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 and Carrying Out Investigations · CCC Stability and Change

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

1. Record what you measure. A dash (–) means there was no blue water.

Run	Blue water reaches 20 cm (s)	Coldest reading at 6 min (°C)	Warmest reading 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. Where was the coldest water at 6 minutes? _____ The warmest? _____ Loop speed at 20 minutes: _____ cm/s.

3. Plan check. What did you change from run to run? _____ Why is the **Neither** run useful?

_____

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

4. Use the word **denser** . Why did the blue water sink and creep along the bottom, while the red water rose?

_____

5. Use Q1 and Q2. The loop was fastest with _____. At 20 minutes it was _____ cm/s. Explain why the **convection** loop stopped.

_____

6. Model check. The ice end stands for _____. The hot end stands for _____. One thing the real ocean has that the box does not: _____

Part 2. Two coasts (Tab 2)

SEP 4 Analyzing and Interpreting 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 _____ side. London is _____°F warmer than Cartwright. What do you notice about the sea next to the warmer place in each pair?

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

9. The **ocean current** that flows past London: _____ Past Cartwright: _____ Explain how a current in the sea can make the land next to it warmer or colder.

10. Predict Bergen, Norway (60.4° N). My prediction: _____°F. The lab says: _____°F. What did you use to make your prediction?

11. If melting ice made the water near the North Pole fresher, the **ocean conveyor belt** could slow down. What could that change for London's winters? Explain.

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

SEP 2 Developing and Using Models · CCC Cause and Effect

Pick each latitude and press **Record**. Copy from **Your records**. Then press **Model: no spin** and **Model: Earth spins** and compare them with **Real winds**.

12. Real winds over the Atlantic, measured by satellite.

Latitude	Real wind blows from the...	Speed (m/s)	Model, no spin: air near the ground moves...
15° N			
30° N			
43° N (Buffalo)			
66° N			

13. In the **no spin** model, the arrows point straight _____ or _____. Which model looks more like the real winds: no spin, or Earth spins? _____ Give one place on the map where you can see it.

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

14. The **prevailing wind** at 15° N: _____ At Buffalo: _____ Use the **Coriolis effect** to explain why Buffalo's air comes from the west, not straight from the south.

15. Why was the wind weakest at 30° N? Then name one thing the three-loop model leaves out.

Wrap it up

SEP 7 Engaging in Argument from Evidence · CCC Energy and Matter

16. A classmate says, "How warm a place is depends only on how far it is from the equator." Argue against this claim. Use one number from Part 2 and one idea from Part 1 or Part 3 about how heat gets moved.

NYSSLS: building toward HS-ESS2-5 and HS-ESS2-7, with DCI ESS2.D Weather and Climate. Environmental Science, Lesson 6.1: What Factors Influence Climate? Tags: SEP = Science and Engineering Practice, CCC = Crosscutting Concept. Tabs 2 and 3 are real data (WMO 1991 to 2020 normals; NOAA OISST; NASA QuikSCAT).