Answer on Question #82647 – Chemistry – General Chemistry

For your titrations of the hydrogen peroxide in a new bottle, calculate the molarity of the new hydrogen peroxide solution using the average volume of permanganate solution dispensed in the fine titration. If you had to perform three fine titrations, disregard the one that was different.

Solution:

$2KMnO_4 + 5H_2O_2 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$

In this titration you start off with a fixed volume of hydrogen peroxide (2 different samples - old hydrogen peroxide should be less reactive, require less $KMnO_4$) but unknown concentration and a known concentration of potassium permanganate. You add the permanganate until all of the H_2O_2 is neutralized. 2 moles of permanganate ion are neutralized by 5 moles of hydrogen peroxide. The reaction requires sulfuric acid $H2SO_4$.

So we start by determining the number of moles of $KMnO_4$ (permanganate). You added 18.08 mL (= 0.01808 L) of a 0.2 M or 0.2 moles/L solution. The number of moles is given by the equation $n = C \times V$.

For the first titration with the new H_2O_2 you had $n = 0.01808\ L \times 0.2\ mol/L = 3.6 \times 10^{-3}$ mol.

Based on the ratio that 2 molecules of permanganate neutralise 5 molecules of H_2O_2, the number of moles of H_2O_2 (that were neutralized) is $5/2 \times$ the number of moles of permangante

$n\ (KMnO_4) = 2$ mol; $n\ (H_2O_2) = 5$ mol

$n\ (KMnO4) = 3.6 \times 10^{-3}$ mol , $n\ (H_2O_2) = 9 \times 10^{-3}$ mol

The molarity (which is the same as concentration) is therefore

If $n = C \times V$, then $C = n/V$, the volume used was 10 mL or 0.01 L

$c\ (H_2O_2) = 9 \times 10^{-3}$ mol / 0.010 L = 0.9 M