



## CHEMISTRY

### BOOKS - UNIVERSAL BOOK DEPOT 1960 CHEMISTRY (HINGLISH)

## ELECTROCHEMISTRY

### Ordinary Thinking Objective Questions (Electrolytes and Electrolysis)

1. On electrolysis of a solution of dilute  $H_2SO_4$  between platinum electrodes, the gas evolved at the anode is

A.  $SO_2$

B.  $SO_3$

C.  $O_2$

D.  $H_2$

**Answer: C**



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2. Sodium is made by the electrolysis of a molten mixture of about 40 % NaCl and 60 %  $\text{CaCl}_2$  because

- A.  $\text{CaCl}_2$  helps in conduction of electricity
- B. This mixture has lower melting point than NaCl
- C.  $\text{Ca}^{2+}$  can displace Na from NaCl
- D.  $\text{Ca}^{2+}$  can reduce  $\text{Na}^+$  to Na

**Answer: B**



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3. Electrolysis of molten anhydrous calcium chloride produces .

A. Calcium

B. Phosphorus

C. Sulphur

D. Sodium

**Answer: A**

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4. The products formed when an aqueous solution of  $NaBr$  is electrolysed in a cell having inert electrodes are :

A. Na and  $Br_2$

B. Na and  $O_2$

C.  $H_2$ ,  $Br_2$  and NaOH

D.  $H_2$ , and  $O_2$

**Answer: C**

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5. Degree of ionisation of a solution produces

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6. Electrolysis of aqueous HCl solution produces

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7. In the electrolysis of which solution  $OH^-$  ions are discharged in preference to  $Cl^-$  ions?

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8. During the electrolysis of fused NaCl, which reaction occurs at anode ?

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9. In electrolysis of aqueous copper sulphate, the gas at anode and cathode is .

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10. Use of electrolysis is .

- A. Electroplating
- B. Electrorefining
- C. Both (a) and (b)
- D. None of these

**Answer: C**

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11. During electrolysis, the species discharged at cathode are .

- A. ions
- B. cation
- C. anion
- D. all of these

**Answer: B**

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**12.** 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

**Answer: C**

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13. Which one of the following material conducts electricity

- A. Diamond
- B. Crystalline sodium chloride
- C. Barium sulphate
- D. Molten sulphur

**Answer: D**

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14. Which pair of electrolytes could not be distinguished by the products of electrolysis, using inert electrodes

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15. The electrolyte used in Lechlanche cell is

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16. The passage of current through a solution of certain electrolyte results in the evolution of  $H_2(g)$  at cathode and  $Cl_2(g)$  at anode. The electrolytic solution is :

A. copper chloride in water

B. aq.NaCl

C.  $H_2SO_4$

D. Water

**Answer: B**

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17. 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

**Answer: A**



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18. Strong electrolytes are those which:

- A. Dissolve readily in water
- B. Conduct electricity
- C. Dissociate into ions at high dilution
- D. Completely dissociate into high ions at all dilutions

**Answer: D**

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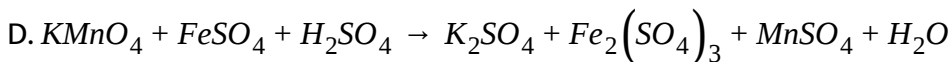
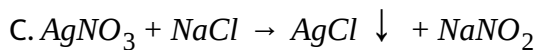
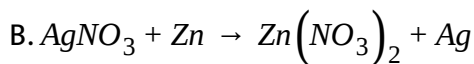
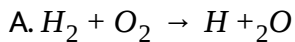
**19.** Electrolysis involves oxidation and reduction respectively at .

- A. Anode and cathode
- B. Cathode and anode
- C. At both the electrodes
- D. none of the above

**Answer: A**

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**20.** Which of the following reactions cannot be a base for electrochemical cell?



**Answer: D**



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21. Which of the following aqueous solutions will conduct an electric current quite well?

A. Glycerol

B. HCl

C. Sugar

D. Pure water

**Answer: B**

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22. On the electrolysis of aqueous solution of sodium sulphate, on cathode we get

A. Na

B.  $H_2$

C.  $SO_2$

D.  $SO_3$

**Answer: B**

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23. The addition of a polar solvent to a solenoid electrolyte results in

A. Polarization

B. Association

C. Ionization

D. Non- liberation of heat

**Answer: C**

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**24.** Electrolysis is a process in which the cations and anions of the electrolyte are

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**25.** During electrolysis of NaCl solution, part of the reaction is  $Na^+ e^- Na$ .

This is termed as

A. Oxidation

B. Reduction

C. Deposition

D. Cathode reaction

**Answer: B**



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26. Which of the following properties of pure metal makes it more useful than the corresponding alloy

- A. It is harder than corresponding alloy
- B. It has high density
- C. It can be extraced easily
- D. It conducts heat and electricity easily

**Answer: D**



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27. Which of the following metals will give  $H_2$  on reaction with  $NaOH$ .

A. Mg

B. Ba

C. Ca

D. Sr

**Answer: A**

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28. When the sample of copper with zinc impurity is to be purified by electrolysis, the appropriate electrode are .

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29. Which of the following is not a non-electrolyte ?

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30. Out of the following metals that cannot be obtained by electrolysis of the aqueous solution of their salts is

A. Cu

B. Ag

C. Mg

D. Au

**Answer: C**

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31. In the electrolysis of aqueous solution of  $CuSO_4$  using copper electrodes, the process that takes place at the anode is

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32. Brine solution on electrolysis will not give.

A. NaOH

B.  $Cl_2$

C.  $H_2$

D.  $O_2$

Answer: D



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33. Which of the following is non-electrolyte ?

A. NaCl

B.  $CaCl_2$

C.  $C_{12}H_{22}O_{11}$

D.  $CH_3COOH$

**Answer:**

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**34.** In a galvanic cell, the electrons flow from :

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**35.** Which of the following does not conduct electricity ?

- A. Fused NaCl
- B. Solid NaCl
- C. Brine solution
- D. Copper

**Answer: B**

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36. In the electrolytic refining of zinc,

- A. Graphite is at the anode
- B. The impure metal is at the cathode
- C. The metal ion gets reduced at the anode
- D. Acidified zinc sulphate is the electrolyte

Answer: D



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37. Pure water does not conduct electricity because it is



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38. Which of the following will give  $H_{2(g)}$  at cathode and  $O_{2(g)}$  at anode on electrolysis using platinum electrodes



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39. Electrolyte can conduct electricity because \_\_\_\_\_.

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40. An electric current passed through aqueous solution of the following which one shall decompose ?

A. Urea

B. Glucose

C.  $AgNO_3$

D. Ethyl alcohol

**Answer: C**

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41. Assertion : A small amount of acid or alkali is added before electrolysis of water.

Reason : Pure water is weak electrolyte.

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42. Assertion : Salts like  $KCl$ ,  $KNO_3$  i.e., inert electrolytes are used in salt bridge.

Reason : An inert electrolyte can easily be filled in the U-tube.

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### Ordinary Thinking Objective Questions (Faradays law of electrolysis)

1. During electrolysis of aqueous  $NaOH$ , 4g of  $O_2$  gas is liberated at NTP at anode,  $H_2$  gas liberated cathode is

A. 2.8 litres

B. 5.6 litres

C. 11.2 litres

D. 22.4 litres

**Answer: B**



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2. Electrolysis rules of Faraday states that mass deposited on electrode is proportional to

A.  $m \propto l^2$

B.  $m \propto Q$

C.  $m \propto Q^2$

D. None of these

**Answer: B**



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3. On the basis of 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 of the electrolysis of  $Al_2O_3$  is ( $F = 96,500Cmol^{-1}$ )

A. 8.56 V

B. 2.14 V

C. 4.28 V

D. 6.42 V

**Answer: B**



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4.  $Al_2O_3$  is reduced by electrolysis at low potentials and high current. If  $4.0 \times 10^4$  amperes of current is passed through molten  $Al_2O_3$  for 6 hours, what mass of aluminium is produced? (Assume 100 % current efficiency, At. Mass of  $Al = 27u$ )

A.  $9.0 \times 10^3 g$

B.  $8.1 \times 10^4 g$

C.  $2.4 \times 10^5 g$

D.  $1.3 \times 10^4 g$

**Answer: B**

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5. During the electrolysis of molten sodium chloride, the time required to produce  $0.10 \text{ mol}$  of chlorine gas using a current of 3 amperes is

A. 330 minutes

B. 55 minutes

C. 110 minutes

D. 220 minutes

**Answer: C**



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6. The number of electrons delivered at the cathode during electrolysis by a current of 1 ampere in 60 seconds is (charge on electron =  $1.60 \times 10^{-19}C$ )

A.  $7.48 \times 10^{23}$

B.  $6 \times 10^{23}$

C.  $6 \times 10^{20}$

D.  $3.75 \times 10^{20}$

**Answer: D**

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7. If the current is passed into the solution of the electrolyte

A. Anions move towards anode, cations towards cathode

B. Anions and cations both move towards anode

C. Anions move towards cathode, cations towards anode

D. No movement of ions take place

**Answer: A**

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8. A certain current liberates 0.5g of hydrogen in 2 hours. How many grams of copper can be liberated by the same current flowing for the same time in a copper sulphate solution ?

A. 12.7 gm

B. 15.9 gm

C. 31.8 gm

D. 63.5 gm

**Answer: B**



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9. On passing one faraday of electricity through the electrolytic cells containing  $Ag^+$ ,  $Ni^{+3}$  and  $Cr^{+3}$  ion solutions, the deposited Ag (At. Wt. = 108) Ni (At. Wt = 59) and Cr (Atwt. = 52) is .



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10. The number of electrons required to deposit 1g atom of aluminium (At. Wt. = 27) from a solution of aluminium chloride will be (where N is Avogadro's number)

A. 1N

B. 2N

C. 3N

D. 4N

Answer: C

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11. Charge required to liberate 11.5g sodium is .

A. 0.5F

B. 0.1F

C. 1.5F

D. 96500 colombs

**Answer: A**

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12. What is the amount of chlorine evolved when 2 amperes of current is passed for 30 minutes in an aqueous solution of  $NaCl$  ?

A. 66g

B. 1.32g

C. 33g

D. 99g

**Answer: B**



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13. The current in a given wire is 1.8 A. The number of coulombs that flow in 1.36 minutes will be \_\_\_\_\_.

A. 100C

B. 147C

C. 247C

D. 347C

**Answer: B**



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14. A current of 96.5 A is passed for 18 min between nickel electrodes in 500 mL solution of  $2\text{Ni}(\text{NO}_3)_2$ . The molarity of solution after electrolysis would be:

- A. 0.46 M
- B. 0.92 M
- C. 0.625 M
- D. 1.25 M

**Answer: B**



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15. An apparatus used for the measurement of quantity of electricity is known as

- A. Calorimeter
- B. Cathetometer

C. Coulometer

D. Colorimeter

**Answer: C**

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16. The number of Faradays needed to reduce 4 g equivalents of  $\text{Cu}^{2+}$  to Cu metal will be

A. 1

B. 2

C. 1/2

D. 4

**Answer: D**

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17. When 0.04 F of electricity is passed through a solution of  $\text{CaSO}_4$ , then the weight of  $\text{Ca}^{2+}$  metal deposited at the cathode is

- A. 0.2 gm
- B. 0.4 gm
- C. 0.6 gm
- D. 0.8 gm

**Answer: D**



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18. How many atoms of calcium will be deposited from a solution of  $\text{CaCl}_2$  by a current of 5mA flowing for 60s?

- A.  $4.68 \times 10^{18}$
- B.  $4.68 \times 10^{15}$
- C.  $4.68 \times 10^{12}$



D.  $4.68 \times 10^9$

**Answer: A**

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19. Three faradays of electricity are passed through molten  $Al_2O_3$  aqueous solution of  $CuSO_4$  and molten  $NaCl$  taken in different electrolytic cells. The amount of  $Al$ ,  $Cu$  and  $Na$  deposited at the cathodes will be in the ratio of .

- A. 1 mole : 2 mole : 3 mole
- B. 3 mole : 2 mole : 1 mole
- C. 1 mole : 1.5 mole : 3 mole
- D. 1.5 mole : 2 mole : 3 mole

**Answer: C**

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20. A current of 0.5 amperes is passed for 30 minute through a voltmeter containing  $CUSO_4$  Solution. Calculate the mass of Cu deposited at the cathode

- A. 3.18 g
- B. 0.318 g
- C. 0.296 g
- D. 0.150 g

**Answer: C**



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21. Which solution will show highest resistance during the passage of current

- A. 0.05 N NaCl
- B. 2N NaCl

C. 0.1 N NaCl

D. 1N NaCl

**Answer: B**

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22. An electrolytic cell contains a solution of  $Ag_2SO_4$  and have platinum electrodes. A current is passed until 1.6gm of  $O_2$  has been liberated at anode. The amount of silver deposited at cathode would be

A. 107.88 gm

B. 1.6 gm

C. 0.8 gm

D. 21.60 gm

**Answer: D**

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23. One Faraday of electricity when passed through a solution of copper sulphate deposits .

- A. 1mole of Cu
- B. 1 gm atom of Cu
- C. 1molecule of Cu
- D. 1 gm equivalent of Cu

**Answer: D**



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24. In the electrolysis of fused salt, the weight of the substance deposited on an electrode will not depend on:

- A. Temperature of the bath
- B. Current intensity

C. Electrochemical equivalent of ions

D. Time of electrolysis

**Answer: A**

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25. Two electrolytic cells, one containing acidified ferrous sulphate and another acidified ferric chloride, are in series. The ratio of masses of Iron deposited at the cathode in the two cells will be

A. 3:1

B. 2:

C. 1:1

D. 3:2

**Answer: D**

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26. The value of one Faraday is

A.  $95500\text{Cmol}^{-1}$

B.  $96550\text{Cmol}^{-1}$

C.  $96500\text{Cmol}^{-1}$

D.  $98500\text{Cmol}^{-1}$

Answer: C



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27. Amount of electricity that can deposit 108g of silver from  $\text{AgNO}_3$

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A. 1 ampere

B. 1 coulomb

C. 1 faraday

D. None of the above

**Answer: C**

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**28.** From the solution of which of the following one faraday of electricity will liberate one gram atom of metal

A. NaCl

B.  $BaCl_2$

C.  $CuSO_4$

D.  $AlCl_3$

**Answer: A**

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29. A solution of a salt of a metal was electrolysed for 150 minutes with a current of 0.15 amperes. The weight of metal deposited was 0.783g. The equivalent weight of the metal is .

A. 55.97 gm

B. 65.97 gm

C. 75.97gm

D. 85.97 gm

**Answer: A**



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30. An electric current is passed through silver voltameter connected to a water voltmeter. The cathode of the silver voltameter is 0.108g more at the end of the electrolysis. The volume of oxygen evolved at STP:

A.  $56\text{cm}^3$



B.  $550\text{cm}^3$

C.  $5.6\text{cm}^3$

D.  $11.2\text{cm}^3$

**Answer: C**



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**31.** An electric current is passed through silver nitrated solution using silver electrodes .  $10.79\text{g}$  of silver gas found to be deposited on the cathode fi the same amount of electricity is passed through copper sulphate solutin using copper electrodes. the weihgt of copper deposited on teh cathode is .

A.  $6.4\text{ g}$

B.  $2.3\text{ g}$

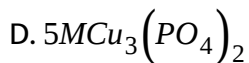
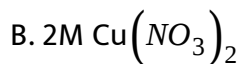
C.  $12.8\text{ g}$

D.  $3.2\text{ g}$

**Answer: D**

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**32.** The amount of copper deposited by one Faraday current will be maximum in an acidic solution of one litre of



**Answer: A**

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**33.** If the aqueous solutions of the following salts are electrolysed for 1 hour with 10 ampere current, which solution will deposit the maximum

mass of the metal at cathode ? The atomic weights are :

$Fe = 56, Zn = 65, Ag = 108, Hf = 178$  and  $W = 184$ .

A.  $ZnSO_4$

B.  $FeCl_3$

C.  $HfCl_4$

D.  $AgNO_3$

**Answer: D**



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**34.** A direct current deposits deposits 54 g of silver (Atomic mass = 108) during electrolysis. How much aluminium (Atomic mass =27) would be deposited from aluminium chloride solution by the same amount of electricity ?

A. 4.5g

B. 5.4g

C. 54g

D. 2.7g

**Answer: A**



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**35.** A current is passed through two cells connected in series. The first cell contains  $X(NO_3)_3(aq)$  and the second cell contains  $Y(NO_3)_2(aq)$ . The relative atomic masses of X and Y are in the ratio 1:2. What is the ratio of liberated mass of X to that of Y?

A. 3:2

B. 1:2

C. 1:3

D. 3:1

**Answer: C**



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36. A current of strength 2.5 amp was passed through  $CuSO_4$  solution for 6 minutes 26 seconds. The amount of copper deposited is:-

(Atomic weight of  $Cu = 63.5$ )

(1 faraday=96500 coulombs)

A. 0.3175 g

B. 3.175 g

C. 0.635 g

D. 6.35 g

**Answer: A**



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37. Total charge on 1 mole of a monovalent metal ion is equal to

A.  $9.65 \times 10^4$  coulomb

B.  $6.28 \times 10^{18}$  coulomb

C.  $1.6 \times 10^{-19}$  coulomb

D. None of these

**Answer: A**



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**38.** The number of electrons passing per second through a cross-section of copper wire carrying  $10^{-6}$  ampere:

A.  $1.6 \times 10^{-19}$

B.  $6 \times 10^{-35}$

C.  $6 \times 10^{-16}$

D.  $6 \times 10^{12}$

**Answer: D**



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39. The same current is passed through solution of silver nitrate and cupric salt connected in series. If the weight of silver deposited is 1.08g. Calculate the weight of copper deposited

A. 0.6454 g

B. 6.354 g

C. 0.3177 g

D. 3.177 g

**Answer: C**



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40. Three faradays of electricity was passed through an aqueous solution of iron (II) bromide. The mass of iron metal (at mass 56) deposited at the cathode is:

A. 56

B. 84

C. 112

D. 168

**Answer: B**



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**41.** When 9.65 coulomb of electricity is passed through a solution of silver nitrate (Atomic mass of Ag =  $108 \text{ g mol}^{-1}$ , the amount of silver deposited is :

A. 10.8 gm

B. 5.4 gm

C. 16.2 gm

D. 21.2 gm



**Answer: A**



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42. Silver is removed electrolytically from 200mL of a 0.1N solution of  $AgNO_3$  by a current of 0.1A. How long will it take to remove half of the silver from the solution ?

- A. 16 sec
- B. 96.5 sec
- C. 100 sec
- D. 10 sec

**Answer: B**



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43. What current is to be passed for 0.25 sec for deposition of certain weight of metal which is equal to its electrochemical equivalent ?

A. 4A

B. 100A

C. 200A

D. 2A

**Answer: A**



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44. To deposit 0.6354g of copper by electrolysis of aqueous cupric sulphate solution, the amount of electricity required (in coulombs) is.

A. 9650

B. 4825

C. 3860

D. 1930

**Answer: D**

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**45.** On passing  $C$  ampere of electricity through an electrolyte solution for  $t$  seconds,  $m$  gram metal deposits on cathode. The eq. wt. of metal is

A.  $E = \frac{C \times t}{m \times 96500}$

B.  $E = \frac{C \times m}{t \times 96500}$

C.  $E = \frac{96500 \times m}{C \times t}$

D.  $E = \frac{C \times t \times 96500}{m}$

**Answer: a**

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46. On passing  $0.1F$  of electricity through aluminium chloride, the amount of aluminium metal deposited on cathode is ( $A_1 = 27$ ).

- A. 0.9gm
- B. 0.3 gm
- C. 0.27 gm
- D. 2.7 gm

**Answer: A**

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47. Which of the following represents the first law of faraday

- A.  $E = mc^2$
- B.  $E = hv$
- C.  $m = ect$
- D.  $PV = nRT$

**Answer: C**



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**48.** On passing 3 A of electricity for 50 min, 1.8 g of metal deposits. The equivalent mass of metal is

A. 20.5

B. 25.8

C. 19.3

D. 30.7

**Answer: C**



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**49.** When 1 ampere of current flows for 1 second through a conductor, this quantity is called \_\_\_\_\_.

A. Faraday

B. Coulomb

C. E.M.F.

D. Ohm

**Answer: B**



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50. When electricity is passed through a solution of  $AlCl_3$  and 13.5g of Al is deposited, the number of Faraday of electricity passed must be.....F.

A. 0.5

B. 1

C. 1.5

D. 2

**Answer: C**

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51. The number of coulombs required for the deposition of 107.870 of silver is

- A. 96500
- B. 48250
- C. 1,93,000
- D. 10000

**Answer: A**

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52. Number of faraday's required to generate one gram atom of magnesium from molten  $MgCl_2$  is :

- A. 1

B. 2

C. 3

D. 4

**Answer: B**



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**53.** Faraday has the dimension of

A. Coulombs

B. Coulomb equivalent

C. Coulomb per equivalent

D. Coulomb per degree kelvin

**Answer: C**



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54. During the electrolysis of molten NaCl solution, 230 g of sodium metal is deposited on the cathode, then how many moles of chlorine will be obtained at anode?

A. 10

B. 5

C. 35.5

D. 17.0

**Answer: B**



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55. How many coulombs are required for the oxidation of  $1\text{ mol}$  of  $H_2O$  to  $O_2$ ?

A.  $1.93 \times 10^5$

B.  $9.6 \times 10^4$

C. 1.8

D. 3.2

**Answer: A**



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56. When during electrolysis of a solution of  $AgNO_3$ , 9650 coulombs of charge pass through the electroplating bath, the mass of silver deposited on the cathode will be:

A. 1.08g

B. 10.8g

C. 21.6g

D. 108g

**Answer: B**



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57. During the process of electrolytic refining of copper some metals present as impurity settle as 'anode mud'. These are

A. Sn and Ag

B. Pb and Zn

C. Ag and Au

D. Fe and Ni

**Answer: C**



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58. What weight of copper will be deposited by passing 2 faradays of electricity through a cupric salt ( atomic weight of  $Cu = 63.5$  ) ?

