Name: _____

Modeling Air Convection

(If you are absent during this demonstration you can go to https://youtu.be/ZIMnZwR4aWE and watch it online.)

1. Diagram the cake pan set up. Make your diagram as big as this box.
The hot plate represents the equator of the Earth and the ice represents areas further north. The water represents air.
2. Right now you can't see the hidden currents. On your diagram, pencil in what you think the currents are doing and then explain why you believe this.
Now I am going to place red (representing heated air) food coloring on the heated side, and blue (representing cooler air) food coloring on the icy side.
3. Describe your observations. Make sure you explain why the food coloring is behaving as it is.
4. Were your predictions from number 2 correct?
5. Which side has the denser air (water)? How do you know?
6. Place an "H" on your diagram, where you think the High pressure is, and an "L" on where you think the Low pressure is.
7. Which direction do you think the global winds are blowing in the Upper atmosphere. Circle one. **A. From the equator to the north or B. from the north moving toward the south.**
8. On the equator, there are periods of time where the wind will just stop, for weeks. Why do you think this is?

Modeling Air Convection Instructions and Insights

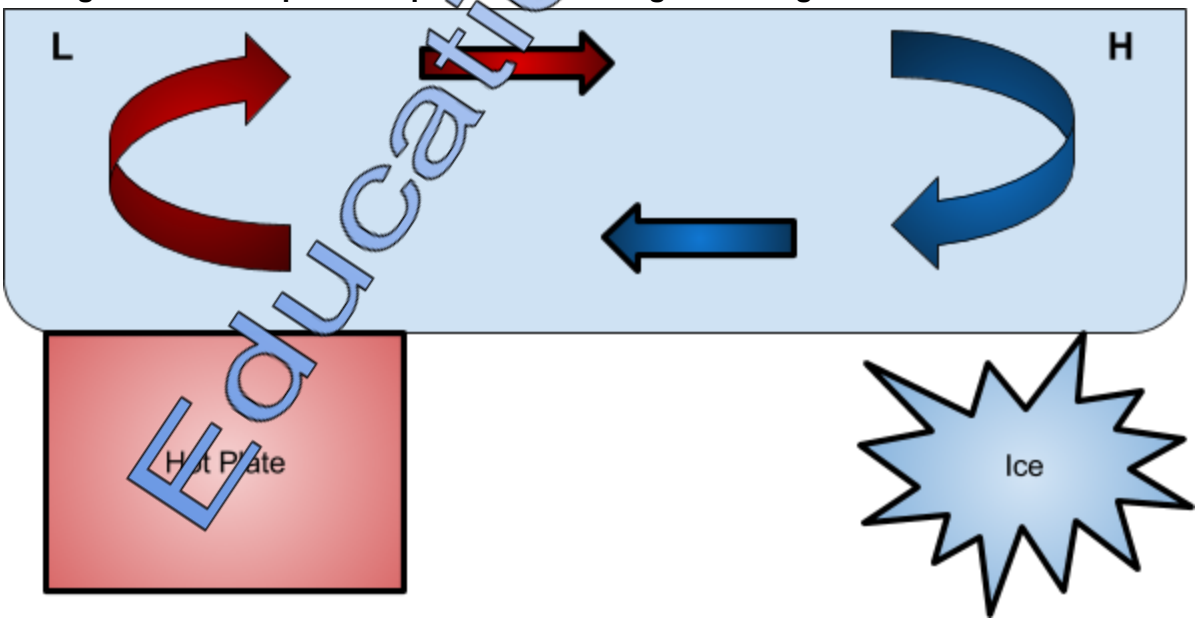
1. You will need a clear pyrex cake dish as big, long and deep as you can get. Mine is just a normal 13 inch dish, but I would love to try this demonstration on a greater scale.
2. You will need a ziplock back of ice cubes.
3. You will need a hot plate.
4. You will need red and blue food coloring
5. Place the dish with one side sitting on top of the edge of a hot plate and the other side sitting on top of your ice cubes, making the dish as level as possible.
    a. The hardest part is to find a way to make it level, because my ziplock bags aren't as tall as a hot plate, so I have to figure out how to get the same height on the ziplock ice side.
    b. Fill the dish to the very top or at least as close as you can without overflowing.
6. Turn the hot plate on medium heat.
7. Once I turn the hot plate on I have the students start answering questions 1 and 2. Next I have a short discussion and critique on how students drew their science diagrams, they usually make them way too small, I explain that they should use the space provided. I am also looking for students who can follow the instruction, "Make your diagram as big as this box."
8. I now add red food coloring on the hot plate side and blue coloring on the ice side.
9. The convection should be visible fairly quickly. I give them time to answer numbers 3 and 4.
10. We then discuss the science behind what is going on.
11. At this point, the point where the blue food coloring reaches the other side and rises and then flows back the other direction, I have them sit down.
12. They complete 6, 7, and 8. I let them work with their neighbors as they try to come up with the solutions.
13. At the end we have a whole group discussion about high and low air pressure as well as describe the word "doldrums."

Name: _____

Modeling Air Convection answers, insights and teacher reflection

(If you are absent during this demonstration you can go to https://youtu.be/ZIMnZwR4aWE and watch it online.)

1. Diagram the cake pan set up. Make your diagram as big as this box.



The hot plate represents the equator of the Earth and the ice represents areas further north. The water represents air.

2. Right now you can't see the hidden currents. On your diagram, pencil in what you think the currents are doing and then explain why you believe this.

a. On this question I am looking to see if students have any understanding as to what convection currents are actually doing. For my class they should already know because we have discussed convection currents during our Plate Tectonics unit. It is definitely a good review because many students don't fully understand what is happening.

Now I am going to place red (representing heated air) food coloring on the heated side and blue (representing cooler air) food coloring on the icy side.

3. Describe your observations. Draw your observation on the diagram as well. Make sure you explain why the food coloring is behaving as it is.

a. Students should describe the movement of the airflow as well as draw arrows and words that might demonstrate their understanding now.

4. Were your predictions from number 2 correct?

a. This is a reflection question from number 2. Did they truly know what was happening?

5. Which side has the densest air (water)? How do you know?

a. We have already talked about density in the minerals, plate tectonics, and volcano units. They should know that the cold side (blue) will sink. They should understand that the reason the cold air is sinking is because it is more dense. Air molecules are closer together and moving slower.

6. Place an "H" on your diagram, where you think the High pressure is, and an "L" on where you think the Low pressure is.

a. Students should place an "L" on the red side and an "H" on the blue side. We have already discussed this fact, during the section on barometers. High pressure is where the air is heavy pushing air onto the barometer which makes the barometer needle or bubble rise. The Low pressure is where air is rising because it is less dense and the air inside your barometer tries to escape.

7. Which direction do you think the global winds are blowing in the Upper atmosphere. Circle one.
A. From the equator to the north or B. from the north moving toward the south.

a. Air is going to be warmer at the equator and therefore rise as cool air replaces it, like the demonstration.

8. On the equator, there are periods of time where the wind will just stop, for weeks. Why do you think this is?

a. This is a question I have my students answer in groups to see if they can come up with the concept, not necessarily the word, of doldrums. I will teach them the word after they have had time to discuss what might be happening.

b. A doldrum occurs when winds stop blowing because around the equator you have two low pressure systems on either side of the equator rising causing a lack of airflow along the equator. You can read more about it here.