Electrical Conduction:

Introduction:-

- Electrical conductivity is a measure of ability of water to carry an electric current
- When an electrical potential difference is placed across a conductor, its movable charges flow, giving rise to an electric current. This property is called conductivity.
- This ability is directly related to the concentration of ions in water
- If there is more ions present Conductivity will increases and If there is less ions present Conductivity will be decreases
- This Conductive ions comes from dissolved salts and inorganic materials such as chlorides sulphides and carbonate compounds

Electrical Conductivity of water and its Unit :-

- The electrical conductivity can be expressed as mhos (Reciprocal of ohms) or as siemens.
- In most water, the conductivity is very low, so **millisiemens or microsiemens** are used as units for water conductivity.
- Measurement units are

1. Millisiemens/cm
2. Micromhos/cm
3. Millimhos/cm

1mSm = 10micromhos/cm

- The conductivity of water is directly linked to the concentration of the ions and their mobility. The ion
- The conductivity depends on the value of the pH, on the temperature of measurement and on the amount of CO_2 which has been dissolved in the water to form ions.
- The conductivity is also affected by the concentration of ions already present in the water such as chloride, sodium and ammonium.
- Chemical composition of water determines its conductivity. Hence this becomes the most widely used measure of the purity of water.

Principle of EC measurement :-

- Conductivity is measured with a probe and a meter.
- A voltage is applied between the two electrodes in the probe immersed in the sample water.
- The drop in voltage caused by the resistance of the water is used to calculate the conductivity per centimeter.
- Conductivity (G), the inverse of resistivity (R) is determined from the voltage and current values according to Ohm's law. i.e. R=V/I then, G=1/R=I/V.
- The meter converts the probe measurement to micro mhos per centimeter and displays the result.

Determination of EC

Aim:- To determine dissolved salt contents of a given sample by conductivity method.

Apparatus

Conductivity Meter with Electrode /Automatic temperature control (ATC) probe, Magnetic Stirrer with stirring bead, Standard flask, Measuring jar, Beaker 250 mL, Funnel , Tissue Paper

Chemicals Required:-

1. Potassium chloride
2. Distilled water

Procedure

For testing the given water sample first the reagents are to be prepared. Then the Conductivity Meter is required to be calibrated.

A) Preparation of reagent

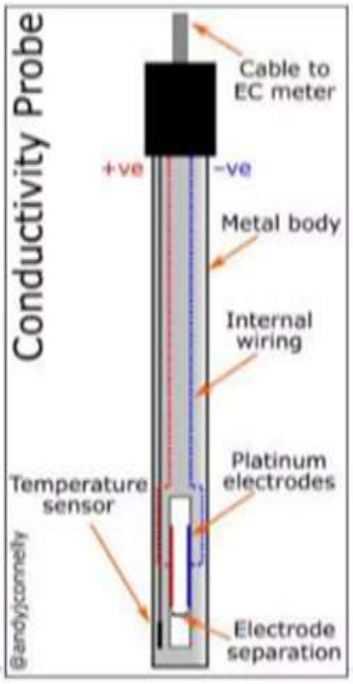
- ***Potassium Chloride Solution (0.1N):***

1. Switch on the Electronic balance, keep the weighing pan, set the reading to zero.
2. Measure 50 mL of distilled water and transfer it to the beaker.
3. Weigh 0.7456g of Potassium chloride.
4. Transfer the 0.7456g of potassium chloride to the beaker contains distilled water and mix it by the glass rod until it dissolves thoroughly.
5. Transfer the contents to the 100 mL standard flask.
6. Make up the volume to 100 mL, by adding distilled water and shake the contents well. This solution is used to calibrate the conductivity meter

Note- 0.1N potassium chloride is approximately 0.0129 mhos/cm = 12900 micromhos/cm = 12.9 millisiemens at 25^0 C

B. CALIBRATION METHOD FIRST:-

- ❑ Switch on the Conductivity Meter and allow it to warmup for sometime and connect the Conductivity cell to the instrument
- ❑ Now read the value of cell constant which is specified by the manufacturer
- ❑ Put the instrument in the calibration mode and adjust the value equal to cell constant is displayed on the instrument
- ❑ To check the accuracy of the instrument at suitable intervals using standard KCl solution



C. Sample testing procedure :

- ❑ To measure the Conductivity of the sample ,simply dip the cell in it
- ❑ Put the instrument in mho, when the reading is stable we will note down the value displayed on the instrument
- ❑ Calculation:

