**Convection Currents**

**Supplies that come with the kits:**

1. (2) Convection Current tanks with dividers
2. (2) Cordless tea kettles
3. (2) 1 gallon sized plastic baggie with 2 clips
4. (2) Square bottle with weights and stopper
5. (2) Ice cube trays

**Procedures for method 1:**

1. Prelab Setup
2. Make or get ice (1 gallon bag per experiment).
3. Gather food coloring.
4. Plug in tea kettles to heat up water.
5. Set up Current tank\*.

\*It is a good idea to have extra water containers to fill tank.

1. Clip gallon baggie on one side of the tank.
2. Fill clipped baggie with ice.
3. Fill tank with room temperature water.
4. Put weights in the square bottle.
5. Put the stopcock in the hole at the bottom.
6. Fill square bottle completely with hot water.
7. Add 4 or 5 drops of red food coloring to bottle.
8. Put 8 drops of blue food coloring in ice.
9. Lower square bottle into opposite corner of baggie.
10. Carefully remove stopcock so that water is not disturbed.
11. If the cold blue water is not coming out, gently raise the baggie a small amount and clip.
12. Throughout the experiment you might have to pour about 50 ml of cold water into the baggie several times.

**Trouble shooting:**

* *The blue overpowers the tank:*
	+ You added too much food coloring.
* *The square bottle does not want to sink:*
	+ Not enough weight in the container OR square bottle was not completely filled with hot water.
* *I forgot to make ice:*
	+ With a large temperature difference, the demo should still work: cold tap water will produce similar results.
* *Classroom blew a fuse/breaker:*
* Make sure tea kettles are plugged into different circuits (each tea kettle pulls a lot of amperage).

**Guiding Questions:**

* What happens to the hot water when the experiment begins?
* What happens to the cold water when the experiment begins?
* When the hot water reaches the cold bag of ice, what happens, and why?
* Does something similar happen to the cold water? Explain.
* What happens to the area in the middle of the tank?
* Define a convection current.

**Procedures for method 2:**

1. Prelab Setup
2. Make or get ice (1 gallon bag per experiment).
3. **Gather food coloring.
4. Plug in tea kettles to heat up water.
5. Set up Current tank with divider\*.

\*It is a good idea to have extra water containers to fill tank.

1. Fill the tank halfway with lukewarm water.
2. Add ice to one side of tank.
3. Quickly match water with hot water on the other side of the tank.
4. Add 5 drops of blue good coloring to cold side. Mix.
5. Add 5 drops of red food coloring to hot side. Mix (not with your hand!).
6. Ask predictions from class, what will happen when the divider is pulled?
7. Quickly remove the divider, and set aside.
8. Gently add a compact ball of ice.
9. Quickly add 2 drops of food coloring to the ice ball.

**Trouble shooting:**

* *The blue overpowers the tank:*
	+ You added too much food coloring OR you used too much ice/too little hot water.
* *I forgot to make ice:*
	+ With a large temperature difference, the demo should still work: cold tap water will produce similar results.
* *Green food coloring did not make a nice layer in the middle:*
* Not all of the food coloring landed on the ice ball.
* *Classroom blew a fuse/breaker:*
* Make sure tea kettles are plugged into different circuits (each tea kettle pulls a lot of amperage).

**Guiding Questions:**

* Describe what happens when the divider is removed.
* What happens to the area in the middle of the tank?
* Describe what happens to the green and explain why.
* Define a convection current.

**Lab Hints:**

* Make sure you know how to work the tea kettles before you start your lab.
* Tea kettles get very hot and can cause burns.
* The bigger the temperature difference, the more dramatic and faster the demo is.
* Between classes, make sure to have tea kettles warming up.
* If working in student groups, make sure you have plenty of ice.
* Don’t overuse food coloring.

**Lesson extensions:**

* Use FLIR cameras to observe heat transfer.
* Have groups run experiment to demonstrate various processes:
1. Melting polar ice caps
2. Thermal pollution
3. El Niño/La Niña
4. Land/sea breeze
5. Energy released from Earth’s core
6. Convection vs. conduction