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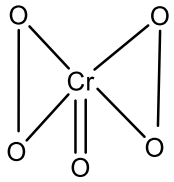
CHEMISTRY

3.REDOX REACTION,REDOX REACTIONS

Single Correct Answer Type

1. The oxidation number of an element in a compound is evaluated on the basis of certain fuel's, 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. Among the properties given below, the set of properties shown by CN^- ion towards metal species is :
   1. Reducing; 2. Oxidising ; 3. Complexation
   a) 1, 3 b) 1, 2, 3
   c) 1, 2 d) 2, 3
3. Oxidation state of chromium
   
   a) +10 b) +6
   c) +3 d) +2
4. A solution of $KMnO_4$ is reduced to MnO_2. The normality of solution is 0.6. The molarity is:
   a) 1.8 M b) 0.6 M
   c) 0.1 M d) 0.2 M
5. Which one is not a redox titration?
   a) $FeSO_4$ $vs.$ $K_2Cr_2O_7$ b) $CuSO_4$ $vs.$ hypo
   c) I_2 $vs.$ hypo d) $AgNO_3$ $vs.$ KCl
6. 0.2 g of a sample of H_2O_2 required 10 mL of N $KMnO_4$ in a titration in the presence of H_2SO_4. Purity of H_2O_2 is :
   a) 25% b) 85%
   c) 65% d) 95%
7. The oxidation number of chromium in potassium dichromate is
   a) +2 b) +4
   c) +6 d) +8
8. An element A in a compound ABD has oxidation number A^{n-}. It is oxidized by $Cr_2O_7^{2-}$ in acidic medium. In the experiment 1.68×10^{-3} mole of $K_2Cr_2O_7$ were used for 3.26×10^{-3} mole of ABD. The new oxidation number of A after oxidation is :
   a) 3 b) $3-n$
   c) $n-3$ d) $+n$
9. What is the oxidation number of As in H_3AsO_3 ?
   a) +4 b) +3
   c) -3 d) +2
10. How many electrons are involved in oxidation of $KMnO_4$ in basic medium?
    a) 1 b) 2
    c) 5 d) 3
11. The eq. wt. of I_2 in the change $I_2 \longrightarrow IO_3^-$ is :
    a) 12.7 b) 63.5
    c) 25.4 d) 2.54
12. In which of the following, the oxidation number of oxygen has been arranged in increasing order?
    a) $BaO_2 < KO_2 < O_3 < OF_2$ b) $OF_2 < KO_2 < BaO_2 < O_3$
    c) $BaO_2 < O_3 < OF_2 < KO_2$ d) $KO_2 < OF_2 < O_3 < BaO_2$
13. The oxidation number of Cr in $K_2Cr_2O_7$ is
    a) +2 b) +4
    c) +6 d) +7
14. 8 g of sulphur are burnt to form SO_2 which is oxidised by Cl_2 water. The solution is treated with $BaCl_2$ solution. The amount of $BaSO_4$ precipitated is :
    a) 1.0 mole b) 0.5 mole
    c) 0.24 mole d) 0.25 mole
15. By using Stock notation, the following compounds, FeO, Fe_2O_3, CuO and MnO_2 can be represented as
    a) Fe (II) O, Fe_2 (III) O_3, Cu (II) O, Mn (IV) O_2, respectively b) Fe(III)O, Fe_2(II)O_3, Cu, respectively
    c) Fe(II)O, Fe_2(IV)O_3, d) Fe(I)O, Fe_2(I)O_3,

