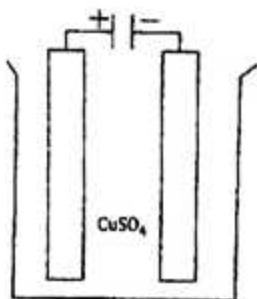


# Chapter Four : Electrochemistry

## Creative Essay Type

1. ▶

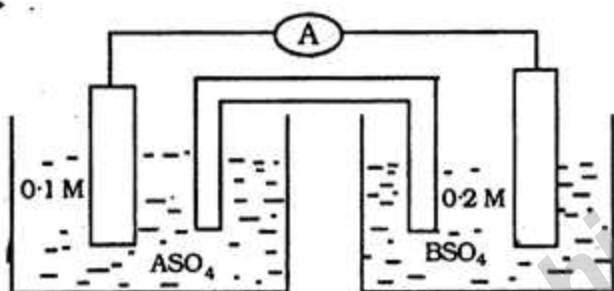


[RAJUK Uttara Model College, Dhaka]

- What is recycling? 1
- What is iodimetry? Explain. 2
- If 0.25A current is passed through a solution of stem for 30 minutes, then what amount of copper will be deposited at cathode? [Cu = 63.5] 3
- Does the solution of stem can be kept in zinc vessel? Analyze mathematically. Where,  $E^\circ_{Zn/Zn^{2+}} = +0.76V$  and  $E^\circ_{Cu/Cu^{2+}} = -0.34V$  4

Ans: See HSC EV Chemistry 2nd Paper 4th Chapter Note Ques. No. 21 of Answer Paper.

2. ▶



$$E^\circ_{A^2+/A} = -0.44 V$$

$$E^\circ_{Zn/Zn^{2+}} = +0.76 V$$

$$E^\circ_{B^2+/B} = -0.34 V$$

[Ideal School and College, Motijheel, Dhaka]

- What is electrochemical equivalent? 1
- Ethanal is homologue of propanal— explain it. 2
- Calculate the EMF of the cell of the stem. 3
- Is it possible to preserve the cathode solution in Zinc container. 4

Ans: See HSC EV Chemistry 2nd Paper 4th Chapter Note Ques. No. 23 of Answer Paper.

3. ▶  $X(s)/X^+_{(aq)} [0.01M]/Y^{2+}_{(aq)} [0.02M]/Y(s)$

$$\text{here, } E^\circ_{X/X^+} = +0.799V \text{ and } E^\circ_{Y/Y^{2+}} = 2.87V$$

$$[\text{atomic mass of Br} = 79.9]$$

[Bangladesh International School and College, Dhaka]

- What is titration? 1
- What is racemic mixture optically inactive? 2
- 1.26F electricity is passed through solution of  $YBr_2$ ; then what is the amount of molecules accumulated at anode? 3
- Is there any change in  $e.m.f$  in case of given reaction and opposite reaction? Analyze mathematically. 4

Ans: See HSC EV Chemistry 2nd Paper 4th Chapter Note Ques. No. 25 of Answer Paper.

4. ▶ In a laboratory demonstrator said to keep nickel salt in a Cooper container but by mistake lab attendant kept it in zinc container. Oxidation potential of Ni and Zn are + 0.25V and + 0.76V respectively. [Daffodil International College, Dhaka]

- What is salt bridge? 1
- What does mean by electro chemical equivalent of Ag is  $0.00118C^{-1}$ ? 2
- How much gm of metal will be deposited if 0.1A of electricity passed by 60 min. 3
- Analyze whether the salt can be kept in zinc container long time? 4

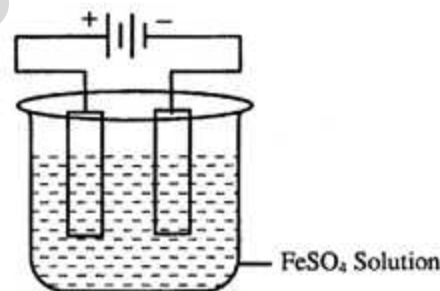
Ans: See HSC EV Chemistry 2nd Paper 4th Chapter Note Ques. No. 27 of Answer Paper.

