Same Sun, Different Climates Lab

Name _____

Date _____

Period _____

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Same sun, different places. Singapore is hot all year. Utqiagvik, Alaska is frozen most of the year. 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 Investigations · CCC Scale, Proportion, and Quantity

Press **90°**, then **Trace and count**. Do the same at **45°** and **20°**. Then use the slider to pick one more angle. Copy from **Your readings**.

1. Record what you measure. Tick how bright the spot looks.

Example: 30 squares at one angle and 15 at 90°. Times as many: 30 ÷ 15 = 2.0. The lab works this out for you.

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

2. A fair test changes only one thing. **Kept the same** (tick two): ☐ the light ☐ the 8 cm distance ☐ the angle

Changed (tick one): ☐ the light ☐ the 8 cm distance ☐ the angle

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

3. At 20°, the light covered about 3 times as many squares. So each square got about ☐ 3 times as much ☐ the same ☐ one third as much light. The **energy per square meter** went ☐ up ☐ down, so the spot looks dim.

4. Noon sun near the **equator** is like: ☐ 90° ☐ 20°

Noon sun near the **poles** is like: ☐ 90° ☐ 20°

5. Predict the squares at 10°:

☐ about 30 ☐ about 60 ☐ over 100

Check in the lab: _____ squares. Each square gets ☐ more ☐ less light.

Part 2. A tilted Earth (Tab 2)

SEP 4 Analyzing Data · CCC Cause and Effect

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

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. As **latitude** goes up, the noon sun gets ☐ higher ☐ lower and the sunlight on each m² gets ☐ more ☐ less.
This happens because Earth is ☐ round (the ground curves away) ☐ closer at the poles

9. Use Q6. Divide July by January.

Example: 1,200 ÷ 600 = 2.0, so July gets 2 times as much.

(a) Sunlight reaching Earth (from **distance**): _____ ÷ _____ = _____

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

The bigger change comes from ☐ distance ☐ angle

10. "Buffalo is cold in winter because Earth is farther from the sun then." In January, Earth is _____ million km from the sun. In July it is _____ million km. So the claim is ☐ right ☐ wrong

Because in January Earth is _____

WORD BANK for Q11: toward · away from · closer · spins

11. Pick Utqiagvik. Noon sun on December 21: _____ June 21: _____. Earth is tilted. In December, the north half leans _____ the sun. In June it leans _____ the sun.

Part 3. Five cities (Tab 3)

SEP 4 Analyzing 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 (°F)
Singapore			
Miami			
Buffalo			
Anchorage			
Utqiagvik			

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

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

CLUE: Weather = one day or one week. **Climate** = the usual pattern over 30 years or more.

14. Tick one box in each row.

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 zone (tropical, temperate or polar). Singapore: _____ Buffalo: _____ Utqiagvik: _____

15. Houston's noon sun is 60°. That is between ☐ Miami and Buffalo ☐ Buffalo and Anchorage, but closer to Miami.
My prediction: _____°F. The lab says: _____°F.

Wrap it up

SEP 7 Arguing from Evidence · CCC Cause and Effect

16. "The poles are cold because they are farther from the sun." I ☐ agree ☐ disagree.

Evidence 1 (Part 1 or 2): _____

Evidence 2 (Part 3): _____

The real reason is ☐ the low angle of sunlight spreads it out ☐ distance from the sun