9. Redox Reactions – Multiple Choice Questions

1. Oxidation Number and Oxidation State

1. The oxidation number of an element in a compound is evaluated on the basis of certain rules. Which of the following is incorrect in this respect
   (a) The oxidation number of hydrogen is always +1
   (b) The algebraic sum of all the oxidation numbers in a compound is zero
   (c) An element in the free or the uncombined state bears oxidation number zero
   (d) In all its compounds, the oxidation number of fluorine is – 1

2. Which of the following arrangements represent increasing oxidation number of the central atom
   (a) $CrO_2^-, ClO_3^-, CrO_4^{-2}, MnO_4^-$
   (b) $ClO_3^-, CrO_4^{2-}, MnO_4^-, CrO_2^-$
   (c) $CrO_2^-, ClO_3^-, MnO_4^-, CrO_4^{2-}$
   (d) $CrO_4^{2-}, MnO_4^-, CrO_2^-, ClO_3^-$

3. The oxidation number of Ba in barium peroxide is
   (a) + 6   (b) + 2
   (c) 1   (d) + 4

4. Which one of the following has the highest oxidation number of iodine
   (a) KI_3 (b) KI
   (c) IF_5 (d) KIO_4

5. In which of the following the oxidation number of oxygen has been arranged in increasing order
   (a) $OF_2 < KO_2 < BaO_2 < O_3$
   (b) $BaO_2 < KO_2 < O_3 < OF_2$
   (c) $BaO_2 < O_3 < OF_2 < KO_2$
   (d) $KO_2 < OF_2 < O_3 < BaO_2$
   (e) $OF_2 < O_3 < KO_2 < BaO_2$

6. Oxidation number of iodine varies from
   (a) – 1 to + 1   (b) – 1 to + 7
   (c) + 3 to + 5   (d) – 1 to + 5

7. The oxidation number of Cr in $K_2Cr_2O_7$ is
   (a) + 6   (b) – 7
   (c) + 2   (d) – 2

8. The oxidation number of phosphorus in $Ba(H_2PO_2)_2$ is
   (a) – 1   (b) + 1
   (c) + 2   (d) + 3

9. In which of the following compounds, is the oxidation number of iodine is fractional
   (a) IF_3 (b) IF_2
   (c) I_3^- (d) IF_7

10. The Largest oxidation number exhibited by an element depends on its outer electronic configuration. With which of the following outer electronic configurations the element will exhibit largest oxidation number
    (a) $3d^1 4s^2$ (b) $3d^3 4s^2$
    (c) $3d^5 4s^1$ (d) $3d^5 4s^2$

11. Oxidation number of cobalt in $K[Co(CO)_4]$ is
    (a) + 1   (b) + 3
    (c) – 1   (d) – 3

12. The sum of the oxidation numbers of all the carbons in C_6H_5CHO is
    (a) + 2   (b) 0
    (c) + 4   (d) – 4

13. The oxidation number and covalency of sulphur in the sulphur molecule (S_8) are respectively
    (a) 0 and 2   (b) 6 and 8
    (c) 0 and 8   (d) 6 and 2

14. Oxidation numbers of two Cl atoms in bleaching powder, $CaOCl_2$ are
    (a) – 1, – 1   (b) + 1, – 1
    (c) + 1, + 1   (d) 0, – 1

15. When $KMnO_4$ is reduced with oxalic acid in acidic solution, the oxidation number of Mn changes from
    (a) 7 to 4   (b) 6 to 4
    (c) 7 to 2   (d) 4 to 2

16. The oxidation number of nickel in $K_4[Ni(CN)_4]$ is
    (a) – 2   (b) – 1
    (c) + 2   (d) 0

17. The oxidation number of fluorine in F_2O is
    (a) – 1   (b) + 1
    (c) + 2   (d) – 2

18. A compound of Xe and F is found to have 53.3% Xe (atomic weight = 133) oxidation number of Xe in this compound is

    (a) + 2

    (b) 0

    (c) + 4

    (d) + 6

19. The oxidation number of oxygen in KO_3, Na_2O_2 is

    (a) 3, 2

    (b) 1, 0

    (c) 0, 1

    (d) – 0.33, –1

20. When $CuSO_4$ reacts with KI, the oxidation number of Cu changes by

    (a) 0

    (b) – 1

    (c) 1

    (d) 2

21. When a manganous salt is fused with a mixture of KNO_3 and solid $NaOH$ the oxidation number of Mn changes from +2 to

