



## CHEMISTRY

### BOOKS - OSWAAL PUBLICATION CHEMISTRY (KANNADA ENGLISH)

#### ELECTRO-CHEMISTRY

Topic 1 Conductance In Electrolytic Solutions Specific And Molar Conductivity Variation Of Conductivity With Concentration Gibb S Energy Kohlrausch S Law Very Short Answer Type Questions

1. Mention the SI unit for molar conductivity.

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2. What happens to molar conductivity when one mole of KCl dissolved in one litre is diluted to five litres?

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3. State Faraday's first law of electrolysis.

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4. How many Faraday of electric current is required to liberate  $5600\text{cm}^3$  of oxygen at STP at the electrolysis of acidified water?

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5. How many faradays are required to liberate  $24\text{ cm}^3$  of  $H_2$  from acidified water at STP.

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6. Define degree of dissociation in terms of molar conductance?

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7. Express the relation between the conductivity and the molar conductivity of a solution.

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8. Express the relation among the conductivity of a solution in the cell, the cell constant and the resistance of solution in the cell.

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9. Define limiting molar conductivity?

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10. Suggest a way to determine the  $\Lambda_m^0$  value of water.



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## Topic 1 Conductance In Electrolytic Solutions Specific And Molar Conductivity Variation Of Conductivity With Concentration Gibb S Energy Kohlrausch S Law Short Answer Type Questions

1. What is limiting molar conductivity? Represent graphically the variation in molar conductivity with concentration for acetic acid.

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2. Mention any one application of Kohlrausch law.

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3. Write any two factors affecting ionic conductance.

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4. State Faraday's first law of electrolysis. For the electrode reaction  $Zn^{+2} + 2e^{-} \rightarrow Zn_{(s)}$ , what quantity of electricity in coulombs is required to deposit one mole of zinc.

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5. What is molar conductivity? How is it related to the conductivity of a solution whose concentration is  $C \text{ mol m}^{-3}$ ?

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6. Write any two merits of Arrhenius theory of electrolytic dissociation.

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7. Mention any two factors which affects the conductivity of electrolytic solution.

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8. A current of 0.2 ampere is passes through a solution of  $CuSO_4$  for 10 minutes calculate the man of Cu deposited on the cathode.

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9. State Faraday's second law of electrolysis.

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10. Calculate the mass of hydrogen gas evolved by passing a current of 0.5 ampere for 40 minutes through acidified water.

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11. Calculate the mass of silver deposited from silver nitrate solution by a current of 2 amperes flowing for 30 minutes?



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**12.** Define molar conductivity. How is it related to the specific conductivity?



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**13.** State Kohlrausch law of independent migration of ions. Why does the conductivity of a solution decreases with dilution?



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**14.** Define the following terms:

(i) Fuel cell

(ii) Limiting molar conductivity



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15. Define the following terms:

(i) Molar conductivity ( $\Lambda_m$ )

(ii) Secondary batteries



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16. The conductivity of 0.001M acetic acid is  $4 \times 10^{-8} S/cm$ . Calculate the dissociation constant of acetic acid, if molar conductivity at infinite dilution for acetic acid is  $390 S\text{cm}^2/mol$ .



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**Topic 1 Conductance In Electrolytic Solutions Specific And Molar Conductivity Variation Of Conductivity With Concentration Gibb S Energy Kohlrausch S Law Long Answer Type Questions I**

1. State and derive Ostwaid dilution law for a weak electrolyte.



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2. Write four assumptions/ Postulates of Arrhenius theory of electrolytic dissociation.

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3. Write any 3 demerits of Arrhenius theory of electrolytic dissociation.

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Topic 2 Redox Reaction Electrochemical Cell Galvanic Cell Emf Of Cell Standard Electrode Potential Nernst Equation Very Short Answer Type Questions

1. Mention the concentration of  $H^+$  ions in the solution used in SHE.

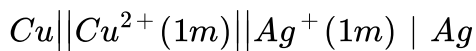
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2. What is a spontaneous process? Write the criteria for spontaneity of a process in terms of  $\Delta G$ .

