QB365

Important Questions - Redox Reactions

11th Standard CBSE

Chemistry

Reg.No. : | | | | | | |

Time : 01:00:00 Hrs

Total Marks : 50

Section-A

1) What is the most essential conditions that must be satisfied in a redox reaction? **1**

2) Write the oxidation and reduction half-reactions from the following redox reaction **1**

$2Fe + 2H_2O + O_2 \rightarrow 2Fe(OH)_2$

3) In the reaction, $MnO_2 + 4HCl \longrightarrow MnCl_2 + Cl_2 + 2H_2O$ which species is oxidised? **1**

4) Define the term reducing agent in term or loss of electrons. **1**

5) What would happen if no salt bridge were used in the electrochemical cell (e.g. Zn - Cu cell)? **1**

6) Is the reaction, $NH_3 + HCl \longrightarrow NH_4^+ + Cl^-$, an oxidation-reduction reaction?Explain your answer **1**

7) Which element in all its compounds shows an oxidation state of -1? **1**

8) Can we use KCI as electrolyte in the salt bridge of the cell, Cu(s) I Cu^2 (aq) II Ag^+(aq) I Ag(s)? **1**

9) When magnesium ribbon is burnt in air, two product are formed, magnesium oxide and magnesium nitride. Point out the oxidising and reducing agents. **1**

10) At what concentration of Cu^{2+} (aq), will the electrode potential become equal to its standard electrode potential? **1**

Section-B

11) Can the following reaction, **2**

$Cr_2O_7^{2-} + H_2O \rightleftharpoons 2Cro_4^{2-} + 2H^+$ be regarded as a redox reaction?

12) Assign oxidation number to the underlined elements in each of the following species. **2**

$NaH_2P\,O_4$

13) How would you know whether a redox reaction is taking place in an acidic, alkaline or netural medium? **2**

14) Consider the reactions **2**

$6CO_2(g)+6H_2O(I) \rightarrow C_6H_{12}O_6(aq) +6O_2(g)$

Why it is more appropriate to write these reactions as

$6CO_2(g)+12H_2O(I) \rightarrow C_6H_{12}O_6(aq) +6H_2O+6O_2(g)$

15) Consider the reactions, **2**

$H_3PO_2(aq) + 4AgNO_3(aq) + 2H_2O(l) \longrightarrow H_3PO_4(aq) + 4ag(s) + 4HNO_3(aq)$

What inference do you draw about the behaviour of Ag^+ and Cu^{2+} from these reactions?

To find the behaviour Ag^+ and Cu^{2+} in the given reactions,find whether there is addition of oxygen or any other electronegative element and addition of hydrogen or any other electropositive element.If there is addition of O to a reactant then other reactant acts as reducing agent (or reductant) and if there is addition of hydrogen , they act as oxidant.

16) Consider the reactions, **2**

$H_3PO_2(aq) + 2CuSO_4(aq) + 2H_2O(l) \longrightarrow H_3PO_4(aq) + 2Cu(s) + H_2SO_4(aq)$

What inference do you draw about the behaviour of Ag^+ and Cu^{2+} from these reactions?

To find the behaviour Ag^+ and Cu^{2+} in the given reactions,find whether there is addition of oxygen or any other electronegative element and addition of hydrogen or any other electropositive element.If there is addition of O to a reactant then other reactant acts as reducing agent (or reductant) and if there is addition of hydrogen , they act as oxidant .

17) Consider the reactions, **2**

$C_6H_5CHO(l) + 2Cu^{2+}(aq) + 5OH^-(aq) \longrightarrow NO \quad change \quad observed.$

What inference do you draw about the behaviour of Ag^+ and Cu^{2+} from these reactions?

