INV. 4 ACTIVITY—PLANET TEMPERATURES

Focus Question: How does distance from the Sun affect a planet's temperature?

In Investigation 2, we created a model of the solar system and found out information about the planets within the system. In this investigation, we investigated how solar energy can transfer to Earth's surface and warm different surfaces/substances.

- How do you think the Sun's energy transfers to other planets in the solar system?
- Does distance from the Sun affect that energy transfer?

Materials:

- Planetary data (see chart below)
- 2 sheets of graph paper (see next 2 pages)

Instructions:

1. Look at the table of planetary data below. You should see data for the average temperature on each planet as well as the average distance the planet is from the Sun.
2. Graph the data onto pieces of graph paper (see next 2 pages). Be sure to label your axis and provide a title for each graph.
3. Compare your graphs and look at patterns.
4. Describe the relationship you see between temperature and distance from the Sun.
5. Which planets, if any don't fit the relationship? Why do you think they don't fit?
6. Do all planets receive and absorb the same amount of energy from the Sun? What is your evidence?

Planet	Average temperature (°C)	Average distance from Sun (kilometers)
Mercury	167	57,910,000
Venus	464	108,200,000
Earth	15	149,600,000
Mars	-65	227,940,000
Jupiter	-110	778,330,000
Saturn	-140	1,429,400,000
Uranus	-195	2,870,990,000
Neptune	-200	4,504,300,000

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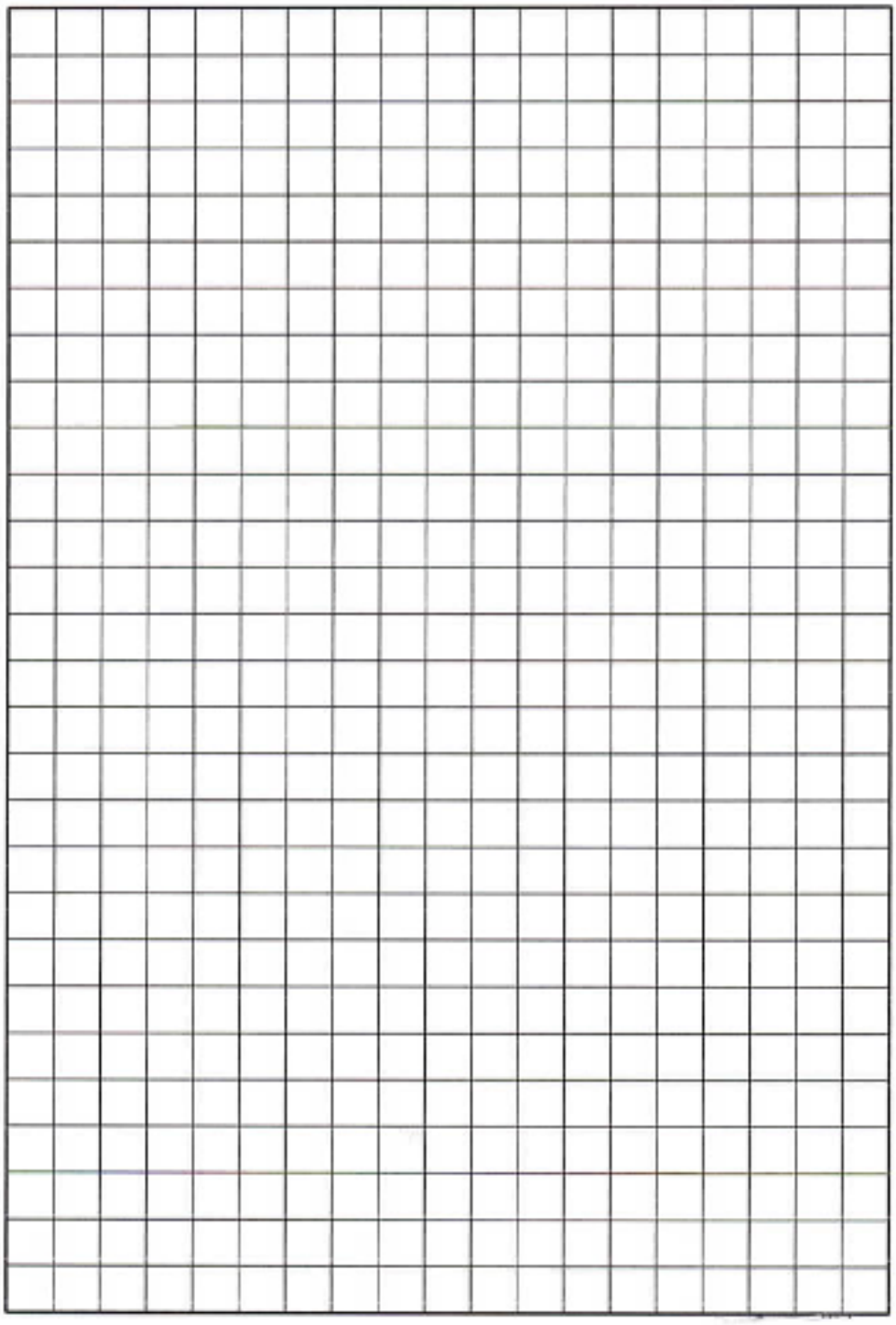
INV. 4 ACTIVITY—PLANET TEMPERATURES (Continued)

