	INDIAN SCHOOL AL WADI AL KABIR	
Class: XII	**DEPARTMENT: SCIENCE 2021 -22** **SUBJECT: CHEMISTRY**	**Date of completion:** **IV week of October, 2021**
Worksheet No: 09 with answers	**TOPIC: ELECTROCHEMISTRY**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

MULTIPLE CHOICE QUESTIONS

Q.NO.	QUESTIONS	Answer Key
1	The cell reaction of this galvanic cell: **$Cu(s) / Cu^{2+}(aq) // Hg^{2+}(aq) / Hg(l)$ is** *(a)* $Hg + Cu^{2+} \longrightarrow Hg^{2+} + Cu$ *(b)* $Hg + Cu^{2+} \longrightarrow Cu^{+} + Hg^{+}$ *(c)* $Cu + Hg \longrightarrow CuHg$ *(d)* $Cu + Hg^{2+} \longrightarrow Cu^{2+} + Hg$	d
2	If limiting molar conductivity of Ca^{2+} and Cl^{-} are 119.0 and 76.3 S cm^2 mol^{-1}, then the value of limiting molar conductivity of $CaCl_2$ will be (a) 195.3 S cm^2 mol^{-1} (b) 271.6 S cm^2 mol^{-1} (c) 43.3 S cm^2 mol^{-1} (d) 314.3 S cm^2 mol^{-1}.	b
3	Ammonium nitrate is used in salt bridge because (a) it forms a jelly like material with agar-agar. (b) it is a weak electrolyte. (c) it is a good conductor of electricity. (d) the transport number of NH_4^{+} and NO_3^{-} ions are almost equal.	d
4	The emf of the cell: Ni / Ni^{2+} (1.0 M) // Au^{3+} (1.0 M) / Au ($E° = -0.25$ V for Ni^{2+}/Ni; $E° = 1.5$ V for Au^{3+}/Au) is: (a) 1.25 V (b) -1.25 V (c) 1.75 V (d) 2.0 V	c

5	The standard emf of a galvanic cell involving cell reaction with n = 2 is formed to be 0.295 V at 25° C. The equilibrium constant of the reaction would be (a) 1.0×10^{10} (b) 2.0×10^{11} (c) 4.0×10^{12} (d) 1.0×10^{2} [Given F = 96500 (mol^{-1}); R = 8.314 JK^{-1} mol^{-1}]	a
6	Which of the following statements is not correct about an inert electrode in a cell? (a) It does not participate in the cell reaction. (b) It provides surface either for oxidation or for reduction reaction. (c) It provides surface for conduction of electrons. (d) It provides surface for redox reaction.	d
7	The cell constant of a conductivity cell (a) changes with change of electrolyte (b) changes with change, of concentration of electrolyte (c) changes with temperature of electrolyte (d) remains constant for a cell	**d**
8	$\Lambda^{o}_{m(NH_4OH)}$ is equal to _____ (a) $\Lambda^{o}_{m(NH_4OH)} + \Lambda^{o}_{m(NH_4Cl)} - \Lambda^{o}_{m(HCl)}$ (b) $\Lambda^{o}_{m(NH_4Cl)} + \Lambda^{o}_{m(NaOH)} - \Lambda^{o}_{m(NaCl)}$ (c) $\Lambda^{o}_{m(NH_4Cl)} + \Lambda^{o}_{m(NaCl)} - \Lambda^{o}_{m(NaOH)}$ (d) $\Lambda^{o}_{m(NaOH)} + \Lambda^{o}_{m(NaCl)} - \Lambda^{o}_{m(NH_4Cl)}$	**b**
9	What will happen during the electrolysis of aqueous solution of $CuSO_4$ by using platinum electrodes? (a) Copper will deposit at cathode. (b) Copper will deposit at anode. (c) Oxygen will be released at cathode. (d) Copper will dissolve at anode.	**a**
10	Which of the following statement is correct? (a) E_{Cell} and $\Delta_r G$ of cell reaction both are extensive properties. (b) E_{Cell} and $\Delta_r G$ of cell reaction both are intensive properties. (c) E_{Cell} is an intensive property while $\Delta_r G$ of cell reaction is an extensive property. (d) E_{Cell} is an extensive property while $\Delta_r G$ of cell reaction is an intensive property.	**c**

