Temp Probe, Light

The Magic of Energy

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

Overview

Energy surrounds us and constantly transforms from one form to another. In this lesson, you will explore three exciting experiments to better understand energy transformations: mechanical energy to thermal energy, solar energy to thermal energy, and light energy to luminous energy.

Background

Energy is a key concept that shapes the way we experience the world around us. It exists in various forms—mechanical, solar, thermal, and light—and is constantly transforming from one type to another. Recognizing these transformations is crucial for understanding how energy powers our daily lives, from heating our homes to illuminating our nights.

Energy transformations occur when energy changes its form. For example, when you rub an object, the mechanical energy of motion converts into thermal energy, producing heat. Similarly, sunlight focused through a magnifying lens can increase the temperature of an object, demonstrating the transformation of solar energy into thermal energy. Even light can charge special objects, enabling them to emit a glow, showcasing the conversion of light energy into luminous energy.

By studying these processes, we gain insights into how energy flows through systems and how it can be effectively harnessed to meet human needs. This lesson invites you to explore and measure these transformations firsthand, deepening your understanding of the science that powers our everyday lives.

What You Will Need/Prep

- Databot with temperature probe
- IOS/Android Smart Device
- Magnifying lens.
- Fluorescent toy.
- A dark box or covered area for light intensity measurements.
- Rubber eraser or cork block
- 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 with databot, you will observe and measure different energy transformations, learning about their significance in everyday life.

Learning Objectives

Students will learn to:

- Use the databot's sensors to measure and record data accurately.
- Observe and analyze energy transformations:
  - Mechanical to thermal.
  - Solar to thermal.
  - Light to luminous.
- Interpret experimental data to draw meaningful conclusions.
- Understand how energy transformations impact daily life.
- Explain energy transformations in your own words.

Important Terms

Energy Transformation: The process of energy changing from one form to another.

Mechanical Energy: Energy associated with motion or position.

Thermal Energy: Heat energy, a form of energy transfer.

Solar Energy: Energy from the sun in the form of light or heat.

Light Energy: Visible electromagnetic radiation.

Luminous Energy: Light emitted by an object after being energized.

Interesting Facts

The law of conservation of energy: Despite all the transformations, energy does not arise from nothing and does not disappear without a trace. It only passes from one form to another.

The energy balance of the Earth: The Sun is the main source of energy for our planet. The energy of the Sun supports all life processes on Earth, from plant growth to the movement of ocean currents.

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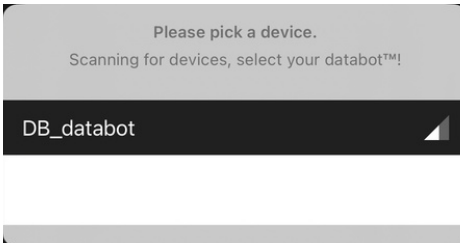
Using Vizeey

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

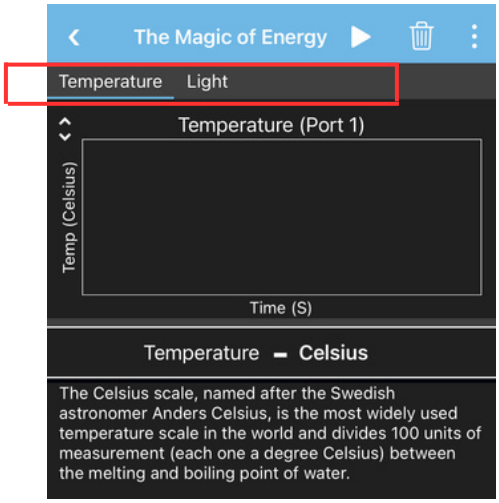
Then select “Add experiment from QR code” and scan the QR code prepared for this experiment. Your experiment will appear in the list.



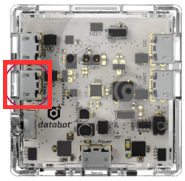
When you start the experiment you will be immediately offered to connect to your databot. Make sure that databot is enabled.

Once in the Experiment

This lab consists of 2 experiments.
Each experiment has its own separate tab for easy access.

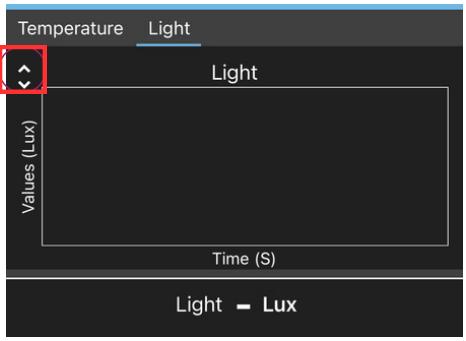


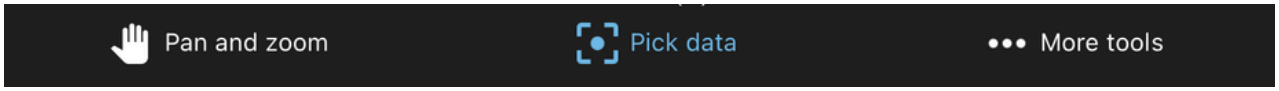
- You can connect 2 temperature sensors to databot at once.
- In the experiment, you use only the one sensor. It is important to connect it to the correct port for normal operation.



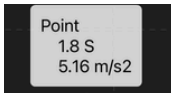
After you run the experiment on the databot, the LED signaling its operation will stop glowing. This is normal, don't worry. This is done so that the light from the LED does not interfere with collecting readings from its own glow.

