

# Chem12 Hydrolysis : Notes/W.S. - 180

**Hydrolysis** is the reaction between an ion and water in which the oxygen-hydrogen bond is broken.

Hydrolysis of a salt is the reaction of a salt with water to form an acidic or basic solution.

## Hydrolysis of Salts

When a salt is added to water, the solution will be acidic, basic, or neutral. There are rules to determine whether the salt solution will be acidic, basic, or neutral.

1) If the salt can be formed from a strong acid and a strong base, then the salt will form a neutral solution when added to water. Anions (- ions) of strong acids and cations (+ ions) of strong bases will not hydrolyze.

2) A salt that can be formed from a weak acid and a strong base, will form a basic solution.

3) A salt that can be formed from a weak base and a strong acid, will form an acidic solution.

4) If the salt can be formed from a weak acid and a weak base, we must find the  $K_a$  value for the cation (+ ion) and  $K_b$  for the anion (- ion). If  $K_a > K_b$ , the solution will be acidic. If  $K_b > K_a$ , the solution is basic.

5) Some metallic ions such as  $Al^{3+}$ ,  $Fe^{3+}$ , and  $Cu^{2+}$  will hydrolyze and form complex ions such as  $Al(H_2O)_6^{3+}$  etc. These ions can donate a proton and will form acidic solutions.

Exercise :

1) State whether the following salts are neutral, acidic, or basic, and explain why.

a)  $Na_2SO_4$ , b)  $Ba(NO_2)_2$ , c)  $(NH_4)_2SO_3$ , d)  $AlCl_3$ , e)  $KNO_3$ , f)  $SrCO_3$ , g)  $KI$ , h)  $NaCN$ , i)  $Cu(NO_3)_2$ , j)  $NH_4Br$ .

Answers : 1)a) N, (salt is from NaOH a strong base and H<sub>2</sub>SO<sub>4</sub> a strong acid), b) B, (salt is from Ba(OH)<sub>2</sub> a strong base and HNO<sub>2</sub> a weak acid), c) B, ( $K_b$  for SO<sub>3</sub><sup>2-</sup> >  $K_a$  for NH<sub>4</sub><sup>+</sup>), d) A, (Al will hydrolyze to give an acid solution, Cl<sup>-</sup> is from HCl a strong acid and does not hydrolyze), e) N, (salt is from KOH a strong base and HNO<sub>3</sub> a strong acid), f) B, (salt is from Sr(OH)<sub>2</sub> a strong base and H<sub>2</sub>CO<sub>3</sub> a weak acid), g) N, (salt is from a strong base KOH and a strong acid HI), h) B, (salt is from NaOH a strong base and HCN a weak acid), i) A, (Cu<sup>2+</sup> ions will hydrolyze to give an acidic solution, NO<sub>3</sub><sup>-</sup> is from a strong acid and will not hydrolyze), j) A, ( $K_a$  for NH<sub>4</sub><sup>+</sup> >  $K_b$  for Br<sup>-</sup>, or NH<sub>4</sub><sup>+</sup> is a proton donor and Br<sup>-</sup> is from a strong acid and will not hydrolyze).