$Cu(I)O, Mn(III)O_2$, respectively | $Cu(III)O, Mn(II)O_2$, respectively

16. A 0.518 g sample of lime stone is dissolved in HCl and then the calcium is precipitated as CaC_2O_4. After filtering and washing the precipitate, it requires 40.0 mL of 0.250 *N* $KMnO_4$, solution acidified with H_2SO_4 to titrate is as, $MnO_4^- + H^+ + C_2O_4^{2-} \longrightarrow Mn^{2+} + CO_2 + 2H_2O$. The percentage of CaO in the sample is :
    a) 54.0 % b) 27.1 %
    c) 42% d) 84%
17. In the reaction, $I_2 + 2S_2O_3^{2-} \longrightarrow 2I^- + S_4O_6^{2-}$, Equivalent weight of iodine will be equal to:
    a) Its molecular weight b) 1/2 of its molecular weight
    c) 1/4 of its molecular weight d) Twice the molecular weight
18. The oxidation number of Xe in XeF_4 and XeO_2 is
    a) +6 b) +4
    c) +1 d) +3
19. In the following redox reaction,
    $Cr_2O_7^{2-} + Fe^{2+} \longrightarrow Fe^{3+} + Cr^{3+}$
    1 mole of $Cr_2O_7^{2-}$ oxidises
    a) 1 mole of Fe^{2+} b) 3 moles of Fe^{2*}
    c) 4 moles of Fe^{2+} d) 6 moles of Fe^{2+}
20. The anion nitrate is converted into ammonium ion. The equivalent mass of nitrate ion in the reaction would be:
    a) 6.20 b) 7.75
    c) 10.5 d) 21.0
21. The oxidation state of sulphur in $H_2S_2O_7$, be is
    a) +4 b) +6
    c) +5 d) +7
22. The difference in the oxidation numbers of the two types of sulphur atoms in $Na_2S_4O_6$ is
    a) 4 b) 5
    c) 6 d) 7
23. In alkaline condition $KMnO_4$ reacts as follows :
    $2KMnO_4 + 2KOH \longrightarrow 2K_2MnO_4 + H_2O + O$.
    The eq. wt. of $KMnO_4$ is :
    a) 52.7 b) 158
    c) 31.6 d) 79
24. Oxalic acid on reacting with acidified $KMnO_4$ is oxidised to :
    a) CO and H_2 b) CO_2 and H_2
    c) CO_2 and H_2O d) CO and H_2O
25. Reaction of acidified $KMnO_4$ with ferrous oxalate gives oxidation products containing :
    a) Fe^{3+} b) CO_2
    c) Both (a) and (b) d) None of these
26. Which of the following reaction has the underlined substance been reduced?
    a) Carbon monoxide + Copper oxide $\longrightarrow$ Carbon dioxide + Copper
    b) Copper oxide + Hydrochlori
    c) Hydrogen + Iron oxide $\longrightarrow$ Iron + Water
    d) Steam + Iron $\longrightarrow$ Iron oxide + Hydrogen
27. In the reaction, $Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 2Cr^{3+} + 3H_2O + 3I_2$, The eq.wt. of Cr^{3+} is :
    a) $\frac{\text{mol. wt.}}{3}$ b) $\frac{\text{at. wt.}}{6}$
    c) $\frac{\text{at. wt.}}{3}$ d) $\frac{\text{mol. wt.}}{6}$
28. The apparatus in which standard solution is prepared is known as :
    a) Measuring flask b) Round bottom flask
    c) Burette d) None of these
29. In the ionic equation,
    $BiO_3^- + 6H^+ + xe^- \longrightarrow Bi^{3+} + 3H_2O$
    The values of x is
    a) 6 b) 2
    c) 4 d) 3
30. One mole of acidified $K_2Cr_2O_7$ on reaction with excess KI will liberate.....mole(s) of I_2.
    a) 6 b) 1
    c) 7 d) 3
31. $Cr_2O_7^{2-} + 2I^- + 14H^+ \rightarrow I_2 + 2Cr^{3+} + 7H_2O$
    Which ions are not in balanced position in above reaction?
    a) $H^+$and H_2O b) $Cr_2O_7^2$ and Cr^{3-}
    c) $I^-$and I_2 d) all are balanced
32. In the reaction,
    $MnO_4^{-2}(aq) + Br^{-1}(aq) \longrightarrow MnO_2(s) + BrO_3^{-1}(aq)$, the correct change in oxidation number of the species involved is
    a) Br^{+5} to Br^{-1} b) Mn^{+7} to Mn^{+2}
    c) Mn^{+7} to Mn^{+3} d) Br^{-1} to Br^{+5}
33. Which of the following is a redox reaction?
    a) $NaCl + KNO_3 \longrightarrow NaNO_3 + KCl$
    b) $CaC_2O_4 + 2HCl \longrightarrow CaCl_2 + H_2C_2O_4$
    c) $Ca(OH)_2 + 2NH_4Cl \longrightarrow CaCl_2 + 2NH_3 + 2H_2O$
    d) $Zn \longrightarrow 2Ag + 2K[Ag(CN)_2] + K_2[Zn(CN)_4]$
34. In an oxidation process for a cell $M_1 \longrightarrow M_1^{n+} + ne$, the other metal ($M_2$) being univalent showing reduction takes up the .....electrons to

complete redox reaction.

