

Chapter 10 & 11 – Review Set

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1. If the mass percent of KOH is 22% and density is $1.52 \left[\frac{\text{g}}{\text{mL}} \right]$, what is the molality?

$$\begin{aligned} 1000[\text{mL}] &\rightarrow 1520[\text{g}_{total}] \\ .22 \cdot 1520 &= 334.4[\text{g}_{\text{KOH}}] \\ 1520 - 334.4 &= 1185.6[\text{g}_{\text{H}_2\text{O}}] \\ \frac{334.4}{39 + 16 + 1} &= 5.97[\text{mol}] \\ \frac{5.97}{1.186} &= 5.03[\text{M}] \end{aligned} \tag{1}$$

2. The molality of $\text{C}_{12}\text{H}_{22}\text{O}$ in water is $1.62 \left[\frac{\text{mol}}{\text{kg}} \right]$. What is the mass percent of the solute?

$$\begin{aligned} 1.62[\text{mol}_{\text{C}_{12}\text{H}_{22}\text{O}}] &\rightarrow 1[\text{kg}] \\ 1.62 \cdot 182 &= 294.84[\text{g}] \\ 1000 + 294.84 &= 1294.84[\text{g}_{\text{H}_2\text{O}}] \\ \frac{294.84}{1294.84} &= 23\% \end{aligned} \tag{2}$$

3. Calculate the mass of HCl in $5.0[\text{mL}]$ of concentrated hydrochloric acid (density = $1.19 \left[\frac{\text{g}}{\text{mL}} \right]$) containing 37.23% HCl by mass.

$$\begin{aligned} 5 \cdot 1.19 &= 5.95 \\ 5.95 \cdot .3723 &= 2.2[\text{g}] \end{aligned} \tag{3}$$

4. A dilute sulfuric acid solution that is $3.39[\text{M}]$ H_2SO_4 has a density of $1.18 \left[\frac{\text{g}}{\text{mL}} \right]$. How many moles of H_2SO_4 are there in $375[\text{mL}]$ of this solution?

$$\begin{aligned} 1.18 \cdot 375 &= 442.5[\text{g}] \\ .4425 \cdot 3.39 &= 1.5[\text{mol}] \end{aligned} \tag{4}$$

5. Calculate the mass percent of H_2SO_4 in a 6.80[M] solution.

6. The mole fraction of $\text{C}_2\text{H}_5\text{OH}$ in a water solution is 0.0532. Calculate the molality of $\text{C}_2\text{H}_5\text{OH}$.

$$\begin{aligned}\frac{.0532}{x - .0532} &= .0532 \\ x &= .9468 [\text{mol}] \\ 18 \cdot .9468 &= 17.0424 [\text{g}] \\ \frac{.0532}{.017} &= 3.12 [\text{M}]\end{aligned}\tag{6}$$

7. How long will it take a first order substance with $k = 0.45 \left[\frac{1}{\text{s}}\right]$ to be reduced to 33% of the original concentration?

$$\begin{aligned}t &= \frac{\ln(3)}{.45} \\ &= 2.44 [\text{s}]\end{aligned}\tag{7}$$

8. How long will it take a first order substance with $k = 0.88 \left[\frac{1}{\text{s}}\right]$ to be reduced to 1/8 of original?

$$\begin{aligned}t &= \frac{\ln(8)}{.88} \\ &= 2.36 [\text{s}]\end{aligned}\tag{8}$$

9. The decomposition of CO_2 is second order with a rate of $0.008 \left[\frac{\text{mol}}{\text{L s}}\right]$ when the concentration is 0.12[M]. Calculate the rate when the concentration of CO_2 is 0.25[M].

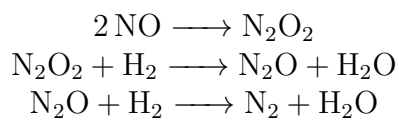
$$\begin{aligned}.008 &= k[.12]^2 \\ k &= .555 \left[\frac{\text{L}}{\text{mol s}}\right] \\ \text{rate} &= .555 \cdot [.25]^2 \\ &= .0347 \left[\frac{\text{M}}{\text{s}}\right]\end{aligned}\tag{9}$$

10. Given the following data for the reaction of BF with H_2 , calculate k

[BF]	[H ₂]	Rate
0.1	0.1	0.0341
0.2	0.233	0.159
0.2	0.0750	0.0512

$$\begin{aligned}
 \frac{.0512}{.159} &= \left(\frac{.075}{.233} \right)^m \\
 m &= 1 \\
 \frac{.0341}{.0512} &= \left(\frac{.1}{.075} \right) \left(\frac{.1}{.2} \right)^n \\
 n &= 1 \\
 .0512 &= k[.075][.2] \\
 k &= 3.41 \left[\frac{1}{\text{M s}} \right]
 \end{aligned} \tag{10}$$

11. Which step must be the rate-determining step in the following mechanism if the rate law is $Rate = k[\text{H}_2][\text{NO}]^2$?



Step Two