

## Answer on Question #73454 – Chemistry – General Chemistry

### Task:

The decomposition of hydrogen peroxide in dilute sodium hydroxide solution is described by the equation:  $2\text{H}_2\text{O}_2(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$

The reaction is first order in  $\text{H}_2\text{O}_2$ , the rate constant for the consumption of  $\text{H}_2\text{O}_2$  at  $20^\circ\text{C}$  is  $1.8 \times 10^{-5} \text{ s}^{-1}$ , and the initial concentration of  $\text{H}_2\text{O}_2$  is  $0.62 \text{ M}$ . What is the concentration of  $\text{H}_2\text{O}_2$  in units of molarity after  $7.33$  hours? Correct Sig Figs!

### Solution:

Since reaction is first order,

$$[\text{H}_2\text{O}_2]_o = 0.62\text{M}; \quad k = 1.8 * 10^{-5}; \quad t = 7.33\text{h}.$$

$$t = (7.33\text{h})\left(\frac{60\text{min}}{\text{h}}\right)\left(\frac{60\text{s}}{\text{min}}\right) = 26388\text{s}.$$

$$\ln\left(\frac{[\text{H}_2\text{O}_2]_t}{[\text{H}_2\text{O}_2]_o}\right) = -kt;$$

$$\ln[\text{H}_2\text{O}_2]_t - \ln[\text{H}_2\text{O}_2]_o = -kt;$$

$$\ln[\text{H}_2\text{O}_2]_t - \ln[0.62] = -1.8 * 10^{-5} * 26388;$$

$$\ln[\text{H}_2\text{O}_2]_t - (-0.478) = -0.474984$$

$$\ln[\text{H}_2\text{O}_2]_t = -0.474984 - 0.478 = -0.952984;$$

$$[\text{H}_2\text{O}_2]_t = e^{-0.952984} = 0.3855887\text{M} = 0.39\text{M}$$

**Answer:**  $[\text{H}_2\text{O}_2]_t = 0.39 \text{ M}$ .