II. Short Answer Type Questions

Question 1. What is meant by electrochemical series? What are characteristics of electrochemical series?
Answer: Electrochemical series is the series of elements in which elements are arranged in decreasing order of their reduction potential.
Reducing power goes on increasing whereas oxidising power goes on dcreasing down the series.

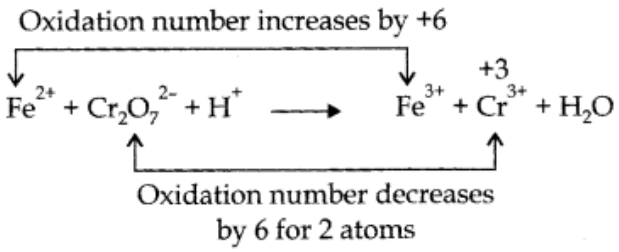
Question 2. What is standard hydrogen electrode? For what purpose it is used? What are signs of oxidation potential and reduction potential decided by using SHE (Standard hydrogen electrode)?
Answer: Standard hydrogen electrode is used as reference electrode. Its electrode potential is taken as 0.000 volt. Hydrogen electrode can be made. If we use a piece of platinum coated with finely divided black containing hydrogen gas absorbed in it. Platinum black catalyses the reaction and equilibrium is attained faster. When the given electrode acts as anode SHE, we give -ve sign to its reduction potential and +ve sign to its oxidation potential.

Question 3. Consider a voltaic cell constructed with the following substances:

$$Cr^{3+}(aq) + 3e^- \longrightarrow Cr(s)$$
$$MnO^{4-}(aq) + 8H^+(aq) + 5e^- \longrightarrow Mn^{2+}(aq) + 4H_2O(l)$$
$$E^\circ = -0.74\ V$$
$$E^\circ = +1.51\ V$$

(a) Which substances are oxidised and reduced in this cell?
(b) Which are the negative and positive electrode?
Answer:
(a) Cr is getting oxidised and MnO_4^- is getting reduced.
(b) Cr is negative electrode, Pt in MnO_4^- acts as positive electrode.

4.(a) Give two important functions of salt bridge.
(b) Balance the following equation by oxidation number method:
$Fe^{2+} + Cr_2O_7^{2-} + H^+ \rightarrow Fe^{3+} + Cr^{3+} + H_2O$
Ans. (a) (i) It completes the internal circuit.
(ii) It maintains the electrical neutrality.
(b) $Fe^{2+} + Cr_2O_7^{2-} + H^+ \rightarrow Fe^{3+} + Cr^{3+} + H_2O$



$$6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$$

Question 5. Write the O.N of all the atoms for the following well known oxidants?

(i) $KMnO_4$ (ii) $K_2Cr_2O_7$ (iii) $KClO_4$

Answer:

(i) $KMnO_4$; K(+l); Mn(+7), 0(-2)

(ii) $K_2Cr_2O_7$; K(+l) ; Cr(+6) ; 0(-2)

(iii) $KClO_4$; K(+l); Cl(+7); 0(-2)

Question 6. (a) Arrange the following in order of increasing O.N of iodine:

I_2, HI, HIO_2, KIO_3, ICl.

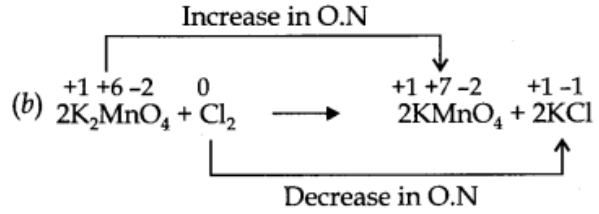
(b) Identify the oxidant and reductant in the following redox reaction:

$2K_2MnO_4 + Cl_2 \rightarrow 2KCl + 2KMnO_4$

Answer: (a) The increasing order is

$$HI < I_2 < ICl < HIO_2 < KIO_3$$

(b)



chlorine is an oxidant and K_2MnO_4 is reductant.

Question 7. Write the cell reactions:

$$Zn \mid Zn^{2+}(1M) \parallel Cd^{2+}(1M) \mid Cd$$

$$E^\circ\ Zn^{2+}/Zn = -0.76\ V,\ E^\circ\ Cd^{2+}/Cd = 0.40\ V$$

Answer:

$$\text{At anode: } Zn(s) \longrightarrow Zn^{2+}(aq) + 2e^-$$

$$\text{At cathode: } Cd^{2+}(aq) + 2e^- \longrightarrow Cd(s)$$

$$Zn(s) + Cd^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cd(s)$$

Question 8. (a) Balance the following equation by oxidation number method or by ion electron (half reaction) method.

$$MnO_4^- Fe^{2+} \longrightarrow Mn^{2+} + Fe^{3+} \text{ acidic medium}$$

(b) Consider the cell,

$Zn \mid Zn^{2+}(aq) \parallel Cu^{2+}(aq) \mid Cu$

The standard electrode potentials are $E^\circ\ Zn^{2+}/Zn = -0.76\ V$; $E^\circ\ Cu^{2+}/Cu = +0.34\ V$ write down the cell reaction.

Answer:

(a)

$$MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$$

$$8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$$

$$5e^- + 8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$$

$$[Fe^{2+} \longrightarrow Fe^{3+} + e^-] \times 5$$

$$5Fe^{2+} + 8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O + 5\,Fe^{3+}$$

(b)

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

Question 9. Identify the substance oxidised, reduced, oxidising agent and reducing agent for each of the following reactions.

(a) $2AgBr(s) + C_6H_6O_2(aq) \longrightarrow 2Ag(s) + 2HBr(aq) + C_6H_4O_2(aq)$

(b) $HCHO(l) + 2[Ag(NH_3)_2]^+(aq) + 3OH^-(aq) \longrightarrow Ag(s) + HCOO^-(aq) + 4NH_3(aq) + 2H_2O(l)$

(c) $N_2H_4(l) + 2H_2O_2(l) \longrightarrow N_2(g) + 4H_2O(l)$

Answer: (a) Ag^+ is reduced, $C_6H_6O_2$ is oxidised.Ag^+ is oxidising agent whereas $C_6H_6O_2$ is reducing agent.

(b) HCHO is oxidised, Ag^+ is reduced.Ag^+ is oxidising agent whereas HCHO is reducing agent.

(c) N_2H_4 is getting oxidised it is reducing agent. H_2O_2 is getting reduced it acts as an oxidising agent.

Question 10. (a) Calculate the oxidation number of
(i) C in CH_3COOH (ii) S in $S_2O_8^{-2}$
(b) Give one example of disproportionation reaction.
Answer:

(a) (i)

$$4 \times 1 - 2 \times 2 + 2(x) = 0$$
$$4 - 4 + 2x = 0$$
$$2x = 0$$
$$x = 0$$

(ii)

$$2x - 12 - 2 = -2$$
$$2x = 12$$
$$x = +6$$

(b) $\overset{+1}{H_3PO_2} \xrightarrow{\text{heat}} \overset{-3}{PH_3} + \overset{+5}{H_3PO_4}$

Since P undergoes decrease as well as increase in oxidation state thus it is an example of disproportionation reaction.

********** END **********