5. ▶ Standard electrode potentials of same metals and cell diagram are —

$$i. E^\circ_{Cu/Cu^{2+}} = -0.34V$$

$$ii. E^\circ_{Fe/Fe^{2+}} = 0.44V$$

$$iii. E^\circ_{Zn/Zn^{2+}} = 0.74V$$



[Millennium Scholastic School & College, Bogura]

- What is nano particle? 1
- Why ETP is used in industry? 2
- How much gm of metal will deposit to cathode when 250A current is passed for 40 minutes? 3
- Which one is suitable to keep the solution of stem in the pot and copper pot-analyze. 4

Ans: See HSC EV Chemistry 2nd Paper 4th Chapter Note Ques. No. 29 of Answer Paper.

▶ Question No. a (Knowledge based)

Ques-1. What is recycling? [D.B.-17]

Ans: Recycling is the process which converts old or waste materials into reuseable materials.

Ques-2. What is salt bridge.[D.B. 16]

Ans: Salt bridge is an inverted U shaped glass tube. Containing an inert electrolyte (Saturated solution of KCl,  $KNO_3$ ,  $NH_4NO_3$ ) that controls the ionic balance between anode and cathode.

Ques-3. What is reference electrode? [Dj.B.-17]

Ans: The electrode of known potential by which the unknown potential of electrode can be determined by connecting with it is called reference electrode.

**Ques-4.** Write down the Faraday's first law of electrolysis.

[All Board- 2018]

**Ans:** The amount of elements deposited or dissolved in an electrode is directly proportional to the amount of electricity passed through it.

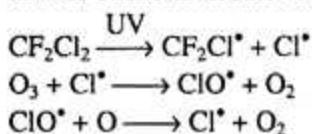
**Ques-5.** What is fuel cell? [R.B.-17]

**Ans:** A fuel cell is an electrochemical cell that convert chemical energy of hydrogen or hydrogen containing fuel into electrical energy.

▶ **Question No. b (Comprehension based)**

**Ques-1.** How CFC depletes ozone layer? [J.B.-17]

**Ans:** Chlorofluoro carbons produce chlorine free radical in presence of UV ray. Chlorine free radical is highly reactive and reacts with ozone molecule ( $O_3$ ) to produce  $ClO^*$  and  $O_2$ . Then  $ClO^*$  reacts with atomic oxygen to produce chlorine free radical and oxygen molecule. Again, Chlorine free radical attacks ozone molecule. In this way CFC depletes ozone layer.



**Ques-2.** Why does fuel cell eco friendly? [D.B.-17]

**Ans:** Fuel cell is type of electrochemical cell which uses  $H_2$  as fuel to produce electrical energy and heat. The product of fuel cell is only water vapor. It does not produce any environmental pollutants. So fuel cell is called eco friendly cell.

**Ques-3.** The standard oxidation potential of Zn electrode is  $E^\circ_{Zn/Zn^{2+}} = +0.76$  V. What is understood by this? [Dj.B-17]

**Ans:** Standard oxidation potential is the voltage difference which is created by donation of electron of anode. Standard electrode potential of Zinc is 0.76V means, if Zn rod is dipped into a solution of 1M  $ZnSO_4$  at  $25^\circ C$ , 0.76V oxidation potential creates.

**Ques-4.** What do you mean by electro chemical equivalent of Ag is 0.001118  $gC^{-1}$ ? [Ctg.B.-16]

**Ans:** Electrochemical equivalent of Ag is 0.001118  $gC^{-1}$  means 0.001118g Ag is deposited if 1C charge is passed during electrolysis.

**Ques-5.** Why is salt-bridge used in electrochemical cell? [B.B. 17]

**Ans:** The reasons behind the use of salt bridge are –

- Salt bridge completes the circuit by connecting two solution of half cells.
- The salt ( $KNO_3$ ) present in salt bridge does not react with solution of electrode but act as a cation or anion provider to continue the electric flow.
- Salt bridge maintains electrical neutrality of two half cell solution.

- iv. In absence of salt bridge redox reaction may be prevented and electrical flow may stop.

