INDIAN SCHOOL AL WADI AL KABIR

CLASS: XII	DEPARTMENT: SCIENCE 2025- 26 SUBJECT: CHEMISTRY	DATE: 19/10/2025
Worksheet No:07 with answers	TOPIC: ELECTROCHEMISTRY	NOTE: A4 FILE FORMAT
CLASS & SEC:	NAME OF THE STUDENT:	ROLL NO:

MULTIPLE CHOICE QUESTIONS

1. ΔG and E^{θ}_{cell} for a spontaneous reaction will be:
(a) positive, negative (b) negative, negative
(c) negative, positive (d) positive, positive

2. The correct cell to represent the following reaction is:
Zn + 2Ag+ Zn2+ + 2Ag
a) $2Ag \mid Ag^{+} \parallel Zn \mid Zn^{2+}$
b) $Ag^{+} \mid Ag \parallel Zn^{2+} \mid Zn$
c) $Ag \mid Ag^{+} \parallel Zn \mid Zn^{2+}$
d) $Zn \mid Zn^{2+} \parallel Ag^{+} \mid Ag$

3. During electrolysis of dilute H2SO4, using platinum electrodes, the gas evolved at the anode is …… (2025 March)
a) H_2 gas
b) O_2 gas
c) SO_2 gas
d) SO_3 gas

4. A conductivity cell contains electrodes made up of:
a) Copper
b) Silver
c) Zinc
d) Platinum

5. A negative E^{o} means that the redox couple is a ……. than the H^{+}/H_2 couple.
a) weaker reducing agent
b) stronger reducing agent
c) stronger oxidising agent
d) None of these

6. The quantity of charge required to obtain one mole of Barium from $BaCl_2$ is …….

a) 1 F b) 2 F
c) 3 F d) 4 F

7. Match the following: **(2025 MARCH)**

Column I	Column II
i. Lead storage cell	a. Wall clock
ii. Mercury cell	b. Apollo Space Programme
iii. Dry cell	c. Wrist watch
iv. Fuel cell	d. Inverter

a) i-a, ii-b, iii-c, iv-d
b) i-d, ii-c, iii-a, iv-b
c) i-c, ii-d, iii-b, iv-a
d) i-b, ii-a, iii-d, iv-c

8. Identify the wrong statement from the following
a) The electronic conductance of metals depends on the nature and structure of the metal.
b) The electronic conductance of metals decreases with increase of temperature
c) The conductivity of electrolytic solutions depends on size of the ions produced and their salvation.
d) The conductivity of electrolytic solutions decreases with the increase of temperature

9. Identify the electrode used in SHE.
a) Pt b) Zn c) Cu d) Mg

10. During the electrolysis of aqueous NaCl, the cathodic reaction is:
a) Oxidation of Cl^- ion
b) Reduction of Na^+ ion
c) Oxidation of H_2O
d) Reduction of H_2O

Read the given passage and answer the questions that follow:

Molar conductivity increases with decrease in concentration. This is because the total volume, *V*, of solution containing one mole of electrolyte also increases. It has been found that decrease in κ on dilution of a solution is more than compensated by increase in its volume. Physically, it means that at a given concentration, Λ_m can be defined as the conductance of the electrolytic solution kept between the electrodes of a conductivity cell at unit distance but having area of cross section large enough to accommodate sufficient volume of solution that contains one mole of the electrolyte.

11. Define conductivity of a solution.
12. Conductivity always decreases with decrease in concentration. Why?
13. What do you mean by limiting molar conductivity?
14. State Kohlrausch law of independent migration of ions.
15. What is the relationship between degree of dissociation, molar conductivity and limiting molar conductivity?

Question – Answer Type:

16. How does molar conductivity vary with concentration of solution? **1**
17. What are the products obtained when molten NaCl undergoes electrolysis? **1**
18. Represent the cell in which the following reaction takes place: **1**

$Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$

19. Write any two factors affecting the electronic conductance of metals. **1**

20. Give the equation connecting cell constant and conductivity. **1**

21. An AC source is used for measuring the resistance of an ionic solution. Why? **1**

(2025 MARCH)

22. Give reasons: **2**

(i) On the basis of E° values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl.

(ii) Conductivity of CH_3COOH decreases on dilution.