Read the given passage and answer the questions that follow:

The concentration of potassium ions inside a biological cell is at least twenty times higher than the outside. The resulting potential difference across the cell is important in several processes such as transmission of nerve impulses and maintaining the ion balance. A simple model for such a concentration cell involving a metal M is $M_{(s)} \mid M^{+}(aq.;\ 0.05\ molar) \parallel M^{+}(aq;\ 1\ molar) \mid M_{(s)}$.

11	Define the term Potential difference.
12	Write the cell representation of Daniel cell.
13.	What is the difference between Ecell and E^0cell.
14.	Write the cell reactions of: $Zn(s) \mid Zn^{2+}(aq) \parallel Ag^{+}(aq) \mid Ag(s)$
15	What will be the carriers of the current in the cell?

Answer key:

11	The difference in potential between an electrode and an electrolyte.
12	Zn(s) / Zn^{2+}(aq) (1M) || Cu^{2+}(aq) (1M) / Cu(s)
13	E cell means electrode potential of a cell at any concentration. E^0 cell means standard electrode potential means electrode potential measured at 1 atmospheric pressure, 1 molar solution at 298K.
14	At anode: Zn(s) ———> Zn^{2+}(aq) + $2e^{-}$ At cathode: $2Ag^{+}$(aq) + $2e^{-}$ ———> 2Ag(s)
15	Ions are responsible for the carriers of the current in the cell.

Assertion and Reasoning Questions

Q.No.	Questions	Answer Key
16	**Assertion :** The resistivity for a substance is its resistance when it is one meter long and its area of cross section is one square meter. **Reason :** The SI units of resistivity is ohm metre . a) Assertion and reason both are correct statements and reason is correct explanation for assertion. b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. c) Assertion is correct statement but reason is wrong statement. d) Assertion is wrong statement but reason is correct statement.	b

17	**Assertion :** On increasing dilution, the specific conductance keep on increasing. **Reason :** On increasing dilution, degree of ionisation of weak electrolyte increases and molality of ions also increases. a) Assertion and reason both are correct statements and reason is correct explanation for assertion. b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. c) Assertion is correct statement but reason is wrong statement. d) Assertion is wrong statement but reason is correct statement.	d
18	**Assertion:** In an electrochemical cell anode and cathode are respectively negative and positive electrodes. **Reason:** At anode oxidation takes place and at cathode reduction takes place. a) Assertion and reason both are correct statements and reason is correct explanation for assertion. b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. c) Assertion is correct statement but reason is wrong statement. d) Assertion is wrong statement but reason is correct statement.	

Question – Answer Type:

Q.19	Out of zinc and tin, whose coating is better to protect iron objects ?
Ans.	Zinc is more reactive than tin.
Q.20	Calculate ΔG° for the reaction $Zn\,(s) + Cu^{2+}\,(aq) \longrightarrow Zn^{2+}\,(aq) + Cu\,(s)$. Given : E° for $Zn^{2+}/Zn = -0{\cdot}76$ V and E° for $Cu^{2+}/Cu = +0{\cdot}34$ V $R = 8{\cdot}314\ JK^{-1}\ mol^{-1}$ $F = 96500\ C\ mol^{-1}$.
Ans.	$E^0cell = E^o_C - E^o_A$ $= 0.34 - (-0.76)$ $= 1.10V$ $\Delta G^o = -nFE^o$ $= -2 \times 1.10 \times 96500$ $= -212300$ J/mol or -212.3 kJ/mol

Q.21

(a) Out of the following pairs, predict with reason which pair will allow greater conduction of electricity :

(i) Silver wire at 30°C or silver wire at 60°C.

(ii) 0·1 M CH_3COOH solution or 1 M CH_3COOH solution.

