

1) Explain what it means for a reaction to be at equilibrium?

The rate of formation of the products and reactants is equal. The reaction continues to form new products and reactants (dynamic process), but the concentrations do not change.

2) How does the value of K_c determine if a reaction favors products or reactants?

The LARGER the value of K_c the greater the concentration of PRODUCTS at eq.
The SMALL the value of K_c the greater the concentration of REACTANTS at eq.

3) How do the values of K_c and Q_c determine the direction a reaction will proceed?

When $K_c > Q_c$, forms more products
When $K_c < Q_c$, forms more reactants
When $K_c = Q_c$, at equilibrium

4) What is the expression and value of K_w ?

$$K_w = [H^+][OH^-] = 1.0 \times 10^{-14}$$

5) Can you identify the conjugate base of any acid? How is acid strength related to conjugate base strength?

For ANY acid, remove the acidic hydrogen, what remains is the conjugate base.

Example: $\text{HCN} \leftrightarrow \text{H}^+ + \text{CN}^-$ The CN^- ion is the conjugate base of the acid HCN.

The STRONGER the acid, the WEAKER the conjugate base.

6) What does the value of K_a tell you about the strength of the acid?

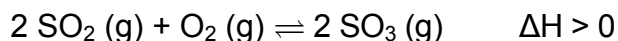
The LARGER the K_a value the STRONGER the weak acid is.

Example; HCN ($K_a=4.9 \times 10^{-10}$) is a weaker acid than HNO_2 ($K_a=4.5 \times 10^{-4}$)

7) Make sure you can calculate the pH of either a Strong Acid or Weak Acid solution.

We did many problems like this in class and on ARIS, review them.

8) Write the equilibrium constant expression for the reaction below.



$$K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2[\text{O}_2]}$$

9) For the reaction above, $K_c = 4.3 \times 10^{-4}$, if the following initial concentrations are used, what happens in the reaction?

$$[\text{SO}_2] = 0.37 \text{ M} \quad [\text{O}_2] = 0.25 \text{ M} \quad [\text{SO}_3] = 5.7 \text{ M}$$

$Q_c = 949.31$ and $K_c = 4.3 \times 10^{-4}$, Therefore; **the reaction produces more reactants.**

10) For the reaction in problem 8 above, explain how decreasing the temperature will affect the equilibrium position of the reaction.

The reaction is ENDOTHERMIC, if WE decrease the temperature, the reaction will try to balance this change by **forming more REACTANTS** and increasing the temperature.

11) Write K_a expressions for all steps in the ionization H_3PO_4 and identify all acid/conjugate base pairs.

See your notes, we did this in class

12) Calculate the pH of a 0.37 M solution of a mono-protic strong acid.

$$[\text{H}^+] = 0.37 \text{ M}$$

$$\text{pH} = -\log(0.37) = 0.43$$

13) What is the percent ionization of a weak acid with an initial concentration of 0.5 M and $[\text{H}^+] = 0.002 \text{ M}$?

$$\text{percent ionization} = (0.002 / 0.5) \times 100 = 0.40 \%$$

14) How does reversing a reaction alter the K_c value? What about multiplying through by a factor of 3?

Reversing reaction: this flips the expression over and the value becomes $1/K_c$

Multiplying by 3: this adds an exponent of 3 to each reactant and product term and therefore adds an exponent of 3 to the K_c value

15) What is the [OH⁻] in a solution with pH = 4.73?

$$\text{pOH} = 14.00 - 4.73 = 9.27$$

$$[\text{OH}^-] = 10^{-9.27} = 5.37 \times 10^{-10}$$

16) Explain the trend in acid strength based on Bond Enthalpy

The STRONGER the bond, the WEAKER the acid.

17) Explain the trend in acid strength based on Electronegativity

The MORE electronegative the central atom, the STRONGER the acid.