EXERCISE-I

Electrolytes and Electrolysis

- 1. Which of the following compounds will not undergo decomposition on passing electricity through aqueous solution
 - (A) Sugar (B) Sodium Chloride
 - (C) Sodium Bromide (D) Sodium Acetate
- **2.** During the electrolysis of an electrolyte, the number of ions produced, is directly proportional to the
 - (A) Time consumed
 - (B) Electro chemical equivalent of electrolysis
 - (C) Quantity of electricity passed
 - (D) Mass of electrons
- **3.** When the sample of copper with zinc impurity is to be purified by electrolysis, the appropriate electrodes are

Cathode	Anode
(A) Pure zinc	Pure copper
(B) Impure sample	Pure copper
(C) Impure zinc	Impure sample
(D) Pure copper	Impure sample

- **4.** In the electrolytic cell, flow of electrons is from
 - (A) Cathode to anode in solution
 - (B) Cathode to anode through external supply
 - (C) Cathode to anode through internal supply
 - (D) Anode to cathode through internal supply
- **5.** An electric current is passed through an aqueous solution of the following. Which one shall decompose
 - (A) Urea (B) Glucose
 - (C) $AgNO_3$ (D) Ethyl alcohol
- 6. The electric conduction of a salt solution in water depends on the
 - (A) Shape of its molecules
 - (B) Size of its molecules
 - (C) Size of solvent molecules
 - (D) Extent of its ionization

7. A solution of sodium sulphate in water is electrolysed using inert electrodes. The products at the cathode and anode are respectively

(A) H_2, O_2	(B) O_2, H_2
(C) O_{2} . Na	(D) O_{2} , SO_{2}

8. On electrolysing a solution of dilute H_2SO_4 between platinum electrodes, the gas evolved at the anode is

(A) SO_2	(B) <i>IF</i> ₅
(C) <i>O</i> ₂	(D) <i>H</i> ₂

- **9.** The addition of a polar solvent to a solid electrolyte results in
 - (A) Polarization(B) Association(C) Ionization(D) Non-liberationof heat
- **10.** During the electrolysis of fused *NaCl*, which reaction occurs at anode
 - (A) Chloride ions are oxidized
 - (B) Chloride ions are reduced
 - (C) Sodium ions are oxidised
 - (D) Sodium ions are reduced
- **11.** Electrolysis is a process in which the cations and anions of the electrolyte are
 - (A) Hydrated (B) Hydrolysed
 - (C) Charged (D) Discharged
- **12.** Degree of ionisation of a solution depends upon
 - (A) Temperature
 - (B) Nature of the electrolyte
 - (C) Nature of the solvent
 - (D) None of these
- 13. Which of the following is non-electrolytes

(A) NaCl	(B) CaCl ₂
(C) $C_{12}H_{22}O_{11}$	(D) CH_3COOH

- 14. When a molten ionic hydride is electrolysed
 - (A) Hydrogen is liberated at the cathode
 - (B) Hydrogen is liberated at the anode
 - (C) There is no reaction
 - (D) H^- ions produced migrate to the cathode
- **15.** During electrolysis, the species discharged at cathode are
 - (A) Ions(B) Cation(C) Anion(D) All of these

Faraday's law of electrolysis

16. Unit of Faraday is

(A) Ampere (B)	Coulomb
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(C) Coulomb $mole^{-1}$ (D) Coulomb Sec^{-1}

17. On passing 0.1 Faraday of electricity through aluminium chloride, the amount of aluminium metal deposited on cathode is (Al = 27)

(A) 0.9 <i>gm</i>	(B) 0.3 <i>gm</i>
(C) 0.27 <i>gm</i>	(D) 2.7 gm

- **18.** Which of the following represents the first law of Faraday
 - (A) $E = mc^2$ (B) E = hv
 - (C) m = ect (D) PV = nRT
- 19. 5 amperes is passed through a solution of zinc sulphate for 40 minutes. Find the amount of zinc deposited at the cathode

(A) 40.65 gm	(B) 4.065 <i>gm</i>
(C) 0.4065 gm	(D) 65.04 gm

20. In an electroplating experiment m g of silver is deposited, when 4 amperes of current flows for 2 minutes. The amount (in *gms*) of silver deposited by 6 amperes of current flowing for 40 seconds will be