(iii) KCl solution at 20°C or KCl solution at 50°C.

(b) Give two points of differences between electrochemical and electrolytic cells.

Ans.

(a) (i) Silver wire at 30°C because as temperature decreases, resistance decreases so conduction increases.

(ii) 0.1 M CH_3COOH, because on dilution degree of ionization increases hence conduction increases.

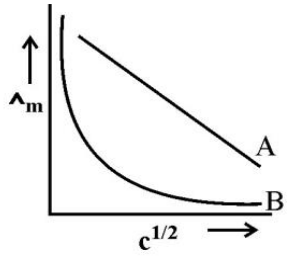
(iii) KCl solution at 50°C, because at high temperature mobility of ions increases and hence conductance increases

(b)

Electrochemical	Electrolytic
(1) Anode -ve Cathode +ve	Anode +ve Cathode -ve
(2) Convert chemical Energy to electrical energy	Convert electrical Energy to chemical energy

Q. 22

In the plot of molar conductivity ($\wedge_m$) vs square root of concentration ($c^{1/2}$), following curves are obtained for two electrolytes A and B :



Answer the following :

(i) Predict the nature of electrolytes A and B.

(ii) What happens on extrapolation of $\wedge_m$ to concentration approaching zero for electrolytes A and B ?

Ans.

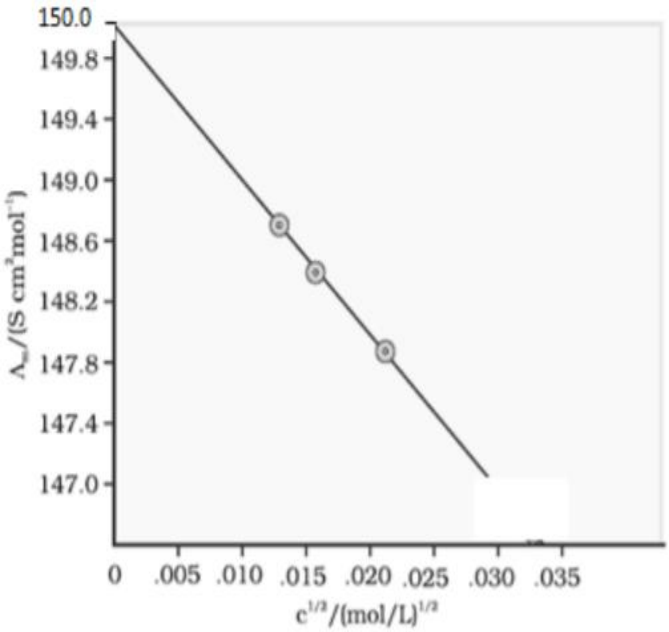
i)A- strong electrolyte , B-Weak electrolyte

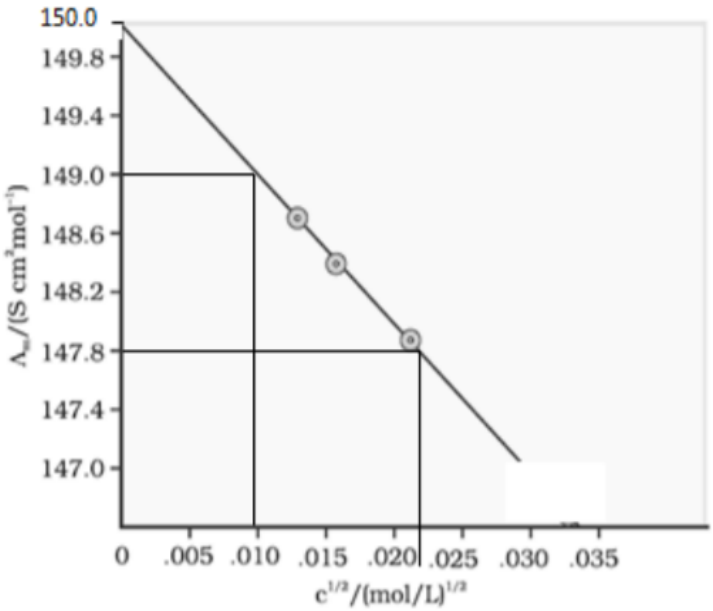
ii)Λ^0m for weak electrolytes cannot be obtained by extrapolation while Λ^0m for strong electrolytes can be obtained as intercept.

