OBJECTIVE QUESTIONS

Section (A) : Basic Terminology and Construction of Electrochemical Cell and Its Repsentation, Salt Bridge

A-1.	Which of the following has been universally accepeted as a reference electrode at all temperatures and has been assigned a value of zero volt?			
	(1) platinum electrode		(2) copper electrode	
	(3) graphite electrode		(4) standard hydrogen e	ectrode
A-2.	Which of the following statements is true	e for an e	electrochemical cell?	
	(1) H_2 is anode and Cu is cathode		(2) H ₂ is cathode and C	u is anode
	(3) reduction occurs at H ₂ electrode		(4) oxidation occurs Cu	electrode
A-3.	The equation representing the process	by which	standard reduction pote	ntial of zinc can be defined is :
	(1) $Zn^{2+}(s) + 2e^{-} \rightarrow Zn$	(2) Zn(g	g) \rightarrow Zn ²⁺ (g) + 2e ⁻	
	(3) $Zn^{2+}(g) + 2e^{-} \rightarrow Zn$	(4) Zn ²⁺	$t(aq.) + 2e^{-} \rightarrow Zn(s)$	
A-4.	 Which is not true for a standard hydroge (1) The hydrogen ion concentration is 1 (2) Temperature is 25°C (3) Pressure of hydrogen is 1 atmosphere (4) It contains a metallic conductor which 	en electro M ere h does n	ode ? ot absorb hydrogen.	
A-5.	Which of the following statement is wron	ng about	galvanic cell ?	
	(1) cathode is positive charged		(2) anode is negatively	charged
	(3) reduction takes place at the anode		(4) reduction takes place	e at the cathode
A-6.	In the galvanic cell Cu Cu ²⁺ (1M) Ag ⁺	(1M) Ag	g the electrons will trave	I in the external circuit :
	(1) from Ag to Cu		(2) from Cu to Ag	
	(3) electrons do not travel in the extern	al circuit	(4) in any direction	
Sectio	on (B) : Application of Electroch	emical	Series	
B-1.	Adding powdered Pb and Fe to a solution	on contair	ning 1.0 M is each of Pb ²⁻	* and Fe ²⁺ ions would result into
	the formation of (1) More of Db and Ea^{2t} ions		(2) More of Eq and Dh^{2}	tione
	(3) More of Fe and Pb		(2) More of Fe ^{$2+$} and Pb ^{$-+$}	p^{2+} ions
B-2.	Which of the following displacement doe (1) T_{P} , $2H$, T_{P}^{2+} , H_{2-}	es not oc	CUIT: (2) For $1.2 \text{ Agt} \rightarrow \text{Fo}^{2}$ t	A.a.
	(1) $\Sigma_{11} + \Sigma_{11} + Z_{11} + Z_{11} + Z_{11} + Z_{11} + Z_{11} + Z_{11}$ (3) $C_{11} + E_{0}^{2+} \rightarrow C_{11}^{2+} + E_{0}^{-1}$		(2) $Pe + 2Ay^2 \rightarrow Pe^{-2} + 2Ay^2$ (4) $7n + Ph^{2+} \rightarrow 7N^{2+} + 2Ay^2$	Ph l
B-3.	The oxidation potential of Zn, Cu, Ag, H	l ₂ and Ni	are 0.76, -0.34, -0.80,	0, 0.55 volt respectively. Which
	(1) $7n + Cu^{2+} \rightarrow Cu + 7n^{2+}$		0aye : (2) 7n + 2∆a+ –→ 2∆a +	- 7n ²⁺
	(3) $H_2 + Cu^{2+} \rightarrow 2H^+ + Cu$		$(2) ZH + ZRg \rightarrow ZRg + (4) H_2 + Ni^{2+} \rightarrow 2H^+ + 1$	Ni
В-4.	I he metal that cannot be produced on r	eduction	of its oxide by aluminium	n is:
	(1) K (2) MN		(3) Ur	(4) FB
B-5.	A correct electrochemical series can be interchanging :	obtaine	d from K, Ca, Na, AI, Mg	l, Zn, Fe, Pb, H, Cu, Hg, Au, by

CHE	MISTRY FOR JEE			ELECTROCHEMISTRY
* <u> </u>	(1) AI and Mg	(2) Zn and Fe	(3) Zn and Pb	(4) Pb and H
B-6.	The standard reduction respectively. The order	n electrode potential va of their reducing powe	alue of the elements A, r is :	B and C 0.68, -2.50 and 0.50 V
	(1) A > B > C	(2) A > C > B	(3) C > B > A	(4) B > C > A
B-7.	Red hot carbon will read oxygen from AO. The a	move oxygen from the activity of metals A, B ar	oxide AO and BO but r nd M in decreasing orde	not from MO, while B will remove r is
	(1) A > B > M	(2) B > A > M	(3) M > B > A	(4) M > A > B
Secti	ion (C) : Concept of	∆G and Nernst Eq	uation	
C-1.	The standard electrode $Sn^{2+}(aq) + 2e^{-} \rightarrow Sn(s)$	potential for the reactions)	on Ag ⁺ (aq) + e ⁻ → Ag(s	5)
	at 25°C are 0.80 volt an Sn Sn ²⁺ (1M) Ag ⁺ (1I	nd – 0.14 volt, respectiv M) Ag is [.]	rely. The emf of the cell.	
	(1) 0.66 volt	(2) 0.80 volt	(3) 1.08 volt	(4) 0.94 volt
C-2.	For a redox reaction, C	$0x + ne \rightarrow red, the Ner$	nst equation has a form	of :
	(1) E = E° + $\frac{RT}{nF} \frac{Ire}{\ln F}$	d] x]	(2) $E = E^\circ - \frac{RT}{nF} \ln \frac{[I]}{I}$	red] Ox]
	(3) E = E° – $\frac{RT}{nF}$ log [C	ed] 0x]	(4) E = E ^o + $\frac{RT}{nF}$ log	[red] [Ox]
C-3.	Which of the following r (1) E° _{red}	respresents the potentia (2) (E° _{red} + 0.059)	al of silver wire dipped in (3) (E° _{OX} – 0.059)	to 0.1 M AgNO₃ solution at 25°C? (4) (E° _{red} – 0.059)
C-4.	The reduction electrode (1) – 2.41	e potential E, of 0.1 M s (2) + 2.41	solution of M ⁺ ions (E° _{RP} $(3) - 4.82$	= – 2.36 V) is : (4) None
C-5.	The Reduction potentia (1) 0.00 V	al of hydrogen electrode (2) – 0.059 V	$e^{(P_{H_2} = 1 \text{ atms}; C_{H}^+ = 0.7)}$ (3) 0.118 V	I M) at 25°C will be – (4) 0.059 V
Secti D-1.	ion (D) : Application The emf of the cell Ti Ti ⁺ (0.0001M) Cu The emf of this cell will (1) Increase the concer	Nernst Equation i ¹²⁺ (0.01M) Cu is 0.83 V be increased by : htration of Cu ²⁺ ions	in Different type of (2) Decreaseing the c	Electrodes and Cells
	(3) Increasing the conc	entration of both	(4) (1) & (2) both	
D-2.	When two half-cells of E_3 , then (when n ₁ , n ₂ a	electrode potential of E nd n ₃ are no. of electror $E_1n_1 + E_2n_2$	and E ₂ are combined to ns exchanged in first, set $\frac{E_1n_1 - E_2n_2}{E_1n_2}$	o form a cell of electrode potential cond and combined half-cells) :
	(1) $E_3 = E_2 - E_1$	(2) $E_3 = \frac{n_3}{n_3}$	(3) $E_3 = n_3^2$	(4) $E_3 = E_1 + E_2$
D-3.	Which graph correctly o	correlates E _{cell} as a fund	ction of concentrations fo	or the cell

 $Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s), E^{\circ}_{cell} = 1.56 V$

$$\label{eq:Y-axis:Ecell} \begin{array}{l} Y\text{-axis:Ecell, X-axis:log_{10}} & \overline{\left[\text{Zn}^{2^+}\right]} \\ \end{array}$$

ELECTROCHEMISTRY

	1.56 \	/	1.56 V	
		.0	(2) -1.0 0 1	
	1.56 V	←	1.56 V	-
	(3) -1.0 0 1	1.0	(4) -1.0 0 1	.0
D-4.	Co Co ²⁺ (C ₂) Co ²⁺ (C (1) C ₂ > C ₁	C1) Co for this cell, ∆G is (2) C1 > C2	(3) C ₁ = C ₂	(4) unpredictable
D-5.	The standard electrode $Ni^{2+} + 2e^{-} = Ni$ $Zn^{2+} + 2e^{-} = Zr$ The emf of cell formed (1) - 1.02 volt	potentials of the two half ; $E^\circ = -0.25 V$ h; $E^\circ = -0.77 V$ by combining the two half (2) + 0.52 volt	f cell are given below : If cells would be : (3) + 1.02 volt	(4) – 0.52 volt
D-6.	For a reaction A(s) + 28 (1) 0.354 V	B⁺ → A²⁺ + 2B K _C has bee (2) 0.708 V	en found to be 10 ¹² . The (3) 0.0098 V	E° cell is : (4) 1.36 V
D-7.	Which respresent a cor (1) Pt H ₂ HCl HCl (3) Zn Zn ²⁺ Cu ²⁺ Cu	ncertration cell ? Pt H₂ u	(2) Pt H ₂ HCl Cl ₂ P (4) Fe Fe ⁺² Cu ²⁺ Cu	t J
Section E-1.	on (E) : Electrolysis The electric charge for (1) 1 amp/sec	electrode deposition of o (2) 96,500 C/sec	of Electrolysis (Fara ne gram equivalent of a (3) 1 amp/hour	aday's law) substance is : (4) 96,500 C
E-2.	The amount of an ion d (1) resistance (3) current strength	lischarged during electrol	ysis is not directly propo (2) time (4) electrochemical equ	rtional to : ivalent of the element
E-3.	Which one is the correct (m \rightarrow mass, c \rightarrow currect (1) mz = ct	ct equation that represent ent, t \rightarrow time) (2) m = czt	ts the first law of electroly $(3) \text{ mc} = zt$	ysis ? (4) c = mzt
E-4.	When one coulomb of electrode is equal to : (1) equivalent weight	electricity is passed thro (2) molecular weight	ough an electrolytic solut (3) electrochemical equ	tion the mass deposited on the ivalent (4) one gram
E-5.	W g of copper deposite hours. If one ampere o will be :	ed in a copper voltamete f electric current is passe	er when an electric curre ed for 4 hours in the sam	ent of 2 ampere is passed for 2 ne voltameter, copper deposited
	(1) W	(2) W/2	(3) W/4	(4) 2W
E-6.	When the same electr amounts of elements de	ic current is passed thro eposited on the electrode	ough the solution of diff as are in the ratio of their	erent electrolytes in series the :