a) $(n-1)$ b) 1

c) n d) 2

35. Oxidation number of 'N' in N_3H(hydrazoic acid) is

a) $-\frac{1}{3}$ b) $+3$

c) 0 d) -3

36. Equivalent mass of IO_4^- when it is converted to I_2 in acid medium :

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

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

37. Which of the following arrangements represents increasing oxidation number of the central atom?

a) CrO_2, $ClO_3^-, CrO_4^2, MnO_4^-$ b) $ClO_3^-, CrO_4^{2-}, MnO_4^-$, Cı

c) $CrO_2^-, ClO_3^-, MnO_4^*$, Cr(d) $CrO_4^{2-}, MnO_4^-, CrO_2^-$, C

38. Eq.wt. of NH_3 in, $NH_3 + O_2 \longrightarrow NO + H_2O$ is :

a) 3.4 b) 17

c) 8.5 d) None of these

39. A group of methods of quantitative chemical analysis involving the measurement of volume of reacting substance is known as :

a) Gravimetric analysis b) Volumetric analysis

c) Both (a) and (b) d) None of the above

40. In which of the following reactions, chlorine acts as an oxidising agent?

(i) $CH_3CH_2OH + Cl_2$ $CH_3CHO + HCl$

(ii)$CH_3CHO + Cl_2$ $CCl_3CHO + HCl$

(iii)$CH_4 + Cl_2$ $CH_3Cl + HCl$

The correct answer is

a) (i) only b) (ii) only

c) (i) and (iii) d) (i),(ii) and (iii)

41. In the reaction,

$Ag_2O + H_2O_2 \longrightarrow 2Ag + H_2O + O_2$

H_2O_2 acts as

a) reducing agent b) oxidising agent

c) bleaching agent d) None of these

42. What is the oxidation number of Mn in MnO_4^{2-} ion?

a) $+6$ b) $+8$

c) -8 d) -6

43. Number of K^+ ions and mole of K^+ ions present in 1 litre of $\frac{N}{5}$ $KMnO_4$ acidified solution respectively are :

a) 0.04 and 2.4×10^{22} b) 2.4×10^{22} and 0.04

c) 200 and 6.023×10^{23} d) 6.023×10^{23} and 200

44. Observe the following reaction,

$2NO_2(g) + 2OH^-(aq) \longrightarrow NO_3^-(aq) + H_2O(I) + NO_2^-(aq)$

In this reaction,

a) $OH^-$is oxidised to H_2O b) $OH^-$is reduced to H_2O

c) $NO_2(g)$ is reduced to $NO_2^-(aq)$ and oxidised to $NO_3^-(aq)$ d) $NO_2(g)$ is reduced to $NO_3^-(aq)$ and oxidised to $NO_2^-(aq)$

45. How many milligram of iron (Fe^{2+}) are equal to 1 mL of 0.1055 N $K_2Cr_2O_7$ equivalent?

a) 5.9 mg b) 0.59 mg

c) 59 mg d) 59×10^{-3} mg

46. The eq. wt. of Fe_3O_4 in , $Fe_3O_4 + KMnO_4 \longrightarrow Fe_2O_3 + MnO_2$ is:

a) $M/6$ b) M

c) $2M$ d) $M/3$

47. Oxidation states of X, Y, Z are $+2$, $+5$ and -2 respectively. Formula of the compound formed by these wii be

a) X_2YZ_6 b) XY_2Z_6

c) XY_5 d) X_3YZ_4

48. $KMnO_4$ acts as ……. indicator in its redox titrations.

a) Self b) External

c) Internal d) Not an

49. For the redox reaction,

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

the correct coefficients of the reactants for the balanced reaction are

MnO_4^- $C_2O_4^{2-}$ H^+

a) 2 5 16 b) 16 5 2

c) 5 16 2 d) 2 16 5

50. The oxidation number of sulphur in $Na_2S_2O_3$ is

a) $+1$ b) $+2$

c) $+3$ d) -3

51. The oxidation state of I in IPO_4 is

a) $+1$ b) $+3$

c) $+5$ d) $+7$

52. I^- reduces $IO_3^-$to I_2 and itself oxidised to I_2 in acidic medium. Final reaction is

a) $I^- + IO_3^- + 6H^+ \rightarrow I_2 + 3H_2O$ b) $I^- + IO_3^- \rightarrow I_2 + O_3$

c) $5I^- + IO_3^- + 6H^+ \rightarrow 3I_2 + 3H_2O$ d) None of the above

53. Which combination appears odd with respect to oxidation number per atom of the underlined?

a) $H_2SO_1, H_2S_2O_6, K_2Cı$ b) $CrO_4, CrO_4^{2-}, SO_4^{2-}$

c) Both (a) and (b) d) None of the above

54. What weight of HNO_3 is needed to convert 5 g of iodine into iodic acid according to the reaction, $I_2 + HNO_3 \longrightarrow HIO_3 + NO_2 + H_2O$?
a) 12.4 g b) 24.8 g
c) 0.248 g d) 49.6 g

55. The equivalent weight of $SnCl_2$ in the reaction, $SnCl_2 + Cl_2 \longrightarrow SnCl_4$ is :
a) 49 b) 95
c) 45 d) 59