(A) 4 <i>m</i>	(B) <i>m</i> / 2
(C) <i>m</i> / 4	(D) 2 <i>m</i>

21. On passing 3 *ampere* of electricity for 50 minutes, 1.8 *gram* metal deposits. The equivalent mass of metal is

(A) 20.5	(B) 25.8
(C) 19.3	(D) 30.7

22. The desired amount of charge for obtaining one mole of Al from Al^{3+} (A) $3 \times 96500 C$ (B) 96500 C

(C)
$$\frac{96500}{3}C$$
 (D) $\frac{96500}{2}C$

23. On passing one faraday of electricity through the electrolytic cells containing Ag^+ , Ni^{+2} and Cr^{+3} ions solution, the deposited Ag (At. wt. = 108), Ni (At.wt. = 59) and Cr (At.wt. = 52) is

Ag	Ni	Cr
(A) 108 gm	29.5 gm	17.3 gm
(B) 108 gm	59.0 gm	52.0 gm
(C) 108.0 gm	108.0 gm	108.0 gm
(D) 108 gm	117.5 gm	166.0 gm

- **24.** One Faraday of electricity when passed through a solution of copper sulphate deposits
 - (A) 1 mole of Cu
 - (B) 1 gm atom of Cu
 - (C) 1 molecule of Cu
 - (D) 1 gm equivalent of Cu
- **25.** When 1 coulomb of charge is passed through electrolyte solution, then the mass deposited is equal to
 - (A) Equivalent weight
 - (B) Atomic weight
 - (C) Electrochemical equivalent
 - (D) Chemical equivalent
- **26.** In a metal oxide, there is 20% oxygen by weight. Its equivalent weight is

27. On the basis of the information available from the reaction $\frac{4}{3}Al + O_2 \rightarrow \frac{2}{3}Al_2O_3$, $\Delta G = -827kJmol^{-1}$

of O_2 , the minimum *emf* required to carry out an electrolysis of Al_2O_3 is $(F = 96500C \ mol^{-1})$

(A) 8.56 V
(B) 2.14 V
(C) 4.28 V
(D) 6.42 V

28. Then during electrolysis of a solution of 36. The mass deposited at an electrode is directly AgNO₃, 9650 coulombs of charge pass proportional to through the electroplating bath, the mass of (A) Atomic weight (B) Equivalent weight silver deposited in the cathode will be (C) Molecular weight (D) Atomic number (A) 1.08 g 37. From the solution of which of the following (B) 10.8 g one faraday of electricity will liberate one (C) 21.6 g (D) 108 g gram atom of metal 29. Total charge on 1 mole of a monovalent metal (A) NaCl ion is equal to (B) $BaCl_2$ (A) 9.65×10^4 Coulomb (B) 6.28×10^{18} Coulomb (C) $CuSO_4$ (D) $AlCl_3$ (C) 1.6×10^{-19} Coulomb (D) None of these 38. On electrolysis, 1 mole of aluminium will be deposited from its molten salt by 30. When an electric current is passed through (A) 3 moles of electrons acidulated water 112 ml of hydrogen gas at (B) 4 moles of electrons N.T.P. collect at the cathode in 965 seconds. (C) 2 moles of electrons The current passed, in amperes is (D) 1 mole of electrons (A) 1.0 (B) 0.5 **39.** The atomic weight of *Fe* is 56. The weight (C) 0.1 (D) 2.0 of Fe deposited from $FeCl_3$ solution by 31. How much chlorine will be liberated on passing one ampere current for 30 minutes passing 0.6 Faraday of electricity is through NaCl solution (A) 5.6 g (B) 11.2 g (A) 0.66 *mole* (B) 0.33 mole (C) 22.4 g (D) 33.6 g (C) 0.66 gm (D) 0.33 gm 40. 2.5 F of electricity are passed through a 32. The number of electrons involved in redox $CuSO_4$ solution. The number of gm equivalent reactions when a Faraday of electricity is of Cu deposited on anode is passed through an electrolyte in solution is (A) Zero (B) 1.25 (B) 6×10^{-23} (A) 6×10^{23} (C) 2.5 (D) 5.0 (D) 8×10^{19} 41. The equivalent weight of a certain trivalent (C) 96500 element is 20. Molecular weight of its oxide is **33.** Coulomb is equal to (B) 56 (A) 152 (A) $ampere \times second$ (B) $ampere \times minute$ (C) 168 (D) 68 (C) watt \times second (D) volt \times second 42. Silver is removed electrically from 200 ml of a 34. The energy required to release 1 electron from 0.1 N solution of $AgNO_3$ by a current of 0.1 He^+ is..... ampere. How long will it take to remove half $(A) + 54.4 \ eV$ of the silver from the solution (B) - 13.6 eV(B) 96.5 sec (A) 16 sec $(C) + 27.2 \ eV$ (C) 100 sec (D) 10 sec (D) Cannot be predicted 43. In order to separate oxygen from one mole of 35. Faraday's laws of electrolysis are related to the H_2O the required quantity of coulomb would (A) Atomic number of cation be (B) Atomic number of anion (B) 9.6×10^4 (A) 1.93×10^5 (C) Equivalent weight of the electrolyte (D) 3.2 (C) 1.8 (D) Speed of the cation