A. 2.0 gm

B. 3.175 gm

C. 63.5 gm

D. 127.0 gm

**Answer: C**

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

A.  $4m$

B.  $m/2$

C.  $m/4$

D.  $2m$

**Answer: B**

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60. When an electric current is passed through acidified water,  $112\text{ml}$  of  $\text{H}_2$  gas at *NTP* is collected at the cathode in 965 seconds. The current passed in amperes is

A. 1.0

B. 0.5

C. 0.1

D. 2.0

**Answer: A**



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61. In a metal oxide, there is 20% oxygen by weight. Its equivalent weight is

A. 40

B. 64

C. 72

D. 32

**Answer: D**

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**62.** The number of electrons involved in the reaction when one faraday of electricity is passed through an electrolyte is

A.  $6 \times 10^{23}$

B.  $6 \times 10^{-23}$

C. 96500

D.  $8 \times 10^{19}$

**Answer: A**

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63. One electrolysis 1 mole Al atoms will be deposited by

- A. 3 moles of electrons
- B. 4 moles of electrons
- C. 2 moles of electrons
- D. 1 mole of electrons

**Answer: A**



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64. The atomic weight of Fe is 56. The weight of Fe deposited from  $FeCl_3$  solution by passing 0.6 Faraday of electricity is \_\_\_\_\_.

- A. 5.6 g
- B. 11.2 g
- C. 22.4 g

D. 33.6 g

**Answer: B**



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65. The amount of silver deposited by passing 241.25C of current through silver nitrated solution is .

A. 2.7g

B. 2.7mg

C. 0.27g

D. 0.54g

**Answer: C**



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66. When 1 F of electricity is passed through acidulated water  $O_2$  evolved is

A.  $11.2 \text{ dm}^3$

B.  $5.6 \text{ dm}^3$

C.  $22.4 \text{ dm}^3$

D.  $1.0 \text{ dm}^3$

**Answer: B**



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67. In the electrolysis of water, one faraday of electrical energy would evolve at STP

A. one mole of oxygen

B. one g atom of oxygen

C. 8 g of oxygen

D. 22.4 litres of oxygen

**Answer: C**



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**68.** The volume of  $H_2$  gas at NTP obtained by passing 4 amperes through acidified  $H_2O$  for 30 minutes is

A. 0.0836L

B. 0.0432L

C. 0.1672L

D. 0.836L

**Answer: D**



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69. A current of 2.0A passed for 5 hours through a molten metal salt deposits 22.2 g of metal (At. Wt. =177). The oxidation state of the metal in the metal salt is

A. +1

B. +2

C. +3

D. +4

**Answer: C**



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70. The SI unit of electric current is

A. Ohm

B. Volt

C. Ampere

D. Coulomb

**Answer: C**



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71. The quantity of electricity required to liberate  $112 \text{ cm}^3$  of hydrogen at STP from acidified water is

A. 0.1 Faraday

B. 1 faraday

C. 965 coulomb

D. 96500 coulomb

**Answer: C**



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72. Faraday constant is defined as

- A. Charge carried by 1 electron
- B. Charge carried by one mole of electrons
- C. Charge required to deposit one mole of substance
- D. Charge carried by two moles of electrons

**Answer: B**



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73. 4 g of copper was dissolved in concentrated nitric acid. The copper nitrate solution on strong heating gave 5g of its oxide. The equivalent weight of copper is

- A. 23
- B. 32
- C. 12

D. 20

**Answer: B**

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74. In the electrolysis of acidulated water, it is desired to obtain 1.12 cc of hydrogen per second under STP condition. The current to be passed is:

A. 9.65A

B. 19.3A

C. 0.965A

D. 1.93A

**Answer: A**

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75. 9.65C of electric current is passed through fused anhydrous magnesium chloride. The magnesium metal thus obtained is completely converted into Grignard reagent. The number of moles of the original reagent obtained of

A.  $5 \times 10^{-4}$

B.  $1 \times 10^{-4}$

C.  $5 \times 10^{-5}$

D.  $1 \times 10^{-5}$

**Answer: C**



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76. The approximate time duration in hours to electroplate 30 g of calcium from molten calcium chloride using a current of 5 amp is [At. Mass of Ca=40]

A. 8

B. 80

C. 10

D. 16

**Answer: A**

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77. On passing C ampere of current for time t sec through 1 litre of 2(M)  $\text{CuSO}_4$  solution (atomic weight of Cu=63.5), the amount of m of Cu (in g) deposited on cathode will be:-

A.  $m = \frac{Ct}{(63.5 \times 96500)}$

B.  $m = \frac{Ct}{(31.25 \times 96500)}$

C.  $m = \frac{C \times 96500}{(31.25 \times t)}$

D.  $m = \frac{31.75 \times C \times t}{96500}$



**Answer: D**



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**78.** Coulomb is equal to

- A. Ampere  $\times$  second
- B. Ampere  $\times$  minute
- C. Watt  $\times$  second
- D. Volt  $\times$  second

**Answer: A**



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**79.** The amount of substance deposited by the passage of 1 A of current for 1s is equal to :

- A. Equivalent mass
- B. Molecular mass
- C. Electrochemical equivalent
- D. Specific equivalent

**Answer: C**

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**80.** When same quantity of electricity is passed for half an hour, the amount of Cu and Cr deposited are respectively 0.375g and 0.30g. Ratio of electrochemical equivalents of Cu and Cr is

- A. 0.8
- B. 1.25
- C. 2.5
- D. 1.62

**Answer: B**

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**81.** Electrolysis of water with 1 faraday electricity gives

- A. 1 mole of oxygen
- B. 1 gram equivalent of oxygen
- C. 1 molecule of oxygen
- D. 1 atom of oxygen

**Answer: B**

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**82.** How many coulombs are required in order to reduce 12.3 g of nitrobenzene to niline ?

A. 115800C

B. 5790C

C. 28950C

D. 579000C

**Answer: D**



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**83.** On passing a current through a molten aluminium chloride for some time, produced 11.2 lit of  $Cl_2$  at NTP at anode, the quantity of aluminium deposited at cathode is

A. 9g

B. 18g

C. 27g

D. 36g

**Answer: A**

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**84.** How many grams of cobalt metal will be deposited when a solution of cobalt (II) chloride is electrolyzed with a current of 10 amperes for 109 minutes? (1 Faraday = 96,500C, Atomic mass of Co= 59u)

A. 4

B. 20

C. 40

D. 0.66

**Answer: B**

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85. A current was passed for two hour through a solution of an acid that liberated 11.2 litre of oxygen at NTP at anode. What will be the amount of copper deposited at the cathode by the same current when passed through a solution of copper sulphate for the same time?

- A. 16g
- B. 63g
- C. 31.5g
- D. 8g

**Answer: B**

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86. During electrolysis of fused aluminium chloride 0.9gm of aluminium was deposited on the cathode. The volume of chlorine liberated at the anode will be

A. 2.24 litres

B. 11.2 litres

C. 1.12 litres

D. 5.6 litres

**Answer: A**



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87. Rgw atomic weight of Al is 27. When a current of  $5F$  is passed through a solution of  $Al^{+++}$  ions, the weight of Al deposited is.

A. 27gm

B. 36gm

C. 45gm

D. 39gm

**Answer: C**

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88. The desired amount of charge for obtaining one mole of Al from  $Al^{3+}$

A.  $3 \times 96500C$

B.  $96500C$

C.  $\frac{96500}{3}C$

D.  $\frac{96500}{2}C$

**Answer: A**

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89. Two platinum electrodes were immersed in a solution of  $CuSO_4$  and electric current was passed through the solution. After some time, it was found that colour of  $CuSO_4$  disappeared with evolution of gas at the electrode. The colourless solution contains.



A. Platimus sulphate

B. Copper hydroxide

C. copper sulphate

D. sulphuric acid

**Answer: D**

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**90.** Equal quantities of electricity are passed through 3 votameters containing  $FeSO_4$ ,  $Fe_2(SO_4)_2$  and  $Fe(NO_3)_3$ . Consider the following statements

(A) The amounts of iron deposited in  $FeSO_4$  and  $Fe_2(SO_4)_3$  are equal

(B) The amount of iron deposited in  $Fe(NO_3)_2$  is  $2/3^{rd}$  of the amount deposited in  $FeSO_4$

(C) The amount of iron deposited in  $Fe_2(SO_4)_3$  and  $Fe(NO_3)_3$  are equal

A. (A) is correct

B. (B) is correct

C. (C) is correct

D. Both (A) and (B) are correct

**Answer: B::C**



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**91.** Assertion : In electrolysis, the quantity of electricity needed for depositing 1 mole silver is different from that required for 1 mole of copper.

Reason : The molecular weights of silver and copper are different.

A. if both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is false

D. If the assertion and reason both are false.

**Answer: B**

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**92.** Statement-I: Equivalent conductance of all electrolytes decreases with increasing concentration.

Because Statement-II: Lesser number of ions are available per gram equivalent at higher concentration.

A. if both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is false

D. If the assertion and reason both are false.

**Answer: A**

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**93. STATEMENT 1 :** one coulomb of electric charge deposits the weight that is equal to electrochemical equivalent of substance and

**STATEMENT 2** One faraday deposits one mole of substance

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: C**

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**94.** Assertion A: Copper does not liberate hydrogen from the solution of dilute hydrochloric acid.

Reason (R): Hydrogen is below copper in the electrochemical series.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: D**



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Ordinary Thinking Objective Questions (Conductor And conductance)

1. If one end of a piece of a metal is heated, the other end becomes hot after some time. This is due to

- A. Energised electrons moving to the other part of the metal
- B. Resistance of the metal
- C. Mobility of atoms in the metal
- D. Minor perturbation in the energy of atoms

**Answer: A**



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2. Which of the following shows electrical conduction ?

- A. Potassium
- B. Graphite
- C. Diamond
- D. Sodium

**Answer: B**



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3. The resistance of  $0.01N NaCl$  solution at  $25^\circ C$  is  $200\Omega$ . Cell constant of conductivity cell is  $1cm^{-1}$ . The equivalent conductance is .

A.  $5 \times 10^2 \Omega^{-1} cm^2 eq^{-1}$

B.  $6 \times 10^3 \Omega^{-1} cm^2 eq^{-1}$

C.  $7 \times 10^4 \Omega^{-1} cm^2 eq^{-1}$

D.  $8 \times 10^5 \Omega^{-1} eq^{-1}$

**Answer: A**



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4. The molar conductance of  $Ba^{2+}$  and  $Cl^-$  are 127 and  $76ohm^{-1}cm^{-1}mol^{-1}$  respectively at infinite dilution. The equivalent

conductance of  $BaCl_2$  at infinite dilution will be

A. 101.5

B. 139.5

C. 203.5

D. 279.5

**Answer: B**



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5. Kohlrausch's law states that at :

A. infinite dilution, each ion makes definite contribution to conductance of an electrolyte

B. Infinite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte



C. Finite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte.

D. Infinite dilution each ion makes definite contribution to equivalent conductance of an electrolyte depending on the nature of the other ion of the electrolyte.

**Answer: B**

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6. The equivalent conductance of  $M/32$  solution of a weak monobasic acid is 8.0 and at infinite dilution is 400. The dissociation constant of this acid is :

A.  $1.25 \times 10^{-5}$

B.  $1.25 \times 10^{-6}$

C.  $6.25 \times 10^{-4}$

D.  $1.25 \times 10^{-4}$

**Answer: A**

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7. An increase in equivalent conductance of a strong electrolyte with dilution is mainly due to:

- A. Increase in number of ions
- B. Increase in ionic mobility of ions
- C. 100% ionisation of electrolyte at normal dilution
- D. Increase in both i.e., number of ions and ionic mobility of ions

**Answer: B**

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8. Which of the following expressions correctly represents the equivalent conductance at infinite dilution of  $Al_2(SO_4)_3$ . Given that  $\Lambda_{Al^{3+}}^{\circ}$  and  $\Lambda_{SO_4^{2-}}^{\circ}$  are the equivalent conductance at infinite dilution of the respective ions?

A.  $2 \Lambda_{Al^{3+}}^{\circ} + 3 \Lambda_{SO_4^{2-}}^{\circ}$

B.  $\Lambda_{Al^{3+}}^{\circ} + \Lambda_{SO_4^{2-}}^{\circ}$

C.  $\left( \Lambda_{Al^{3+}}^{\circ} + \Lambda_{SO_4^{2-}}^{\circ} \right) \times 6$

D.  $\frac{1}{3} \Lambda_{Al^{3+}}^{\circ} + \left( 1 \Lambda_{SO_4^{2-}}^{\circ} \right) \frac{1}{2}$

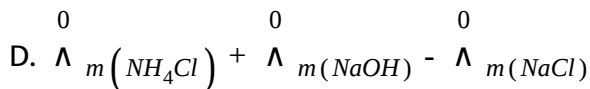
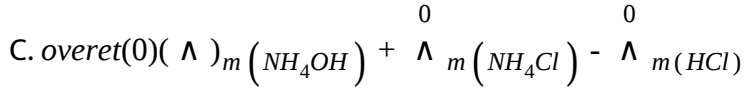
**Answer: B**

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9. Limiting molar conductivity of  $NH_4OH$  [i.e.,  $\Lambda_m^{\circ}(NH_4OH)$ ] is equal to:

A.  $\Lambda_m^{\circ}(NH_4Cl) + \Lambda_m^{\circ}(NaCl) - \Lambda_m^{\circ}(NaOH)$

B.  $\Lambda_m^{\circ}(NaOH) + \Lambda_m^{\circ}(NaCl) - \Lambda_m^{\circ}(NH_4Cl)$



**Answer: D**

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10. At  $25^\circ C$  molar conductance of 0.1 molar aqueous solution of ammonium hydroxide is  $9.54 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$  and at infinite dilution its molar conductance is  $238 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ . The degree of ionisation of ammonium hydroxide at the same concentration and temperature is

A. 40.800 %

B. 2.080 %

C. 20.800 %

D. 4.008 %

**Answer: D**

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11. The molar conductivity of a  $0.5\text{mol}/\text{dm}^3$  solution of  $\text{AgNO}_3$  with electrolytic conductivity of  $5.76 \times 10^{-3}\text{Scm}^{-1}$  at  $298\text{K}$  is

A.  $28.8\text{S cm}^2/\text{mol}$

B.  $2.88\text{S cm}^2/\text{mol}$

C.  $11.52\text{S cm}^2/\text{mol}$

D.  $0.086\text{S cm}^2/\text{mol}$

**Answer: C**



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12. 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

**Answer: D**

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13. The specific conductivity of N/10 KCl solution at  $20^{\circ}\text{C}$  is  $0.0212\text{ohm}^{-1}\text{cm}^{-1}$  and the resistance of the cell containing this solution at  $20^{\circ}\text{C}$  is 55 ohm. The cell constant is :

A.  $1.166\text{cm}^{-1}$

B.  $2.173\text{cm}^{-1}$

C.  $3.324\text{cm}^{-1}$

D.  $4.616\text{cm}^{-1}$

**Answer: A**



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14. The units of equivalent conductivity are

A. Ohm cm

B.  $\text{Ohm}^{-1}\text{cm}^2$  (gm equivalent)<sup>-1</sup>

C. Ohm  $\text{cm}^2$  (gm equivalent)

D. S  $\text{cm}^{-2}$

**Answer: B**



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15. The electrolytic conductance is a direct measure of

A. Resistance

B. Potential

C. concentration

D. Dissociation

**Answer: D**



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**16.** The conductivity of a strong electrolyte:

- A. Increase on dilution slightly
- B. Decrease on dilution
- C. Does not change with dilution
- D. Depend upon density of electrolytes itself

**Answer: A**



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**17.** Which of the following conducts electricity ?



A. Fused NaCl

B.  $CO_2$

C.  $Br_2$

D.  $Si$

**Answer: A**



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**18.** At  $18^\circ C$ , the conductance of  $H^+$  and  $CH_3COO^-$  at infinite dilution are 315 and 35  $mho\ cm^2eq^{-1}$  respectively. The equivalent conductance of  $CH_3COOH$  at infinite dilution is .....  $mho\ cm^2eq^{-1}$ .

A. 350

B. 280

C. 30

D. 315

**Answer: A**

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**19.** Specific conductance of 0.1M nitric acid is  $6.3 \times 10^{-2} \text{ohm}^{-1} \text{cm}^{-1}$ . The molar conductance of the solution is:

- A.  $630 \text{ohm}^{-1} \text{cm}^2 \text{mole}^{-1}$
- B.  $315 \text{ohm}^{-1} \text{cm}^2 \text{mole}^{-1}$
- C.  $63.0 \text{ohm}^{-1} \text{cm}^2 \text{mole}^{-1}$
- D.  $6300 \text{ohm}^{-1} \text{cm}^2 \text{mole}^{-1}$

**Answer: A**

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**20.** The best conductor of electricity is

A. 1M  $CH_3COOH$  solution

B. 1M  $H_2SO_4$  solution

C. 1M HCl solution

D. 1M  $H_3BO_3$  solution

**Answer: B**

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21. The conductance of a solution of an electrolyte is equal to that of its specific conductance The cell constant of the conductivity cell is equal to

A. Resistance

B. Faraday

C. Zero

D. Unity

**Answer: D**

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22. The electrical properties and their respective SI units are given below.

Identify the wrongly matched pair:-

- A. Electrical property-Specific conductance, SI-unit- $S m^{-1}$
- B. Electrical property-conductance, SI Unit-S
- C. Electrical property-Equivalent Conductance,  $S m^2 (gm \text{ equiv})^{-1}$
- D. Electrical property-Cell constant, SI unit-m

**Answer: D**

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23. On the basis of the given equivalent conductivity

$$\lambda_{\infty} (NH_4Cl) = 130$$

$$\lambda_{\infty} (OH^-) = 174$$

$$\lambda_{\infty}(\text{Cl}^{-}) = 66$$

The value of  $\lambda_{\infty}(\text{NH}_4\text{OH})$  will be

A. 304

B. 238

C. 108

D. 64

**Answer: B**



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**24.** Which one of the following statements is correct

A. The oxidation number of oxygen in  $\text{KO}_2$  is zero

B. The specific conductance of an electrolyte solution decreases with increase in dilution

C.  $\text{Sn}^{2+}$  oxidises  $\text{Fe}^{3+}$

D.  $Zn/ZnSO_4$  is a reference electrode

**Answer: B**

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25. The limiting molar conductivities of HCl,  $CH_3COONa$  and NaCl are respectively 425, 90 and 125  $mho\ cm^2\ mol^{-1}$  and  $25^\circ C$ . The molar conductivity of 0.1M  $CH_3COCH$  solution is  $7.8\ mho\ cm^2\ mol^{-1}$  at the same temperature then degree of dissociation is

A. 0.1

B. 0.20

C. 0.15

D. 0.03

**Answer: B**

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26. The equivalent conductance of 1M benzoic acid is  $12.8 \text{ ohm}^{-1} \text{ cm}^2$ . If the conductance of benzoate ion and  $H^+$  ion are 12 and  $288.42 \text{ ohm}^{-1} \text{ cm}^2$  respectively. Its degree of dissociation is :

- A. 0.39
- B. 3.9 %
- C. 0.0035
- D. 0.039 %

**Answer: B**



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27. At  $25^\circ \text{C}$ , the molar conductances at infinite dilution for the strong electrolytes

$\text{NaOH}$ ,  $\text{NaCl}$  and  $\text{BaCl}_2$  are  $248 \times 10^{-4}$ ,  $126 \times 10^{-4}$  and  $280 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$  respectively.  $\Lambda_m^\circ \text{Ba(OH)}_2$  in  $\text{Sm}^2 \text{ mol}^{-1}$

A.  $52.4 \times 10^{-4}$

B.  $524 \times 10^{-4}$

C.  $402 \times 10^{-4}$

D.  $262 \times 10^{-4}$

**Answer: B**



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**28.** What is the % dissociation of  $CH_3COOH$ , if equivalent conductivity at this dilution and at infinite dilution are 148 and 398  $S\ cm^2/mol$  respectively

A. 37.18 %

B. 47 %

C. 48.78 %

D. 10.8 %



**Answer: A**

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29. Electrolytic conduction differs from metallic conduction. In case of metallic 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.

