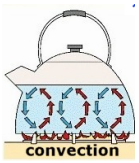

Convection Currents

Lesson Concept Differential heating causes convection currents, which transfer heat from one place to another in fluids like air and water.

Link In the previous lesson the students learned about the differential heating of the Earth's surface (e.g., land and water). In this lesson, they learn about convection currents and their application to weather. In the next lesson, students will learn how convention currents contribute to the formation of wind.

Time 60 minutes

Materials

Whole class

Electric kettle or microwave

Bill Nye The Science Guy on Wind

http://www.youtube.com/watch?v=uBqohRu2RRk&list=UUjYM-YemQPCooH9U378GcVw&index=23&feature=plcp

Ice Water

Hot Water

Per Group (groups of 6-7)

2- Gallon clear plastic tub

Red and blue food coloring

2 Styrofoam cups

2 Push pins

Hot and cold water

Safety glasses

Poster paper

Red and Blue markers

Individual

Convection Currents Lab Sheet

Science Notebook

1 Red and 1 blue pencil

Advance preparation

1. Boil water using a teakettle on a hot plate. Heat up enough water for 5 stations (the hotter, the better)
2. Put water in a pitcher on ice for 5 stations (use a lot of ice, the colder the better!)
3. Fill each group's "ocean" bucket with water from the sink and place on the student work area.
3. Distribute the rest of the materials for each group except the poster paper and markers.
4. Copy the Convection Currents Lab Sheet.
5. Cue up Bill Nye Video Clip

Procedure:

Engage ***(5 minutes) Wind can be observed.***

1. Ask students to write 2-3 sentences in their science notebook to describe what they know about wind. Ask them to share with a partner and find one thing they have in common and one idea that is unique.
2. Ask the partners to share aloud the one thing in common and the one unique thing. Make a class chart.
3. Explain to students that they will be exploring some of these ideas about wind over the next two lessons.

Explore #1 ***(25 minutes) Hot water rises and cool water sinks setting up a current where as the hot water rises, the cold water follows filling in the space vacated by the hot water.***

4. Ask the students to reflect on the experiments with differential heating they did in the last lesson. Working with a partner, ask students to review their notebooks to answer these questions:
    - Over which landform was air warmer during the day: land or water?
    - Which is a warmer place to stand, the sand or the water?
    - Which air mass is more dense—that which is over land or water? Why?
5. Have several groups report on their discussion. Explain that students will use the concept of differential heating to see its impact on water, and then they will infer its impact on air.
6. Distribute lab sheets, reminding students to discuss and follow the directions on the sheet.

Teacher Note: You might want to model where to put the push pin and how to release it under the water (just simulate the action, don't do it with the "real" supplies or you will spoil the observation!

7. Ask students to begin the investigation. Walk around the class to monitor and assist with the pin placement and remova.

8. Have students observe and draw what is happening on their Convection Current Lab sheet, making sure that they use the 3 boxes over time.
9. Ask students to glue the lab sheet into their notebooks.

Explain ***(20 minutes) Differential heating causes convection currents, which transfer heat from one place to another.***

10. Have the students discuss in their groups what happened with the cold and hot water and compare and contrast their illustrations.
11. Distribute posters and markers to each group. Ask them to draw (using red and blue markers) a composite poster illustrating what is happening with the cold and hot water. Ask students to answer these two questions on their drawing
    - How is the temperature of the water related to its movement?
    - How is density related to the movement of the water?
12. Select several groups to share their illustrations and their explanation. Ask the class what is similar and different in their drawings and their explanations.
13. Based on the groups' finding, generate a whole class diagram on the board. Label the movement as convection currents.
14. Based on the explanations the students offered, write a class definition of convection currents. (e.g., as water heats up it becomes less dense and rises, and as it cools it becomes more dense and sinks, creating a cycle or current).
15. Ask students to edit their drawing (on their lab sheet, or new piece of paper in their notebook) if necessary and add the class definition to their notebook.

Extend ***(5 minutes) Differential heating causes convection currents, which transfer heat from one place to another.***

16. Explain that we used water to demonstrate convection currents, because it is very easy to see. Air, because it is also a fluid, behaves in the same manner.
17. Show the Bill Nye Weather Video Clip (http://www.youtube.com/watch?v=uBqohRu2RRk&list=UUjYM-YemQPCooH9U378GcVw&index=23&feature=plcp.

    This clip is a demo of how air works in a convection current.
18. Ask students to relate what they noticed to their water convention current. How are they the same? How are they different?

Teacher Note: To see or show an animation, you can also check out these webites:
http://uccpbank.k12hsn.org/courses/APEnvironmentalScience/course%20files/multimedia/lesson21/animations/2d_Air_Movement.html
http://www.absorblearning.com/media/attachment.action?quick=an&att=758
http://www.wisc-online.com/Objects/ViewObject.aspx?ID=sce304

Evaluate ***(5 minutes) Differential heating causes convection currents, which transfer heat from one place to another.***

19. Ask students to review what they wrote about wind in their notebook. Ask them to add to their thinking based on this lesson. How might convention currents contribute to wind?

Name: _____

Convection Currents Lab Sheet

Directions

- Set the “ocean” container so that everyone in your group can see.
- From the supply table, get one Styrofoam cup with hot water and one cup with ice-cold water.
- Add red food coloring (about 4 drops) into the hot water cup and stir.
- Add blue food coloring (about 4 drops) into the cold water cup and stir.
- Place a push pin into the side of EACH cup near the bottom.
- Slowly and carefully place the cup with red water and pin into the left side of the “ocean” and place the cup with the blue water and pin in the right side of the “ocean.”
- Draw the set up in Box #1.
- Without disturbing the water, remove the pins (underwater) from both cups and observe the red and blue water entering the "ocean.”
- Observe for 1 minute and draw what you observe in Box #2
- Observe for several more minutes and draw what you observe in Box #3.

Draw what you observe.

Box 1

Box 2

Box 3

1. Describe the movement of the water in Box 2 and Box 3_____

_____

_____

2. How is temperature related to the movement?_____

_____

_____

3. How is density related to the movement?_____

_____

_____