- 44. A current of 0.25*A* is passed through $CuSO_4$ solution placed in voltameter for 45 *minutes*. The amount of *Cu* deposited on cathode is (At weight of *Cu* = 63.6)
 - (A) 0.20 g (B) 0.22 g
 - (C) 0.25 g (D) 0.30 g
- **45.** Faraday constant
 - (A) Is a numerical constant
 - (B) Depends on equivalent
 - (C) Depends upon the current passed
 - (D) Depends on the number of electrons

Conductor and conductance

- **46.** Which of the following conducts electricity
 - (A) Fused NaCl (B) CO_2
 - (C) Br_2 (D) Si
- **47.** Which of the following shows electrical conduction
 - (A) Potassium (B) Graphite
 - (C) Diamond (D) Sodium
- **48.** The unit of equivalent conductivity is (A) *ohm cm*
 - (B) $ohm^{-1}cm^2 (gm \ equivalent)^{-1}$
 - (C) ohm cm² (gm equivalent)
 - (D) $S cm^{-2}$
- **49.** It has been observed that gaseous hydrogen chloride is a very poor conductor of electricity but a solution of hydrogen chloride gas in water is a good conductor of electricity. This is due to the fact that
 - (A) Water is good conductor of electricity
 - (B) Hydrogen chloride gas in water solution ionizes
 - (C) A gas is non-conductor but a liquid conducts electricity
 - (D) Gas does not obey Ohm's law whereas solution does

- **50.** Electrolytic conduction differs from metallic conduction in that in the case of electrolytic conduction
 - (A) The resistance increases with increasing temperature
 - (B) The resistance decreases with increasing temperature
 - (C) The flow of current does not generate heat
 - (D) The resistance is independent of the length of the conductor
- **51.** The electrolytic conductance is a direct measure of
 - (A) Resistance (B) Potential
 - (C) Concentration (D) Dissociation
- **52.** Conductivity of a strong electrolyte
 - (A) Increases on dilution
 - (B) Does not change considerably on dilution
 - (C) Decreases on dilution
 - (D) Depends on density
- **53.** Which of the following statements is not applicable to electrolytic conductors
 - (A) New products show up at the electrodes
 - (B) Ions are responsible for carrying the current
 - (C) Show a positive temperature coefficient for conductance
 - (D) A single stream of electrons flows from cathode to anode
- 54. Which one is not a conductor of electricity
 - (A) NaCl (aqueous) (B) NaCl (solid)
 - (C) NaCl (molten) (D) Ag metal
- **55.** Solid sodium chloride is bad conductor of electricity because
 - (A) It contains only molecules
 - (B) It does not possess ions
 - (C) The ions present in it are not free to move
 - (D) It does not contain free molecules

Cell constant and Electrochemical Cells

- **56.** A cell from the following which converts electrical energy into chemical energy
 - (A) Dry cell
 - (B) Electrochemical cell
 - (C) Electrolytic cell
 - (D) None of these
- **57.** In the cell $Zn | Zn^{2+} || Cu^{2+} | Cu$, the negative electrode is
 - (A) Cu (B) Cu^{2+}
 - (C) Zn (D) Zn^{2+}
- **58.** Which of the following statements is correct ? Galvanic cell converts
 - (A) Chemical energy into electrical energy
 - (B) Electrical energy into chemical energy
 - (C) Metal from its elemental state to the combined state
 - (D) Electrolyte into individual ions
- **59.** Hydrogen–oxygen fuel cells are used in space–craft to supply
 - (A) Power for heat and light
 - (B) Power for pressure
 - (C) Oxygen
 - (D) Water
- **60.** The standard cell potential of $Zn | Zn^{2+}_{(aq)} || Cu^{2+}_{(aq)} | Cu$ cell is 1.10 V. The maximum work obtained by this cell will be

(A) $106.15 \ kJ$ (B) $- 212.30 \ kJ$ (C) $- 318.45 \ kJ$ (D) $- 424.60 \ kJ$

- **61.** The relationship between standard reduction potential of cell and equilibrium constant is shown by
 - (A) $E_{cell}^{0} = \frac{n}{0.059} \log K_{c}$ (B) $E_{cell}^{0} = \frac{0.059}{n} \log K_{c}$ (C) $E_{cell}^{0} = 0.059 n \log K_{c}$ (D) $E_{cell}^{0} = \frac{\log K_{c}}{n}$