**Answer: a**

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30. At  $3Y$ , minimum numbers of electrolyte required for a compound to obtained its conductivity is

A. 2

B. 3

C. 4

D. 1

**Answer: A**



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**31. Which one is NOT a conductor of electricity ?**

A. NaCl (aqueous)

B. NaCl (solid)

C. NaCl (molten)

D. Ag metal

**Answer: B**



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**32.** What is the effect of dilution on the equivalent conductance of strong electrolyte

- A. Decrease on dilution
- B. Remains unchanged
- C. Increase on dilution
- D. None of the above

**Answer: C**

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**33.** Conductivity (Unit Siemen's 'S') is directly proportional to area of the vessel and the concentration of the solution in it and is inversely proportional to the length of the vessel, then the unit of constant of proportionality is :

A.  $\text{Sm mol}^{-1}$

B.  $\text{Sm}^2\text{mol}^{-1}$

C.  $\text{S}^{-2}\text{m}^2 \text{mol}$

D.  $\text{S}^2\text{m}^2\text{mol}^{-2}$

**Answer: B**



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**34.** The highest electrical conductivity of the following aqueous solutions is of

A. 0.1 M acetic acid

B. 0.1 M chloroacetic acid

C. 0.1 M fluoroacetic acid

D. 0.1 M difluoroacetic acid

**Answer: D**

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35. The molar conductivities  $\Lambda_{NaOAc}^{\circ}$  and  $\Lambda_{HCl}^{\circ}$  at infinite dilution in water at  $25^{\circ}C$  are  $91.0$  and  $426.2 S cm^{\circ} / mol$  respectively. To calculate  $\Lambda_{HOAc}^2$ , the additional value required is:

- A.  $\Lambda_{H_2O}^{\circ}$
- B.  $\Lambda_{KCl}^{\circ}$
- C.  $\Lambda_{NaOH}^{\circ}$
- D.  $\Lambda_{NaCl}^{\circ}$

**Answer: D**

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

solution is  $520\Omega$ . the molar conductivity of  $0.02M$  solution of the electrolyte will be:

A.  $124 \times 10^{-4} Sm^2 mol^{-1}$

B.  $1240 \times 10^{-4} Sm^2 mol^{-1}$

C.  $1.24 \times 10^{-4} Sm^2 mol^{-1}$

D.  $1.24 \times 10^{-4} Sm^2 mol^{-1}$

**Answer: A**



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**37.** The equivalent conductances of two strong electrolytes at infinite dilution in  $H_2O$  (where ions move freely through a solution) at  $25^\circ C$  are given below :

$$\Lambda_{CH_3COONa}^\circ = 91.0 Sm^2 / equiv.$$

$\Lambda_{HCl}^\circ = 426.2 Sm^2 / equiv.$  What additional information//quantity one need to calculate  $\Lambda^\circ$  of an aqueous solution of acetic acid ?

A.  $(\Lambda)^{\circ}$  of NaCl

B.  $(\Lambda)^{\circ}$  of  $CH_3COOK$

C. The limiting equivalent conductance of  $H^+$   $(\Lambda)^{\circ}H^+$

D.  $(\Lambda)^{\circ}$  of chloroacetic acid  $(Cl/CH_2COOH)$

**Answer: A**

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**38.** The molar conductivities of KCl, NaCl and  $KNO_3$  are 152, 128 and 111  $S\ cm^2\ mol^{-1}$  respectively. What is the molar conductivity of  $NaNO_3$ ?

A. 101  $S\ cm^2\ mol^{-1}$

B. 87  $S\ cm^2\ mol^{-1}$

C. -101  $S\ cm^2\ mol^{-1}$

D. -391  $S\ cm^2\ mol^{-1}$

**Answer: B**

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39. If  $X$  is the conductivity of the solution and  $M$  is the molarity of the solution, the molar conductivity of the solution is given by \_\_\_\_\_.

A.  $\frac{1000X}{M}$

B.  $\frac{1000}{MX}$

C.  $\frac{1000M}{X}$

D.  $\frac{MX}{1000}$

**Answer: B**

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40. The unit  $ohm^{-1}$  is used for

A. Molar conductivity

B. Equivalent conductivity



C. Specific conductivity

D. Conductivity

**Answer: D**

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41. The correct expression in SI system relating the equivalent conductance ( $\lambda_C$ ), specific conductance ( $\kappa$ ) and equivalent (C) is:-

A.  $\lambda_C = \frac{\kappa}{C}$

B.  $\lambda_C = \kappa \times \frac{1000}{C}$

C.  $\lambda_C = \frac{\kappa \times 10^{-3}}{C}$

D.  $\lambda_C = \frac{\kappa \times 10^{-6}}{C}$

**Answer: B**

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42. Assertion: Molar conductivity increases with decrease in concentration.

Reason: Conductivity always decrease with decrease in concentration.

A.

B.

C.

D.

**Answer:**



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43. The molar conductivity is maximum for the solution of concentration \_\_\_\_\_.

A. 0.001 M

B. 0.005 M

C. 0.002 M

D. 0.004 M

**Answer: A**

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**44.** The units of molar conductance are

A.  $\Omega^{-1}mol^{-1}$

B.  $\Omega cm^{-2}mol^{-1}$

C.  $\Omega^{-1}cm^2mol^{-1}$

D.  $\Omega cm^2mol$

**Answer: C**

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45. Molar conductance of electrolytic solution  $\Lambda_m$  is

- A.  $\propto 1$
- B.  $\propto (1/A)$
- C.  $\propto (1/C)$
- D.  $\propto (\sqrt{C})$

**Answer: C**



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46. Conductivity of a solution is directly proportional to

- A. Dilution
- B. Number of ions
- C. Current density
- D. Volume of the solution

**Answer: B**

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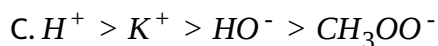
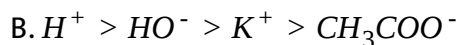
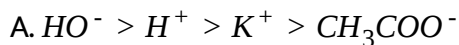
47. When a solution of an electrolyte is heated the conductance of the solution

- A. Increases because of the electrolyte conducts better
- B. Decreases because of the increased heat
- C. Decreases because of the dissociation of the electrolyte is suppressed
- D. Increases because the electrolyte is dissociated more

**Answer: D**

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48. The correct order of equivalent the electrolyte is dissociated more the correct order of equivalent conductances at infinite dilution in water at room temperature for  $H^+$ ,  $CH_3COO^-$  and  $HO^-$  ions is



Answer: B



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49. Equivalent conductivity at infinite dilution for sodium potassium oxalate  $(COO^-)_2Na^+K^+$  will be [given, molar conductivities of oxalate,  $K^+$  and  $Na^+$  ions at infinite dilution are 148.2, 50.1, 73.5  $S\ cm^2\ mol^{-1}$ , respectively]

A.  $271.8 \text{ cm}^2 \text{ eq}^{-1}$

B.  $67.95 \text{ S cm}^2 \text{ eq}^{-1}$

C.  $543.6 \text{ S cm}^2 \text{ eq}^{-1}$

D.  $135.9 \text{ S cm}^2 \text{ eq}^{-1}$

**Answer: D**

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**50.** Given  $l/a = 0.5 \text{ cm}^{-1}$ ,  $R = 50 \text{ ohm}$ ,  $N = 1.0$ . The equivalent conductance of the electrolytic cell is .

A.  $10 \text{ ohm}^{-1} \text{ cm}^2 \text{ gmeq}^{-1}$

B.  $20 \text{ ohm}^{-1} \text{ cm}^2 \text{ gmeq}^{-1}$

C.  $300 \text{ ohm S cm}^2 \text{ eq}^{-1}$

D.  $135.9 \text{ S cm}^2 \text{ eq}^{-1}$

**Answer: A**

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51. Conductivity of 0.01M NaCl solution is  $0.00147 \text{ ohm}^{-1}\text{cm}^{-1}$ . What happen to this conductivity if extra 100m L of  $H_2O$  will be added to the above solution?

- A. Increases because of the electrolyte conducts better
- B. Decreases because of the increased heat
- C. Remains unchanged
- D. First increases and then decreases

**Answer: B**

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52. Unit of ionic mobility is :

- A.  $m^2\text{sec}^{-1}\text{volt}^{-1}$



B.  $\text{msec}^{-1}$

C.  $\text{msec}^{-1}\text{volt}$

D.  $\text{m sec}^{-1}\text{volt}^{-1}$

**Answer: A**



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**53.** Which of the following statement is incorrect with respect to metallic or electronic conductivity

A. Metallic conductivity depends on the structure of metal and its characteristics

B. Metallic conductivity depends on the number of electrons in the valencshell of atom of metal

C. The electrical conductivity of metal increases with increase in temperature

D. There is no change in the structure of metal during electrical conduction

**Answer: C**



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54. The factor which is not affecting the conductivity of any solution is

A. Dilution

B. Nature of electrolyte

C. Temperature

D. None of these

**Answer: D**



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55. 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

**Answer: B**



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56. The 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 :

Assertion : According to Kohlrausch's law the molar conductivity of a strong electrolyte at infinite dilution is sum of molar conductivities of its

ions.

Reason : The current carried by cation and anion is always equal.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: C**

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**57.** Assertion: Electrical conductivity of copper increases with increase in temperature.

Reason: The electrical conductivity of metals is due to the motion of electrons.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. if assertion is false but reason is true.

**Answer: D**



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**58.** Assertion: The resistivity for a substance is its resistance when its is one meter long and its area of cross section is one square meter.

Reason: The SI units of resistivity are ohm metre ( $\Omega \text{ m}$ ) and ohm centimeter ( $\Omega \text{ cm}$ )

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.

- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: B**

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**59.** Assertion: If  $\lambda_{Na}^{\circ} + \lambda_{Cl}^{\circ}$  are molar limiting conductivity of the sodium and chloride ions respectively, then the limiting molar conductivity for sodium chloride is given by the equation:  $\Lambda_{NaCl}^{\circ} = \lambda_{Na}^{\circ} + \lambda_{Cl}^{\circ}$ .

Reason: This is according to Kohlrausch law of independent migration of ions.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.

- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**

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## Ordinary Thinking Objective Questions (Cell constant and Electrochemical cells)

1. The molar conductance of NaCl, HCl and  $CH_3COONa$  at infinite dilution are 126.45, 426.16 and  $91 \text{ ohm}^{-1}\text{cm}^2\text{mol}^{-1}$  respectively. The molar conductance of  $CH_3COOH$  at infinite dilution is :

A.  $201.28\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$

B.  $390.71\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$

C.  $698.28\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$

D.  $540.48\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$

**Answer: B**

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2. The specific conductance of a  $0.1\text{NKCl}$  solution at  $23^\circ\text{C}$  is  $0.012\text{ohm}^{-1}\text{cm}^{-1}$ . The resistance of cell containing the solution at the same temperature was found to be  $55\text{ohm}$ . The cell constant will be

A.  $0.142\text{ cm}^{-1}$

B.  $0.66\text{ cm}^{-1}$

C.  $0.918\text{ cm}^{-1}$

D.  $1.12\text{ cm}^{-1}$

**Answer: C**

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3. The efficiency of a fuel cell is given by:

A.  $\frac{\Delta H}{\Delta G}$

B.  $\frac{\Delta G}{\Delta S}$

C.  $\frac{\Delta G}{\Delta H}$

D.  $\frac{\Delta S}{\Delta \Delta G}$

**Answer: C**



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4. A device that converts energy of combustion of fuels like hydrogen and methane, directly into electrical energy is known as .

A. Electrolytic cell

B. Dynamo

C. Ni-Cd cell

D. Fuel cell

**Answer: D**

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5. 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 .

- A. The positive and negative ions will move towards the anode
- B. The positive ions will start moving towards the anode, the negative ions will stop moving
- C. The negative ions will continue to move towards the anode and the positive ions will stop moving
- D. The positive and negative ions will start moving randomly

**Answer: D**



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6. Among  $Na$ ,  $Hg$ ,  $S$ ,  $Pt$  and graphite which can be used as electrodes in electrolytic cell having aqueous solutions?

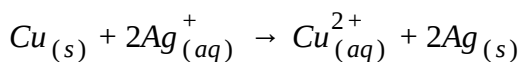
- A.  $Na$ ,  $Pt$  and graphite
- B.  $Na$  and  $Hg$
- C.  $Hg$ ,  $Pt$  and graphite only
- D.  $Na$  and  $S$  only

**Answer: C**

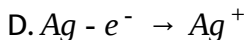
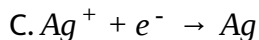
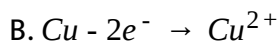
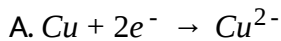


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7. In the reaction



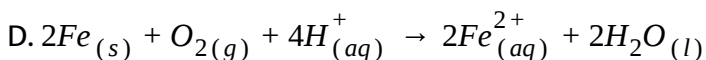
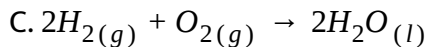
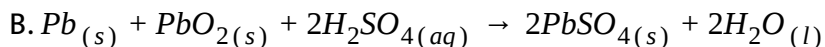
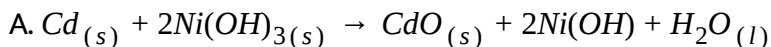
the reduction half-cell reaction is:-



**Answer: C**

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8. Which of the following reaction is reaction is used to make a fuel cell .



**Answer: C**

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9. Which of the following statement is true for the electrochemical Daniell cell ?

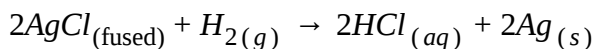
- A. Electrons flow from copper electrode to zinc electrode
- B. Current flows from zinc electrode to copper electrode
- C. Cations move towards copper electrode which is cathode
- D. Cations move towards zinc electrode

**Answer: C**



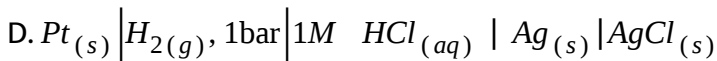
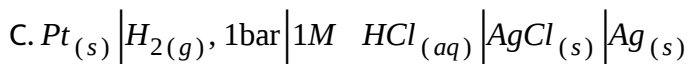
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10. The chemical reaction



taking place in a galvanic cell is represented by the notation





**Answer: B**

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**11. In Cu-Zn cell**

A. Reduction occurs at the copper cathode

B. oxidation occurs at the copper cathode

C. Reduction occurs at the anode

D. Chemical energy is converted to light energy

**Answer: A**

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12. Which of the following is used widely in the manufacture of lead storage battery?

- A. Arsenic
- B. Lithium
- C. Bismuth
- D. Antimony

**Answer: D**



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13. If a spoon of copper 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

**Answer: D**

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**14.** In an 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

**Answer: C**

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**15.** Which of the following statements is true for an electrochemical cell of  $\text{Cu-H}_2$ ?



- A.  $H_2$  is cathode and Cu is anode
- B.  $H_2$  is anode and Cu is cathode
- C. Reduction occurs at  $H_2$  electrode
- D. Oxidation occurs at Cu electrode

**Answer: B**

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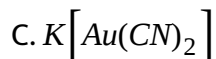
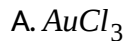
**16.** The acid used in lead storage battery is`

- A.  $H_2SO_4$
- B.  $H_3PO_4$
- C.  $HCl$
- D.  $HNO_3$

**Answer: A**

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17. For gold plating, the electrolyte used is



D. None of these

**Answer: C**



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18.  $Zn_{(s)} | Zn^{2+}_{(aq)} || Cu^{2+}_{(aq)} | Cu_{(s)}$  (cathode) (anode) is

A. Weston cell

B. Daniel cell

C. Calomel cell

D. Faraday cell

**Answer: B**

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19. A weak electrolyte having the limiting equivalent conductance of  $400 \text{ S cm}^2\text{g. equivalent}^{-1}$  at  $298 \text{ K}$  is  $2\%$  ionized in its  $0.1\text{N}$  solution. The resistance of this solution (in ohms) in an electrolytic cell of cell constant  $0.4 \text{ cm}^{-1}$  at this temperature is:-

A. 200

B. 300

C. 400

D. 500

**Answer: D**

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20. In balancing the half reaction,  $S_2O_3^{2-} \rightarrow S$ , the number of electrons that must be added is :-

- A. 4 on the left
- B. 3 on the right
- C. 2 on the left
- D. 2 on the right

**Answer: A**



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21. If hydrogen electrodes dipped in two solutions of  $pH = 3$  and  $pH = 6$  are connected by a salt bridge, the  $EMF_{cell}$  is

- A. 0.177V
- B. 0.3V
- C. 0.052V

D. 0.104V

**Answer: A**



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**22.** In electroplating, the article to be electroplated serves as:

A. Cathode

B. Electrolyte

C. Anode

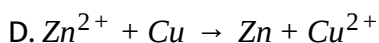
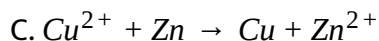
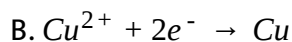
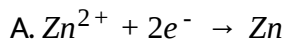
D. Conductor

**Answer: A**



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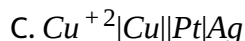
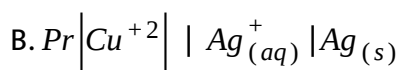
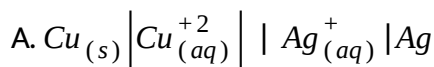
23. Consider the Galvanic cell  $Zn \mid ZnSO_4 \parallel CuSO_4 + Cu^{\oplus}$  the reaction at cathode is .



**Answer: B**

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24. The cell reaction  $Cu + 2Ag^+ \rightarrow Cu^{+2} + Ag$  is best represented by

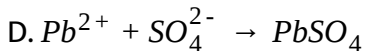
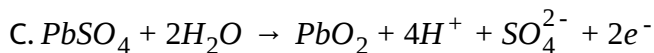
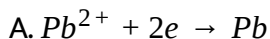


D. None of the above representation

**Answer: A**

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25. During charging of lead storage battery, the reaction occurring at the cathode is:-



**Answer: C**

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26. 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

**Answer: A**



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27. Hydrogen-oxygen fuel cell are used in space-craft to supply

- A. Power for heat and light
- B. Power for pressure
- C. Oxygen
- D. Water



**Answer: B::D**



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28. In the cell  $Zn|Zn^{2+}||Cu^{2+}|Cu$ , the negative terminal is

A. Cu

B.  $Cu^{2+}$

C. Zn

D.  $Zn^{2+}$

**Answer: D**



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29. When a lead storage battery is charged:

A. Lead dioxide dissolves

- B. Sulphuric acid is regenerated
- C. The lead electrode becomes coated with lead sulphate
- D. The amount of sulphuric acid decreases

**Answer: B**

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**30.** 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

**Answer: A**

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31. In charging the lead accumulator battery

- A.  $PbO_2$  dissolves
- B.  $H_2SO_4$  is reproduced
- C.  $PbSO_4$  deposits on lead electrode
- D. Pb deposits on lead electrode

**Answer: B**



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32. The site of oxidation in an electrochemical cell is:-

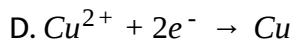
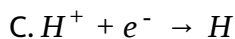
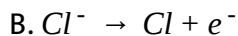
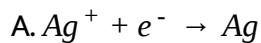
- A. The anode
- B. The cathode
- C. The electrode
- D. Reference electrode

**Answer: A**



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**33.** Which of the following reaction does not take place at cathode

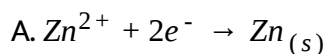


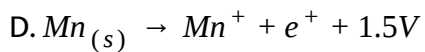
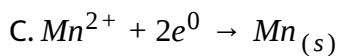
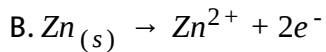
**Answer: B**



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**34.** In dry cell , reaction which takes place at the anode is \_\_\_\_\_.





**Answer: B**

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**35. The units of cell constant are .....**

A.  $ohm^{-1}cm^{-1}$

B.  $ohm\ cm$

C.  $cm$

D.  $cm^{-1}/m^{-1}$

**Answer: D**

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36. Mark the false statement

A. A salt bridge is used to eliminate liquid junction potential

B. The Gibbs free energy change,  $\Delta G$  is related with electromotive force (E), as  $\Delta G = -nFE$

C. Nernst equation for single electrode potential is

$$E = E^{\circ} - \frac{RT}{nF} \ln a_{M^{n+}}$$

D. The efficiency of a hydrogen oxygen fuel cell is 23%

Answer: C



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37. The standard cell potential of  $Zn \left| Zn^{2+}_{(aq)} \parallel Cu^{2+}_{(aq)} \right| Cu$  cell is 1.10 V . The maximum work obtained by this cell will be \_\_\_\_\_.

A. 106.15 kJ

B. -212.30 kJ

C.  $-318.45\text{kJ}$

D.  $-424.60\text{kJ}$

**Answer: B**

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**38.** The relationship between standard reduction potential of a cell and equilibrium constant is shown by

A.  $E_{cell}^{\circ} = \frac{n}{0.059} \log K_c$

B.  $E_{cell}^{\circ} = \frac{0.059}{n} \log K_c$

C.  $E_{Cell}^{\circ} = 0.059n \log K_c$

D.  $E_{cell}^{\circ} = \frac{\log K_c}{n}$

**Answer: B**

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39. Calculate the cell constant if the specific conductance of a Solution  $0.2$

$\text{ohm}^{-1}\text{cm}^{-1}$  and its conductance is  $0.04 \text{ ohm}^{-1}$ .

- A.  $1 \text{ cm}^{-1}$
- B.  $0 \text{ cm}^{-1}$
- C.  $5 \text{ cm}^{-1}$
- D.  $0.2 \text{ cm}^{-1}$

**Answer: C**



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40. If the specific conductance and conductance of a solution are same, then its cell constant is equal to:

- A. 1
- B. zero
- C. 0.5

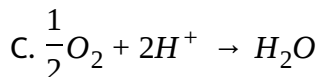
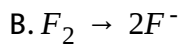
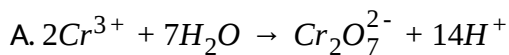


D. 4

**Answer: A**

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**41.** Which of the following reaction is possible at anode ?



D. None of these

**Answer: A**

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**42.** 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

**Answer: B**

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**43.** The reduction potential of hydrogen half cell will be negative if :

A.  $P(H_2) = 1\text{atm}$  and  $[H^+] = 2.0M$

B.  $P(H_2) = 1\text{atm}$  and  $[H^+] = 1.0M$

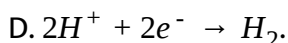
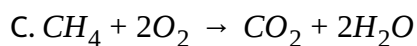
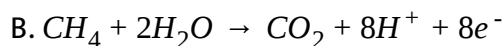
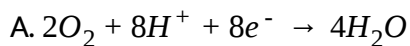
C.  $P(H_2) = 2\text{atm}$  and  $[H^+] = 1.0M$

D.  $P(H_2) = 2\text{atm}$  and  $[H^+] = 2.0M$

**Answer: C**

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44. The electrode reactions that takes place at the anode of  $CH_4 - O_2$  fuel cell is :



**Answer: B**



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45. The electrochemical cell stops working after some time because:

A. Electrode potential of both the electrodes becomes zero

B. Electrode potential of both the electrodes becomes equal

C. One of the electrode is eates away

D. The cell reaction gets reversed

**Answer: B**



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**46.** The cathode reaction in electrolysis of dilute sulphuric acid with Platinum electrode is

A. Oxidation

B. Reduction

C. Oxidation and reduction both

D. Neutralisation

**Answer: B**



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47. If the half-cell reaction  $A + e^- \rightarrow A^-$  has a large negative reduction potentials, it follows that:

- A. A is readily reduced
- B. A is readily oxidised
- C.  $A^-$  is readily reduced
- D.  $A^-$  is readily oxidised

**Answer: D**



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48. At  $25^\circ\text{C}$  specific conductivity of a normal solution of  $KCl$  is  $0.0022765$  ohm. The resistance of cell is 400 ohms. The cell constant is .