СНЕ	MISTRY FOR JEE		ELECTROCHEMISTRY		
•	(1) atomic number	(2) atomic masses	(3) specific gravities	(4) equivalent masses	
E-7.	The ratio of weights aqueous H ₂ SO ₄ and f (1) 1 : 8	of hydrogen and magn used MgSO4 are : (2) 1 : 12	esium deposited by the (3) 1 : 16 (4)	same amount of electricity from None of these	
E-8.	Faraday's law of elect (1) Temperature is ind (3) A mixture of electr	trolysis fails when : creased olytes is used	(2) Inert electrodes are (4) In none of the abov	e used ve cases	
E-9.	An ion is reduced to t ion is: (1) 0.10	the element when it abs	orbs 6 × 10 ²⁰ electrons. 7 (3) 0.001	The number of equivalents of the	
E-10.	Electrolysis can be us metal in 100 minutes. (1) 100	ced to determine atomic Calculate the atomic ma (2) 45.0	masses. A current of 0.5 ass of the metal if n = 3 : (3) 48.25	(4) 144.75 (4) 144.75	
E-11.	How many minutes w (Atomic weight : Cr = (1) 254	ill it take to plate out 5.0 52.0) (2) 30	g of Cr from a Cr ₂ (SO ₄) ₃ (3) 152	solution using a current of 15 A ? (4) 103	
E-12.	An electrolysis of a ox is the charge of tungs (1) 6	y tungsten complex ion u ten in the material ? (Ato (2) 2	using 1.10 A for 40 min pro omic weight : W = 184) (3) 4	oduces 0.838 g of tungsten. Wha (4) 1	
Secti F-1.	on (F) : Faraday la In an electrolytic cell o (1) Increases	b ws (Electrolysis) of Ag/AgNO₃/Ag, when c (2) Decreases	current is passed, the cond (3) Remains same	centration of AgNO₃ (4) None of these	
F-2.	When a lead storage (1) PbSO4 is formed	battery is discharged (2) Pb is formed	(3) SO ₂ is consumed	(4) H ₂ SO ₄ is formed	
F-3.	By the electrolysis of (1) O_2 at anode and H (3) O_2 at anode and C	aqueous solution of CuS I₂ at cathode Cu at cathode	6O4, the products obtained (2) H2 at anode and C (4) H2S2O8 at anode a	d at both the electrodes are u at cathode nd O₂ at cathode	
F-4.	A spoon to be electro (1) cathode	plated with gold should t (2) anode	be : (3) electrolyte	(4) none of these	
F-5.	Which of the substand aqueous solution ? (1) Hg and Pt	ces Na, Hg, S, Pt and gra (2) Hg, Pt and graphi	aphite can be used as elec te (3) Na, S	ctrodes in electrolytic cells having (4) Na, Hg, S	
F-6.	How many coulomb of AgNO ₃ for 30 minute (1) 108	of electricity are consum during an electrolysis ex (2) 18000	ned when 100 mA curren periment : (3) 180	t is passed through a solution of (4) 3000	
F-7.	During the electrolysis (1) Chloride ions are o (3) Sodium ions are o	s of fused NaCl, the reac oxidized xidized	ction that occurs at the an (2) Chloride ions are r (4) Sodium ions are re	ode is educed educed	

F-8. A fuel cell is :

(1) The voltaic cells in which continuous supply of fuels are send at anode to give oxidation

(2) The votalic cell in which fuels such as : CH_4 , H_2 , CO are used up at anode

(3) It involves the reactions of H_2-O_2 fuel cell such as :

 $2H_2 + 4OH^- \longrightarrow 4H_2O(\ell) + 4e$ Anode : $O_2 + 2H_2O(\ell) + 4e \longrightarrow 4OH^-$ Cathode : (4) All of the above F-9. A certain current liberated 0.504 g of hydrogen in 2 hours. How many grams of copper can be liberated by the same current flowing for the same time in copper sulphate solution (1) 31.8 q (2) 16.0 g (3) 12.7 g (4) 63.5 q Section (G) : Electrical Conductance (Basic Definitions and Calculation of **Conductance of Different Mixtures**) The ionization constant of a weak electrolyte is 25×10^{-6} while the equivalent conductance of its 0.01 M G-1. solution is 19.6 S cm² eq⁻¹. The equivalent conductance of the electrolyte at infinite dilution (in S cm² eq⁻¹) will be : (1) 250 (3) 392 (4) 384 (2) 196 G-2. If the specific resistance of a solution of concentration C g equivalent litre⁻¹ is R, then its equivalent conductance is : 100R RC 1000 С (4) 1000R (2) 1000 (3) RC С (1)G-3. The specific conductance of a salt of 0.01 M concentration is 1.061 × 10⁻⁴ molar conductance of the same solution will be : (1) 1.061×10^{-4} (2) 1.061 (3) 10.61 (4) 106.1 G-4. Which of the following solutions of NaCl will have the highest specific condutance ? (3) 0.01 N (1) 0.001 N (2) 0.1 N (4) 1.0 N G-5. The molar conductance at infinite dilution of AgNO₃, AgCl and NaCl are 116.5, 121.6 and 110.3 respectively. The molar conductances of NaNO3 is : (1) 111.4 (3) 130.6 (2) 105.2 (4) 150.2 Resistance of 0.1 M KCl solution in a conductance cell is 300 ohm and conductivity is 0.013 Scm⁻¹. The G-6. value of cell constant is : (1) 3.9 cm⁻¹ (2) 39 m⁻¹ (3) 3.9 m⁻¹ (4) None of these

Section (H) : Kohlrausch Law and Its Applications

- H-1. The specific conductivity of a saturated solution of AgCl is 3.40×10^{-6} ohm⁻¹ cm⁻¹ at 25 °C. If $\lambda_{Ag+} = 62.3$ ohm⁻¹ cm² mol⁻¹ & $\lambda_{Cl} = 67.7$ ohm⁻¹ cm² mol⁻¹, the solubility of AgCl at 25 °C is : (1) 2.6×10^{-5} M (2) 4.5×10^{-3} M (3) 3.6×10^{-5} M (4) 3.6×10^{-3} M
- H-2. At infinite dilution, the eq. conductances of CH₃COONa, HCl and CH₃COOH are 91, 426 and 391 mho cm² respectively at 25°C, The eq. conductance of NaCl at infinite dilution will be :
 (1) 126 (2) 209 (3) 391 (4) 908
- H-3. The equivalent conductivity of 0.1 N CH₃COOH at 25°C is 80 and at infinite dilution 400. The degree of dissociation of CH₃COOH is :
 (1) 1
 (2) 0.2
 (3) 0.1
 (4) 0.5
- H-4. The specific conductance of a 0.01 M solution of KCl is 0.0014 ohm⁻¹ cm⁻¹ at 25°C. its equivalent conductance (cm² ohm⁻¹ equiv⁻¹) is : (1) 140 (2) 14 (3) 1.4 (4) 0.14
- **H-5.** The value of λ_{m}^{∞} for NH₄Cl, NaOH and NaCl are 129.8, 248.1 and 126.4 ohm⁻¹ cm² mol⁻¹ respectively. Calculate λ_{m}^{∞} for NH₄OH solution (in ohm⁻¹ cm² mol⁻¹) (1) 215.5 (2) 251.5 (3) 244.7 (4) 351.5
- **H-6.** Following curve for conductometric titration is obtained when:



- (1) NaOH solution is added in to HCl solution
- (2) NaOH solution is added in to CH₃COOH solution
- (3) NH₄OH solution is added in to HCl solution
- (4) NH_4OH solution is added in to CH_3COOH solution

Section (I) : Comercial cells and corrosion :

I-1. Rusting of iron is catalysed by which of the following

	(1) Fe	e (2) O	2 (3) Zn	(4) H+
--	--------	---------	----------	--------

- I-2. Corrosion of iron is essentially an electrochemical phenomenon where the cell reactions are
 (1) Fe is oxidised to Fe²⁺ and dissolved oxygen in water is reduced to OH⁻
 - (2) Fe is oxidised to Fe³⁺ and H₂O is reduced to O_2^{2-}
 - (3) Fe is oxidised to Fe²⁺ and H₂O is reduced to $\frac{O_2^{2-}}{2}$
 - (4) Fe is oxidised to Fe^{2+} and H_2O is reduced to O_2
- I-3. Which of the following cell is used in Cars and Bikes ? (1) Leclanche cell (2) CH₄-O₂ fuel cell (3) Daniel cell (4) Lead storage battery