## Creative Multiple Choice

- Which one is used in pace maker in heart? [D.B.-17]  
a) Lithium ion-battery    b) PEM - ion battery  
c) Lithium SVO battery    d) Dry cell battery    **(a)**
- Which salt is used in salt – bridge? [C.B.-15]  
a)  $CaCl_2$     b)  $CuCl_2$   
c) KCl    d)  $Al_2(SO_4)_3$     **(b)**
- Which of the cells is environmental friendly? [D.B.-15]  
a) Fuel cell    b) Lead storage battery  
c) Cadmium battery    d) Lithium ion battery.    **(a)**
- Which one is a weak electrolyte?  
a)  $HNO_3$     b) NaOH  
c) HCl    d)  $NH_4OH$     **(d)**
- Which one is primary reference electrode? [D.B.-16]  
a) Calomel    b) Gas electrode  
c) Hydrogen    d) Oxidation-reduction    **(c)**
- What is the amount of Zn dissolved at the anode when 1.0C charge is passed through  $ZnSO_4$  solution?  
a) 32.7 g    b) 34.7 g  
c) 0.000338    d) 0.0000338 g    **(c)**
- Which ion will be easily freed from charge? [S.B.-17]  
a)  $Cu^{2+}$     b)  $H^+$   
c)  $Au^{3+}$     d)  $Ag^+$     **(c)**
- Which component of electrode can easily give up electrons?  
a) Zn    b) Hg  
c) Cl    d) Br    **(a)**
- How many ohms are the internal resistance of lead storage battery? [J.B.-15]  
a) 0.80    b) 0.50  
c) 0.02    d) 0.01    **(d)**
- Which of the following is used as anode and cathode in hydrogen fuel cell? [S.B.-15]  
a) Ni    b) Ag  
c) Pt    d) Graphite    **(d)**
- Which is the formula for the determination of cell emf? [Dj.B.-16]  
a)  $E_{cell} = E_{anode(OX)} - E_{cathode(OX)}$   
b)  $E_{cell} = E_{cathode(OX)} - E_{anode(OX)}$   
c)  $E_{cell} = E_{anode(Red)} - E_{cathode(Red)}$   
d)  $E_{cell} = E_{anode(OX)} + E_{cathode(OX)}$     **(b)**
- $E^\circ_{Zn/Zn^{2+}} = 0.76V$ ,  $E^\circ_{H/H^+} = 0$ ; The cell representation formed from these electrodes is — [Dj.B.-16]  
a)  $Zn(s)/Zn^{2+} \parallel H^+(aq)/H_2, Pt$   
b)  $Zn/Zn^{2+}(aq) \parallel H^+(aq)/H_2, (1 \text{ atm}), Pt$   
c)  $Pt, (1 \text{ atm})H_2/H^+(aq) \parallel Zn^{2+}(aq)/Zn(s)$   
d)  $Pt, H_2/H^+(aq) \parallel Zn^{2+}(aq)/Zn(s)$     **(d)**

