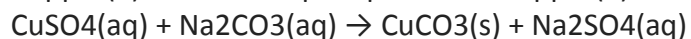


Answer on Question #70862 - Chemistry - General Chemistry

Question:

There are two possible methods for recovering copper from a solution of copper (II) sulfate, one uses precipitation and the other uses redox.

Copper(II) ions can be precipitated as copper(II) carbonate.



- 1.) How many mL of 0.35 M Na_2CO_3 would be needed to precipitate all of the copper ions in 26 mL of 0.43 M CuSO_4 ?
- 2.) How many grams of $\text{CuCO}_3(\text{s})$ would be formed from the copper ions in 55.4 mL of 1.71 M CuSO_4 ?

Solution:

- 1.) As one could see from the reaction equation, 1 mole of copper sulphate reacts with 1 mole of sodium carbonate. Let's calculate the number of the moles of copper sulphate in 26 mL of 0.43 M CuSO_4 :

$$n(\text{CuSO}_4) = cV = 0.43(\text{mol L}^{-1}) \cdot 26 \cdot 10^{-3}(\text{L}) = 0.0112 \text{ mol}$$

Now we can calculate the volume of the solution of sodium carbonate needed to precipitate 0.0112 mol of copper sulphate:

$$V(\text{Na}_2\text{CO}_3) = \frac{n}{c} = \frac{0.0112 \text{ mol}}{0.35 (\text{mol L}^{-1})} = 0.032 \text{ L, or } 32 \text{ mL}$$

- 2.) The number of the moles of copper in 55.4 mL of 1.71 M CuSO_4 :

$$n(\text{Cu}) = n(\text{CuSO}_4) = cV = 1.71(\text{mol L}^{-1}) \cdot 55.4 \cdot 10^{-3}(\text{L}) = 0.095 \text{ mol}$$

The mass of copper carbonate formed from this number of the moles of copper:

$$\begin{aligned} m(\text{CuCO}_3) &= n(\text{CuCO}_3) \cdot M(\text{CuCO}_3) = n(\text{Cu}) \cdot M(\text{CuCO}_3) \\ &= 0.095 (\text{mol}) \cdot 221.116 (\text{g mol}^{-1}) = 20.95 (\text{g}) \end{aligned}$$

Answer: 32 mL; 20.95 g.

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