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***Pre-laboratory Questions***

I. Classify each of the following reactions as Redox, SR (single replacement), DR (double replacement), C (combination), D(decomposition) reactions. If a reaction falls into more than one classification, you need to indicate both of them.

1) $4\ HNO_3(aq) + \mathbf{Cu(s)} \Longrightarrow \mathbf{Cu(NO_3)_2}\ (aq) + 2\ NO_2\ (g) + 2\ H_2O\ (l)$
2) $\mathbf{Cu(NO_3)_2\ (aq)} + 2\ NaOH\ (aq) \Longrightarrow \mathbf{Cu(OH)_2(s)} + 2\ NaNO_3\ (aq)$
3) $\mathbf{Cu(OH)_2(s)} + \text{heat} \Longrightarrow \mathbf{CuO\ (s)} + H_2O\ (l)$
4) $\mathbf{CuO\ (s)} + 2\ HCl\ (aq) \Longrightarrow \mathbf{CuCl_2\ (aq)} + H_2O\ (l)$
5) $\mathbf{CuCl_2\ (aq)} + Mg(s) \Longrightarrow \mathbf{MgCl_2}\ (aq) + \mathbf{Cu(s)}$

II. For the ones you have identified as Redox reactions above, further identify the oxidizing and reducing reagents and the number of electrons exchanged by using the oxidation number method.

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***Data Sheet and Questions***

OBSERVATIONS AND EQUATIONS

1. *Cu(s) + concentrated $HNO_3$*

Observation:

Reaction Equation: _____
Reaction Type: _____
What is in the solution after reaction is complete? _____

2. *$Cu(NO_3)_2$ + NaOH*

Observation:

Reaction Equation: _____
Reaction Type: _____
What is formed besides $Cu(OH)_2$? In what form does it exist?

3. *$Cu(OH)_2$ + heat*

Observation:

Reaction Equation: _____
Reaction Type: _____
What is removed by the washing and decanting processes?

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***Data Sheet and Questions***

*4. CuO + HCl*

Observation:

Reaction Equation: _____
Reaction Type: _____
What is in the solution after reaction is complete? _____

*5. Mg + $CuCl_2$*

Observation:

What happens when magnesium is added? _____
What is the gas produced in the reaction? _____

Reaction Equation: _____
Reaction Type: _____

Other reaction:

$$Mg + HCl \rightarrow$$

*6. Cu metal generated*

What is removed by the final three washing steps & why?

1) washing with water: _____
2) washing with ethanol: _____
3) washing with acetone: _____

What color is the recoverd copper?

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***Quantitative Data, Calculation and Problems***

**Data:**

Mass of empty evaporating dish: _____ g

Mass of evaporating dish and recovered copper: _____g

Mass of recovered copper: _____g

**Calculations:**

1. We started the reaction with 20 mL 0.100 M $Cu(NO_3)_2$ stock solution. Based on this information, what should be the theoretical yield of copper?

2. What is the percent yield of Copper?

3. What steps/factors in the experiment could have increased or decreased your obtained percent yield of Copper?