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## Topic 2 Redox Reaction Electrochemical Cell Galvanic Cell Emf Of Cell Standard Electrode Potential Nernst Equation Short Answer Type Questions

1. Standard EMF of the cell:



is 0.46 at  $25^\circ C$ . Find the value of standard free energy change for the reaction that occurs in the cell.

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2. Calculate the electrode potential developed when a silver electrode is dipped in 0.025 M silver nitrate solution at 289K.

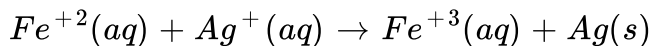
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3. Draw a neat labeled diagram of Standard Hydrogen Electrode (SHE).

Write its Half-Cell reaction.

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4. Calculate  $\Delta_r G^\circ$  for the following reactions:



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5. The value of equilibrium constant  $K_p$  for the reaction

$CO(g) + H_2O(g) \leftrightarrow CO_2(g) + H_2(g)$  is  $1.06 \times 10^5$  at  $25^\circ C$  Calculate standard free energy change of the reaction at the same temperature.

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6. Write Gibb's free energy equation and name the terms in it.

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7. Write any two demerits of standard hydrogen electrode.

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8. Calculate standard free energy change at 300K for a reaction whose equilibrium constant is  $1 \times 10^4$  at 300K.

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9. Calculate the standard free energy change for a reaction at 273K, if the equilibrium constant of the reaction at 273K is 20

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10. Write Gibb's Helmholtz equation. For a process, if  $\Delta H$  and  $T\Delta S$  are positive and  $T\Delta S > \Delta H$ , predict the spontaneity of the process.

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11. The equilibrium constant  $K_p$  for the,  $A + B \leftrightarrow C + D$  is 8.25 at  $27^\circ C$ . Calculate the standard free energy change of reaction at the same temperature.

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12. Write the relationship between standard free energy change and the equilibrium constant of a reaction. What is the sign of standard free energy change when the equilibrium constant is less than one?

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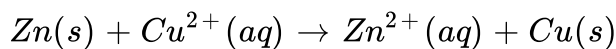
13. A solution of Ni ( $NO_3$ )<sub>2</sub> is electrolysed between platinum electrodes using a current of 5 amperes for 20 minutes. What mass of Ni is deposited at the cathode.

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14. The conductivity of 0.20M solution of KCl of 298K is  $0.0248 S cm^{-1}$ . Calculate its molar conductivity.

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15. The standard electrode potential ( $E^\circ$ ) for Daniel cell is +1.1V. Calculate the  $\Delta G^\circ$  for the reaction.



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16. The conductivity of 0.20M solution of KCL at 298K is  $0.025\text{Scm}^{-1}$ .

Calculate its molar conductivity.

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17. For the cell

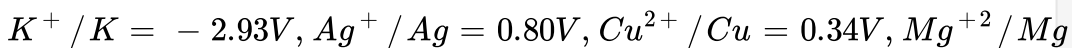


(a) Write equation for each half reaction.

(b) Calculate the cell potential at  $25^\circ\text{C}$

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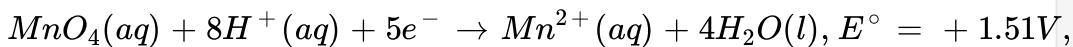
18. Give that the standard electrode potentials ( $E^\circ$ ) of metals are:



Arrange these metals in an increasing order of their reducing power.

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19. Two half reactions of an electro-chemical cell are given below:

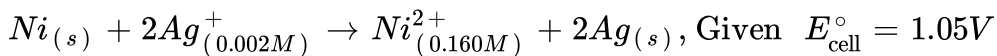


Construct the redox reaction equation from the two half reactions and calculate the cell potential from the standard potentials are predict if the reaction is reactant or product favoured.

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Topic 2 Redox Reaction Electrochemical Cell Galvanic Cell Emf Of Cell Standard Electrode Potential Nernst Equation Long Answer Type Question I

1. Calculate the e.m.f. of the cell in which the following reaction takes place.



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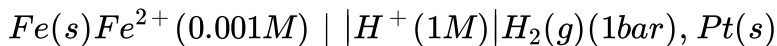
2. Describe the construction and working of standard hydrogen electrode.

