

Chemical Equilibrium Review Sheet

I. Part 1 – Multiple Choice

1. This section will account for 20 points on the test and will be OPEN NOTES.
2. Have the following notes and quizzes organized, highlighted, and reviewed.

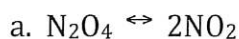
- *Chemical Equilibrium*
- *Factors Affecting Equilibrium*
- *Limiting Reactants & Percent Yield*

II. Part 2 – Performance Assessment

This section will account for 20 points on the test and will be CLOSED NOTES.

#1 – Equilibrium Constants

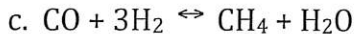
1. Write equilibrium constant expressions for these equilibria.



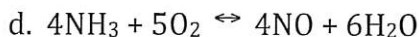
$$K_{eq} = \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]}$$



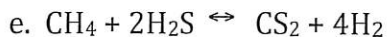
$$K_{eq} = \frac{[\text{H}_2]^2 [\text{S}_2]}{[\text{H}_2\text{S}]^2}$$



$$K_{eq} = \frac{[\text{CH}_4] [\text{H}_2\text{O}]}{[\text{CO}] [\text{H}_2]^3}$$



$$K_{eq} = \frac{[\text{NO}]^4 [\text{H}_2\text{O}]^6}{[\text{NH}_3]^4 [\text{O}_2]^5}$$



$$K_{eq} = \frac{[\text{CS}_2] [\text{H}_2]^4}{[\text{CH}_4] [\text{H}_2\text{S}]^2}$$

2. Calculate K_{eq} for the equation, $\text{N}_2\text{O}_4 \leftrightarrow 2\text{NO}_2$, if $[\text{N}_2\text{O}_4] = 0.0185 \text{ mol/L}$ and $[\text{NO}_2] = 0.0627 \text{ mol/L}$.

$$K_{eq} = \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]} = \frac{(0.0627)^2}{(0.0185)} = 0.213$$

3. The reaction, $\text{COCl}_2 \leftrightarrow \text{CO} + \text{Cl}_2$ reaches equilibrium at 900 K. $K_{\text{eq}} = 8.2 \times 10^{-2}$. If the equilibrium concentrations of CO and Cl_2 are 0.150 M, what is the equilibrium concentration of COCl_2 ?

$$\begin{array}{l} \textcircled{1.} \quad \frac{[\text{CO}][\text{Cl}_2]}{[\text{COCl}_2]} = 8.2 \times 10^{-2} \\ \textcircled{2.} \quad \frac{(0.150)(0.150)}{[\text{COCl}_2]} = 8.2 \times 10^{-2} \\ \textcircled{3.} \quad [\text{COCl}_2] = \frac{(0.150)(0.150)}{8.2 \times 10^{-2}} = \textcircled{0.28 \text{ M}} \end{array}$$

#2 - Percent Yield

1. How many grams of silver can be produced by the reaction of 5.05 grams of silver nitrate with excess copper? $[\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{Ag}]$

$$5.05 \text{ g AgNO}_3 \times \frac{1 \text{ mol AgNO}_3}{170 \text{ g AgNO}_3} \times \frac{2 \text{ mol Ag}}{2 \text{ mol AgNO}_3} \times \frac{108 \text{ g Ag}}{1 \text{ mol Ag}} = \textcircled{3.21 \text{ g Ag}}$$

2. The amount of product in a given reaction turns out to be only 1.68 grams, although the theoretical amount was calculated to be 1.84 grams. What is the percentage yield?

$$\frac{1.68 \text{ g}}{1.84 \text{ g}} \times 100 = \textcircled{91.3 \%}$$

3. In the reaction from question 1., if 0.947 grams of copper react with silver nitrate how many grams of copper II nitrate are produced?

$$0.947 \text{ g Cu} \times \frac{1 \text{ mol Cu}}{63.546 \text{ g Cu}} \times \frac{1 \text{ mol Cu}(\text{NO}_3)_2}{1 \text{ mol Cu}} \times \frac{187.56 \text{ g Cu}(\text{NO}_3)_2}{1 \text{ mol Cu}(\text{NO}_3)_2} = \textcircled{2.795 \text{ g Cu}(\text{NO}_3)_2}$$

If 1.89 grams of silver is actually produced, what is the percent yield?

$$\frac{1.89 \text{ g}}{3.21 \text{ g}} \times 100 = \textcircled{58.9 \%}$$