    (a) + 4

    (b) + 3

    (c) + 6

    (d) + 7

22. The oxidation number of sulphur in $H_2S_2O_8, H_2S_2O_4, H_2S_2O_6$ are respectively

    (a) + 3, + 4, + 5

    (b) + 5, + 4, + 3

    (c) + 6, + 3, + 5

    (d) + 3, + 5, + 4

23. In which of the following compounds, an element exhibits two different oxidation states

    (a) NH_2OH

    (b) NH_4NO_3

    (c) N_2H_4

    (d) N_3H

24. In which compound, oxidation state of nitrogen is 1

    (a) NO

    (b) N_2O

    (c) NH_2OH

    (d) N_2H_4

25. Oxidation state of chlorine in perchloric acid is

    (a) – 1

    (b) 0

    (c) – 7

    (d) + 7

26. When SO_2 is passed through acidic solution of potassium dichromate, then chromium sulphate is formed. Change in valency of chromium is

    (a) + 4 to + 2

    (b) + 5 to + 3

    (c) + 6 to + 3

    (d) + 7 to + 2

27. Oxidation state of oxygen in hydrogen peroxide is

    (a) – 1

    (b) + 1

    (c) 0

    (d) – 2

28. Highest oxidation state of Mn is present in

    (a) $KMnO_4$

    (b) K_2MnO_4

    (c) Mn_2O_3

    (d) MnO_2

29. Nitrogen show different oxidation states in the range

    (a) 0 to +5

    (b) – 3 to + 5

    (c) – 5 to + 3

    (d) – 3 to + 3

30. The oxidation state of nitrogen in N_3H is

    (a) $+\dfrac{1}{3}$

    (b) + 3

    (c) –1

    (d) $-\dfrac{1}{3}$

31. A compound is in its high oxidation state. Then its will be

    (a) Highly acidic

    (b) Highly basic

    (c) Highest oxidising property

    (d) Half acidic, half basic

32. Oxidation state of oxygen atom in potassium superoxide is

    (a) 0

    (b) – 1

    (c) $-\dfrac{1}{2}$

    (d) – 2

33. Oxidation states of vanadium in

    $V \to V^{2+} + 2e,$

    $V^{2+} \to V^{3+} + e,$

    are 2 and 3 respectively. The oxidation states of vanadium in this following reaction.

    $V^{3+} + H_2O \to VO^{2+} + 2H^+ + e$

    (a) 1

    (b) 2

    (c) 3

    (d) 4

34. The oxidation states of S atoms in $S_4O_6^{2-}$ 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

2. Oxidizing and Reducing Agent

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

    (a) $CuO + H_2 \longrightarrow Cu + H_2O$

    (b) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

    (c) $2K + F_2 \longrightarrow 2KF$

    (d) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$

2. The ultimate products of oxidation of most of hydrogen and carbon in food stuffs are

(a) H_2O alone   (b) CO_2 alone

(c) H_2O and CO_2 (d) None of these

3. The conversion of sugar $C_{12}H_{22}O_{11} \rightarrow CO_2$ is

(a) Oxidation

(b) Reduction

(c) Neither oxidation nor reduction

(d) Both oxidation and reduction

4. Consider the following statements :

In the chemical reaction

$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$

(1) Manganese ion is oxidised

(2) Manganese ion is reduced

(3) Chloride ion is oxidised

(4) Chloride ion is reduced

Which of these statements are correct

(a) 1 and 3   (b) 1 and 4

(c) 2 and 3   (d) 2 and 4

5. H_2O_2 oxidises $K_4Fe(CN)_6$

(a) In neutral solution   (b) In acidic solution

(c) In non-polar solvent   (d) In alkaline solution

6. One gas bleaches the colour of flowers by reduction while the other by oxidation

(a) CO and Cl_2 (b) SO_2 and Cl_2

(c) H_2S and Br_2 (d) NH_3 and SO_2

7. H_2S may provide the colloidal sulphur by

(a) Oxidation   (b) Reduction

(c) Neutralization   (d) Hydrolysis

8. Which one of the following does not get oxidised by bromine water

(a) Fe^{+2} to Fe^{+3} (b) Cu^+ to Cu^{+2}

(c) Mn^{+2} to MnO_4^- (d) Sn^{+2} to Sn^{+4}

9. Max. number of moles of electrons taken up by one mole of NO_3^- when it is reduced to

(a) NH_3 (b) NH_2OH

(c) NO (d) NO_2

10. Which one of the following reactions does not involve either oxidation or reduction

(a) $VO_2^+ \rightarrow V_2O_3$ (b) $Na \rightarrow Na^+$

(c) $CrO_4^{2-} \rightarrow Cr_2O_7^{2-}$ (d) $Zn^{2+} \rightarrow Zn$

11. In $C + H_2O \rightarrow CO + H_2$, H_2O acts as

(a) Oxidising agent   (b) Reducing agent

(c) (a) and (b) both   (d) None of these

12. Thiosulphate reacts differently with iodine and bromine in the reactions given below

$$2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$$

$$S_2O_3^{2-} + 2Br_2 + 5H_2O \rightarrow 2SO_4^{2-} + 2Br^- + 10H^+$$

Which of the following statements justifies the above dual behaviour of thiosulphate