- **62.** Consider the Galvanic cell $Zn^{\Theta} | ZnSO_4 || CuSO_4 | Cu^{\oplus}$ the reaction at cathode is
 - (A) $Zn^{2+} + 2e^- \rightarrow Zn$
 - (B) $Cu^{2+} + 2e^- \rightarrow Cu$
 - (C) $Cu^{2+} + Zn \rightarrow Cu + Zn^{2+}$
 - (D) $Zn^{2+} + Cu \rightarrow Zn + Cu^{2+}$
- 63. The cell reaction $Cu + 2Ag^+ \rightarrow Cu^{+2} + Ag$ is best represented by
 - (A) $Cu_{(s)} | Cu^{+2}_{(aq)} || Ag^{+}_{(aq)} | Ag_{(s)}|$
 - (B) $Pt | Cu^{+2} || Ag^{+}_{(aq)} | Ag_{(s)}$
 - (C) $Cu^{+2} | Cu || Pt | Ag$
 - (D) None of the above representations
- **64.** $Zn_{(s)} | Zn^{2+}_{(aq)} | | Cu^{2+}_{(aq)} | Cu_{(s)}$ is (anode) (cathode)
 - (A) Weston cell(B) Daniel cell(C) Calomel cell(D) Faraday cell
- **65.** The specific conductance of a solution is 0.2 $ohm^{-1}cm^{-1}$ and conductivity is 0.04 ohm^{-1} . The cell constant would be

(A)
$$1 \ cm^{-1}$$
 (B) $0 \ cm^{-1}$
(C) $5 \ cm^{-1}$ (D) $0.2 \ cm^{-1}$

- **66.** In electroplating, the article to be electroplated serves as
 - (A) Cathode(B) Electrolyte(C) Anode(D) Conductor
- **67.** 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
 - (A) The spoon will get coated with Al
 - (B) An alloy of *Cu* and *Al* is formed
 - (C) The solution becomes blue
 - (D) There is no reaction

- **68.** In a electrochemical cell
 - (A) Potential energy changes into kinetic energy
 - (B) Kinetic energy changes into potential energy
 - (C) Chemical energy changes into electrical energy
 - (D) Electrical energy changes into chemical energy
- 69. In galvanic cell, the salt bridge is used to
 - (A) Complete the circuit
 - (B) Reduce the electric resistance in the cell
 - (C) Separate cathode from anode
 - (D) Carry salts for the chemical reaction
- **70.** If a strip of *Cu* metal is placed in a solution of ferrous sulphate
 - (A) Copper will precipitate out
 - (B) Iron will precipitate out
 - (C) Copper will dissolve
 - (D) No reaction will take place
- **71.** Which of the following is not used to construct salt bridge
 - (A) CH_3COOK (B) KCl
 - (C) NH_4NO_3 (D) KNO_3
- 72. The reference electrode is made by using
 - (A) $ZnCl_2$ (B) $CuSO_4$
 - (C) $HgCl_2$ (D) Hg_2Cl_2
- **73.** In a hydrogen oxygen fuel cell, combustion of hydrogen occurs to
 - (A) Produce high purity water
 - (B) Create potential difference between the two electrodes
 - (C) Generate heat
 - (D) Remove adsorbed oxygen from electrode surfaces

74. $\lambda_{CICH_{2}COONa} = 224 \, ohm^{-1} cm^{2} gmeq^{-1}$,

 $\lambda_{NaCl} = 38.2 \, ohm^{-1} cm^2 \, gmeq^{-1} \,,$

 $\lambda_{HCl} = 203 \, ohm^{-1} cm^2 gmeq^{-1},$

- What is the value of $\lambda_{CICH,COOH}$
- (A) $288.5 ohm^{-1}cm^2 gmeq^{-1}$
- (B) $289.5 ohm^{-1}cm^2 gmeq^{-1}$
- (C) $388.5 ohm^{-1}cm^2 gmeq^{-1}$
- (D) $59.5 ohm^{-1}cm^2 gmeq^{-1}$
- **75.** Which of the following statement is true for the electrochemical Daniel cell
 - (A) Electrons flow from copper electrode to zinc electrode
 - (B) Current flows from zinc electrode to copper electrode
 - (C) Cations move toward copper electrode which is cathode
 - (D) Cations move toward zinc electrode

