DPP –2 [Electrode Potential and EMF]

Chapter: Electrochemistry

"Take a deep breath. Detach from marks, parents, rank, and future. Earn this page with full focus.'

TYPE–1 : Standard Hydrogen Electrode & Standard Potentials

1. **The equation representing the process by which standard reduction potential of zinc can be defined is:**
   (1) Zn^{2+} (s) + $2e^-$ $\longrightarrow$ Zn (s)
   (2) Zn (g) $\longrightarrow$ Zn^{2+} (g) + $2e^-$
   (3) Zn^{2+} (g) + $2e^-$ $\longrightarrow$ Zn (s)
   (4) Zn^{2+} (aq.) + $2e^-$ $\longrightarrow$ Zn (s)
2. **A standard hydrogen electrode has zero electrode potential because:**
   (1) Hydrogen is easiest to oxidize.
   (2) This electrode potential is assumed to be zero.
   (3) Hydrogen atom has only one electron.
   (4) Hydrogen is the lightest element.
3. **Which is not true for a standard hydrogen electrode?**
   (1) The hydrogen ion concentration is 1 M.
   (2) Temperature is 25°C.
   (3) Pressure of hydrogen is 1 bar.
   (4) It contains a metallic conductor which does not adsorb hydrogen.

TYPE–2 : EMF & Cell Potential Calculations

4. **Consider the following relations for emf of a electrochemical cell :**
   (a) emf of cell =(Oxidation potential of anode) − (Reduction potential of cathode)
   (b) emf of cell = (Oxidation potential of anode) + (Reduction potential of cathode)
   (c) emf of cell = (Reduction potential of anode) + (Reduction potential of cathode)
   (d) emf of cell = (Oxidation potential of anode) − (Oxidation potential of cathode)
   Which of the above relations are correct :
   (1) (a) and (b) (2) (c) and (d)
   (3) (b) and (d) (4) (c) and (a)
5. **The emf of the cell,**
   $Ni|Ni^{2+}(1.0\ M)||Ag^{+}(1.0\ M)|Ag$ (E° of $Ni^{2+}|Ni = -0.25$ volt, E° for $Ag^{+}|\ Ag = 0.80$ volt)
   (1) 0.55 volt
   (2) −1.05 volt
   (3) +1.05 volt

(4) -0.55 volt

6. **Given electrode potentials :**

   $Fe^{3+} + e \longrightarrow Fe^{2+}$; $E^\circ = 0.771$ V

   $I_2 + 2e \longrightarrow 2I^-$; $E^\circ = 0.536$ V

   E° cell for the cell reaction

   $2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$ is -

   (1) $(2 \times 0.771 - 0.536) = 1.006$ V

   (2) $(0.771 - 0.5 \times 0.536) = 0.503$ V

   (3) $0.771 - 0.536 = 0.235$ V

   (4) $0.536 - 0.771 = -0.235$ V

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

   $E^\circ\ (Au^{3+}\ /\ Au) = 1.50$ V

   The emf of the voltaic cell.

   $Ni\ /\ Ni^{2+}$ (1.0 M) | | Au^{3+} (1.0 M) | Au is :

   (1) 1.25 V (2) -1.75 V

   (3) 1.75 V (4) 4.0 V

8. **If $E^\circ_{Fe^{2+}/Fe} = -0.441$V and $E^\circ_{Fe^{3+}/Fe^{2+}} = 0.771$V**

   the standard EMF of the reaction

   $Fe + 2Fe^{3+} \rightarrow 3Fe^{2+}$ will be :

   (1) 0.330 V

   (2) 1.653 V

   (3) 1.212 V

   (4) 0.111 V

9. **For Zn^{+2} | Zn $E^\circ = -0.76$ V then EMF of this cell**

   Zn | Zn^{+2}(1M) || $2H^+$(1M) | H_2(1 atm) will be :–

   (1) -0.76 V (2) 0.76 V

   (3) 0.38 V (4) -0.38 V

10. **The standard reduction potential of Pb and Zn electrodes are -0.126 and -0.763 volts respectively. The e.m.f. of the cell**

    Zn | Zn^{2+} (0.1 M) || Pb^{2+} (1 M) | Pb is

    (1) 0.637 V (2) 0.607 V

    (3) 0.667 V (4) 0.889 V

11. **Consider the cell given below :**

    Ag(s) / Ag^+ || Cu^{2+}/Cu(s)