(a) Bromine is a stronger oxidant than iodine

(b) Bromine is a weaker oxidant than iodine

(c) Thiosulphate undergoes oxidation by bromine and reduction by iodine in these reactions

(d) Bromine undergoes oxidation and iodine undergoes reduction in these reactions

13. Which halide is not oxidised by MnO_2

(a) F (b) Cl

(c) Br (d) I

14. The oxidant which is used as an antiseptic is

(a) $KBrO_3$ (b) $KMnO_4$

(c) CrO_3 (d) KNO_3

15. Which of the following cannot work as oxidising agent

(a) O_2 (b) $KMnO_4$

(c) I_2 (d) None of these

16. Which one is oxidising substance

(a) $C_2H_2O_2$ (b) CO

(c) H_2S (d) CO_2

17. H_5IO_6 is a

(a) Strong reducing agent   (b) Strong base

(c) Strong oxidizing agent   (d) Weak base

18. The ion(s) that act/s as oxidizing agent in solution is/ are

(a) Tl^+ and Al^{3+} (b) B^{3+} and Al^{3+}

(c) Tl^{3+} only   (d) B^{3+} only

(e) Ti^{3+} only

19. Which of the following pairs of transition metal ions are the stronger oxidising agents in aqueous solutions

(a) V^{2+} and Cr^{2+} (b) Ti^{2+} and Cr^{2+}

(c) Mn^{3+} and Co^{3+} (d) V^{2+} and Fe^{2+}

(e) Ni^{2+} and Fe^{2+}

20. What is the oxidising agent in chlorine water

(a) HCl (b) $HClO_2$

(c) $HOCl$ (d) None of these

21. Reducing property of SO_2 is represented by the following reaction

(a) $2H_2S + SO_2 \rightarrow 3S + 2H_2O$

(b) $I_2 + SO_2 + H_2O \rightarrow SO_4^{2-} + 2I^- + 4H^+$

(c) $3Fe + SO_2 \rightarrow 3FeO + FeS$

(d) $4Na + 3SO_2 \rightarrow Na_2SO_3 + Na_2S_2O_3$

22. Strongest reducing agent is

(a) F^- (b) Cl^-

(c) Br^- (d) I^-

23. In which of the following reactions H_2O_2 is a reducing agent

(a) $2FeCl_2 + 2HCl + H_2O_2 \rightarrow 2FeCl_3 + 2H_2O$

(b) $Cl_2 + H_2O_2 \rightarrow 2HCl + O_2$

(c) $2HI + H_2O_2 \rightarrow 2H_2O + I_2$

(d) $H_2SO_3 + H_2O_2 \rightarrow H_2SO_4 + H_2O$

24. Pick out the stronger reducing agent among the following oxyacids of phosphorus

(a) Hypophosphorous acid

(b) Phosphorous acid

(c) Hypophosphoric acid

(d) Pyrophosphorous acid

(e) Phosphoric acid

25. Which of the following acid possesses oxidising, reducing and complex forming properties

(a) HNO_3 (b) H_2SO_4

(c) HCl (d) HNO_2

26. Which of the following substances acts as an oxidising as well as a reducing agent

(a) Na_2O (b) $SnCl_2$

(c) Na_2O_2 (d) $NaNO_2$

27. In the reaction $H_2S + H_2O_2 \longrightarrow S + 2H_2O$

(a) H_2S is an acid and H_2O_2 is a base

(b) H_2S is a base and H_2O_2 is an acid

(c) H_2S is an oxidizing agent and H_2O_2 is a reducing agent

(d) H_2S is a reducing agent and H_2O_2 is oxidizing agent

(e) H_2S is hydrolysed to S

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

(a) Cl^- (b) ClO_4^-

(c) ClO^- (d) MnO_4^-

(e) NO_3^-

29. Of all the three common mineral acids, only sulphuric acid is found to be suitable for making the solution acidic because

