Lab. 4:

1-The H_2 ion concentration (pH) and degree of reaction:

It's the negative logarithm of hydrogen ion concentration by molar measurement.

$pH = - \log [H^+]$

$$H_2O \underset{K2}{\overset{K1}{\rightleftharpoons}} [H^+] + [OH^-]$$

$$\frac{K1}{K2} = \frac{[H][OH]}{[H_2O]} \Longrightarrow Kw = \frac{[H][OH]}{[H_2O]} = 10^{-14}$$

$\{\frac{K1}{K2} = Kw = 10^{-14}\}$ = Constant ionization for water at room temperature

This formula means that the result of H & OH ion for mole/ liter for any watery solution at the room temperature is constant and equal to 10^{-14} and symbolized by (Kw).

$Kw = [H^+] [OH^-]$

$-\log Kw = -\log [H]\ -\log [OH]$

$-\log (1\times\ 10^{-14}) = pH + POH$

$-(\log 1 + \log 10^{-14})$

$-(0 - 14 \times 1) \Longrightarrow (0 +14) \Longrightarrow pH + POH = 14$

1 2 3 4 5 6 7 8 9 10 12 13

pH=0 ---|-----|-----|-------|-----|-------|----|------|----|-----|--------|-----|---| pH=14

More acidic ⇧ more alkaline

Equalization point

At equalization point [pH=7, POH = 7]

The hydrogen ion concentration is measured by Normality

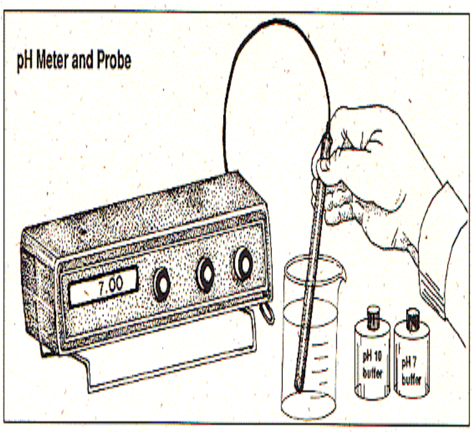
Value of PH	Value of PH by Mole	Concentration of H+ ion by normality
0	10zero	1
1	10^{-1}	0.1
2	10^{-2}	0.01
3	10^{-3}	0.001
4	10^{-4}	0.0001
5	10^{-5}	0.00001
6	10^{-6}	0.000001
7	10^{-7}	0.0000001
8	10^{-8}	0.00000001
9	10^{-9}	0.000000001
10	10^{-10}	0.0000000001
11	10^{-11}	0.00000000001
12	10^{-12}	0.000000000001
13	10^{-13}	0.0000000000001
14	10^{-14}	0.00000000000001

That's mean at pH = 4 H_2 ion concentration is 10^{-4}
So decreasing (pH) value one degree means increasing (H_2 ion conc.) Ten times.
And decreasing (pH) value tow degree means increasing (H_2 ion conc.) hindered times.

pH measuring methods*:*
1- Color method by using special papers (indicator papers) called Litmus paper. The (pH) value will evaluated according to the changing of papers color which represented the relation between the color and (PH) value.

Color	pH value	
Red	1-2	↑ More Acidic
Red-orange	3-4	
Orange	5	
Yellow	6	
Green-Yellowed	7	
Green	8	
Blue-green	9	↓
Blue	10	More alkaline

2- ***Using (*****pH –** ***meter)***



1. Calibrate the probe and meter according to the manufacturer's directions. Use of two buffers (pH 7 and 10) for calibration is recommended.
2. Sample water can be collected in any glass or plastic container. Collect enough sample water so that you can submerge the tip of the probe. Rinse the probe with sample water before placing it in the sample.
3. Place the probe in the sample and wait for the meter to equilibrate. If the meter needs to be manually adjusted to correct for temperature – you'll know it does if it has an extra temperature knob – adjust it to the temperature of the sample before allowing it to equilibrate. The meter will have come to equilibrium when the signal becomes steady. If it is taking a long time to equilibrate, you may try gently stirring the probe. However, do not agitate the sample since this may cause changes in the pH.
4. Read the pH directly from the meter according to the manufacturer's directions.

Question1*:*
Why we study the (pH), and what its relation with plant?
Answer:
1. Because some of essential physiological phenomenon effected by great degree with hydrogen ion concentration [H+] in the medium which occurs in it. Example opening and closing pore of leaves and other part.

2. large number of enzymatic reaction are sensitive for the changes that occur on [H+] ion concentration, and a lot of enzymes loses its properties due to this changes.
3. Affecting [H+] ion concentration on elements solubility in soil solution and affecting on availability range for absorption of this elements by plants.

Question2*:*

Some time we add the acid such as citric acid into the nutrient medium which we require to sterilize it, why?

The presence of the Bactria may adapt at [pH] and by adding acids, [pH] will decrease, this will cause to death of Bactria.

Question3*:*

[pH] value has a great importance in protein chemistry?

The enzyme which consists of protein has specified [pH] value which leads to completely reactions, but changing [pH] value cause to prevent [pH] activity.

Question4*:*

Calculate [pH] & [pOH] for NaOH solution, molar concentration of [OH] is 0.01M?

Answer*:*

N NaOH = M NaOH

POH = - log $^{-2}$

POH = 2

pH + POH = 14 $\Longrightarrow$ 14-2 = 12 pH

Question5*:*

A solution has an [H+] of 10^{-7} M. What is its pH?