$$\text{Conductivity} = G \times K$$

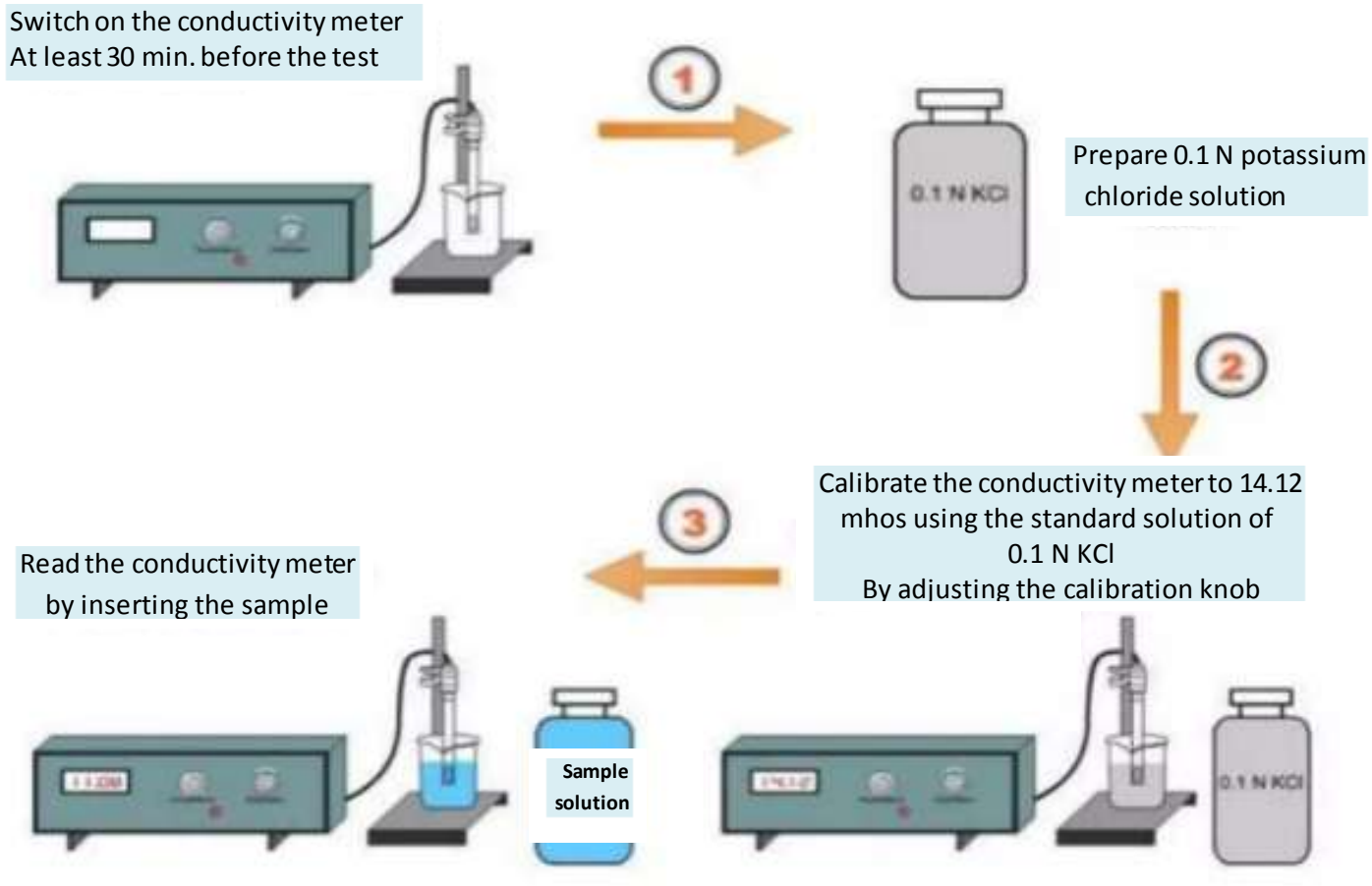
Where ,
G - Conductance (micromho or millimho)
K - Cell constant (1/cm)

- ❑ Conductivity of the sample also depend on the temperature.
- ❑ If the Temperature is high the Conductivity will increase so therefore the standard temperature of

measurement is 25°C should be used for measurement.

- ❑ If we are not making the measurement on 25°C then we need to apply the correction on measured

conductivity.



- Electrical conductivity is proportional to the ionizable fraction of dissolved solid concentration. Therefore measurement of conductivity may be used to obtain a quick major of dissolved salts in water.
- For water with pH 5 to 9 and temperature 10^0C and 40^oC, an empirical expression is

$$\underset{\text{(mg/lt)}}{\text{Total dissolved solids (inorganic)}} = K \times (1.02)^{T-25} \times \underset{\text{(micromhos/cm)}}{\text{conductivity}}$$

Does the human body conduct electricity?

Our cells are specialized to conduct electrical currents. **Electricity** is required for the nervous system to send signals throughout the body and to the brain, making it possible for us to move, think and feel

How do cells control electrical currents?

The elements in our bodies, like sodium, potassium, calcium, and magnesium, have a specific electrical charge. Almost all of our cells can use these charged elements, called ions, to generate electricity. The contents of the cell are protected from the outside environment by a cell membrane. This cell membrane is made up of lipids that create a barrier that only certain substances can cross to reach the cell interior and acts as a way for the cell to generate electrical currents.

العناصر الموجودة في أجسامنا، مثل الصوديوم والبوتاسيوم والكالسيوم والمغنيسيوم، لها شحنة كهربائية محددة. يمكن لجميع خلايانا تقريبًا استخدام هذه العناصر المشحونة، والتي تسمى الأيونات، لتوليد الكهرباء. محتويات الخلية محمية من البيئة الخارجية بواسطة غشاء الخلية. يتكون غشاء الخلية من الدهون التي تشكل حاجزًا لا يمكن إلا لمواد معينة عبوره للوصول إلى داخل الخلية و يعمل كوسيلة للخلية لتوليد التيارات الكهربائية