Exercise-2

PART - I : OBJECTIVE QUESTIONS

- Given : $E^{0}(Cu^{2+} | Cu) = 0.337 \text{ V}$ and $E^{0}(Sn^{2+} | Sn) = -0.136 \text{ V}$. Which of the following statements is 1. correct? (1) Cu^{2+} ions can be reduced by $H_2(g)$ (2) Cu can be oxidized by H⁺ (3) Sn^{2+} ions can be reduced by $H_2(q)$ (4) Cu can reduce Sn²⁺ 2. How much will the potential of a hydrogen electrode change when its solution initially at pH = 0 is neutralised to pH = 7? (1) Increase by 0.059 V (2) Decrease by 0.059 V (3) Increase by 0.41 V (4) Decrease by 0.41 V 3. How many electrons flow when a current of 5 amperes is passed through a conductor for 200 seconds? (2) 6.0241 × 10²¹ (3) 6.241 × 10²² (4) 6.0241 × 10²² (1) 6.214×10^{21} The products formed when an aqueous solution of NaBr is electrolyzed in a cell having inert eletrodes 4. are: (3) H₂, Br₂ and NaOH (1) Na and Br₂ (2) Na and O_2 (4) H_2 and O_2 5. The weight of silver (eq. wt = 108) displaced by that quantity of current which displaced 5600 ml. of
- hydrogen at STP is : (1) 54 g (2) 108 g (3) 5.4 g (4) None of these
- 6. In the adjacent diagram the electrolytic cell contains 1 L of an aqueous 1 M Copper (II) sulphate solution. If 0.4 mole of electrons passed through of cell, the concentration of copper ion after passage of the charge will be



- A solution containing one mole per litre of each Cu(NO₃)₂; AgNO₃; Hg₂(NO₃)₂; is being electrolysed by using inert electrodes. The values of standard electrode potentials in volts (reduction potentials) are: Ag/Ag⁺ = -0.80 V, Hg/Hg²⁺⁺ = -0.79 V, Cu/Cu⁺⁺ = -0.34 V, Mg/Mg⁺⁺ = + 2.37 V With increasing voltage, the sequence of deposition of metals on the cathode will be :

 (1) Ag, Hg, Cu, Mg
 (2) Mg, Cu, Hg, Ag
 (3) Ag, Hg, Cu
 (4) Cu, Hg, Ag
- **8.** In H_2 - O_2 fuel cell the reaction occuring at cathode is :

(1)
$$2 H_2O + O_2 + 4 e_- \rightarrow 4 OH_-$$

(2) $2 H_2 + O_2 \rightarrow 2 H_2O(\hbar)$
(3) $H^+ + OH_- \rightarrow H_2O$
(4) $H^+ + e_- \rightarrow \frac{1}{2} H_2$.

9. Which process involves corrosion ?

ELECTROCHEMISTRY

	(1) Brown deposits on(3) Black deposits on s	eposits on iron articles(2) Green deposits on battary terminalseposits on silver coin(4) All of the above		battary terminals	
10.	The corrosion of iron o (1) Presence of H ⁺ ion (3) Presence of impurit	bject is favaoured by : ies in iron object	(2) Presence of moisture in air(4) All of the above		
11.	Chlorine gas is passed in CHCl ₃ layer is : (1) Violet due to format	l into a solution containin	g KF, KI, and KBr and C (2) Orange due to form	$_{\rm J}$ KF, KI, and KBr and CHCl ₃ is added. The initial colour (2) Orange due to formation Br ₂	
12.	 (3) Colourless due to formation of F₂ (4) No colour change due to no reaction A hydrogen electrode placed in a buffer solution of CH₃COONa and CH₃COOH in the ratios of x : y : x has electrode potential values E₁ volts and E₂ volts, respectively at 25°C. The pK_a values of acid is (E₁ and E₂ are oxidation potentials) 		ue to no reaction ₃COOH in the ratios of x : y and t 25ºC. The pKa values of acetic		
	(1) $\frac{E_1 + E_2}{0.118}$	(2) $\frac{E_2 - E_1}{0.118}$	$(3) - \frac{E_1 + E_2}{0.118}$	(4) $\frac{E_1 - E_2}{0.118}$	
13.	If $\text{E}^{\circ}_{\text{Fe}^{2+}/\text{Fe}} = -0.441 \text{ V}$ and $\text{E}^{\circ}_{\text{Fe}^{3+}\text{Fe}^{2+}} = 0.771 \text{ V}$, the standard EMF of the reaction Fe + 2Fe ³⁺ \rightarrow 3Fe ²⁺				
	(1) 1.212 V	(2) 0.111 V	(3) 0.330 V	(4) 1.653 V	
14.	In a salt bridge, KCI is used because: (1) it is an electrolyte (2) it is good conductor of electricity (3) the transport number of K ⁺ and CI ⁻ ions are nearly same or both have same ionic mobility (4) it is ionic compound				
15.	By how much will the potential of half cell Cu ²⁺ / (1) Increases by 59 mV (3) Increases by 29.5 mV		 ⁷ Cu change if the solution is diluted to 100 times at 298K (2) Decreases by 59 mV (4) Decreases by 29.5 mV 		
16.	The weight ratio of AI a (1) 9 : 108	and Ag deposited using th (2) 2 : 12	ne same quantity of curre (3) 108 : 9	ent is: (4) 3 : 8	
17.	Electro chemical equiv (1) 65	alent of a substance is 0. (2) 67.35	.0006735 ; its eq. wt. is : (3) 130	(4) cannot be calculated	
18.	When molten lithium chloride (LiCl) is electrolyzed, lithium metal is formed at the cathode. If current efficiency is 75% then how many grams of lithium are liberated when 1930 C of charge pass through the cell : (Atomic weight : $Li = 7$)				
	(1) 0.105	(2) 0.120	(3) 0.28	(4) 0.240	
19.	A 1 M solution of H ₂ S respectively	O4 is electrolyzed. Sele	ct right statement with p	products at anode and cathode	

Given : $2SO_4^{2-} \longrightarrow S_2O_8^{2-} + 2e^-$; $E^0 = -2.01 \text{ V}$

 $H_2O(\ell) \longrightarrow 2H^+(aq) + 1/2O_2(g) + 2e^-; \qquad E^0 = -1.23 V$

- (1) concentration of H₂SO₄ remain constant ; H₂, O₂
- (2) concentration of H₂SO₄ increases ; O₂, H₂
- (3) concentration of H₂SO₄ decreases ; O₂, H₂
- (4) concentration of H_2SO_4 remains constant ; $S_2O_8^{2-}$, H_2
- A solution of sodium sulphate in water is electrolysed using inert electrodes. The products at the cathode and anode are respectively
 (1) H₂, O₂
 (2) O₂, H₂
 (3) O₂, Na
 (4) O₂, SO₂
- 21. During electrolysis of fused calcium hydride, the hydrogen is produced at :
 (1) Cathode
 (2) Anode
 (3) Hydrogen is no liberated at all
 (4) H₂ produced reacts with oxygen to form water
- **22.**The passage of current liberates H_2 at cathode and Cl_2 at anode the solution:
(1) $CuSO_4$ (aq)(2) $CuCl_2$ (aq.)(3) NaCl(aq.)(4) Water
- 23.Electrolysis of a solution of MnSO4 in aqueous sulphuric acid is a method for the preparation of MnO2.
Passing a current of 27A for 24 hours gives 1kg of MnO2. The current efficiency in this process is :
(1) 100%(2) 95.185%(3) 80%(4) 82.951%
- When the electric current is passed through a cell having an electrolyte, the positive ions move towards cathode and negative ions towards the anode. If the cathode is pulled out of the solution (1) the positive and negative ions will move towards anode
 - (1) the positive and negative ions will move towards anode
 - (2) the positive ions will start moving towards the anode while negative ions will stop moving
 - (3) the negative ions will continue to move towards anode while positive ions will stop moving
 - (4) the positive and negative ions will start moving randomly
- **25.** Assertion : E^o_{cell} = 0 for a chloride ion concentration cell.

$$\frac{[C|^{-}]_{LHS}}{[C|^{-}]_{LHS}}$$

Reason : For this concentration cell where $E_{cell} = \overline{nF} \ln [Cl^-]_{RHS}$

- (1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
- (2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
- (3) The assertion is incorrect, but the reason is correct
- (4) Both are assertion and reason are incorrect
- **26. Assertion :** Conductivity always increases with the decreased in concentration both the weak and strong electrolytes.

Reason : No. of ions per unit volume linearly decreases in both electrolytes.

- (1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
- (2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
- (3) The assertion is incorrect, but the reason is correct
- (4) Both are assertion and reason are incorrect
- 27. Assertion : If SRP of substance is -0.5 V then reduction of substance is possible only in basic medium. Reason : SRP of water is -0.8274 V and at reduction potential is zero at pH = 7.
 - (1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
 - (2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
 - (3) The assertion is incorrect, but the reason is correct
 - (4) Both are assertion and reason are incorrect

