# Pre-Lab Information

**Purpose** To compare how different materials on Earth’s surface absorb heat and to understand how the angle of insolation affects the heating of Earth’s surface

**Time** Approximately 60 minutes

**Question** What factors influence the absorption of sunlight at Earth's surface?

**Summary** In this virtual lab, you will measure how quickly different materials (soil, sand, water, and air) heat up. You will also determine how the angle of light affects how much heat soil absorbs. Finally, you will learn from a virtual model how differences in surface temperature create wind.

# Lab Procedure

1. **Prepare for the project.**
2. Read through this guide before you begin, so you know the expectations for this lab.
3. If anything is not clear to you, be sure to ask your teacher.
4. **Open the virtual lab.**
5. **Compare absorption rates of materials.**
   1. Read about why different places on Earth have different temperatures.
   2. Press the **“?”** button to learn more about absorption rate.
   3. Press the **“Start the Lab”** button to start the lab.
   4. Drag the soil into the first container, the sand into the second container, and the water into the third container. The last container contains the air sample.
   5. Proceed to the next step of the activity by pressing the **“Continue”** button.
   6. Press the light switch to turn on the lamps and start the timer.
   7. Observe how the temperature of the different materials changes.
   8. Record the temperature of each material every 3 minutes for 15 minutes in **Table A** of the **Data** section of this guide. Every time the timer stops, record the temperatures, and then start the timer to complete your observations.
   9. Press the **“x2”** button to make the timer go faster. To go back to the slower speed, press the **“x2”** again. Press the **“Stop/Play”** button (purple button) to pause and unpause the animation and timer.
   10. Move on to the next activity.
6. **Observe how the angle of insolation affects heat absorbed by soil.**
   1. Read about why places at different latitudes have different temperatures.
   2. Press the **“?”** button to learn more about the angle of insolation.
   3. Press the **“Explore!”** button to proceed.
   4. Press the light switch to turn on the lamp and start the timer. Note that in this setup, the soil sample receives light at an angle of 0 degrees.
   5. Observe how the temperature of the soil changes. Record the temperature of the soil every 3 minutes for 15 minutes in **Table B** of the **Data** section of this guide.
   6. Press the **“x2”** button to make the timer go faster. To go back to the slower speed, press the **“x2”** again. Press the **“Stop/Play”** button (purple button) to pause and unpause the animation and timer.
   7. Proceed to the next step of the activity.
   8. Press the light switch to turn on the lamp and start the timer. Note that in this setup, the soil sample receives light at an angle of 45 degrees.
   9. Observe how the temperature of the soil changes. Record the temperature of the soil every 3 minutes for 15 minutes in **Table B** ofthe **Data** section of this guide.
   10. Press the **“x2”** button to make the timer go faster. To go back to the slower speed, press the **“x2”** again. Press the **“Stop/Play”** button (purple button) to pause and unpause the animation and timer.
   11. Copy the data from the Soil row in **Table A** to the 90 degrees row in **Table B**. This will serve as your data for soil that receives light at an angle of 90 degrees.
   12. Move on to the next activity.
7. **Learn about sea breezes.**
   1. Read about an effect of the unequal heating of Earth’s surface.
   2. Drag the bonfire to the left side of the sand, under the coconut tree.
   3. Observe how the smoke from the bonfire moves. Record your observations in **Table C** inthe **Data** section of this guide.
   4. Proceed to the next step of the activity.
   5. Drag the bonfire to the middle of the sand.
   6. Observe how the smoke from the bonfire moves. Record your observations in **Table C** in the **Data** section of this guide.
   7. Proceed to the next step of the activity.
   8. Drag the bonfire to the right side of sand, near where the sand meets the ocean.
   9. Observe how the smoke from the bonfire moves. Record your observations in **Table C** in the **Data** section of this guide.
   10. Read about the science behind sea breezes.
   11. Move on to the next activity in the Virtual Classroom.

# Data

Record your data either in your lab notebook or in the space below.

**Table A: Temperature of Different Materials**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Material** | **Temperature (°C)** | | | | |
| **3 minutes** | **6 minutes** | **9 minutes** | **12 minutes** | **15 minutes** |
| **Soil** |  |  |  |  |  |
| **Sand** |  |  |  |  |  |
| **Water** |  |  |  |  |  |
| **Air** |  |  |  |  |  |

**Table B: Angle of Insolation and Soil Temperature**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Angle** | **Temperature (°C)** | | | | |
| **3 minutes** | **6 minutes** | **9 minutes** | **12 minutes** | **15 minutes** |
| **0 degrees** |  |  |  |  |  |
| **45 degrees** |  |  |  |  |  |
| **90 degrees** |  |  |  |  |  |

**Table C: Bonfire Smoke Direction**

|  |  |
| --- | --- |
| **Bonfire Location** | **Smoke Direction** |
| **Left side of sand** |  |
| **Middle of sand** |  |
| **Right side of sand** |  |