Answer on Question #70932, Chemistry / General Chemistry : completed

a) Calculate the mass of potassium ferrocyanide and the volume of water needed to prepare a w(potassium ferrocyanide) = 4.0% solution with a density of ρ = 1.0256 g mL-1

b) How big would the relative error (in percent) be when instead of using the values calculated in a) just 40 g of salt are dissolved in 1000 mL of water?

Solution.

$$w\left(K_4\left[Fe(CN)_6\right]\right) = 4\%$$
$$\rho = 1.0256 g / ml$$

$$m\left(K_4\left[Fe(CN)_6\right]\right) - ?$$

Solution weight:

$$m = \rho \cdot V = 1000 ml \cdot 1.0256 g / ml$$
$$m = 1025.6 g$$

If volume of solution V = 1 l = 1000 ml, than:

$$w\left(K_4\left[Fe(CN)_6\right]\right) = \frac{m\left(K_4\left[Fe(CN)_6\right]\right)}{m} \cdot 100\%$$

And:

$$m\left(K_4\left[Fe(CN)_6\right]\right) = \frac{m \cdot w\left(K_4\left[Fe(CN)_6\right]\right)}{100\%}$$
$$m\left(K_4\left[Fe(CN)_6\right]\right) = \frac{1025.6 g \cdot 4\%}{100\%}$$
$$m\left(K_4\left[Fe(CN)_6\right]\right) = 41.024 g$$

Solution weight H_2O:

$$m(H_2O) = m - m\left(K_4\left[Fe(CN)_6\right]\right) = 1025.6 g - 41.024 g$$
$$m(H_2O) = 984.576 g$$

Relative error (in percent):

$$\varepsilon = \frac{\Delta m}{m} = \frac{41.024 g - 40 g}{41.024 g} \cdot 100\%$$
$$\varepsilon = 2.496\%$$

Answer: $m\left(K_4\left[Fe(CN)_6\right]\right) = 41.024 g$, $m(H_2O) = 984.576 g$, $\varepsilon = 2.496\%$.