Answer on Question #72239, Chemistry / Inorganic Chemistry

A metal, X forms 2 different chlorides. if 12.70g of chloride A and 16.30g of chloride B contain 7.10g and 10.70g of chlorine respectively, what will be the formula of the compounds?

Solution

The general formulas of the chlorides are XCl_n and XCl_m, where n,m – metal valence. Metal index is always 1, because chlorine valence is 1.

Find the mass of metal in each compound:

	XCl_n	XCl_m
Total mass	12.7	16.3
Mass of Cl	7.1	10.7
Mass of X	5.6	5.6

As it is seen there are the same masses of metal in the compounds. That means that there are the same amounts of it.

Find the amount of chlorine in the first compound (XCl_n):

$v_1 = \frac{7.1}{35.5} = 0.2 (mole)$

If the formula is XCl, there is the same amount of metal in it (0.2 mole). Find its molar mass:

$M = \frac{5.6}{0.2} = 28$ (g/mole). It's silicon. But silicon doesn't form chloride SiCl. So the proposed formula is wrong.

If the formula is XCl_2, the amount of metal X is 0.1 mole. Find its molar mass:

$M = \frac{5.6}{0.1} = 56$ (g/mole). It's iron. Iron does form chloride $FeCl_2$.

Let's check our prediction using another chloride XCl_m, remembering that the amount of metal in it is the same (0.1 mole).

Find the amount of chlorine:

$v_2 = \frac{10.7}{35.5} = 0.3 (mole)$

As the amount of X is 0.1 mole than the formula is XCl_3. Iron does form chloride $FeCl_3$.

Answer

$FeCl_2$, $FeCl_3$.