- A. 0.815
- B. 1.016
- C. 1.106

D. 2.016

**Answer: C**



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**49.** The tendency of an electrode to lose electrons is known as

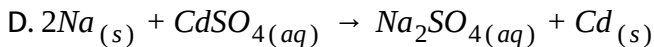
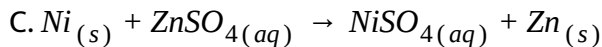
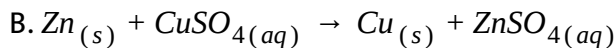
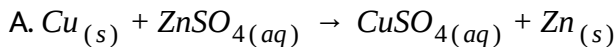
- A. Electrode potential
- B. Reduction potential
- C. Oxidation potential
- D. E.M.F.

**Answer: C**



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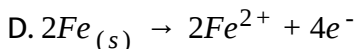
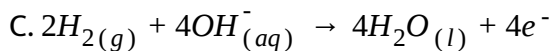
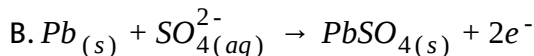
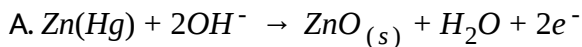
**50.** What is the cell reaction occurring in Daneill cell (galvanic cell) ?



**Answer: B**

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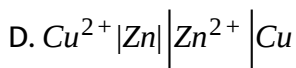
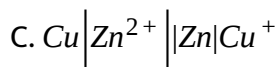
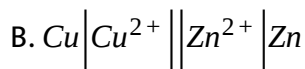
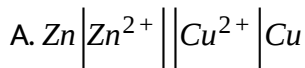
**51. Anode reaction of a fuel cell is:-**



**Answer: C**

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52. The cell reaction  $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ , is best represented by-



**Answer: A**



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53. A conductivity cell has been calibrated with a 0.01 M 1:1 electrolyte solution (specific conductance,  $k = 1.25 \times 10^{-3} S \text{ cm}^{-1}$ ) in the cell and the measured resistance was 800 ohms at 25 °C. The constant will be

A. 1.02 cm

B.  $0.102 \text{ cm}^{-1}$



C.  $1.00 \text{ cm}^{-1}$

D.  $0.5 \text{ cm}^{-1}$

**Answer: C**



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54. Which colorless gas evolves when  $\text{NH}_4\text{Cl}$  reacts with zinc in a dry cell battery ?

A.  $\text{NH}_4$

B.  $\text{N}_2$

C.  $\text{H}_2$

D.  $\text{Cl}_2$

**Answer: C**



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55.  $\lambda_{\text{ClCH}_2\text{COONa}} = 224 \text{ ohm}^{-1} \text{ cm}^2 \text{ gm eq}^{-1}$ ,

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

$\lambda_{\text{HCl}} = 203 \text{ ohm}^{-1} \text{ cm}^2 \text{ gm eq}^{-1}$ .

What is the value of  $\lambda_{\text{ClCH}_2\text{COOH}}$ ?

A.  $288.5 \text{ ohm}^{-1} \text{ cm}^2 \text{ gmeq}^{-1}$

B.  $289.5 \text{ ohm}^{-1} \text{ cm}^2 \text{ gmeq}^{-1}$

C.  $388.8 \text{ ohm}^{-1} \text{ cm}^2 \text{ gmeq}^{-1}$

D.  $59.5 \text{ ohm}^{-1} \text{ cm}^2 \text{ gmeq}^{-1}$

**Answer: C**

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56. Which of the following statement about galvanic cell is incorrect

A. Anode is positive

B. Oxidation occurs at the electrode with lower reduction potential

C. Cathode is positive

D. Reduction occurs at cathode

**Answer: A**

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57. When electric current is passed through an ionic hydride in molten state:

A. Hydrogen is obtained at anode

B. Hydrogen is obtained at cathode

C. No change

D. Hydride ion moves towards cathode

**Answer: A**

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58. In electrolytic cell, cathode acts as an/a

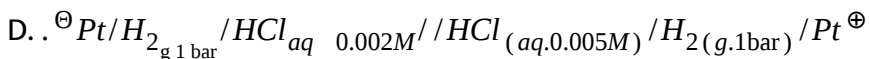
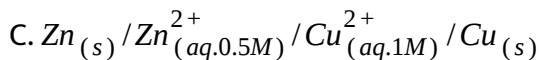
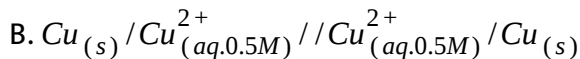
- A. Oxidising agent
- B. Reducing agent
- C. Either of the two
- D. Neither (a) nor (b)

Answer: B



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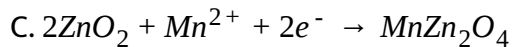
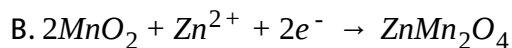
59. Which of the following is concentration cell



**Answer: D**

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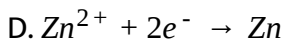
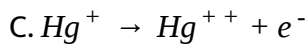
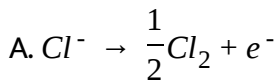
**60.** Which of the following reaction occurs at the cathode of a common dry cell



**Answer: B**

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**61.** Which one is not called a anode reaction from the following?



**Answer: D**

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**62.** The electrodes of a conductivities cell are 3 cm apart and have a cross-sectional area of  $4\text{ cm}^2$ . The cell constant of the cell (in  $\text{cm}^{-1}$ ) is \_\_\_\_\_

A.  $4 \times 3$

B.  $4/3$

C.  $3/4$

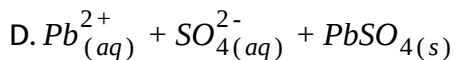
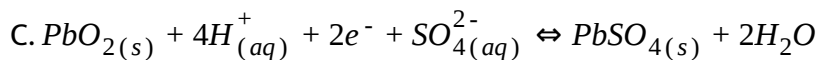
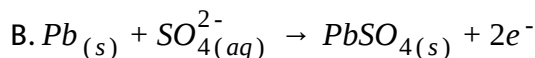
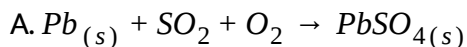
D.  $9/4$

**Answer: C**

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63. Cell reaction during discharging of lead storage battery at cathode is

:-



**Answer: B**

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64. A depolarizer used in dry cell is :

A. Ammonium chloride

B. Manganese dioxide

C. Potassium hydroxide

D. Sodium phosphate

**Answer: B**

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65. 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

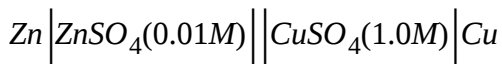
D. There is no reaction

**Answer: D**

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66. The emf of a Daniell cell at 298K is  $E_1$



When the concentration of  $\text{ZnSO}_4$  is 1.0M and that of  $\text{CuSO}_4$  is 0.01M, the emf changed to  $E_2$ . What is the relationship between  $E_1$  and  $E_2$  ?

A.  $E_1 - E_2 = 0$

B.  $E_1 < E_2$

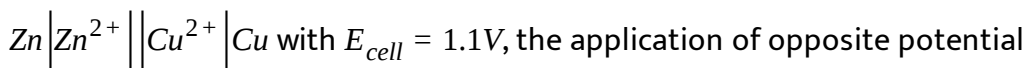
C.  $E_1 > E_2$

D.  $E_1 = 10^2 E_2$

Answer: C

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67. Assertion (A): For a Daniell cell :



greater than  $1.1V$  results into the flow of electron from cathod to anode.

Reason ( $R$ ): Zn is deposited at anode and Cu is dissolved at cathode

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**



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**68.** Assertion: The cell potential of mercury cell is  $1.35V$  which remains constant.

Reason: In mercury cell, the electrolyte is a paste of KOH and ZnO.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: B**

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69. Assertion: For a cell reaction  $Zn_{(s)} + Cu_{(aq)}^{2+} \rightarrow Zn_{(aq)}^{2+} + Cu_{(s)}$ , at the equilibrium voltmeter gives zero reading.

Reason: At the equilibrium, there is no change in the concentration of  $Cu^{2+}$  and  $Zn^{2+}$  ions.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.

- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**

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**70.** Assertion: Galvanic cells containing hydrogen, methane, methanol etc. as fuels are called fuel cells.

Reason: They are designed to convert the energy of combustion of fuels directly into electrical energy.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is false

D. If the assertion and reason both are false.

**Answer: A**

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71. (A) Identification of cathode and anode is done with the help of thermometer.

(R ) Higher is the value of reduction potential. greater would be its reducing power.

A. if both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is false

D. If the assertion and reason both are false.

**Answer: D**



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72. (A) An electrochemical cell can be set-up only if the redox reaction is spontaneous.

(R) A reaction is spontaneous if free energy change is negative.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: B**



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**73.** Assertion: In an electrochemical cell anode and cathode are respectively negative and positive electrodes.

Reason: At anode oxidation takes place and at cathode reduction takes place.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**



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74. Assertion:  $Ni/Ni^{2+}(1.0M) \mid Au^{3+}(1.0M) \mid Au$ , for this cell emf is 1.75V if

$$E_{Au^{3+}/Au}^{\circ} = 1.50 \text{ and } E_{Ni^{2+}/Ni}^{\circ} = 0.25V$$

Reason: Emf of the cell =  $E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ}$

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**

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75. Assertion: E.m.f. and potential difference are same for cell.

Reason: Both gives the difference in electrode potential under any



condition.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: D**



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**76.** *K* and *Cs* are used in photoelectric cells.

*K* and *Cs* emit electrons on exposure to light.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.

- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**

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### Ordinary Thinking Objective Questions (Electrode potential $E_{cell}$ , Nernst equation and ECS)

1. Standard reduction potential at  $25^\circ\text{C}$  of  $\text{Li}^+/\text{Li}$ ,  $\text{Ba}^{2+}/\text{Ba}$ ,  $\text{Na}^+/\text{Na}$  and  $\text{Mg}^+/\text{Mg}$  are -3.05, -2.90, -2.71 and -2.37 volt respectively. Which one of the following is the strongest oxidising agent ?

A.  $\text{Na}^+$

B.  $\text{Li}^+$



**Answer: D**

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2. Which of the following displaces  $Br_2$  from an aqueous solution containing bromide ions ?



**Answer: A**

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3. An electrochemical cell is shown below

$Pt, H_2(1\text{atm})|HCl(0.1M)|CH_3COOH(0.1M) | H_2(1\text{atm})$ , The emf of the 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

**Answer: A**



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4.  $E^\circ$  for the cell

$Zn(s) | Zn^{2+}(aq) | Cu^{2+}(aq) | Cu(s)$  is 1.1V at  $25^\circ C$  the equilibrium constant

for the cell reaction is about

- A.  $10^{-28}$

B.  $10^{37}$

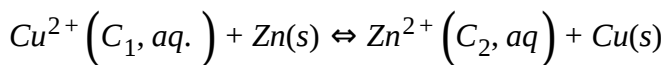
C.  $10^{+18}$

D.  $10^{+17}$

**Answer: B**

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5. For the cell reaction



of an electrochemical cell, the change in free energy ( $\Delta G$ ) of a given temperature is a function of

A.  $\ln (C_1)$

B.  $\ln (C_2)$

C.  $\ln (C_1 + C_2)$

D.  $\ln (C_2/C_1)$

**Answer: D**

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**6. Which is the strongest reducing agent among alkali metals?**

A. Li

B. Na

C. K

D. Cs

**Answer: A**

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**7. Electode potential of  $Zn^{2+} / Zn$  is  $-0.7V$  and that of  $Cu^{2+} / Cusi = 0.34V$ .**

**The EMF of the cell constructed between these two elctrodes is .**

A. 1.10V

B. 0.42V

C. -1.1V

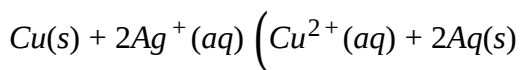
D. -0.42V

**Answer: A**



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8. Which one of the following condition will increase the voltage of the cell represented by the equation?



A. Increase in the concentration of  $Ag^+$  ion

B. Increase in the concentration of  $Cu^+$  ion

C. Increase in the dimension of silver electrode

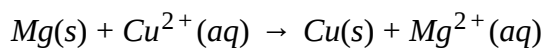
D. Increase in the dimension of copper electrode

**Answer: A**



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**9.** The cell reaction of a cell is



if the standard reduction potential of Mg and Cu are -2.37 V and +0.34 V respectively The emf of the cell is

A. 2.03V

B. -2.03V

C. +2.71V

D. -2.71V

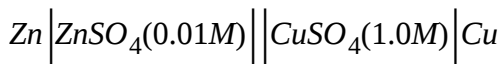
**Answer: C**



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10. The emf of a Daniell cell at 298K is  $E_1$



When the concentration of  $\text{ZnSO}_4$  is 1.0M and that of  $\text{CuSO}_4$  is 0.01M,

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.  $E_1 < E_2$

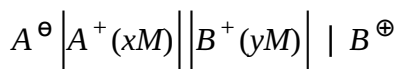
D.  $E_1 = E_2$

**Answer: B**



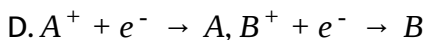
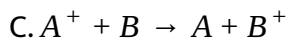
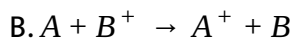
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11. A hypothetical electrochemical cell is shown below:



The emf measured is +0.20V. The cell reaction is

A. The cell reaction cannot be predicted



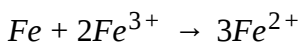
**Answer: B**

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12. If  $E_{Fe^{2+}/Fe}^{\circ} = -0.441V$

and  $E_{Fe^{3+}/Fe^{2+}}^{\circ} = 0.771V$

The standard *EMF* of the reaction



will be:

A. 1.212V

B. 0.111V

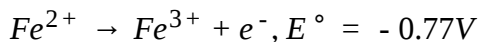
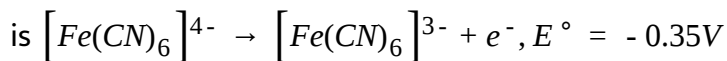
C. 0.330V

D. 1.653V

**Answer: A**

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13. On the basis of the following  $E^\circ$  values, the strongest oxidizing agent



A.  $\text{Fe}^{3+}$

B.  $[\text{Fe}(\text{CN})_6]^{3-}$

C.  $[\text{Fe}(\text{CN})_6]^{4-}$

D.  $\text{Fe}^{2+}$

**Answer: A**

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14. Standard free energies of formation (l  $\text{kJ/mol}$  ) at 298K are -237.2, -394.4 and -8.2 for  $\text{H}_2\text{O}(l)$ ,  $\text{CO}_2(g)$  and pentane (g) , respectively . The value of  $E_{cell}^\circ$  for the pentane-oxygen fuel cell is .

A. 1.0968V

B. 0.0968

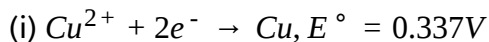
C. 1.968V

D. 2.0968V

**Answer: C**

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15. Given:



Electrode potential,  $E^\circ$  for the reaction,  $\text{Cu}^+ + e^- \rightarrow \text{Cu}$ , will be

A. 0.52 V

B. 0.90 V

C. 0.30 V

D. 0.38 V

**Answer: A**



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**16.** For the reduction of silver ions with copper metal, the standard cell potential was found to be  $+0.46\text{V}$  at  $25^\circ\text{C}$ . The value of standard Gibbs energy,  $\Delta G^\circ$  will be ( $F = 96,500\text{Cmol}^{-1}$ ):

A.  $-98.0\text{kJ}$

B.  $-89.0\text{kJ}$

C.  $-89.0\text{J}$

D.  $-44.5\text{kJ}$

**Answer: B**

17. Consider the following relations for  $emf$  of a electrochemical cell

(i)  $emf$  of cell = (Oxidation potential of anode)-(Reduction potential of cathode)

(ii)  $emf$  of cell = (Oxidation potential of anode)+(Reduction potential of cathode)

(iii)  $emf$  of cell = (Reduction potential of anode)+(Reduction potential of cathode)

(iv)  $emf$  of cell = (Oxidation potential of anode)-(Oxidation potential of cathode)

Which of the above realtions are correct?

A. 3 and 1

B. 1 and 2

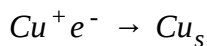
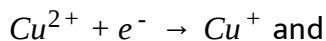
C. 3 and 4

D. 2 and 4

**Answer: D**

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**18.** The electrode potentials for



are +0.15V and +0.50V respectively the value of  $E_{\frac{\text{Cu}^{2+}}{\text{Cu}}}^{\circ}$  will be?

A. 0.150 V

B. 0.500V

C. 0.325V

D. 0.650V

**Answer: C**

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19. Standard electrode potential for  $\text{Sn}^{4+}/\text{Sn}^{2+}$  couple is +0.15 V and that for the  $\text{Cr}^{3+}/\text{Cr}$  couple is -0.74V . These two couples in their standard state are connected to make a cell . The cell potential will be

A. +1.83V

B. +1.19V

C. +0.89V

D. +0.18V

**Answer: C**



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20. If the  $E^\circ$  for a given reaction has a negative value, then which of the following gives the correct relationship for the of  $\Delta G^\circ$  and  $K_{eq}$ ?

A.  $\Delta G^\circ > 0, K_{eq} < 1$

B.  $\Delta^\circ > 0, K_{eq} > 1$



C.  $\Delta G^+ < 0, K_{eq} > 1$

D.  $\Delta G^\circ < 0, K_{eq} < 1$

**Answer: A**

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21. A solution contains  $Fe^{2+}$ ,  $Fe^{3+}$  and  $I^-$  ions. This solution was treated with iodine at  $35^\circ C$ .  $E^\circ$  for  $Fe^{3+}, Fe^{2+}$  is  $0.77V$  and  $E^\circ$  for  $I_2/2I^- = 0.536 V$ . The favourable redox reaction is:

A.  $I^-$  will oxidised to  $I_2$

B.  $Fe^{2+}$  will be oxidised to  $Fe^{3+}$

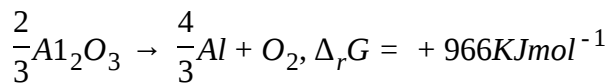
C.  $I_2$  will be reduced to  $I^-$

D. There will be no redox reaction

**Answer: A**

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22. The Gibbs energy for the decomposition of  $Al_2O_3$  at  $500^\circ C$  is as follows



The potential difference needed for electrolytic reduction of  $Al_2O_3$  at  $500^\circ$  is at least :

A. 5.0V

B. 4.5V

C. 3.0V

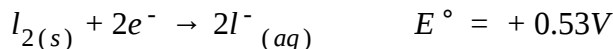
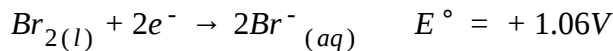
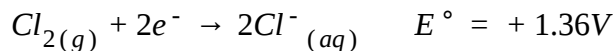
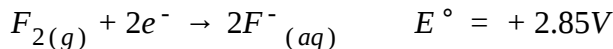
D. 2.5V

**Answer: D**

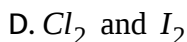
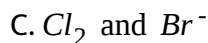
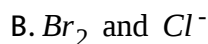
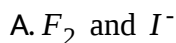


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23. Standard reduction potentials of the half reactions are given below



The strongest oxidising and reducing agents respectively are



**Answer: A**

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24. Four successive members of the first series of the transition metals are listed below. For which one of them the standard potential  $(E^{\circ}_{M^{2+}/M})$  value has a positive sign?

A.  $Co(Z = 27)$

B.  $Ni(Z = 28)$

C.  $Cu(Z = 29)$

D.  $Fe(Z = 26)$

**Answer: C**

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25. A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl or  $pH = 10$  and by passing hydrogen gas around the platinum wire at one atm pressure . The oxidation potential of electrode would be ?

A. 1.81 V

B. 0.059V

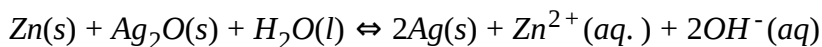
C. 0.59V

D. 0.118V

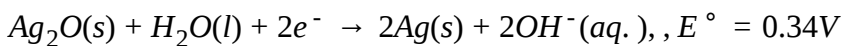
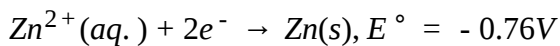
**Answer: C**

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**26.** A button cell used in watched functions as following



If half cell potentials are



The cell potential will be

A. 1.34V

B. 1.10V

C. 0.42V

D. 0.84V

**Answer: B**

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27. The pressure of  $H_2$  required to make the potential of  $H_2$  - electrode zero in pure water at 289K is :

A.  $10^{-14} atm$

B.  $10^{-12} atm$

C.  $10^{-10} atm$

D.  $10^{-4} atm$

**Answer: A**

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28. If the  $E_{cell}^\circ$  for a given reaction has a positive value, then which of the following gives the correct relationship for the values of  $\Delta G^\circ$  and  $K_{eq}$  :-

A.  $\Delta G^\circ < 0, K_{eq} < 1$

B.  $\Delta G^\circ > 0, K_{eq} < 1$

C.  $\Delta G^\circ > 0, K_{eq} > 1$

D.  $\Delta G^\circ < 0, K_{eq} > 1$

**Answer: B**

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29. Which of the following has been universally accepted as a reference electrode at all temperature and has been assigned a value of zero volt?