(a) It does not react with $KMnO_4$ or the reducing agent

(b) Hydrochloric acid reacts with $KMnO_4$

(c) Nitric acid is an oxidising agent which reacts with reducing agent

(d) All of the above are correct

## 3. Auto Oxidation and Disproportionation

1. In the equation $H_2S + 2HNO_3 \rightarrow 2H_2O + 2NO_2 + S$

The equivalent weight of hydrogen sulphide is

(a) 16   (b) 68

(c) 34   (d) 17

2. What is the equivalent mass of IO_4^- when it is converted into I_2 in acid medium

(a) $M/6$ (b) $M/7$

(c) $M/5$ (d) $M/4$

(e) None of these

3. In the reaction $I_2 + 2S_2O_3^{--} \rightarrow 2I^- + S_4O_6^{--}$ equivalent weight of iodine will be equal to

(a) 1/2 of molecular weight

(b) Molecular weight

(c) 1/4 of molecular weight

(d) None

4. The equivalent weight of potassium permanganate when it acts as oxidising agent in ferrous ion estimation is

(a) 158   (b) 31.6

(c) 79   (d) 39.5

5. Identify disproportionation reaction

(a) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

(b) $CH_4 + 4Cl_2 \longrightarrow CCl_4 + 4HCl$

(c) $2F_2 + 2OH^- \longrightarrow 2F^- + OF_2 + H_2O$

(d) $2NO_2 + 2OH^- \longrightarrow NO_2^- + NO_3^- + H_2O$

6. Which of the following elements does not show disproportionation tendency

(a) Cl (b) Br

(c) F (d) I

7. The reaction that takes place when Cl_2 gas is passed through conc. $NaOH$ solution is

(a) Oxidation   (b) Reduction

(c) Displacement   (d) Disproportionation

8. The following species will not exhibit disproportionation reaction

(a) ClO^- (b) ClO_2^-

(c) ClO_3^- (d) ClO_4^-

9. In the disproportionation reaction

$3HClO_3 \longrightarrow HClO_4 + Cl_2 + 2O_2 + H_2O$, the equivalent mass of the oxidizing agent is (molar mass of $HClO_3 = 84.45$)

(a) 16.89   (b) 32.22

(c) 84.45   (d) 28.15

(e) 29.7

4. Redox Reaction and Method for Balancing Redox Reaction

1. Which of the following reactions involves oxidation-reduction

(a) $NaBr + HCl \rightarrow NaCl + HBr$

(b) $HBr + AgNO_3 \rightarrow AgBr + HNO_3$

(c) $H_2 + Br_2 \rightarrow 2HBr$

(d) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

2. The value of 'n' in the reaction:

$Cr_2O_7^{2-} + 14H^+ + nFe^{2+} \rightarrow 2Cr^{3+} + nFe^{3+} + 7H_2O$ will be

(a) 2   (b) 3

(c) 6   (d) 7

3. The set of numerical coefficient that balances the equation $K_2CrO_4 + HCl \rightarrow K_2Cr_2O_7 + KCl + H_2O$ is

(a) 1, 1, 2, 2, 1   (b) 2, 2, 1, 1, 1

(c) 2, 1, 1, 2, 1   (d) 2, 2, 1, 2, 1

4. In balancing the half reaction $S_2O_3^{2-} \rightarrow S_{(s)}$ the number of electrons that must be added is

(a) 4 on the left   (b) 3 on the right

(c) 2 on the left   (d) 2 on the right

5. How many moles of $K_2Cr_2O_7$ can be reduced by 1 mole of Sn^{2+}

(a) 1/3   (b) 1/6

(c) 2/3   (d) 1

6. In a balanced equation $H_2SO_4 + xHI \rightarrow H_2S + yI_2 + zH_2O$, the values of x, y, z are

(a) $x = 3, y = 5, z = 2$ (b) $x = 4, y = 8, z = 5$

(c) $x = 8, y = 4, z = 4$ (d) $x = 5, y = 3, z = 4$

7. Ceric ammonium sulphate and potassium permanganate are used as oxidising agents in acidic medium for oxidation of ferrous ammonium sulphate to ferric sulphate. The ratio of number of moles of cerric ammonium sulphate required per mole of ferrous ammonium sulphate to the number of moles of $KMnO_4$ required per mole of ferrous ammonium sulphate, is

(a) 5.0   (b) 0.2

(c) 0.6   (d) 2.0

8. In the equation

$4M + 8CN^- + 2H_2O + O_2 \rightarrow 4[M(CN)_2]^- + 4OH^-$
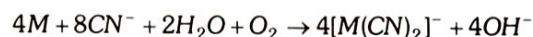
Identify the metal M

