

**PROBLEM SOLVING  
TECHNIQUES OF  
PHYSICAL CHEMISTRY  
FOR NEET**

**BY  
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**ELECTROCHEMISTRY**

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## BASIC EXERCISE

### ELECTROLYTIC CONDUCTANCE

1. Strong electrolyte are those which :

- (1) dissolve readily in water (2) conduct electricity  
(3) dissociate into ions even at high concentration (4) dissociate into ions at high dilution.

**Ans. (3)**

2. Molten sodium chloride conducts electricity due to the presence of :

- (1) free electrons (2) free ions (3) free molecules (4) free atoms of Na and Cl

**Ans. (2)**

3. Electrolytic conduction is due to the movement of :

- (1) molecules (2) atoms (3) ions (4) electrons

**Ans. (3)**

4. Which of the following solutions of KCl has the lowest value of equivalent conductance ?

- (1) 1 M (2) 0.1 M (3) .01 M (4) .001 M

**Ans. (1)**

5. If  $V$ , in the equation  $\Lambda = \text{sp. cond.} \times V$ , is the volume in CC containing 1 eq. of the electrolyte;  $V$  for a  $\frac{N}{10}$  solution will be :

- (1) 10 c.c. (2) 100 c.c. (3) 1000 c.c. (4) 10,000 c.c.

**Ans. (4)**

6. If the specific resistance of a solution of concentration  $C$  g equivalent litre<sup>-1</sup> is  $R$ , then its equivalent conductance is :

- (1)  $\frac{100R}{C}$  (2)  $\frac{RC}{1000}$  (3)  $\frac{1000}{RC}$  (4)  $\frac{C}{1000R}$

**Ans. (3)**

7. The specific conductance of a salt of 0.01 M concentration is  $1.061 \times 10^{-4}$ . Molar conductance of the same solution will be :

- (1)  $1.061 \times 10^{-4}$  (2) 1.061 (3) 10.61 (4) 106.1

**Ans. (3)**

8. Which of the following solutions of NaCl will have the highest specific conductance ?

- (1) 0.001 N (2) 0.1 N (3) 0.01 N (4) 1.0 N

**Ans. (4)**

9. The value of molar conductivity of HCl is greater than that of NaCl at a particular temperature because :

- (1) Molecular mass of HCl is less than that of NaCl.  
(2) Velocity of  $H^+$  ions is more than that of  $Na^+$  ions  
(3) HCl is strongly acidic  
(4) Ionisation of HCl is larger than that of NaCl

**Ans. (2)**

10. Which statement is not correct :-

- (1) Conductance of an electrolytic solution increases with dilution
- (2) Conductance of an electrolytic solution decreases with dilution
- (3) Specific conductance of an electrolytic solution decreases with dilution
- (4) Equivalent conductance of an electrolytic solution increases with dilution.

Ans. (2)

11. The resistance of 0.01 N solution of an electrolyte was found to be 210 ohm at 298 K using a conductivity cell of cell constant  $0.66 \text{ cm}^{-1}$ . The equivalent conductance of solution is :-

- (1)  $314.28 \text{ mho cm}^2 \text{ eq}^{-1}$
- (2)  $3.14 \text{ mho cm}^2 \text{ eq}^{-1}$
- (3)  $314.28 \text{ mho}^{-1} \text{ cm}^2 \text{ eq}^{-1}$
- (4)  $3.14 \text{ mho}^{-1} \text{ cm}^2 \text{ eq}^{-1}$

Ans. (1)

12. Electrolytic conduction differs from metallic conduction from the fact that in the former

- (1) The resistance increases with increasing temperature
- (2) The resistance decreases with increasing temperature
- (3) The resistance remains constant with increasing temperature
- (4) The resistance is independent of the length of the conductor

Ans. (2)

13. The specific conductance of a 0.01 M solution of KCl is  $0.0014 \text{ ohm}^{-1} \text{ cm}^{-1}$  at  $25^\circ \text{C}$ . Its equivalent conductance ( $\text{cm}^2 \text{ ohm}^{-1} \text{ equiv}^{-1}$ ) is :-

- (1) 140
- (2) 14
- (3) 1.4
- (4) 0.14

Ans. (1)

### KOHLRAUSCH LAW

14. The conductivity of a saturated solution of  $\text{BaSO}_4$  is  $3.06 \times 10^{-6} \text{ ohm}^{-1} \text{ cm}^{-1}$  and its molar conductance is  $1.53 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ . The  $K_{sp}$  of  $\text{BaSO}_4$  will be

- (1)  $4 \times 10^{-12}$
- (2)  $2.5 \times 10^{-9}$
- (3)  $2.5 \times 10^{-13}$
- (4)  $4 \times 10^{-6}$

Ans. (4)

15. The molar conductance at infinite dilution of  $\text{AgNO}_3$ ,  $\text{AgCl}$  and  $\text{NaCl}$  are 116.5, 121.6 and 110.3 respectively. The molar conductances of  $\text{NaNO}_3$  is :-

- (1) 111.4
- (2) 105.2
- (3) 130.6
- (4) 150.2

Ans. (2)

16. The equivalent conductivity of 0.1 N  $\text{CH}_3\text{COOH}$  at  $25^\circ \text{C}$  is 80 and at infinite dilution 400. The degree of dissociation of  $\text{CH}_3\text{COOH}$  is :

- (1) 1
- (2) 0.2
- (3) 0.1
- (4) 0.5

Ans. (2)

17. For HCl solution at  $25^\circ \text{C}$ , equivalent conductance at infinite dilution, is  $425 \text{ ohm}^{-1} \text{ cm}^2 \text{ equiv}^{-1}$ . The specific conductance of a solution of HCl is  $3.825 \text{ ohm}^{-1} \text{ cm}^{-1}$ . If the apparent degree of dissociation is 90% the normality of the solution is :-

- (1) 0.90 N
- (2) 1.0 N
- (3) 10 N
- (4) 1.2 N

Ans. (3)

## **GALVANIC CELL**

**18.** In the galvanic cell  $\text{Cu} | \text{Cu}^{2+} (1\text{M}) || \text{Ag}^+ (1\text{M}) | \text{Ag}$  the electrons will travel in the external circuit :

- (1) from Ag to Cu (2) from Cu to Ag  
(3) electrons do not travel in the external circuit (4) in any direction

**Ans. (2)**

**19.** The passage of electricity in the Daniel cell when Zn and Cu electrodes are connected is :

- (1) from Cu to Zn in the cell (2) from Cu to Zn out side the cell  
(3) from Zn to Cu outside the cell (4) in any direction in the cell