A. Graphite electrode

B. Copper electrode

C. Platinum electrode

D. Standard hydrogen electrode

**Answer: D**

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30. The *emf* of a galvanic cell, with electrode potentials of silver = + 0.80V and that of copper = + 0.34V, is .

- A. -1.1V
- B. +1.1V
- C. +0.46V
- D. +0.76V

**Answer: C**



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31. What is the single electrode potential of a half-cell for zinc electrode dipping in 0.01 M  $ZnSO_4$  solution at  $25^\circ C$  ? The standard electrode potential of  $Zn/Zn^{2+}$  system is 0.763 volt at  $25^\circ C$ .

- A. 0.8221 V
- B. 8.221 V



C. 0.5282 V

D. 9.232 V

**Answer: A**

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**32.** The standard *EMF* of a galvanic cell involving cell reaction with  $n = 2$  is found to be 0.295V at 25 ° C . The equilibrium constant of the reaction would be

A.  $2 \times 10^{11}$

B.  $4 \times 10^{12}$

C.  $1 \times 10^2$

D.  $1 \times 10^{10}$

**Answer: D**

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33. Which of the following is false for  $Hg$ ?

A. it can evolve hydrogen from  $H_2S$

B. It is a metal

C. It has high specific heat

D. It is less reactive than hydrogen

**Answer: A**



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34. The metal that forms a self-protecting film of oxide to prevent corrosion is:

A. Cu

B. Al

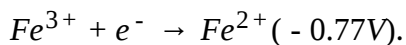
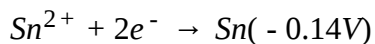
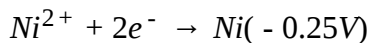
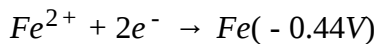
C. Na

D. Au

**Answer: B**

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**35.** Which one among the following is the strongest reducing agent



A. Fe

B.  $Fe^{2+}$

C. Ni

D. Sn

**Answer: A**

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36. Beryllium is placed above magnesium in the *II* group. Beryllium dust, therefore, when added to  $MgCl_2$  solution will:

- A. Have no effect
- B. Precipitate Mg metal
- C. precipitate MgO
- D. Lead to dissolution of Be metal

**Answer: A**



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37. Four metals A, B, C and D are having standard reduction potential as -3.06, -1.66, -0.40 and 0.80 volt respectively. The most reactive metal is

- A. A
- B. B

C. C

D. D

**Answer: A**



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**38.** Which metal can deposit copper from copper sulphate solution ?

A. Mercury

B. Iron

C. Gald

D. Platinum

**Answer: B**



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39. In an experiment setup 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

**Answer: D**



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40.  $K$ ,  $Ca$  and  $Li$  metals may be arranged in the decreasing order of their standard electrode potentials as

- A.  $K$ ,  $Ca$ ,  $Li$
- B.  $Ca$ ,  $K$ ,  $Li$

C. Li, Ca, K

D. Ca, Li, K

**Answer: B**



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41. Which one of the following metals cannot resolve  $H_2$  from acids or  $H_2O$  from its compounds ?

A. Hg

B. Al

C. Pb

D. Fe

**Answer: A**



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## 42. Reduction Potential

- A. it is easily oxidised
- B. It is easily reduced
- C. It acts as oxidising agent
- D. It has redox nature

Answer: C



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43.  $E^\circ$  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.  $-\frac{RT}{nF} \log \frac{[C]^c [d]^D}{[a]^A [B]^b}$



**Answer: A**

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44. When Zn piece is kept in  $CuSO_4$  solution, the copper get precipitated due to standard potential of zinc is

- A.  $>$  copper
- B.  $<$  copper
- C.  $>$  sulphide
- D.  $<$  sulphate

**Answer: B**

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45. Which of the following metal does not react with the solution of copper sulphate

A. Mg

B. Fe

C. Zn

D. Ag

**Answer: D**



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**46.** The standard reduction potentials of 4 elements are given below.

Which of the following will be the most suitable reducing agent.

$I = -3.04V, II = -1.90V, III = 0V, IV = 1.90V$

A. I

B. II

C. III

D. IV

**Answer: A**

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47. Aluminium displaces hydrogen from acids, but copper does not. A galvanic cell prepared by combining  $Cu | Cu^{2+}$  and  $Al | Al^{3+}$  has an emf of 2.0 V at 298 K. If the potential of copper electrode is + 0.34 V, that of aluminium electrode is

A. +1.66V

B. -1.66V

C. +2.34V

D. -2.3V

**Answer: B**

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48. 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

**Answer: D**



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49. When an acid cell is charged, then

- A. Voltage of cell increases
- B. Electrolyte of cell dilutes
- C. Resistance of cell increases
- D. None of these

**Answer: A**



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50.  $2\text{Ce}^{4+} + \text{Co} \rightarrow 2\text{Ce}^{3+} + \text{Co}^{2+}$ ,  $E_{\text{cell}}^{\circ} = 1.89\text{V}$

$E_{\text{Co}^{2+}/\text{Co}}^{\circ} = -0.277\text{V}$ . Hence  $E_{\text{Ce}^{4+}/\text{Ce}^{3+}}^{\circ}$  is

A.  $-1.64\text{V}$

B.  $+1.61\text{V}$

C.  $-2.08\text{V}$

D.  $+2.17\text{V}$

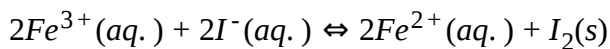
**Answer: B**



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51. The equilibrium constant of the following redox reaction at 298 K is

$1 \times 10^8$



If the standard reducing potential of iodine becoming iodide is +0.54 V.

what is the standard reduction potential of  $Fe^{3+}/Fe^{2+}$  ?

A. +1.006V

B. -1.006V

C. +0.77V

D. -0.77V

**Answer: C**



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52. The electrode potential  $E_{Zn^{+2}/Zn}$  of a zinc electrode or  $25^{\circ}C$  with an aqueous solution of  $0.1M ZnSO_4$  is

$$\left[ E_{(Zn^{+2}/Zn)} = -0.76V \right] \left[ \text{assume } \frac{2.3 - 3RT}{F} = 0.06 \text{ at } 298K \right]$$

A. +0.73

B. -0.79

C. -0.82

D. -0.70

**Answer: B**



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**53.** The standard redox potentials for the reactions,

$Mn^{2+} + 2e^- \rightarrow Mn$  and  $Mn^{3+} + e^- \rightarrow Mn^{2+}$  are -1.18V and 1.51V respectively. What is

the redox potential for the reaction  $Mn^{3+} + 3e^- \rightarrow Mn$ ?

A. 0.33V

B. 1.69V

C. -0.28V

D. -0.85V

**Answer: C**

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54. The standard electrode potential for the two electrode  $A^+ / A$  and  $B^+ / B$  are respectively 0.5V and 0.75V. The emf of the given cell

$A \left| A^+(a = 1) \right| \left| B^+(a = 1) \right| B$  will be

A. 1.25V

B. -1.25V

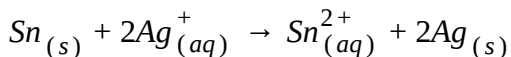
C. -0.25V

D. 0.25V

**Answer: D**

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55. Which will increase the voltage of the cell





- A. Increase in the concentration of  $Ag^+$  ion
- B. Increase in the concentration of  $Sn^{2+}$  ions
- C. Increase in size of the silver rod none of these
- D. None of these

**Answer: A**

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56. Copper cannot replace\_\_\_\_\_ from solution

- A. Fe
- B. Au
- C. Hg
- D. Ag

**Answer: A**

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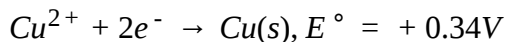
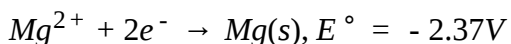
57. If  $Zn^{2+} / Zn$  electrode is diluted 100 times, then the change in reduction potential is

- A. Increase of 59 mV
- B. Decrease of 59 mV
- C. Increase of 29.5 mV
- D. Decrease of 29.5 mV

**Answer: A**

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58. The voltage of a cell whose half-cells are given below is



standard EMF of the cell is

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59. In the electrochemical cell

$H_2(g), 1 \text{ atm} \mid H^+(1M) \parallel Cu^{2+}(1M) \mid Cu(s)$ , which one of the following

statements is true?

- A.  $H_2$  is cathode, Cu is anode
- B. Oxidation occurs at Cu electrode
- C. Reduction occurs at  $H_2$  electrode
- D.  $H_2$  is anode, Cu is cathode

**Answer: D**



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60. The element which can displace three other halogens from their compound is :

- A. Cl

B. F

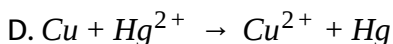
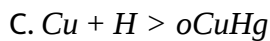
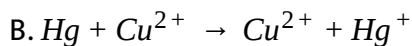
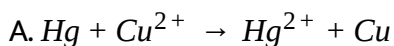
C. Br

D. I

**Answer: B**

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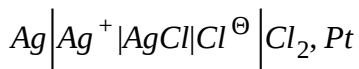
61. The cell reaction of the galvanic cell :  $Cu_{(s)} \left| Cu_{(aq)}^{2+} \right| \left| Hg_{(aq)}^{2+} \right| Hg_{(l)}$  is



**Answer: d**

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62. For the following cell reaction,



$$\Delta G_f^\circ(AgCl) = -109 \text{ kJ/mol}$$

$$\Delta G_f^\circ(Cl^\ominus) = -129 \text{ kJ/mol}$$

$$\Delta G_f^\circ(Ag^+) = 78 \text{ kJ/mol}$$

$E^\circ$  of the cell is:-

A. -0.60V

B. 0.60V

C. 6.0V

D. None of these

**Answer: A**



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63. The standard electrode potential a  $Ag^+ / Ag$  is +0.80 V and of  $Cu^{2+} / Cu$  is +0.34 V. These electrodes are connected through a salt bridge and if :

- A. copper electrode work like anode then  $E_{cell}^o$  is +0.45V
- B. Silver electrode work like anode then  $E_{cell}^o$  is -0.34V
- C. Copper electrode work like anode then  $E_{cell}^o$  is +0.46V
- D. Silver electrode work like cathode then  $E_{cell}^o$  is -0.34V

**Answer: C**



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64. The potential of the cell for the reaction,  $M(s) + 2H^+(1M) \rightarrow H_2(g)(1atm) + M^{2+}(0.1m)$  is 1.500 V. The standard reduction potential for  $M^{2+} / M(s)$  couple is :

- A. 0.1470V
- B. -1.470V

C. 14.70V

D. None of these

**Answer: B**

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65. The potential of standard hydrogen electrode is zero. This implies that

A.  $\Delta G_f^\circ(H^+, aq) = 0$

B.  $\Delta H_f^\circ(H^+, aq) = 0$

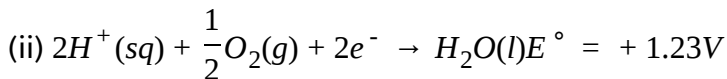
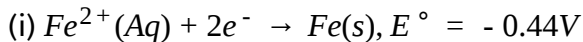
C.  $\Delta G_f^\circ(H^+, aq) < 0$

D.  $\Delta G_f^\circ(H^+, aq) > 0$

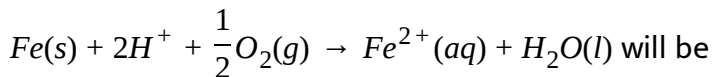
**Answer: A**

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66. If the half cell reactions are given as



The  $E^{\circ}$  for the reaction



A. +1.67V

B. -1.67V

C. +0.79V

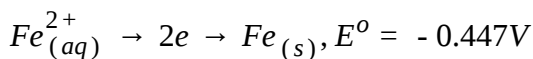
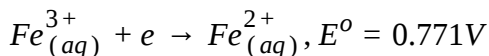
D. -0.79V

**Answer: A**



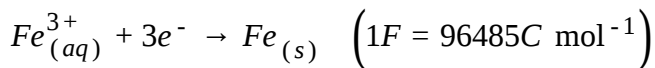
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67. The  $E^{\circ}$  values of the following reduction reactions are given





What will be the free energy change for the reaction



A.  $+18.51kJ \text{ mol}^{-1}$

B.  $+11.87kJ \text{ mol}^{-1}$

C.  $-8.10kJ \text{ mol}^{-1}$

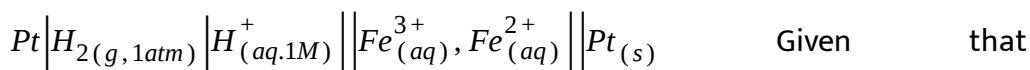
D.  $-10.41kJ \text{ mol}^{-1}$

**Answer: B**



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**68.** Consider the cell



$E_{Fe^{3+} | Fe^{2+}}^{\circ} = 0.771V$  the ratio of conc. Of  $Fe_{(aq)}^{2+}$  to  $Fe_{(aq)}^{3+}$  is, when the

cell potential is  $0.830V$

A. 0.101

B. 0.924

C. 0.12

D. None of these

**Answer: A**

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69. The standard reduction potential for  $Li^+ / Li$ ,  $Zn^{2+} / Zn$ ,  $H^+ / H_2$  and  $Ag^+ / Ag$  is -3.05, -0.762, 0.00 and +0.80V.

Which of the following has highest reducing capacity

A. Ag

B.  $H_2$  is anode and  $Cu$  is cathode

C. Zn

D. Li

**Answer: D**

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70. When  $E_{Ag^+ / Ag}^\circ = 0.8V$  and  $E_{Zn^{2+} / Zn}^\circ = -0.76V$ . 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 and reduce  $Zn^{2+}$  ion

**Answer: A**



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71. Electrode potentials ( $E_{red}^\circ$ ) of 4 element A,B, C,D are -1.36,-0.32,0,-1.26V respectively. The decreasing reactivity order of these elements is

- A. A,D,B and C
- B. C,B,D and A

C. B,D,A and C

D. C,A,,D and B

**Answer: B**

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72. Amongst the following electrodes the one with zero electrode potential is

A. Calomel electrode

B. Standard hydrogen electrode

C. Glass electrode

D. Gas electrode

**Answer: B**

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73. In which of the following cell the energy of combustion of the reaction is directly converted into electricity?

- A. Leclanche cell
- B. Concentration cell
- C. Fuel cell
- D. Lead storage battery

**Answer: C**



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74. What is the potential of a cell containing hydrogen electrodes, the negative one in contact with  $10^{-10}MH^+$  and positive one in contact with  $0.025MH^+$ ?

- A. 0.18 V
- B. 0.28 V

C. 0.38V

D. 0.48V

**Answer: C**

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75. If the  $\Delta G^\circ$  of a cell reaction  $AgCl + e^- \rightarrow Ag + Cl^-$  is -21.20 kJ, the standard emf of cell is

A. 0.229V

B. 0.220V

C. -0.220V

D. -0.110V

**Answer: B**

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76. Reduction potentials of four elements P, Q, R, S is  $-2.90V$ ,  $0.34V$ ,  $1.2V$  and  $-0.76V$ . The decreasing order of reducing power is

A.  $P > Q > R > S$

B.  $Q > P > R > S$

C.  $R > Q > S > P$

D.  $P > S > Q > R$

**Answer: D**



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77. 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

**Answer: D**



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**78.** The reaction is spontaneous if the cell potential is .

A. Positive

B. Negative

C. Zero

D. Infinite

**Answer: A**



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79. Reduction potentials of A,B,C and D are 0.8 V 0.79 V, 0.34 V and -2.37 V respectively which element displaces all the other three elements

A. B

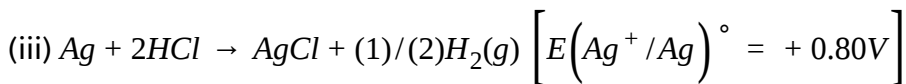
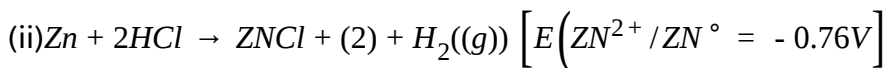
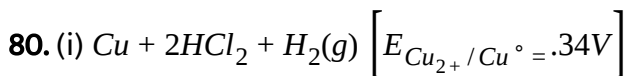
B. A

C. D

D. C

**Answer: C**

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Which of the following reaction is feasible ?

A. (ii)

B. (i)

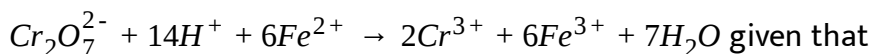
C. (iii)

D. All the above

**Answer: A**

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**81.** In a galvanic cell the following reaction takes place at  $298^\circ K$



$$: E^{\circ}(Cr_2O_7^{2-}, H^+, Cr^{3+} / Pt) = 1.33V$$

$E^{\circ}(Fe^{3+}, Fe^{2+} / Pt) = 0.77V$ . The standard e.m.f. of the cell is

A.  $(1.33+0.77)V$

B.  $(1.33-0.77)V$

C.  $-(1.33 + 0.77)V$

D.  $(- 1.33 + 0.77)V$

**Answer: B**

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**82.** Write a mathematical expression for Standard Cell Potential.

A.  $E_{\text{cathode}} + E_{\text{anode}}$

B.  $E_{\text{anode}} - E_{\text{cathode}}$

C.  $E_{\text{cathode}} - E_{\text{anode}}$

D.  $E_{\text{left}} - E_{\text{right}}$

**Answer: C**

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**83.** Oxidation and reduction take place in a cell, then its electromotive force will be

A. Positive

B. Negative

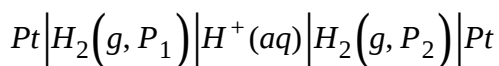
C. Zero

D. Stable

**Answer: A**

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**84.** What will be the emf for the given cell ?



A.  $\frac{RT \ln(P_1)}{f P_2}$

B.  $\frac{RT \ln(P_1)}{2f P_2}$

C.  $\frac{RT \ln(P_2)}{f P_1}$

D. None of these

**Answer: B**

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**85.** Enf of a cell in terms of reduction potential of its left and right electrodes is :

A.  $E = E_{\text{left}} - E_{\text{right}}$

B.  $E = E_{\text{left}} + E_{\text{right}}$

C.  $E = E_{\text{right}} - E_{\text{left}}$

D.  $E = (E_{\text{right}} + E_{\text{left}})$

**Answer: C**

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**86.** Consider the following reaction,

$Zn(s) + Cu^{2+}(0.1M) \rightarrow Zn^{2+}(1M) + Cu(s)$  above reaction, taking place in a

cell,  $E_{\text{cell}}^{\circ}$  is 1.10V.  $E_{\text{cell}}$  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

**Answer: C**



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**87.** In a cell that utilizes the reaction ,

$Zn_{(s)} + 2H_{(aq)}^{+} \rightarrow Zn_{(aq)}^{2+} + H_{2(g)}$ , addition of  $H_2SO_4$  to cathode compartment will :

A. Increase the E and shift equilibrium to the right

B. Lower the E and shift equilibrium to the right

C. Lower the E and shift equilibrium to the left

D. Increase the E and shift equilibrium to the left

**Answer: A**

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**88.** The standard e.m.f of a cell, involving one electron change is found to be 0.591 V at 25 °C. The equilibrium constant of the reaction is :

$$\left( F = 96,500 \text{ C mol}^{-1}; R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1} \right)$$

A.  $1.0 \times 10^{10}$

B.  $1.0 \times 10^5$

C.  $1.0 \times 10^1$

D.  $1.0 \times 10^{30}$

**Answer: A**

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89. Consider the following  $E^\circ$  values  $E^\circ$  values  $E_{Fe^{3+}/Fe^{2+}}^\circ = 0.77V$  ,  
 $E_{Sn^{2+}/Sn}^\circ = -0.14$  under standard condition the potential for the reaction  
 $Sn_s + 2Fe^{3+}(aq) \rightarrow 2Fe^{2+}(aq) + Sn^{2+}(aq)$  is :

A. 0.91 V

B. 1.40V

C. 1.68V

D. 0.63V

**Answer: A**



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90. The  $E_{M^{3+}/M^{2+}}^\circ$  values for Cr, Mn, Fe and Co are 0.41, + 1.57, + 0.77 and + 1.97V respectively. For which one of these metal the change in oxidation state from +2 to +3 is easiest:

A. Fe

B. Mn



C. Cr

D. Co

**Answer: C**

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

A. -ve,  $> 1$ , +ve

B. +ve,  $> 1$ , -ve

C. -ve,  $< 1$ , -ve

D. -ve,  $> 1$ , -ve

**Answer: A**

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92. The cell  $Zn|Zn^{2+}(1M)||Cu^{2+}(1M)|Cu$  ( $E^\circ_{cell} = 1.10V$ ) was allowed to be completely discharged at 298 K. The relative concentration

of  $Zn^{2+}$  to  $Cu^{2+}$   $\left(\frac{[Zn^{2+}]}{[Cu^{2+}]}\right)$  is :

A. Antilog (24.08)

B. 37.3

C.  $10^{37.3}$

D.  $9.65 \times 10^4$

**Answer: C**



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93. Given  $E^\circ_{Cr^{3+}/Cr} = 0.72V$ ,  $E^\circ_{Fe^{2+}/Fe} = -0.42V$ . The potential for the cell  $Cr|Cr^{3+}(0.1M)||Fe^{2+}(0.01M)|Fe$  is :

A. 0.339V

B. -0.339V

C. -0.26V

D. 0.26V

**Answer: D**

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94.  $E_{Fe^{3+}/Fe}^{\circ} = -0.036V$ ,  $E_{Fe^{2+}/Fe}^{\circ} = -0.0439V$ . The value of standard electrode potential for the change,  $Fe^{3+}(aq) + e^{-} \rightarrow Fe^{2+}(aq)$  will be

A. -0.072V

B. 0.385V

C. 0.020V

D. -0.270V

**Answer: C**

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95. The correct order of  $E_{M^{2+}/M}^{\circ}$  Values with negative sign for the four successive elements *Cr, Mn, Fe* and *Co* is:

- A. CrgtMngtFegtCo
- B. MngtCrgtFegtCo
- C. CrgtFegtMngtCo
- D. FegtMngtCrgtCo

**Answer: B**

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96. The standard reduction potentials for  $Zn^{2+}/Zn$ ,  $Ni^{2+}/Ni$  and  $Fe^{2+}/Fe$  are -0.76, -0.23 and -0.44V respectively. The reaction  $X + Y^{2+} \rightarrow X^{2+} + Y$  will be spontaneous when :

- A.  $X = Ni, Y = Fe$

B.  $X = Ni, Y = Zn$

C.  $X = Fe, Y = Zn$

D.  $X = Zn, Y = Ni$

**Answer: D**



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97. The tendencies of the electrodes made up of Cu, Zn and Ag to release electrons when dipped in their respective salt solutions decrease in the order :

A.  $Zn > Ag > Cu$

B.  $Cu > Zn > Ag$

C.  $Zn > Cu > Ag$

D.  $Ag > Cu > Zn$

**Answer: C**



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98. Will Fe be oxidised to  $Fe^{2+}$  by reaction with 1.0 M HCl?  $E^\circ$  for  $Fe/Fe^{2+} = +0.44$  volt.