Exercise-3

PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

	OFFLINE JEE(MAIN)				
1.	For the following cell wi Pt H ₂ (g) H ⁺ (a	th hydrogen electro aq) H2 (g) Pt	odes at two different p	ressure p₁and p	2,
	$p_{1} = 1M$ emf is given by : $\frac{RT}{F} \log_{e} \frac{p_{1}}{p_{2}}$ (1)	(2) $\frac{RT}{2F}log_{e}\frac{p_1}{p_2}$	(3) $\frac{RT}{F}log_{e}\frac{p_2}{p_1}$	(4) RT	[AIEEE-2002, 3/225] $\log_{e} \frac{p_2}{p_1}$
2.	Which of the following r (1) 2 Cr ³⁺ + 7H ₂ O \rightarrow Cr: $\frac{1}{2}$	eactions is possible 2O7 ^{2–} + 14H ⁺	e at anode : (2) F₂ → 2F⁻		[AIEEE-2002, 3/225]
	(3) $^{2}O_{2} + 2H^{+} \rightarrow H_{2}O$		(4) displaceme	nt reaction	
3.	For a cell given below : Ag Ag+ Cu ²⁺ – +	Cu			[AIEEE-2002, 3/225]
	Ag ⁺ + e ⁻ → Ag Cu ²⁺ + 2e ⁻ → The value of E ^o _{cell} is : (1) x + 2y	$E^{0} = x$ Cu, E (2) 2x + y	° = y (3) y -x	(4) y – 2x	
4.	Conductance (with uniconcentration of the selectrode plates. Then (1) Sm mol ⁻¹ .	t Siemens S) is d olution in the cell a the unit of the cons (2) Sm ² mol ⁻¹ .	irectly proportional to and is inversely prop tant of proportionality (3) S ⁻² m ² mol.	o area of the el ortional to the s is : (4) S²r	ectrode plates and the separation between the [AIEEE-2002, 3/225] n ² mol ⁻¹ .
5.	For a cell reaction invol 25°C. The equilibrium c (1) 1 × 10 ⁻¹⁰	ving a two electron constant of the reac (2) 29.5 × 10 ⁻²	change, the standard tion at 25°C will be : (3) 10	emf of the cell i [AIEEI (4) 1 ×	s found to be 0.295 V at E -2003, 3/225] 10 ¹⁰
6.	Standard electrode pot The reducing power of (1) B > C > A	entials of three met these metals is in th (2) A > B > C	tals A, B and C are + he order : (3) C > B > A	0.5 V, – 3.0 V a (4) A >	nd – 1.2 V respectively. [AIEEE-2003, 3/225] · C > B
7.	Consider the following $E^{0}_{Fe^{3+}/Fe^{2+}} = + 0$ Under standard condition	E ⁰ values :).77 V ; ons. the cell potenti	$S^{0} = -0.14 \text{ V}$	en below is :	[AIEEE-2004. 3/225]
	$Sn_{(s)} + 2Fe^{3+}_{(aq)} \rightarrow 2Fe^{2}$	+(aq) + Sn ²⁺ (aq)	j		
	(1) 1.68 V	(2) 1.40 V	(3) 0.91 V	(4) 0.6	3 V
8.	The limiting molar cond The value of A ^o for NaB	uctivities ∧º for NaC r is :	CI, KBr and KCI are 12	6, 152 and 150 \$ [AIEEE-2004,	S cm ² mol ⁻¹ respectively. 3/225]
	(1) 128 S cm² mol⁻¹	(2) $176 \text{ S cm}^2 \text{ mol}$	$(3) 278 \text{ S cm}^2 \text{ r}$	mol⁻¹ (4) 302	2 S cm ² mol ⁻¹
9.	In a cell that utilizes the addition of H_2SO_4 to ca (1) lower the E and shif (2) lower the E and shif (3) increase the E and s	reaction Z thode compartment t equilibrium to the t the equilibrium to shift the equilibrium	$n_{(s)} + 2H_{(aq)} \rightarrow Zn^{2+}_{(ad)}$ t will : left. the right. to the right.	_{q)} + H _{2(g)} ,	[AIEEE-2004, 3/225]

2.303R(298)

(4) increase the E and shift the equilibrium to the left.

- **10.** The $E_{M^{3+}/M^{2+}}^{U}$ values for Cr, Mn, Fe and Co are -0.41, +1.57, +0.77 and +1.97 V respectively. For which one of these metals, the change in oxidation state from +2 to +3 is easiest :[AIEEE-2004, 3/225] (1) Cr (2) Mn (3) Fe (4) Co
- 11. The highest electrical conductivity among the following aqueous solutions is of : [AIEEE-2005, 3/225]
 (1) 0.1 M acetic acid
 (2) 0.1 M chloroacetic acid
 (3) 0.1 M fluoroacetic acid
 (4) 0.1 M difluoroacetic acid
- **13.** The molar conductivities Λ^{0}_{NaOAc} and Λ^{0}_{HCI} at infinite dilution in water at 25°C are 91.0 and 426.2 Scm²/mol respectively. To calculate Λ^{0}_{HOAc} , the additional value required is :[AIEEE-2006, 3/165] (1) $\Lambda^{0}_{H_{2}O}$ (2) Λ^{0}_{KCI} (3) Λ^{0}_{NaOH} (4) Λ^{0}_{NaCI}
- 14. Given data is at 25°C : Ag + I⁻ \rightarrow AgI + e⁻ ; E° = 0.152 V Ag \rightarrow Ag⁺ + e⁻ ; E° = - 0.800 V

What is the value of log Ksp for AgI : $(Take \frac{0.474}{0.059} = 8.065)$ [AIEEE-2006, 3/165](1) - 8.12(2) + 8.612(3) - 37.83(4) - 16.13

The equivalent conductances of two strong electrolytes at infinite dilution in H₂O (where ions move freely through a solution) at 25°C are given below : [AIEEE-2007, 3/120]

 $\Lambda^{0}_{CH_{3}COONa} = 91.0 \text{ Scm}^{2}/\text{equiv}$ and $\Lambda^{0}_{HCI} = 426.2 \text{ Scm}^{2}/\text{equiv}$ What additional information/quantity one needs to calculate Λ^{0} of an aqueous solution of acetic acid :

- (1) The limiting equivalent conductance of H⁺ $(\lambda^{-}_{H^+})$ (2) Λ^{0} of chloroacetic acid (CICH₂COOH) (3) Λ^{0} of NaCl (4) Λ^{0} of CH₃COOK
- 16. The cell Zn | $Zn^{2+}(1M)$ || $Cu^{2+}(1M)$ | Cu : (E[°]_{cell} = 1.10 V) was allowed to completely discharge at 298 K.
 - The relative concentration of Zn^{2+} to $Cu^{2+} \begin{bmatrix} Zn^{2+} \\ Cu^{2+} \end{bmatrix}$ is : (Take $\frac{1.1}{0.059} = 18.65$) [AIEEE-2007, 3/120] (1) $10^{37.3}$ (2) 9.65×10^4 (3) antilog (24.08) (4) 37.3
- **17.** Given : $E^0_{Cr^{3+}/Cr} = -0.72$, $E^0_{Fe^{2+}/Fe} = -0.42 \text{ V}$

The potential for the cell Cr | Cr³⁺(0.1 M) || Fe²⁺(0.01 M) | Fe at 298 K is : (Take F = 0.06) [AIEEE-2008, 3/105]

ELECTROCHEMISTRY

·	(1) 0.339 V	(2) – 0.339 V	(3) – 0.26 V	(4) 0.26 V
18.	Given : $E_{Fe^{3+}/Fe}^{0} = -0.0$	$36 \text{ V}, \frac{E_{Fe^{2+}/Fe}^0}{Fe^{2+}/Fe} = -0.439 \text{ V}$	V	[AIEEE-2009, 8/144]
	The value of standard e (1) 0.385V	electrode potential for the (2) 0.770V	e change, ^{Fe³⁺ (3) –0.270V}	→ Fe ²⁺ (4) –0.072V
19.	The Gibbs energy for the 2 4	ne decomposition of Al ₂ C	0₃ at 500⁰C is as follows :	[AIEEE-2010, 4/144]
	$\overline{3}$ Al ₂ O ₃ $\rightarrow \overline{3}$ Al + O ₂ ; A Al ₂ O ₃ at 500°C is at lease	∆rG = + 966 kJmol ^{_1} . The st :	e potential difference nee	eded for electrolytic reduction of
	(1) 4.5 V	(2) 3.0 V	(3) 2.5 V	(4) 5.0 V
20.	The reduction potential (1) $p(H_2) = 1$ atm and [H (3) $p(H_2) = 2$ atm and [H	of hydrogen half-cell wil H*] = 2.0 M H*] = 1.0 M	l be negative, if : (2) p(H ₂) = 1 atm and [H (4) p(H ₂) = 2 atm and [H	[AIEEE-2011(1), 4/120] H⁺] = 1.0 M H⁺] = 2.0 M
21.	The standard reductio respectively. The reacti (1) $X = Ni$, $Y = Fe$	n potentials for Zn^{2+}/Zr on X + Y ²⁺ \rightarrow X ²⁺ + Y wil (2) X = Ni, Y = Zn	n, Ni ²⁺ /Ni and Fe ²⁺ /Fe a I be spontaneous, when (3) X = Fe, Y = Zn	are -0.76, -0.23 and -0.44 V : [AIEEE-2012, 4/120] (4) X = Zn, Y = Ni
22.	Given :			[JEE(Main)-2013, 4/120]
	$E^{0}_{Cr^{3+}/Cr} = -0.74 \text{ V}$	$nO_4^{-}/Mn^{2+} = 1.51 \text{ V}$		
	$E_{Cr_2O_7^{2^-}/Cr^{3+}}^0 = 1.33 \text{ V}$	0 = 1.36 V		
	Based on the data give (1) Cl	n above, strongest oxidis (2) Cr ³⁺	sing agent will be : (3) Mn ²⁺	(4) MnO₄⁻
23.	Resistance of 0.2 M so m^{-1} . The resistance of solution of the electroly 2014 4/1201	lution of an electrolyte is 0.5 M solution of the sau te in S m² mol ^{_1} is :	s 50 Ω. The specific conc me electrolyte is 280 Ω.	luctance of the solution is 1.4 S The molar conductivity of 0.5 M [JEE(Main)-
	(1) 5×10^{-4}	(2) 5 × 10 ^{−3}	(3) 5 × 10 ³	(4) 5 × 10 ²
24.	The equivalent conductance of NaCI at concentration C and at infinite dilution are Λ_C and Λ_{∞} , respectively The correct relationship between Λ_C and Λ_{∞} is given as : (where the constant B is positive) [JEE(Main)-2014, 4/120]			
	(1) $\Lambda_C = \Lambda_{\infty} + (B)C$	(2) $\Lambda_C = \Lambda_{\infty} - (B)C$	(3) $\Lambda_{\rm C} = \Lambda_{\infty} - ({\rm B})^{\sqrt{\rm C}}$	(4) $\Lambda_{\rm C} = \Lambda_{\infty} + ({\rm B}) \sqrt{{\rm C}}$
25.	The metal that cannot b	e obtained by electrolys	is of an aqueous solutior	of its salts is :
	(1) Ag	(2) Ca	(3) Cu	[JEE(MAIN)-2014, 4/120] (4) Cr
26.	Given below are the ha $Mn^{2+} + 2e^- \rightarrow Mn$; E ⁰ $2(Mn^{3+} + e^- \rightarrow Mn^{2+})$; The E ⁰ for $3Mn^{2+} \rightarrow M$	lf-cell reactions : = −1.18 V Eº = +1.51 V n + 2Mn ³⁺ will be :		[JEE(Main)-2014, 4/120]
	(1) -2.69 V; the reaction (3) -0.33 V; the reaction	on will not occur	(2) - 2.69 V; the reaction $(4) - 0.33 V$; the reaction	on will occur on will occur
27.	Two Faraday of electric	city is passed through a	solution of CuSO4. The r	nass of copper deposited at the
	cathode is : (at. mass of	of Cu = 63.5 amu)		[JEE(Main)-2015, 4/120]
	(1) 0 g	(2) 63.5 g	(3) 2 g	(4) 127 g
28	Galvanization is applyir	ng a coating of :		[JEE(Main)-2016, 4/120]