**Ans. (2)**

**20.** The equation representing the process by which standard reduction potential of zinc can be defined is :

- (1)  $\text{Zn}^{2+} (\text{s}) + 2\text{e}^- \longrightarrow \text{Zn}$  (2)  $\text{Zn} (\text{g}) \longrightarrow \text{Zn}^{2+} (\text{g}) + 2\text{e}^-$   
(3)  $\text{Zn}^{2+} (\text{g}) + 2\text{e}^- \longrightarrow \text{Zn}$  (4)  $\text{Zn}^{2+} (\text{aq.}) + 2\text{e}^- \longrightarrow \text{Zn} (\text{s})$

**Ans. (4)**

**21.** A standard hydrogen electrode has zero electrode potential because :

- (1) Hydrogen is easiest to oxidize  
(2) This electrode potential is assumed to be zero  
(3) Hydrogen atom has only one electron  
(4) Hydrogen is the lightest element

**Ans. (2)**

**22.** Which is not true for a standard hydrogen electrode ?

- (1) The hydrogen ion concentration is 1 M  
(2) Temperature is  $25^\circ\text{C}$   
(3) Pressure of hydrogen is 1 atmosphere  
(4) It contains a metallic conductor which does not adsorb hydrogen.

**Ans. (4)**

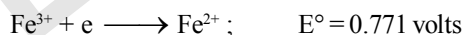
**23.**  $\text{Cu} | \text{Cu}^{+2} (1\text{M}) || \text{Zn}^{+2} (1\text{M}) | \text{Zn}$

A cell represented above should have emf.

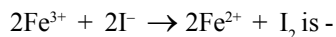
- (1) Positive (2) Negative (3) Zero (4) Cannot be predicted

**Ans. (2)**

**24.** Given electrode potentials :



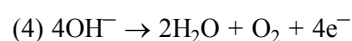
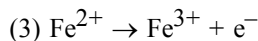
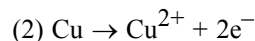
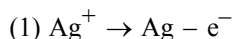
$E^\circ$  cell for the cell reaction



- (1)  $(2 \times 0.771 - 0.536) = 1.006 \text{ volts}$  (2)  $(0.771 - 0.5 \times 0.536) = 0.503 \text{ volts}$   
(3)  $0.771 - 0.536 = 0.235 \text{ volts}$  (4)  $0.536 - 0.771 = -0.235 \text{ volts}$

**Ans. (3)**

25. Which of the following is not an anodic reaction–



Ans. (1)

26. Which of the following statements is correct :–

(1) Oxidation occur at anode in both galvanic and electrolytic cell

(2) Reduction occurs at anode in both galvanic and electrolytic cell

(3) Reduction occur at anode in electrolytic cell where as oxidation occur at cathode in galvanic cell

(4) Oxidation occur at anode in electrolytic cell where as reduction occur at anode in a galvanic cell

Ans. (1)

27. Other things being equal, the life of a daniel cell may be increased by :–

(1) Keeping low temperature

(2) Using large copper electrode

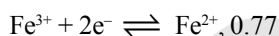
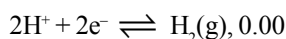
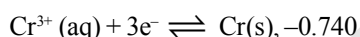
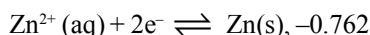
(3) Decreasing concentration of copper ions

(4) Using large zinc electrodes

Ans. (4)

### ELECTROCHEMICAL SERIES

28. The standard reduction potentials at 25°C for the following half reactions are given against each :



Which is the strongest reducing agent ?

(1) Zn

(2) Cr

(3)  $\text{H}_2(\text{g})$

(4)  $\text{Fe}^{2+}(\text{aq})$

Ans. (1)

29. Red hot carbon will remove oxygen from the oxide XO and YO but not from ZO. Y will remove oxygen from XO. Use this evidence to deduce the order of activity of the three metals X, Y and Z putting the most active first.

(1) XYZ

(2) ZYX

(3) YXZ

(4) ZXY

Ans. (2)

30. If a spoon of copper metal is placed in a solution of ferrous sulphate :

(1) Cu will precipitate out

(2) Iron will precipitate

(3) Cu and Fe will precipitate

(4) No reaction will take place

Ans. (4)

31. Which one will liberate  $\text{Br}_2$  from KBr ?

(1) HI

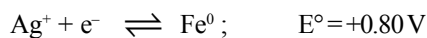
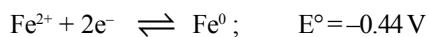
(2)  $\text{I}_2$

(3)  $\text{Cl}_2$

(4)  $\text{SO}_2$

Ans. (3)

32. Using the standard electrode potential values given below, decide which of the statements, I, II, III and IV are correct. Choose the right answer from (1), (2), (3) and (4).



- I. Copper can displace iron from  $\text{FeSO}_4$  solution.  
II. Iron can displace copper from  $\text{CuSO}_4$  solution.  
III. Silver can displace copper from  $\text{CuSO}_4$  solution.  
IV. Iron can displace silver from  $\text{AgNO}_3$  solution.

- (1) I and II                      (2) II and III                      (3) II and IV                      (4) I and IV

Ans. (3)

33. The standard electrode potential value of the elements A, B and C are 0.68, -2.50 and 0.50 V respectively. The order of their reducing power is :

- (1)  $A > B > C$                       (2)  $A > C > B$                       (3)  $C > B > A$                       (4)  $B > C > A$

Ans. (4)

34. Zn can not displace following ions from their aqueous solution :

- (1)  $\text{Ag}^+$                       (2)  $\text{Cu}^{2+}$                       (3)  $\text{Fe}^{2+}$                       (4)  $\text{Na}^+$

Ans. (4)

35. A gas X at 1 atm. is bubbled through a solution containing a mixture of  $1 \text{ M Y}^-$  and  $1 \text{ M Z}^-$  at  $25^\circ \text{C}$ . If the reduction potential of  $Z > Y > X$  then :

- (1) Y will oxidise X and not Z                      (2) Y will oxidise Z and not X  
(3) Y will oxidise both X and Z                      (4) Y will reduce both X and Z

Ans. (1)

36. The standard electrode potential of Zn, Ag and Cu are -0.76, 0.80 and 0.34 volt respectively, then :

- (1) Ag can oxidise Zn and Cu  
(2) Ag can reduce  $\text{Zn}^{2+}$  and  $\text{Cu}^{2+}$   
(3) Zn can reduce  $\text{Ag}^+$  and  $\text{Cu}^{2+}$   
(4) Cu can oxidise Zn and Ag

Ans. (3)

37. Each of the three metals x, y and z were put in turn into aqueous solution of the other two.  $x + \text{salt of y (or z)} = y \text{ (or z)} + \text{salt of x}$ . Which one of the following observation is probably incorrect ?