Electrode potential, E_{Cell}, Nernt equation and ECS

76. The correct representation of Nernst's equation is

(A)
$$E_{M^{n+}/M} = E_{M^{n+}/M}^{o} + \frac{0.0591}{n} \log(M^{n+})$$

(B) $E_{M^{n+}/M} = E_{M^{n+}/M}^{o} - \frac{0.0591}{n} \log(M^{n+})$

(C)
$$E_{M^{n+}/M} = E_{M^{n+}/M}^{o} + \frac{n}{0.0591} \log(M^{n+})$$

- (D) None of the above
- **77.** Standard electrode potential of *NHE* at 298 K is
 - (A) 0.05 V
 (B) 0.1 V
 (C) 0.00 V
 (D) 0.11 V
- **78.** When a copper wire is placed in a solution of $AgNO_3$, the solution acquires blue colour. This is due to the formation of
 - (A) Cu^{2+} ions
 - (B) Cu^+ ions
 - (C) Soluble complex of copper with $AgNO_3$
 - (D) Cu^{-} ion by the reduction of Cu

- **79.** Consider the reaction $M_{(ag)}^{n+} + ne^- \rightarrow M_{(s)}$. The standard reduction potential values of the elements M_1, M_2 and M_3 are -0.34V, -3.05Vand -1.66V respectively. The order of their reducing power will be
 - (A) $M_1 > M_2 > M_3$ (B) $M_3 > M_2 > M_1$ (C) $M_1 > M_3 > M_2$ (D) $M_2 > M_3 > M_1$
- 80. $E^0 = \frac{RT}{nE}$ In K_{eq} . This is called
 - (A) Gibb's equation
 - (B) Gibb's-Helmholtz equation
 - (C) Nernst's equation
 - (D) Vander Waal's equation
- 81. Four alkali metals A, B, C and D are having respectively standard electrode potential as -3.05,-1.66,-0.40 and 0.80. Which one will be the most reactive

(A) A	(B) B
(C) C	(D) D

82. Which one of the following metals cannot evolve H_2 from acids or H_2O or from its compounds

(A) Hg	(B) <i>Al</i>
(C) <i>Pb</i>	(D) <i>Fe</i>

- 83. Which one of the following reaction is not possible
 - (A) $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$
 - (B) $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$
 - (C) $2KBr + I_2 \rightarrow 2KI + Br_2$
 - (D) $CuO + H_2 \rightarrow Cu + H_2O$
- 84. When a rod of metal A is dipped in an aqueous solution of metal B (concentration of B^{2+} ion being 1M) at $25^{\circ}C$, the standard electrode potentials are $A^{2+} / A = -0.76$ volts, $B^{2+}/B = +0.34$ volts
 - (A) A will gradually dissolve
 - (B) B will deposit on A
 - (C) No reaction will occur
 - (D) Water will decompose into H_2 and O_2

- **85.** The reaction $Zn^{2+} + 2e^- \rightarrow Zn$ has a standard potential of -0.76V. This means (A) Zn can't replace hydrogen from acids (B) Zn is a reducing agent
 - (C) Zn is a oxidising agent
 - (D) Zn^{2+} is a reducing agent
- 86. A cell constructed by coupling a standard copper electrode and a standard magnesium electrode has emf of 2.7 volts. If the standard reduction potential of copper electrode is + 0.34 volt that of magnesium electrode is $(A) + 3.04 \ volts$ $(B) - 3.04 \ volts$ (D) - 2.36 volts (C) + 2.36 volts
- 87. When $E_{A\rho^+/A\rho}^o = 0.8 \text{ volt}$ and $E_{Zn^{2+}/Zn}^o = -0.76$ *volt*, which of the following is correct
 - (A) Ag^+ can be reduced by H_2
 - (B) Ag can oxidise H_2 into H^+
 - (C) Zn^{2+} can be reduced by H_2
 - (D) Ag can reduce Zn^{2+} ion
- 88. Adding powdered lead and iron to a solution that is 1.0 M in both Pb^{2+} and Fe^{2+} ions, would result a reaction, in which
 - (A) More iron and Pb^{2+} ions are formed
 - (B) More lead and Fe^{2+} ions are formed
 - (C) Concentration of both Pb^{2+} and Fe^{2+} ions increases

