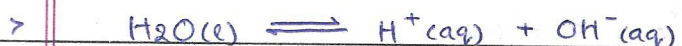


20 - Ionic Equilibria.Q-1) K_w - ionic product of water.

$$K_w = [\text{H}^+][\text{OH}^-]$$

$$K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6} \text{ at } 298 \text{ K.}$$

In water, $[\text{H}^+] = [\text{OH}^-]$

$$\therefore K_w = [\text{H}^+]^2$$

$$\therefore [\text{H}^+] = 1.00 \times 10^{-7} \text{ mol dm}^{-3}$$

Q-2) What is pH?

> pH is the negative logarithm to the base 10 of the hydrogen ion concentration.

$$\text{pH} = -\log_{10} [\text{H}^+]$$

$$\therefore [\text{H}^+] = 10^{-\text{pH}}$$

Q-3) Calculating pH of strong acids and strong bases.

Strong acid:

$[\text{H}^+]$ is same as [acid] since they are completely ionised.

$$\text{pH} = -\log_{10} [\text{H}^+]$$

strong base:

$[\text{OH}^-]$ is same as [alkali]

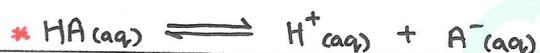
① use $[\text{H}^+] = \frac{K_w}{[\text{OH}^-]}$ to find $[\text{H}^+]$

② then use $-\log_{10} [\text{H}^+]$



Q-4) K_a - acid dissociation constant.

> K_a is the equilibrium constant for the dissociation of weak acids.



$$K_a = \frac{[H^+][A^-]}{[HA]}$$

* In the equation, the H^+ arising from the ionisation of water (aq) are ignored. $\therefore [H^+] = [A^-]$

* We assume that ionisation of weak acid is v. small that $[HA]$ at equilibrium is same as $[HA]$ at start.

$$\therefore K_a = \frac{[H^+]^2}{[HA]}$$

pK_a values can be used to compare strengths of weak acids

$$pK_a = -\log_{10} K_a$$

High value of K_a = STRONG ACID

Low value of pK_a = STRONG ACID.

* Equilibrium constant K_c

$$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b} \quad \text{if} \quad aA + bB \rightleftharpoons cC + dD$$

continued on pg 15...

20 - Ionic Equilibria continued...

Q-5) Acid-base titrations.

* Strong acid - strong base.

end point : 10.5 - 3.5.

* Strong acid - weak base

end point : 7.5 - 3.5.

* Weak acid - strong base

end point : 11 - 7.5

* Weak acid - weak base

no indicator.

Q-6) What are buffer solutions?

> A buffer solution is a solution in which the pH does not change significantly when small amounts of acids or alkalis are added.



• equilibrium shift and large reserve of ions means the pH doesn't change significantly.

$$[\text{H}^+] = K_a \frac{[\text{acid}]}{[\text{salt}]}$$

OR

$$\text{pH} = \text{p}K_a + \log_{10} \frac{[\text{salt}]}{[\text{acid}]}$$

Q-7) What is solubility product?

- > Solubility product is the product of the concentrations of each ion in a saturated solution of a sparingly soluble salt at 298K, raised to the power of their relative concentrations.

$$K_{sp} = [C^{y+}]^a [A^{x-}]^b$$

↓ ↓
cation anion

Q-8) What is the common ion effect?

- > The common ion effect is the reduction in the solubility of a dissolved salt achieved by adding a solution of a compound which has an ion in common with the dissolved salt.

Q-9) What is partition co-efficient?

- > Partition co-efficient is the distribution of a solute in two immiscible solvents.

$$K_{pc} = \frac{[\text{organic top layer}]}{[\text{inorganic bottom layer}]}$$

* see notebook for example.