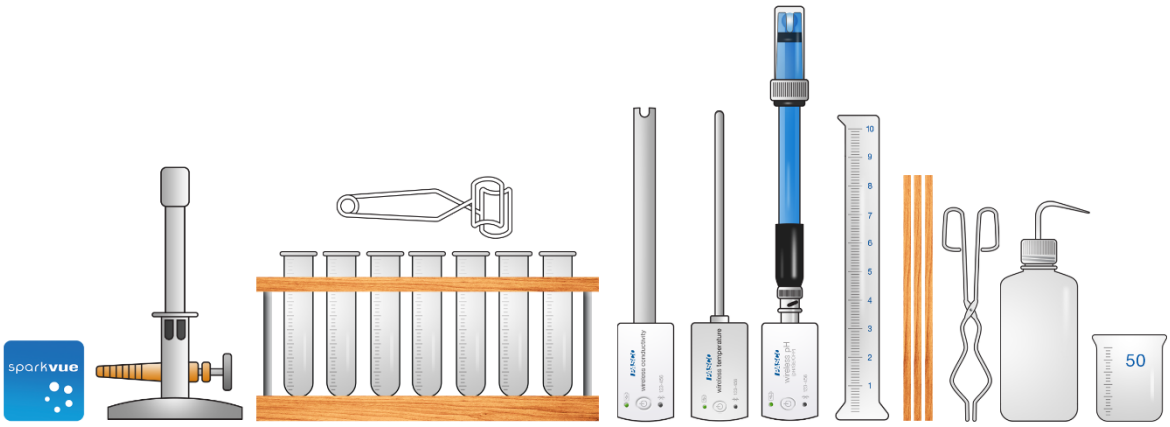
7B – CHEMICAL REACTIONS

INQUIRY

What happens to atoms in a chemical equation?

MATERIALS

- Device with SPARKvue software
- pH sensor
- Temperature sensor
- Conductivity sensor
- Beakers, 50-mL (2)
- Graduated cylinder, 10-mL
- Test tubes (7)
- Test tube rack
- Stopper to fit test tube
- Test tube holder
- Bunsen burner
- Flint striker
- Tongs
- Wooden splints (3)
- Magnesium ribbon, 1-cm pieces (2)
- Zinc metal, 1-2 g
- Ammonium chloride solid, NH_4Cl, 1-2 g
- 1.0 M $CaCl_2$ in dropper bottle, 1 mL
- 1.0 M Na_3PO_4 in dropper bottle, 1 mL
- 1.0 M $CuSO_4$ in dropper bottle, 2 mL
- Copper(II) carbonate solid, $CuCO_3$, 1-2 g
- 1.0 M Na_2CO_3 in dropper bottle, 1 mL
- Strontium hydroxide octahydrate solid, $Sr(OH)_2 \cdot 8H_2O$, 1-2 g
- 1.0 M NaOH in dropper bottle, 1 mL
- 1.0 M HCl in dropper bottle, 4 mL
- Phenolphthalein, 1 drop
- Wash bottle with distilled water



BACKGROUND

Chemical reactions involve the rearrangement of atoms to create new compounds. The driving forces behind a chemical reaction include the formation of a pure substance (solid, liquid, or gas) as well as the formation of a weak electrolyte. You will combine a variety of elements and/or compounds and make detailed observations to come up with a list of common indications that a chemical reaction has taken place.

SAFETY

Follow these important safety precautions in addition to your regular classroom procedures:

- Wear safety goggles at all times.
- Dispose of all chemicals in the waste container as directed by your teacher.
- Do not point the test tube opening towards yourself or anyone else while heating the test tube.

PROCEDURE

Part 1 – Qualitative observations

1. Complete each of the following reactions in a separate test tube, except for the last reaction. Record your observations in Table 1 on your answer sheet. Observations may include color change, change in smell, release or absorption of energy as either heat or light, bubbling, formation of a precipitate, and other changes.

    a. Use the calcium chloride solution to test how many drops it takes to reach a volume of 1 mL in the graduated cylinder. Pour the 1 mL of calcium chloride solution into a test tube. Count the same number of drops to add 1 mL of sodium phosphate solution to the test tube. Use number of drops to measure volume in 1 mL increments for parts c, d, f, and g. Rinse the graduated cylinder and set it aside for the remainder of the investigation.

    b. Add about 1-2 grams of copper(II) carbonate to a test tube. Hold the test tube with a clamp and heat it with a Bunsen burner set to a low flame. Point the test tube opening away from yourself and others. After you notice significant changes, light a splint. Turn off the Bunsen burner, and place the flaming splint in the opening on the test tube.

    c. Measure 2 mL of hydrochloric acid solution and add it to a test tube. Place a small piece of magnesium metal in the solution. Loosely stopper the test tube for a few seconds, then place a flaming splint in the opening of the test tube (without touching the mixture).

    d. Add 1 mL of hydrochloric acid solution to 1 mL of sodium carbonate solution in a test tube. Loosely cap the test tube for a few seconds. Place a flaming splint in the opening of the test tube (without touching the mixture).

    e. Add 1-2 g of strontium hydroxide to 1-2 g of ammonium chloride in a test tube.

    f. Add 2 mL of copper(II) sulfate solution to a test tube, then add a small piece of zinc metal.

    g. Add 1-2 drop of phenolphthalein to a test tube, then add 1 mL of sodium hydroxide and gently swirl. Add 1 mL of hydrochloric acid to the solution and gently swirl.

    h. Use a pair of tongs to burn a small piece of magnesium metal in the hottest part of a Bunsen burner flame. The inner blue cone is the hottest part of the flame. Your teacher may perform this reaction as a demonstration.

2. After making all the observations, complete and balance the equations for the reactions that you observed on your answer sheet. Reaction E is completed for you, but you need to balance it.

ANALYSIS

Complete the analysis for Part 1 on your answer sheet.

PROCEDURE

Part 2 – Quantitative observations

1. Your teacher will help you select one of the reactions for further analysis. Record your Trial letter and the reaction in Table 2 on your answer sheet.

2. Open the 07B Chemical Reactions lab file in SPARKvue.

3. Connect the available Temperature, pH and Conductivity sensors.

4. Put each of your reactants into separate 50 mL beakers. If you have a solution, make sure there is enough reactant to cover the probe and ensure an accurate measurement.

PROCEDURE

5. Start data collection and measure the Temperature, pH and Conductivity of your reactants. Record the values in Table 2.

6. Mix the reactants and measure the Temperature, pH and Conductivity of your mixture of products.

7. Record values in Table 2, then stop data collection.

ANALYSIS

Complete the analysis for Part 2 on your answer sheet.

QUESTIONS

Answer the questions on your answer sheet.