- (1)  $y + \text{salt of x} = \text{no action observed}$   
(2)  $y + \text{salt of z} = z + \text{salt of y}$   
(3)  $z + \text{salt of x} = x + \text{salt of z}$   
(4)  $z + \text{salt of y} = \text{no action observed}$

Ans. (3)

38. The oxidation potential of Zn, Cu, Ag,  $\text{H}_2$  and Ni are 0.76, -0.34, -0.80, 0, 0.55 volt respectively. Which of the following reaction will provide maximum voltage ?

- (1)  $\text{Zn} + \text{Cu}^{2+} \longrightarrow \text{Cu} + \text{Zn}^{2+}$                       (2)  $\text{Zn} + 2\text{Ag}^+ \longrightarrow 2\text{Ag} + \text{Zn}^{2+}$   
(3)  $\text{H}_2 + \text{Cu}^{2+} \longrightarrow 2\text{H}^+ + \text{Cu}$                       (4)  $\text{H}_2 + \text{Ni}^{2+} \longrightarrow 2\text{H}^+ + \text{Ni}$

Ans. (2)

39. A standard reduction electrode potentials of four elements are  
 $A = -0.250 \text{ V}$ ,  $B = -0.140 \text{ V}$   
 $C = -0.126 \text{ V}$ ,  $D = -0.402 \text{ V}$   
 The element that displaces A from its compounds aqueous solution is :-  
 (1) B (2) C (3) D (4) None of the above

Ans. (3)

40. Which of the following displacement does not occur  
 (1)  $\text{Zn} + 2\text{H}^+ \rightarrow \text{Zn}^{2+} + \text{H}_2 \uparrow$  (2)  $\text{Fe} + 2\text{Ag}^+ \rightarrow \text{Fe}^{2+} + \text{Ag} \downarrow$   
 (3)  $\text{Cu} + \text{Fe}^{2+} \rightarrow \text{Cu}^{2+} + \text{Fe} \downarrow$  (4)  $\text{Zn} + \text{Pb}^{2+} \rightarrow \text{Zn}^{2+} + \text{Pb} \downarrow$

Ans. (3)

41. Adding powdered Pb and Fe to a solution containing 1.0 M in each of  $\text{Pb}^{+2}$  and  $\text{Fe}^{+2}$  ions would result into the formation of :-  
 (1) More of Pb and  $\text{Fe}^{+2}$  ions (2) More of Fe and  $\text{Pb}^{2+}$  ions  
 (3) More of Fe and Pb (4) More of  $\text{Fe}^{+2}$  and  $\text{Pb}^{2+}$  ions

Ans. (1)

### NERNST EQUATION

42.  $E^\circ(\text{Ni}^{2+}/\text{Ni}) = -0.25 \text{ volt}$ ,  
 $E^\circ(\text{Au}^{3+}/\text{Au}) = 1.50 \text{ volt}$ .  
 The emf of the voltaic cell.  
 $\text{Ni} / \text{Ni}^{2+} (1.0 \text{ M}) || \text{Au}^{3+} (1.0 \text{ M}) | \text{Au}$  is :  
 (1) 1.25 volt (2) -1.75 volt (3) 1.75 volt (4) 4.0 volt

Ans. (3)

43. The emf of the cell in which the following reaction  
 $\text{Zn(s)} + \text{Ni}^{2+} (a = 0.1) \rightleftharpoons \text{Zn}^{2+} (a = 1.0) + \text{Ni(s)}$   
 occurs, is found to be 0.5105 V at 298 K. The standard e.m.f. of the cell is :-  
 (1) -0.5105 V (2) 0.5400 V (3) 0.4810 V (4) 0.5696 V

Ans. (2)

44. The potential of hydrogen electrode  
 $(\text{P}_{\text{H}_2} = 1 \text{ atm}; \text{C}_{\text{H}^+} = 0.1 \text{ M})$  at  $25^\circ\text{C}$  will be -  
 (1) 0.00 V (2) -0.059 V (3) 0.118 V (4) 0.059 V

Ans. (2)

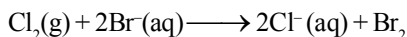
45. Which of the following represents the potential of silver wire dipped in to 0.1 M  $\text{AgNO}_3$  solution at  $25^\circ\text{C}$  ?  
 (1)  $E^\circ_{\text{red}}$  (2)  $(E^\circ_{\text{red}} + 0.059)$  (3)  $(E^\circ_{\text{ox}} - 0.059)$  (4)  $(E^\circ_{\text{red}} - 0.059)$

Ans. (4)

46. The potential of a hydrogen electrode at  $\text{pH} = 1$  is  
 (1) 0.059 volt (2) 0.00 volt (3) -0.059 volt (4) 0.59 volt

Ans. (3)

47. Consider the reaction



The emf of the cell when

$[\text{Cl}^-] = [\text{Br}_2] = [\text{Br}^-] = 0.01 \text{ M}$  and  $\text{Cl}_2$  gas at 1 atm pressure will be ( $E^\circ$  for the above reaction is = 0.29 volt)

- (1) 0.54 volt (2) 0.35 volt (3) 0.24 volt (4) -0.29 volt

Ans. (2)

48. The standard emf for the cell reaction  $\text{Zn} + \text{Cu}^{2+} \longrightarrow \text{Zn}^{2+} + \text{Cu}$  is 1.10 volt at 25 °C. The emf for the cell reaction when 0.1 M  $\text{Cu}^{2+}$  and 0.1 M  $\text{Zn}^{2+}$  solution are used at 25°C is:

- (1) 1.10 volt (2) 0.110 volt (3) -1.10 volt (4) -0.110 volt

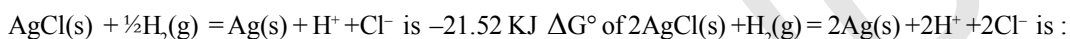
Ans. (1)

49.  $E^\circ$  for  $\text{F}_2 + 2\text{e}^- = 2\text{F}^-$  is 2.8 V,  $E^\circ$  for  $\frac{1}{2}\text{F}_2 + \text{e}^- = \text{F}^-$  is ?

