Ministry of Higher Education and Scientific Research

Al-Muthanna University

College of Science

وزارة الـتعليم الـعالـي والـبحث الـعلمي

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Electrochemistry

Lecture (3)

Stage 3

Prof. Hassan Sabih

Electrolyte Connectivity

Classification of electrolytes

Electrolytes can be divided according to the number of moles of ions resulting from one molar of
Electrolytes to symmetrical electrolytes and other non-GERs
Symmetrical . (unsymmetrical electrolytes)

Symmetrical Electrolytes Equivalent:

Electrolyte mono-mono-univalent electrolyte:
Like (KCl, NaCl)
Di-electrolyte – Bivalent and Bi-Bivalent Electrolyte
Such as: ($CuSO$ 4 , $ZnSO_4$)
Electrolyte w la thi – w no thi equivalence o tri-trivalent electrolyte
Like $LaPO_{4:}$

Electrolytes are not symmetrical equivalent :

Electrolyte monocrystalline – di-bivalent electrolyte
Such as: (Na 2 CO_3 , Na_2SO_4)
Diolyte electrolyte – mono-univalent electrolyte
Such as: (MgBr 2 , $CaCl_2$)
Electrolyte mono-w no thi tekav o uni-trivalent electrolyte
Such as: ($K_3Fe(CN)_6$)
Electrolyte w la thi – mono-cavac or tri-univalent electrolyte
Like $LaCl_{3:}$
Di-Electrolyte – W No Thi Equivalence or Bi-Trivalent Electrolyte
Such as: ($Pb_3[Fe(CN)_6]$ 2 $5H_2O$)
Electrolyte w la thi – di-bivalent electrolyte
Like . ($La_2(SO_4)_3$:

Electrolytic Conduction

The ions in the solutions move in motion and in the form of a stentive pattern, but this is the movement of the

Do not say in the end to the transition of the material from C G A L A K R F Y shop and if K K K Turkish G

Equal in all the analyzed ag, because for any number of ions moving in the direction of the solution.

There will be an equivalent number of electrons moving in the opposite direction of the ATH . Therefore , it's not relevant.

The Ionic movement will be zero, and this is of course in the absence of any electric hard work and influence on

The solution .

In the presence of an electric hard disorder between two poles inside the solution, the ion is the effect of the mouth and the crown.

Those ions towards the poles that are contrary to it, the Henna, and with that the ion of the Ionic in the T Y LTDF

Towards the poles and this is what is called the connection. (conduction)

And the effect of the ion is on the recommendation of the electricity yb sh this is the electron mug and the amount of it

The current passing through the solution .

The recommender is not electrolytic – like it is like the recommender is not a metal – it is a tensor

Passing current (I) in it in the unit of amper(A) inversely with resistance of electrolytic solution (R)

Measured in units of ohm's law (Ω):

$$I = \frac{E}{R}$$

Where(e) is the furnace of the effort in units of volts. (V)
The resistance of Mosul is also forgotten by the Radi A.A.A.I.T., and the Guardian of (L) and the Ak Sia A.A.M . Square
Its syllable (A) means that :

$$R = \rho \left(\frac{L}{A}\right)$$

Where (ρ) is a proportional constant, and it is called the specific resistance. Its unit is ($\Omega\, cm\;\; or\;\; \Omega\, m$).

The inverted resistor is defined by electrical conductivity and is denoted by the symbol : (G)

$$G = \frac{1}{R}$$

By twisting Z with a value of $\left(R = \rho\left(\frac{L}{A}\right)\right)$ in the previous equation :

Know the Recommendation

$$G = \frac{1}{R}$$

$$G = \frac{1}{\rho\left(\frac{L}{A}\right)}$$

$$G = \frac{1}{\rho} \times \frac{A}{L}$$

$$G = k\,\frac{A}{L}$$

Where the symbol k stands for conductivity, which was formerly called specific conductance

	unit
electrical conduction (G)	(Ω^{-1}) or (S) relative to siement
Connectivity (k)	$(\Omega^{-1}\, cm)$ or $(\Omega^{-1}\, m)$

Definition of the Connection k

Recommending the Wheel to the Electrolyte Shop and the Electrolyte Yin Qutb Y M Square

The middle of each of them (1 cm 2) or (m 2) and sells Dan a n b z they are the baa z m safa (1 cm) or (1 m) And there is among them the fury of the effort of the destiny . (1 V)

According to Ohm's law , the current passing through the shop and the L x is equal to the frying pan and the resistance (R)
Or equal to the electrical connection . (G) For a conductor whose volume is a unit of volumes , the following:

$$G = k$$

Impact of Focus on Electrolytic Conductivity

Effect of Concentration on Electrolytic Conduction

The connection (k) changes with the focus. In the definition of the receipt, the size of the electrolyte is determined as the unit of volumes, so that the size of the electrolyte has been taken up in the form of the calculation. However , for the sake of D , the revelation of the Hajj M.F.I.K.L.M.R. , the H.S.D.H I have the process of recommending yell, and for the mouth n b dihi to change t (k) m a Turkish g
This can be understood from Figure 2.2.