Answer*:*

pH = -log [H+]

pH = -log 10^{-7}

pH = - (- 7) $\Longrightarrow$ pH = 7

2- Amphoteric compounds:

Defined as materials which act as weak acid in some times and as weak alkaline in other times. For example; the water has such property that's mean its able to react like acid or alkaline. In other wards it's able to give and receive the protons like amino acid which consisting the protein.

It will act like base in presence of acid and it will receive one proton:

$$H_2O + HCl \longrightarrow H_3O^+ + Cl^-$$

It will act like acid in presence of base and it will give one proton:

$$H_2O + NH_3 \longrightarrow NH4^+ + OH^-$$

3- Electrolytes & non-electroly*tes materials:*

Electrolytes compounds defined as material which has electric conductivity when be dissolved in water. It be analyzed to –ve ions and +ve ions during electric current passing, and the process called electrolysis like acid, alkaline and salts.

Non-electrolytes compounds defined as material which has not electric conductivity during dissolving in water like Alcohol, Ethers & sugars.

$$NaCl \longrightarrow Na^{+} + Cl^{-}$$

$$KH_2PO_4 \longrightarrow K^{+} + H^{+} + H^{+} + PO_4^{=}$$

Weak electrolytes $CuSO_4$ (22%)
Strong electrolytes HNO_3 (82%)

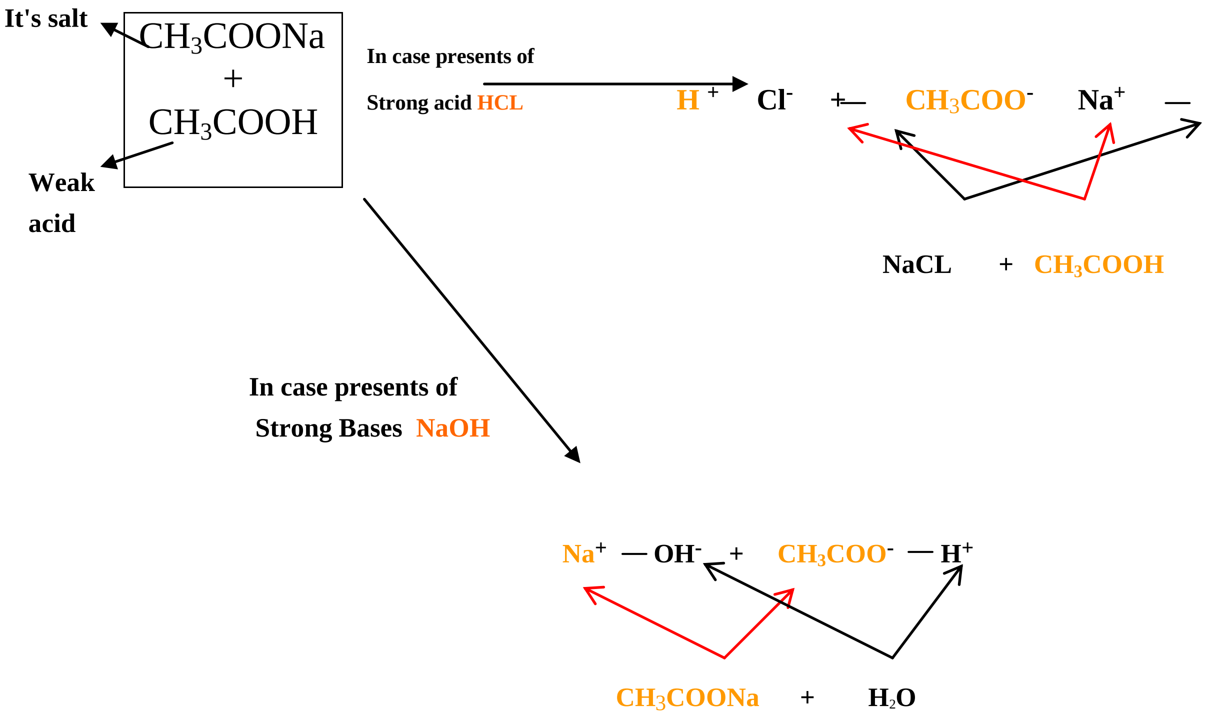
4- Buffer solutions:

It's the solution which resists the suddenly changing in [H_2] which produced by increasing the [H] or [OH] ions concentration during adding strong acid or alkyl.

Buffer solution consists of weak acid and its salt or weak alkyl and its salt.

In plant cells there are buffer solutions consists of [H_3PO4] phosphoric or oxalic, citric, [CH3COOH] acetic acids, tartaric, carbonic acids and its salts.

Mechanisms of buffer solution:



pH =PKa + Log [Salt] / [Acid]

POH=PKb+ Log [Salt] / [Base]

Q: For prepare phosphate buffer mixes (0.1M) of Na_2HPO_4 with (0.1M) H_2PO_4 by ratio 2:1, calculate produced pH if you known that Pk for acid equal to 6.7?

$$pH = Pka + \log \frac{[salt]}{[acid]}$$

$$pH = 6.7 + \log \frac{2 \times 0.1}{1 \times 0.1} \Longrightarrow pH = 6.7 + \log 2$$

$$pH = 6.7 + 0.3 = 7$$

5- Acids, Bases & salts:

Acid is the material which produce [H] ion when dissolving in water.

Bases are the material which produce [OH] ion when dissolving in water.

$$HCl \longrightarrow H^+ + Cl^-$$

$$KOH \longrightarrow K^+ + OH^-$$

Salt will be produced by mixing acid with bases as a result of anions of acid with bases cation.

$$HCl + NaOH \longrightarrow NaCl + H_2O$$