PocketLab

Name: _____

Period: _____ Group Name: _____

Lab Activity: Energy Conservation – Transferring Kinetic Energy to Thermal Energy

Introduction:

The law of conservation of energy states that the total energy of an isolated system remains the same. Over time, all energy is conserved. Energy is neither created nor destroyed – instead it transfers from one form to another. Objects in motion have kinetic energy. Thermal energy is energy in a system due to its temperature.

Objective:
In this experiment, students will:

1. Observe how kinetic energy transfers to thermal energy.
2. Use evidence collected during the lab to better understand the law of conservation of energy.
3. Trace the thermal energy in the sand to energy from sunlight.

In the Hypothesis box below, write a prediction to the answer the following question:
When shaking a jar of sand, what happens to the temperature of the sand? Explain your answer.

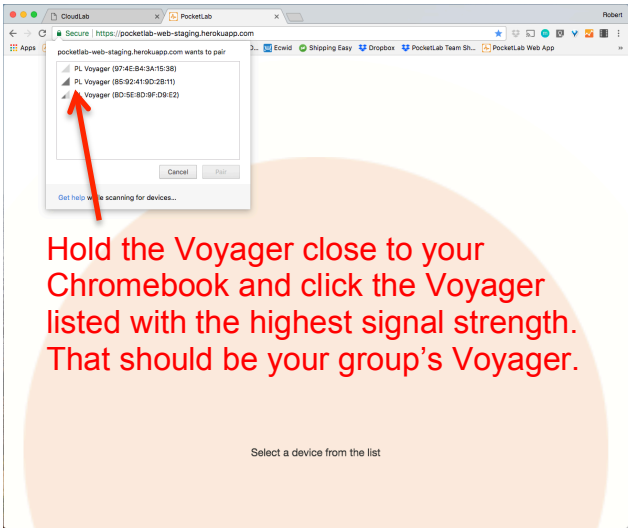
In today's lab activity we will test to see whether your hypothesis was correct.

Hypothesis:

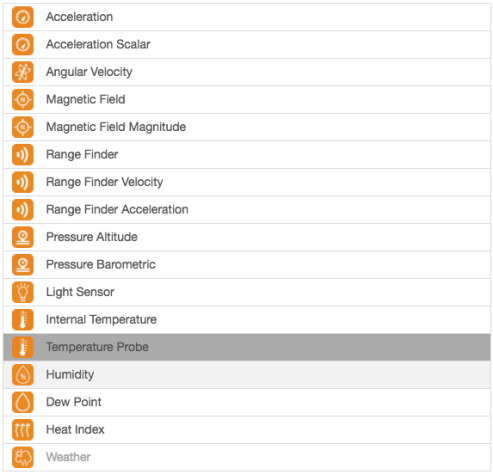
Part 1: Collecting data as a group with PocketLab

In part 1 of the lab activity, your group will collect data using PocketLab Voyager and the PocketLab app (The screenshots were taken using the PocketLab web app. The PocketLab mobile app will look slightly different). Follow the steps below:

1. Go to the PocketLab web app (in a Chrome browser) using the following address: https://pocketlab-web-staging.herokuapp.com/ or open up the PocketLab mobile app.
2. Turn on the PocketLab Voyager by clicking the button on the top.
3. If using the web app, click the text that reads, "Click here to connect". If using the mobile app, the PocketLab Voyager should automatically connect.
4. Web app only: A pop-up box should appear showing all the PocketLab Voyagers that are turned on. Hold your PocketLab Voyager close to your computer/Chromebook. Click the PocketLab Voyager with the highest "signal strength."



5. Click on the “Change Graph” icon  .
   Click “Temperature Probe” and unclick “Acceleration.”



6. Plug in the temperature probe into the side of the PocketLab Voyager.

You are now ready to collect data for your two runs and answer data analysis questions.

Data collection for Run 1: Control Run – Change in temperature of sand while not shaking.

1. Place the temperature probe in the jar of sand. Make sure the temperature probe will stay in the sand while shaking. It may be helpful to tape the temperature probe to the bottom of the jar.
2. Close the lid of the jar. (Hint: If you don’t have a jar where you can run the probe through a hole in the lid, use a “to go” coffee cup/mug with a lid. The probe will fit through the small drinking hole in the lid, while allowing you to keep the cup sealed).
3. Begin data recording by clicking the “Record” button below the graph.
4. You will record data for 5 minutes (300 seconds).
5. Keep an eye on the graph. As a group, observe and discuss how the graph changes over time.
6. At 5 minutes (300 seconds), hit the “Stop” button at the bottom of the “Temperature Probe” graph.
7. Save your data and take a screenshot of the graph.
8. In your lab notes write the original temperature of the sand at 0 seconds, the temperature at 2.5 minutes (150 seconds) and the final temperature of the sand at 5 minutes (300 seconds). Also, add any observations you made as a group about the data.

Data collection for Run 2: Experimental Run - Change in temperature of sand while shaking.

1. Begin a new data recording by clicking the “Record” button below the graph.
2. You will record data for 5 minutes (300 seconds).
3. During the recording shake the jar of sand. Don’t stop shaking the sand for the entire five minutes. Switch between group members if necessary.
4. Keep an eye on the graph. As a group, observe and discuss how the graph changes over time.
5. At 5 minutes (300 seconds), hit the “Stop” button at the bottom of the “Temperature Probe” graph.
6. Keep an eye on the graph. As a group, observe and discuss how the graph changes over time.
7. At 5 minutes (300 seconds), hit the “Stop” button at the bottom of the “Temperature Probe” graph.
8. Save your data and take a screenshot of the graph.
9. In your lab notes write the original temperature of the sand at 0 seconds, the temperature at 2.5 minutes (150 seconds) and the final temperature of the sand at 5 minutes (300 seconds). Also, add any observations you made as a group about the data.
10. Repeat steps 1-9 for additional trials.

Data Analysis

Run 1 – Control Run
1. How much did the temperature of the sand change in the first 2.5 minutes?
2. How much did the temperature of the sand change in the last 2.5 minutes?
3. How much did the temperature of the sand change in the entire 5 minutes?

Run 2 – Experimental Run
1. How much did the temperature of the sand change in the first 2.5 minutes for each trial?
2. How much did the temperature of the sand change in the last 2.5 minutes for each trial?
3. How much did the temperature of the sand change in the entire 5 minutes for each trial?
4. What was the average temperature change for all 3 trials for the entire 5 minutes?

Part 2: Write a Lab Report

A lab report is a great way to summarize how you conducted your experiment and tested your hypothesis, the data collected, and any conclusions you can draw about the scientific question that was tested.

In your lab report include:
1. Your original hypothesis from the beginning of the lab.
2. The objective or scientific question you wanted to answer with the lab activity.
3. What materials you used in the experiment.
4. A detailed description of how the lab was set up and how you tested your hypothesis.
5. A summary of your data and the answers to your data analysis questions.
6. Any observations you made with your group.
7. A conclusion paragraph that answers the following questions:

-Was there a greater temperature change when shaking the sand or when the sand stayed at rest? How do you know?

-Was your hypothesis correct?

-How did the kinetic energy from shaking the sand affect the thermal energy of the sand. Support your answer with evidence (data) collected during your experiment.

-Think about how the jar was shaken. It required energy for you to shake the jar. Did that energy disappear after you used it? Where did it go? How did you get the energy to shake the jar in the first place? Trace the energy change in the sand to energy that comes to Earth through sunlight. How does this help explain the law of conservation of energy?