Redox Lab name: _____ 40 minutes

Objective: to observe a redox reaction between copper (II) chloride solution and aluminum metal and then to dissect the half reactions out of it.

READ THIS FIRST: This is a goggles on lab. Be careful with glass and any temperature situations you encounter. Clean up info below.

Materials needed: two clean 250 mL beakers, a glass stirring rod, and approximately 60 cm^3 of aluminum foil (as shown), and one small scoop of $CuCl_2$ crystals to dissolve into about a 50 mL solution with deionized water. Also a filter paper and funnel set up to filter the beaker of solids.

Procedure: Put $CuCl_2$ crystals into a beaker, pour in the deionized water. Stir until all is dissolved. Take observation notes at all times. Next, tear the foil into bits, collect these bits and put them into the $CuCl_{2(AQ)}$ solution you just made. Stir with the glass rod. Observe visually and touch beaker with hand carefully. If solution is not clear, add more aluminum foil bits until the solution is clear. When the reaction is over observe residue and remaining solution. Discuss what happened with your lab partner.

Lab questions to answer later...

1. When my gold wedding band was put into the hydrochloric acid earlier in the year, was that an example of a redox reaction? Explain.

2. If you placed a new penny that you filed the edges of into hydrochloric acid, the zinc inside the penny dissolves. Is this a redox reaction?

3. Why didn't the copper also undergo a single replacement reaction with the $HCl_{(AQ)}$. Isn't copper higher on Table J than hydrogen is?

4. Write the oxidation half reactions that take place in the beaker in lab between the copper (II) chloride solution and the aluminum foil.

5. Write the reduction half reactions that take place in the beaker in lab between the copper (II) chloride solution and the aluminum foil.

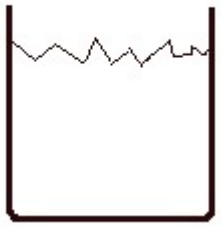
6. Write the NET IONIC EQUATION for this reaction.

7. During lab you were asked to feel the beaker during the reaction to feel if it got hotter or colder. Is the ΔH positive or negative?

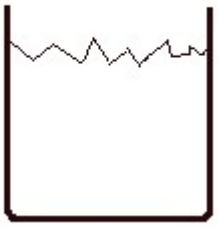
8. What sort of solution is in an <u>alkaline</u> battery, acid or base?

9. List the three chemical reasons that a voltaic cells would "die"?

Color the diagrams and then label them to show what they are filled with (solutions and solids). Label them with chemical symbols as well. Then filter the beaker as shown.



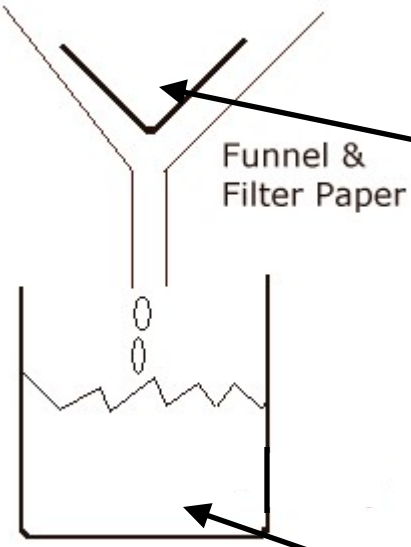
$CuCl_2$



$CuCl_2$ $_{(S)}$ + H_2O

$_{(AQ)}$ + Al

_____?



What is in there?

_____

What is in the beaker?

There are 3 things that could happen with this reaction:

1. You could eyeball measure perfectly, putting in exactly enough aluminum to completely react with the $CuCl_{2(AQ)}$ with out any left over Al or $CuCl_{2(AQ)}$.

2. You could add too little aluminum to completely react with the solution you made.

3. You could add too much aluminum to react completely with the $CuCl_{2(AQ)}$.

Which of these three happened to you? _____

Imagine these three scenarios—chemically speaking. What would be in the filter paper in the funnel, and what would be in your catch beaker under it, for each? Use proper chemical symbols with phases ONLY.

aluminum is add-ed to the copper chloride solution	**what is in your funnel with the filter paper? check one**	**what is in your catch beaker under your filter paper and funnel?**
You add a perfect amount of Al to react with the $CuCl_{2(AQ)}$	____ Cu only ____ Al only ____ Cu + Al	____ $CuCl_{2(AQ)}$ only ____ $AlCl_{3(AQ)}$ only ____ both $CuCl_{2(AQ)}$ + $AlCl_{3(AQ)}$
You add too little aluminum to react with the $CuCl_{2(AQ)}$	____ Cu only ____ Al only ____ Cu + Al	____ $CuCl_{2(AQ)}$ only ____ $AlCl_{3(AQ)}$ only ____ both $CuCl_{2(AQ)}$ + $AlCl_{3(AQ)}$
You add too much aluminum react with the $CuCl_{2(AQ)}$	____ Cu only ____ Al only ____ Cu + Al	____ $CuCl_{2(AQ)}$ only ____ $AlCl_{3(AQ)}$ only ____ both $CuCl_{2(AQ)}$ + $AlCl_{3(AQ)}$

Part 5: Observation and a Souvenir

A voltaic cell uses the redox chemical reactions and produces electricity. The other kind of electrochemical cell is called the electrolytic cell. With electrolytic cells you use electricity to force a redox reaction. It is used for electroplating one metal with a more precious metal. For instance, you might take a ring made of copper and then plate it with silver or even with gold. The outside part of the ring, the part people see, is now beautiful, while the inside, the hidden part is made up of much cheaper material. A ring like that looks just as good, but costs much less than a ring made up of all gold.

Pick out three shiny pennies from the teacher's desk. Place 2 of them into the lightly boiling NaOH solution containing granulated zinc. Let them sit for 2 minutes then carefully remove them with crucible tongs. Immediately put them into clean tap water to cool and wash them off.

They both are now quite silvery colored. Keep one aside, hold the other in the tongs and heat it up in the Bunsen burner flame. Not too long, pennies can melt. It turns a golden colored. By melting the zinc coating with the copper of the penny you form brass, an alloy that's golden brown. Dunk in water then dry it off.

These pennies are yours, under one condition. You go home and explain to someone (preferably over dinner) how chemistry makes electricity in a voltaic cell.

Technically speaking, this is an example of a type of electrolytic cell, but without electricity. No chemist quite understands this chemical process, although I am working hard behind the scenes to figure it out! Your pennies are plated now, with zinc, and with brass. Keep them safe. The brass one should be golden indefinitely. The zinc one will eventually combine with copper and become brass as well. (remind yourself now, I Love Chemistry!)

Details of unusual electroplating setup.

50 mL of 3 Molar NaOH + 25 g granulated zinc + heat to boil. Add clean pennies. Pennies must touch the zinc, rinse before touching, use clean crucible tongs only. Clean up: decant the base with water down drain, zinc can spontaneously combust as is, dissolve with concentrated HCl.

This lab	requires	for these points
Cover	Title, single sentence objective.	1 + 1
Drawings	colors, labels, symbols	3
3 scenarios	fill in boxes	3
Page 3	9 questions	9
Extended Conclusion	describe redox reactions, describe this one: write the half reactions and the net ionic equation. Describe the chemical ways that voltaic cells conk out.	8
due date: _____		25