56. $C_2H_6(g) + nO_2 \longrightarrow CO_2(g) + H_2O(r)$
In this equation, ratio of the coefficients of CO_2 and H_2O is
Ratio of the coefficient of CO_2 and H_2O is 4: 6 and 2: 3.
a) 1:1 b) 2: 3
c) 3:2 d) 1:3

57. Which one of the following reaction is possible at anode?
a) $F_2 + 2e^- \longrightarrow 2F^-$ b) $2H^+ + \frac{1}{2}O_2 + 2e^- \longrightarrow H_2O$
c) $2Cr^{3+} + 7H_2O \longrightarrow Cr_2O_7^{2-} + 14H^+ + 6e^-$ d) $Fe^{2+} \longrightarrow Fe^{3+} + e^-$

58. In the following reaction
$M^{x+} + MnO_4 \quad MO_3 + Mn^{2+} + \frac{1}{2}O_2$,
If one mole of MnO_4 oxidises 2.5 moles of M^{x+} then the value of x is
a) 5 b) 3
c) 4 d) 2

59. What volume of 0.1 M $KMnO_4$ is needed to oxidise 100 mg of FeC_2O_4 in acidic solution?
a) 4.1 mL b) 8.2 mL
c) 10.2 mL d) 4.6 mL

60. Which of the following acts as both an oxidizing as well as reducing agent?
a) HNO_3 b) HNO_2
c) HI d) H_2SO_4

61. In which among the following compounds, oxidation number of nitrogen is +5?
a) N_2O b) N_2O_3
c) NO_2 d) HNO_3

62. When the ion $Cr_2O_7^{2-}$ acts as an oxidant in acidic aqueous solution the ion $Cr^{3+}$is formed. How many mole of Sn^{2+} would be oxidised to Sn^{4+} by one of $Cr_2O_7^{2-}$ ions?
a) 2/3 b) 3/2
c) 2 d) 3

63. Oxidation states of the metal in the minerals haematite and magnetite, respectively, are
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

64. The coefficients of I^-, $IO_3^-$and H^+in the balanced redox reaction, $I^- + IO_3^- + H^+ \longrightarrow I_2 + H_2O$; are respectively
a) 5, 1, 6 b) 1, 5, 6
c) 6, 1, 5 d) 5, 6, 1

65. When $K_2Cr_2O_7$ is converted into K_2CrO_4, the change in oxidation number of chromium is
a) 0 b) 5
c) 7 d) 9

66. What is the oxidation number of gold in the complex $[AuCl_4]^{1-}$?
a) +4 b) +3
c) +2 d) +1

67. Which one of the following cannot acts as a reducing agent?
a) CO_2 b) SO_2
c) NO_2 d) ClO_2

68. Nitric oxide acts as a reducing agent in the reaction
a) $4NH_2 + 5O_2 \longrightarrow 2NO + 6H_2O$ b) $2NO + 3H_2 + 4H_2O \longrightarrow 2NO_5^- + 6I + 8H^+$
c) $2NO + H_2SO_3 \longrightarrow N_2O + H_2SO_4$ d) $2NO + H_2S \longrightarrow N_2O + S + H_2O$

69. What weight of HNO_3 is needed to convert 5 g I_2 into HIO_3, $HNO_3 \longrightarrow NO$?
a) 4.13 g b) 24.8 g
c) 6.2 g d) 10.2 g

70. In which of the following reaction, oxidation number of Cr has been affected?
a) $2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$ b) $Cr_2O_5^{2-} + 2OH \longrightarrow 2CrO_4^{2-} + H_2O$
c) $(NH_4)_2Cr_2O_7 \longrightarrow N_2 + Cr_2O_3 + 4H_2O$ d) $CrO_2Cl_2 + 2OH \longrightarrow CrO_2^{2-} + 2HCl$

71. In the compounds $KMnO_4$ and $K_2Cr_2O_7$, the highest oxidation state is of the element
a) Mn b) K
c) O d) Cr

72. Volumetric estimation of $CuSO_4$ using hypo as intermediate solution along with KI solution and starch as indicator is an example of :
a) Redox titration b) Acid-base titration
c) Precipitation titration d) None of these

73. What volume of 2N $K_2Cr_2O_7$ solution is required to oxidise 0.81 g of H_2S in acidic

medium?

