

Teacher Resource Sheet

Kinetic and Potential Energy Lesson Plan

Standards

MS- PS3 – 1: Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object

MS – PS3 – 2: Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

MS – PS3 – 5: Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Science and Engineering Practices

Objective

SWBAT investigate and describe the relationship between kinetic and potential energy

SWBAT investigate and describe characteristics of kinetic and potential energy and motion

SWBAT use evidence from the investigation to design and construct a roller coaster and launcher using concepts of kinetic and potential energy

Essential Question: How do things move? How can you increase the amount of energy in an object?

Engage:

- Teacher defines energy as the ability to do work and the two broad categories of energy is kinetic and potential energy
- Introduce: Rubber band physics
- Have students make observations about the rubber band and explain if it has any energy
- Teacher explains that the rubber band is at equilibrium – no energy
- Teacher demonstrates with rubber, pulling it back, asking students to describe how the rubber has now changed (using the word potential)
- Ask students: It has the POTENTIAL to do what?
- Extend a bit further: What happens if you pull it really far back? Does it have more or less potential? When I let it go, what happens?

Explore

- Build a cotton ball launcher: Link [<https://www.sciencebuddies.org/stem-activities/cotton-ball-launcher>] to safely investigate potential energy using rubber bands
- To build this launcher, you'll need, scissors, two toilet paper rollers, tape, a pencil and 2 rubber bands and a cotton ball or something small to launch (you want something lightweight and can fit loosely into the toilet paper roll (3 – 4 min)

- Have students explore using the launcher using the guiding questions:
 - How can you launch it more? What happens when you launch it higher? Lower? What if you put something heavier? Can you do this with longer tubes?

Explain

- Teacher explains; When you pull the pencil back, you are stretching the rubber bands and giving it more potential energy to move further! Turns out that movement is called kinetic energy.
 1. KE: energy of motion
 2. PE: stored energy

Elaborate

- Exploring the energy transformation, the relationships between kinetic and potential energy.
- Teacher explains: Energy can be transferred or transformed from one form to another
- Build a ramp using marbles, a ball or toy cars
- Begin: ask students to move the object on a flat ramp without touching it.
- Students explore how to move the object without touching by manipulating the height of the ramp, exploring the relationship between height and final motion/speed
- Students can record the time it takes for the object to reach the bottom with varying speeds or use dominos to investigate the force the object exerts with varying heights.
- Teacher asks students to consider certain points on the ramp as it relates to potential and kinetic energy
- Students make observations about potential energy converting to kinetic.
- After testing height, students can test:
 - The effect of mass on potential and kinetic energy by add mass to a car or using balls with more mas
 - The effect of different surfaces on potential and kinetic energy by covering the ramp with various materials. Teacher can introduce friction and thermal energy as energy “lost” during the energy transformation

Evaluate

- Students take all of the information and are challenge to build a roller coaster with minimal human interruption
- Teacher can determine and set the criteria and constraints for the design
- Some suggestions are:
 - # loops
 - # hills
 - Materials used
- Teacher can use timing as a form of evaluation for the roller coaster