СН	EMISTRY FOR JE	E	ELECTROCHEMISTRY			
•	(1) Cr	(2) Cu	(3) Zn	(4) Pb		
29.	Given					
	$E^{\circ}_{Cl_2/Cl^-} = 1$.36 V, $E_{Cr^{3+}/Cr}^{\circ} = -0.74 V$				
	E° _{Cr2O7} ²⁻ /Cr ³⁺	$= 1.33 \text{ V}$ $\text{E}^{\circ}_{\text{MnO}_{4}^{-}/\text{Mn}^{2+}} = 1$	51 V			
	Among the following	g, the strongest reducing a	agent is :	[JEE(Main)-2017, 4/120]		
	(1) Mn ²⁺	(2) Cr ³⁺	(3) Cl⁻	(4) Cr		
		ONLINE	JEE(MAIN)			
1.	The standard elect	rode potentials $(E^{\circ}_{M^{+}/M})$ of	four metals A, B, C an	d D are –1.2 V, 0.6 V, 0.85 V and		
	-0.76 V, respective	ly. The sequence of depos	sition of metals on apply	ing potential is :		
			[JEE(Mair	a) 2014 Online (09-04-14), 4/120]		
	(1) A, C, B, D	(2) B, D, C, A	(3) C, B, D, A	(4) D, A, B, C		
2.	A current of 10.0 A	flows for 2.00 h through a	an electrolytic cell conta	ining a molten salt of metal X. This		
	results in the decomposition of 0.250 mol of metal X at the cathode. The oxidation state of X in the molten					
	salt is : (F = 96,500	C)	[JEE(Main) 2014	Online (09-04-14), 4/120]		
	(1) 1 +	(2) 2 +	(3) 3 +	(4) 4 +		
3.	Given : Fe	$^{3+}$ (aq) + e ⁻ \rightarrow Fe ²⁺ (aq) ; E	$E^{0} = + 0.77 V$			
	Al ³	+ (aq) + 3e ⁻ → AI(s); E° = -	-1.66 V			
	Br ₂	$(aq) + 2e^{-} \rightarrow 2Br^{-}; E^{\circ} = -$	⊦1.09 V			
	Considering the ele	ectrode potentials, which	of the following repres	ents the correct order of reducing		
	power ? (1) $Ee^{2+} < \Delta I < Br$	(2) Br- < Fo ²⁺ < ∆I	[JEE(Ma (3) AI < Br- < Fo ²⁺	(4) ΔI < Eρ ²⁺ < Br−		
4.	How many electron	s would be required to dep	posit 6.35 g of copper at	the cathode during the electrolysis		
	of an aqueous	solution of copper s	sulphate ? (Atomic	mass of copper = 63.5 u,		
	$N_A = Avogadro S co$	nstant). N	[JEE(IWain) N	2014 Online (12-04-14), 4/120]		
	(1) $\frac{N_A}{20}$	(2) $\frac{N_A}{10}$	$(3) \frac{\overline{N_A}}{5}$	(A) $\frac{N_A}{2}$		
	(')	(4)	(3)	(ד)		
5.	A variable, opposit	e external potential (E _{ext})	is applied to the cell Z	2n Zn ²⁺ (1 M) Cu ²⁺ (1M) Cu, of		
	potential 1.1 V. Wh	potential 1.1 V. When $E_{ext} < 1.1$ V and $E_{ext} > 1.1$ V respectively electrons flow from :				
	(1) Cathode to ano	de in both cases	(2) cathode to anode and anode to cathode			
	(3) anode to cathod	le and cathode to anode	(4) anode to cathod	e in both cases		
6	At 209 K, the stand	ard raduation natantials a	ro 1 E1 V for MpO Mr	x2+ 1 26 \/ for CL CL 1 07 \/ for Pr		
0.	Al 290 K, the Stand	ard reduction potentials a				
	Rr and 0.54 V for	In I At nH - 2 pormana	anata is avposted to avi	$\left(\frac{1}{F} = 0.059 V\right)$		
	ום , מוע 0.54 ע וסן, מוע	12 1-. At $p = 3$, permang	I.IEE/Mai	uize . in) 2015 Online (11-04-15), 4/1201		
	(1) Cl_, Br_ and I_	(2) Br- and I-	(3) Cl- and Br-	(4) I- only		

- What will occur if a block of copper metal is dropped into a beaker containing a solution of 1M ZnSO₄?
 [JEE(Main) 2016 Online (09-04-16), 4/120]
 - (1) The copper metal will dissolve and zinc metal will be deposited.
 - (2) The copper metal will dissolve with evolution of oxygen gas.
 - (3) The copper metal will dissolve with evolution of hydrogen gas.
 - (4) No reaction will occur.
- 8. Identify the correct statement :

[JEE(Main) 2016 Online (10-04-16), 4/120]

- (1) Corrosion of iron can be minimized by forming an impermeable barrier at its surface.
- (2) Iron corrodes in oxygen-free water.
- (3) Iron corrodes more rapidly in salt water because its electrochemical potential is higher.

(4) Corrosion of iron can be minimized by forming a contact with another metal with a higher reduction potential.

- 9. What is the standard reduction potential (E⁰) for Fe³⁺ ς Fe ?
 - Given that : [JEE(Main) 2017 Online (08-04-17), 4/120] $Fe^{2+} + 2e^{-} \rightarrow Fe; \stackrel{E^{\circ}_{Fe^{2+}/Fe}}{=} - 0.47 \text{ V}$ $Fe^{3+} + e^{-} \rightarrow Fe^{2+}; \stackrel{E^{\circ}_{Fe^{2+}/Fe}}{=} \stackrel{E^{\circ}_{Fe^{2+}/Fe^{2+}}}{=} + 0.77 \text{ V}$ (1) + 0.30 V (2) - 0.057 V (3) + 0.057 V (4) - 0.30 V
- 10. Consider the following standard electrode potentials (E^o in volts) in aqueous solution :

	Element	<u>M³⁺ / M</u>	<u>M+ / M</u>	[JEE(Mair) 2017 Online (08-04-17)	, 4/120]
	AI	-1.66	+ 0.55			
	ТΙ	+1.26	- 0.34			
	Based on the	ese data, which	of the following	statements is correct ?	,	
	(1) Al⁺ is mo	re stable than A	³⁺	(2) TI ³⁺ is more sta	ble than Al ³⁺	
	(3) TI+ is mo	re stable than A	3+	(4) TI+ is more stat	ble than Al+	
11.	Which of the	following ions of	does not liberate	hydrogen gas on react	ion with dilute acids ?	
				[JEE(Mair	a) 2017 Online (09-04-17)	, 4/120]
	(1) Mn ²⁺	(2)	Ti ²⁺	(3) V ²⁺	(4) Cr ²⁺	
12.	To find the s	tandard potentia	al of M ³⁺ /M elect	rode, the following cell i	s constituted :	
	Pt / M / M ³⁺	(0.001 mol L ⁻¹) /	′ Ag+ (0.01 mol L	_ ^{_1})/Ag		
	The emf of	the cell is fou	ind to be 0.42	1 volt at 298 K. The	standard potential of ha	If reactior
	M ³⁺ + 3e ⁻	→ M at 298 K wil	l be :	[JEE(Mai	n) 2017 Online (09-04-17)), 4/120]
	(Given $E^{-}_{_{Ag^{+}/.}}$	^{Ag} at 298 K = 0.8	0 volt)			
	(1) 0.32 Volt	(2)	0.66 Volt	(3) 0.38 Volt	(4) 1.28 Volt	
Ρ	ART - II : J	EE (ADVA	NCED) / IIT	JEE PROBLEM	S (PREVIOUS YEA	ARS)
* Mar	ked Question	s may have mo	re than one co	rrect option.		

1. The emf of the cell, Zn | Zn²⁺(0.01 M) || Fe²⁺(0.001 M) | Fe at 298 K is 0.2905 V. Then the value of equilibrium constant for the cell reaction is:[JEE 2004, 3/84] $(A) e^{\frac{0.32}{0.0295}}$ (B) $10^{\frac{0.32}{0.0295}}$ (C) $10^{\frac{0.26}{0.0295}}$ (D) $10^{\frac{0.32}{0.059}}$ 2. The half cell reactions for rusting of iron are :

 $\begin{array}{c} \frac{1}{2} \\ 2H^{+} + \frac{1}{2} \\ O_{2} + 2e^{-} &\longrightarrow H_{2}O; \ E^{0} = +1.23 \ V \& \ Fe^{2+} + 2e^{-} &\longrightarrow Fe \ ; \ E^{0} = -0.44 \ V \\ \Delta G^{0} \ (\text{in kJ/mol}) \ \text{for the overall reaction is :} \\ (A) - 76 \qquad (B) - 322 \qquad (C) - 122 \qquad (D) - 176 \end{array}$

Comprehension # 1

Chemical reactions involve interaction of atoms and molecules. A large number of atoms/molecules (approximately 6.023×10^{23}) are present in a few grams of any chemical compound varying with its atomic/molecular masses. To handle such large number conveniently, the mole concept was introduced. This concept has implications in diverse areas such as analytical chemistry, biochemistry, electrochemistry and radiochemistry. The following example illustrates a typical case, involving chemical/electrochemical reaction, which requires a clear understanding of the mole concept.

