the assignment and the criteria by which students will be evaluated.
- The teacher will monitor student safety and make sure the equipment is properly used.
- The teacher will take role.
- The teacher will use formative assessment to identify and address mistakes as they occur.
- The teacher will answer questions.
- The teacher will help identify sources of error.
- The teacher will ensure that all members of lab groups are working effectively.
- The teacher will monitor the time and help students pace themselves so they can finish the lab before the end of the period.
- The teacher will evaluate whether students correctly predicted the stretch of the spring with the drop test.

Student Activities

- Students will calculate the spring constant of their spring.
- Students will write a simplified equation that models how much a particular spring will stretch when a mass is attached to it and dropped.
- Students test the accuracy of their model at the front of the classroom under the supervision of the teacher.
- Students shut down the computers, return the computer carts, and return the lab equipment.

Group Configuration

- Students will work with their normal lab groups.
- Three students are assigned per group.

Activity Prompts

- Students will follow the
- See the attached file “Springs Activity Worksheet” under the “Resources and Planning” section of this lesson plan.

Differentiated Instruction

The teacher will provide differentiated instruction to groups and individual students throughout the class period. The teacher will use formative assessment to identify groups and individuals that need additional instruction. The instructor will respond to individual students and use his background knowledge of students to provide relevant and individualized instruction that best meets the needs of students.

Monitoring and Assessing Learning

The teacher will circulate throughout the class the entire period to monitor the progress and learning of students. Formative assessment will be used to assess student learning. The teacher will ask students verbal questions to gauge their understanding of concepts and the procedure. In addition, the teacher will inspect student data and look for errors.

Student learning will formally be assessed by the rubric shown below.

Rubrics (if applicable)

Rubric

Completing the task on the first attempt – 5 points.

Completing the task on the second attempt – 3 points.

Completing the task on the third attempt – 1 points.

The corresponding “Spring Activity Worksheet” will be graded out of a total of 7 points. 1 point will be given for each correct and complete answer.

Resources and Materials

- Springs
- Mass hangers
- Masses
- Rings stands
- Ring stand clamps
- Coffee cans
- Rubber bands
- Tissue paper
- Balance
- Tape
- Computers
- Graphing Software (Logger Pro 3 or Microsoft Excel)

Attachments:

1. **Spring Activity Worksheet** This is the worksheet that students will be given to help scaffold this activity.

REFLECTION

Reflection

Directing Learning Tasks

The goal of this learning activity was not clear enough. I explained it verbally, but I also should have modeled a successful "pen drop" so students could see what their end goal should look like.

I intentionally did not give students the steps to accomplish this task, because this was a synthesis task where students were supposed to integrate their prior knowledge and apply it to this new situation. I attempted to scaffold this through the worksheet that I passed out and my instructions in class. However, I had to provide additional scaffolding to almost every group. This indicates that my original presentation of the material was not adequate.

Inquiry Skills

Students had to combined and apply the inquiry skills they learned in the previous two labs to complete this task. All students were eventually able to do this with additional scaffolding.

Time Management

There was not enough time in class to complete this activity. Several groups had to come back at lunch to finish it. I should have given the instructions and worksheet the previous day, and given students the worksheet for homework so they would be able to come to class ready for the activity. This would have reduced the stress level in the classroom and allowed students to focus on using good lab technique. It also would have given me time to bring closure to the activity and discuss it with the class.

Summary

Students were very enthusiastic about the activity and were very motivated by the competitive aspect of the activity. This activity required higher order thinking and inquiry. Eventually, every group was able to successfully calculate how far the pen would drop when attached to the spring. However, this took more time than I originally allocated and additional scaffolding.