(a) Copper   (b) Iron

(c) Gold   (d) Zinc

9. A redox reaction among the following is

(a) $CdCl_2 + 2KOH \rightarrow Cd(OH)_2 + 2KCl$

(b) $BaCl_2 + K_2SO_4 \rightarrow BaSO_4 + 2KCl$

(c) $CaCO_3 \rightarrow CaO + CO_2$

(d) $2Ca + O_2 \rightarrow 2CaO$

10. Which of the following is not an oxidation – reduction reaction

(a) $H_2 + Br_2 \rightarrow 2HBr$

(b) $NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$

(c) $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$

(d) $Cl_2 + H_2O \rightarrow HCl + HOCl$

5. IIT-JEE/ AIEEE

1. The oxidation number of sulphur in S_8, S_2F_2, H_2S respectively, are   **[1999]**

(a) 0, +1 and – 2   (b) + 2, +1 and – 2

(c) 0, + 1 and + 2   (d) – 2, + 1 and – 2

2. The oxidation number of carbon in CH_2O is   **[1982]**

   (a) -2 (b) $+2$

   (c) 0 (d) $+4$

3. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen   **[2012]**

   (a) HNO_3, NO, NH_4Cl, N_2 (b) HNO_3, NO, N_2, NH_4Cl

   (c) HNO_3, NH_4Cl, NO, N_2 (d) NO, HNO_3, NH_4Cl, N_2

4. Amongst the following, identify the species with an atom in $+$ 6 oxidation state   **[2000]**

   (a) MnO_4^- (b) $Cr(CN)_6^{3-}$

   (c) NiF_6^{2-} (d) CrO_2Cl_2

5. Oxidation states of the metal in the minerals haematite and magnetite, respectively, are   **[2011]**

   (a) II, III in haematite and III in magnetite

   (b) II, III in haematite and II in magnetite

   (c) II in haematite and II, III in magnetite

   (d) III in haematite and II, III in magnetite

6. The oxidation state of Cr in $[Cr(NH_3)_4Cl_2]^+$ is   **[2005]**

   (a) $+3$ (b) $+2$

   (c) $+1$ (d) 0

7. The oxidation states of the most electronegative element in the products of the reaction of BaO_2 with dilute H_2SO_4 are   **[1991; 1992]**

   (a) 0 and -1 (b) -1 and -2

   (c) -2 and 0 (d) -2 and $+1$

8. The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is   **[2005]**

   (a) $+4$ (b) $+6$

   (c) $+2$ (d) $+3$

9. The oxidation states of Cr in $[Cr(H_2O)_6]Cl_3, [Cr(C_6H_6)_2]$, and $K_2[Cr(CN)_2(O)_2(O_2)(NH_3)]$ respectively are   **[2018]**

   (a) $+3, 0,$ and $+6$ (b) $+3, 0,$ and $+4$

   (c) $+3, +4,$ and $+6$ (d) $+3, +2,$ and $+4$

10. When P reacts with caustic soda, the products are PH_3 and NaH_2PO_2. This reaction is an example of   **[1980; 1997]**

   (a) Oxidation

   (b) Reduction

   (c) Oxidation and reduction (Redox)

   (d) Neutralization

11. Which of the following chemical reactions depicts the oxidizing behaviour of H_2SO_4 **[2006]**

   (a) $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$

   (b) $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$

   (c) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

   (d) $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

12. For the reactions, $C + O_2 \rightarrow CO_2; \Delta H = -393J$

   $2Zn + O_2 \rightarrow 2ZnO; \Delta H = -412J$ **[2002]**

   (a) Carbon can oxidise Zn

   (b) Oxidation of carbon is not feasible

   (c) Oxidation of Zn is not feasible

   (d) Zn can oxidise carbon

13. In which of the following reaction H_2O_2 acts as a reducing agent   **[2014]**

   (1) $H_2O_2 + 2H^+ + 2e^- \longrightarrow 2H_2O$

   (2) $H_2O_2 - 2e^- \longrightarrow O_2 + 2H^+$

   (3) $H_2O_2 + 2e^- \longrightarrow 2OH^-$

   (4) $H_2O_2 + 2OH^- - 2e^- \longrightarrow O_2 + 2H_2O$

   (a) (1), (2) (b) (3), (4)

   (c) (1), (3) (d) (2), (4)

14. For H_3PO_3 and H_3PO_4 the correct choice is   **[2003]**

   (a) H_3PO_3 is dibasic and reducing

   (b) H_3PO_3 is dibasic and non-reducing

   (c) H_3PO_4 is tribasic and reducing

   (d) H_3PO_3 is tribasic and non-reducing

15. HBr and HI can reduce H_2SO_4, HCl can reduce $KMnO_4$ and HF can reduce   **[1981]**

   (a) H_2SO_4 (b) $KMnO_4$

   (c) $K_2Cr_2O_7$ (d) None of the above

16. The compound which could not act both as oxidising as well as reducing agent is   **[1991]**

   (a) SO_2 (b) MnO_2

   (c) Al_2O_3 (d) CrO

17. The product of oxidation of I^- with MnO_4^- in alkaline medium is   **[2004]**

   (a) IO_3^- (b) I_2

   (c) IO^- (d) IO_4^-

18. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is **[2007]**

(a) 3

(b) 4

(c) 5

(d) 6

19. The reaction of white phosphorus with aqueous $NaOH$ gives phosphine along with another phosphorus containing compound. The reaction type; the oxidation states of phosphorus in phosphine and the other product are respectively **[2012]**

(a) Redox reaction; –3 and –5

(b) Redox reaction; +3 and +5

(c) Disproportionation reaction; –3 and +5

(d) Disproportionation reaction; –3 and +3

20. When $KMnO_4$ acts as an oxidising agent and ultimately forms $[MnO_4]^{-2}$, MnO_2, Mn_2O_3, Mn^{+2} then the number of electrons transferred in each case respectively is **[2002]**

