Light,Temp Probe, Sound

The Great Energy Switch

Grades: Middle School
Time: 45 Minutes
Subject: Physical Science
Topics: Energy, Energy Transformation

Overview

Energy is all around us, constantly changing from one form to another. In this lesson, you'll explore how energy transforms in everyday situations—like how electrical energy powers a lightbulb or how mechanical energy creates sound. Let's dive into the science of energy transformations and see how they power our world!

Background

Energy is a fundamental concept that plays a crucial role in our daily lives, existing in various forms and constantly transforming from one type to another. Understanding **energy transformation**s is essential for grasping how the world operates, from powering our homes to enabling movement and communication.

The process of **energy transformation** occurs when energy changes from one form to another. This can happen in various everyday situations. For example, when you turn on a light bulb, **electrical energy** is converted into **light energy**, illuminating the room. Similarly, when you eat food, your body converts the **chemical energy** stored in the food into **mechanical energy** for movement and **thermal energy** to maintain body temperature.

Understanding these transformations helps us comprehend how energy flows through systems and how it can be harnessed for practical use.

What You Will Need/Prep

- Databot with temperature probe
- IOS/Android Smart Device
- Small LED light (for electrical to light transformation)
- Hand warmer pack or vinegar and baking soda
- Rubber band or small drum
- Install Vizeey™ on your Smart device.
- Scan the QR code to load the experiment.

- Test your databot™ connection.
- You will be prompted to select and connect to databot™ each time you launch an experiment.
- If there are two or more databot™'s listed, the one closest to your device will be highlighted.
- Study the background information and terms and prepare to explore!

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Through hands-on activities and exciting demonstrations, you'll discover the amazing ways energy moves and transforms to make life possible.

Learning Objectives

Students will learn to:

- Use databot's sensors to collect, measure, and accurately record data.
- Identify and distinguish between different forms of energy, including electrical, light, thermal, and sound energy.
- Explore how electrical energy is transformed into light energy.
- Investigate chemical energy transformations in chemical reactions by observing temperature changes.
- Explore the connection between motion and sound.
- Interpret experimental data to draw conclusions about the nature and significance of energy transformations in everyday life.

Important Terms

Energy: The ability to do work or cause change. It exists in various forms and is essential for all physical processes.

Energy Transformation: The process of converting one form of energy into another, such as electrical energy into light energy.

Electrical Energy: The energy carried by electric charges, which can be transformed into other forms of energy, like light or thermal energy.

Light Energy: A form of electromagnetic radiation that is visible to the human eye, produced by sources such as light bulbs.

Chemical Energy: The energy stored in the bonds of chemical compounds; it is released during chemical reactions, such as combustion.

Sound Energy: The form of energy associated with the vibration of matter, which can be produced through mechanical actions.

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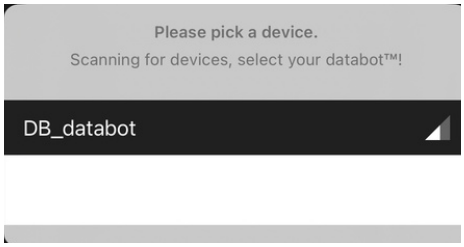
Using Vizeey

In order to work with the experiment you need to launch the Vizeey application and click on + in the upper right corner.

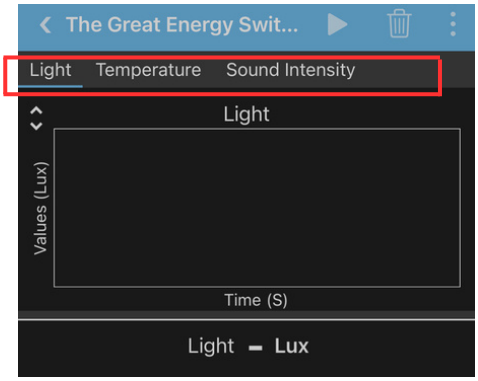
Then select “Add experiment from QR code” and scan the QR code prepared for this experiment. Your experiment will appear in the list.

When you start the experiment you will be immediately offered to connect to your databot. Make sure that databot is enabled.

