

Lab 2: Physical and Chemical Changes

Purpose:

- Observe and record different reactions and processes.
- Understand, and apply, various concepts of chemical reactions and physical processes.

Focus on:

- Physical and chemical changes
- Molecular equations, ionic equations, and net ionic equations
- Types of reactions
- Oxidation-Reduction reactions
- Law of Conservation of Mass
- Percent error and percent yield

Pre-lab Work:

1. Prepare your lab notebook as usual.
2. Answer the prelab questions on Moodle.

Materials:

- Test tubes (4x)
- Test tube rack
- Different sized beakers
- Disposable transfer pipettes
- Graduated cylinder
- Analytical balance (+/- 0.001g)
- Test tube stopper
- Lighter and wooden sticks
- Evaporating dish
- Watch glass
- Hot plate

Chemicals:

- 0.25 M Copper (II) sulfate in dropper bottle
- 0.25 M Sodium carbonate in dropper bottle
- 3.0 M Hydrochloric acid in dropper bottle
- 6.0 M Hydrochloric acid in fumehood
- Solid Sodium carbonate powder
- Solid Zinc pellets
- Acetone in dropper bottle
- Phenol red in dropper bottle

Procedure:

Note: From a dropper bottle 1 mL can be approximated as 20 drops

Part 1: HCl(aq) with Zn(s).

1. Label one test tube: Reaction 1.
2. Add 1 mL of the 3.0 M HCl solution into this test tube.
3. Add a few small pellets of solid zinc to the same test tube.
4. Immediately close the test tube with an appropriate stopper and wait for about 30 seconds.
5. After 30 seconds, light a wooden stick. Open the test tube and introduce the flame into the opening of the test tube. Keep the opening of the test tube pointed away from people. *Note: be prepared for a sudden sound.*
6. Record all observations.

Part 2: CuSO₄(aq) with Na₂CO₃(aq).

1. Label one test tube CuSO₄(aq) and another test tube Na₂CO₃(aq).
2. Place both test tubes standing up in a medium-size beaker.
3. Collect 1 mL of CuSO₄(aq) with a transfer pipette and empty it into the appropriately labelled test tube.
4. Collect 1 mL of Na₂CO₃(aq) with another transfer pipette and empty it into the appropriately labelled test tube.
5. Weigh the beaker with the test tubes and record the mass.
6. Transfer the content of one test tube into the other test tube. Swirl gently to make certain that the two solutions mix.
7. Record all observations.
8. Weigh the beaker using the same scale and record the mass.

Part 3: CuSO₄(aq) with acetone CH₃COCH₃(l).

1. Label a test tube: Reaction 3.
2. Collect 1 mL of CuSO₄(aq) using a transfer pipette. Empty the contents into the test tube.
3. Collect 5 mL of acetone in a 10 mL graduated cylinder. Empty the contents into the test tube.
4. Record all observations.

Part 4: Na₂CO₃(s) with HCl(aq).

1. At your bench use a 250 mL beaker and add approximately 100 mL of tap water. Start heating

this on a hot plate. This will be the steam bath for this part.

2. Using an analytical scale, weigh the empty evaporating dish. Record its mass.
3. Zero the scale and add 0.3 g of $\text{Na}_2\text{CO}_3(\text{s})$. Record the exact mass.
4. To the evaporating dish with the solid add 1-2 drops of the phenol red indicator solution, and a few drops of tap water.
5. Cover the evaporating dish with a watch glass and bring it to the fumehood.
6. Under the fumehood, transfer 10-20 mL of 6.0 M $\text{HCl}(\text{aq})$ from the stock bottle into the small beaker.
7. Still under the fumehood, lift the watch glass and add 6.0 M $\text{HCl}(\text{aq})$ to the evaporating dish dropwise with gentle swirling until the indicator permanently changes colour to yellowish-peach colour. Replace the watch glass over the evaporating dish again.
8. Once there is a permanent yellow-peach colour, hold the watch glass over the evaporating dish and rinse the bottom with a small amount of distilled water into the evaporating dish.
9. Place the evaporating dish on the steam bath without the watch glass to allow the liquid to evaporate from the evaporation dish.
10. Once almost all the liquid has evaporated remove the dish from the steam bath. Wipe the bottom of the evaporation dish.
11. Remove the steam bath from the hot plate and reduce the heat on the hot plate.
12. Place the evaporation dish directly on the hot plate and evaporate to dryness (~ 15 minutes). If spattering is observed, remove the evaporating dish from the hot plate briefly.
13. Remove evaporation dish from hot plate and let cool to room temperature.
14. Weigh the dish using the same balance as before.
15. Record the final mass.

Follow-Up Work:

- Once you have completed the experiment, you will be given a document titled “Tables of Results,” which each student needs to complete as part of their follow-up work.
- Your Follow-Up work will consist of the photos of the completed Tables of Results, an appendix with sample calculations, along with the digital record of your signed Lab Notebook for this experiment.

Due date:

- Submit your Follow-Up (as described above) as a SINGLE PDF in the appropriate folder on Moodle by the due date and time indicated by your instructor.