A 4.0 molar aqueous solution of NaCl is prepared and 500 mL of this solution is electrolysed. This leads to the evolution of chlorine gas at one of the electrodes.

(Given : Atomic masses : Na = 23, Hg = 200; 1 Faraday = 96500 coulombs) Now answer the following three questions :

3.	The total number	[JEE 2007, 4/162]		
	(A) 0.5	(B) 1.0	(C) 2.0	(D) 3.0
4.	If the cathode is Hg electrode, the maximum weight (in g) of amalgam formed from this s			
	(A) 200	(B) 225	(C) 400	(D) 446
5.	The total charge (i	in coulombs) required fo	or complete electrolysis is :	[JEE 2007, 4/162]
	(A) 24125	(B) 48250	(C) 96500	(D) 193000

Comprehension # 2

Redox reactions play a pivoted role in chemistry and biology. The values of standard redox potential (E°) of two half-cell reactions decide which way the reaction is expected to proceed. A simple example is a Daniel cell in which zinc goes into solution and copper gets deposited. Given below is a set of half-cell reactions (acidic medium) along with their E° values with respect to normal hydrogen electrode. Using this data, obtain the correct explanations to questions 18 - 19.

$I_2 + 2e^- \rightarrow 2I^-$	$E^{o} = 0.54 V$	
$Cl_2 + 2e^- \rightarrow 2Cl^-$	E ^o = 1.36 V	
$Mn^{3+} + e^- \rightarrow Mn^{2+}$	E ^o = 1.50 V	
$Fe^{3+} + e^- \rightarrow Fe^{2+}$	E ^o = 0.77 V	
$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$	E ^o = 1.23 V	

6. Among the following, identify the correct statement : [JEE 2007, 4/162]
(A) Chloride ion is oxidised by O₂
(B) Fe²⁺ is oxidised by iodine
(C) Iodine ion is oxidised by chlorine
(D) Mn²⁺ is oxidised by chlorine

- 7.While Fe³⁺ is stable, Mn³⁺ is not stable in acid solution, because :[JEE 2007, 4/162](A) O_2 oxidises Mn²⁺ to Mn³⁺(B) O_2 oxidises both Mn²⁺ to Mn³⁺ and Fe²⁺ to Fe³⁺(C) Fe³⁺ oxidises H₂O to O_2 (D) Mn³⁺ oxidises H₂O to O_2
- 8. Electrolysis of dilute aqueous NaCl solution was carried out by passing 10 milliampere current. The time required to liberate 0.01 mole of H₂ gas at the cathode is : (1 Faraday = 96500 C) [JEE 2008, 3/163] (A) 9.65×10^4 sec (B) 19.3×10^4 sec (C) 28.95×10^4 sec (D) 38.6×10^4 sec

Comprehension # 3

ELECTROCHEMISTRY

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) | M⁺(aq ; 0.05 molar) || M⁺(aq ; 1 molar) | M(s) For the above electrolytic cell, the magnitude of the cell potential is $|E_{cell}| = 70 \text{ mV}$. Now answer the following two questions :

- 9. [JEE 2010, 3/163] For the above cell : (A) E_{cell} < 0 ; ΔG > 0 (B) Ecell > 0; $\Delta G < 0$ (C) $E_{cell} < 0$; $\Delta G^{o} > 0$ (D) $E_{cell} > 0$; $\Delta G^{o} < 0$
- 10. If the 0.05 molar solution of M⁺ is replaced by a 0.0025 molar M⁺ solution, then the magnitude of the cell potential would be : [JEE 2010, 3/163] (B) 70 mV (C) 140 mV (D) 700 mV
 - (A) 35 mV

11. AgNO₃(aq.) was added to an aqueous KCI solution gradually and the conductivity of the solution was measured. The plot of conductance (Λ) versus the volume of AqNO₃ is : [JEE 2011, 3/180]



12. Consider the following cell reaction :

 $2Fe(s) + O_2(g) + 4H^+(aq) \rightarrow 2Fe^{2+}(aq) + 2H_2O(I)$

[JEE 2011, 3/180]

 $E^{\circ} = 1.67 V$

At $[Fe^{2+}] = 10^{-3}$ M, P(O₂) = 0.1 atm and pH = 3, the cell potential at 25°C is : 2.303R(298) F (Take = 0.06)

(A) 1.47 V (B) 1.77 V (C) 1.87 V (D) 1.57 V

Comprehension # 4

The electrochemical cell shown below is a concentration cell. M|M²⁺ (saturated solution of a sparingly soluble salt,MX₂)|| M²⁺ (0.001 mol dm⁻³) |M The emf of the cell depends on the difference in concetration of M²⁺ ions at the two electrodes. The emf of the cell at 298 is 0.059 V

2

- 13. The solubility product (K_{sp}; in mol³ dm⁻⁹) of MX₂ at 298 K based on the information available in the given concentration cell is : (Take 2.303× R × 298/F = 0.059 V) [IIT-JEE 2012, 3/66] (A) 1 × 10⁻¹⁵ (B) 4 × 10⁻¹⁵ (C) 1 x 10⁻¹² (D) 4 × 10⁻¹²
- The value of ΔG (in kJ mol⁻¹) for the given cell is : (Take 1F = 96500 C mol⁻¹) 14. [IIT-JEE 2012, 3/136] (A) – 5.7 (B) 5.7 (C) 11.4 (D) -11.4
- 15. The standard reduction potential data at 25°C is given below. [JEE(Advanced) 2013, 3/120] E^{0} (Fe³⁺.Fe²⁺) = + 0.77 V ; E^{0} (Fe²⁺.Fe) = -0.44 V; $E^{0}(Cu^{2+}.Cu) = + 0.34 V;$ $E^{\circ}(Cu^{+}.Cu) = +0.52 V;$ $E^{0}(O_{2}(g) + 4H^{+} + 4e^{-} \rightarrow 2H_{2}O) = +1.23 V;$ $E^{\circ}(O_2(g) + 2H_2O + 4e^- \rightarrow 4OH) = + 0.40 V$

 $E^{o}(Cr^{3+}.Cr) = -0.74 V;$

 $E^{0}(Cr^{2+}.Cr) = -0.91 V$

Match E^o of the rebox pair in List I with the values given in List II and select the correct answer using the code given below the lists :

	List-	·I						List-	11		
Ρ.	Eº (F	E ^o (Fe ^{3+,} Fe) 1.							– 0.18 V		
Q.	Eº (4	$E^{\circ} (4H_2O \implies 4H^+ + 4OH^-)$ 2.						-0.4	V		
R.	Eº (C	$E^{o} (Cu^{2+} + Cu \rightarrow 2Cu^{+}) \qquad \qquad$						-0.04	4 V		
S.	Eº(C	$E^{0}(Cr^{3+}, Cr^{+2})$ 4.						-0.8	3 V		
Code	s :										
	Р	Q	R	S			Р	Q	R	S	
(A)	4	1	2	3		(B)	2	3	4	1	
(C)	1	2	3	4		(D)	3	4	1	2	

16. In a galvanic cell, the salt bridge

- (A) does not participate chemically in the cell reaction.
- (B) stops the diffusion of ions from one electrode to another.
- (C) is necessary for the occurrence of the cell reaction.
- (D ensures mixing of the two electrolytic solutions.
- **17.** For the following electrochemical cell at 298 K, $Pt(s) \mid H_2(g, 1 \text{ bar}) \mid H^+(aq, 1 \text{ M}) \mid \mid M^{4+}(aq) \mid M^{2+}(aq) \mid Pt(s)$

$$\begin{bmatrix} M^{2+(aq)} \\ M^{4+(aq)} \end{bmatrix} = 10^{x}.$$

Given : $E_{M^{4+}/M^{2+}}^{0} = 0.151 \text{ V}; 2.303 \frac{\text{RT}}{\text{F}} = 0.059 \text{ V}$

The value of x is

(A) -2
(B) -1
(C) 1
(D) 2

- **18.** The conductance of a 0.0015 M aqueous solution of a weak monobasic acid was determined by using a conductivity cell consisting of platinized Pt electrodes. The distance between the electrodes is 120 cm with an area of cross section of 1 cm². The conductance of this solution was found to be 5×10^{-7} S. The pH of the solution is 4. The value of limiting molar conductivity (Λ_m^0) of this weak monobasic acid in aqueous solution is Z × 10² S cm⁻¹ mol⁻¹. The value of Z is : [JEE(Advanced) 2017, 3/124]
- **19.** For the following cell,

[JEE(Advanced) 2017, 3/124]

$$\label{eq:2.1} \begin{split} &Zn(s) \mid ZnSO_4(aq) \mid \mid CuSO_4\ (aq) \mid Cu(s) \\ & \text{when the concentration of } Zn^{2+} \text{ is 10 times the concentration of } Cu^{2+}, \text{ the expression for } \Delta G\ (\text{in J mol}^{-1}) \\ & \text{is : } [F \text{ is Faraday constant; } R \text{ is gas constant; } T \text{ is temperature; } E^o(\text{cell}) = 1.1 \text{ V}] \\ & (A) \ 2.303 \text{ RT} + 1.1 \text{ F} \qquad (B) \ 1.1 \text{ F} \qquad (C) \ 2.303 \text{ RT} - 2.2 \text{ F} \qquad (D) \ -2.2 \text{ F} \end{split}$$

[JEE(Advanced) 2016, 3/124]

[JEE(Advanced) 2014, 3/120]

Additional Problems For Self Practice (APSP)

Marked Questions may have for Revision Questions.