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3. Explain construction of Daniel cell. Write half cell reactions. How is Daniel cell symbolically represented?

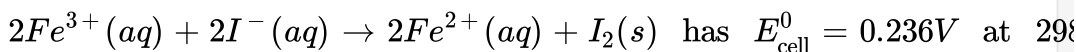
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4. Calculate the emf of the following cell at 298K,



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5. The cell in which of the following reaction occurs:



Calculate the standard Gibbs energy and the equilibrium constant of the cell reaction.

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6. A strip of nickel metal is placed in a 1 molar solution of  $Ni(NO_3)_2$  and a strip of silver metal is placed in a one molar solution of  $AgNO_3$ . An electrochemical cell is created when the two solutions are connected by a salt bridge and the two strips are connected by wires to a voltmeter.

(a) Write the balanced equation for the overall reaction occurring in the cell and calculate the cell potential.

(b) Calculate the cell potential,  $E$  at  $25^\circ C$  for the cell, if the initial concentration of  $Ni(NO_3)_2$  is 0.100 molar and the initial concentration of  $AgNO_3$  is 1.00 molar.

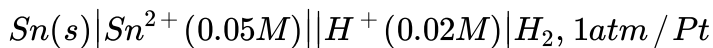
$$\left[ E_{Ni^{2+}/Ni}^\circ = -0.25V, E_{Ag^+/Ag}^\circ = 0.80V \right]$$

$$\log 10^{-1} = -1$$

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7. Write the Nernst equation and compute the emf of the following cell at

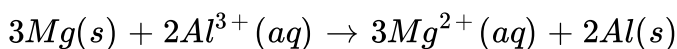
298 K:



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## Topic 2 Redox Reaction Electrochemical Cell Galvanic Cell Emf Of Cell Standard Electrode Potential Nernst Equation Long Answer Type Question II

1. Calculate the standard free energy change for the following reaction occurring in the galvanic cell at 298 K.

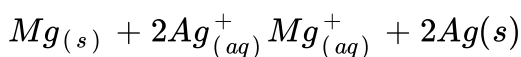


Given :  $E_{\text{Mg}^{2+} / \text{Mg}}^{\circ} = -2.37V$  and  $E_{\text{Al}^{3+} / \text{Al}} = -1.66V$



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2. Calculate the EMF of the cell for the reaction.



Given:  $E^{\circ} \text{Mg}^{2+} / \text{Mg} = -2.37V$

$$E^\circ \text{Ag}^+ / \text{Ag} = 0.08\text{V}$$

$$[\text{Mg}^{2+}] = 0.001\text{M}, [\text{Ag}^+] = 0.0001\text{M}$$

$$\log 10^5 = 5$$

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3. Describe the construction and working of standard hydrogen electrode.

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4. Explain construction of Daniel cell. Write half cell reactions. How is Daniel cell symbolically represented?

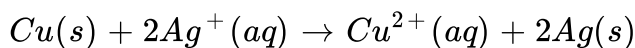
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5. A voltaic cell is set up at  $25^\circ\text{C}$  with the half cells  $\text{Ag}^+ (0.001\text{M}) / \text{Ag}$  and  $\text{Cu}^{2+} (0.10\text{M})$ . What should be its cell potential. [  $E^\circ_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$ ,  $E^\circ_{\text{Ag}^+/\text{Ag}} = +0.08\text{V}$  ]

$$g = + 0.8 \text{ V}]$$

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6. (i) Write the formulation for the galvanic cell in which the reaction



Takes place . Identify the cathode and anode reactions in it.

(ii) Write Nernst eq. and calculate the emf of the following cell.



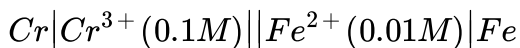
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7. (a) Explain why electrolysis of aqueous solution of NaCl gives  $H_2$  at cathode and  $Cl_2$  at anode. Write overall reaction.