13. Which should be used as cathode with Pt,  $H_2/H^+$ ,  $CE^0 = 0.0V$ ). [Ctg. B.-17]  
 (a)  $Zn^{2+}/Zn$  (b)  $Mg^{2+}/Mg$   
 (c)  $Cu^{2+}/Cu$  (d)  $Fe^{2+}/Fe$
14. If 0.1A current is passed through the M(III) Sulphate solution 1.0 g M is deposited on cathode. (Atomic mass of metal M = 40). How many time will be required to deposit 1.0 g metal M? [All Board -18]  
 (a) 20 s (b) 1206 s  
 (c) 24, 125 s (d) 72, 375 s
15. Which one has higher ability to retain charge having equal mass?  
 (a) Li (b) Na  
 (c) K (d) RB
16. What is the potential of standard hydrogen electrode? [Ctg. B.-15]  
 (a) + 1.00 V (b) -1.34 V  
 (c) 0V (d) +1.076V
17. Which of the following is an electrolyte?  
 (a)  $CCl_4$  (b)  $C_{12}H_{22}O_{11}$   
 (c)  $H_2O(H^+)$  (d)  $C_2H_5OH$
18. Which of the following will be freed from charge first?  
 (a)  $K^+$  (b)  $Ag^+$   
 (c)  $Cu^+$  (d)  $Au^{3+}$
19. In which cases electricity does not produce? [All Board -18]  
 (a) Electrolytic cell (b) Lead-storage cell  
 (c) Lithium-ion battery (d) Galvanic cell
20. Used in lead storage battery — [C.B. -16]  
 (a)  $HNO_3$  (b)  $H_2SO_4$   
 (c) HCl (d)  $CH_3COOH$
21. Which of the following can replace hydrogen from dilute  $H_2SO_4$ ?  
 (a) Pb (b) Hg  
 (c) Cu (d) Ca
22. Which one is the strongest reducing agent? [J.B. -17]  
 (a) Fe (b) Al  
 (c) Li (d) Zn
23. The standard reduction potentials of Zn and Cu are 0.76 V and 0.34V respectively. What is the value of  $E^{\circ}_{cell}$  of the reaction,  $Cu + Zn^{2+} \rightleftharpoons Cu^{2+} + Zn$ ?  
 (a) -0.101 V (b) -1.10 V  
 (c) +0.101 V (d) +1.1 V
24. What is the value of emf of a dry cell? [Dj.B.-15]  
 (a) + 1.2V (b) + 1.3V  
 (c) + 1.4V (d) + 1.5V
25. How many grams of  $H_2$  gas at the cathode will be liberated when 2F current is passed through sufficient acid mixed water?  
 (a) 0.5g (b) 1g  
 (c) 2g (d) 4g
26. What is the electro chemical equivalent of Al?  
 (a)  $9.3 \times 10^{-5}gc^{-1}$  (b)  $9.3 \times 10^{-4}gc^{-1}$   
 (c)  $9.3 \times 10^{-2}gc^{-1}$  (d)  $9.3 \times 10^{-2}gc^{-1}$
27. Used electrode for cell construction—[D.B. -17]  
 (a)  $Zn(s)/Zn^{2+}(aq)$  (b)  $Fe^{2+}(aq)/Fe(s)$   
 (c)  $Zn(s)/Zn^+(aq)$  (d)  $Cu^{2+}(aq)/Cu(s)$
28. More moles of which metal will be deposited when 1F of electricity is passed through molten  $NaCl$ ,  $MgCl_2$ ,  $AlCl_3$  and  $SnCl_4$ ?  
 (a) Na (b) Mg  
 (c) Al (d) Sn
29. How many atoms of copper will be deposited at cathode if 0.5A current is passed through aqueous solution of  $CuSO_4$  for 10 minutes?  
 (a)  $9.35 \times 10^{20}$  (b)  $9.35 \times 10^{21}$   
 (c)  $9.35 \times 10^{22}$  (d)  $9.35 \times 10^{23}$
30. The reduction potentials of A, B, C and D are 0.5 V, 0.3 V, - 0.6 V and - 0.83 respectively. Which one is more reactive?  
 (a) A (b) B  
 (c) C (d) D
31. Which is the representation of lead storage cell? [Dj.B.-17]  
 (a)  $Pb/Pb^{2+} || Cu^{2+}/Cu$   
 (b)  $Pb/PbSO_4 || H_2SO_4(aq)/PbO_2.Pb$   
 (c)  $Zn/Zn^{2+} || Pb^{2+}/Pb$   
 (d)  $Pb/Pb^{2+} || H^+/H_2$
32. What is the oxidation state of  $Co^{3+}$  during the charging of lithium battery?  
 (a) +1 (b) +2  
 (c) +4 (d) +6
33. Used as electrolyte in lead storage battery — [J.B. -16]  
 (a)  $H_2SO_4$  (b)  $PbSO_4$   
 (c) PbO (d)  $PbO_2$
34. Which cell containing the metal-pair will produce maximum current?  
 (a) Zn and Cu (b) Zn and Ag  
 (c) Zn and Al (d) Ag and Al
35. How many Faradays of electricity have to be passed through 1 mole of molten  $Al_2O_3$  to deposit the metallic substance completely?  
 (a) 1F (b) 3F  
 (c) 4F (d) 6F
36. How many Faradays of electricity have to be passed through  $CuSO_4$  solution to deposit 1 mol of Cu at the cathode? [Ctg.B.-17]  
 (a) 1 F (b) 2 F  
 (c) 3 F (d) 4 F