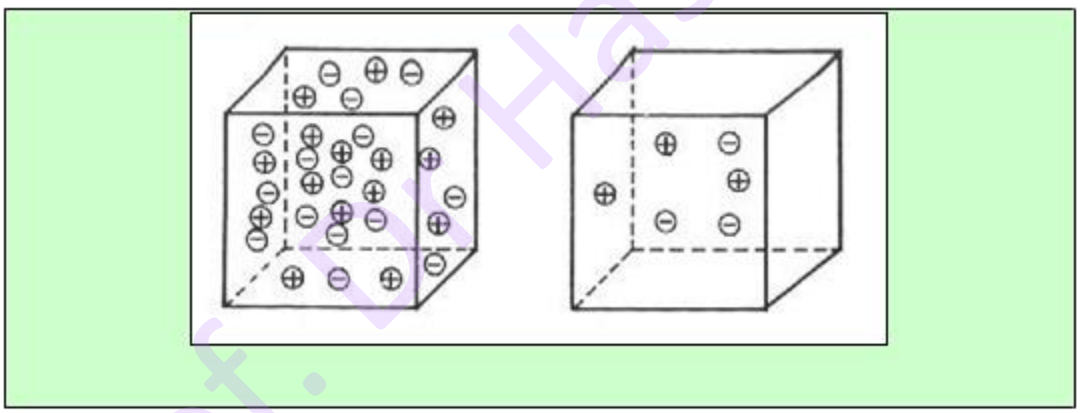

Figure **2: Optimization change with electrolyte concentration despite equal volumes due to** the **difference in the number of ions.**

Table (2) is as follows:

Table 2: Effect of Solution Concentration (KCl) on Conductivity at ºC (25)

Molarity	$k\ (\Omega^{-1} cm^{-1})$
0.01	0.001427
0.1	0.012896
1.0	0.11187

From the foregoing, it is possible to compare the conductivity of two loci if they contain the same number of ions, and therefore a new quantity was introduced that expresses the delivery of a volume of the solution and does not contain

One mole of electrolytes between two electrodes, distant from each other, at a distance of one unit The distances (1 cm, 1 m) are large enough to confine the solution between them. It is called molar conductivity and is symbolized by the symbol (Λ).

The molar conductivity (Λ) is known mathematically by the following equation:

$$(\Lambda) = \frac{k}{C}$$

Where: molar C and its units are mol/L, and its units can be converted to mol/cm3 or mol/m3

The relationship between the units of volume is:

$$1\ L = 1000\ cm^3 = 1000\ ml = 0.001\ m^3$$

The units of molar conductivity (L) depend on the conductivity k, as shown in the table: (3)

molar conduction unit (Λ)	K Unit	volume unit
$(\Lambda) = \frac{k}{C} = \frac{\Omega^{-1}\ cm^{-1}}{mol\ cm^{-3}} = \Omega^{-1}\ cm^2\ mol^{-1}$	$(\Omega^{-1}\ cm^{-1})$	cm^3
$(\Lambda) = \frac{k}{C} = \frac{\Omega^{-1}\ m^{-1}}{mol\ m^{-3}} = \Omega^{-1}\ m^2\ mol^{-1}$	$(\Omega^{-1}\ m^{-1})$	m^3

And if (V) is the volume of the solution containing one mole of electrolyte, then:

$$\frac{1}{C} = \frac{1}{1 mol\ L^{-1}} = \frac{L}{1\ mol}$$

$$\frac{1}{C} = V$$

$$\Lambda = k\left(\frac{1}{C}\right)$$

$$\Rightarrow \Lambda = k\ V$$

Example // Calculate the molar conductivity (Λ) of a solution (KCl of concentration) (0.1 mol/L) if you learned that its conductivity at (25 ºC) is equal to ($k = 0.012896\ \Omega^{-1}\ \mathrm{cm}^{-1}$)

solution

The units of concentration in question are mol/L and must be converted to units of mol/cm^3 b because The units of conductivity are: Ω^{-1} cm

$$C = \frac{0.1\ \mathrm{mol}}{1\mathrm{L}} = \frac{0.1\ \mathrm{mol}}{1000\ \mathrm{cm}^3} = 1 \times 10^{-4}\ \mathrm{mol\ cm}^{-3}$$

So the molar conductivity:

$$\Lambda = \frac{k}{C} = \frac{0.012896\ \Omega^{-1}\ \mathrm{cm}^{-1}}{1 \times 10^{-4}\ \mathrm{mol\ cm}^{-3}} = 128.96\ \Omega^{-1}\ \mathrm{cm}^2\ \mathrm{mol}^{-1}$$

Example // Calculate the molar conductivity (Λ by units) of $\Omega^{-1}\ m^2\ mol^{-1}$ for the KCl solution of concentration (0.1 mol L^{-1}) if you know that (k) at (25 ºC) is equal to ($k = 1.29\ \Omega^{-1}\ m^{-1}$)?

solution

We convert the concentration from unit (mol L^{-1}) to unit (mol m^{-3}) as follows:

$$C = \frac{0.1\ \mathrm{mol}}{\mathrm{L}}$$

$$C = \frac{0.1\ \mathrm{mol}}{0.001\ \mathrm{m}^3} = \frac{0.1\ \mathrm{mol}}{1 \times 10^{-3}}$$

$$C = 0.1 \times 10^3 = 100\ \mathrm{mol\ m}^{-3}$$

So the molar conductivity:

$$\Lambda = \frac{k}{C} = \frac{1.29\ \Omega^{-1}\ \mathrm{m}^{-1}}{100\ \mathrm{mol\ m}^{-3}} = 0.0129\ \Omega^{-1}\ \mathrm{m}^2\ \mathrm{mol}^{-1}$$