- (1) 2.8 V (2) 1.4 V (3) -2.8 V (4) -1.4 V

Ans. (1)

50.  $\Delta G^\circ$  of the cell reaction



- (1) -21.52 KJ (2) -10.76 KJ (3) -43.04 KJ (4) 43.04 KJ

Ans. (3)

51. How much will the potential of  $\text{Zn} / \text{Zn}^{2+}$  change if the solution of  $\text{Zn}^{2+}$  is diluted 10 times

- (1) increase by 0.03 V (2) decreases by 0.03 V  
(3) increases by 0.059 V (4) decreases by 0.059 V

Ans. (1)

52. 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

Ans. (4)

53. Which of the following will increase the voltage of the cell with following cell reaction



- (1) Increase in the size of silver rod (2) Increase in the concentration of  $\text{Sn}^{2+}$  ions  
(3) Increase in the concentration of  $\text{Ag}^+$  ions (4) Decrease in the concentration of  $\text{Ag}^+$  ions

Ans. (3)

54.  $E^\circ$  for the reaction  $\text{Fe} + \text{Zn}^{2+} \rightarrow \text{Zn} + \text{Fe}^{2+}$  is -0.35V. The given cell reaction is :

- (1) feasible (2) not feasible (3) in equilibrium (4) can't say anything

Ans. (2)

55. For a reaction -  $\text{A}(\text{s}) + 2\text{B}^+ \rightarrow \text{A}^{2+} + 2\text{B}$

$K_c$  has been found to be  $10^{12}$ . The  $E^\circ$  cell is:

- (1) 0.354 V (2) 0.708 V (3) 0.0098 V (4) 1.36 V

Ans. (1)



56. The standard electrode potential ( $E^\circ$ ) for  $\text{OCl}^-/\text{Cl}^-$  and  $\text{Cl}^- / \frac{1}{2} \text{Cl}_2$  respectively are 0.94 V and -1.36V. The  $E^\circ$  value of  $\text{OCl}^- / \frac{1}{2} \text{Cl}_2$  will be :  
(1) -2.20 V (2) -0.42 V (3) 0.52 V (4) 1.04 V

Ans. (3)

57. The emf of the cell  
 $\text{Ti}/\text{Ti}^+ (0.0001 \text{ M}) \parallel \text{Cu}^{2+} (0.01 \text{ M})/\text{Cu}$  is 0.83 V

The emf of this cell will be increased by :-

- (1) Increasing the concentration of  $\text{Cu}^{++}$  ions (2) Decreasing the concentration of  $\text{Ti}^+$   
(3) Increasing the concentration of both (4) (1) & (2) both

Ans. (4)

58. Consider the cell  $\text{Cu}/\text{Cu}^{+2} \parallel \text{Ag}^+/\text{Ag}$ . If the concentration of  $\text{Cu}^{+2}$  and  $\text{Ag}^+$  ions becomes ten times the emf of the cell:-  
(1) Becomes 10 times (2) Remains same  
(3) Increase by 0.0295 V (4) Decrease by 0.0295 V

Ans. (3)

## ELECTROLYSIS

59. When an electric current is passed through acid diluted water, 112 ml. of hydrogen gas at STP collects at the cathode in 965 second. The current passed, in ampere is :  
(1) 1.0 (2) 0.5 (3) 0.1 (4) 2.0

Ans. (1)

60. Two electrolytic cells one containing acidified ferrous chloride and another acidified ferric chloride are connected in series. The ratio of iron deposited at cathodes in the two cells when electricity is passed through the cells will be :  
(1) 3 : 1 (2) 2 : 1 (3) 1 : 1 (4) 3 : 2

Ans. (4)

61. The same amount of electricity was passed through two separate electrolytic cells containing solutions of nickel nitrate  $[\text{Ni}(\text{NO}_3)_2]$  and chromium nitrate  $[\text{Cr}(\text{NO}_3)_3]$  respectively. If 0.3 g of nickel was deposited in the first cell, the amount of chromium deposited is :  
(at. wt. of Ni = 59, at. wt. of Cr = 52)  
(1) 0.1 g (2) 0.17 g (3) 0.3 g (4) 0.6 g

Ans. (2)

62. How many coulombs of electricity are required for the oxidation of 1 mole of  $\text{H}_2\text{O}$  to  $\text{O}_2$  ?  
(1)  $9.65 \times 10^4 \text{ C}$  (2)  $4.825 \times 10^5 \text{ C}$  (3)  $1.93 \times 10^5 \text{ C}$  (4)  $1.93 \times 10^4 \text{ C}$

Ans. (3)

63. The mass of copper that will be deposited at cathode in electrolysis of 0.2 M solution of copper sulphate when a quantity of electricity equal to that required to liberate 2.24 L of hydrogen at STP from 0.1 M aqueous  $\text{H}_2\text{SO}_4$  is passed (At. mass of Cu = 63.5) will be :  
(1) 1.59 g (2) 3.18 g (3) 6.35 g (4) 12.70 g

Ans. (3)

64. 10800 C of electricity through the electrolyte deposited 2.977 g of metal with atomic mass  $106.4 \text{ g mol}^{-1}$ . The charge on the metal cation is -  
(1) +4 (2) +3 (3) +2 (4) +1

Ans. (1)

65. On passing electricity through dil.  $\text{H}_2\text{SO}_4$  solution the amount of substance liberated at the cathode and anode are in the ratio :  
 (1) 1 : 8                      (2) 8 : 1                      (3) 16 : 1                      (4) 1 : 16  
**Ans. (1)**
66. During electrolysis of fused calcium hydride, the hydrogen is produced at :  
 (1) Cathode  
 (2) Anode  
 (3) Hydrogen is not liberated at all  
 (4)  $\text{H}_2$  produced reacts with oxygen to form water  
**Ans. (2)**
67. A solution of sodium sulphate in water is electrolysed using inert electrodes. The product at the cathode and anode are respectively :-  
 (1)  $\text{H}_2$ ,  $\text{SO}_2$                       (2)  $\text{O}_2$ ,  $\text{H}_2$                       (3)  $\text{O}_2$ , Na                      (4)  $\text{H}_2$ ,  $\text{O}_2$   
**Ans. (4)**
68. One Faraday of electricity will liberate one mol atomic mass of the metal from the solution of  
 (1) Auric chloride                      (2) Silver nitrate                      (3) Calcium chloride                      (4) Copper sulphate  
**Ans. (2)**
69. When 96500 coulombs of electricity are passed through barium chloride solution, the amounts of barium deposited will be :-  
 (1) 0.5 mol.                      (2) 1.0 mol.                      (3) 1.5 mol.                      (4) 2.0 mol.  
**Ans. (1)**
70. A factory produces 40 kg. of calcium in two hours by electrolysis. How much aluminium can be produced by the same current in two hours :-  
 (At wt. of Ca = 40, Al = 27)  
 (1) 22 kgm.                      (2) 18 kgm.                      (3) 9 kgm.                      (4) 27 kgm.  
**Ans. (2)**
71. How many moles each of  $\text{Ag}^+$  ion,  $\text{Cu}^{+2}$ ,  $\text{Fe}^{+3}$  ion would be deposited by passage of same quantity of electricity through solutions of their salts :-  
 (1) Same number of moles of each                      (2)  $1 : \frac{1}{2} : \frac{1}{3}$  moles  
 (3)  $\frac{1}{3} : \frac{1}{2} : 1$                       (4) 1 : 2 : 3  
**Ans. (2)**
72. The passage of current liberates  $\text{H}_2$  at cathode and  $\text{Cl}_2$  at anode the solution is :-  
 (1)  $\text{CuSO}_4$  (aq)                      (2)  $\text{CuCl}_2$  (aq.)                      (3)  $\text{NaCl}$  (aq.)                      (4) Water  
**Ans. (3)**
73. Electrolysis of aq.  $\text{CuSO}_4$  produces :-  
 (1) An increase in pH                      (2) A decrease in pH  
 (3) Either decrease or increase                      (4) None  
**Ans. (2)**