PART - I : PRACTICE TEST PAPER

This Section is not meant for classroom discussion. It is being given to promote self-study and self testing amongst the Resonance students.

Max. Marks : 120

Important Instructions

- 1. The test is of **1 hour** duration.
- 2. The Test Booklet consists of 30 questions. The maximum marks are 120.
- 3. Each question is allotted 4 (four) marks for correct response.
- 4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
- 5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.
- The standard electrode potentials (reduction) of Pt/Fe³⁺, Fe²⁺ and Pt/Sn⁴⁺, Sn²⁺ are + 0.77 V and 0.15 V 1. respectively at 25° C. The standard EMF of the reaction $Sn^{4+} + 2Fe^{2+} \rightarrow Sn^{2+} + 2Fe^{3+}$ is (1) - 0.62 V(2) - 0.92 V(3) + 0.31 V(4) + 0.85 VThe standard oxidation potentials, E^o, for the half reactions are as 2. $Zn \rightarrow Zn^{2+} + 2e^{-}$; $E^{0} = + 0.76 V$ $Fe \rightarrow Fe^{2+} + 2e^{-}$: $E^{0} = + 0.41 V$ The EMF for the cell : $Fe^{2+} + Zn \rightarrow Zn^{2+} + Fe$ (1) -0.35 V (2) + 0.35 V (3) + 1.17 V (4) - 1.17 V Which is/are correct among the following ? 3.

Given, the half cell emf's $\begin{array}{l} E^{0}_{Cu^{+2}|Cu} = 0.337, \ E^{0}_{Cu^{+1}|Cu} = 0.521 \\ (1) \ Cu^{+1} \ disproportionates \\ (3) \ E^{0}_{Cu}|_{Cu^{+2}} + E^{0}_{Cu^{+1}|Cu} \ is \ positive \\ \end{array}$ (4) (1) and (3) Both

$$CIO_{3}^{-} \xrightarrow{0.54 \text{ V}} CIO^{-} \xrightarrow{0.45 \text{ V}} \frac{1}{2} CI_{2}^{-} \xrightarrow{1.07\text{ V}} CI^{-}$$

$$0.76 \text{ V}$$

$$E^{\circ}$$

4.

The E° in the given figure is about : (1) 0.5 V (2) 0.6 V

5. How many g of silver will be displaced from a solution of AgNO₃ by 4 g of magnesium? (1) 18 g (2) 4 g (3) 36 g (4) 16 g

6. The standard reduction potential for Zn^{+2}/Zn ; Ni⁺²/Ni; and Fe⁺²/Fe are -0.76V, -0.23V, -0.44V respectively. The reaction X + Y⁺² --> X⁺² + Y will be non-spontaneous when :

(3) 0.7 V

(4) 0.8 V

	Х	Y		
(I)	Ni	Fe		
(11)	Ni	Zn		
(III)	Fe	Zn		
(VI)	Zn	Ni		
(1) I, II	, IV	(2) I, II, III	(3) II, III, IV	(4) all of these

7. The electrode potentials for

Max. Time : 1 Hr.

8.

ELECTROCHEMISTRY

$Cu^{2+}(aq) + e^- \rightarrow C$	u ⁺ (aq) and Cu ⁺ (aq	$+ e^- \rightarrow Cu_{(s)}$	
are +0.15 V and + 0.50	0V respectively. The valu	Le of $E^{o}_{Cu^{2+}/Cu}$ will be :	
(1) 0.500 V	(2) 0.325 V	(3) 0.650 V	(4) 0.150 V
A given cell reaction is (1) E° _{red} is negative	s spontaneous when : (2) E° _{red} is positive	(3) E ^o cell is positive	(4) E _{cell} is positive

- **9.** How much will the reduction potential of a hydrogen electrode change when its solution initially at pH = 0 is neutralised to pH = 7 at 25° C ?
 - (1) Increases by 0.059 V(3) Increases by 0.41 V

- (2) Decreases by 0.059 V
- (4) Decreases by 0.41 V
- **10.** Consider the following Galvanic cell as shown in figure. By what will value the cell voltage change when concentration of ions in anodic and cathodic compartments are both increased by factor of 10 at 298 K



- **11.**Pt | Cl_2 (P₁ atm) | HCl (0.1 M) | Cl_2 (P₂ atm) | Pt, cell reaction will be spontaneous if :
(1) P₁ = P₂(2) P₁ > P₂(3) P₂ > P₁(4) P₁ = P₂ = 1 atm
- - (1) increase the cell emf and shift equilibrium to the left.
 - (2) lower the cell emf and shift equilibrium to the right.
 - (3) increase the cell emf and shift equilibrium to the right.
 - (4) lower the cell emf and shift equilibrium to the left.
- **13.** In the galvanic cell : $Pt(s) | I_2(g) | I^-(aq) || Fe^{3+}(aq) | Fe^{2+}(aq) | Pt(s)$
 - (1) Representation of anode is incorrect and cell will not work
 - (2) $[Fe^{3+}] = [Fe^{2+}] = [I^-] = 1$ M is sufficient for $E_{cell} = \frac{E_{cell}^0}{1}$
 - (3) I^- gets oxidized to I_2 and Fe^{3+} gets reduced to $Fe^{2+}.$
 - (4) None of these
- 14. The chemical reaction, 2AgCl(s) + H₂ (g) → 2HCl (aq) + 2Ag (s) taking place in a galvanic cell (under standard condition) is represented by the notation. (1) Pt(s) | H₂ (g), 1 bar | 1 M KCl (aq) | AgCl(s) | Ag (s)
 - (2) $\mathsf{Pt}(s) \mid \mathsf{H}_2\left(g\right),$ 1 bar \mid 1 M HCl (aq) \mid 1 M Ag^{\scriptscriptstyle +}\left(aq\right) \mid Ag (s)
 - (3) $Pt(s) \mid H_2(g)$, 1 bar | 1 M HCl (aq) | AgCl (s) | Ag (s)
 - (4) $Pt(s) \mid H_2(g)$, 1 bar | 1 M HCI (aq) | Ag (s) | AgCI (s)
- **15.** For the cell, $Pt | H_2(g) | H^+(aq) || Cu^{2+}(aq) | Cu(s)$

	$E^{\circ}_{Cu/Cu^{2+}} = -0.34 V$							
	Then calculate approxi	mate value of K _{eq} ?						
	(1) 5 × 10 ¹²	(2) 2 × 10 ¹¹	(3) 2 × 10 ⁻¹¹	(4) 5 × 10 ⁻¹²				
16.	A 5 ampere current is deposited at the cathoo	passed through a solution le is :	on of zinc sulphate for 4	0 minutes. The amount of zinc				
	(1) 40.65 g	(2) 4.065 g	(3) 0.4065 g	(4) 65.04 g				
17.	Cost of electricity for th the production 'X' litre C (1) 2X	e production of 'X' litre H 02 gas at NTP at anode w (2) 4X	 at NTP at cathode is R ill : (assume 1 mole of ele (3) 16X 	ectrons as one unit of electricity for(4) 32X				
18.	A current of 0.1 A was p was deposited on the c (1) 79 %	bassed for 965 second th athode. Calculate the cu (2) 39.5 %	rough a solution of Cu ⁺ s rrent efficiency for the co (3) 63.25 %	olution and 0.03175 g of copper pper deposition. (Cu – 63.5) (4) 50 %				
19.	A current is passed throand second has Y_2SO_4 the mass of X liberated	ough 2 voltameters conn (aq.). The relative atomi to the mass of Y liberate	ected in series. The first c masses of X and Y are ed is	voltameter contains XSO ₄ (aq.) in the ratio of 2 : 1. The ratio of				
	(1) 1.1	(2) 1.2	(3) 2 . 1					
20.	A current of 9.95 amp f	ollowing for 10 minutes,	deposits 3 g of a metal. E	Equivalent weight of the metal is				
	(1) 12.5	(2) 18.5	(3) 21.5	(4) 48.5				
21.	The ratio of wt. deposit $3:2:1$ then the ratio o (1) 1:1:1	ted of metal x, y, z on pa f equivalent weights for t (2) 1 : 2 : 3	assing electric charge in he above metals respect (3) 3 : 2 : 1	ratio of 1 : 2 : 3 respectively is ively is : (4) 9 : 3 : 1				
22.	Charge produced in but (1) 26 F	tane – O ₂ Fuel cell if 2 m (2) 49 F	ol butane is consumed, v (3) 21 F	vill be : (4) 52 F				
23.	A resistance of 50 Ω is solution of a strong ele in figure. If the solution submerge the electrode	registered when two ele ctrolyte such that exactly is diluted by adding pur- es, the new resistance of	ctrodes are suspended i half of the them are sub water (negligible condu- fered by the solution wou- mathinspace in the solution wou- mat	nto a beaker containing a dilute omerged into solution as shown uctivity) so as to just completely uld be :				
	(1) 50 Ω	(2) 100 Ω	(3) 25 Ω	(4) 200 Ω				
24.	The specific conductan	ce of a N/10 KCl at 25°C	; is 0.0112 ohm ⁻¹ cm ⁻¹ . T	he resistance of cell containing				

- 24. The specific conductance of a N/10 KCl at 25°C is 0.0112 ohm⁻¹ cm⁻¹. The resistance of cell containing solution at the same temperature was found to be 55 ohms. The cell constant will be :
 (1) 6.16 cm⁻¹
 (2) 0.616 cm⁻¹
 (3) 0.0616 cm⁻¹
 (4) 616 cm⁻¹
- **25.** The equivalent conductance of a N/10 NaCl solution at 25°C is 10^{-2} Sm²eq⁻¹. Resistance of solution contained in the cell is 50 Ω . Cell constant is : (1) 50 m⁻¹ (2) 50 × 10^{-6} m⁻¹ (3) 50 × 10^{-3} m⁻¹ (4) 50 × 10^{3} m⁻¹
- **26.**For an NaCl (aq.) solution, which of the following quantities go to zero as NaCl concentration goes to
zero ? (Assume the solvent's contribution to conductivity has been subtracted off).
(1) Λ_m (2*) κ (3) $\Lambda_m(Na^+)$ (4) $\Lambda_m(Cl^-)$
- **27.** Find the value of λ_{eq}^{α} for potash alum.

