Acid Base Properties of Salts

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Type of Salt** | | | **Examples** | | **Comment** | | **pH of Solution** |
| Cation is from a strong base, anion from a weak acid | | | NaC2H3O2  KCN, NaF | | Cation is neutral,  Anion is basic | | Basic |
| **The basic anion can accept a proton from water:** | | | | | | | |
| C2H3O2 − + | H2O | | ⮀ | HC2H3O2 + | | OH− | |
| *Base* | *acid* | |  | *acid* | | *base* | |
|  |  | |  |  | |  | |
| Cation is the conjugate acid of a weak base, anion is from a strong acid | | | NH4Cl,  NH4NO3 | | Cation is acidic,  Anion is neutral | | Acidic |
| **The acidic cation can act as a proton donor:** | | | | | | | |
| NH4+(aq) | | | ⮀ | | NH3(aq) + | | H+(aq) |
| Acid | | |  | | Conjugate base | | Proton |
|  | | |  | |  | |  |
| Cation is the conjugate acid of a weak base, anion is conjugate base of a weak acid | | | NH4C2H3O2  NH4CN | | Cation is acidic,  Anion is basic | | See below |
| * IF *Ka* for the acidic ion is greater than *Kb* for the basic **ion**, the solution is acidic * IF *Kb* for the basic ion is greater than *Ka* for the acidic **ion**, the solution is basic * IF *Kb* for the basic ion is equal to *Ka* for the acidic ion, the solution is neutral | | | | | | | |
|  | | |  | |  | |  |
| Cation is a highly charged metal ion; Anion is from strong acid | | | Al(NO3)3  FeCl3 | | Hydrated cation acts as an acid; Anion is neutral | | Acidic |
| **Step #1:** | | | | | | | |
| AlCl3(s) + | | 6H2O | → | | Al(H2O)63+(aq) | | + Cl-(aq) |
| Salt | | Water |  | | Complex Ion | | Anion |
|  | | |  | |  | |  |
| **Step #2:** | | |  | |  | |  |
| Al(H2O)63+(aq) | | | → | | Al(OH)(H2O)52+(aq) | | + H+(aq) |
| Acid | | |  | | Conjugate Base | | Proton |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Type of Salt** | | | **Examples** | | **Comment** | | **pH of Solution** |
| Cation is from a strong base, anion from a weak acid | | | NaC2H3O2  KCN, NaF | | Cation is neutral,  Anion is basic | | Basic |
| **The basic anion can accept a proton from water:** | | | | | | | |
| C2H3O2 − + | H2O | | ⮀ | HC2H3O2 + | | OH− | |
| *Base* | *acid* | |  | *acid* | | *base* | |
|  |  | |  |  | |  | |
| Cation is the conjugate acid of a weak base, anion is from a strong acid | | | NH4Cl,  NH4NO3 | | Cation is acidic,  Anion is neutral | | Acidic |
| **The acidic cation can act as a proton donor:** | | | | | | | |
| NH4+(aq) | | | ⮀ | | NH3(aq) + | | H+(aq) |
| Acid | | |  | | Conjugate base | | Proton |
|  | | |  | |  | |  |
| Cation is the conjugate acid of a weak base, anion is conjugate base of a weak acid | | | NH4C2H3O2  NH4CN | | Cation is acidic,  Anion is basic | | See below |
| * IF *Ka* for the acidic ion is greater than *Kb* for the basic **ion**, the solution is acidic * IF *Kb* for the basic ion is greater than *Ka* for the acidic **ion**, the solution is basic * IF *Kb* for the basic ion is equal to *Ka* for the acidic ion, the solution is neutral | | | | | | | |
|  | | |  | |  | |  |
| Cation is a highly charged metal ion; Anion is from strong acid | | | Al(NO3)3  FeCl3 | | Hydrated cation acts as an acid; Anion is neutral | | Acidic |
| **Step #1:** | | | | | | | |
| AlCl3(s) + | | 6H2O | → | | Al(H2O)63+(aq) | | + Cl-(aq) |
| Salt | | Water |  | | Complex Ion | | Anion |
|  | | |  | |  | |  |
| **Step #2:** | | |  | |  | |  |
| Al(H2O)63+(aq) | | | → | | Al(OH)(H2O)52+(aq) | | + H+(aq) |
| Acid | | |  | | Conjugate Base | | Proton |