**Karan Arora**  **R.L. Institute M: 9416974837**

**N.C.E.R.T EXERCISE**

1. Assign the oxidation numbers to the underlined elements in each of the following species ; a) NaH2PO4

b) NaHSO4 c) H4P2O7 d) K2 MnO4 e) CaO2 f) NaBH4 g) H2S2O7 h) KAl (SO4)2 . 12H2O

1. What are the oxidation numbers of the underlined elements in each of the following and how do you rationalize your results ?

a) KI3 b) H2S4O6 c) Fe3O4 d) CH3CH2OH e) CH3COOH

1. How will you justify that the following reactions are redox reactions in nature ?

a) CuO (s) + H2 (g) → Cu (s) + H2O (g)

b) Fe2O3 (s) + 3 CO (g) → 2 Fe (s) + 3 CO2 (g)

c) 2 K (s) + F2 (g) → 2 K+ F – (s)

d) 4 NH3 (g) + 5 O2 (g) → 4 NO (g) + 6 H2O (g)

1. Fluorine reacts with ice as follows : H2O (s) + F2 (g) → HF (g) + HOF (g) , Justify that this reaction is a redox reaction.
2. Calculate the O.N. of sulphur, chromium and nitrogen in H2SO5 , CrO5 , ion. Suggest structure of these compounds. Account for the fallacy if any .
3. Write the formulas of the following compounds :

a) Mercury (II) chloride b) Nickel (II) sulphate c) Tin (IV) oxide d) Thallium (I) sulphate e) Iron (III) sulphate f) Chromium (III) oxide

1. Suggest a list of substances where carbon can exhibit oxidation states from –4 to +4 and nitrogen from – 3 to +5.
2. While sulphur dioxide and hydrogen peroxide can acts as oxidizing as well as reducing agents in their reactions, ozone and nitric acid can act only as oxidizing agents. Why ?
3. Consider the reactions :

a) 6 CO2 (g) + 6 H2O (l) → C6H12O6 (s) + 6 O2 (g)

b) O3 (g) + H2O2 (l) → H2O (l) + 2 O2 (g)

Why it is more appropriate to write these reactions as :

a) 6 CO2 (g) + 12 H2O (l) → C6H12O6 (s) + 6 H2O (l) + 6 O2 (g)

b) O3 (g) + H2O2 (l) → H2O (l) + O2 (g) + O2 (g)

Also suggest a technique to investigate the path of the above (a) and (b) redox reactions.

1. The compound AgF2 is an unstable compound. However if formed, the compound acts as a very strong oxidizing agent. Why ?
2. Whenever a reaction between an oxidizing agent and reducing agent is carried out, a compound of lower oxidation state is formed if the reducing agent is in excess and a compound of higher oxidation state is formed if the oxidizing agent is in excess. Justify this statement giving three illustrations.
3. a) Though alkaline potassium permanganate and acidic potassium permanganate both are used as oxidants, yet in the manufacture of benzoic acid from toluene, we use alcoholic potassium permanganate as an oxidant, why ? Write a balance redox equation for the reaction.

b) When concentrated sulphuric acid is added to an organic mixture containing chloride, we get a colourless pungent smelling gas HCl. However, if mixture contains bromide, then red vapours of bromine are evolved. Why ?

REDOX Page No. 1

1. Identify the substance oxidized, reduced, oxidizing agent and reducing agent for each of the following reactions :

a) 2 AgBr (s) + C6H6O2 (aq) → 2 Ag (s) + 2 HBr (aq) + C6H4O2 (aq)

b) HCHO (l) + 2 [ Ag(NH3)2 ]+ (aq) + 3 OH – (aq) → 2 Ag (s) + HCOO – (aq) + 4 NH3 (aq) + 2 H2O (l)

c) HCHO (l) + 2 Cu2+ (aq) + 5 OH –  (aq)  → Cu2O (s) + HCOO – (aq) + 3 H2O (l)

d) N2H4 (l) + 2 H2O2 (l) → N2 (g) + 4 H2O (l)

e) Pb (s) + PbO2 (s) + 2 H2SO4 → 2 PbSO4 (s) + 2 H2O (l)

1. Consider the reactions : 2 S2 (aq) + I2 (s) → S4 (aq) + 2 I – (aq)

S2 (aq) + 2 Br2 (l) + 5 H2O (l) → 2 (aq) + 4 Br – (aq) + 10 H+ (aq)

Why does the same reductant thio sulphate react differently with iodine and bromine ?