37. Which of the following liquid solutions has the most electric conductivity?  
 (a) AgF (b) AgCl (c) AgBr (d) AgI **(a)**
38. Which of the following solutions have the lowest conductivity?  
 (a) 1% CH<sub>3</sub>COOH (b) 2% CH<sub>3</sub>COOH (c) 5% CH<sub>3</sub>COOH (d) 10% CH<sub>3</sub>COOH **(a)**
39. Which metal reacts with dilute HCl to produce H<sub>2</sub> gas at the least possible time?  
 (a) Na (b) K (c) Zn (d) Pb **(b)**
40. Which one is used in calomel electrode? [D.B.-16]  
 (a) HgCl<sub>2</sub> (b) Hg<sub>2</sub>Cl<sub>2</sub> (c) MnO<sub>2</sub> (d) NH<sub>4</sub>Cl **(b)**
41. Which of the following metal ions will be deposited most at the cathode through passage of 1F electricity? [D.B.-17]  
 (a) Zn (b) Al (c) K (d) Ca **(c)**
42. Which one is reduced in lead-storage cell? [All Board - 18]  
 (a) Pb (b) PbO (c) PbSO<sub>4</sub> (d) PbO<sub>2</sub> **(d)**
43.  $\text{LiCoO}_2 \rightleftharpoons \text{A} + n\text{Li}^+ + n\text{e}^-$ ; what is the oxidation state of Co in A compound?  
 (a) +1 (b) +2 (c) +3 (d) +4 **(d)**
44. Butane-oxygen fuel Cell is —  
 (a) Low temperature fuel Cell (b) Middle temperature fuel Cell (c) High temperature fuel Cell (d) Very high temperature fuel Cell **(d)**
45. Which one is used as electrolyte in fuel Cell?  
 (a) aqueous KOH (b) aqueous KCl (c) Al(OH)<sub>3</sub> solution (d) KCl solution **(a)**
46. What amount of Cu will be deposited when 0.25 A current is passed through CuSO<sub>4</sub> solution for 30 minutes?  
 (a) 0.0148g (b) 0.1048g (c) 0.148g (d) 0.248g **(c)**
47. In hydrogen fuel Cell — [Dj.B.-16]  
 i. working efficiency (60%)  
 ii. Hydrogen is used as fuel  
 iii. Concentration of alkali remains unchanged.  
 Which is correct?  
 (a) i and ii (b) i and iii (c) ii and iii (d) i, ii and iii **(b)**
48. 1.0F electricity is —  
 i. 96500 Coulomb electricity  
 ii. 1 mole electrons flow  
 iii. Valency/1 mol atoms  
 Which is correct?  
 (a) i and ii (b) i and iii (c) ii and iii (d) i, ii and iii **(d)**
49. Conditions of spontaneity? [J.B.-15]  
 i.  $E^0_{\text{cell}}$  is positive (b) i and iii  
 ii.  $\Delta G^0$  is negative (d) i, ii and iii  
 iii.  $\Delta G^0$  is positive **(d)**
50. Secondary reference electrode is — [S.B.-15]  
 i. Pt, H<sub>2</sub> (1 atm)/H<sup>+</sup>(1M)  
 ii. Ag(s), AgCl(s)/HCl (aq)  
 iii. Hg (l), Hg<sub>2</sub>Cl<sub>2</sub>(s)/KCl(aq)  
 Which is correct?  
 (a) i and ii (b) i and iii (c) ii and iii (d) i, ii and iii **(b)**
51. Used as fuel in fuel cell —  
 i. H<sub>2</sub> (b) i and iii  
 ii. CH<sub>4</sub> (d) i, ii and iii  
 iii. CH<sub>3</sub>-CH<sub>2</sub>-OH **(d)**
52. Rechargeable battery is — [C.B.-17]  
 i. lead storage battery  
 ii. lithium ion battery  
 iii. lithium battery.  
 Which is correct?  
 (a) i and ii (b) i and iii (c) ii and iii (d) i, ii and iii **(a)**
53. Function of salt-bridge is to —  
 i. Establishing indirect linkage between two electrodes  
 ii. Supplying necessary opposite ions at electrode  
 iii. To keep the cell reaction continued.  
 Which one is correct?  
 (a) i and ii (b) i and iii (c) ii and iii (d) i, ii and iii **(d)**
54. Faraday's law is applicable to — [J.B.-16]  
 i. metal extraction (b) i and iii  
 ii. electroplating (d) i, ii and iii  
 iii. metal purification **(d)**
55. In alkaline fuel cell —  
 i. Working efficiency is 70%  
 ii. Pt electrode is used as catalyst  
 iii. Pure H<sub>2</sub> is used as fuel.  
 Which of the following is correct?  
 (a) i and ii (b) i and iii (c) ii and iii (d) i, ii and iii **(d)**

56. In lead storage cell — [D.B.-17]

- i. Pb strip is anode
- ii. PbO<sub>2</sub> coated Pb strip is cathode
- iii. 30% H<sub>2</sub>SO<sub>4</sub> is used as electrolyte

Which of the following is correct?

- (a) i and ii
- (b) ii and iii
- (c) i and iii
- (d) i, ii and iii

57. By-product of a fuel cell is —

- i. H<sub>2</sub>O(l)
- ii. CO<sub>2</sub>(g)
- iii. SO<sub>2</sub>(g)

Which of the following is correct?