- A. Yes
- B. No
- C. May be
- D. Can't say

**Answer: A**



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99. Which of the following has highest electrode potential

- A. Li
- B. Cu

C. Au

D. Al

**Answer: C**



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**100.** Which of the following is most electropositive ?

A. Carbon

B. Calcium

C. Chlorine

D. Potassium

**Answer: D**



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101. For the feasibility of a redox reaction in a cell, the emf should be.

- A. Positive
- B. Fixed
- C. Zero
- D. Negative

Answer: A



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102. Which of the following statements (or equation) is correct

A. The unit of cell e.m.f. is  $V\ cm^{-1}$

B.  $\Delta G = - \frac{nF}{E_{cell}}$

C. In galvanic cell, chemical energy is transformed into electrical energy



D. Oxidation state of Mn in potassium permanganate is +6

Answer: C

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**103.** The standard reduction electrode potentials of the three electrodes P, Q and R are respectively -1.76V, 0.34V and 0.8V. Then

- A. Metal Q will displace the cation of P from its aqueous solution and deposit the metal P
- B. Both metals Q and R will displace the cation of P from its aqueous solution and deposit the metal P
- C. Metal R will displace the cation of P from its aqueous solution and deposit the metal R
- D. Metal P will displace the cation of R from its aqueous solution and deposit the metal R

**Answer: D**

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**104.** Consider the reaction  $M_{(aq)}^{n+} + ne^{-} \rightarrow M_{(s)}$ . The standard reduction potential values of the element  $M_1, M_2$  and  $M_3$  are  $-0.34V, -3.05$  and  $-1.66V$  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.  $M_2 > M_3 > M_1$

**Answer: D**

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105. Calculate the reduction potential of a half cell consisting of a platinum electrode immersed in  $2.0MFe^{2+}$  and  $0.02MFe^{3+}$  solution.

Given  $E_{Fe^{3+}/Fe^{2+}}^{\circ} = 0.771V$ .

A. 0.653V

B. 0.889V

C. 0.683V

D. 2.771V

**Answer: A**



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106. Aluminium is more reactive than iron. But aluminium 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  $H_2O$

**Answer: C**

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**107.** What is wrongly stated about electrochemical series

A. It is the representation of element in order of increasing or decreasing standard electrode reduction 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

**Answer: B**

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108. The e.f.m. of the cell  $Ag|Ag^+(0.1M)||Ag^+(1M)|Ag$  at 298K is

A. 0.0059V

B. 0.059V

C. 5.9V

D. 0.59V

**Answer: B**



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109. The standard electrode potentials ( $E^\circ$ ) for  $Ocl^-/Cl^-$  and  $Cl^-/\frac{1}{2}Cl_2$  respectively are 0.94 V and -1.36V. The  $E^\circ$  value for  $Ocl^-/\frac{1}{2}Cl_2$  will be:

A. -0.42V

B. -2.20V

C. 0.52V

D. 1.04V

**Answer: C**

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**110.** Normal aluminium electrode coupled with normal hydrogen electrode gives an emf of 1.66V. So the standard electrode potential of aluminium is ,

A. -1.66V

B. +1.66V

C. -0.83V

D. +0.83V

**Answer: A**

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111. A cell constructed by coupling a standard copper electrode and a standard magnesium electrode has EMF to 2.7 volts. If the standard reduction potential of copper electrode is +0.34 volt that of magnesium electrode is:-

- A. +3.04volts
- B. -3.04 volts
- C. +2.36 volts
- D. -2.36 volts

**Answer: D**

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112. The hydrogen electrode is dpped in a solution of pH=3 at 25 ° C. The potential of the cell would be (the value of  $2.303RT/F$  is 0.059V)

- A. 0.177V
- B. -0.177V

C. 0.087V

D. 0.059V

**Answer: B**

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**113.** The standard electrode potential of  $Zn^{2+}/Zn$  and  $Ag^+/Ag$  are  $-0.763$  and  $+0.799V$  respectively. The standard potential of the cell is:-

A. 1.56V

B. 0.036V

C. -1.562V

D. 0.799V

**Answer: A**

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114. When a rod of metal A is dipped in an aqueous solution of metal B (concentration of  $B^{2+}$  ion being 1 M) at  $25^\circ\text{C}$ , 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  $O_2$

**Answer: B**



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115. The reaction:  $Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$  has a electrode potential of  $-0.76$  V. This means-

- A. Zn can't replace hydrogen from acids
- B. Zn is a reducing agent

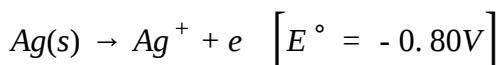
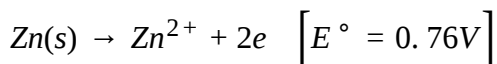
C. Zn is an oxidising agent

D.  $Zn^{2+}$  is a reducing agent

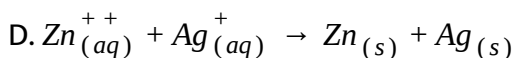
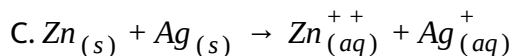
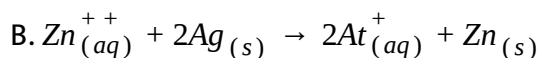
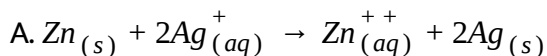
**Answer: B**

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**116.** The standard oxidation potentials of Zn and Ag in water at  $25^\circ\text{C}$  are



Which of the following reactions actually takes place ?



**Answer: A**

117. 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 2.46V. The reduction potential of silver electrode is +0.80V. The reduction potential of aluminium electrode is

- A. +1.66V
- B. -3.26V
- C. 3.26V
- D. -1.66V

**Answer: D**

118. The standard electrode potential is measured by

- A. Electrometer

B. Voltmeter

C. Pyrometer

D. Galvanometer

**Answer: B**

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119. when compared to  $\Delta G^\circ$  for the formation of  $Al_2O_3$  the  $\Delta g^\circ$  for the formation of  $Cr_2O_3$  is

A. same

B. Upredicted

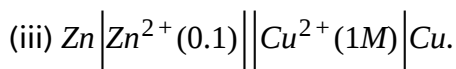
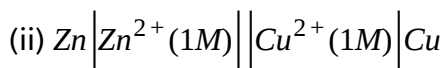
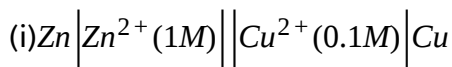
C. Higher

D. Lower

**Answer: C**

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120. If  $E_1, E_2$  and  $E_3$  are the emf values of the three galvanic cells respectively



Which one of the following is true.

A.  $E_2 > E_3 > E_1$

B.  $E_3 > E_2 > E_1$

C.  $E_1 > E_2 > E_3$

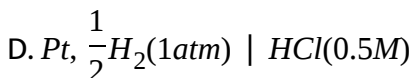
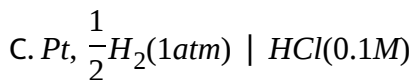
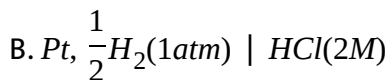
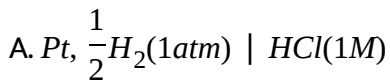
D.  $E_1 > E_3 > E_2$

**Answer: B**



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121. Which one of the following has a potential more than zero

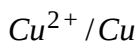


**Answer: B**

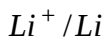
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**122.** Li occupies higher position in the electrochemical series of metals as compared to Cu since

A. The standard reduction potential of  $Li^+ / Li$  is lower than that of



B. The standard reduction potential of  $Cu^{2+} / Cu$  is lower than that of



C. The standard oxidation potential of  $Li/Li^+$  is lower than that of  $Cu/Cu^{2+}$

D. Li is smaller in size as compared to Cu

**Answer: A**

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**123.** Which of the following expression is correct?

A.  $\Delta G^\circ = -nFE_{cell}^\circ$

B.  $\Delta G^\circ = +nFE_{cell}^\circ$

C.  $\Delta G^\circ = -2.303RTnFE_{cell}^\circ$

D.  $\Delta G^\circ = -nF \log K_C$

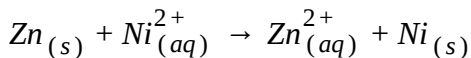
**Answer: A**

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124. Given  $E^\circ (Zn^{2+} / Zn) = -0.76V$

$$E^\circ (Ni^{2+} / Ni) = -0.25V$$

Calculate the EMF of the cell where the following reaction is taking place



A. 0.51V

B. 1.01V

C. -0.51V

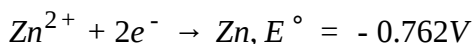
D. 0.25V

**Answer: A**



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125. The standard potential at  $25^\circ$  for the following Half reaction is given :



When Zinc dust is added to the solution of  $MgCl_2$ .



- A.  $ZnCl_2$  is formed
- B. Zinc dissolves in the solution
- C. No reaction takes place
- D. Mg is precipitated

**Answer: C**

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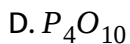
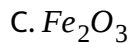
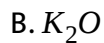
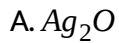
**126.** What is  $E^\circ$  for electrode represented by  $Pt, O_2(1atm)/2H^+(1m)$

- A. Unpredictable
- B. Zero
- C. 0.018V
- D. 0.118V

**Answer: B**

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127. The oxide that is not reduced by hydrogen is

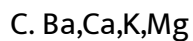
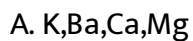


**Answer: B**



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128. Arrange the following in the order of their decreasing electrode potentials: Mg, K, Ba, Ca

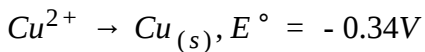
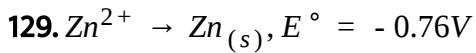


D. Mg,Ca,Ba,K

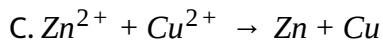
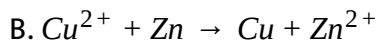
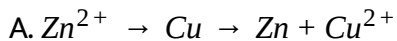
Answer: D



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which of the following is spontaneous

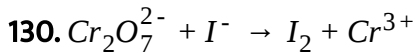


D. none of these

Answer: B



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$E_{cell}^{\circ} = 0.79V, E_{Cr_2O_7^{2-}}^{\circ} = 1.33V, E_{I_2}^{\circ}$  is

A. -0.10V

B. +0.18V

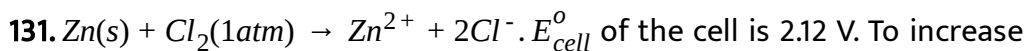
C. -0.54V

D. 0.54V

**Answer: D**



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E

A.  $[Zn^{2+}]$  should be increased

B.  $[Zn^{2+}]$  should be decreased

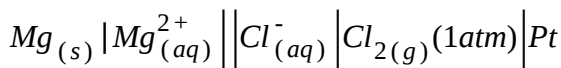
C.  $[Cl^-]$  should be decreased

D.  $P_{Cl_2}$  should be decreased

Answer: B::C

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132. Which is the CORRECT Nernst equation for reaction taking place in the following cell ?



$$A. E_{cell} = E_{cell}^{\circ} - \frac{0.0592}{n} \times \log \left( \frac{[Cl^-]^2}{[Mg^{2+}]} \right)$$

$$B. E_{cell} = E_{cell}^{\circ} - \frac{0.0591}{n} \times \log \left( \frac{[M^{2+}]}{[Cl^-]} \right)$$

$$C. E_{cell} = E_{cell}^{\circ} - \frac{0.592}{n} \times \log [Mg^{2+}] [Cl^-]^2$$

$$D. E_{cell} = E_{cell}^{\circ} - \frac{0.0591}{n} \times \log \left( \frac{[Mg^{2+}]}{[Cl^-]^2} \right)$$

Answer: C



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$$133. Ag_{(s)} \left| Ag^+_{(aq)} (0.01M) \right| \left| Ag^+_{(aq)} (0.1M) \right| Ag_{(s)} E^{\circ}_{Ag_{(s)}/Ag_{(aq)}} = 0.80\text{volt}$$

A. Cell cannot function as anode and cathode are of same material

B.  $E_{cell} = 0.0592V$

C.  $E_{cell} = 0.80V$

D.  $E_{cell} = 0.0296V$

Answer: B



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134. The e.m.f. of the following cell at 25 ° C is \_\_\_\_\_.  $Fe(s) \left| \left| FeSO_4(aq) (0.1M) \right| \right| \left| \left| CuSO_4(aq) (0.01M) \right| \right| Cu(s)$  ( $E^{\circ}_{Fe^{2+} | Fe} = -0.44V$  and  $E^{\circ}_{Cu^{2+} | Cu} = 0.337V$ )

A. x cannot be predicted

B.  $x=0.01M$

C.  $x > 0.01M$

D.  $x < 0.01M$

**Answer: B**

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**135.** Which equation gives relation between concentration of ions in solution , electrode potential (E) and standard electrode potential ( $E^\circ$  ?)

A. Kohlrausch's equation

B. Nernst's equation

C. Ohm's equation

D. Faraday's equation

**Answer: B**

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136. The correct representation of Nernst's equation is .

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

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

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

D. none of these

Answer: A



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137. (i) Copper metal dissolves in 1M silver nitrate solution and crystals of silver metal get deposited.

(ii) Silver metal does not react with 1M zinc nitrate solution.

Zinc metal dissolves in 1M copper sulphate solution and copper metal gets deposited



Hence the order of decreasing strength of the three metals as reducing agents will be

A.  $cu > Ag > Zn$

B.  $Ag > Cu > Zn$

C.  $Zn > Cu > Ag$

D.  $Cu > Zn > Ag$

**Answer: C**



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**138.** Standard electrode potential of Zn and Fe are known to be (i)  $-0.76V$  and (ii)  $-0.44V$  respectively. How does it explain that galvanization prevents rusting of iron while zinc slowly dissolves away

A. Since (i) is less than (ii), zinc becomes the cathode and iron the anode

B. Since (i) is less than (ii), zinc becomes the anode and iron the cathode

C. Since (i) is more than (ii), zinc becomes the anode and iron the cathode

D. Since (i) is more than (ii), zinc becomes the cathode and iron the anode

**Answer: B**



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**139.** Assertion: In the electrolysis of aqueous NaCl, Na is preferentially discharged at mercury cathode forming sodium amalgam.

Reason: It is due to the fact that hydrogen gas a high over voltage at mercury cathode.

A. if both assertion and reason are true and the reason is the correct explanation of the assertion.

- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**

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**140.** Assertion : A larger dry cell has higher emf.

Reason : The emf of a dry cell is proportional to its size.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false

D. If the assertion and reason both are false.

**Answer: D**

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**141.** Assertion(A): When acidified  $ZnSO_4$  solution is electrolyzed between  $Zn$  electrodes, it is  $Zn$  that is deposited at the cathode and  $H_2(g)$  is not evolved.

Reason (R): The electrode potential of  $Zn$  is more negative than hydrogen as the overpotential for hydrogen evolution in  $Zn$  is quite large.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**

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**142.** Statement-1: Gold chloride ( $AuCl_3$ ) solution cannot be stored in a vessel made of copper, iron, nickel, chromium, zinc or tin.

Statement-2 Gold is a very precious metal.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: B**

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**143.** Assertion: A negative value of standard reduction potential means that reduction takes place on this electrode with reference to standard hydrogen electrode.

Reason: The standard electrode potential of a half cell has a fixed value.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If assertion is false but reason is true.

**Answer: D**



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**144.** Assertion: Weston is a standard cell.

Reason: its e.m.f. does not change with temperature.

- A. if both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**

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**145.** Statement-1: Zinc displaces copper from copper sulphate solution.

Statement-2: The  $E_{298}^{\circ}$  of Zn is -0.76 volts and that of Cu is +0.34 volts.

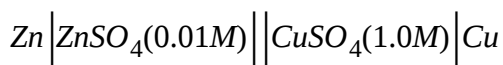
- A. If both assertion and reason are true and the reason is the correct explanation of the assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
- C. If assertion is true but reason is false
- D. If the assertion and reason both are false.

**Answer: A**



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**146.** The emf of a Daniell cell at 298K is  $E_1$



When the concentration of  $\text{ZnSO}_4$  is 1.0M and that of  $\text{CuSO}_4$  is 0.01M, the emf changed to  $E_2$ . What is the relationship between  $E_1$  and  $E_2$  ?

A.  $E_1 < E_2$

B.  $E_1 > E_2$



C.  $E_2 = 0 \neq E_1$

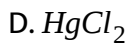
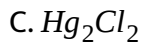
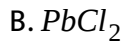
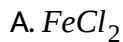
D.  $E_1 = E_2$

**Answer: B**

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### Ordinary Thinking Objective Questions (Corrosion)

1. Which of the following is a highly corrosive salt?



**Answer: D**

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2. Which metal is used as a coating on steel to prevent corrosion:-

A. Na

B. Ca

C. K

D. Zn

**Answer: D**



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3. Which metal is used as a coating on steel to prevent corrosion where the cell reactions are:-

A. Fe is oxidised to  $Fe^{2+}$  and dissolved oxygen in water is

$\ominus$   
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  $O_2$

**Answer: A**

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4. If an iron rod is dipped in  $CuSO_4$  solution

A. Blue colour of the solution turns green

B. Brown layer is deposited on iron rod

C. No change occurs in the colour of the solution

D. Blue colour of the solution vanishes

**Answer: B**

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5. The rusting of iron is catalysed by which of the following ?

A. Fe

B.  $O_2$

C. Zn

D.  $H^+$

**Answer: D**



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6. Assertion (A): Galvanized iron does not rust.

Reason (R): Zn has a more negative electrode potential than Fe.

A. if both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is false

D. If the assertion and reason both are false.

**Answer: A**



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### Critical Thinking Objective Question

1. The mass of carbon anode consumed (giving only carbon dioxide) in the production of  $270\text{kg}$  of aluminium metal from bauxite by the Hall process is

A.  $180\text{kg}$

B.  $270\text{kg}$

C.  $540\text{ kg}$

D.  $90\text{kg}$

**Answer: D**

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2. 4.5g of aluminium (at mass  $27u$ ) is deposited at cathode from  $Al^{3+}$  solution by a certain quantity of electric charge. The volume of hydrogen gas produced at *STP* from  $H^+$  ions in solution by the same quantity of electric charge will be:

- A. 22.4L
- B. 44.8L
- C. 5.6L
- D. 11.2L

**Answer: C**

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3. The standard emf of the cell

$Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$  is 1.10V at

25 °C the emf of the cell when 0.1 M  $Cu^{2+}$  and 0.1 M  $Zn^{2+}$  solution are used will be

- A. 1.10V
- B. 0.110V
- C. -1.10V
- D. -0.110V

**Answer: A**

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4. Consider two half cells based on the reaction  $Ag^+_{(aq)} + e^- \rightarrow Ag_{(s)}$ . The left half cell contains  $Ag^+$  ions at concentration of  $Ag^+$  ions, but just enough  $NaCl_{(aq)}$  has been added to completely precipitate the  $Ag^+_{(aq)}$  as  $AgCl$ . If the emf of the cell is 0.29V, then  $\log_{10} K_{sp}$  would have been

A. 9.804

B. -9.804

C. -4.902

D. 10.004

**Answer: C**



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5. A current of 10.0A is passed through 1.0L of 1.0M HCl solution for 965 seconds, pH of the solution at the end of the experiment is:-

A. 0

B. 0.2

C. 0.8

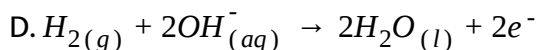
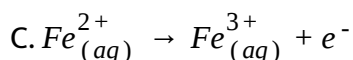
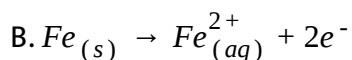
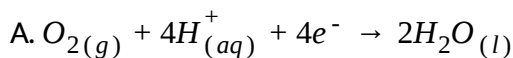
D. none of the above

**Answer: D**



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6. On the basis of electrochemical theory of aqueous corrosion, the reaction occurring at the cathode is



**Answer: A**

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7. What will be the reduction potential of a hydrogen electrode which is filled with HCl solution of pH value 1.0? (at 298 Kelvin)

A. -59.15V

B. +59.15V

C. +59.15mV

D. -59.15mV

**Answer: D**

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8. The limiting molar conductivities  $\Lambda^\circ$  for NaCl, KBr, and KCl are 126, 152 and 150  $\text{Scm}^2\text{mol}^{-1}$  respectively. The  $\Lambda^\circ$  for NaBr \_\_\_\_\_.