(D) There is no net change

89. Given standard electrode potentials

$$Fe^{++} + 2e^{-} \rightarrow Fe; \quad E^{o} = -0.440 V$$

 $Fe^{+++} + 3e^{-} \rightarrow Fe; E^{\circ} = -0.036 V$

The standard electrode potential (E°) for

 $Fe^{+++} + e^- \rightarrow Fe^{++}$ is

(A) - 0.476 V(B) - 0.404 V(D) +0.771 V(C) + 0.404 V

90. Reduction potential of four elements P, Q, R, S is -2.90, +0.34, +1.20 and -0.76. Reactivity decreases in the order (B) O > P > R > S

- (A) P > Q > R > S
- (C) R > O > S > P(D) P > S > O > R

91. Which of the following metal can deposit copper from copper sulphate solution(A) Mercury(B) Iron

(C) Gold (D) Platinum
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- **92.** Standard electrode potential of Ag^+ / Ag and Cu^+ / Cu is +0.80V and +0.34V respectively. these electrodes are joint together by salt bridge if
 - (A) Copper electrode is work like cathode, then E_{cell}^o is +0.45V
 - (B) Silver electrode is work like anode then E_{cell}^o is -0.34V
 - (C) Copper electrode is work like anode then E_{cell}^o is +0.46V
 - (D) Silver electrode is work like cathode then E_{cell}^{o} is -0.34V
- **93.** The reaction is spontaneous if the cell potential is

(A) Positive (B) Negative

(C) Zero (D) Infinite

94. Which substance eliminates bromine from *KBr* solution

(A) I_2 (B) Cl

- (C) HI (D) SO_2
- **95.** A standard hydrogen electrode has zero electrode potential because
 - (A) Hydrogen is easiest to oxidise
 - (B) The electrode potential is assumed to be zero
 - (C) Hydrogen atom has only one electron
 - (D) Hydrogen is the lightest element
- **96.** E° for the cell $Zn | Zn^{2+}(aq) || Cu^{2+}(aq) | Cu$ is 1.10V at 25°C, the equilibrium constant for the reaction $Zn + Cu^{2+}(aq) = Cu + Zn^{2+}(aq)$ is of the order of

(A) 10^{-28}	(B) 10^{-37}
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(C) 10^{+18} (D) 10^{+17}

97. Standard reduction potentials at $25^{\circ}C$ of $Li^+ \mid Li, Ba^{2+} \mid Ba, Na^+ \mid Na$ and $Mg^{2+} \mid Mg$ are -3.05, -2.90, -2.71 and -2.37 volt respectively. Which one of the following is the strongest oxidising agent (A) Na^+ (B) Li^+ (C) Ba^{2+} (D) Mg^{2+} **98.** Which of the following displaces Br_2 from an aqueous solution containing bromide ions (A) Cl_2 (B) Cl^{-} (C) *I*₂ (D) I_3^{-} 99. For the cell reaction $Cu^{2+}(C_1aq) + Zn(s) = Zn^{2+}(C_2aq) + Cu(s)$ of an electrochemical cell, the change in free energy at a given temperature is a function of (A) $\ln (C_1)$ (B) $\ln (C_2)$ (C) $\ln (C_1 + C_2)$ (D) $\ln (C_2 / C_1)$ 100. The e.m.f. of the cell in which the following reaction $Zn(s) + Ni^{2+}(a=1.0) = Zn^{2+}(a=10) + Ni(s)$ occurs, is found to be 0.5105V at 298K. The standard e.m.f. of the cell is (A) 0.5400 (B) 0.4810 V (C) 0.5696 V (D) - 0.5105 V**101.**For the redox reaction $Zn(s) + Cu^{2+}(0.1M) \rightarrow Zn^{2+}(1M) + Cu(s)$

taking place in a cell, E_{cell}^{o} is 1.10 volt. E_{cell} for the cell will be $\left(2.303 \frac{RT}{F} = 0.0591\right)$ (A) 2.14 volt (B) 1.80 volt (C) 1.07 volt (D) 0.82 volt

102. The *emf* of a Daniel cell at 298K is E_1 $Zn | ZnSO_4 || CuSO_4 | Cu$ when the concentration of $ZnSO_4$ is 1.0 M and that of $CuSO_4$ is 0.01 M_1 the *emf* changed to E_2 . What is the relationship between E_1 and E_2

(A) $E_2 = 0 \neq E_1$ (B) $E_1 > E_2$ (C) $E_1 < E_2$ (D) $E_1 = E_2$ **103.** The oxidation potentials of following half-cell reactions are given $Zn \rightarrow Zn^{2+} + 2e^-$; $E^o = 0.76 V$, $Fe \rightarrow Fe^{2+} + 2e^-$; $E^o = 0.44 V$ what will be the *emf* of cell, whose cell-reaction is