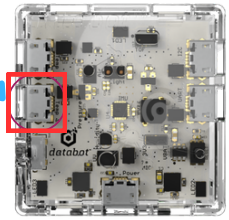


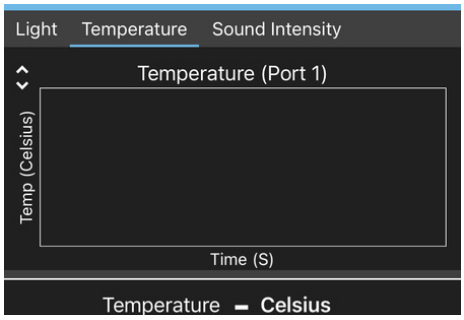
Once in the Experiment

This lab consists of 3 experiments.
There is a separate tab for each experiment.

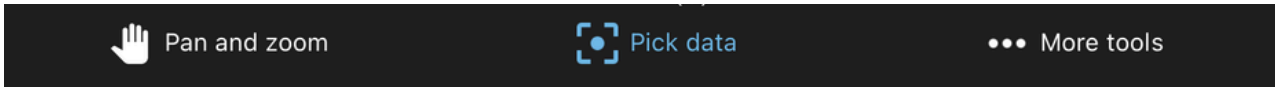


- You can connect 2 temperature sensors to the databot at once.
- In the experiment, we use only the one sensor. It is important to connect it to the correct port for normal operation.

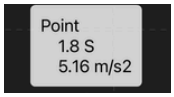




- Analyze the graph
- By default you will be in Pan and zoom mode which allows you to move the data side from side to side with your finger or pinch to zoom in or out.
- To see the values at any point of the graph, you first need to press the “Pick data” button.



- Click on any point on the chart to see the values.



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Part 1: Initial Observations and Questions

Can you list some examples of heat, chemical, and electrical energy that you see or use in everyday life? _____

_____

_____

What are some examples of energy transformations you see in your daily life?

_____

_____

Have you ever noticed a change in temperature when mixing substances or using a battery-operated device? Describe your experiences.

_____

_____

Part 2: Hypothesis

Predict the type of energy transformation you expect to see in each experiment and describe how it might occur.

Prediction for Electrical to Light Energy:

_____

Prediction for Chemical to Thermal Energy:

_____

Prediction for Mechanical to Sound Energy:

_____

Part 3: Experiment Procedure and Data Analysis

Electrical to Light Energy

By doing this experiment, you will gain hands-on experience observing how electrical energy is converted into light energy, which will strengthen your understanding of energy conversion in everyday life.

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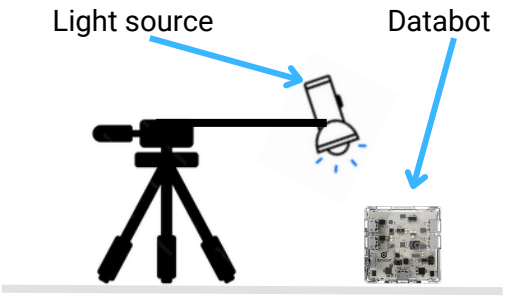
Prepare:

- Databot
- Light source (e.g., a lamp or LED light)
- Power source for the lamp



Experiment Steps:

- Install the lamp and fix it securely. Turn it on.
  - This is your light source.
- Turn on databot.
- Tap on **"The Great Energy Switch"** in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Choose the tab *"Illuminance"* and start your experiment using: ▶
- Use these icons ▶ ⏸ at the top of the screen in Vizeey to start and to pause the experiment.
- Position databot at a specific distance from the light source.
- Gradually move databot closer to or further away from the lamp while observing the changes in light intensity displayed on the graph.

Write down your observations.

_____

_____

_____

Why Does a Lamp Emit Light?

A lamp emits light as a result of electrical energy being transformed into light energy through a process called incandescence.

Incandescent Bulbs: In incandescent bulbs, electrical energy flows through a filament, heating it until it glows and emits visible light. The conversion of electrical energy into thermal energy causes the filament to reach high temperatures, producing both heat and light.

LEDs (Light Emitting Diodes): In LED lights, electrical energy excites electrons in a semiconductor material, causing them to release energy in the form of photons (light). This process is much more efficient than traditional incandescent bulbs, resulting in less heat loss and more effective light production.