    $Ag^+ + e^- \longrightarrow Ag$; $E^\circ = x$

    $Cu^{2+} + 2e^- \longrightarrow Cu$; $E^\circ = y$

    E°_{cell} is

    (1) x + 2y (2) 2x + y

    (3) y - x (4) y - 2x

12. **For an electrochemical cell Al |Al^{3+} (1 M) || Cu^{2+}(1M)|Cu, it is given that $E^\circ_{Al/Al^{3+}} = 1.66$V and $E^\circ_{Cu/Cu^{2+}} = -0.34$V .**

    The value of E_{cell} is

    (1) 2.00 V (2) 3.02 V

    (3) 1.75 V (4) 2.25 V

13. **E° for the half cell $Zn^{2+} \mid Zn$ is -0.76 V. E.m.f. of the cell $Zn \mid Zn^{2+}$ (1M) $\|$ $2H^{+}$ (1M) $\mid H_2$ (1 atm) is**

(1) -0.76 V (2) $+0.76$ V
(3) -0.38 V (4) $+0.38$ V

14. **Consider the following E^0 values**

$E^\circ_{Fe^{3+}/Fe^{2+}} = +0.77V$

$E^\circ_{Sn^{2+}/Sn} = -0.14V$

Under standard conditions the potential for the reaction

$Sn(s) + 2Fe^{3+}(aq) \longrightarrow 2Fe^{2+}(aq) + Sn^{2+}(aq)$ is

(1) 0.91 V (2) 1.40 V
(3) 1.68 V (4) 0.63 V

15. **A button cell used in watches function as following**

$Zn(s)+Ag_2O(s)+H_2O(\ell) \rightleftharpoons 2Ag(s)+Zn^{2+}(aq)+2OH^{-}(aq)$

If half cell potentials are

$Zn^{2+}(aq) + 2e^{-} \rightarrow Zn(s)$; $E^\circ = -0.76$ V

$Ag_2O(s) + H_2O(\ell) + 2e^{-} \rightarrow 2Ag(s) + 2OH^{-}(aq)$;

$E^\circ = 0.34$ V

The cell potential will be :–

(1) 1.34 V (2) 1.10 V
(3) 0.42 V (4) 0.84 V

16. **Find out the E°_{cell} from the given data**

(a) $Zn \mid Zn^{+2} \| Cu^{+2} \mid Cu$; $E^\circ_{cell} = 1.10$ V

(b) $Cu \mid Cu^{+2} \| Ag^{+} \mid Ag$; $E^\circ_{cell} = 0.46$ V

(c) $Zn \mid Zn^{+2} \| Ag^{+} \mid Ag$; $E^\circ_{cell} = ?$

(Given $E_{Cu^{+2}/Cu} = 0.34V$)

(1) -0.04 V (2) $+0.04$ V
(3) $+0.30$ V (4) 1.56 V

17. **Aluminium displaces hydrogen from dilute HCl whereas silver does not, the E.M.F. of a cell prepared by combining Al/Al^{+3} and Ag/Ag^{+} is 2.46 V. The reduction potential of silver electrode is $+0.80$ V. The reduction potential of aluminium electrode is :**

(1) -3.26 V (2) $+1.66$ V
(3) -1.66 V (4) 3.26 V

18. **Deduced from the following E° values of half cells, what combination of two half cells would result in a cell with the largest potential?**

(i) $A^{3-} \rightarrow A^{2-} + e^{-}$, $E^\circ = 1.5$ V

(ii) $B^{2+} + e^{-} \rightarrow B^{+}$, $E^\circ = 2.1$ V

(iii) $C^{2+} + e^{-} \rightarrow C^{+}$, $E^\circ = +0.5$ V

(iv) $D \rightarrow D^{2+} + 2e^{-}$, $E^\circ = -1.5$ V

(1) (i) and (iii) (2) (i) and (ii)
(3) (ii) and (iv) (4) (iii) and (iv)

19. **The oxidation potential of Zn, Cu, Ag, H_2 and Ni are 0.76 V, -0.34 V, -0.80 V, 0 V, 0.55 V respectively. Which of the following reaction will provide maximum voltage ?**

(1) $Zn + Cu^{2+} \longrightarrow Cu + Zn^{2+}$

(2) $Zn + 2Ag^{+} \longrightarrow 2Ag + Zn^{2+}$

(3) $H_2 + Cu^{2+} \longrightarrow 2H^{+} + Cu$

(4) $H_2 + Ni^{2+} \longrightarrow 2H^{+} + Ni$

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

(1) +1.19 V
(2) +0.89 V
(3) +0.18 V
(4) +1.83 V

21. **$Cu(s) \mid Cu^{+2}(1\ M) \mid\mid Zn^{+2}(1\ M) \mid Zn(s)$**

A cell represented above should have emf.

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