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**COMMERCIAL CELLS**

74. When lead accumulator is charged it is :

- (1) an electrolytic cell      (2) a galvanic cell      (3) a daniel cell      (4) none of the above

**Ans. (1)**

75. When a lead storage battery is charged :

- (1)  $\text{PbO}_2$  dissolves      (2) The lead electrode becomes coated with lead sulphate  
(3) Sulphuric acid is regenerated      (4) The amount of acid decreases

**Ans. (3)**

## ANALYTICAL EXERCISE

1. A current of  $i$  ampere was passed for  $t$  sec. through three cells P, Q and R connected in series. These contain respectively silver nitrate, mercuric nitrate and mercurous nitrate. At the cathode of the cell P, 0.216 g of Ag was deposited. The weights of mercury deposited in the cathode of Q and R respectively are : (at. wt. of Hg = 200.59)
- (1) 0.4012 and 0.8024 g      (2) 0.4012 and 0.2006 g      (3) 0.2006 and 0.4012 g      (4) 0.1003 and 0.2006 g

Ans. (3)

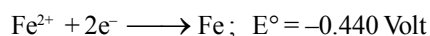
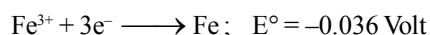
2. The electrochemical equivalent of silver is 0.0011180g. When an electric current of 0.5 ampere is passed through an aqueous silver nitrate solution for 200 sec., the amount of silver deposited is:
- (1) 1.1180 g      (2) 0.11180 g      (3) 5.590 g      (4) 0.5590 g

Ans. (2)

3. A current of 9.65 amp. is passed through an aqueous solution of NaCl using suitable electrodes for 1000 s. Given that 1 faraday equals 96500 coulombs the amount of NaOH (mol wt. 40.00) formed on electrolysis is :
- (1) 2.0 g      (2) 8.0 g      (3) 4.0 g      (4) 1.0 g.

Ans. (3)

4. Given standard electrode potentials

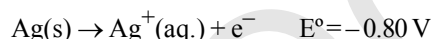
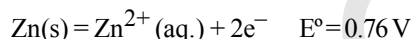


The standard electrode potential  $E^\circ$  for  $\text{Fe}^{3+} + \text{e}^- \longrightarrow \text{Fe}^{2+}$  is :

- (1) -0.476 volt      (2) -0.404 volt      (3) 0.440 volt      (4) +0.772 volt

Ans. (4)

5. The standard oxidation potential of Zn and Ag in water at 20°C are :-



Which one of the following reactions actually takes place :-

- (1)  $\text{Zn(s)} + 2\text{Ag}^+(\text{aq.}) \rightarrow \text{Zn}^{2+} + 2\text{Ag(s)}$       (2)  $\text{Zn}^{2+}(\text{aq.}) + 2\text{Ag(s)} \rightarrow 2\text{Ag}^+(\text{aq.}) + \text{Zn(s)}$   
(3)  $\text{Zn(s)} + \text{Ag(s)} \rightarrow \text{Zn}^{2+}(\text{aq.}) + \text{Ag}^+(\text{aq.})$       (4)  $\text{Zn}^{2+}(\text{aq.}) + \text{Ag}^+(\text{aq.}) \rightarrow \text{Zn(s)} + \text{Ag(s)}$

Ans. (1)

6. The thermodynamic efficiency of cell is given by-

- (1)  $\frac{\Delta H}{\Delta G}$       (2)  $\frac{nFE}{\Delta G}$       (3)  $-\frac{nFE}{\Delta H}$       (4) Zero

Ans. (3)

7. For the redox reaction :



$E^\circ_{\text{cell}}$  is 1.10 volt.  $E_{\text{cell}}$  for the cell will be  $\left( 2.303 \frac{RT}{F} = 0.0591 \right)$

- (1) 1.07 volt      (2) 0.82 volt      (3) 2.14 volt      (4) 1.80 volt

Ans. (1)

