Answer on the question #63487, Chemistry / General Chemistry

Question:

In the reaction K2CrO4 (aq) + PbCl2 (aq) 2KCl (aq) + PbCrO4(s), how many grams of PbCrO4 will precipitate out from the reaction between 25.0 millilitres of 3.0 M K2CrO4 in an excess of PbCl2?

Solution:

Let's write the reaction equation:

$$K_2CrO_{4(aq)} + PbCl_{2(aq)} \rightarrow 2KCl_{(aq)} + PbCrO_{4(s)} \downarrow.$$

As we see from the stoichiometry of the equation, in condition that there is an excess of lead chloride $PbCl_{2(aq)}$, and thus potassium chromate $K_2CrO_{4(aq)}$ is the limiting reagent, the number of the moles of lead chromate $PbCrO_{4(s)}$ is equal to the number of the moles of potassium chromate :

$$n\left(PbCrO_{4(s)}\right) = n\left(K_2CrO_{4(aq)}\right).$$

The number of the moles of potassium chromate is the product of the volume and the concentration of its solution:

$$n\left(K_2CrO_{4(aq)}\right) = cV = 3.0(M) \cdot 25.0 \cdot 10^{-3}(L) = 7.5 \cdot 10^{-2} mol.$$

$$n\left(PbCrO_{4(s)}\right) = 7.5 \cdot 10^{-2} mol$$

The mass of lead chromate is the product of the number of the moles $n\left(PbCrO_{4(s)}\right)$ and molar mass $M\left(PbCrO_{4(s)}\right)$:

$$m\left(PbCrO_{4(s)}\right) = n\left(PbCrO_{4(s)}\right) \cdot M\left(PbCrO_{4(s)}\right) = 7.5 \cdot 10^{-2}(mol) \cdot 323.2(g\ mol^{-1}) = 24.24\ g$$

Answer: 24.24 g