A. 278  $\text{S cm}^2\text{mol}^{-1}$

B. 176  $\text{S cm}^2\text{mol}^{-1}$

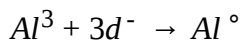
C. 128  $\text{S cm}^2\text{mol}^{-1}$

D. 302  $\text{S cm}^2\text{mol}^{-1}$

**Answer: C**

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9. Aluminium oxide may be electorlysed at  $1000^{\circ}C$  to furnish aluminim metal (Atomic Mass = 27 amu,  $1F = 96,500C$ ). The cathode reaction is



To prepare 5.12kg of aluminimu metal by this method woold require .

A.  $5.49 \times 10^7C$  of electricity

B.  $1.83 \times 10^7C$  of electricity

C.  $5.49 \times 10^4C$  of electricity

D.  $5,49 \times 10^1C$  of electricity

**Answer: A**



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Electrolyte  $\Lambda . ^{\infty} \left( S cm^2 mol^{-1} \right)$

*KCl* 149.9

10. *KNO<sub>3</sub>* 145.0

*HCl* 426.2

*NaOAc* 91.0

*NaCl* 126.5

Calculate  $\Lambda_{HOAc}^{\infty}$  using appropriate molar conductance of the electrolytes listed above at infinite dilution in  $H_2O$  at  $25^{\circ}C$

A. 517.2

B. 552.7

C. 390.7

D. 217.5

**Answer: C**



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11. During spontaneous discharge of an electrochemical cell Gibb's free energy will

- A. Increase
- B. Decrease
- C. Not change
- D. Be infinity

**Answer: B**

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**12.** In which of the following pairs, the constants/quantities are not mathematically related to each other?

- A. Gibb's free energy an standard cell potential
- B. Equilibriu constant and standard cell potential
- C. Rate constant and activation energy
- D. Rate constant and standard cell potential

**Answer: D**

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13. Small quantities of compounds TX, TY and TZ are put into separate test tubes containing X, Y and Z solutions. TX does not react with any of these. TY reacts with both X and Z. TZ reacts only with X. The decreasing order of ease of oxidation of the anions  $X^-$ ,  $Y^-$  and  $Z^-$  is

A.  $Y^-$ ,  $Z^-$ ,  $X^-$

B.  $Z^-$ ,  $X^-$ ,  $Y^-$

C.  $Y^-$ ,  $X^-$ ,  $Z^-$

D.  $X^-$ ,  $Z^-$ ,  $Y^-$

**Answer: A**

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14. The oxidation potential of a hydrogen electrode at  $pH = 10$  and

$P_{H_2} = 1$  is

A. 0.059V

B. 0.59V

C. 0.00V

D. 0.51V

**Answer: B**



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15. Which of the following curve gives the variation of  $\Lambda_m^\infty$  with  $\sqrt{c}$  for

$CH_3COOH$

A. 

B. 

C. 

D. None of these

**Answer: D**

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16. "Maintenance free" batteries now in use in place of common batteries have

- A. Electrode made of lead-lead oxide
- B. Electrodes made of calcium-containing lead alloy
- C. Non aqueous solvents as medium
- D. Platinum electrodes

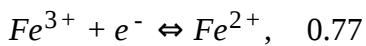
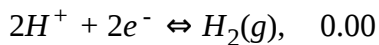
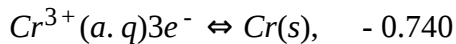
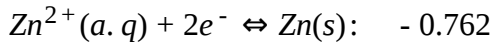
**Answer: B**

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**Jee Section (Only one choice correct answer)**

1. The standard reduction potentials at  $25^{\circ}\text{C}$  for the following half reactions are given against each:





Which is the strongest reducing agent?

A.  $\text{Zn}(\text{s})$

B.  $\text{Cr}(\text{s})$

C.  $\text{H}_2(\text{g})$

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

**Answer: A**



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2. Which has ability to release bromine from  $\text{KBr}$  ?

A.  $\text{I}_2$

B.  $\text{Cl}_2$

C.  $HI$

D.  $SO_2$

**Answer: B**

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3. Faraday's laws of electrolysis are related to the

A. Atomic number of the reaction

B. Atomic number of the anion

C. Equivalent weight of the electrode

D. Speed of the cation.

**Answer: C**

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4. In electrolysis of dilute  $H_2SO_4$  using platinum electrodes .

- A.  $H_2$  is evolved at cathode
- B.  $NH_3$  is produced at anode
- C.  $Cl_2$  is obtained at cathode
- D.  $O_2$  is produced

**Answer: A**



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5. The electric charge for electrode deposition of one gram equivalent of a substance is:

- A. One ampere per second
- B. 96,500 coulombs per second
- C. One ampere for one hour
- D. Charge on one mole of electrons

**Answer: D**

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6. A solution containing  $1\text{ mol}$  per litre of each  $\text{Cu}(\text{NO}_3)_2$ ,  $\text{AgNO}_3$ , and  $\text{Hg}_2(\text{NO}_3)_2$  is being electrolyzed by using inert electrodes. The values of standard electrode potentials in volts (reduction potential) are

$$\text{Ag}|\text{Ag}^{\oplus} = +0.80, 2\text{Hg}|\text{Hg}_2^{2+} = +0.79$$

$$\text{Cu}|\text{Cu}^{2+} = +0.34, \text{Mg}|\text{Mg}^{2+} = -2.37.$$

With increasing voltage, the sequence of deposition of metals at the cathode will be

A. Ag, Hg, Cu, Mg

B. Mg, Cu, Hg, Ag

C. Ag, Hg, Cu

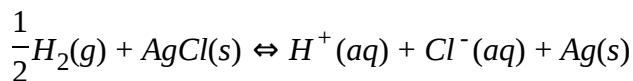
D. Cu, Hg, Ag

**Answer: A**

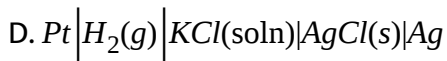
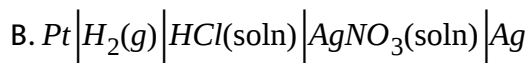
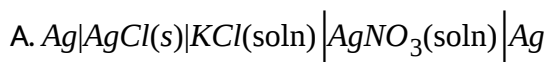


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7. The reaction



occurs in the galvanic cell



Answer: C



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8. When a lead storage battery is discharged

A.  $SO_2$  is evolved

B. Lead sulphate is consumed

C. Lead is formed

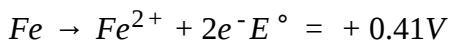
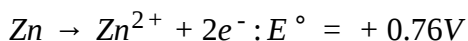
D. Sulphuric acid is consumed

**Answer: D**

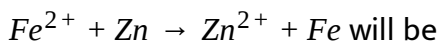


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9. The standard oxidation potential  $E^\circ$  for the half cell reactions are



EMF of the cell reaction



A.  $-0.35\text{V}$

B.  $+0.35\text{V}$

C.  $+1.17\text{V}$

D.  $-1.17\text{V}$

**Answer: B**

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10. 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

**Answer: A**

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11. Which one of the following metals can not be obtained on electrolysis of aqueous solution of its salts?

A. *Ag*

B. *Mg*

C. *Cu*

D. *Cr*

**Answer: B**



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**12.** The standard reduction potential for  $Fe^{2+}/Fe$  and  $Sn^{2+}/Sn$  electrodes are -0.44 and -0.14 volt respectively. For the given cell reaction  $Fe^{2+} + Sn \rightarrow Fe + Sn^{2+}$ , the standard *EMF* is.

A. +0.30V

B. -0.58V

C. +0.58V

D. -0.30V



**Answer: D**



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13.  $Cu^+$  ion is not stable in aqueous solution because because of disproportionation reaction.  $E^\circ$  value of disproportionation of  $Cu^+$  is

$$\left[ E_{Cu^{2+}/Cu^+}^\circ = +0.15V, E_{Cu^{2+}/Cu}^\circ = 0.34V \right]$$

A. -0.49V

B. 0.19V

C. -0.38V

D. 0.38V

**Answer: B**



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14. The required charge for one equivalent weight of silver deposited on cathode is.

A.  $9.65 \times 10^7 C$

B.  $9.65 \times 10^4 C$

C.  $9.65 \times 10^3 C$

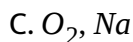
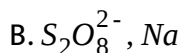
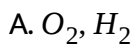
D.  $9.65 \times 10^5 C$

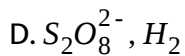
**Answer: B**



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15. A dilute aqueous solution of  $Na_2SO_4$  is electrolyzed using platinum electrodes. The products at the anode and cathode are :





**Answer: A**

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16. The standard reduction potentials of  $Cu^{2+} | Cu$  and  $Cu^{2+} | Cu^{\oplus}$  are  $0.337V$  and  $0.153V$ , respectively. The standard electrode potential for  $Cu^{\oplus} | Cu$  half cell is

- A.  $0.184V$
- B.  $0.827V$
- C.  $0.521$
- D.  $0.490V$

**Answer: C**

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17. A standard hydrogen electrode has zero electrode potential because :

- A. Hydrogen is easier to oxidise
- B. This electrode potential is assumed to be zero
- C. Hydrogen atom has only one electron
- D. Hydrogen is the lightest element.

**Answer: B**



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18. The standard reduction potential values of three metallic cations,  $X$ ,  $Y$ , and  $Z$  are  $0.52$ ,  $-3.03$ , and  $-0.18V$ , respectively. The order of reducing power of the corresponding metal is

- A.  $Y > Z > X$
- B.  $X > Y > Z$
- C.  $Z > Y > X$

D.  $Z > X > Y$

**Answer: A**

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**19.** The emf of the cell in which the following reactions,

$Zn(s) + Ni^{2+}(0.1M) \rightarrow Zn^{2+}(1.0M) + Ni(s)$  occurs, is found to 0.5105 V at

298 K. The standard emf of the cell is :

A. 0.54

B. 0.4810V

C. 0.5696V

D. -0.5400V

**Answer: B**

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20. A gas X at 1 atm is bubbled through a solution containing a mixture of 1M  $Y^-$  and 1M  $Z^-$  at 25 ° C. If the reduction potential of  $Z > Y > X$ , then
- A. Y will oxidize X and not Z
  - B. Y will oxidize Z and not X
  - C. Y will oxidize both X and Z
  - D. Y will reduce both X and Z

**Answer: A**



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21. For a cell reaction involving a two electron change, the standard emf of the cell is found to be 0.295 V at 25 ° C. The equilibrium constant of the reaction at 25 ° C will be:

- A.  $1 \times 10^{-10}$
- B.  $29.5 \times 10^{-2}$

C. 10

D.  $1 \times 10^{10}$

**Answer: D**

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22. For the electrochemical cell  $(M | M^+) || (X^- | X)$

$$E^\circ (M^+ / M) = 0.44V \text{ and } E^\circ (X / X^-) = 0.33V$$

From this data one can deduce that :

A.  $M + X \rightarrow M^+ + X^-$  is the spontaneous reaction

B.  $M^+ + X^- \rightarrow M + X$  is the spontaneous reaction

C.  $E_{cell} = 0.77V$

D.  $E_{cell} = -0.77V$

**Answer: B**

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23. Which of the following liberate hydrogen on reaction with dilute  $H_2SO_4$ ?

A. Fe

B. Cu

C. Al

D. Hg

**Answer: C**

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24. A galvanic cell is set up from a zinc bar weighing 50g and 1.0 litre, 1.0M,  $CuSO_4$  solution. How long would the cell run, assuming it delivers a steady current of 1.0 ampere

A. 48hrs



B. 41hrs

C. 21hrs

D. 1hr

**Answer: C**

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25. Saturated solution of  $KNO_3$  is used to make "salt bridge" because .

A. Velocity of  $K^+$  is greater than that of  $NO_3^-$

B. Velocity of  $NO_3^-$  is greater than that of  $K^+$

C. Velocities of both  $K^+$  and  $NO_3^-$  are nearly the same

D.  $KNO_3$  is highly soluble in water

**Answer: C**

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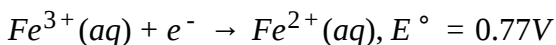
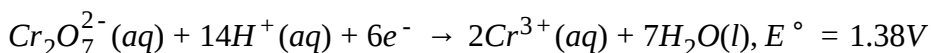
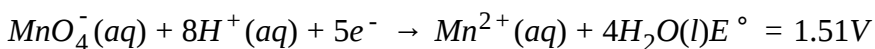
26. The correct order of equivalent conductance at infinite dilution of  $LiCl$ ,  $NaCl$  and  $KCl$  is:

- A.  $LiCl > NaCl > KCl$
- B.  $KCl > NaCl > LiCl$
- C.  $NaCl > KCl > LiCl$
- D.  $LiCl > KCl > NaCl$

**Answer: B**

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27. Standard electrode potential data are useful for understanding the suitability of an oxidant in a redox titration. Some half cell reaction and their standard potentials are given below:





Identify the only correct statement regarding quantitative estimation of aqueous  $Fe(NO_3)_2$

- A.  $MnO_4^-$  can be used in aqueous HCl
- B.  $Cr_2O_7^{2-}$  can be used in aqueous HCl
- C.  $MnO_4^-$  can be used in aqueous  $H_2SO_4$
- D.  $Cr_2O_7^{2-}$  can be used in aqueous  $H_2SO_4$

**Answer: A**



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**28.** In the electrolytic cell, flow of electrons is form :

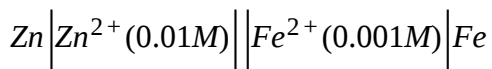
- A. Cathode to anode in solution
- B. Cathode to anode through external supply
- C. Cathode to anode through internal supply

D. Anode to cathode through internal supply

**Answer: C**

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29. The emf of the cell,



at 298 K is 0.2905 then the value of equilibrium constant for the cell reaction is:

A.  $e^{\frac{0.32}{0.0295}}$

B.  $10^{\frac{0.32}{0.0295}}$

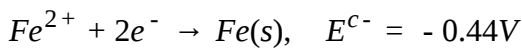
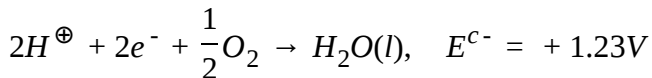
C.  $10^{\frac{0.26}{0.0295}}$

D.  $10^{\frac{0.32}{0.0591}}$

**Answer: B**

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30. The rusting of iron takes place as follows :



Calculate  $\Delta G^{c^{-}}$  for the net process.

A.  $-322kJ \text{ mol}^{-1}$

B.  $-161kJ \text{ mol}^{-1}$

C.  $-152kJ \text{ mol}^{-1}$

D.  $-76kJ \text{ mol}^{-1}$

**Answer: A**



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31. Electrolysis of dilute aqueous  $NaCl$  solution was carried out by passing  $10mA$  current. The time required to liberate  $0.01mol$  of  $H_2$  gas at the cathode is  $\left(1F = 96500Cmol^{-1}\right)$

A.  $9.65 \times 10^4 \text{sec}$

B.  $19.3 \times 10^4 \text{sec}$

C.  $28.95 \times 10^4 \text{sec}$

D.  $38.6 \times 10^4 \text{sec}$

**Answer: B**



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32.  $\text{AgNO}_3(\text{aq})$  was added to an aqueous KCl solution gradually and the conductivity of the solution was measured. The plot of conductance ( $\Lambda$ ) versus the value of  $\text{AgNO}_3$  is



A. (P)

B. (Q)

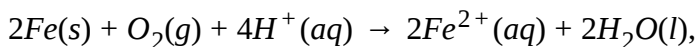
C. (R)

D. (S)

**Answer: D**

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**33.** Consider the following cell reaction.



$$E^\circ = 1.67\text{V}$$

At  $[\text{Fe}^{2+}] = 10^{-3}\text{M}$ ,  $P(\text{O}_2) = 0.1 \text{ atm}$  and  $\text{pH}=3$ , the cell potential at  $25^\circ\text{C}$  is

A. 1.47V

B. 1.77V

C. 1.87V

D. 1.57V

**Answer: D**

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34. Given

$$E_{Cr^{3+}/Cr}^0 = -0.74V, E_{MnO_4^-/Mn^{2+}}^0 = 1.51V$$

$$E_{Cr_2O_7^{2-}/Cr^{3+}}^0 = 1.33V, E_{Cl/Cl^-}^0 = 1.36V$$

Based on the data given above, strongest oxidising agent will be:

A.  $Cl$

B.  $Cr^{3+}$

C.  $Mn^{2+}$

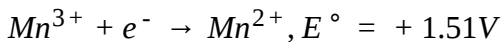
D.  $MnO_4^-$

Answer: D



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35. Given below are the half-cell reactions



The  $E^\circ$  for  $3Mn^{2+} \rightarrow Mn + 2Mn^{3+}$  will be \_\_\_\_\_.



- A.  $-2.69\text{V}$ , the reaction will not occur
- B.  $-2.69\text{V}$ , the reaction will occur
- C.  $-0.33\text{V}$ , the reaction will not occur
- D.  $-0.33\text{V}$ , the reaction will occur

**Answer: A**

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**36.** Resistance of  $0.2\text{ M}$  solution of an electrolyte is  $50\Omega$ . The specific conductance of the solution of  $0.5\text{ M}$  solution of same electrolyte is  $1.4\text{Sm}^{-1}$  and resistance of same solution of the same electrolyte is  $280\Omega$ . The molar conductivity of  $0.5\text{ M}$  solutions of the electrolyte is  $5\text{m}^2\text{mol}^{-1}$  is

- A.  $5 \times 10^{-4}$
- B.  $5 \times 10^{-3}$
- C.  $5 \times 10^3$
- D.  $5 \times 10^2$

**Answer: A**

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37. The equivalent conductance of NaCl at concentration  $C$  and at infinite dilution are  $\lambda_C$  and  $\lambda_\infty$ , respectively. The correct relationship between  $\lambda_C$  and  $\lambda_\infty$  is given as (where, the constant  $B$  is positive)

A.  $\lambda_C = \lambda_\infty + (B)C$

B.  $\lambda_C = \lambda_\infty - (B)C$

C.  $\lambda_C = \lambda_\infty - (B)\sqrt{C}$

D.  $\lambda_C = \lambda_\infty + (B)\sqrt{C}$

**Answer: C**

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38. 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 solution

**Answer: A**

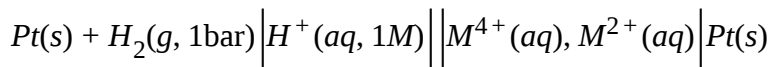
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**39.** Two faraday of electricity is passed through a solution of  $CuSO_4$ . The mass of copper deposited at the cathode is: (at mass of Cu = 63.5 amu)

- A. 0g
- B. 63.5g
- C. 2g
- D. 127g

**Answer: B**

40. For the following electrochemical cell at 298K



$$E_{\text{cell}} = 0.092\text{V} \text{ when } \frac{[\text{M}^{2+}(aq)]}{[\text{M}^{4+}(aq)]} = 10^x$$

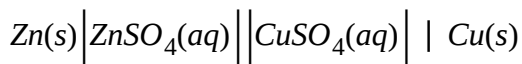
$$\text{Given, } E_{\text{M}^{4+}/\text{M}^{2+}}^{\circ} = 0.151\text{V}, 2.303 \frac{RT}{F} = 0.059$$

The value of x is-

- A. -2
- B. -1
- C. 1
- D. 2

Answer: D

41. For the following cell,



When the concentration of  $\text{Zn}^{2+}$  is 10 times the concentration of  $\text{Cu}^{2+}$ ,

the expression for  $\Delta G$

(in  $\text{J mol}^{-1}$ )

[F is Faraday constant, R is gas constant] T is temperature,  $E^\circ(\text{cell}) = 1.1\text{V}$

A.  $2.303RT + 1.1F$

B.  $1.1F$

C.  $2.303RT - 2.2F$

D.  $-2.2F$

**Answer: C**



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42. How long (approximate) should water be electrolysed by passing through 100 amperes current so that the oxygen released can completely

burn 27.66 g of diborane?

(Atomic weight of B = 10.8 u)

A. 0.8 hours

B. 3.2 hours

C. 1.6 hours

D. 6.4 hours

**Answer: B**



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**43.** Among the following metals, the strongest reducing agent is

A.  $Mn^{2+}$

B.  $Cr^{3+}$

C.  $Cl^-$

D.  $Zn$

**Answer: D**

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## Jee Section (More than one choice correct answer)

1. Which of the following is displaced by Fe ?

A. Ag

B. Hg

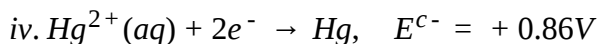
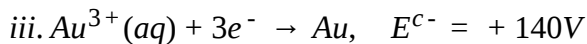
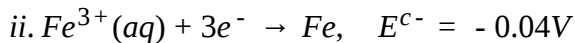
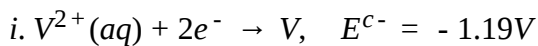
C. Zn

D. Na

**Answer: A**

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2. For the reduction of  $\text{NO}_3^{\ominus}$  ion in an aqueous solution,  $E^{\ominus}$  is +0.96V, the values of  $E^{\ominus}$  for some metal ions are given below :



The pair(s) of metals that is / are oxidized by  $\text{NO}_3^{\ominus}$  in aqueous solution is / are

A. V and Hg

B. Hg and Fe

C. Fe and Su

D. Fe and V

**Answer: A::B::D**



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### 3. Reduction electrode potentials of half cells

(1)  $Pt(H_2) | H^+ (C_f)$ , (2)  $Pt(Cl_2) | (Cl^-) (C_2)$  and (3)  $Ag^+ | Ag^+ (C_3)$  on increasing  $C_1, C_2$ , and  $C_3$  (all gases are at 1 atm pressure)

A. Will increase on increasing  $C_1, C_2$  and  $C_3$

B. Will decrease on increasing  $C_1, C_2$  and  $C_3$

C. Will decrease on increasing  $C_1$  and  $C_3$  and increase on increasing  $C_2$

D. Will remain constant if  $C_1$  or  $C_2$  is doubled and  $p_1$  or  $p_2$  is made four times.

**Answer: C::D**

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### 4. There is blue colour formation if:

A. Cu electrode is placed inside  $AgNO_3$  solution

B. Cu electrode is placed inside  $ZnSO_4$  solution

C. Cu electrode is placed inside dil  $HNO_3$

D. Cu electrode is placed inside dil  $H_2SO_4$

**Answer: A::C**

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5. The formation of rust on the surface of iron occurs through the reaction (s) .