- 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 mechanical, solar, and light energy that you encounter in everyday life? _____

_____

_____

What are some examples of energy transformations you notice in your surroundings?

_____

_____

Have you used objects that glow in the dark after being exposed to light? How do you think they store and release energy?

_____

_____

Part 2: Hypothesis

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

Prediction for Mechanical to Thermal Energy:

_____

Prediction for Solar to Thermal Energy:

_____

Prediction for Light to Luminous Energy:

_____

Part 3: Experiment Procedure and Data Analysis

Mechanical to Thermal Energy

By doing this experiment, you will gain hands-on experience observe and measure the transformation of mechanical energy into thermal energy by rubbing a material and recording the temperature changes.

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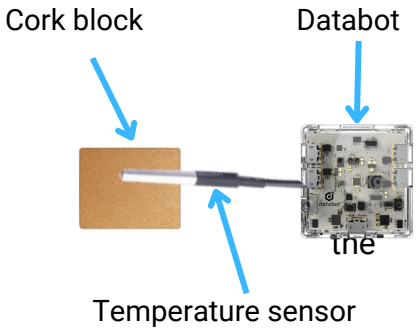
Prepare:

- Databot with a temperature sensor
- Rubber eraser or cork block



Experiment Steps:

- Turn on the databot and connect the temperature sensor.
- Tap on "**The Magic of Energy**" in Vizeey to load 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"* and start your experiment using: ▶
- Use these icons ▶ ⏸ at the top of the screen in Vizeey to start and to pause the experiment.
- Place the sensor on the surface of the cork block and leave it for 4 minutes to return to normal temperature
- Record the initial temperature. _____
- Remove the temperature sensor and vigorously rub the cork block for 30 seconds.
- Immediately place the sensor back on the surface and record the final temperature. _____
- Note the change in temperature and analyze how friction converts mechanical energy into heat.

Write down your observations.

_____

_____

_____

- Repeat the experiment several times with different materials and fill in the table.

Material	Initial temperature	Final temperature

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Solar to Thermal Energy

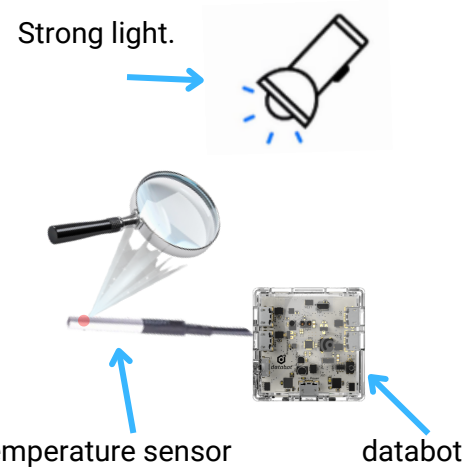
By doing this experiment, you will observe and measure the transformation of solar energy into thermal energy by focusing sunlight with a magnifying lens.

Materials Needed

- Databot with a temperature sensor
- Magnifying lens
- A sunny outdoor location or a strong indoor light source (e.g., a lamp that mimics sunlight)

Experiment Steps:

- Turn on the databot and connect the temperature sensor.
- Place the databot in a location where it can receive direct sunlight or strong light.
- Ensure the temperature sensor is exposed to the light.
- Tap on **"The Magic of Energy"** 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". Start your experiment using: ▶
- Use these icons ▶ ⏸ at the top of the screen in Vizeey to start and to pause the experiment.
- Place the sensor on the surface and leave it for 4 minutes to return to normal temperature
- Record the initial temperature _____
- Hold the magnifying lens above the sensor and adjust its position to focus the sunlight (or light) onto a small area of the sensor.
- Keep the focused light steady for 30–60 seconds.
- Record the final temperature of the sensor. _____



Write down your observations.

_____

_____

_____

The temperature sensor can withstand temperatures up to 150 degrees Celsius. Do not heat above this temperature.

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Mechanical to Sound Energy

By doing this experiment, you will observe and measure the transformation of light energy into luminous energy using a fluorescent toy that absorbs light and later emits it as a glow.

Materials Needed

- Databot
- Fluorescent toy (e.g., glow-in-the-dark toy)
- Light source (e.g., flashlight or LED lamp)
- Dark box

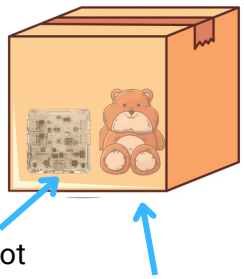
Experiment Steps:

- Turn on the databot.
- Place the fluorescent toy in a dark box with the databot and close the box
- Tap on **"The Magic of Energy"** in Vizeey.
- 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 run your experiment.
- Use these icons ▶ ⏸ at the top of the screen in Vizeey to start and to pause the experiment.
- Measure its initial light intensity and record the readings.

  _____
- Remove the toy from the box and shine a light source on it for 1-2 minutes. Make sure the light source is close enough to effectively charge the toy.
- Place the charged toy back in the dark box and measure its light intensity again with the databot.
- Record the new readings.

  _____
- Compare the light intensity before and after exposure to the light source to assess the glow effect.

databot Fluorescent toy



databot

Fluorescent toy

Write down your observations.

_____

_____

_____

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Part 5: Concept Questions

Data Interpretation:

1. What factors affect the temperature change in Experiment 1?

2. What other materials besides a fluorescent toy can be used in Experiment 3 and why?

3. How does the distance between the magnifying lens and the sensor affect the temperature change in Experiment 2?

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?