Currents and Climate Lab

Name _____

Date _____

Period _____

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Do Now You fill a long bathtub with room-temperature water. At one end you dump a bag of ice. At the other end the hot tap drips. Nobody touches the water. 2 minutes, before you open the lab

A. Where will the coldest water end up? ☐ At the top ☐ At the bottom ☐ Spread evenly through the tub

B. Why do you think so?

_____

☐ I can use a model to show how uneven heating makes water move in a loop.

☐ I can explain how an ocean current carries heat and changes the climate of a coast.

☐ I can explain how Earth's spin bends the winds.

Part 1. Currents in a box (Tab 1)

SEP 3 Planning Investigations · CCC Stability and Change

Run each setup to 6 minutes: **Ice + hot water**, **Ice only**, **Hot water only**, **Neither**. Then run **Ice + hot water** again and press **Keep going to 20 minutes**. Copy from **Your runs**.

1. Record what you measure. Write a dash (–) if there was no blue water.

Example: readings of 20.0, 14.0, 23.5 and 18.0. Coldest 14.0, warmest 23.5. Gap: 23.5 – 14.0 = 9.5. The lab works the gap out for you.

Run	Blue water reaches 20 cm (s)	Coldest at 6 min (°C)	Warmest at 6 min (°C)	Gap (°C)	Loop speed at 6 min (cm/s)
Ice + hot water					
Ice only					
Hot water only					
Neither					

2. Ice + hot water. The coldest water was at the ☐ top of the ice end ☐ bottom of the ice end
The warmest water was at the ☐ top of the warm end ☐ bottom of the warm end Loop speed at 20 minutes: _____ cm/s

3. Plan check. From run to run I changed ☐ what was at each end ☐ the size of the box
The **Neither** run is useful because it shows ☐ what happens with no heating or cooling ☐ the fastest loop

READ FIRST. In the lab, find the green **Learn It** box and read it. Then answer 4 to 6.

WORD BANK for Q4 to Q6: denser · rises · sinks · the poles · the equator · lighter · the moon

4. Cold water is _____ than warm water, so cold water _____ and warm water _____.

5. The loop was fastest with ☐ ice + hot water ☐ ice only ☐ hot water only At 20 minutes it was _____ cm/s.
The **convection** loop stopped because
☐ the ice melted and the two ends became the same ☐ the water got too salty

6. Model check. The ice end stands for the ocean near _____. The hot end stands for the ocean near _____.
The real ocean has this, but the box does not (tick all):
☐ wind ☐ a spinning Earth ☐ cold water and warm water

Part 2. Two coasts (Tab 2)

SEP 4 Analyzing Data · CCC Patterns

Pick each place and press **Record**. Copy from **Your places**. Then press **Show currents**.

7. Real January averages, 1991 to 2020.

Place	Latitude	January average (°F)	Sea nearby in January (°C)	Side of the Atlantic
Bordeaux, France				east
Yarmouth, Canada				west
London, England				east
Cartwright, Canada				west
Reykjavík, Iceland				east
Iqaluit, Canada				west
Buffalo, New York			–	inland

8. In every pair, the warmer place is on the ☐ east side ☐ west side London minus Cartwright: _____ – _____ = _____°F

The sea next to the warmer place is ☐ warmer ☐ colder

READ FIRST. In the lab, find the green **Learn It** box and read it. Then answer 9 to 11.

WORD BANK for Q9: Gulf Stream and North Atlantic Drift · Labrador Current · Canary Current · the wind

9. The **ocean current** past London: _____ Past Cartwright: _____

The air over the water takes on the water's temperature, and _____ carries that air over the land.

10. Bergen, Norway is at 60.4° N, on the east side, next to the North Atlantic Drift. I predict its January is ☐ below 0°F ☐ near 20°F ☐ above 30°F The lab says: _____°F

11. If the **ocean conveyor belt** slowed down, less warm water would reach London. London's winters could get ☐ colder ☐ warmer

Part 3. Winds on a spinning Earth (Tab 3)

SEP 2 Using Models · CCC Cause and Effect

Pick each latitude and press **Record**. Copy from **Your records**. Then look at **Model: no spin** and **Model: Earth spins**.

12. Real winds over the Atlantic, measured by satellite. Tick where the real wind blows from.

Latitude	Real wind blows from the...	Speed (m/s)	Model, no spin: air near the ground moves...
15° N	☐ northeast ☐ west		☐ toward the equator ☐ toward the pole ☐ sinking here
30° N	☐ northeast ☐ west		☐ toward the equator ☐ toward the pole ☐ sinking here
43° N (Buffalo)	☐ northeast ☐ west		☐ toward the equator ☐ toward the pole ☐ sinking here
66° N	☐ northeast ☐ west		☐ toward the equator ☐ toward the pole ☐ sinking here

13. In the **no spin** model, the arrows point ☐ straight north or south ☐ east or west The model that looks more like the real winds: ☐ no spin ☐ Earth spins

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

WORD BANK for Q14: trade winds · westerlies · polar easterlies · right · left · Gulf Stream

14. The **prevailing wind** at 15° N: _____ At Buffalo: _____

The **Coriolis effect** : Earth spins, so moving air in the north bends to the _____.

15. The wind was weakest at 30° N because there the air is ☐ sinking ☐ blowing hard sideways

The three-loop model leaves out ☐ land and storms ☐ the equator

Wrap it up

SEP 7 Arguing from Evidence · CCC Energy and Matter

16. "How warm a place is depends only on how far it is from the equator." I ☐ agree ☐ disagree

Evidence (a number from Part 2): _____

Heat is also moved by ☐ ocean currents ☐ winds ☐ the moon (tick two). Because

_____

NYSSLS: building toward HS-ESS2-5 and HS-ESS2-7 (DCI ESS2.D). Environmental Science, Lesson 6.1. Tabs 2 and 3 are real data.