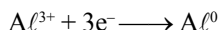
8. When during electrolysis of a solution of  $\text{AgNO}_3$  9650 coulombs of charge pass through the electroplating bath, the mass of silver deposited on the cathode will be :  
(1) 21.6g (2) 108g (3) 1.08g (4) 10.8g  
**Ans. (4)**
9. An electric current is passed through silver voltameter connected to a water voltameter. The cathode of the silver voltameter weighed 0.108g more at the end of the electrolysis. The volume of oxygen evolved at STP is :  
(1)  $56\text{cm}^3$  (2)  $550\text{cm}^3$  (3)  $5.6\text{cm}^3$  (4)  $11.2\text{cm}^3$   
**Ans. (3)**
10. Specific conductance of 0.1 M Nitric acid is  $6.3 \times 10^{-2}\text{ohm}^{-1}\text{cm}^{-1}$ . The molar conductance of the solution is:  
(1)  $630\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$  (2)  $315\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$   
(3)  $100\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$  (4)  $6.300\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$   
**Ans. (1)**
11. Which of the following statements is TRUE for the electrochemical Daniel cell :  
(1) Electrons flow from copper electrode to zinc electrode.  
(2) Current flows from zinc electrode to copper electrode.  
(3) Cations move toward copper electrode.  
(4) Cations move toward zinc electrode.  
**Ans. (3)**
12. Consider the following  $E^0$  values  
 $E^0_{\text{Fe}^{3+}/\text{Fe}^{2+}} = +0.77\text{V}$   
 $E^0_{\text{Sn}^{2+}/\text{Sn}} = -0.14\text{V}$   
Under standard conditions the potential for the reaction  
 $\text{Sn(s)} + 2\text{Fe}^{3+}(\text{aq}) \longrightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{Sn}^{2+}(\text{aq})$  is  
(1) 0.91V (2) 1.40V (3) 1.68V (4) 0.63V  
**Ans. (1)**
13. In a cell that utilises the reaction  
 $\text{Zn(s)} + 2\text{H}^+(\text{aq.}) \rightleftharpoons \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$  addition of  $\text{H}_2\text{SO}_4$  to cathode compartment, will  
(1) increase the  $E_{\text{cell}}$  and shift equilibrium to the right  
(2) lower the  $E_{\text{cell}}$  and shift equilibrium to the right  
(3) lower the  $E_{\text{cell}}$  and shift equilibrium to the left  
(4) increase the  $E_{\text{cell}}$  and shift equilibrium to the left  
**Ans. (1)**
14. The  $E^0_{\text{M}^{3+}/\text{M}^{2+}}$  values for Cr, Mn, Fe and Co are  $-0.41, +1.57, +0.77$  and  $+1.97\text{V}$  respectively. For which one of these metals the change in oxidation state from +2 to +3 is easiest ?  
(1) Fe (2) Mn (3) Cr (4) Co  
**Ans. (3)**
15. Aluminium displaces hydrogen from dilute HCl whereas silver does not, the E.M.F. of a cell prepared by combining  $\text{Al}/\text{Al}^{3+}$  and  $\text{Ag}/\text{Ag}^+$  is 2.46V. The reduction potential of silver electrode is +0.80V. The reduction potential of aluminium electrode is :  
(1)  $-3.26\text{V}$  (2)  $+1.66\text{V}$  (3)  $-1.66\text{V}$  (4)  $3.26\text{V}$   
**Ans. (3)**

16. For a spontaneous reaction the  $\Delta G$ , equilibrium constant (K) and  $E_{\text{Cell}}^0$  will be respectively

- (1) -ve, < 1, -ve (2) -ve, > 1, -ve (3) -ve, > 1, +ve (4) +ve, > 1, -ve

Ans. (3)

17. Aluminium oxide may be electrolysed at  $1000^\circ\text{C}$  to furnish aluminium metal (At. Mass = 27 amu; 1 Faraday = 96500 Coulombs). The cathode reaction is



To prepare 5.12 kg of aluminium metal by this method would require.

- (1)  $5.49 \times 10^4$  C of electric charge (2)  $5.49 \times 10^1$  C of electric charge  
(3)  $5.49 \times 10^7$  C of electric charge (4)  $1.83 \times 10^7$  C of electric charge

Ans. (3)

18. The highest electrical conductivity of the following aqueous solution is of

- (1) 0.1 M fluoroacetic acid (2) 0.1 M difluoroacetic acid  
(3) 0.1 M acetic acid (4) 0.1 M chloroacetic acid

Ans. (2)

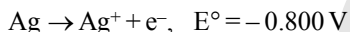
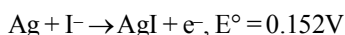
Electrolyte	KCl	$\text{KNO}_3$	HCl	NaOAc	NaCl
$\Lambda^\infty (\text{S cm}^2 \text{mol}^{-1})$	149.9	145.0	426.2	91.0	126.5

Calculate  $\Lambda_{\text{HOAc}}^\infty$  using appropriate molar conductances of the electrolytes listed above at infinite dilution in  $\text{H}_2\text{O}$  at  $25^\circ\text{C}$

- (1) 390.7 (2) 217.5 (3) 517.2 (4) 552.7

Ans. (1)

20. Given the data at  $25^\circ\text{C}$ ,



What is the value of  $\log K_{\text{sp}}$  for AgI?  $\left(2.303 \frac{RT}{F} = 0.059\text{V}\right)$

- (1) -8.12 (2) +8.612 (3) -37.83 (4) -16.13

Ans. (4)

21. Resistance of a conductivity cell filled with a solution of an electrolyte of concentration 0.1M is  $100\Omega$ . The conductivity of this solution is  $1.29 \text{ S m}^{-1}$ . Resistance of the same cell when filled with .02M of the same solution is  $520\Omega$ . The molar conductivity of 0.02M solution of the electrolyte will be.

- (1)  $124 \times 10^{-4} \text{ S m}^2 \text{mol}^{-1}$  (2)  $1240 \times 10^{-4} \text{ S m}^2 \text{mol}^{-1}$  (3)  $1.24 \times 10^{-4} \text{ S m}^2 \text{mol}^{-1}$  (4)  $12.4 \times 10^{-4} \text{ S m}^2 \text{mol}^{-1}$

Ans. (1)

22. The reduction potential of hydrogen half-cell will be negative if :-

- (1)  $p(\text{H}_2) = 2 \text{ atm}$   $[\text{H}^+] = 1.0 \text{ M}$  (2)  $p(\text{H}_2) = 2 \text{ atm}$  and  $[\text{H}^+] = 2.0 \text{ M}$   
(3)  $p(\text{H}_2) = 1 \text{ atm}$  and  $[\text{H}^+] = 2.0 \text{ M}$  (4)  $p(\text{H}_2) = 1 \text{ atm}$  and  $[\text{H}^+] = 1.0 \text{ M}$

Ans. (1)

23. Resistance of 0.2 M solution of an electrolyte is  $50 \Omega$ . The specific conductance of the solution is  $1.3 \text{ S m}^{-1}$ . If resistance of the 0.4M solution of the same electrolyte is  $260 \Omega$ , its molar conductivity is :-

- (1)  $6250 \text{ S m}^2 \text{mol}^{-1}$  (2)  $6.25 \times 10^{-4} \text{ S m}^2 \text{mol}^{-1}$   
(3)  $625 \times 10^{-4} \text{ S m}^2 \text{mol}^{-1}$  (4)  $62.5 \text{ S m}^2 \text{mol}^{-1}$

Ans. (2)

