

## 9. Salts

- ① Salts dissociate 100% in water
- ② The ions from the salt will either:
  - Undergo "Hydrolysis"
  - Be Spectator Ions

### a) What is "Hydrolysis"?

- i) Reaction between an ion from the salt with water.
- ii) **The ion will react with water to form a basic solution if the ion is on the base (right) side of the Table of Relative Strengths p.334.**



$\text{Na}^+$  is not on the table. It is a spectator ion.

$\text{SO}_3^{2-}$  is found on the base side



Therefore,  $\text{Na}_2\text{SO}_3$  added to water will form a basic solution.

- iii) **The ion will react with water to form an acidic solution if the ion is on the acid (left) side of the Table of Relative Strengths p.334.**



$\text{Br}^-$  is not on the table. It is a spectator ion.

$\text{NH}_4^+$  is found on the acid side



Therefore,  $\text{NH}_4\text{Br}$  added to water will form an acidic solution.

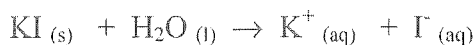
## b) Spectator Ions

i) Ions that do not react with water (*not* found on Table of Relative Strengths)

ii) Most common spectator ions:

- alkali and alkaline earth metals
- $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{ClO}_4^-$

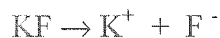
iii) KI salt in water:



Solution is neutral because no hydrolysis occurs

## c) Will the Following Salts be Acidic, Basic or Neutral in Water?

i) KF

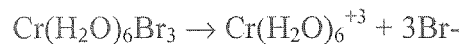


$\text{K}^+$  is a spectator;  $\text{F}^-$  is found on the base side



Solution is **basic**

iii)  $\text{Cr}(\text{H}_2\text{O})_6\text{Br}_3$



$\text{Br}^-$  is spectator;  $\text{Cr}(\text{H}_2\text{O})_6^{+3}$  is on acid side



Solution is **acidic**.

ii)  $\text{MgSO}_4$

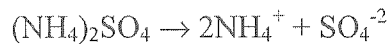


$\text{Mg}^{+2}$  is a spectator;  $\text{SO}_4^{-2}$  is on base side



Solution is **basic**

iv)  $(\text{NH}_4)_2\text{SO}_4$



$\text{NH}_4^+$  is on acid side;  $\text{SO}_4^{-2}$  is on base side

Must compare whether  $\text{NH}_4^+$  produces more  $\text{H}_3\text{O}^+$  than  $\text{SO}_4^{-2}$  produces  $\text{OH}^-$ . (Compare  $K_a$  and  $K_b$ )

$$K_a(\text{NH}_4^+) = 5.6 \times 10^{-10}$$

$$K_b(\text{SO}_4^{-2}) = K_w / K_a(\text{HSO}_4^-)$$

$$K_b(\text{SO}_4^{-2}) = 1.0 \times 10^{-14} / 1.2 \times 10^{-2} = 8.3 \times 10^{-13}$$

$K_a > K_b$  so solution is **acidic**.

\*amphiprotic ion

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$\text{NaH}_2\text{PO}_4$