a) 47.8 mL b) 23.8 mL

c) 40 mL d) 72 mL

74. Corrosion of iron is :

a) Redox process b) Neutralization process

c) Precipitation process d) None of these

75. White phosphorus reacts with caustic soda, the products are PH_3 and NaH_2PO_2. This reaction is an example of

a) Oxidation b) Reduction

c) Disproportionation d) Neutralisation

76. In which of the following reactions, hydrogen is acting as an oxidising agent?

a) With Li to form LiH b) With I_2 to give HI

c) With S to give H_2S d) None of the above

77. The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is

a) +3 b) +2

c) +6 d) +4

78. Which of the following reaction involves oxidation and reduction?

a) $NaBr + HCl \longrightarrow NaCl + HBr$ b) $HBr + AgNO_3 \longrightarrow AgBr + HNO_3$

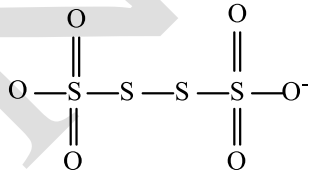
c) $H_2 + Br_2 \longrightarrow 2HBr$ d) $Na_2O + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O$

79. In which of the following reactions, H_2O_2 acts as a reducing agent?

a) $HOCl + H_2O_2 \xrightarrow{H^+} H_3O^+ + Cl^- + O_2$ b) $Mn^{2+} + H_2O_2 \xrightarrow{OH^+} Mn^{4+} + 2OH^-$

c) $2Fe^{2+} + H_2O_2 \xrightarrow{OH^-} 2Fe^{3+} + 2OH^-$ d) $PbS(s) + 4H_2O_2(aq) \xrightarrow{H^+} PbSO_4 4H_2O(t)$

80. The oxidation state of S-atoms in $S_4O_8^{2-}$ from left to right are respectively



a) +3, +1, +1, +3 b) +4, +1, +1, +4

c) +5, 0, 0, +5 d) +6, 0, 0, +6

81. Hot concentrated sulphuric acid is a moderately strong oxidising agent. Which of the following reaction does not show oxidising behaviour?

a) $Cu + 2H_2SO_4 \longrightarrow CuSO_4 + SO_2 + 2H_2O$ b) $3\,S + 2H_2SO_4 \longrightarrow 3SO_2 + 2H_2O$

c) $C + 2H_2SO_4 \longrightarrow CO_2 + 2SO_2 + 2H_2O$ d) $CaF_2 + H_2SO_4 \longrightarrow CaSO_4 + 2HF$

82. The equivalent weight of iron in Fe_2O_3 would be :

a) 18.6 b) 28

c) 56 d) 11

83. 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) None of these

84. For the redox reaction,

$Zn + NO_3^- \longrightarrow Zn^{2+} + NH_4^+$

In basic medium, coefficients of Zn, NO_3^- and OH^- in the balanced equation are respectively.

a) 7,4,1 b) 4,1,10

c) 1,4,10 d) 4,1,7

85. Cerric ammonium sulphate and potassium permanganate are used as oxidising agents in acidic medium for oxidation of ferrous ammonium sulphate to ferric sulpahte. 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

86. In the reaction, $SO_2 + 2H_2S \rightarrow 3S + 2H_2O$ the substance that oxidizes is,

a) H_2S b) SO_2

c) S d) H_2O

87. The couple having oxidised and reduced forms of a substance taking part in an oxidation or reduction half-reaction is called

a) redox couple b) oxidised couple

c) reduced couple d) None of the above

88. Amount of oxalic acid present in a solution can be determined by its titration with $KMnO_4$ solution in the presence of H_2SO_4. The titration gives unsatisfactory result when carried out in the presence of HCl, because HCl :

a) Oxidises oxalic acid to carbon dioxide and water b) Gets oxidized by oxalic acid to chlorine

c) Furnishes H^+ ions in d) Reduces

addition to those from oxalic acid

permanganate to Mn^{2+}

89. Oxidation number of sulphur in Caro's acid is
a) +6 b) +4
c) +8 d) +7

90. Both oxidation and reduction takes place in
a) $NaBr + HCl \longrightarrow NaCl + HBr$
b) $HBr + AgNO_3 \longrightarrow AgBr + HNO_3$
c) $H_2 + Br_2 \longrightarrow 2HBr$
d) $CaO + H_2SO_4 \longrightarrow CaSO_4 + H_2O$

91. In the reduction of dichromate by Fe (II), the number of electrons involved per chromium atom is :
a) 3 b) 1
c) 2 d) 4

92. In an experiment 50 mL of 0.1 *M* solution of a salt reacted with 25 mL of 0.1 *M* solution of sodium sulphite. The half equation for the oxidation of sulphite ion is :
$SO_3^{2-}(aq) + H_2O(l) \longrightarrow SO_4^{2-}(aq) + 2H^+(aq) + 2e^-$
If the oxidation number of metal in the salt was 3, what would be the new oxidation number of metal?
a) Zero b) 1
c) 2 d) 4