- (a) i and ii
- (b) i and iii
- (c) ii and iii
- (d) i, ii and iii

A galvanic cell contains two half cells —



[B.B.-17]

Answer the questions 58 and 59 from the stem.

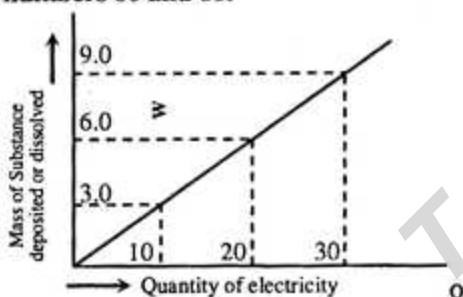
58. What is the value of  $E^\circ_{\text{cell}}$  given in the stem? [B.B.-17]

- (a) +1.7
- (b) +1.02
- (c) -1.02
- (d) -1.7

59. Which is the correct representation of the cell? [B.B.-17]

- (a) Cu(s)/Cu<sup>+</sup>(aq) || Cl<sub>2</sub>(g)/2Cl<sup>-</sup>(aq)
- (b) Pt(s), Cu(s)/Cu<sup>2+</sup>(aq) || Cl<sub>2</sub>(g)/2Cl<sup>-</sup>(aq), Pt(s)
- (c) Cu(s)/Cu<sup>2+</sup>(aq) || Cl<sub>2</sub>(g)/2Cl<sup>-</sup>(aq), Pt(s)
- (d) Cu(s)/Cu<sup>2+</sup>(aq) || 2Cl<sup>-</sup>(aq)/Cl<sub>2</sub>(g), Pt(s)

Read the following stem and give answer to questions numbers 60 and 61.



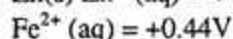
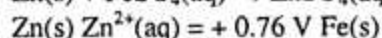
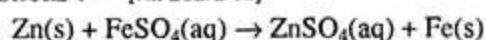
60. What is the slope of the graph?

- (a) 2.33
- (b) 3.33
- (c) 4.33
- (d) 5.33

61. Which law does the graph support?

- (a)  $W = It$
- (b)  $W = ZI$
- (c)  $W = ZIt$
- (d)  $Q = It$

Read the following stem and then answer the next two questions : — [All Board-18]



62. What is cell potential according to stem?

- (a) -0.42 V
- (b) -1.20 V
- (c) +0.42 V
- (d) +1.20 V

N.B. Correct answer is +0.32 Volt.

63. The correct informations for the reaction of the stem are —

- i. zinc solution can be kept in iron pot
- ii. iron solution can be kept in zinc pot
- iii. the cell reaction will be spontaneous

Which one is correct?

- (a) i
- (b) ii
- (c) i and iii
- (d) i, ii and iii

An electrochemical cell is formed by Zn and Fe metal. The standard reduction potentials of Zn and Fe are -0.76 V and -0.44 V respectively. [C.B.-16]

Give answers to questions 64 and 65 in the light of the stem.

64. The value of cell potential is —

- (a) +0.32 V
- (b) -0.33
- (c) +1.20 V
- (d) -1.20 V

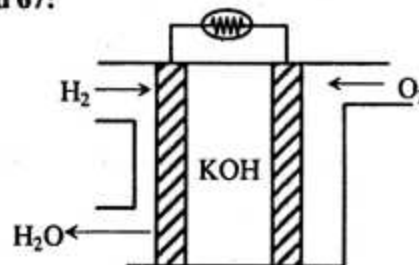
65. On the basis of the information —

- i. Zn-salt solution cannot be kept in Fe- container for a long time
- ii. The cell reaction is spontaneous
- iii. Zinc will be corroded.

Which one is correct?

- (a) i and ii
- (b) ii and iii
- (c) i and iii
- (d) i, ii and iii

Observe the following stem and give answers to questions 66 and 67:



[D.B.-15]

66. What is the value of cell emf?

- (a) 0.76V
- (b) 1.10V
- (c) 1.23V
- (d) 2.03V

67. Which one is the correct cell reaction?

- (a)  $2\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O}$
- (b)  $2\text{H}_2\text{O} \longrightarrow 2\text{H}_2 + \text{O}_2$
- (c)  $\text{H}_2 + \text{O}_2 \longrightarrow \text{H}_2\text{O}_2$
- (d)  $\text{H}_2\text{O} + \frac{1}{2} \text{O}_2 \longrightarrow \text{H}_2\text{O}_2$