

Answer on Question #56087 - Chemistry - General chemistry

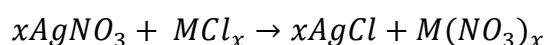
Question:

a 1.537g sample of an unknown chloride compound was treated with excess AgNO_3 and the AgCl product was collected and dried. The mass of recovered AgCl was 4.081g. What is the identity of the unknown chloride compound?

explain

Solution:

With the addition of silver nitrate AgNO_3 to unknown metal salt MCl_x , the precipitation of silver chloride AgCl occurs. The model reaction equation is:



Then, let's calculate the number of the moles of AgCl precipitated:

$$n(\text{AgCl}) = \frac{m(\text{AgCl})}{M(\text{AgCl})} = \frac{4.081 \text{ g}}{143.32 \text{ g/mol}} = 0.02848 \text{ mol}$$

As it is evident from AgCl formula, the number of the moles of AgCl is equal to the number of the moles of Cl^- reacted and the number of the moles of unknown chloride will be $n(\text{AgCl})/x$.

Let's calculate the molar mass of the unknown chloride:

$$M(\text{MCl}_x) = \frac{m(\text{MCl}_x)}{n(\text{MCl}_x)} \cdot x = \frac{1.537 \text{ g}}{0.02848 \text{ mol}} \cdot x = 53.98x$$

Then, molar mass of the metal is $M(M) = M(\text{MCl}_x) - xM(\text{Cl})$:

$$M(M) = x(53.98 - 35.45) = 18.53x$$

Let's presume, that the x value is 1, or 2, or 3. The molar mass of the metal, calculated with $x = 1$ and $x = 2$ don't correspond any elements in the periodic table (18.5 and 37.1 g/mol, respectively). If we use an assumption that $x = 3$, we will get 55.6 g/mol value, we can find out that the unknown metal is iron. Hence, the unknown compound is FeCl_3 .

Answer: FeCl_3