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18) A solution of silver nitrate was stirred with iron rod.Will it cause any change in the concentration of silver and nitrate ions? **2**

19) An iron rod is immersed in solution containing 1.0M $NiSO_4$ and 1.0 M $ZnSO_4$ .Predict giving reasons which of the following reactions is likely to proceed? **2**

Fe reduce Zn^{2+} ions

20) Arrange the following metals in the order in which they displace each other from the solution of their salts.Al, Cu, Fe, Mg, and ZN **2**

Section-C

21) Rishi observed that many a times people mixed household chemicals for different uses. He called a meeting to discuss about this with the members of his colony and tell them the hazard of mixing the chemicals. He told them when bleach (ClO-) is mixed with toilet cleaner (HCl), it is highly dangerous to human health, as this reaction produces water and the highly toxic chlorine gas. **5**

What values are associated with Rishi?

22) Justify that the following reaction are redox reaction **5**

$CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(g)$

23) Identify the substance oxidised, reduced, oxidising agent and reducing agent for each of the reactions. **5**

(i) $2ABr(s) + C_2H_6O_2(aq) \rightarrow 2Ag(s) + 2HBr(aq) + C_2H_6O_2(aq)$

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

(iii) $HCHO(l) + 2Cu^{2+}(aq) + 5OH^-(aq) \rightarrow Cu_2O(s) + HCOO^-(aq) + 3H_2O(l)$

(iv) $N_2H_4(l) + 2H_2O_2(l) \rightarrow N_2(g) + 4H_2O(l)$

(v) $Pb(s) + PbO_2(s) + 2H_2SO_4(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$

To identify which substance is oxidised, reduced or act as oxidant or reductant, find the oxidation state of each element. The substance in which oxidation state of an element is increasing gets oxidised, i.e act as reducing agent while that in which oxidation state decreases, gets reduced, i.e acts as oxidising agent.

24) Calculate the oxidation number of the underlined element in 5

(i) $\underline{V}O_2^-$

(ii) $\underline{U}O_2^{2+}$

(iii) $Ba_2\underline{Xe}O_6$

(iv) $K_4\underline{P_2}O_7$

(v) $K_2\underline{S}$

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Section-A

1) 1

In a redox reaction, the total number of electrons lost by reducing agent must be equal to the number of electrons gained by the oxidising agent

2) $Fe \longrightarrow Fe^{2+} + 2e^- \qquad (Oxidation)$ 1

$\frac{1}{2}O_2 + H_2O + 2e^- \longrightarrow 2OH^- \qquad (Reduction)$

3) 1

4) 1

5) 1

If no salt bridge is used, the positive ions(i.e Zn^{2+}) formed by loss of electrodes will assemble around the zinc electrode and negative ions (i.e.SO^{2-}_4) left after reduction of Cu^{2+} ions will accumulate around the copper electrode.Thus, the solution will develop charges.Further, since the inner circuit is not complete, the current stops flowing

6) 1

7) 1

8) 1

KCl cannot be used as electrolyte in the salt bridge because Cl^- ions will combine with Ag^+ ions to form white precipitates of AgCl

9) 1

10) 1

Section-B

11) 2

In this reaction, oxidation number of Cr in $Cr_2O_7^{2-}$ is +6 and oxidation number of Cr in $Cr_2O_7^{2-}$ is +6. Since, during the reaction, the oxidation number of Cr has neither decreased nor increased, therefore, the above reaction is not a redox reaction.

12) **2**

$NaH_2P\ O_4$ Let the oxidation number of P be x. Writing the oxidation number of each atom above its symbol, we get $\overset{+1}{Na}\overset{+1}{H_2}\overset{x}{P}\overset{-2}{O_4}$ In neutral compounds the sum of the oxidation numbers of all the atoms is zero.

1(+1)+2(+1)+x+4(-2)=0 3+x+(-8) =0 x=8-3=+5 Hence, the oxidation number of P in NaH_2PO_4 is +5. Calculate oxidation number of other elements in the same way as shon in(i). You will get oxidation number of S,P,Mn,O,B,S,S,Cr,S in the given compound as +6,+5,+6,-1,+3,+6,+6,+6,+2 respectively. **Note** H_2 O is a neutral molecule, therefore sun of oxidation numbers of all atoms in H_2O is Zero. Hence, the oxidation number of S in $KAI(SO_4)_2.12H_2O$ is +6.