(a) 4, 3, 1, 5

(b) 1, 5, 3, 7

(c) 1, 3, 4, 5

(d) 3, 5, 7, 1

21. Which of the following is a redox reaction **[2002]**

(a) $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$

(b) $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$

(c) $Mg(OH)_2 + 2NH_4Cl \rightarrow MgCl_2 + 2NH_4OH$

(d) $Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$

22. When MnO_2 is fused with KOH, a coloured compound is formed, the product and its colour is **[2003]**

(a) K_2MnO_4, purple green

(b) $KMnO_4$, purple

(c) Mn_2O_3, brown

(d) Mn_3O_4, black

23. Which of the following reactions is an example of a redox reaction **[2017]**

(a) $XeF_2 + PF_5 \rightarrow [XeF]^+ PF_6^-$

(b) $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$

(c) $XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4HF$

(d) $XeF_4 + O_2F_2 \rightarrow XeF_6 + O_2$

24. Hydrogen peroxide oxidises $[Fe(CN)_6]^{4-}$ to $[Fe(CN)_6]^{3-}$ in acidic medium but reduces $[Fe(CN)_6]^{3-}$ to $[Fe(CN)_6]^{4-}$ in alkaline medium. The other products formed are, respectively **[2018]**

(a) H_2O and $(H_2O + O_2)$

(b) H_2O and $(H_2O + OH^-)$

(c) $(H_2O + O_2)$ and H_2O

(d) $(H_2O + O_2)$ and $(H_2O + OH^-)$

6. NEET/ AIPMT/ CBSE-PMT

1. Oxidation numbers of P in PO_4^{3-}, of S in SO_4^{2-} and that of Cr in $Cr_2O_7^{2-}$ are respectively **[2009]**

(a) +5, +6 and +6

(b) +3, +6 and +5

(c) +5, +3 and +6

(d) –3, +6 and +6

2. When Cl_2 gas reacts with hot and concentrated sodium hydroxide solution, the oxidation number of chlorine changes from **[2012]**

(a) Zero to +1 and Zero to –5

(b) Zero to –1 and Zero to +5

(c) Zero to –1 and Zero to +3

(d) Zero to +1 and Zero to –3

3. The oxidation state of I in $H_4IO_6^-$ is **[1994]**

(a) + 7

(b) + 5

(c) + 1

(d) – 1

4. In which of the following compounds, nitrogen exhibits highest oxidation state **[2012]**

(a) N_2H_4

(b) NH_3

(c) N_3H

(d) NH_2OH

5. In acidic medium, H_2O_2 changes $Cr_2O_7^{-2}$ to CrO_5 which has two $(-O-O-)$ bonds. Oxidation state of Cr in CrO_5 is **[2014]**

(a) +6

(b) –10

(c) +5

(d) +3

6. In which of the following compound transition metal has zero oxidation state **[1999]**

(a) CrO_5

(b) $NH_2.NH_2$

(c) $NOClO_4$

(d) $[Fe(CO)_5]$

7. The oxidation states of sulphur in the anions SO_3^{2-}, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ follow the order **[2003]**

(a) $S_2O_6^{2-} < S_2O_4^{2-} < SO_3^{2-}$

(b) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

(c) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$

(d) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$

8. Oxidation states of P in $H_4P_2O_5$, $H_4P_2O_6$, $H_4P_2O_7$ are respectively **[2010]**

(a) + 3, + 4, + 5

(b) + 3, + 5, + 4

(c) + 5, + 3, + 4

(d) + 5, + 4, + 3

9. A mixture of potassium chlorate, oxalic acid and sulphuric acid is heated. During the reaction which element undergoes maximum change in the oxidation number **[2012]**

(a) S

(b) H

(c) Cl

(d) C

10. The correct order of N – compounds in its decreasing order of oxidation states is **[2018]**

(a) HNO_3, NO, N_2, NH_4Cl

(b) HNO_3, NO, NH_4Cl, N_2

(c) HNO_3, NH_4Cl, NO, N_2

(d) NH_4Cl, N_2, NO, HNO_3

11. Which of the following processes does not involve oxidation of iron **[2015]**

(a) Decolourization of blue $CuSO_4$ solution by iron

(b) Formation of $Fe(CO)_5$ from Fe

(c) Liberation of H_2 from steam by iron at high temperature

(d) Rusting of iron sheets

12. Which of the following is redox reaction **[1997]**

(a) H_2SO_4 with $NaOH$

(b) In atmosphere, O_3 from O_2 by lightning

(c) Evaporation of H_2O

(d) Nitrogen oxides form nitrogen and oxygen by lightning

13. Which is the best description of the behaviour of bromine in the reaction given below

$$H_2O + Br_2 \rightarrow HOBr + HBr$$ **[2004]**

(a) Oxidised only

(b) Reduced only

(c) Proton acceptor only

(d) Both oxidised and reduced

14. Which of the following is the most powerful oxidizing agent **[1992; 2009]**

(a) F_2

(b) Cl_2

(c) Br_2

(d) I_2

15. Hot concentrated sulphuric acid is a moderately strong oxidizing agent. Which of the following reactions does not show oxidizing behaviour **[2016]**