24. The resistance of 0.0025 M solution of  $K_2SO_4$  is 326 ohm. The specific conductance of the solution, if cell constant is 4.  
(1)  $4.997 \times 10^{-4}$  (2)  $5.997 \times 10^{-7}$  (3)  $6.997 \times 10^{-4}$  (4)  $1.20 \times 10^{-2}$   
**Ans. (4)**
25. The conductivity of four electrolytes P, Q, R, S in  $ohm^{-1} cm^{-1}$  are as follows P ( $5 \times 10^{-5}$ ); Q ( $1 \times 10^{-10}$ ); R ( $7 \times 10^{-8}$ ); S ( $9.2 \times 10^{-3}$ ). The one which offers highest resistance to the passage of electric current is  
(1) P (2) S (3) R (4) Q  
**Ans. (4)**
26. Zn rod is placed in 100 ml of 1M  $CuSO_4$  solution so that molarity of  $Cu^{2+}$  changes to 0.7 M. The molarity of  $SO_4^{2-}$  at this stage will be  
(1) 0.8 M (2) 1 M (3) 0.7 M (4) 1.8 M  
**Ans. (2)**
27. The time taken by the galvanic cell which operates almost ideally under reversible conditions at a current of  $10^{-16} A$  to deliver 1 mole of electron is  
(1)  $19.30 \times 10^{20} s$  (2)  $4.825 \times 10^{20} s$  (3)  $9.65 \times 10^{20} s$  (4)  $3.14 \times 10^{11} s$   
**Ans. (3)**
28. A direct current deposits 54 g of silver (atomic mass = 108) during the electrolysis. The same quantity of electricity would deposit aluminium chloride in molten state equal to  
(1) 4.5 g (2) 5.4 g (3) 54 g (4) 27 g  
**Ans. (1)**
29. During the electrolysis of water 4 mol of electrons were transferred from anode to cathode. The total volume of gases produced at STP will be approximately  
(1) 67.2 L (2) 22.4 L (3) 44.8 L (4) 89.4 L  
**Ans. (1)**
30. Which of the following can oxidise fluoride ions ?  
(1)  $O_3$  (2)  $Cl_2$  (3)  $Br_2$  (4) No chemical substance  
**Ans. (4)**
31. Electrolysis of  $H_2SO_4$  (conc.) gives the following at anode  
(1)  $H_2$  (2)  $O_2$  (3)  $H_2S_2O_3$  (4)  $H_2S_2O_8$   
**Ans. (4)**
32. If the standard reduction potential  $E^\circ$  for four divalent elements X, Y, Z, W are  $-1.46V$ ,  $-0.36V$ ,  $0.15V$  and  $-1.24 V$  respectively then  
(1) X will replace  $Z^{2+}$  from aqueous solution (2) Y will replace  $Z^{2+}$  from aqueous solution  
(3) W will replace  $Z^{2+}$  from aqueous solution (4) All statements are correct  
**Ans. (4)**
33. In SHE, the pH of the acid solution should be  
(1) 7 (2) 14 (3) 0 (4) 4  
**Ans. (3)**
34. E.M.F. of  $Ni(s)|Ni^{2+}(aq)||Cu^{2+}(aq)|Cu(s)$  cell can be increased by  
(1) Adding  $NH_3$  in the right half-cell (2) Increasing the conc. of  $Ni^{2+}$  ions  
(3) Adding dimethyl glyoxime into the left half-cell (4) Changing the electrolyte present in salt bridge  
**Ans. (3)**

35. For given cell;  $\text{Zn} | \text{Zn}^{+2} (\text{C}_1) || \text{Zn}^{+2} (\text{C}_2) | \text{Zn}$ ;  $\Delta G$  is negative if  
 (1)  $\text{C}_1 = \text{C}_2$  (2)  $\text{C}_1 > \text{C}_2$  (3)  $\text{C}_2 > \text{C}_1$  (4) Can't predicted

Ans. (3)

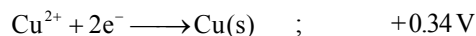
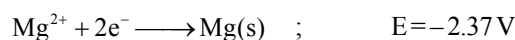
36. The emf of the cell,  $\text{Zn} | \text{Zn}^{+2} || \text{Ag}^+ | \text{Ag}$  is independent of  
 (1) The volume of  $\text{Zn}^{2+}$  and  $\text{Ag}^+$  solution (2) The molarity of  $\text{Zn}^{2+}$  ions in solution  
 (3) The molarity of  $\text{Ag}^+$  ions in solution (4) Temperature

Ans. (1)

37. Standard cell voltage for the cell  $\text{Pb} | \text{Pb}^{2+} || \text{Sn}^{2+} | \text{Sn}$  is  $-0.01 \text{ V}$ . If the cell is to exhibit  $E_{\text{cell}} = 0$ , the value of  $\log [\text{Sn}^{2+}] / [\text{Pb}^{2+}]$  should be  
 (1) 0.33 (2) 0.5 (3) 1.5 (4)  $-0.5$

Ans. (1)

38. The voltage of a cell whose half cell reactions are given below is



- (1)  $-2.03 \text{ V}$  (2)  $1.36 \text{ V}$  (3)  $2.71 \text{ V}$  (4)  $2.03 \text{ V}$

Ans. (3)

39. The quantity of electricity required to reduce 12.3 g of nitro benzene to aniline assuming 50% current efficiency is  
 (1) 115800 C (2) 57900 C (3) 231600 C (4) 28950 C

Ans. (1)

40. A 100 watt, 110 volt lamp is connected in series with an electrolytic cell containing  $\text{CdSO}_4$  solution, the weight of Cd deposited by the current for 10 hrs is (At. wt. Cd = 112.4)  
 (1) 19.06 g (2) 38.12 g (3) 1.906 g (4) 3.812 g

Ans. (1)

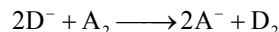
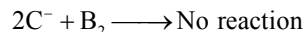
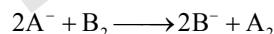
41. The two platinum electrodes fitted in a conductance cell are 1.5 cm apart while the cross sectional area of each electrode is  $0.75 \text{ cm}^2$ . What is the cell constant?  
 (1)  $1.25 \text{ cm}$  (2)  $0.5 \text{ cm}$  (3)  $2.0 \text{ cm}^{-1}$  (4)  $0.2 \text{ cm}^{-1}$

Ans. (3)

42. A current of 2.0 A is passed for 5 hours through a molten metal salt deposits 22.2 g of metal (At. mass : 177). The oxidation state of the metal in metal salt is  
 (1) +1 (2) +2 (3) +3 (4) +4

Ans. (3)