13) **2**

If H^+ or any acid appears on either side ofthe chemical equation, the reaction takes place in the acidic solution.If OH^-, or any base, appears on either side of the chemical equation, the solution is basic.If neither H^+,OH^- nor any acid or base is present in the chemical equation, the solution is netrual

14) **2**

Mechanism of photosynthesis

Step I $12H_2O(I) \rightarrow 12H_2\ (g)+6O_2(g)$ (decomposition of water)

Step II $6CO_2(g)+12H_2O(g) \rightarrow C_6H_{12}O_6(s) +6H_2O(I)$

(H_2 formed in step first reduces CO_2 to $C_6H_{12}O_6$ in the second step).Hence, it is more appropriate to write the equation for photosynthesis as follows.(By adding step I and step II)

$6CO_2(g)+12H_2O(I) \rightarrow C_6H_{12}O_6(s) +6H_2O(I)+6O_2(g)$

Actually in the process of photosynthesis, $12H_2$ O are used up in first step and $6H_2$ O are formed per molecule of glucose (carbohydrate)

15) In reactions,(i) and (ii)reactions, $AgNO_3$ and $CuSO_4$ act as oxidising agents respectively. **2**

They Oxidise H_3PO_2 (hypophosphorous acid) to (orthophosphoric acid).

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17) Cu^{2+} do not oxidise benzaldehyde (C_6H_5CHO) to benzoic acid. **2**

This includes that Ag^+ is a stronger oxidising agent than Cu^{2+}.

18) **2**

Since, E^0 of Fe^{2+} /Fe (-0.44 V) is lower than that of Ag^+ /Ag (+0.80 V) electrode, therefore, Ag^+ gets reduced and Fe gets oxidised.As a result, concentration of Ag^+ ions decreases while that of NO^-_3 ions remain unchanged

$2Ag^+\ (aq) +Fe(s) \rightarrow\ 2Ag(s) + Fe^{2+}{}_{(aq)}$

19) **2**

Since, E^0 of Zn is more negative than that of Fe, therefore, Zn will be oxidised to Zn^{2+} ions while Fe^{2+} ions will be reduced to Fe.In other words, Fe will not reduce Zn^{2+} ions

20) **2**

$E^0_{Al^{3+}/Al}$ = -.166V, $E^0_{Cu^{2+}/Cu}$ =+ 0.34 V

$E_{Fe^{2+}/Fe}$ = - 0.44 V, $E_{Mg^{2+}/Mg}$ = - 2.36 V

and $E^0_{Zn^{2+}/Zn}$ = - 0.76 V

A metal with more negative value of E^0_{red} is a stronger reducing agent than those which have less negative or positive value of E^0_{red} .Therefore, Mg can displace all the given metals from their aqueous salt solutions.AI can displace all metals from their aqueous salt solutions.Zinc can displace Fe and Cu from their aqueous salt solutions and Fe can displace only Cu from its aqueous salt solution.Hence, the orderin which they can display each other from the solution of their salts is as follows

Mg, AI, Zn, Fe, Cu

Section-C

21) Rishi is a social worker. He is conscious about environment and health problems. **5**

22) **5**

$$CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(g)$$

Assign oxidation numbers of each atom above its symbol.

$$\overset{+2-2}{CuO}(s) + \overset{0}{H_2}(g) \rightarrow \overset{0}{Cu}(s) + \overset{+1}{H_2}\quad\overset{-2}{0}\quad(g)$$

Oxidation number of Cu in Cuo is +2.It decreases from +2 to zero in Cu.While oxidation number of hydrogen increases from 0(in H_2) to +1 (in H_2O)

This shows the CuO is reduced to Cu but H_2 is oxidised to H_2O.Hence,it is an example of redox reaction

23) **5**

S,No	**Substance oxidised** (reducing agent)	**Substance reduced** (oxidising agent)
(i)	$C_2H_6O_2(aq)$	AgBr(s)
(ii)	HCHO(l)	$[Ag(NH_3)_2]^+(aq)$
(iii)	HCHO(l)	$Cu^{2+}(aq)$
(iv)	$N_2H_4(l)$	$H_2O_2(l)$
(v)	Pb(s)	$PbO_2(s)$
(v)	Pb(s)	$PbO_2(s)$

24) **5**