

Copper Cycle Stoichiometry

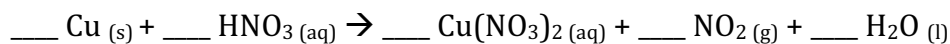
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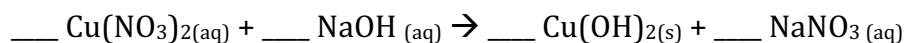
Show all steps and calculations in the space provided below.

1. Consider the reaction below, which is the first step in the process of recycling copper



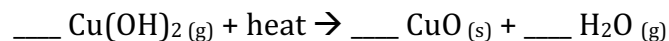
- a. If a student began the experiment with 0.020g of copper metal, what volume (in mL) of 15.8M HNO_3 would be required to complete the reaction?
- b. How many mL of NO_2 gas would be produced in the reaction was carried out at STP?
- c. How much $\text{Cu}(\text{NO}_3)_2$ (in grams) would be produced?

2. The next step in the process follows the reaction below:



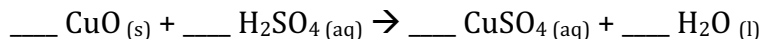
- a. If all of the $\text{Cu}(\text{NO}_3)_2$ produced in question 1 was used, what would be the mass of the solid produced in the reaction above?
- b. How much base (mL of 0.10M NaOH) would be needed in order to have a complete reaction?

3. The solid copper (II) hydroxide decomposes in heat to form copper (II) oxide and steam according to the reaction below



What mass of solid CuO would result if the reaction went to completion?

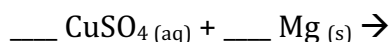
4. When reacted with sulphuric acid (H₂SO₄), the reaction follows the following equation:



a. What volume in milliliters of 6.0 M sulphuric acid (H₂SO₄) would be needed to fully react with the CuO produced in question 3?

b. What mass of copper (II) sulphate (CuSO₄) would be in solution at the end of the reaction?

5. In the final step of the process, solid copper metal is reformed using magnesium metal, according to the following reaction (complete the reaction):



a. What mass of MgSO₄ would be produced in this reaction?

b. What is the minimum mass of magnesium metal that could be used in this reaction?

c. What should the final mass of copper metal be? How does this mass compare to the starting mass of copper metal in question 1?

Answers:

1. a. 0.080 mL HNO ₃	b. 14 mL NO ₂	c. 0.059g Cu(NO ₃) ₂
2. a. 0.031g Cu(OH) ₂	b. 6.3 mL NaOH	
3. 0.025 g CuO		
4. a. 0.052 mL H ₂ SO ₄	b. 0.050g CuSO ₄	
5. a. 0.038g MgSO ₄	b. 0.0076g Mg	c. 0.020g Cu