Investigation 4: Heating Earth



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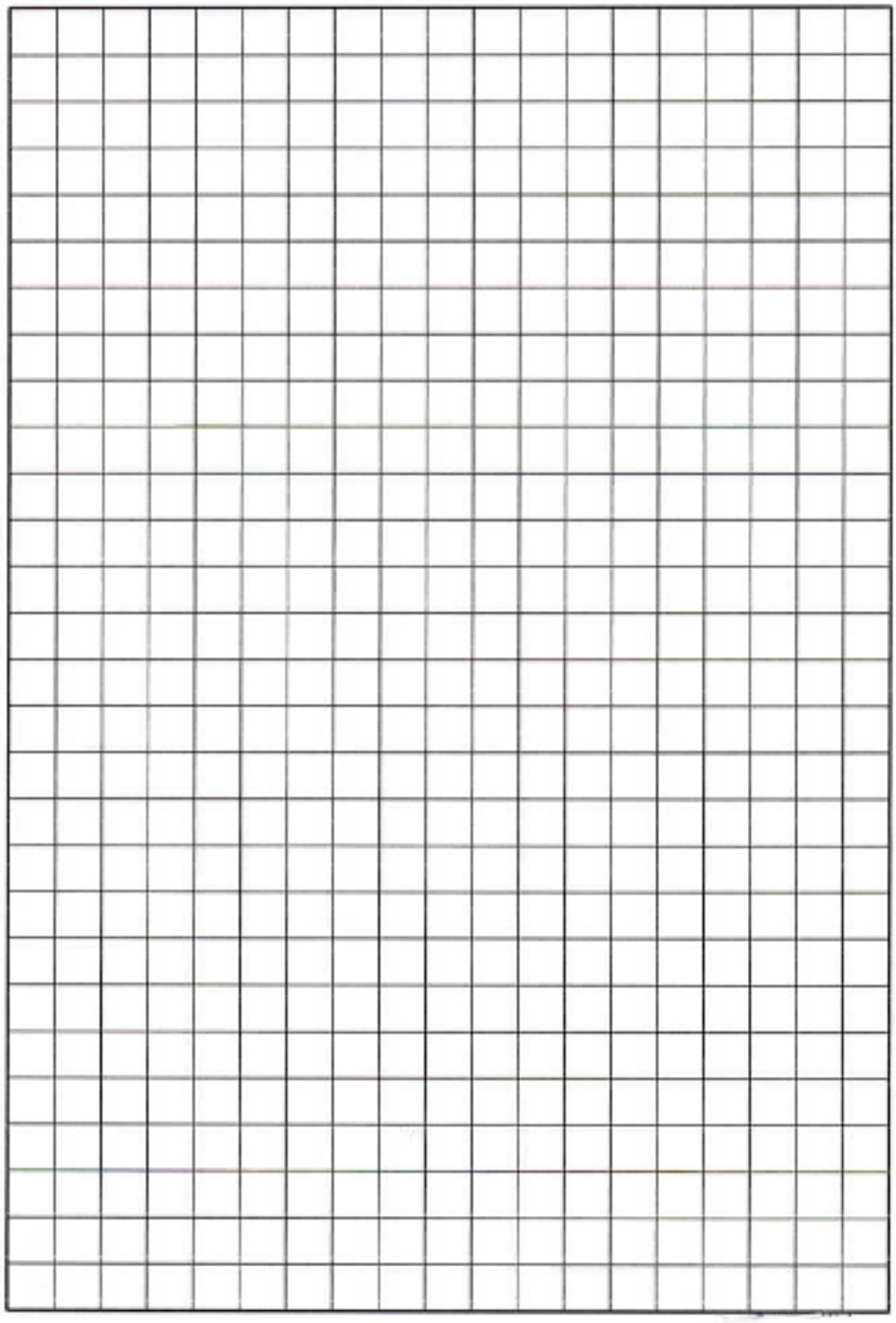
INV. 4 ACTIVITY—PLANET TEMPERATURES (Continued)