(a) $CaF_2 + H_2SO_4 \longrightarrow CaSO_4 + 2HF$

(b) $Cu + 2H_2SO_4 \longrightarrow CuSO_4 + SO_2 + 2H_2O$

(c) $3S + 2H_2SO_4 \longrightarrow 3SO_2 + 2H_2O$

(d) $C + 2H_2SO_4 \longrightarrow CO_2 + 2SO_2 + 2H_2O$

16. Which substance is serving as a reducing agent in the following reaction

$$14H^+ + Cr_2O_7^{2-} + 3Ni \rightarrow 2Cr^{3+} + 7H_2O + 3Ni^{2+}$$ **[1994]**

(a) H_2O

(b) Ni

(c) H^+

(d) $Cr_2O_7^{2-}$

17. (i) $H_2O_2 + O_3 \rightarrow H_2O + 2O_2$

(ii) $H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

Role of hydrogen peroxide in the above reactions is respectively

(a) Reducing in (i) and (ii)

(b) Oxidizing in (i) and (ii)

(c) Oxidizing in (i) and reducing in (ii)

(d) Reducing in (i) and oxidizing in (ii)

18. When 0.1 mol MnO_4^{2-} is oxidised the quantity of electricity required to completely oxidise MnO_4^{2-} to MnO_4^- is **[2014]**

(a) 9650 C

(b) 96.50 C

(c) 96500 C

(d) 2×96500 C

19. The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphite ion in acidic solution is **[2007]**

(a) $\dfrac{3}{5}$

(b) $\dfrac{4}{5}$

(c) $\dfrac{2}{5}$

(d) 1

20. For the redox reaction

$$MnO_4^- + C_2O_4^{-2} + H^+ \rightarrow Mn^{2+} + CO_2 + H_2O$$

the correct coefficients of the reactants for the balanced reaction are **[1988, 92, 2013, 2018]**

	MnO_4^-	$C_2O_4^{2-}$	H^+
(a)	2	5	16
(b)	16	5	2
(c)	5	16	2
(d)	2	16	5

21. The number of moles of $KMnO_4$ reduced by one mole of KI in alkaline medium is: **[2005]**

(a) One fifth

(b) Five

(c) One

(d) Two

1. Identify the element which can have highest oxidation numbers **[1996]**

   (a) N

   (b) O

   (c) Cl

   (d) C

2. The oxidation number of sulphur in $H_2S_2O_7$ and iron in $K_4Fe(CN)_6$ is respectively **[2000]**

   (a) $+6$ and $+2$

   (b) $+2$ and $+2$

   (c) $+8$ and $+2$

   (d) $+6$ and $+4$

3. HNO_2 acts both as reductant and oxidant, while HNO_3 acts only as oxidant. It is due to their **[2000]**

   (a) Solubility ability

   (b) Maximum oxidation number

   (c) Minimum oxidation number

   (d) Minimum number of valence electrons

4. Oxidation number of nickel in $Ni(CO)_4$ **[1984]**

   (a) 0

   (b) $+4$

   (c) -4

   (d) $+2$

5. Oxidation number of osmium (Os) in OsO_4 is **[1999]**

   (a) $+4$

   (b) $+6$

   (c) $+7$

   (d) $+8$

6. What is the oxidation number of sulphur in $Na_2S_4O_6$

   [1998]

   (a) $\frac{2}{3}$

   (b) $\frac{3}{2}$

   (c) 0 and +5

   (d) $\frac{5}{2}$

7. The oxidation states of iodine in HIO_4, H_3IO_5 and H_5IO_6 are, respectively **[2008]**

   (a) +1, +3, +7

   (b) +7, +7, +3

   (c) +7, +7, +7

   (d) +7, +5, +3

8. The brown ring complex compound is formulated as $[Fe(H_2O)_5 NO^+]SO_4$. The oxidation state of iron is

   [1987; 1997]

