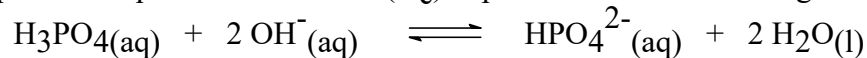


Chem 10123, Quiz 2

January 29, 2020

Answer Key

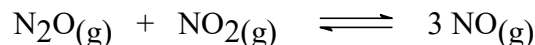
1. (3 points) Complete the equilibrium constant (K_c) expression for the following reaction.



$$K_c = [\text{HPO}_4^{2-}] / [\text{H}_3\text{PO}_4][\text{OH}^-]^2$$

2. (3 points) If $K_c = 125$ for this reaction: $2 \text{A} \rightleftharpoons 3 \text{B} + \text{C}$, then the value of K_c for the related reaction: $\text{B} + 1/3 \text{C} \rightleftharpoons 2/3 \text{A}$, is equal to **0.20**.

3. Consider the following reaction that is known to be endothermic ($\Delta H^\circ = 156 \text{ kJ}$).



- (a) (4 points) Which of the factors listed below would cause the equilibrium concentration of NO to increase? Circle all that apply.

add a catalyst

increase the temperatureremove some NO_2 **decrease the pressure****add some N_2O**

- (b) (10 points) **SHOW ALL WORK.** *Clearly state and justify any assumptions that you may make.* At 27°C , the above reaction has an equilibrium constant, $K_c = 2.70 \times 10^{-20}$. In one experiment, 0.020 moles of N_2O and 0.050 moles of NO_2 were added to an empty 1.00-liter container. Determine the molar concentration of NO in this system after equilibrium is established.

	$\text{N}_2\text{O}(\text{g})$	+	$\text{NO}_2(\text{g})$	\rightleftharpoons	$3 \text{NO}(\text{g})$
I	0.020 M		0.050 M		0
C	- x		- x		+ 3x
E	0.020 - x		0.050 - x		3x

$$K_c = 2.70 \times 10^{-20} = [\text{NO}]^3 / [\text{N}_2\text{O}][\text{NO}_2] = (3x)^3 / (0.020 - x)(0.050 - x)$$

(assume $x \ll 0.020, 0.050$)

$$2.70 \times 10^{-20} \approx (3x)^3 / (0.020)(0.050) \approx 27x^3 / 1.0 \times 10^{-3}$$

$$x \approx 1.0 \times 10^{-8} \quad (\text{assumption is valid})$$

$$[\text{NO}] = 3x \approx 3.0 \times 10^{-8} \text{ M}$$