Test 12: Acids, bases and salts

1. Electrolytes:

* Substances that when dissolved in form s a solution capable of conducting an electric current (mobile ions)
* The higher the concentration of ions, the better the solution conducts electricity.
* Strong acids, strong bases and soluble salts are all strong electrolytes.

1. Operational definition of acids and bases

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| --- | --- |
| ACIDS | BASES |
| 1. Electrolyte: aqueous acids produce mobile ions and therefore conduct an electric current 2. Strong acids: completely dissociate (HCl, HNO3,H2SO4,HBr and HI) 3. Weak acids: do not dissociate completely into ions (all the rest) | 1. Electrolytes: aqueous bases produce mobile ions and therefore conduct an electric current. 2. Strong bases: completely dissociate (soluble hydroxides on table F except ammonium hydroxide is not) 3. Weak bases: do not completely dissociate into ions (insoluble hydroxides on table F) |
| 1. Change color of acid-base indicators: pH: 1-7 / litmus: red/ phenolphthalein: clear/ bromthymol blue: yellow   (see table M for others) | 2.Change color of acid-base indicators:  pH:7-14/litmus:blue/phenolphthalein:pink/  bromthymol blue : blue (see table M for others) |
| 1. Taste sour (orange juice, lemon juice) | 3.Taste bitter and feel soapy |
| 1. Undergo neutralization:   Acid + base→salt + water | 4.Undergo neutralization: acid + base→salt +water |
| 1. Metal + acid →salt + hydrogen gas   (the metal must be above hydrogen on table J) | 5.Emulsify fats and oils |

1. Conceptual definition of acids and bases
2. Arrhenius definition:

* Acids yield H+ or H3O+ (hydronium) as the only positive ion in aqueous solution.
* Bases yield OH- (hydroxide) as the only negative ion in aqueous solution.

1. Bronsted-Lowry (also referred to as an “alternative theory”

* An acid is a proton donor.
* A base is a proton acceptor.
* For example: NH3 + HOH ↔ NH4+ + OH-

Base1 + acid2 ↔ acid1 + base2

* Water can behave as an acid or a base and is called amphoteric.

1. Neutralization:

* Acid + base → salt + water
* H+ + OH\_ → H2O
* A titration is an experimental procedure performed to find unknown concentration of either an acid or base. In this method, a volume of solution of known concentration is used to determine the concentration of another solution.
* For calculations use: #H(Ma)(Va)=#OH(Ma)(Va)
* Example: 50.0 milliliters of hydrochloric acid is titrated with 25.0 milliliters of 0.40M sodium hydroxide. Write the neutralization reaction and also calculate the concentration of hydrochloric acid.
* Answer: HCl(aq) + NaOH(aq) → NaCl(aq) + HOH(aq)

#H(Ma)(Va)=#OH(Mb)(Vb)

1(Ma)(50.0 ml)= 1(4.0M)(25.0 ml)

Ma = 0.20 M

1. Salts:

* Ionic compounds composed of metals and nonmetals
* When dissolved in water conducts an electric current (electrolyte)
* Soluble salts are strong electrolytes and insoluble salts are weak electrolytes ( table F)
* Salts can be acidic, basic or neutral depending on the acid and base it produces when it hydrolyzes: salt + water → acid + base
* Case 1: Salts produced from strong acids and strong bases are neutral.
* Case 2: Salts produced from strong acids and weak bases are acidic.
* Case 3: Salts produced from weak acids and strong bases are basic.
* Case 4: Salts produced from weak acids and weak bases may be acidic, basic, or neutral.

1. pH:

* pH is a measure of the hydrogen ion concentration in an aqueous solution
* Each decrease of one unit of pH represents a tenfold increase in [H+]
* Acids have a pH between 1-7 and the [H+]>[OH-]
* Neutral substances have a pH =7 and the [H+] = [OH-]
* Bases have a pH between 7-14 and the [OH-] > [H+]
* pH =-log [H+], pOH = - log [OH-], pH + pOH =14
* 10-pH = [H+], 10-pOH = [OH-], [H+][OH-] = 1.0 x 10-14