93. What weight of HNO_3 is required to make 1 litre of 2 *N* solution to be used as an oxidising agent in the reaction? $3Cu + 8HNO_3 \longrightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$
a) 63 g b) 21 g
c) 42 g d) 84 g

94. Starch gives blue colour with :
a) KI b) I_2
c) Cl_2 d) None of these

95. In the equation, $SnCl_2 + 2HgCl_2 \longrightarrow Hg_2Cl_2 + SnCl_4$. The equivalent weight of stannous chloride (molecular weight = 190) will be :
a) 190 b) 95
c) 47.5 d) 154.5

96. A good indicator must possess the following characteristics :
a) The colour change should be sharp
b) The colour change should be clear
c) It must be sensitive to the equivalent point
d) All of the above

97. The oxidation number of xenon in $XeOF_2$ is
a) Zero b) 2
c) 4 d) 3

98. 25 mL of 0.50 *M* H_2O_2 solution is added to 50 mL of 0.20 *M* $KMnO_4$ in acidic solution. Which of the following statements is true?
a) 0.010 mole of oxygen is liberated
b) 0.005 mole of $KMnO_4$ are left
c) 0.030 g atom of oxygen gas is evolved
d) 0.0025 mole H_2O_2 does not react with $KMnO_4$

99. In the titration of $CuSO_4$ *vs*. Hypo in presence of KI, which statement is wrong?
a) It is iodometric titration
b) I_2 with starch gives blue colour
c) $CuSO_4$ is reduced to white Cu_2I_2 during redox change
d) The solution before titration, on addition of KI appears blue

100. Choose the disproportionation reaction among the following redox reactions.
a) $3Mg(s) + N_2(g) \longrightarrow Mg_3N_2(s)$
b) $P_4(s) + 3NaOH(aq) + 3H_2O(l) \rightarrow PH_3(g) + 3NaH_2PO_2(aq)$
c) $Cl_2(g) + 2KI(aq) \longrightarrow 2KCl(aq) + I_2(s)$
d) $Cr_2O_3(s) + 2Al(s) \longrightarrow Al_2O_3(s) + 2Cr(s)$

101. The value of n in the following equation is
$Cr_2O_7^{2-} + 14H^+ + nFe^{2+} \longrightarrow 2Cr^{3+} + nFe^{3+} + 7H_2O$
a) 4 b) 3
c) 7 d) 6

102. Equivalent mass of $Na_2S_2O_3$ in its reaction with I_2 is equal to :
a) Molar mass b) Molar mass / 2
c) Molar mass / 3 d) Molar mass / 4

103. 1 mole of chlorine combines with a certain weight of a metal giving 111 g of its chloride. The atomic weight of the metal (assuming its valency to be 2) is :
a) 40 b) 20
c) 80 d) None of these

104. 100 mL of 0.1 *M* solution of a reductant is diluted to 1 litre, which of the following changes?
a) Molarity b) Millimole
c) Milliequivalent d) None of these

105. The oxidation state of a metal in a compound is represented according to the notation which is known as
a) Alfred stock b) German stock
c) Stock notation d) Haworth stock

106. Titre value is the volume of titrant used for a

definite amount of unknown reagent at its :

a) Equivalence point b) End point

c) Neutralization point d) All of these

107. 2 mole of $FeSO_4$ are oxidized by $'X'$ mole of $KMnO_4$ whereas 2 mole of FeC_2O_4 are oxidized by $'Y'$mole of $KMnO_4$. The ration f $'X'$ and $'Y'$ is :

a) 1 : 3 b) 1 : 2

c) 1 : 4 d) 1 : 5

108. A compound contains atoms of three elements A, B and C. If the oxidation number of A is +2, B is +5 and that of C is −2, then possible formula of the compound is

a) $A_2(BC_3)_2$ b) $A_3(BC_4)_2$

c) $A_3(B_4C)_2$ d) ABC_2

109. The coefficients w, x, y, z in the reaction

$wCr_2O_7^{2-} + xFe^{2+} \longrightarrow yCr^{3+} + zFe^{3+} + H_2O$

w x y z

a) 1, 2, 6, 6 b) 6, 1, 2, 4

c) 1, 6, 2, 6 d) 1, 2, 4, 6

110. Which of the following is a redox reaction?

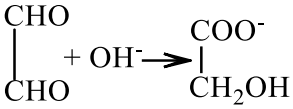
a) $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$

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

c) $Ca(OH)_2 + 2NH_4Cl \rightarrow CaCl_2 + 2NH_3 + 2H_2O$

d) $Zn \rightarrow 2Ag + 2K[Ag(CN)_2] + K_2[Zn(CN)_4]$

111. Consider the following reaction.

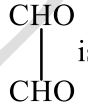


Select the incorrect statement.

a) It is a disproportionation reaction.

b) It is intermolecular redox reaction.

c) $OH^-$is a reducing as well as oxidising agent.

d)  is a reducing as well as oxidising agent.