23. For a galvanic cell, the following half reactions are given. Decide, which will remain as reduction reaction and which will be reversed to become an oxidation reaction. Give reason for your answer. **2**

(2025 MARCH)

(I) $Cr^{3+} + 3e^- \rightarrow Cr(s)$; $E^\theta = -0.74$ V

(II) $Fe^{2+} + 2e^- \rightarrow Fe(s)$; $E^\theta = -0.44$V

24. Solutions of two electrolytes 'A' and 'B' are diluted. The limiting molar conductivity of 'B' increases to a smaller extent while that of 'A' increases to a much larger extent comparatively. Which of the two is a strong electrolyte? Justify your answer. **2**

25. Predict the products of electrolysis in each of the following: **2**

i) A dilute solution of H_2SO_4 with platinum electrodes

ii) An aqueous solution of $CuCl_2$ with platinum electrodes

26. 0.1 M KCl solution offered a resistance of 100 ohms in a conductivity cell at 298 K. If the cell constant of the cell is 1.29 cm^{-1}, calculate the molar conductivity of KCl solution. **2**

27. Calculate ΔG° and $\log K_c$ for the following reaction at 298 K : **3**

$$2Cr(s) + 3Fe^{2+}(aq) \longrightarrow 2Cr^{3+}(aq) + 3Fe(s)$$

Given : $E^\circ_{cell} = 0.30$ V

28. The conductivity of 0.001 mol L^{-1} solution of CH_3COOH is 3.905×10^{-5} S cm^{-1}. Calculate its molar conductivity and degree of dissociation (α). **3**

Given : $\lambda^\circ (H^+) = 349.6$ S cm^2 mol^{-1} and $\lambda^\circ (CH_3COO^-) = 40.9$ S cm^2 mol^{-1}.

29. **Passage based question.** **4**

In a galvanic cell, chemical energy of a redox reaction is converted into electrical energy, whereas in an electrolytic cell the redox reaction occurs on passing electricity. The simplest galvanic cell is in which Zn rod is placed in a solution of $ZnSO_4$ and Cu rod is placed in a solution of $CuSO_4$. The two rods are connected by a metallic wire through a voltmeter. The two solutions are joined by a salt bridge. The difference between the two electrode potentials of the two electrodes is known as electromotive force. In the process of electrolysis, the decomposition of a substance takes place by passing an electric current. One mole of electric charge when passed through a cell will discharge half a mole of a divalent metal ion such as Cu^{2+}. This was first formulated by Faraday in the form of laws of electrolysis.

Answer the following questions :

(a) What is the function of a salt bridge in a galvanic cell ?

(b) When does galvanic cell behave like an electrolytic cell ?

(c) Can copper sulphate solution be stored in a pot made of zinc ? Explain with the help of the value of E° cell.

($E° Cu^{2+} / Cu = 0.34$ V)

($E° Zn^{2+} / Zn = -0.76$ V)

OR

(c) How much charge in terms of Faraday is required for the following :

(i) 1 mol of MnO_4^- to Mn^{2+}

(ii) 1 mol of H_2O to O_2

30. (i) State Faraday's first law of electrolysis. How much charge, in terms of Faraday, is required for the reduction of 1 mol Cu^{2+} to Cu ? **5**

(ii) Calculate emf of the following cell at 298 K for

$Mg\ (s) \mid Mg^{2+}\ (0{\cdot}1\ M) \parallel Cu^{2+}\ (0{\cdot}01\ M) \mid Cu\ (s)$

$[E^\circ_{cell} = +\ 2{\cdot}71\ V,\ \ 1\ F = 96500\ C\ mol^{-1},\ \ \log 10 = 1]$