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

(A) -1.20 V (B) +0.32 V(C) -0.32 V (D) +1.20 V

- **104.** The E^{o} for half cells Fe / Fe^{2+} and Cu / Cu^{2+} are -0.44 V and +0.32 V
 - Cu/Cu^{-1} are -0.44 v and +0.3 respectively. Then
 - (A) Cu^{2+} oxidises Fe (B) Cu^{2+} oxidises Fe^{2+}
 - (C) Cu oxidises Fe^{2+} (D) Cu reduces Fe^{2+}
- **105.** What is E° for electrode represented by $Pt, O_2(1 atm)/2H^+$ (Im)
 - (A) Unpredictable
 (B) Zero
 (C) 0.018 V
 (D) 0.118 V
- **106.** Which of the following has been universally accepted as a reference electrode at all temperatures and has been assigned a value of zero volt
 - (A) Graphite electrode
 - (B) Copper electrode
 - (C) Platinum electrode
 - (D) Standard hydrogen electrode
- 107. Aluminium is more reactive than *Fe*. But *Al* is less easily corroded than iron because (A) *Al* is noble metal
 - (B) Iron forms both mono and divalent ions
 - (C) Oxygen forms a protective oxide layer
 - (D) Fe undergoes reaction easily with H_2O
- **108.**Zinc displaces copper from the solution of its salt because
 - (A) Atomic number of zinc is more than that of copper
 - (B) Zinc salt is more soluble in water than the copper salt
 - (C) Gibbs free energy of zinc is less than that of copper
 - (D) Zinc is placed higher than copper in electro-chemical series

- 109. An electrochemical cell is set up as follows
 - $Pt(H_2, 1atm) / 0.1M HCl$
 - $\parallel 0.1 M$ acetic acid /(H_2 , 1 atm) Pt
 - E.M.F. of this cell will not be zero because
 - (A) The *pH* of 0.1 *M HCl* and 0.1 *M* acetic acid is not the same
 - (B) Acids used in two compartments are different
 - (C) E.M.F. of a cell depends on the molarities of acids used
 - (D) The temperature is constant
- **110.** Cu^+ ion is not stable in aqueous solution because of disproportionation reaction. E^o value for disproportionation of Cu^+ is (Given $E^o_{Cu^{2+}/Cu^+} = 0.15$, $E^o_{Cu^{2+}/Cu} = 0.34V$) (A) - 0.49 V (B) 0.49 V (C) - 0.38 V (D) 0.38 V
- **111.** E° of a cell $aA + bB \rightarrow cC + dD$ is

(A)
$$-\frac{RT}{nF}\log\frac{[C]^{c}[D]^{d}}{[A]^{a}[B]^{b}}$$
 (B) $-RT\log\frac{[a]^{A}[b]^{B}}{[a]^{C}[d]^{D}}$

(C)
$$-\frac{RT}{nF}\log\frac{[C]^{c}[d]^{D}}{[A]^{a}[B]^{b}}$$
 (D) $-\frac{RT}{nF}\log\frac{[C]^{c}[d]^{D}}{[a]^{A}[B]^{b}}$

- **112.** In the experiment set up for the measurement of *EMF* of a half cell using a reference electrode and a salt bridge, when the salt bridge is removed, the voltage
 - (A) Does not change
 - (B) Decreases to half the value
 - (C) Increase to maximum
 - (D) Drops to zero
- **113.**Electrode potentials of five elements A, B, C, D and E are respectively -1.36, -0.32, 0, -1.26 and -0.42. The reactivity order of these elements are in the order of

(A) *A*, *D*, *E*, *B* and *C*(B) *C*, *B*, *E*, *D* and *A*(C) *B*, *D*, *E*, *A* and *C*(D) *C*, *A*, *E*, *D* and *B*

- **114.**What is wrongly stated about electrochemical series
 - (A) It is the representation of element in order of increasing or decreasing standard electrode reductional potential
 - (B) It does not compare the relative reactivity of metals
 - (C) It compares relative strengths of oxidising agents
 - (D) H_2 is centrally placed element
- **115.**Which of the following statements is true for fuel cells
 - (A) They are more efficient
 - (B) They are free from pollution
 - (C) They run till reactants are active

(D) All of these

- **116.** A galvanic cell with electrode potential of 'A' = +2.23 V and 'B' = -1.43 V. The value
 - of E°_{cell} is