112. Oxidation state of oxygen in H_2O_2 is

a) −1 b) +2

c) $+\frac{1}{2}$ d) −2

113. In the reaction,

$3Br_2 + 6CO_3^2 + 3H_2O \longrightarrow 5Br^- + BrO_3^- + 6HCO_3^-$

a) bromine is oxidised and the carbonate radical is reduced

b) bromine is reduced and the carbonate radical is oxidised

c) bromine is neither reduced nor oxidised

d) bromine is both reduced and oxidised

114. 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) $2\,K + F_2 \longrightarrow 2KF$

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

115. Which of the following acts as an oxidising as well as reducing agent?

a) Na_2O b) Na_2O_2

c) $NaNO_3$ d) $NaNO_2$

116. In the reaction, $H_2O_2 + Na_2CO_3 \rightarrow Na_2O_2 + CO_2 + H_2O$ the substance undergoing oxidation is

a) H_2O_2 b) Na_2CO_3

c) Na_2O_2 d) None of these

117. The oxidation number of Cr in CrO_5 is

a) +3 b) +5

c) +6 d) 0

118. Arrange the following as increase in oxidation number

(i) Mn^{2+} (ii) MnO_2

(iii) $KMnO_4$ (iv) K_2MnO_4

a) (i)>(ii)>(iii)>(iv) b) (i)<(ii)<(iv)<(iii)

c) (ii)<(iii)<(i)<(iv) d) (iii)>(i)>(iv)>(ii)

119. The number of mole of ferrous oxalate oxidised by one mole of $KMnO_4$ is:

a) 1/5 b) 3/5

c) 2/3 d) 5/3

120. What volume of 0.40 M $Na_2S_2O_3$ would be required to react with the I_2 liberated by adding excess of KI to 50 mL of 0.20 M $CuSO_4$ solution?

a) 12.5 mL b) 25 mL

c) 50 mL d) 2.5 mL

121. The number of mole of oxalate ions oxidized by one mole of MnO_4^- ion is:

a) 1/5 b) 2/5

c) 5/2 d) 5

122. How many gram of I_2 are present in a solution which requires 40 mL, of 0.11 N $Na_2S_2O_3$ to react with it, $S_2O_3^{2-} + I_2 \longrightarrow S_4O_6^{2-} + 2I^-$?

a) 12.7 g b) 0.558 g

c) 25.4 g d) 11.4 g

123. Titration of KI with H_2O_2 in presence of acid is a :

a) Clock reaction b) Redox reaction

c) Intermolecular redox d) All of these

124. In the reaction, $VO + Fe_2O_3 \longrightarrow FeO + V_2O_5$. The eq.wt. of V_2O_5 is equal to its :

a) mol. wt. b) mol. wt./8
c) mol. wt./6 d) None of these

125. What is the oxidation state of P in $Ba(H_2PO_2)_2$?
a) $+1$ b) $+2$
c) $+3$ d) -1

126. 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
a) $+5$ b) $+3$
c) $+6$ d) -10

127. MnO_4^- is a good oxidising agent in different medium changing to
$MnO_4^- \longrightarrow Mn^{2+} \longrightarrow MnO_4^{2-} \longrightarrow MnO_2$
Changes in oxidation number respectively, are
a) 1, 3, 4, 5 b) 5, 4, 3, 2
c) 5, 1, 3, 4 d) 2, 6, 4, 3

128. Which of the following is the example of a disproportionation reaction?
a) $CaCO_3 \longrightarrow CaO + CO_2$ b) $2HCuCl_2 \longrightarrow Cu + Cu^{2+} + 4Cl^- + 2H^+$
c) $PCl_5 \longrightarrow PCl_3 + Cl_2$ d) $2H_2S + SO_2 \longrightarrow 3S + 2H_2O$

129. $Cl_2 + H_2S \longrightarrow 2HCl + S$ In this reaction, oxidation state of chlorine changes from
a) zero to -1 b) 1 to zero
c) zero to 1 d) remains unchanged

130. The eq. wt. of K_2CrO_4 as an oxidising agent in acid medium is :
a) (mol. wt.)/2 b) (2 × mol. wt.)/3
c) (mol. wt.)/3 d) (mol. wt.)/6

131. The number of electrons lost or gained during the change $Fe + H_2O \rightarrow Fe_3O_4 + H_2$ is
a) 2 b) 4
c) 6 d) 8