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Chemical to Thermal Energy

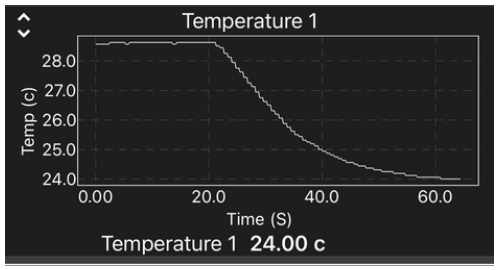
By doing this experiment, you will observe and measure the transformation of chemical energy into thermal energy using databot and a chemical reaction.

Materials Needed

- Databot
- Temperature sensor
- Vinegar and baking soda
- Container

Experiment Steps:

- Gather all necessary materials and ensure that the workspace is clean and organized.
- Turn on databot.
- Connect the temperature probe to databot.
- Tap on "**The Great Energy Switch**" in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Choose the tab *"Temperature"* for this part of experiment.
- Start and stop your experiment using:
- Measure approximately 1 tablespoon of baking soda and place it in the container.
- Place the temperature probe into the container with baking soda. Write down the initial temperature in the table.
- Pour about 1/4 cup of vinegar into the container with the baking soda.
- Be prepared for bubbling and fizzing as a result of the reaction.
- Observe the temperature changes and enter the data you received in the table.



Experiment Variable	Starting Reading	End Reading	Net Change +/-
Temperature (C)			

Write down your observations.

Ensure that students remain at a safe distance from any reactions, especially if using vinegar and baking soda, as it can produce foam.

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Mechanical to Sound Energy

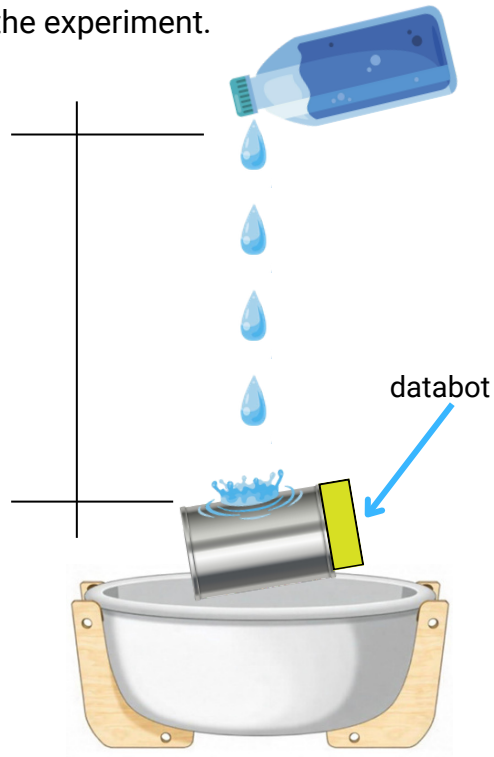
By doing this experiment, you will observe and measure the transformation of mechanical energy into sound energy using databot and drops of water .

Materials Needed

- Databot
- Plastic bottle with a lid (filled with water)
- Metal can
- A container to catch the dripping water
- Tape (for securing databot)

Experiment Steps:

- Prepare databot and the metal can. Use tape to securely attach databot to the metal can, ensuring that the sensors are directed towards the can.
- Take a second plastic bottle filled with water, turn it upside down, and slightly loosen the lid to allow water to drip out slowly.
- Turn on databot.
- Tap on **"The Great Energy Switch"** in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Choose the tab *"Sound Intensity"* for this part of experiment.
- Start your experiment using ▶ and ⏸ to pause the experiment.
- Make sure the classroom is as quiet as possible to accurately capture sound data.
- Hold the bottle with water above the metal can so that the water drips onto it. The droplets should fall directly onto the surface of the can.
- databot will record the sound produced by each droplet hitting the metal can.
- Change the height from which the water droplets fall and observe how this affects the sound level recorded by databot.
- After collecting data, analyze how changes in drop height influence sound intensity



Place the bottle at an angle so that water drops do not fall on databot.

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Part 5: Concept Questions

Data Interpretation:

1. What factors affect the intensity of light measured in Experiment 1?

2. Why is it important to understand energy transformations in everyday life?

3. What is the relationship between the height of a water drop and the sound produced in Experiment 3?

Part 6: Reflection

1. What was the most surprising or interesting observation you made during the experiments? Why did it stand out to you?

2. How has your understanding of energy transformations changed as a result of these experiments? Can you explain energy transformations in your own words now?

3. If you were to repeat these experiments, what changes would you make to improve data collection or observations?