   (a) 1

   (b) 2

   (c) 3

   (d) 0

9. Oxidation state of Fe in Fe_3O_4 is **[1999; 2002]**

   (a) $\frac{3}{2}$

   (b) $\frac{4}{5}$

   (c) $\frac{5}{4}$

   (d) $\frac{8}{3}$

10. In the reaction $Zn + 2H^+ + 2Cl^- \rightarrow Zn^{2+} + 2Cl^- + H_2$, the spectator ion is **[2001]**

    (a) Cl^-

    (b) Zn^{2+}

    (c) H^+

    (d) All of these

11. Following reaction describes the rusting of iron

    $$4Fe + 3O_2 \rightarrow 4Fe^{3+} + 6O^{2-}$$

    Which one of the following statement is incorrect **[1998]**

    (a) This is an example of a redox reaction

    (b) Metallic iron is reduced to Fe^{3+}

    (c) Fe^{3+} is an oxidising agent

    (d) Metallic iron is a reducing agent

12. The oxide which cannot act as a reducing agent is **[2000]**

    (a) SO_2

    (b) NO_2

    (c) CO_2

    (d) ClO_2

13. The compound that can work both as oxidising and reducing agent is **[1996, 2008]**

    (a) $KMnO_4$

    (b) H_2O_2

    (c) BaO_2

    (d) $K_2Cr_2O_7$

14. The charge required for the reduction of 1 mol of MnO_4^- to MnO_2 is **[2006]**

    (a) $1\,F$

    (b) $3\,F$

    (c) $5\,F$

    (d) $6\,F$

15. For decolourization of 1 mole of $KMnO_4$, the moles of H_2O_2 required is **[2004]**

    (a) 1/2

    (b) 3/2

    (c) 5/2

    (d) 7/2

16. MnO_4^{2-} (1 mole) in neutral aqueous medium is disproportionate to **[2003, 15]**

    (a) 2/3 mole of MnO_4^- and 1/3 mole of MnO_2

    (b) 1/3 mole of MnO_4^- and 2/3 mole of MnO_2

    (c) 1/3 mole of Mn_2O_7 and 1/3 mole of MnO_2

    (d) 2/3 mole of Mn_2O_7 and 1/3 mole of MnO_2

17. In the balanced chemical reaction,

$$IO_3^- + a\,I^- + b\,H^+ \rightarrow c\,H_2O + d\,I_2$$
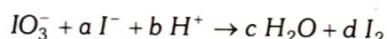
a, b, c and d respectively correspond to   **[2005]**

(a) 5, 6, 3, 3   (b) 5, 3, 6, 3

(c) 3, 5, 3, 6   (d) 5, 6, 5, 5

8. Assertion and Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

(c) If assertion is true but reason is false.

(d) If the assertion and reason both are false.

(e) If assertion is false but reason is true.

1. Assertion   : SO_2 and Cl_2 both are bleaching agents.

    Reason   :   Both are reducing agents. **[AIIMS 1995]**

2. Assertion   :   Fluorine exists only in –1 oxidation state.

    Reason   :   Fluorine has $2s^2 2p^5$ configuration.

                                 [AIIMS 2001]

3. Assertion   :   Stannous chloride is a powerful oxidising agent which oxidises mercuric chloride to mercury.

    Reason   :   Stannous chloride gives grey precipitate with mercuric chloride, but stannic chloride does not do so.   **[AIIMS 2002]**

4. Assertion   : $HClO_4$ is a stronger acid than $HClO_3$.

    Reason   :   Oxidation state of Cl in $HClO_4$ is $+VII$ and in $HClO_3$ $+V$.   **[AIIMS 2004]**

5. Assertion   :   The oxidation numbers are artificial, they are useful as a 'book-keeping' device of electrons in reactions.

    Reason   :   The oxidation numbers do not usually represent real charges on atoms, they are simply conventions that indicate what the maximum charge could possibly be on an atom in a molecule.

6. Assertion   :   Equivalent weight of NH_3 in the reaction $N_2 \rightarrow NH_3$ is 17/3 while that of N_2 is 28/6.

    Reason   :   Equivalent weight

$$= \frac{\text{Molecular weight}}{\text{number of } e^- \text{lost or gained}}.$$

9. Redox Reactions – Answers Keys

1. Oxidation Number and Oxidation State

1	a	2	a	3	b	4	d	5	b
6	b	7	a	8	b	9	c	10	d
11	c	12	d	13	a	14	b	15	c
16	d	17	a	18	d	19	d	20	c
21	c	22	c	23	b	24	b	25	d
26	c	27	a	28	a	29	b	30	d
31	c	32	c	33	d	34	c		

2. Oxidizing and Reducing Agent

1	d	2	c	3	a	4	c	5	b
6	b	7	a	8	c	9	a	10	c
11	a	12	a	13	a	14	b	15	c
16	d	17	c	18	c	19	c	20	c
21	b	22	d	23	b	24	a	25	d
26	d	27	d	28	c	29	d		

3. Auto Oxidation and Disproportionation

1	d	2	b	3	a	4	b	5	d
6	c	7	d	8	d	9	a		

4. Redox Reaction and Method for Balancing Redox Reaction

1	c	2	c	3	d	4	a	5	a
6	c	7	a	8	c	9	d	10	b

5. IIT-JEE/ AIEEE

1	a	2	c	3	b	4	d	5	d
6	a	7	b	8	d	9	a	10	c
11	a	12	d	13	d	14	a	15	d
16	c	17	a	18	d	19	c	20	c
21	d	22	a	23	d	24	a		

6. NEET/ AIPMT/ CBSE-PMT

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

7. AIIMS

1	c	2	a	3	b	4	a	5	d
6	d	7	c	8	a	9	d	10	a
11	b	12	c	13	b	14	b	15	c
16	a	17	a						

8. Assertion & Reason

1	c	2	b	3	e	4	b	5	a
6	a								