1. Justify giving reactions that among halogens, fluorine is the best oxidant and among hydrohalic compounds, hydroiodic acid is the best reductant.
2. Why does the following reaction occur ?

(aq) + 2 F – (aq) + 6 H+ (aq) → XeO3 (g) + 3 H2O (l)

What conclusion about the compound Na4XeO6 (of which is a part) can be drawn from the reaction?

1. Consider the reactions :

a) H3PO2 (aq) + 4 AgNO3 (aq) + 2 H2O (l) → H3PO4 (aq) + 4 Ag (s) + 4 HNO3 (aq)

b) H3PO2 (aq) + 2 CuSO4 (aq) + 2 H2O (l) → H3PO4 (aq) + 2 Cu (s) + 2 H2SO4 (aq)

c) C6H5CHO (l) + 2 [Ag (NH3)2 ]+ (aq) + 3 OH – (aq) → C6H5COO – (aq) + 2 Ag (s) + 4 NH3 (aq) + 2 H2O (l)

d) C6H5CHO (l) + 2 Cu2+ (aq) + SOH – (aq) → No change observed

What interference do you draw about the behavior of Ag+ and Cu2+ ions from these reactions ?

1. Balance the following equations by ion-electron method

a) (aq) + I – (aq) → MnO2 (s) + I2 (s) [ In Basic medium ]

b) (aq) + SO2 (g) → Mn2+ (aq) + (aq) [ In Acidic medium ]

c) H2O2 (aq) + Fe2+ (aq) → Fe3+ (aq) + H2O (l) [ In Acidic medium ]

d) (aq) + SO2 (g) → Cr3+ (aq) + (aq) [ In Acidic medium ]

1. Balance the following equations in basic medium by ion-electron method and oxidation number method and identify the oxidizing agent and the reducing agent.

a) P4 (s) + OH – (aq) → PH3 (g) + H2 (aq)

b) N2H4 (l) + (aq) → NO (g) + Cl – (g)

c) Cl2O7 (g) + H2O2 (aq) → (aq) + O2 (g) + H+

1. Write four informations about the reactions :

(CN)2 (g) + 2 OH – (aq) → CN – (aq) + CNO – (aq) + H2O (l)

1. The Mn3+ ion is unstable in solution and undergo disproportionation to give Mn2+ , MnO2 and H+ ion. Write balanced ionic equation for the reaction.
2. Consider the elements : Cs , Ne , I , F

a) Identify the element that exhibit only – ve oxidation state.

b) Identify the element that exhibit only + ve oxidation state.

c) Identify the element that exhibit + ve and – ve oxidation states.

d) Identify the element that neither exhibit + ve and – ve oxidation states.

1. Chlorine is used to purify drinking water. Excess of chlorine is harmful. The excess of chlorine is removed by treating with sulphur dioxide. Present a balanced equation for this redox change taking place.
2. From the periodic table, select three non-metals and three metals which can show disproportionation reaction.

REDOX Page No. 2

1. In the Ostwald process for the manufacture of nitric acid, the first step involves the oxidation of ammonia gas by oxygen gas to give nitric oxide and steam. What is the maximum weight of nitric oxide that can be obtained starting only with 10 gm of ammonia and reacting with 20 gm of oxygen ?
2. Using the standard electrode potentials given in the table, predict if the reaction between the following is feasible.

a) Fe3+ (aq) and I – (aq) b) Ag+ (aq) and Cu (s) c) Fe3+ (aq) and Cu (s)

d) Ag (s) and Fe3+ (aq) e) Br2 (aq) and Fe2+ (aq)

1. Predict the product of electrolysis of each of the following :

a) An aqueous solution of AgNO3 using silver electrodes.

b) An aqueous solution of AgNO3 using platinum electrodes.

c) A dilute solution of H2SO4 using platinum electrodes.

d) An aqueous solution of CuCl2 using platinum electrodes.