 $\begin{array}{l} \text{Given}: \ \ ^{\lambda^{\alpha}_{m(K^{+})}} = 73.5 \ \Omega^{-1}\text{cm}^{2}\text{mol}^{-1}, \ \ ^{\lambda^{\alpha}_{m(A^{l^{+3}})}} = 198\Omega^{-1}\text{cm}^{2}\text{mol}^{-1}, \ \ ^{\lambda^{\alpha}_{m(SO_{4}^{-1})}} = 160 \ \Omega^{-1}\text{cm}^{2}\text{mol}^{-1} \\ \text{(1)} \ 145.6 \ \Omega^{-1}\text{cm}^{2}\text{eq}^{-1} \\ \text{(2)} \ 1165 \ \Omega^{-1}\text{cm}^{2}\text{eq}^{-1} \\ \text{(3)} \ 532 \ \Omega^{-1}\text{cm}^{2}\text{eq}^{-1} \\ \text{(4)} \ 195.5 \ \Omega^{-1}\text{cm}^{2}\text{eq}^{-1} \\ \end{array}$

28. A graph of molar conductivity of three electrolytes (NaCl, HCl and NH₄OH) is plotted against \sqrt{C}



Which of the following options is correct ?

	(1)	(2)	(3)
(1)	NaCl	HCI	NH₄OH
(2)	NH₄OH	NaCl	HCI
(3)	HCI	NaCl	NH₄OH
(4)	NH₄OH	HCI	NaCl

29. 0.1 molar solution NaCl filled in different conductivity cell. Order of equivalent conductance of NaCl solution is :

	Cell – 1	Cell – 2	Cell – 3
Α	5 cm ²	6 cm ²	10 cm ²
I	2 cm	3 cm	4 cm ²
Equivalents :	а	b	С
conductance	A = Area of cross se	ection	
	I = distance betwee	n two electrode.	
(1) Cell – 1 > 0	Cell – 2 > Cell – 3	(2) Ce	ell – 1 = Cell – 2 = Cell – 3
(3) Cell – 1 > 0	Cell – 3 < Cell – 2	(4) No	one of these

- **30.** Acetic acid is titrated with NaOH solution. Which of the following statement is correct for this titration? (1) conductance increases upto equivalence point, then it decreases
 - (2) conductance increases upto equivalence point, then it increases
 - (3) first conductance increases slowly upto equivalence point and then increases rapidly
 - (4) first conductance increases slowly upto equivalence point and then drops rapidly .

Practice Test (IIT-JEE (Main Pattern))

OBJECTIVE RESPONSE SHEET (ORS)

				-			-	-		
Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

PART - II : PRACTICE QUESTIONS

ELECTROCHEMISTRY

1.	Strongest reducing age (1) K	nt is : (2) Mg	(3) AI	(4) I				
2.	The position of some metals in the electrochemical series in decreasing electropositive character is given as Mg > Al > Zn > Cu > Ag. What will happen if a copper spoon is used to stir a solution of aluminium nitrate?							
	(3) The solution become	es blue	(4) There is no reaction					
3.	What will be the emf for Pt H ₂ (g, P ₁) H ⁺ (aq) $\frac{RT}{F} ln \frac{P_1}{P_2}$	the given cell ? $ H_2 (g, P_2) Pt$ $\frac{RT}{2F} ln \frac{P_1}{P_2}$	$(3) \frac{\text{RT}}{\text{F}} \ln \frac{\text{P}_2}{\text{P}_1}$	(4) None of these				
4.	Which of the following v	vill increase the voltage o	of the cell with following c	cell reaction				
	Sn _(s) + 2Ag ⁺ _(aq) \rightarrow Sn ⁺² _{(a} (1) Increase in the size (3) Increase in the conc	_{lq)} + 2Ag _(s) of silver rod entration of Ag⁺ ions	(2) Increase in the cond(4) Increase in the value	entration of Sn ²⁺ ions e of equilibrium constant				
5.	108 g fairly concentrate solution is :	solution of AgNO₃ is elec	ctrolyzed using 0.1 F of el	ectricity. The weight or resulting				
	(1) 94 g	(2) 11.6 g	(3) 96.4 g	(4) None				
6	20 ml KOH solution was	s titrated with 0.2 mol/l H	2SO4 solution in conduct	vity cell				
	15 $300 Volume of H2SO4 (ml)$							
	Concentration of KOH s (1) 0.3 M	olution was (2) 0.15	(3) 0.12	(4) None of these				
7.	Silver is removed electr How long will it take to r (1) 10 sec.	rolytically from 200 ml. o remove half of the silver t (2) 16 sec.	f a 0.1 N solution of AgN from the solution : (3) 100 sec.	IO ₃ by a current of 0.1 ampere. (4) 9650 sec.				
8.	 Which statement is correct. (1) A solution of copper (II) sulphate can be stored in iron vessel. (2) An oxide layer on zinc vessel can be easily removed by washing with dilute HCI. (3) Molten PbBr₂ is good conductor of electricity because it contains free ions. 							
	(4) In the reaction, Li +	2 H ₂ \rightarrow LiH, hydrogen is	a reducing agent.					
9.	$Zn Zn^{2+} (C_1) Zn^{2+} (C_2)$ (1) $C_1 = C_2$	2) Zn. for this cell ∆G is n (2) C1 > C2	egative if - (3) $C_2 > C_1$	(4) None				
10.	If a salt bridge is remov (1) drops to zero	ed from the two half cells (2) does not change	s, the voltage: (3) increases gradually	(4) increases rapidly				
11.	A metal having negative (1) to pass into the solu (3) to become electrical	e reduction potential whe tion ly positive	n dipped in the solution ((2) to be deposited from (4) to remain neutral	of its own ions, has a tendency: In the solution				

12.	Time required to deposit one millimole of aluminium metal by the passage of 9.65 amperes through aqueous solution of aluminium ion is :						
	(1) 30 s	(2) 10 s	(3) 30,000 s	(4) 10,000 s			
13.	If ^{E⁰_{Au⁺ / Au}} is 1.69 V and (1) 0.19 V	E ⁰ _{Au³⁺/Au} is 1.40 V, then (2) 2.945 V	E ⁰ _{Au⁺/Au³⁺} (3) 1.255 V	(4) None of these			
14.	If the pressure of hy- concentration constant (1) 0.059 V	drogen gas is increased t at 1M, the voltage of the (2) – 0.059 V	d from 1 atm. to 100 a e hydrogen half cell is at (3) 0.295 V	atm, keeping the hydrogen ion 25°C will be (4) 0.118 V			
15.	The standard free ener ?	gy change for the following	ng reaction is – 210 kJ. V	Vhat is the standard cell potential			
	$2H_2O_2$ (aq) $\rightarrow 2H_2O_2$	₂ O (ℓ) + O ₂ (g)					
	$2H_2O_2$ (aq) $\rightarrow 2H_2O_2$	₂O (ℓ) + O₂ (g)					
	(1) +0.752	(2) +1.09	(3) +0.420	(4) +0.640			
16.	When a lead storage b (1) PbO ₂ dissolves (2) The lead electrode (3) Sulphuric acid is re (4) The amount of acid	attery is charged : becomes coated with le generated decreases	ad sulphate				
17.	If x specific resistance (in S cm ² mol–1) is give $\frac{1000x}{y}$	(in S ₋₁ cm) of the electro en by : $1000 \frac{x}{y}$	blyte solution and y is the $\frac{1000}{xy}$	molarity of the solution, then Λ_m			
18.	The limiting conductivit limiting equivalent ionic for Na+ ions would be	ty of NaCl, KCl and KBr a c conductance for Br– is	(5) are 126.5, 150.0 and 151 78 S cm2 eq-1. The limiti	.5 S cm ₂ eq ₋₁ , respectively. The ng equivalent ionic conductance			
19.	 (1) 128 The specific conducta conductivity of Ag+ an (molar mass of AgBr = 	(2) 125 ance of a saturated solu d Br– ions are x and y, 188)	(3) 49 ution of silver bromide respectively. The solubil	(4) 50 is κ S cm-1. The limiting ionic lity of silver bromide in gL-1 is :			
	(1) $\frac{\kappa \times 1000}{x-y}$	(2) $\frac{\kappa}{x+y} \times 188$	$(3) \frac{\kappa \times 1000 \times 188}{x + y}$	$(4) \frac{x+y}{\kappa} \times \frac{1000}{188}$			
20.	Molar conductance of dilution is 380.8 ohm-1 (1) 226 × 10-5 mol dm- (3) 1.66 × 10-2 mol dm	0.1 M acetic acid is 7 oh cm2 mol-1, the value of -3 -3	m-1 cm2 mol-1. If the mo dissociation constant will (2) 1.66 × 10-3 mol dm (4) 3.442 × 10-5 mol dr	lar cond. of acetic acid at infinite be : -1 m-3			
21.	Equivalent conductand 200 ohm–1 cm2, equiv- (1) 5%	ce of 1M CH ₃ COOH is -1. Hence % ionisation of (2) 2%	10 ohm-1 cm2 equiv-1 CH ₃ COOH is : (3) 4%	and that at infinite dilution is (4) 1%			