Lab 10.2a
Types of Chemical Reactions

I. PURPOSE
To observe basic types of chemical reactions and learn to recognize types by looking at equations.

II. MATERIALS
1. Bunsen burner 6. chemical scoop 11. mossy zinc 16. 1 M Na₂SO₃
2. evaporating dish 7. test tubes 12. copper wire 17. 6 M HCl
3. ring stand 8. test tube rack 13. magnesium ribbon 18. 1 M CuSO₄
4. utility clamp 9. wood splints 14. CuCO₃ (cr) 19. 0.1 M Na₃PO₄
5. crucible tongs 10. sand paper

III. PROCEDURES
Make observations before, during, and after each step of the lab.
Part A
1. Clean a piece of copper wire with sandpaper. Using crucible tongs, hold the copper wire in the hottest part of flame (top of inner cone). Observe during and after heating.
2. Clean a piece of magnesium ribbon with sandpaper. Put an evaporating dish near the burner. Using crucible tongs, hold the magnesium ribbon in the hottest part of flame (top of inner cone). CAUTION: DO NOT STARE AT THE FLAME. When the ribbon starts to burn, place it in the evaporating dish. Examine the remains carefully.

Part B
1. Place about 1 cm of CuCO₃ in a clean dry test tube. Place the test tube in a utility clamp on the ring stand at a 45° angle and heat with the burner in your hand for 2 to 3 minutes.
2. Remove burner from test tube, light a wooden splint and insert the splint into the test tube. Note any other changes.

Part C
1. Place a clean test tube in the test tube rack and add about 5 mL of 6 M HCl. CAUTION: HANDLE ACIDS WITH CARE. Drop a small piece of zinc into the acid and observe.
2. Place another test tube over the first and collect the gas. The second test tube should be held firmly with the utility clamp.
3. Light a wooden splint and place the lit end into the upper test tube with the gas. Note any other observations.
4. Add about 5 mL of 1 M CuSO₄ to a clean test tube. Place a small piece of zinc in the solution and observe. Leave the test tube in the rack for at least 5 minutes.

Part D
1. Add about 2 mL (2 pipets full) of 0.1 M Zn(C₂H₃O₂)₂ to a clean test tube.
2. Now, add about 2 mL of 0.1 M Na₃PO₄ to the same test tube and observe.
3. Add about 5 mL of 1 M Na₂SO₃ to a clean test tube. Now add about 1 mL of 6 M HCl to the same test tube and observe the odor given off by wafting some of the gas to your nose with care. CAUTION: DO NOT SMELL THE GAS DIRECTLY.

IV. PRE-LAB QUESTIONS
1. What is the purpose of cleaning the metals in Part A?
2. What is the purpose of keeping the test tube at an angle in Part B?
3. What types of changes should be expected in a chemical reaction?
4. What do chemical changes differ from physical changes?

V. DATA & CALCULATIONS
A. DATA
B. CALCULATIONS
1. The equations below represent the reactions that occurred in each part of the lab. For each equation, balance the equation, write the names of each substance below the formula in the equation, and write a description for each of the substance as observed in lab.
   Part A
   a. Cu + O₂ → CuO
   b. Mg + O₂ → MgO

   Part B
   a. CuCO₃ → CuO + CO₂
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**Part C**

a. \( \text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2 \)  
b. \( \text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu} \)

**Part D**

a. \( \text{Zn(C}_2\text{H}_3\text{O}_2)_2 + \text{Na}_3\text{PO}_4 \rightarrow \text{NaC}_2\text{H}_3\text{O}_2 + \text{Zn}_3(\text{PO}_4)_2 \)  
b. \( \text{Na}_2\text{SO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{SO}_2 \)

VI. QUESTIONS & DISCUSSION OF ERROR

A. QUESTIONS

1. Using the equation from the calculations for Part B, describe why the splint goes out in Part B?
2. Explain the sound generated in Part C.
3. List five observable changes that indicate a chemical reaction has taken place.
4. Describe the relationship between synthesis and decomposition reactions, and between single replacement and double replacement reactions.

B. DISCUSSION OF ERROR

Discuss any errors or sources of bias that affected the observations made in this lab. Describe the qualitative effects and magnitude of these errors. Suggest alterations to the lab that would reduce or eliminate these errors.

VII. CONCLUSION

Explain how the observations made in this lab allow for the identification of the five types of chemical reactions.