1. Arrange the following metals in the order in which they displace each other from their salts.

Al , Cu , Fe , Mg and Zn

1. Given the standard electrode potentials

K+ / K = - 2.93 V ; Ag+ / Ag = 0.80 V ; Hg2+ / Hg = 0.79 V ; Mg2+ / Mg = - 2.37 V ; Cr3+ / Cr = - 0.74 V

Arrange these metals in increasing order of their reducing power.

1. Depict the galvanic cell in which the reaction ; Zn (s) + 2 Ag+ (aq) → Zn2+ (aq) + 2 Ag (s) takes place . Further show :

a) which electrode is negatively charged.

b) the carriers of the current in the cell.

c) individual reaction at each electrode.

**COMPETITION FOCUS**

1. Which of the following is not an example of redox reaction ?

|  |  |
| --- | --- |
| a) CuO + H2  → Cu + H2O | b) Fe2O3 + 3 CO → 2 Fe + 3 CO2 |
| c) 2 K + F2 → 2 KF | d) BaCl2 + H2SO4 → BaSO4 + 2 HCl |

1. In which of the following compounds, an element exhibit two different oxidation states ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) NH2OH | b) NH4NO3 | c) N2H4 | d) N3H |

1. Which of the following arrangements represent increasing oxidation number of the central atom

|  |  |
| --- | --- |
| a) , , , | b) , , , |
| c) , , , | d) , , , |

1. Identify disproportionation reaction

|  |  |
| --- | --- |
| a) CH4 + 2 O2 → CO2 + 2 H2O | b) CH4 + 4 Cl2 → CCl4 + 4 HCl |
| c) 2 F2 + 2 OH – → 2 F – + OF2 + H2O | d) 2 NO2 + 2 OH – → + + H2O |

1. Which of the following elements does not show disproportionation tendency ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) Cl | b) Br | c) F | d) I |

1. The oxidation state of the two nitrogen atoms from left to right in NH4NO3 respectively are

|  |  |  |  |
| --- | --- | --- | --- |
| a) + 1 , – 1 | b) – 3 , + 5 | c) + 3 , + 5 | d) – 1 , + 1 |

1. A metal ion M3+ loses 3 electrons, its oxidation number will be

|  |  |  |  |
| --- | --- | --- | --- |
| a) + 3 | b) + 6 | c) 0 | d) – 3 |

REDOX Page No. 3

1. Which of the following statement is correct ?

a) Oxidation number of Fe in [Fe (H2O)5 NO]SO4 is + 1.

b) Oxidation number of sodium in sodium amalgam is – 1.

c) Oxidation state of carbon in HCN is + 4.

d) All statements are correct.

1. In the given reaction, K2Cr2O7 + X H2SO4 + Y SO2 → K2SO4 + Cr2(SO4)3 + Z H2O ; X , Y , Z are

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 , 3 , 1 | b) 4 , 1 , 4 | c) 3 , 2 , 3 | d) 2 , 1 , 2 |

1. a K2Cr2O7 + b KCl + c H2SO4 → x CrO2Cl2 + y KHSO4 + z H2O ; The above equation balances when

a) a = 2 , b = 4 , c = 6 and x = 2 , y = 6 , z = 3

b) a = 4 , b = 2 , c = 6 and x = 6 , y = 2 , z = 3

c) a = 6 , b = 4 , c = 2 and x = 6 , y = 3 , z = 2

d) a = 1 , b = 4 , c = 6 and x = 2 , y = 6 , z = 3

1. The values of x and y in the following redox reaction, x Cl2 + 6 OH – → + y Cl – + 3 H2O ; are

|  |  |  |  |
| --- | --- | --- | --- |
| a) x = 2 , y = 4 | b) x = 5 , y = 3 | c) x = 3 , y = 5 | d) x = 4 , y = 2 |

1. Oxidation state of Cl in CaOCl2 is/are

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0 | b) + 1 | c) – 1 | d) + 1 , – 1 |

1. CrO5 has structure as shown



The oxidation number of chromium in the above compound is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 4 | b) 5 | c) 6 | d) 10 |

