**Thermal Chemical Reactions Investigation**

*Explore*

**Experimental Question:** Which chemical reactions absorb heat and which chemical reactions release heat?

**Materials**

* Calcium chlo**r**ide (used to melt ice on d**r**i**v**eways in winte**r**)
* Potassium chlo**r**ide (e.g., Mo**r**ton **L**ite**™**)
* Sodium bica**r**bonate (baking soda)
* Vinegar
* Five sandwich**-**size zip**-**lock bags
* Tablespoon measu**r**ing spoons
* 100 ml graduated cylinder
* Water
* Sharpie

**Procedure**

1. Put 1 tablespoon calcium chloride into a plastic bag, labeled “calcium chloride.” Using your graduated cylinder, add 65 mL water and then close and shake the bag. Let out gas as needed. Observe what happens and record your observations in the data table on your student handout.
2. Put 1 tablespoon sodium bicarbonate into a plastic bag, labeled “sodium bicarbonate.” Using your graduated cylinder, add 65 mL water and then close and shake the bag. Let out gas as needed. Observe what happens and record your observations in the data table on your student handout.
3. Put 1 tablespoon potassium chloride into a plastic bag, labeled “potassium chloride”. Using your graduated cylinder, add 65 mL water and then close and shake the bag. Let out gas as needed. Observe what happens and record your observations in the data table on your student handout.
4. Put 1 tablespoon sodium bicarbonate and 1 tablespoon calcium chloride into a plastic bag, labeled “sodium bicarbonate and calcium chloride.” Using your graduated cylinder, add 65 mL water and then close and shake the bag. Let out gas as needed. Observe what happens and record your observations in the data table on your student handout.
5. Put 1 tablespoon sodium bicarbonate into a plastic bag, labeled “sodium bicarbonate and vinegar.” Using your graduated cylinder, add 65 mL vinegar to the bag. Do not close the bag and carefully shake the contents. Observe what happens and record your observations in the data table on your student handout.

**Designing Heat-Regulation Devices**

*Elaborate*

**Possible Materials To Build Your Prototypes**

* Pick your substances from the following list: calcium chloride, potassium chloride, sodium bicarbonate, vinegar, water
* Cold water
* Warm water
* Tablespoon measu**r**ing spoons
* 100-ml graduated cylinder
* Sandwich**-**size zip**-**lock bags
* 500-ml beakers
* Ice
* Thermometers
* Additional Materials Provided By Teacher



**Procedure**

1. Set up your experiment using the following questions and instructions to guide you:
   1. Based on what you know about your river environment, what temperature should the water in your beakers start at? Record this temperature in the data table on your student handout.
   2. Alternate pouring warm and cold water into a beaker until it has reached the desired temperature.
   3. Split this water into equal amounts in two beakers.
2. Based on the models you drew, gather the materials to build your two prototypes.
3. Assemble your two prototype devices, using the materials provided and procedural knowledge you gained in the *Explore* investigations.
4. Place a prototype device into each beaker of water and observe. Record data in the data table on your student handout.