(C) 5.9 V

- (A) 3.66 V (B) 0.80 V(C) - 0.80 V (D) - 3.66 V
- 117. The *e.m.f.* of a cell whose half cells are given below is $Mg^{2+} + 2e^- \rightarrow Mg(s) E^\circ = -2.37 V$ $Cu^{2+} + 2e^- \rightarrow Cu(s) E^\circ = +0.34 V$ (A) + 1.36 V (B) + 2.71 V (C) + 2.17 V (D) - 3.01 V 118. For the cell reaction, $2Ce^{4+} + Co \rightarrow 2Ce^{3+} + Co^{2+}$ E°_{cell} is 1.89 V. If $E^\circ_{Ce^{4+}/Ce^{3+}}$

 Ce^{AV}/Ce^{-V} (A) - 1.64 V(B) + 1.64 V(C) - 2.08 V(D) + 2.17 V

119. If the ΔG of a cell reaction $AgCl + e^- \rightarrow Ag + Cl^$ is -21.20 KJ; the standard *e.m.f.*, of cell is (A) 0.229 V (B) 0.220 V

(A) 0.229 V	$(\mathbf{B}) 0.220 V$
(C) - 0.220 V	(D) – 0.110 V

120. The *e.m.f.* of the cell $Ag | Ag^+(0.1M) || Ag^+(1M) | Ag$ at 298 K is (A) 0.0059 V (B) 0.059 V

(D) 0.59 V

121.The *e.m.f.* of the cell $Zn | Zn^{2+}(0.01M) || Fe^{2+}(0.001M) || Fe$ at 298 *K* is 0.2905 then the value of equilibrium for the cell reaction is

(A)
$$\frac{0.32}{e^{0.0295}}$$
 (B) $\frac{0.32}{10^{0.0295}}$
(C) $\frac{0.26}{10^{0.0295}}$ (D) $\frac{0.32}{10^{0.0591}}$

- **122.** Aluminium displaces hydrogen from dilute *HCl* whereas silver does not. The *e.m.f.* of a cell prepared by combining Al / Al^{3+} and Ag / Ag^+ is 2.46 V. The reduction potential of silver electrode is +0.80 V. The reduction potential of aluminium electrode is (A) +1.66 V (B) -3.26 V
 - (C) 3.26V (D) -1.66V

123.Consider the following E^0 values : $E^0_{E^{0^{3+}/E^{0^{2+}}}}$ $=+0.77 V E_{Sn^{2+}/Sn}^{0} = -0.14 V$ Under standard conditions the potential for the reaction $Sn_{(s)} + 2Fe^{3+}(aq) \rightarrow 2Fe^{2+}(sq) + Sn^{2+}(aq)$ is (A) 0.91 V (B) 1.40 V (C) 1.68 V (D) 0.63 V **124.** $Cr_2 O_7^{2-} + I^- \rightarrow I_2 + Cr^{3+} E_{cell}^0 = 0.79 V$ $E_{C_{I_2}O_{1}^{2^-}}^{0} = 1.33 V, E_{I_2}^{0}$ is (A) -0.10V (B) +0.18V(C) -0.54V(D) 0.54 V **125.** $Zn(s) + Cl_2(1 \text{ atm}) \rightarrow Zn^{2+} + 2Cl^-$. E_{aut}^0 of the cell is 2.12 V. To increase E

- (A) $[Zn^{2+}]$ should be increased
- (B) $[Zn^{2+}]$ should be decreased
- (C) $[Cl^{-}]$ should be decreased
- (D) P_{Cl_2} should be decreased
- **126.**For the feasibility of a redox reaction in a cell, the e.m.f. should be

(A) Positive	(B) Fixed
(C) Zero	(D) Negative

Corrosion

- 127. Corrosion is basically a
 - (A) Altered reaction in presence of H_2O
 - (B) Electrochemical phenomenon
 - (C) Interaction
 - (D) Union between light metal and heavy metal
- **128.**Rusting of iron is catalysed by which of the following
 - (A) Fe (B) O_2

(C) Zn (D) H^+

129.Which of the following is a highly corrosive salt

(A) $FeCl_2$ (B) $PbCl_2$

(C) Hg_2Cl_2 (D) $HgCl_2$

- **130.**Corrosion of iron is essentially an electrochemical phenomenon where the cell reactions are
 - (A) Fe is oxidised to Fe^{2+} and dissolved oxygen in water is reduced to OH
 - (B) Fe is oxidised to Fe^{3+} and H_2O is reduced to O_2^{2-}
 - (C) Fe is oxidised to Fe^{2+} and H_2O is reduced to O_2^-
 - (D) Fe is oxidised to Fe^{2+} and H_2O is reduced to O_2