Same Sun, Different Climates Lab

Name _____

Date _____

Period _____

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It is the same sun over Singapore and over Utqiagvik, Alaska. One is hot all year. One is frozen most of the year. Find out why.

☐ I can measure how the angle of light changes the area it covers.

☐ I can explain why the equator is warm and the poles are cold.

☐ I can tell weather from climate and use data to predict a city's climate.

Part 1. The flashlight test (Tab 1)

SEP 3 Planning and Carrying Out Investigations · CCC Scale, Proportion, and Quantity

Press **90°**, then **Trace and count**. Do the same at **45°** and **20°**. Then pick one more angle of your own with the slider. Copy from **Your readings**. Look at the spot to judge how bright it is.

1. Record what you measure.

Light angle	Squares lit	Times as many as at 90°	Light on each square	How bright? (bright, medium, dim)
90° (straight down)		1.0		
45°				
20°				
My angle: _____°				

2. This was a fair test. Two things we kept the same: _____ and _____. The one thing we changed: _____.

READ FIRST. In the lab, find the green **Learn It** box and read it. Then answer 3 to 5.

3. At 20°, each square got about _____ (what fraction?) of the light it got at 90°. Use the words **energy per square meter** to explain why the 20° spot looks dim.

4. Which of your lights is like the noon sun near the equator? Which is like the noon sun near the poles? Give a squares number for each.

5. Use the pattern on the graph. Predict the squares at 10°: _____. Now check in the lab: _____. What happens to the light on each square?

Part 2. A tilted Earth (Tab 2)

SEP 4 Analyzing and Interpreting Data · CCC Cause and Effect

Pick **Buffalo**. Pick **Jan** and press **Record**. Then pick **Jul** and press **Record**. Then pick **Mar** and record **Singapore**, **Buffalo** and **Utqiagvik**. Copy from **Your records**.

6. Buffalo in winter and summer.

Buffalo	Distance from the sun (million km)	Sunlight reaching Earth (W/m^2)	Noon sun height	Sunlight on each m^2 (W/m^2)
January 21				
July 21				

7. Three places on March 21.

Place	Latitude	Noon sun height	Sunlight on each m^2 (W/m^2)
Singapore			
Buffalo			
Utqiagvik			

READ FIRST. In the lab, find the green **Learn It** box and read it. Then answer 8 to 11.

8. Use Q7. As **latitude** goes up, the noon sun gets _____ and the sunlight on each m² gets _____. Explain why, using the shape of Earth.

9. Use Q6. Divide July by January.

(a) Sunlight reaching Earth: _____ ÷ _____ = _____ This change comes from **distance** .

(b) Sunlight on each m²: _____ ÷ _____ = _____ This change comes mostly from the **angle** .

Which one changes Buffalo's sunlight more, distance or angle? _____

10. A classmate says, "Buffalo is cold in winter because Earth is farther from the sun then." Use two numbers from Q6 to argue for or against.

11. Pick Utqiagvik. Noon sun on December 21: _____ June 21: _____. Use Earth's **tilt** to explain the difference.

Part 3. Five cities (Tab 3)

SEP 4 Analyzing and Interpreting Data · CCC Patterns

Pick each city and press **Plot this city**. Copy from **Your cities**. Then move the slider in **One year of weather in Buffalo**.

12. Real averages, 1991 to 2020.

City	Noon sun in March	Year average (°F)	Gap: warmest month minus coldest month (°F)
Singapore			
Miami			
Buffalo			
Anchorage			
Utqiagvik			

13. Buffalo, 2025. March 19: _____°F (normal _____°F). January 22: _____°F (normal _____°F). The whole year: _____°F (normal _____°F).

READ FIRST. In the lab, find the green **Learn It** box and read it. Then answer 14 to 16.

14. Tick one box in each row.

Statement	Weather or climate?
It was 62.5°F in Buffalo on March 19, 2025.	☐ weather ☐ climate
Buffalo averages 48.8°F a year.	☐ weather ☐ climate
Singapore is warm all year.	☐ weather ☐ climate

Climate zones: Singapore _____ Buffalo _____ Utqiagvik _____

15. Houston, Texas has a noon sun of 60° in March. Use the pattern in Q12 to predict its year average: _____°F. Lock it in and check in the lab: _____°F. Which cities did you use to decide, and why?

Wrap it up

SEP 7 Engaging in Argument from Evidence · CCC Cause and Effect

16. A classmate says, "The poles are cold because they are farther from the sun." Argue against this claim. Use one number from Part 1 or Part 2 and one number from Part 3.

NYSSLS: building toward HS-ESS2-5 and HS-ESS2-7, with DCI ESS2.D Weather and Climate. Environmental Science, Chapter 6 introduction and Lesson 6.1: What Factors Influence Climate? Tags: SEP = Science and Engineering Practice, CCC = Crosscutting Concept. Tab 3 is real data (NOAA and Singapore NEA normals; Buffalo 2025).