43. The following facts are available



Which of the following statement is correct

- (1)  $E_{\text{C}^-/\text{C}_2}^\circ > E_{\text{B}^-/\text{B}_2}^\circ > E_{\text{A}^-/\text{A}_2}^\circ > E_{\text{D}^-/\text{D}_2}^\circ$  (2)  $E_{\text{C}^-/\text{C}_2}^\circ < E_{\text{B}^-/\text{B}_2}^\circ < E_{\text{A}^-/\text{A}_2}^\circ < E_{\text{D}^-/\text{D}_2}^\circ$   
 (3)  $E_{\text{C}^-/\text{C}_2}^\circ < E_{\text{B}^-/\text{B}_2}^\circ > E_{\text{A}^-/\text{A}_2}^\circ > E_{\text{D}^-/\text{D}_2}^\circ$  (4) Can't predict

Ans. (2)



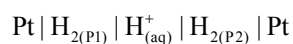
44. The hydrogen electrode is dipped in a solution of pH = 3 at 25°C. The reduction potential of the electrode would be  
(1) 0.177 V (2) 0.087 V (3) -0.177 V (4) 0.059 V

Ans. (3)

45. A current of 0.965 ampere is passed through 500 ml of 0.2 M solution of  $\text{ZnSO}_4$  for 10 minutes. The molarity of  $\text{Zn}^{2+}$  after deposition of zinc is  
(1) 0.1 M (2) 0.5 M (3) 0.8 M (4) 0.194 M

Ans. (4)

46. What will be the emf of the given cell ?



- (1)  $\frac{RT}{F} \ln \frac{P_1}{P_2}$  (2)  $\frac{RT}{2F} \ln \frac{P_1}{P_2}$  (3)  $\frac{RT}{F} \ln \frac{P_2}{P_1}$  (4)  $\frac{RT}{2F} \ln \frac{P_2}{P_1}$

Ans. (2)

## ASSERTION & REASON QUESTIONS

These questions consist of two statements each, printed as *Assertion* and *Reason*. While answering these Questions you are required to choose any one of the following four responses.

- A. If both *Assertion* & *Reason* are True & the *Reason* is a correct explanation of the *Assertion*.
- B. If both *Assertion* & *Reason* are True but *Reason* is not a correct explanation of the *Assertion*.
- C. If *Assertion* is True but the *Reason* is False.
- D. If both *Assertion* & *Reason* are False.

1. *Assertion* :- Electrolysis of molten calcium hydride produces hydrogen gas at anode.  
*Reason* :- Hydrogen in calcium hydride is present as  $H^-$  ion.  
Ans. (A)
2. *Assertion* :- Conductance of 0.1 M  $NH_4OH$  solution is less than that of 0.001M  $NH_4OH$  solution.  
*Reason* :- Dilution increases the degree of ionisation of  $NH_4OH$   
Ans. (A)
3. *Assertion* :- Salt bridge is used generally in the electrochemical cells.  
*Reason* :- The ions of the electrolyte used in the salt bridge should have nearly same transport number.  
Ans. (B)
4. *Assertion* :- The electrode potential of SHE is zero.  
*Reason* :- SHE is a standard reference electrode.  
Ans. (B)
5. *Assertion* :- Copper sulphate solution cannot be stored in iron-vessel.  
*Reason* :- Copper atoms are oxidised by iron ions.  
Ans. (C)
6. *Assertion* :- Absolute value of  $E_{red}^0$  of an electrode cannot be determined.  
*Reason* :- Neither oxidation nor reduction can take place alone.  
Ans. (A)
7. *Assertion* :- A dry cell became dead after long time even if it has not been used.  
*Reason* :- The  $NH_4Cl$  slowly and gradually corrodes the zinc container.  
Ans. (A)
8. *Assertion* :- The molar conductance of weak electrolytes is low as compared to that of strong electrolytes at moderate concentrations.  
*Reason* :- Weak electrolytes at moderate concentration dissociation to a much greater extent as compared to strong electrolytes.  
Ans. (C)
9. *Assertion* :- Galvanised iron does not rust.  
*Reason* :- Zinc has a more negative electrode potential than iron.  
Ans. (A)
10. *Assertion* :- Increase in the concentration of copper half cell in Daniel cell increases the emf of the cell.  
*Reason* :- According to the Nernst equation  
$$emf \text{ of cell} = E_{cell}^0 + \frac{0.059}{2} \log \frac{[Cu^{+2}]}{[Zn^{+2}]}$$
  
Ans. (A)
11. *Assertion* :- Sodium ions are discharged at the Hg electrode during electrolysis in preference to  $H^+$  ions.  
*Reason* :- The nature of electrode also affect the order of discharge of cations.  
Ans. (A)
12. *Assertion* :- The cell constant of a cell depends upon the nature of the material of the electrodes.  
*Reason* :- The observed conductance depends upon the nature of the electrolyte and the concentration of the solution.  
Ans. (D)

13. **Assertion :-** At the end of electrolysis using platinum electrodes, an aqueous solution of copper sulphate turns colourless.  
**Reason :-** Copper in  $\text{CuSO}_4$  is converted to  $\text{Cu}(\text{OH})_2$  during the electrolysis.  
Ans. (C)
14. **Assertion :-** In electrolysis, the quantity of electricity needed for depositing 1 mole of silver is different from that required for 1 mole of copper.  
**Reason :-** The atomic weight of silver and copper are different.  
Ans. (B)
15. **Assertion :-** Reduction potential of Mn (+3 to +2) is more positive than Fe (+3 to +2) [AIIMS-2011]  
**Reason :-** Ionisation potential of Mn is more than that of Fe  
Ans. (C)
16. **Assertion :-** A reaction is spontaneous if  $E_{\text{cell}} = +ve$  [AIIMS-2011]  
**Reason :-** For  $E_{\text{cell}} = +ve$ ,  $\Delta G$  is always  $-ve$   
Ans. (A)
17. **Assertion :-** pH of solution increases during electrolysis of aqueous solution of NaCl.  
**Reason :-** Electrolysis is non-spontaneous process.  
Ans. (B)
18. **Assertion :-** Cu is stronger reducing agent than  $\text{H}_2$ .  
**Reason :-**  $E^\circ$  of  $\text{Cu}^{+2}/\text{Cu}$  is negative.  
Ans. (D)
19. **Assertion :-** For cell reaction ; at 298 K  
$$\text{Zn}_{(s)} + \text{Cu}^{+2}(1\text{M}) \rightleftharpoons \text{Zn}^{+2}(1\text{M}) + \text{Cu}(s)$$
  
$$E_{\text{cell}}^0 = 0$$
  
**Reason :-** At standard condition ; cell potential is always zero.  
Ans. (D)
20. **Assertion :-** Li forms ethynide with acetylene.  
**Reason :-**  $E_{\text{Li}^+/\text{Li}}^0 = +3.04\text{V}$   
Ans. (C)