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Solution of Electrolytes

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Objectives

- Properties Solution of electrolytes
- Arrhenius theory of dissociation
- Theory of strong electrolytes
- Ionic strength
- Debye-Huckle theory
- Coefficients for expressing colligative properties.

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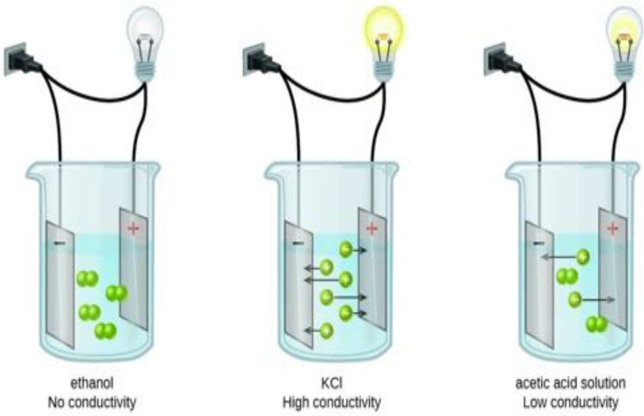
Properties of electrolyte solutions

- Electrolysis
- Transference numbers
- Faraday's laws
- Conductance
- Colligative properties



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Why?

- The electrodes made up from Platinum.
- Hydroxyl ion oxidized instead of Sulfate ion.
- In the oxidation process there is an increase in oxidation umber.
- In the reduction process there is a decrease in the oxidation number.
- Sulfuric acid solution is found around the anode.

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Faraday’s Laws (1838,1839)

- Faraday's laws: 96500 of coulombs = 1 g of substance.
- Each 1g of ions carries Avogadro's number (6.02×10^{23}) of + or - charges.
- From Faraday's laws, the passage of 96,500 coulombs of electricity results in the transport of 6.02×10^{23} electrons in the cell.
- One faraday is an Avogadro's number of electrons.
- Faraday's laws can be used to compute the charge on an electron in the following way:

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Electrolytic Conductance

- The resistance, *R.* in ohms is directly proportional to its length (cm) and inversely proportional to area (cm^2).
- The conductance, C is reciprocal of R.
- Specific conductance, measures the current-carrying capacity of all ions in a unit volume of solution and accordingly varies with concentration.
- Equivalent conductance is used to study the dissociation of molecules into ions, independent of the concentration of the electrolyte. Where it measures the current- carrying capacity of all ions after complete dissociation.

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Colligative properties of electrolytic and non electrolytic solutions

$$\pi = RTc \qquad\qquad \pi = iRTc$$

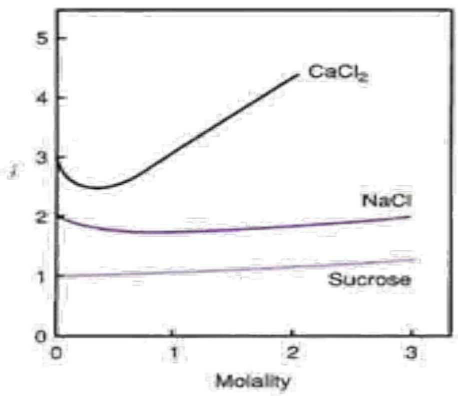

Fig. 6–5. van't Hoff *i* factor of representative compounds.

EXAMPLE 6–5

Osmotic Pressure of Sodium Chloride

What is the osmotic pressure of a 2.0 *m* solution of sodium chloride at 20°C?

The *i* factor for a 2.0 *m* solution of sodium chloride as observed in Figure 6–5 is about 1.9. Thus,

$$\pi = 1.9 \times 0.082 \times 293 \times 2.0 = 91.3 \text{ atm}$$

Drugs and Ionization

- Some drugs, such as anionic and cationic antibacterial and antiprotozoal agents, are more active when found in the ionic state.
- While compounds, such as the hydroxy benzoate esters (parabens) and many general anesthetics, have action as non electrolytes (non ionic).
- Others act by both forms like the sulfonamides.

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Theory of electrolyte dissociation

$$H_2O + Na^+Cl^- \rightarrow Na^+ + Cl^- + H_2O$$

Ionic compound **Strong electrolytes**

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

Covalent compound **Strong electrolytes**

$$H_2O + CH_3COOH \rightarrow H_3O^+ + CH_3COO^-$$

Covalent compound **weak electrolytes**

Strong Electrolytes	Weak electrolytes
HCl, HNO_3, H_2SO_4 NaOH, KOH $Ba(OH)_2$, $Ca(OH)_2$	H_3BO_3, H_2CO_3, NH_4OH $HgCl_2$, HgI, lead actate, HBr $Hg(NH_3)^{2-}$, $Cu(NH_3)_4^{2+}$, $Fe(CN)_6^{3-}$