

Energy at Play – LAB SUMMARY

Energize your students with this exploration of the way energy transforms and transfers. Using Tinker Toys™, household items and their knowledge, students build fun contraptions that will make a ball move and hit a target.

Grade Levels: 3-8

Educational Outcomes:

- 1) Students will be able to identify the Potential Energy stored in various objects.
- 2) Students will be able to identify the form of Potential Energy (gravitational or elastic) stored in various objects.
- 3) Students will be able to identify the Kinetic Energy of various objects.
- 4) Students will develop a deeper understanding of the Law of Conservation of Energy.

Estimated Time: 1.5 hours

- **Introductory Design Challenge Activity:** 20 min.
- **Basic Science Discussion:** 15 minutes
- **Design Challenge 2:**
 - **Building** – 40 minutes
 - **Sharing** – 10 minutes
 - **Clean-up** – 5 minutes

California Content Standards Connections:

- **Physical Science: Grade 3 - 1c, 1d**
- **Physical Science: Grade 6 - 3a**
- **All grades - Investigation and Experimentation:** 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 three strands, students should develop their own questions and perform investigations.

Pre-Visit Vocabulary

These are words and concepts that we will discuss in the lab. Your students' lab experience will be enhanced if they are familiar with these terms prior to your visit.

- **Conservation of Energy:** Energy cannot be created or destroyed; it may be transformed from one form into another, or transferred from one place to another, but the total amount of energy never changes.
- **Energy:** The capacity to do work. Measured in joules. Appears in many forms, most of which are ultimately derived from the sun or from radioactivity.
- **Force:** A push or pull upon an object resulting from the object's interaction with another object.
- **Kinetic Energy (KE):** Energy of motion. $KE = \frac{1}{2} \text{ mass} \times \text{velocity}^2 = \frac{1}{2} mv^2$ Note that small changes in speed can result in large changes of KE (it's speed squared!). Net force x distance = KE. Includes heat, sound, and light (motion of molecules). KE is a scalar quantity; it cannot be canceled.
- **Mechanical Energy:** Energy possessed by an object due to its motion or its stored energy of position. Mechanical energy can be either kinetic energy (energy of motion) or potential energy (stored energy of position).
- **Potential Energy (PE):** Energy of position; energy that is stored and held in readiness. Includes chemical energy, such as fossil fuels, electric batteries, and the food we eat.
- **Work:** force acting on an object to move it across a distance. Pushing, pulling, and lifting are common forms of work.

Tech Museum Gallery Connections:

- Innovation Gallery: Virtual Design
 - Bike Design Studio
 - Students design a bicycle for different uses and determine which materials are appropriate for various styles
- Destination: Space
 - Space Perspectives, Journey to the Planets
 - Students can compare the atmospheric characteristics of different planets and theorize how life would be different in these environments.
- Outside the group entrance
 - Big Ball Machine
 - Students can witness an elaborate demonstration of energy and motion and the transfer of energy

Teacher Resources

- **Department of Energy – Energy Kids Page: relatively easy to understand website, with particularly interesting graphics about energy transformation and energy sources -**
<http://www.eia.doe.gov/kids/energyfacts/science/formsofenergy.html>
- **Mass on a Spring: simple graphics illustrate principles of elastic potential energy (Grades 4-8) -**
<http://id.mind.net/~zona/mstm/physics/mechanics/energy/massOnASpring/massOnASpring.html>
- **How Stuff Works – Roller Coasters: Forces behind roller coasters and why they make you feel the way they do (no lessons) –** <http://science.howstuffworks.com/roller-coaster.htm>

Post-Lab Activities

- **Circle of Pong (Grades 3-8, handout available in Tech lab classroom or at**
http://www.thetech.org/education/downloads/dconline/CircleOfPong_2003.pdf)
 - Students use their knowledge of potential and kinetic energy, and explore forces and motion to place a ball into the center of a 6-foot diameter circle.
- **Rat Round Up (Grades 3-8)**
http://www.thetech.org/education/downloads/dconline/ratRoundup_2005.pdf
 - Build a device that will capture and carry a pet rat (or other moving toy) safely back to its cage.
- **Double Toss (Grades 6-8)**
http://www.thetech.org/education/downloads/dconline/doubleToss_2003.pdf
 - Students use their knowledge of potential and kinetic energy, and explore forces and motion as they work together to solve this introductory level Design Challenge.