Thermoregulation Lab

Name _____

Date _____

Period _____

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DAY 1 Your cells make heat all day, yet you stay near **37°C**. Today: how heat **leaves** through the skin.

☐ I can name four ways heat leaves the skin, and show with data that evaporation cools.

☐ I can explain how sweat glands and dermis blood vessels change how fast heat leaves, and why humid heat is dangerous.

Part 1. Wet and dry (Tab 1)

SEP 3 Investigating · SEP 4 Data · CCC Cause and Effect

Humidity **50%**, water **Room temperature**. Change only the thermometer and the air. Press **Run 5 minutes**. Copy from **Your runs**.

1. A fair test. Every run starts at room temperature. **Drop = start − after 5 min.**

Run	Start (°C)	After 5 min (°C)	Drop (°C)
Dry, still air			
Dry, fanned			
Wet, still air			
Wet, fanned			

2. (a) Which run is the **control**? _____ What does **Dry, fanned** prove? _____
(b) **Myth check:** "A wet towel cools you because the water is cold." Run **Wet, fanned** with **cold water from the fridge**: start _____°C, after 5 min _____°C. The room-water run ended at _____°C. Does the myth hold up? Why?

3. Wet, fanned, room-temperature water. Change only the humidity.

Humidity	20%	50%	80%	100%
Drop in 5 min (°C)				

READ FIRST. In the lab, find the **Learn It** box under the drawing and read it. Then answer 4.

4. (a) The water was room temperature, yet the wet thermometer got colder. Use the word **evaporation** to explain why. (b) Use one number from Q1 and one from Q3 to explain why fanning and dry air both help.

Part 2. Four ways out (Tab 2)

SEP 4 Data · CCC Energy and Matter · Patterns

5. Read the bars for each scene. Pick the main way out. Copy from **Scenes you solved**.

Scene	Main way heat leaves	Its watts
1. Sitting in class		
2. By a cold window		
3. Cold metal bench		
4. Windy walk		
5. Cold lake		
6. Run on a hot day		

6. In scene 6, radiation is _____ W and convection is _____ W. What does a **negative** number mean here? Which way is left to lose heat?

READ FIRST. In the lab, find the **Learn It** box under the drawing and read it. Then answer 7.

7. Name the way heat leaves: a thermal camera sees you _____ · a fan blows on you _____ · you sit on a cold step _____ · sweat dries _____. Why does the cold lake (scene 5) pull out more heat than the air on the windy walk?

Part 3. Football practice (Tab 3)

SEP 4 Data · SEP 6 Explanations · CCC Cause and Effect · Structure and Function

8. 90°F, **Shorts and a T-shirt**, water breaks **None**. Change only the humidity. Press **Run practice**.

Humidity	Heat index (°F)	Core at end (°C)	Sweat made (L)	Dripped off (L)	Evaporated (%)
40%					
60%					
80%					

9. 90°F, 80%, **Full pads**, no breaks: core _____°C, danger _____. Same, with water breaks: core _____°C. Watch the **Skin, close up**: during practice the vessel is _____ and the face turns _____.

READ FIRST. In the lab, find the **Learn It** box under the drawing and read it. Then answer 10.

10. The coach says: "It is 90°F, the same as last week when the humidity was 40%. Same practice." Reply to the coach with two numbers from Q8 or Q9 and the word **evaporate**.

DAY 2 A **feedback loop** in the brain turns sweat, blood vessels and shivering on and off to hold the **set point**.

☐ I can name the parts of a negative feedback loop and find them in my own data.

☐ I can explain why a fever makes you shiver at a normal temperature and sweat when it breaks.

Part 4. The loop (Tab 4)

SEP 3 Investigating · SEP 4 Data · CCC Stability and Change

11. Hot: exercise, **Medium**. Press **Record this time** at each time.

When	Pulse (per min)	Cheek color (1 to 4)	Palm (°C)	Sweat?	Vessels
At rest, before					
Right after					
After 2 min of rest					
After 4 min of rest					

12. Cold: bus stop, **Just a T-shirt**. Record each time.

When	Cheek skin (°C)	Color	Shivering?	Goosebumps?	Core (°C)
Indoors, before					
5 min outside					
10 min outside					
5 min back inside					

13. Build the loop. Place all eight cards. Then fill in the loop for **too hot**.

Stimulus	Receptor	Control center	Effector	Response

READ FIRST. In the lab, find the **Learn It** box under the drawing and read it. Then answer 14 and 15.

14. Nobody told the sweat glands to stop, but at 4 minutes the sweating stopped. Use the five parts of the loop and your Q11 data to explain what turned it off. Why is this called **negative** feedback?

15. At the bus stop the cheek dropped _____°C but the core dropped only _____°C. Is the loop failing? Explain with **vasoconstriction** and **shivering**.

Part 5. Fever (Tab 5)

SEP 4 Data · SEP 6 Explanations · CCC Stability and Change

16. Set point **39°C**, medicine **None**. Press **Next hour** and fill in these hours.

Hour	0	1	2	6	7	8
Set point (°C)						
Body (°C)						
Shivering?						
Sweating?						

17. Try **40°C**: how many hours of shivering? _____ Try **Fever medicine at hour 3** (39°C): what happens to the set point at hour 3? _____

READ FIRST. In the lab, find the **Learn It** box under the drawing and read it. Then answer 18 and 19.

18. (a) At hour 0 the temperature is a normal 37°C, but the person shivers under two blankets. Why? (b) At hour 7 a relative says, "Look at all that sweat, the fever is getting worse." Use your Q16 numbers to reply.

Wrap it up

SEP 6 Explanations · SEP 7 Argument · CCC Stability and Change

19. Claim: one negative feedback loop holds body temperature near its set point, whether you are too hot or too cold. Give **evidence** from Part 4 and Part 5. For your **reasoning**, name the receptor, the control center and two effectors.

NYSSLS: building toward HS-LS1-2 and HS-LS1-3. Hole's Essentials 6.4 (skin functions: body temperature) (AP.3.6.8). Heat index: National Weather Service. Wet-bulb temperatures: Stull (2011). The pulse, colors and hours in Parts 4 and 5 are from a model made to match typical results; they are not measurements. SEP = Science and Engineering Practice, CCC = Crosscutting Concept.