ANSWERS

1.	c
2.	d
3.	d

4.	d
5.	b
6.	b
7.	b
8.	d
9.	a
10.	d
11.	The conductivity of a solution at any given concentration is the conductance of one unit volume of solution kept between two platinum electrodes with unit area of cross section and at a distance of unit length.
12.	The number of ions per unit volume that carry the current in a solution decreases on dilution.
13.	Molar conductivity at infinite dilution is called limiting molar conductivity.
14.	Limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte.
15.	$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$
16.	Molar conductivity increases with decrease in concentration
17.	Sodium metal and Cl_2 gas.
18.	$Zn(s) \mid Zn^{2+}(aq) \parallel Ag^{+}(aq) \mid Ag(s)$
19.	(i) the nature and structure of the metal (ii) the number of valence electrons per atom (iii) temperature (it decreases with increase of temperature).
20.	$G^* = \frac{l}{A} = R\ \kappa$
21.	Concentration of ionic solution will change if DC source is used.
22.	(i) Due to over potential of O_2 (ii) The number of ions per unit volume decreases.
23.	$Fe^{2+} + 2e^- \rightarrow Fe(s)$ will remain as reduction reaction $Cr^{3+} + 3e^- \rightarrow Cr(s)$ will be reversed to become an oxidation reaction because it has more negative E^θ. Therefore, it is preferred at anode.
24.	Electrolyte B is a strong electrolyte. Limiting molar conductivity increases only to a smaller extent for a strong electrolyte, as on dilution the interionic interactions are overcome. Limiting molar conductivity increases to a larger extent for a weak electrolyte, as on dilution the degree of dissociation increases, therefore the number of ions in total volume of solution increases.
25.	(i) H_2 at cathode, O_2 at anode (ii) Cu at cathode, Cl_2 at anode.

26.

$$G^* = \kappa R$$

$$\kappa = \frac{1.29}{100} = 0.0129\ S\,cm^{-1}$$

$$\Lambda_m = \frac{1000\ \kappa}{C}$$

$$\Lambda_m = \frac{1000\ x\ 0.0129}{0.1}$$

$$\Lambda_m = 129\,S\,cm^2\,mol^{-1}$$

27.

Given $E^\circ_{Cell} = +\ 0.30V$; $F = 96500C\ mol^{-1}$

$n = 6$ (from the given reaction)

$\Delta_r G^O = -\ n \times F \times E^\circ_{Cell}$ $\Delta_r G^O = -\ 6 \times 96500\ C\ mol^{-1} \times 0.30V$

$= -\ 173{,}700\ J / mol$ or $-\ 173.7\ kJ / mol$

$$\log Kc = \frac{n\,E^\circ_{Cell}}{0.059}$$

$$\log Kc = \frac{6 \times 0.30}{0.059}$$

$\log Kc = 30.5$

28.

$$\Lambda_m = \frac{\kappa}{c}$$

$$= \frac{3.905 \times 10^{-5}\ S\ cm^{-1}}{0.001 mol\ L^{-1}} \times \frac{1000 cm^3}{L}$$

$\Lambda_m = \mathbf{39.05\ Scm^2 mol^{-1}}$

$\Lambda_o = \lambda^\circ(H^+) + \lambda^\circ(CH_3COO^-)$

$= (349.6 + 40.9)\ Scm^2 mol^{-1}$

$\Lambda_o = 390.5\ Scm^2 mol^{-1}$

	$\alpha = \frac{\Lambda_m}{\Lambda_o}$ $= \frac{39.05\ Scm^2mol^{-1}}{390.5\ Scm^2mol^{-1}}$ $\alpha = \mathbf{0.1}$
29.	(a) It allows flow of ions and the circuit is completed / itmaintains the electrical neutrality. (or any other correct reason). (b) When $E_{ext} > E_{cell}$ (c) $E^o_{cell} = E^o_{Cu^{2+}/Cu} - E^o_{Zn^{2+}/Zn}$ $= 0 \cdot 34 - (-0 \cdot 76) = 1 \cdot 10$ V As E^o_{cell} = +ve, the reaction takes place, so copper sulphate cannot be stored ina zinc pot OR (c) (i) 5F (ii) 2 F
30.	(i) It states that the mass of a substance deposited /liberated at the electrodes is directly proportional to the charge/quantity of electricity passed through the electrolyte. 2F charge is required. (ii) $E_{cell} = E^\circ_{cell} - \frac{0 \cdot 0591}{2} \log \frac{[Mg^{2+}]}{[Cu^{2+}]}$ $= 2 \cdot 71\ V - \frac{0 \cdot 0591}{2} \log \frac{0 \cdot 1}{0 \cdot 01}$ $= 2 \cdot 71\ V - \frac{0 \cdot 0591}{2} \log 10$ $= 2 \cdot 71\ V - 0 \cdot 0295$ $= 2 \cdot 6805\ V$

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