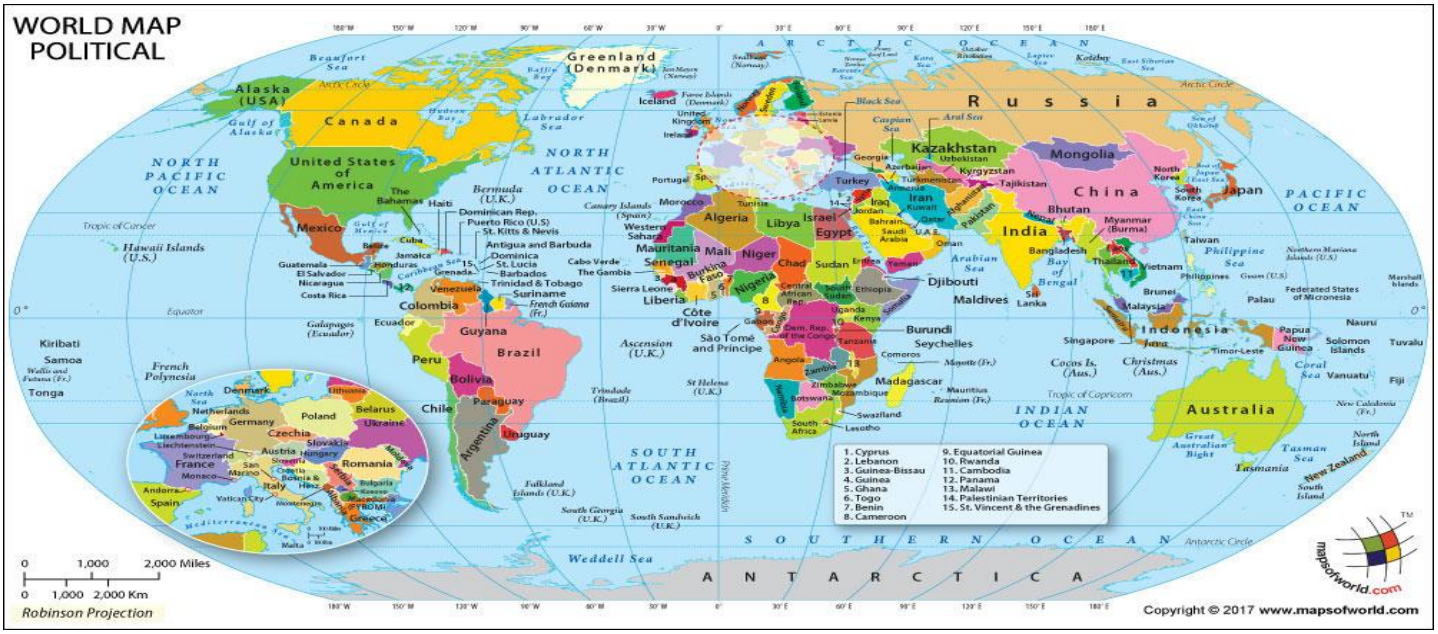
Angle of Sunlight Lab

Name: _____ Date: _____ Period: _____

LT: I can explain how the temperature on the Earth is affected by the angle of sunlight.



Part 1: Experimental Procedure

1. When your science teacher comes around with a flashlight, shine the light directly onto the grid paper at a height of about 15cm. This is a 90° angle. Trace the lit area with a pencil. This measurement simulates the angle of sunlight that hits the Earth at the equator.

2. Now hold the flashlight at about a 30° angle. Trace the lit area with a pencil. This measurement simulates the approximate angle of sunlight that hits nearer the Earth's poles.

3. To determine the lit area of the grid when the flashlight is held at 90°, count the number of full blocks and partial blocks within the pencil outline. Estimate the number of full blocks. This is the approximate area. This information should be recorded as data.

4. Now fill the area with beans. The beans represent the amount of solar energy that hits the Earth. Since the sun is the same distance from the Earth, no matter where you are on the Earth, the amount of solar energy is the same. This means you will use the same number of beans for the remainder of the lab.

5. Now you can calculate the temperature of one block in °C. This is the temperature at the equator.

6. To determine the lit area of the grid when the flashlight is held at 30°, count the number of full blocks and partial blocks within the pencil outline. Estimate the number of full blocks. This is the approximate area. Record this information.

7. Remember that the number of beans will be the same that you found in step 3. **Do not add any beans.** The solar energy is constant regardless of where you are on the Earth.

8. Now calculate the temperature of one block in °C. This is the temperature closer to the poles.

Part 2: Data Collection and Analysis

Data:

Lit area: 90°						
Approximate Area _____ (# of whole squares)						

Lit area: 30°						
Approximate Area _____ (# of whole squares)						

Calculations: To determine the differential heating of the earth at the equator vs closer to the poles, calculate the amount heat absorbed by one block in each area. Each "bean" absorbs 40°C of energy from the sun. You can use this to calculate the total heat absorbed by one block in each area by using this formula:

(# of beans used × 40°C per bean) ÷ approximate lit area = temperature of one block in that area

*Remember that you are using the same number of beans because the energy from the sun is constant, so the first part of the equation is the same for anywhere on Earth. Calculate this value and enter into the table below.

Total Heat Energy available from the sun = _____ × 40°C = _____ °C

Now calculate the temperature in one block at the equator and in one block closer to the poles and enter your data in the table below.

Heat absorbed = Total Heat Energy from the sun (°C) ÷ Approximate Area

Place	Angle of Sunlight	Heat Energy from Sun (°C)	Approximate Area (# of squares lit)	Heat absorbed (°C) (Heat energy ÷ area)
Equator	90°			
Closer to the Poles	30°			

Part 3: Summary Questions

Directions: Complete the following questions using complete sentences and precise language.

1. Was more heat absorbed at the equator or closer to the poles?

   _____

   _____

2. Is this what you would expect? _____

   Why or why not? _____

   _____

   _____

   _____

3. If the flashlight were sunlight, which angle would heat the paper the **most**?

   _____

   _____

4. In general, where would the Earth have higher temperatures? _____

   _____

   Why?_____

   _____

   _____

5. Using the world map on the first page state at least 6 different countries you think would have the highest temperatures on the planet.

   _____

   _____

   _____

6. If the flashlight were sunlight, which angle would heat the paper the **least**?

   _____

   _____

7. In general, where would the Earth have lowest temperatures? _____

   _____

   Why?_____

   _____

   _____

8. Using the world map on the first page state at least 6 different countries you think would have the coolest temperatures on the planet.

_____

_____

_____

9. Now think about how the angle of sunlight affects the temperature of the lit area.

   As the angle of the sun moves away from 90°, the temperature of the lit area is _____.

   As the angle of the sun moves toward 90°, the temperature of the lit area is _____.

10. Which area (90^0 or 30^0) would be called

    direct sunlight? _____

    indirect sunlight? _____

11. Miami, Florida, is much warmer on average than West Linn. Explain why **using what you learned** in this lab.

_____

_____

_____

_____

_____

12. Toronto, Canada, is much warmer, on average, than West Linn. Explain why **using what you learned** in this lab. (Hint: What is the latitude of Toronto vs the latitude of West Linn?)

_____

_____

_____

_____

_____