(b) The resistance of a conductivity cell containing 0.000M KCl solution at 298K is  $1500\Omega$ . Calculate the cell constant if conductivity of 0.001M KCl solution at 298K is  $0.146 \times 10^{-3} S cm^{-1}$ .

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8. (a) Calculate the emf for the given cell at  $25^{\circ}C$ :



(b) calculate the strength of the current required to deposit 1.2g of magnesium from molten  $MgCl_2$  in 1 hour.

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### Topic 3 Electrolysis Laws Of Electrolysis Batteries Fuel Cells And Corrosion Very Short Answer Type Questions

1. A galvanic cell after use is recharged by passing current through it. What type of cell is it? Give an example.

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2. What are fuel cells?

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3. What is secondary cell?

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4. Name two materials other than hydrogen that can be used as fuels in fuel cells.

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5. What is battery?

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6. Represent the galvanic cell in which the reaction  $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$  takes place.

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## Topic 3 Electrolysis Laws Of Electrolysis Batteries Fuel Cells And Corrosion

### Short Answer Type Questions

1. What type of cell is a lead storage battery? Write the anode and the cathode reactions and the overall cell reaction occurring in the use of a lead storage battery?

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2. What is corrosion? Explain the electro-chemical theory of rusting of iron and write the reactions involved in the rusting of iron?

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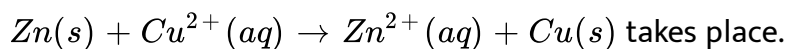
3. Rusting of iron is an electrochemical phenomenon. Explain.

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4. (a) What are fuel cells? Explain the electrode reactions involved in the working of  $H_2 - O_2$  fuel cell.

(b) Represent the galvanic cell in which the reaction



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5. Silver is uniformly electro-deposited on a metallic vessel of surface area of  $900\text{cm}^2$  by passing a current of 0.5 ampere for 2 hours. Calculate the thickness of silver deposited.

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6. Write the overall reaction that occurs during use (discharging) of nickel- cadmium cell. Is it a primary or a secondary cell? Mention its one merit over the lead storage cell.

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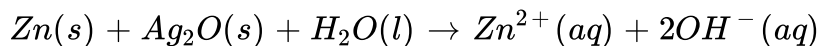
7. Mention the reactions occurring at (i) anode (ii) cathode, during working of a mercury cell. Why does the voltage of a mercury cell remain constant during its operation?

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### Topic 3 Electrolysis Laws Of Electrolysis Batteries Fuel Cells And Corrosion Long Answer Type Questions

1. (a) What type of a battery is the lead storage battery? Write the anode and the cathode reactions and the overall reaction occurring in a lead storage battery when current is drawn from it.

(b) In the button cell, widely used in watches, the following reactions takes place:



Determine  $E^\circ$  and  $\Delta G^\circ$  for the reaction:

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2. (a) Define the following terms:

(i) Limiting molar conductivity

(ii) Fuel cell.

(b) Resistance of a conductivity cell filled with  $0.1 \text{ molL}^{-1} \text{KCl}$  solution is  $100\Omega$ . IF the resistance of the same cell when filled with  $0.02 \text{ molL}^{-1} \text{KCl}$  solution is  $520\Omega$ , calculate the conductivity and molar conductivity of  $0.02 \text{ molL}^{-1} \text{KCl}$  solution. The conductivity of  $0.1 \text{ molL}^{-1} \text{KCl}$  solution is  $1.29 \times 10^{-2} \Omega^{-1} \text{cm}^{-1}$ .



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3. Rahul visited the house of the friend Shayam and found that all the water taps were rusted. On enquiry, he came to know that these were iron taps. Rahul advised his friend to use either chrome plated or nickel plated taps. Shyam accepted his advice. On the basis of above passage give the answer of the following questions:

(i) Why did iron tap get rusted?

(ii) What was the purpose of chrom plating or nickel plating?

(iii) What is the value associated with this?

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4. A 100W and 110V incandescent lamp is connected in series with an electrolytic cell containing  $CdSO_4$  solution. What mass of cadmium will be deposited at the cathode after 4hrs of electricity.

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