

PheET Pendulum Simulation Lesson 8th Grade
CAP UNIT: Forces and Motion

TEACHER PLANNING

GOALS:

1. Students will understand the continual transfer of kinetic to potential energy in a pendulum system.
2. Students will understand the relationships of mass, length, and angle to period of a pendulum.
3. Students will understand how to acquire and record data.
4. Students will understand how to measure mass, length, arc and time.

SKILLS:

Collecting and recording a variety of data.
Measuring mass, length, arc, time
Determining dependent and independent variables
Construction and interpreting of line graphs

PREDICTIONS

1. What variables of a pendulum will most affect the speed of the swing (period)?
2. When will a pendulum have the most kinetic energy? When will it have the most potential energy?
3. When is a pendulum useful as a tool?

PROCEDURES

Students need to have access to the PhET Pendulum Activity. At the outset allow students just to play with the program and to understand

Student Data Collection

Step 1. Set up the pendulum as follows: Control the mass and the pullback angle. Use five different pendulum lengths. Record the lengths and corresponding periods (time of swing from vertical, to the left, all the way to the right and back to vertical; a complete round trip) to two decimal places.

Step 2. Set up the pendulum as follows: Control the length of the pendulum and the pullback angle. Use five different pendulum masses. Record the masses and corresponding periods to two decimal places.

Step 3. Set up the pendulum as follows: Control the length and mass. Use five different pullback angles. Record the degrees of the pullback angles and the length of the period.

Student Data Analysis

The primary goal of getting all the data from Steps 1, 2 and 3 (above) is to determine what controls the period of the pendulum: What makes it swing faster?

HOW TO MAKE THIS WORK

- A. The pendulum-based activities can be done as individual daily activities where student pairs can complete a worksheet on specific days.
- B. The unit can be completed as a week-long, immersion, class activity where students must complete all the activities as small groups and submit a completed pendulum packet.
- C. The class may be broken up into multiple groups where each group can investigate one aspect of the pendulum variables. At the end of the week the individual groups can report out their conclusions to the class.

EXTENSIONS

- 1. Foucault pendulum and Earth's rotation; observable in many planetaria.
- 2. Pendula, clocks and longitude. For latitude, measurement is relatively easy. Longitude however, required the development of a clock which could determine precise time at sea (despite a ship's motion), relative to the place where the voyage started. The British government offered a significant prize for such a timepiece (tie to Earth Science and language arts)
- 3. By varying the planets upon which the simulation occurs the effects of gravitational variation can be observed. Can study sports on other planets.
- 4. Musical metronome where constant timing is important. Music with different beats can be studied.