A.  $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$  at anode

B.  $O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$  at cathode

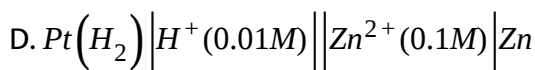
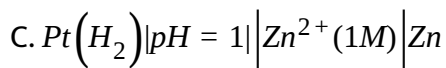
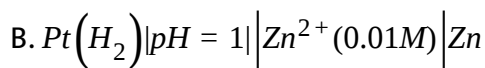
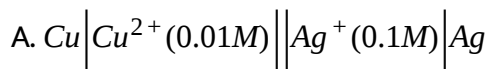
C.  $4Fe^{2+}(aq) + O_2(g) + 4H_2O(l) \rightarrow 2Fe_2O_3(s) + 8H^+$

D.  $Fe_2O_3(s) + xH_2O(l) \rightarrow Fe_2O_3 \cdot xH_2O$

**Answer: A**

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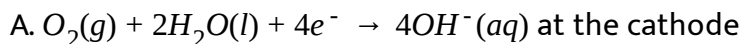
6. In which case  $(E_{\text{cell}} - E_{\text{cell}}^{\circ})$  is zero



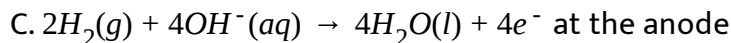
Answer: A::B

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7. Reaction taking place in a fuel cells are:



B. Reaction in (a) at the cathode



D. Reaction in (c) at the cathode

**Answer: A::C**

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**8.** It is not advisable to:

- A. Stir sugar solution with a steel spoon
- B. Stir copper sulphate solution with a silver spoon
- C. Stir copper sulphate solution with a zinc spoon
- D. Stir silver nitrate solution with a copper spoon

**Answer: C::D**

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**9.** By passage of 1 F of electricity

- A. 1 mol of Cu is deposited

B. 0.5 mol of Mg is deposited

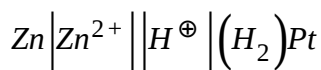
C. 9g of Al is deposited

D. 5.6 L of  $O_2$  gas evolved at anode

**Answer: B::C::D**

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**10.** In the following electrochemical cell :



$E_{cell} = E^{C-}_{cell}$ . This will be when

A.  $[Zn^{2+}] = [H^+] = 1M$  and  $pH_2 = 1atm$

B.  $[Zn^{2+}] = 0.01M$ ,  $[H^+] = 0.1M$  and  $pH_2 = 1atm$

C.  $[Zn^{2+}] = 1M$ ,  $[H^+] = 0.1M$  and  $pH_2 = 0.1atm$

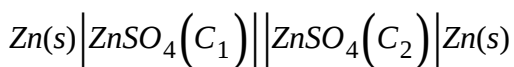
D.  $[Zn^{2+}] = [H^+] = 0.1M$  and  $pH_2 = 0.1atm$

**Answer: A::B**



## Jee Section (Reasoning type question)

1. Statement 1: The standard emf ( $E_{cell}^{\circ}$ ) of following concentration cell is zero.



Statement 2: The electrolyte concentration cell will be is greater in cathodic half-cell.

- A. Statement 1 is true, statement 2 is true, statement 2 is a correct explanation for statement 1
- B. Statement 1 is true, statement 2 is true, statement 2 is not a correct explanation for statement 1
- C. Statement 1 is true, statement 2 is false
- D. statement 1 is false,statement 2 is true

**Answer: B**



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2. Statement -1 : During the electrolysis of water, two faraday of charge will produce a total of 33.6 litre of gases at STP at electrodes.

Statement -2 : In the electrolysis of water, two faraday of charge will produce half mole of  $H_2$  gas and one fourth mole of  $O_2$  gas.

A. Statement 1 is true, statement 2 is true, statement 2 is a correct explanation for statement 1

B. Statement 1 is true, statement 2 is true, statement 2 is not a correct explanation for statement 1

C. Statement 1 is true, statement 2 is false

D. statement 1 is false,statement 2 is true

**Answer: C**



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3. Statement-I: In the Daniel cell, if concentration of  $Cu^{2+}$  and  $Zn^{2+}$  ions are doubled the emf of the cell will not change.

Because Statement-II: If the concentration of ions in contact with the metals is doubled, the electrode potential is doubled.

A. Statement 1 is true, statement 2 is true, statement 2 is a correct explanation for statement 1

B. Statement 1 is true, statement 2 is true, statement 2 is not a correct explanation for statement 1

C. Statement 1 is true, statement 2 is false

D. statement 1 is false,statement 2 is true

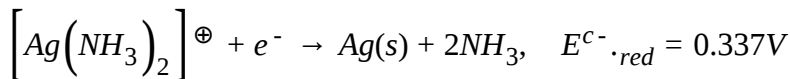
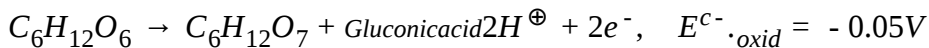
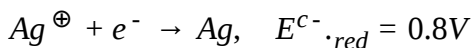
**Answer: D**

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**Jee Section (Comprehension Type question)**



1. Tollen reagent is used for the detection of aldehydes. When a solution of  $AgNO_3$  is added to glucose with  $NH_4OH$ , then gluconic acid is formed.



$$\left[ \text{Use } 2.303 \times \frac{RT}{F} = 0.0592 \text{ and } \frac{F}{RT} = 38.92 \text{ at } 298K \right]$$

$2Ag^{\oplus} + C_6H_{12}O_6 + H_2O \rightarrow 2Ag^s + C_6H_{12}O_7 + 2H^{\oplus}$  Find  $\ln K$  of this reaction.

A. 66.13

B. 58.38

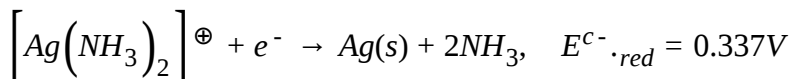
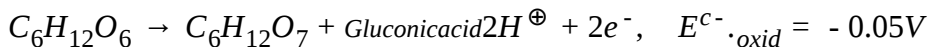
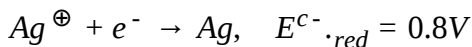
C. 28.30

D. 46.29

**Answer: B**

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2. Tollen reagent is used for the detection of aldehydes. When a solution of  $AgNO_3$  is added to glucose with  $NH_4OH$ , then gluconic acid is formed.



$$\left[ \text{Use } 2.303 \times \frac{RT}{F} = 0.0592 \text{ and } \frac{F}{RT} = 38.92 \text{ at } 298K \right]$$

When ammonia is added to the solution,  $pH$  is raised to 11. Which half cell reaction is affected by  $pH$  and by how much ?

A.  $E_{oxi}$  will increase by a factor of 0.65 from  $E_{oxi}^{\circ}$

B.  $E_{oxi}$  will decrease by a factor of 0.65 from  $E_{oxi}^{\circ}$

C.  $E_{red}$  will increase by a factor of 0.65 from  $E_{red}^{\circ}$

D.  $E_{red}$  will decrease by a factor of 0.65 from  $E_{red}^{\circ}$ .

**Answer: C**



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3. Ammonia is always added in this reaction. Which of the following must be incorrect

A.  $NH_3$  combines with  $Ag^+$  to form a complex

B.  $Ag(NH_3)_2^+$  is a stronger oxidising reagent than  $Ag^+$

C. In absence of  $NH_3$  silver salt of gluconic acid is formed

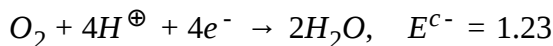
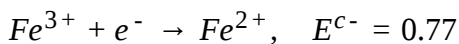
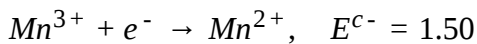
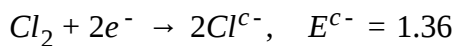
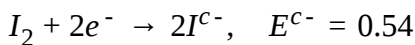
D.  $NH_3$  has affected the standard reduction potential of glucose/gluconic acid electrode

Answer: D

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4. Redox reactions play a pivotal role in chemistry and biology. The values standard redox potential ( $E^{c-}$ ) of two half cell reactions decided which way the reaction is expected to proceed. A simple example is a Daniell cell in which zinc goes into solution and copper sets deposited. Given below are a set of half cell reactions ( acidic medium ) along with their  $E^{c-}$  (V

with respect to normal hydrogen electrode ) values. Using this data, obtain correct explanations for Question.



Among the following, identify the correct statement.

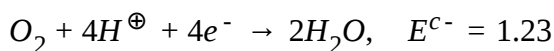
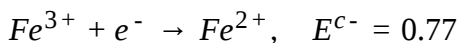
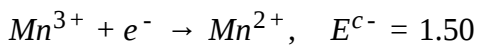
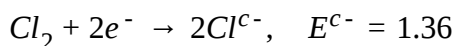
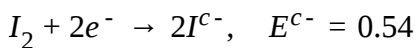
- A. Chloride ion oxidised  $O_2$
- B.  $Fe^{2+}$  is oxidised by iodine
- C. Iodide ion is oxidised by chlorine
- D.  $Mn^{2+}$  is oxidised by chlorine

**Answer: C**



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5. Redox reactions play a pivotal role in chemistry and biology. The values standard redox potential ( $E^{c-}$ ) of two half cell reactions decided which way the reaction is expected to proceed. A simple example is a Daniell cell in which zinc goes into solution and copper sets deposited. Given below are a set of half cell reactions ( acidic medium ) along with their  $E^{c-}$  (V with respect to normal hydrogen electrode ) values. Using this data, obtain correct explanations for Question.



While  $Fe^{3+}$  is stable,  $Mn^{3+}$  is not stable in acid solution because

A.  $O_2$  oxidises  $Mn^{2+}$  to  $Mn^{3+}$

B.  $O_2$  oxidises both  $Mn^{2+}$  to  $Mn^{3+}$  and  $Fe^{2+}$  to  $Fe^{3+}$

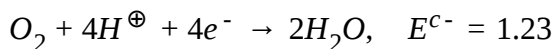
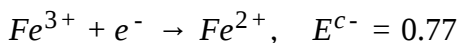
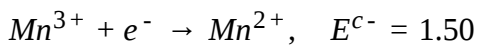
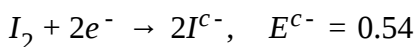
C.  $Fe^{3+}$  oxidises  $H_2O$  to  $O_2$

D.  $Mn^{3+}$  oxidises  $H_2O$  to  $O_2$

Answer: D

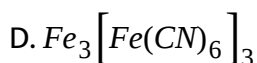
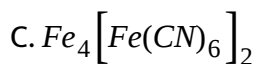
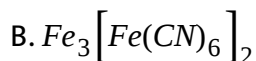
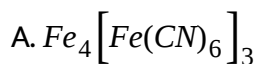
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6. Redox reactions play a pivotal role in chemistry and biology. The values standard redox potential ( $E^{c-}$ ) of two half cell reactions decided which way the reaction is expected to proceed. A simple example is a Daniell cell in which zinc goes into solution and copper sets deposited. Given below are a set of half cell reactions ( acidic medium ) along with their  $E^{c-}$  (V with respect to normal hydrogen electrode ) values. Using this data, obtain correct explanations for Question.



Sodium fusion extract obtained from aniline on treatment with iron (II)

sulphate and  $H_2SO_4$  in the presence of air gives a Prussian blue precipitate. The blue colour is due to the formation of



**Answer: A**



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7. Chemical reactions involve interaction of atoms and molecules. A large number of atoms / molecules ( approximately  $6.023 \times 10^{23}$  ) are present in a few grams of any chemical compound varying with their atomic / molecular masses. To handle such large numbers 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 4.0M aqueous solution of  $NaCl$  is prepared and 500mL of this solution is electrolyzed. This leads to the evolution of chlorine gas at one of the electrodes ( atomic mass of  $Na$  is 23 and  $Hg$  is 200)( $1F = 96500C$ ).

The total number of moles of chlorine gas evolved is

- A. 0.5
- B. 1.0
- C. 2.0
- D. 3.0

**Answer: B**



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8. Chemical reaction involve interaction of atoms and molecules. A large number of atoms/molecules (approximately  $6.022 \times 10^{23}$ ) are present in a few grams of any chemical compound varying with their atomic/molrcular



mass. To handle such a large numbers conveniently, the mole concept was introduced. This concept has implications in diverse areas such as analytical 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 (atomic mass: Na=23, Hg=200,  $1F=96500$  coulombs)

If cathode is a Hg electrode, the maximum weight(g) of amalgam formed from the solution is

- A. 200
- B. 225
- C. 400
- D. 446

**Answer: D**



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9. Chemical reaction involve interaction of atoms and molecules. A large number of atoms/molecules (approximately  $6.022 \times 10^{23}$ ) are present in a few grams of any chemical compound varying with their atomic/molecular mass. To handle such a large numbers conveniently, the mole concept was introduced. This concept has implications in diverse areas such as analytical 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 (atomic mass: Na=23, Hg=200,  $1F=96500$  coulombs)

The total charge in coulombs required to complete the electrolysis

A. 24125

B. 48250

C. 96500

**Answer: D**

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10. 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 mode for such a concentration cell involving a metal  $M$  is :



For the above electrolytic cell the magnitude of the cell potential

$$\left| E_{cell} \right| = 70\text{mV}$$

For the above cell :

A.  $E_{cell} < 0, \Delta G > 0$

B.  $E_{cell} > 0, \Delta G < 0$

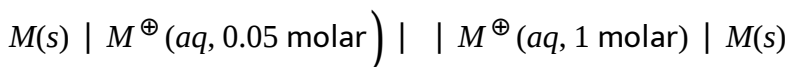
C.  $E_{cell} < 0, \Delta G^\circ > 0$

$$D. E_{cell} > 0, \Delta G^\circ < 0$$

Answer: B

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11. The concentration of potassium ions inside a biological cell is at least 20 times higher than 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 a concentration cell involving a metal  $M$  is



For the above electrolytic cell, the magnitude of the cell potential is

$$\left| E_{cell} \right| = 70 \text{ mV}.$$

If the 0.05 molar solution of  $M^\oplus$  is replaced by a 0.0025 molar  $M^\oplus$  solution, then the magnitude of the cell potential would be

A. 35 mV

B. 70 mV

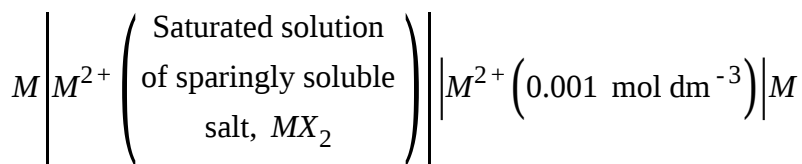
C. 140 mV

D. 700 mV

**Answer: C**

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12. The electrochemical cell shown below is a concentration cell.



The emf of the cell depends on the difference in concentrations of  $M^{2+}$  ions at the two electrodes. The emf of the cell at 298 K is 0.059 V.

The solubility product ( $K_{sp}$ ,  $\text{mol}^3 \text{dm}^{-9}$ ) of  $MX_2$  at 298 K based on the information available for the given concentration cell is

(take  $2.303 \times R \times 298/F = 0.059\text{V}$ ):

A.  $4 \times 10^{-15}$

B. 5.7

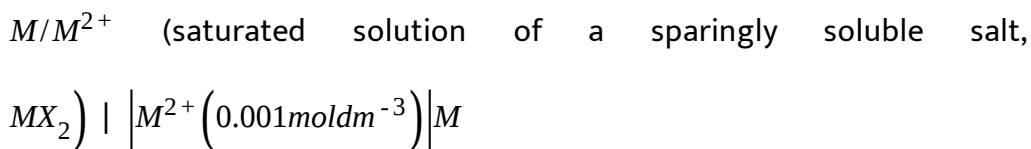
C.  $1 \times 10^{-12}$

D.  $4 \times 10^{-12}$

**Answer: A**

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**13.** The electrochemical cell shown below is a concentration cell



The emf of the cell depends on the difference in concentrations of  $Mn^{2+}$  ions at the two electrodes. The emf of the cell at 298K is 0.059V.

The value of  $\Delta G$  ( $\text{kJ mol}^{-1}$ ) for the given cell is : (take  $1F = 96500 \text{ C mol}^{-1}$ )

A. -5.7

B. 5.7

C. 11.4

D. -11.4

Answer: D

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### Jee Section (Integer type Questions)

1. The molar conductivity of a solution of a weak acid  $HX(0.01M)$  is 10 times smaller than the molar conductivity of a solution of a weak acid  $HY(0.10M)$ . If  $\lambda_{X^-}^{\circ} = \lambda_{Y^-}^{\circ}$ , the difference in their  $pK_a$  values,  $pK_a(HX) - pK_a(HY)$ , is (consider degree of ionisation of both acids to be  $< < 1$ ):

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2. The conductance of a  $0.0015\text{ M}$  aqueous solution of a weak monobasic acid was determined by using a conductivity cell consisting of Pt electrodes. The distance between the electrodes is  $120\text{ cm}$  with an area of cross section of  $1\text{ cm}^2$ . The conductance of this solution was found to be

$5 \times 10^{-7} \text{S}$ . The pH of the solution is 4. The value of limiting molar conductivity ( $\Lambda^\circ$ ) of this monobasic acid in aqueous solution is  $Z \times 10^2 \text{Scm}^{-1} \text{mol}^{-1}$ . The value of Z is .....

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3. An alloy of Pb-Ag weighing 1.08g was dissolved in dilute  $\text{HNO}_3$  and the volume made to 100 mL. A silver electrode was dipped in the solution and the emf of the cell dipped in the solution and the emf of the cell set-up as  $\text{Pt}(s), \text{H}_2(g) | \text{H}^+(1\text{M}) || \text{Ag}^+(aq.) | \text{Ag}(s)$  was 0.62V. If  $E^\circ_{\text{cell}}$  is 0.80V, what is the percentage of Ag in the alloy? (At  $25^\circ \text{C}$ ,  $RT/F = 0.06$ )

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4. The half cell potentials of a halfcell  $\text{A}^{(x+n)+}, \text{A}^{x+} | \text{pt}$  were found to be as follows :

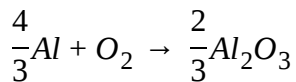
% of reduced form	24.4	48.8
Half cell potential (V)	0.101	0.115

Determine the value of  $n$ .

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5.  $\Delta G$  for the reaction :



is  $-772kJmol^{-1}$  of  $O_2$ .

Calculate the minimum *EMF* in volts required to carry out an electrolysis of  $Al_2O_3$

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### Jee Section (Matrix Match type questions)

1. An aqueous solution of X is added slowly to an aqueous solution of Y as shown in column I. the variation in conductivity of these reaction is given in column II. Match column I with column II.



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2. The standard reduction potential data at 25 ° C is given below

$$E^\circ \left( Fe^{3+}, Fe^{2+} \right) = + 0.77V, E^\circ \left( Fe^{2+}, Fe \right) = - 0.44V,$$

$$E^\circ \left( Cu^{2+}, Cu \right) = + 0.34V, E^\circ \left( Cu^+, Cu \right) = + 0.52V,$$

$$E^\circ \left( O_2(g) + 4H^+ + 4e^- \rightarrow 2H_2O \right) = + 1.23V$$

$$E^\circ \left( O_2(g) + 2H_2O + 4e^- \rightarrow 4OH^- \right) = + 0.40V$$

$$E^\circ \left( Cr^{2+}, Cr \right) = - 0.74V$$

$$E^\circ \left( Cr^{3+}, Cr \right) = - 0.91V$$

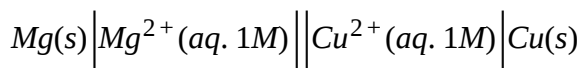
Match  $E^\circ$  of the redox pair in column I with the values given in column II



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### Jee Section JEE (Advanced) 2018 (Numeric answer Type Questions)

1. For the electrochemical cell,



the standard emf of the cell is 2.70 V at 300 K. When the concentration of  $Mg^{2+}$  is changed to x M, the cell potential changes to 2.67 V at 300 K. The

value of  $x$  is \_\_\_\_\_ .

(Given  $\frac{F}{R} = 11500 \text{ kV}^{-1}$ . where  $F$  is the Faraday constant and  $R$  is the gas constant,  $\ln(10) = 2.30$ )

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2. Consider an electrochemical cell :

$A_{(s)} | A^{n+} (aq, 2M) || B^{2n+} (aq, 1M) | B_{(s)}$  The value of  $\Delta H^\circ$  for the

cell reaction is twice that of  $\Delta G^\circ$  at 300K . If the emf of the cell is zero,

the  $\Delta S^\circ$  (in  $\text{JK}^{-1}\text{mol}^{-1}$ )

of the cell reaction per mole of  $B$  or  $medat 300K$  is \_\_\_\_\_ . (Given  $\ln(2) = 0.7$ ,  $R($

$8.3 \text{ JK}^{-1}\text{mol}^{-1}$ ).  $H$ ,  $S$  and  $G$  are enthalpy , entropy and gibbs energy,

respectively).

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