AP/IB Chem: Reaction types

Objective: To view the actual chemical reactions, write the correct balanced chemical equation, and type of chemical reaction.

Materials: burner, test tube, crucible tongs, microspatula, wood splints, test tube holder, test tube rack, wood splints, fine sandpaper, zinc metal, micro-well plate

Chemicals: copper (wire), magnesium (ribbon), copper (II) carbonate 6 *M* HCl, 1 *M* $CuSO_4$, 1 *M* $Pb(NO_3)_2$, 1 *M* KI, 1 *M* Na_2SO_3

Safety: Always wear safety goggles. Concentrated hydrochloric acid can burn skin. Insoluble products are discarded in the solid-waste container and not down the sink. The oxidation of magnesium produces lots of UV, which can be dangerous if staring at the flame.

Procedures:

Part #1

1. Use the fine sandpaper to clean a piece of copper wire until shiny. Using tongs, hold the wire in the hottest part of the burner flame for 1-2 minutes.
2. Hold a small coil of magnesium ribbon over a warm flame to ignite it. (WARNING: AVOID LOOKING DIRECTLY AT THE FLAME). Hold this over a wet paper towel.
3. Place 2 heaping microspatulas of copper (II) carbonate into a clean, dry test tube. Using a test tube holder, hold the test tube (at a 45° angle pointed away from people) over the Bunsen burner flame for 3 minutes or until completely black. Light a wood splint and hold it inside the mouth of the test tube.

Part #2

1. Place 3 mL of 6 M hydrochloric acid in a test tube. Add a piece of zinc metal to the test tube. Quickly hold a second test tube (using a test tube holder) over the first test tube to collect a gas given off (may take a couple of minutes). Light a wood splint, hold the wood splint inside the collection test tube.
2. Add 3 mL of 1 M copper (II) sulfate solution to a clean, dry test tube. Add a piece of zinc metal to the test tube.
3. Add 4 drops of lead nitrate and 4 drops of potassium iodide to a well in a micro-well plate.
4. Add a small scoop of solid sodium sulfite and 2 mL of 3 M $HCl_{(aq)}$ in a small test tube. (WARNING: Conduct this in the fume hood, exhaust fumes when finished)
5. Clean and return all lab equipment.

Data Table:

Construct a data table to record all quantitative and qualitative observations associated with each reaction. This should be done before you start any empirical work.

Questions:

1. Copper and magnesium react with oxygen to form oxides of each metal. Write a balanced chemical equation for each reaction below.

2. What type of chemical reactions occurred with the heated copper and magnesium?

3. In the copper (II) carbonate reaction, a gas was produced. If oxygen was produced the flame would have gotten brighter and burned more, if hydrogen was produced a "pop" and short blue flame will be produced, but if carbon dioxide was produced it would extinguish the flame.
   a. What gas was produced in the copper (II) carbonate reaction?

b. Reviewing the appearance of the copper (II) carbonate after being in the flame, does it appear that elemental copper is formed? If YES, write copper as a product, but if NO, a compound was formed. What was that compound?

c. What type of reactions occurred with the copper (II) carbonate?

d. Write the balanced equation for the reaction involving copper (II) carbonate.

Part #2 Questions:

1. Zinc reacted with hydrochloric acid to give off a gas. If oxygen was produced the flame would have gotten brighter and burned more, if hydrogen was produced a "pop" and short blue flame will be produced, but if carbon dioxide was produced it would extinguish the flame.
   a. Write a balanced chemical equation for zinc + hydrochloric acid

   b. Write a balanced chemical equation for zinc + copper (II) sulfate.

2. Identify the type of chemical reaction that occurred with zinc reacting with hydrochloric acid and copper (II) sulfate?

3. Identify the type of reaction that occurred between lead (II) nitrate and potassium iodide.

4. Write a balanced chemical equation for the reaction between lead (II) nitrate and potassium iodide

5. Sodium sulfite reacted with hydrochloric acid to form three compounds, one being sulfur dioxide (stinky gas usually released from volcanoes). Write the balanced chemical equation for this reaction.

V. Conclusion:

1. Write a short explanation for each of the following:
   a. A reaction between aluminum and bromine is driven by a redox process
   b. Nitric acid and lithium hydroxide is an acid/base neutralization reaction, driven by the formation of water.
   c. Atoms in reactions are always conserved but moles are not necessarily conserved.

2. How does a person know if a chemical reaction has occurred?

3. The lit splint test is used to test for specific gas products. List the gases and how we discern from the results of the lit splint test.