Q.23	E°_{cell} for the given redox reaction is 2.71 V $Mg_{(s)} + Cu^{2+}_{(0.01\ M)} \longrightarrow Mg^{2+}_{(0.001\ M)} + Cu_{(s)}$ Calculate E_{cell} for the reaction. Write the direction of flow of current when an external opposite potential applied is (i) less than 2.71 V and (ii) greater than 2.71 V
Ans.	$E_{cell} = E^\circ_{cell} - \frac{0.059}{n} \log K_c$ $= E^\circ_{cell} - \frac{0.059}{2} \log \frac{10^{-3}}{10^{-2}}$ $= 2.71 + 0.0295$ $E_{cell} = 2.7395$ V i)Cu to Mg / Cathode to anode / Same direction ii)Mg to Cu / Anode to cathode / Opposite direction
Q.24	Which of the following option will be the limiting molar conductivity of CH_3COOH if the limiting molar conductivity of CH_3COONa is 91 Scm^2mol^{-1}? Limiting molar conductivity for individual ions are given in the following table.

S.No	Ions	limiting molar conductivity / Scm^2mol^{-1}
1	H+	349.6
2	Na+	50.1
3	K+	73.5
4	OH^-	199.1

Ans.	390.5 Scm^2mol^{-1}
Q.25	(i) State Kohlrausch law. (ii) Calculate the emf of the following cell at 298 K: $Al(s)/Al^{3+}(0.15M)//Cu^{2+}(0.025M)/Cu(s)$ (Given $E^o(Al^{3+}/Al) = -1.66$ V, $E^o(Cu^{2+}/Cu) = 0.34$V, log 0.15 = -0.8239, log 0.025 = - 1.6020)
Ans.	(i) limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte. (ii) $E^o cell = E^o cathode - E^o anode = 0.34-(-1.66) = 2.00$ V $Ecell = E^o cell - \frac{0.059}{n} \log \frac{[Al^{3+}]^2}{[Cu^{2+}]^3}$ Here n = 6 $Ecell = 2 - \frac{0.059}{6} \log \frac{[0.15]^2}{[0.025]^3}$ $= 2 - 0.059/6\ (2\log 0.15 - 3 \log 0.025)$ $= 2 - 0.059/6\ (-1.6478 + 4.8062) = 2 - 0.0311 = 1.9689$V

Q.26	On the basis of E^o values identify which amongst the following is the strongest oxidising agent $Cl_2(g) + 2\ e^- \rightarrow 2Cl^-$ $E^o = +1.36$ V, $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ $E^o = +1.51$ V $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ $E^o = +1.33$ V
Ans	$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ $E^o = +1.51$ V
Q. 27	The following represents variation of (Λ_m) vs $\sqrt{c}$ for an electrolyte. Here Λ_m is the molar conductivity and c is the concentration of the electrolyte.  a) Define molar conductivity b) Identify the nature of electrolyte on the basis of the above plot. Justify your answer. c) Determine the value of Λ_m^o for the electrolyte. d) Show how to calculate the value of A for the electrolyte using the above graph.

Ans.	(a) Molar conductivity of a solution at a given concentration is the conductance of the volume V of solution containing one mole of electrolyte kept between two electrodes with area of cross section A and distance of unit length. (b)Strong electrolyte, For strong electrolytes, Λm increases slowly with dilution (c) $\Lambda m = \Lambda m^\circ - A\, c^{1/2}$ Therefore $\Lambda m^\circ = 150\ S\ cm^2\ mol^{-1}$ (d)  A = – slope = - (149 – 147.8/ 0.010-0.022) = 100 S cm^2 mol^{-1}/(mol/L^{-1})$^{1/2}$.

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