Activities To Go

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In every issue of The Science Reflector look for this new section including activities you can use in your classroom tomorrow. If you have activities you would like to share please email the editor.

Ziptop Bag Chemistry - explore exothermic and endothermic reactions
Equilibrium - demonstrate how the earth's atmosphere is a system in disequilibrium.

Ziptop Bag Chemistry

from The Science House, Countertop Chemistry

Three reactions are performed in a sealed Ziploc™ bag so that they can be easily observed.

Materials per lab group	Substitutions per lab group
4 ziptop bags	
1 Tbsp. calcium chloride	
2 Tbsp. sodium hydrogencarbonate	2 Tbsp. baking soda
30 mL water	
35 mm film canister (top optional)	1 small paper cup of water
30 mL indicator solution (phenol red)	30 mL red cabbage juice

Procedure

1. Add 2 Tbsp. sodium hydrogen carbonate to a Ziploc™ bag. Gently place a film canister (approximately1/3 full of water) inside the bag in the upright position. Squeeze out any excess air and seal the bag. Spill the water into the bag by shaking. Look, listen, and feel. Record your observations.
2. Add 1 Tbsp. of calcium chloride to a second Ziploc™ bag. Repeat the remaining steps in procedure 1 for the calcium chloride, and record your observations for this material.
3. Mix 2 Tbsp. of sodium bicarbonate and 1 Tbsp. of calcium chloride in a third Ziploc™ bag and mix thoroughly. Repeat the remaining steps.
4. Repeat procedure 3, replacing the water in the film canister with 30mL of indicator solution.

Data and Observations

1. sodium hydrogencarbonate in water
2. calcium chloride in water
3. $NaHCO_3$ + $CaCl_2$ in water
4. $NaHCO_3$ + $CaCl_2$ with indicator solution

Questions

1. Classify each of these changes as chemical or physical. Use your observations to help you make your decisions.
2. In the fourth bag, what did the indicator tell you about the observed reaction?
3. What gas is being produced? How could you test this?

4. Write an equation for any chemical changes that have taken place.
5. Define heat of solution. Is it a physical change or a chemical change?

Teacher's Notes

1. a) There is a physical change in the first bag. See note 5 below for explanation
   b) A physical change occurs in the second bag.
   c) In the third and fourth bags, a chemical change occurs. See note 4 for the equation.
2. The indicator should show that the reaction occurring in the third bag is acidic. Cabbage juice will turn from red to blue in color, while phenol red will turn from red to yellow.
3. The gas that is produced is carbon dioxide, CO_2. It is formed from the carbonate ion, HCO_3 -. A burning splint would show that the gas extinguishes the flame. Some fire extinguishers use carbon dioxide for this reason.
4. The chemical changes that occur in bags 3 and 4 can be represented by the following equation:
   $2NaHCO_3$ (aq) + $CaCl_2$ (aq)-> $CaCO_3$ (aq) + 2NaCl (aq) + H_2O (l) + CO_2 (g)
5. A physical or chemical change may be accompanied by a change of energy. If the change requires heat from the environment, it is said to be endothermic.
   Solute + Solvent + HEAT ---> Solution
   If it releases energy to the environment, it is said to be exothermic.
   Solute + Solvent ----> Solution + HEAT
6. Phenol red can be used to show the presence of an acidic solution. It can be purchased at a swimming-pool supply store. Many foods also contain indicators. One of these is red cabbage juice.

Safety Precautions

As the Ziploc bags expand, care should be used to prevent excessive pressure build-up. The bags may burst.

Disposal

Solid wastes may be placed in a solid-waste container. All solutions may be poured down the drain, followed by water. When calcium chloride is dissolved in water, heat is given off. Handle these solutions with care.

Equilibrium

from The Storm Shelter

Equilibrium is defined as a state of balance (equality of distribution). This is a trait that the Earth's atmosphere is continually striving for, but can never attain in the short-term.

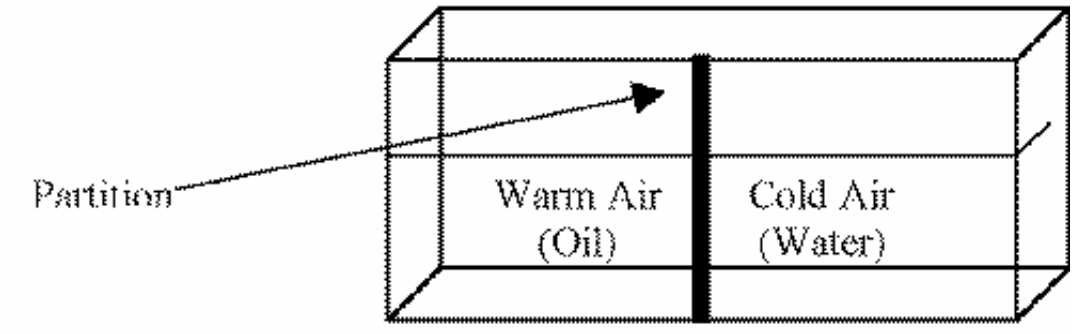
Objective: This demonstration is an example of how the atmosphere is a system of disequilibrium.

Materials: Large clear container, water, oil, partition (to separate water and oil in container (e. g. Modeling clay). Have approximately the same amount of oil and water for the container.

Procedure:

1. Place the partition in the large container (large clear bowl or aquarium will work).
2. On one side of the partition, place red food coloring (to represent warm air) and cooking oil. Mix well to give red coloring throughout the oil.
3. On the other side place blue food coloring and water. Mix well to make sure the blue color is distributed throughout the water.
4. Make sure the level of water and oil is the same. The amount depends on the size of the container you are using. Fill the container approximately half full of both substances.

5. The red oil represents warm, less dense air. The blue water represents cold, dense air.
6. Quickly remove the partition and observe what occurs between the two substances.
7. The cold, dense air (blue) will push beneath the warm air (red). The warm air (red) will rise above the cold (blue).
8. There should be some swirling of substances as they both seek equilibrium.
9. If the container is left undisturbed, eventually the liquids will settle out, with the cooler, denser air (blue) on bottom and the warmer, less dense air (red) on top.



Why is the Earth's atmosphere a system in disequilibrium?

The Earth's atmosphere cannot find short-term equilibrium because the temperature is constantly changing as the sun heats the Earth. Temperature at the Earth's surface is controlled principally by an energy balance between incoming solar radiation and outgoing long-wavelength thermal radiation. In winter, the polar latitudes receive no sunlight and cool rapidly. Furthermore, land and water heat differently because land cannot hold as much heat as water. The resulting warm and cold air masses are constantly forming and moving across the Earth and interacting, just as in our experiment, Systems in disequilibrium are easily excitable and "need only the slightest provocation to give, at times, disproportionately large effects." The atmosphere and its weather are one such system.

Sources:
http://www.i-sis.org.uk/FOI4.php
http://www.stormsurf.com/page2/tutorials/weatherbasics.shtml

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