1. The oxidation number of the sulphur atoms in peroxomono sulphuric acid (H2SO5) and peroxodi sulphuric acid (H2S2O8) are respectively

|  |  |  |  |
| --- | --- | --- | --- |
| a) + 8 & + 7 | b) + 3 & + 3 | c) + 6 & + 6 | d) + 4 & + 6 |

1. In the redox reaction : x KMnO4 + NH3 → y KNO3 + MnO2 + KOH + H2O

|  |  |  |  |
| --- | --- | --- | --- |
| a) x = 4 , y = 6 | b) x = 3 , y = 8 | c) x = 8 , y = 6 | d) x = 8 , y = 3 |

1. In the balanced chemical reaction : + a I – + b H+ → c H2O + d I­2 ; a , b , c and d correspond to

|  |  |  |  |
| --- | --- | --- | --- |
| a) 5 , 6 , 3 , 3 | b) 5 , 3 , 6 , 3 | c) 3 , 5 , 3 , 6 | d) 5 , 6 , 5 , 5 |

1. The oxidation state of S atoms in S4 from left to right respectively are



|  |  |  |  |
| --- | --- | --- | --- |
| a) + 6 , 0 , 0 , + 6 | b) + 3 , + 1 , + 1 , +3 | c) + 5 , 0 , 0 , + 5 | d) + 4 , + 1 , + 1 , +4 |

1. Oxidation state of P in H4P2O5 , H4P2O6 , H4P2O7 are respectively

|  |  |  |  |
| --- | --- | --- | --- |
| a) + 3 , + 5 , + 4 | b) + 5 , + 3 , + 4 | c) + 5 , + 4 , + 3 | d) + 3 , + 4 , + 5 |

1. The oxidation number of sulphur in H2S2O8 , H2S2O4 , H2S2O6 are respectively

|  |  |  |  |
| --- | --- | --- | --- |
| a) + 3 , + 4 , + 5 | b) + 5 , + 4 , + 3 | c) + 6 , + 3 , + 5 | d) + 3 , + 5 , + 4 |

1. Which of the following have been arranged in decreasing order of oxidation number of sulphur ?

|  |  |
| --- | --- |
| a) Na2S4O6 > H2S2O7 > Na2S2O3 > S8 | b) H2SO4 > SO2 > H2S > H2S2O8 |
| c) > > > | d) H2SO5 > H2SO3 > SCl2 > H2S |

1. Which of the following species can function both as oxidizing agent as well as reducing agent ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) Cl – | b) | c) ClO – | d) |

REDOX Page No. 4

**Karan Arora M: 9416974837**

**More Than One Option**

1. Which of the following statements is/are not true about the following decomposition reaction :

2 KClO3 → 2 KCl + 3 O2

a) Potassium is undergoing oxidation

b) Chlorine is undergoing oxidation

c) Oxygen is reduced

d) None of the species are undergoing oxidation or reduction

1. Identify the correct statement (s) in relation to the following reaction :

Zn + 2 HCl → ZnCl2 + H2

|  |  |
| --- | --- |
| a) Zinc is acting as an oxidant | b) Chlorine is acting as a reductant |
| c) Hydrogen ion is acting as an oxidant | d) Zinc is acting as a reductant |

1. The exhibition of various oxidation states by an element is also related to the outer orbitals electronic configuration of its atom. Atom having which of the following outermost electronic configurations will exhibit more than one oxidation state in its compounds.

|  |  |  |  |
| --- | --- | --- | --- |
| a) 3s1 | b) 3d1 4s2 | c) 3d2 4s2 | d) 3s2 3p3 |

1. Identify the correct statement with reference to the given reaction :

P4 + 3 OH – + 3 H2O → PH3 + 3 H2

a) Phosphorus is undergoing reduction only.

b) Phosphorus is undergoing oxidation only.

c) Phosphorus is undergoing oxidation as well as reduction.

d) Hydrogen is undergoing neither oxidation nor reduction.

**Answers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. d | 2. b | 3. a | 4. d | 5. c | 6. b | 7. b |
| 8. a | 9. a | 10. d | 11. c | 12. d | 13. c | 14. c |
| 15. d | 16. a | 17. c | 18. d | 19. c | 20. d | 21. c |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 22. a , b , c , d | 23. c , d | 24. b , c , d | 25. c , d |  |

REDOX Page No. 5