Investigation 4: Heating Earth



INV. 4 ACTIVITY—SOLAR WATER HEATER

Challenge: Design a solar water heater in a zip bag.

Engineer a solar water heater in a zip bag that will heat water at least 10° C (18° F) through energy transfer from the Sun. You can choose to address this challenge by investigating one of these variables.

- Orientation to the Sun
- Kind of surface beneath the bag
- Color of surface beneath the bag
- Color of the bag
- Amount of water in the bag
- Other variable of your own choosing

Materials:

1 Zip bag, 1 L (quart size) or 4 L (gallon size)

- Different materials for your background surface for the solar water heater such as fabrics, different colored surfaces
- Markers for coloring the bag
- Thermometer
- Water and water measuring tool
- A sunny day

Instructions:

1. Get a zip bag. For any additional trials, make sure you use the same size bag.
2. Choose the variable you wish to investigate.
3. Design your solar water heater. Record (draw) your design in your science notebook.
4. Add the water to your water heater. (How much water are you adding? Be sure to record the amount in your science notebook.)
5. Measure the initial temperature of the water and record that in your notebook.
6. Place your solar water heater in a sunny location outside for 5 minutes.
7. Measure the temperature of the water after 5 minutes.
8. If the temperature difference is not 10°C (18° F) or more, re-design your solar water heater and try again. Be sure to keep all other variables the same (amount of water, amount of time in the sunlight, etc.)

Extension: Try a different variable. Can you successfully design a solar water heater that investigates a different variable?

INV. 4 ACTIVITY—DESIGN A SOLAR OVEN

Challenge: Design a solar oven that will heat and cook a hot dog.

A solar oven is a device created to heat food using the energy of the Sun. It focuses the energy of the Sun directly to the food it is to cook. Can you design your own oven that will cook a hot dog?

Materials:

- Cardboard box and pieces
- Aluminum foil
- BBQ skewers
- Hot dog
- Other materials for your design

Instructions:

1. You may want to conduct an Internet search on solar ovens for more information on solar cookers.
2. Start your plan for your design by seeing what materials are available to you and drawing some ideas in your science notebook.
3. Design your solar oven. Record your test design in your notebook.
4. Attach your hot dog and place your solar oven in a sunny location outside.
5. Does your solar oven cook the hot dog?

   What is your evidence?

   How long does it take?
6. If the hot dog is not cooking after several minutes or is cooking very slowly, modify your design.

   What do you see that needs to be done to more efficiently focus the Sun's energy onto the hot dog?

INV. 4 ACTIVITY—ENERGY TRANSFER MEDIA RESOURCES

Online Resources on FOSSweb (Must log in to FOSSweb with your username and password.)

Use these online resources to help review content from **Investigation 4 of Earth and Sun**. The tutorials and virtual investigations provide interactive resources that review concepts from the FOSS active investigations. The virtual investigations often mimic the active investigations that were done in class.

For the articles in *FOSS Science Resource*s, access the **interactive eBoo**k and make sure to click on the interactive links within the readings. Be sure to take notes on what you learn from all online resources and answer the questions from the articles in your science notebook.

Investigation 4 Resources

Online Activities

- Particles in Solids, Liquids, Gases
- Energy Transfer
- Aluminum and Steel Strips (Video)
- Tutorial—Radiation
- Virtual Investigations—Uneven Heating

Media Library

• eBook readings (Interactive eBook)

- *Uneven Heating*
- *Heating the Air: Radiation and Conduction*
- *Wind and Convection*
- *Wind Power*
- *Solar Technology*

• Streaming Video

- *Convections*