132. What weight of $FeSO_4$ (mol. wt. =152) will be oxidised by 200 mL of normal $KMnO_4$ solution in acidic solution?
a) 30.4 g b) 60.8 g
c) 121.6 g d) 15.8 g

133. For redox reaction,
$MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$
coefficient of reactants in balanced states are

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

134. What is the normality of a $KMnO_4$ solution to be used as an oxidant in acid medium, which contain 15.8 g of the compound in 100 mL of solution? Mol. wt. of $KMnO_4$ is 158 :
a) 2 *N* b) 3 *N*
c) 4 *N* d) 5 *N*

135. The eq. wt. of $Na_2S_2O_3$ as reductant, in the reaction, $Na_2S_2O_3 + 5H_2O + 4Cl_2 \longrightarrow 2NaHSO_4 + 8HCl$:
a) (Mol. wt.)/1 b) (Mol. wt.)/2
c) (Mol. wt.)/6 d) (Mol. wt.)/8

136. A substance, that by its sharp colour change indicates the completion of reaction is known as :
a) Acid b) Base
c) Indicator d) None of these

137. NaClO solution reacts with H_2SO_3 as, $NaClO + H_2SO_3 \longrightarrow NaCl + H_2SO_4$
A solution of NaClO used in the above reaction contained 15 g of NaClO per litre. The normality of the solution would be :
a) 0.40 b) 0.20
c) 0.60 d) 0.80

138. The oxidation number of sulphur in S_8 molecule is
a) 6 b) 0
c) 2 d) 3

139. The equivalent weight of $KMnO_4$ (acidic medium) is (at. wt. of K = 39; Mn = 55) :
a) 158 b) 15.8
c) 31.6 d) 3.16

140. In which of the following transformations, oxygen is not the reducing agent?
a) $Ag_2O \longrightarrow 2Ag + \frac{1}{2}O_2$ b) $4NH_3 + 3O_2 \longrightarrow 2N_2 + 6H_2O$
c) $2F_2 + 2H_2O \longrightarrow 4HF + O_2$ d) $2AgNO_3 + H_2O_2 \longrightarrow 2Ag + 2HNO_3 + O_2$

141. The oxidation state of Fe in Fe_3O_4 is
a) $+3$ b) 8/3
c) $+6$ d) $+2$

142. Given, $xNa_2HAsO_3 + yNaBrO_3 + zHCl \longrightarrow NaBr + H_3AsO_4 + NaCl$
The value of x, y and z in the above redox reaction respectively are
a) 2,1,2 b) 2,1,3
c) 3,1,6 d) 3,1,4

143. The equivalent weight of a reductant or an oxidant is given by :
a) $= \frac{\text{mol. weight of red}}{\text{no. of electrons l}}$ b) Eq. wt. $= \frac{\text{mol. wt.}}{\text{valence}}$
Eq. wt. $= \frac{\text{1 molecule of rec}}{}$
c) $= \frac{\text{mol. wt}}{\text{total charge on cati}}$ d) All of the above

144. Titrations in which I_2 solution is used as

intermediate are known as ....titrations.

a) Iodometric b) Iodimetric

c) Acidimetric d) alkalimetric

145. M is the molecular weight of $KMnO_4$. The equivalent weight of $KMnO_4$ when it is converted into K_2MnO_4 is :

a) M b) $M/3$

c) $M/5$ d) $M/7$

146. The oxidation state of two sulphur atoms in $H_2S_2O_8$

a) -6 b) -2

c) $+6$ d) -4

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

a) 3,2 b) 1,0

c) 0,1 d) $-0.33, -1$

148. The ratio of amounts of H_2S needed to precipitate all the metal ions from 100 mL 1M $AgNO_3$ and 100 mL of 1M $CuSO_4$ is :

a) 1 : 2 b) 2 : 1

c) Zero d) infinite

149. When $KMnO_4$ as oxidising agent and ultimately forms MnO_4^{2-}, Mn_2O_3 and Mn^{2+}, the number of electrons transferred per mole of $KMnO_4$ each case respectively is :

a) 4, 3, 1, 5 b) 1, 5, 3, 7

c) 1, 3, 4, 5 d) 1, 3, 8, 5

150. The oxidation states of iodine in HIO_4, H_3IO_5 and H_5IO_6 are respectively

a) +1,+3,+7 b) +7,+7,+3

c) +7,+7,+7 d) +7,+5,+3

151. For the reaction : $N_2 + 3H_2 \longrightarrow 2NH_3$; if E_1 and E_2 are equivalent masses of NH_3 and N_2 respectively, then $E_1 - E_2$ is :

a) 1 b) 2

c) 3 d) 4

152. A chemical balance used normally for weighing in laboratory can weigh upto a least count of :

a) 0.0001 g b) 0.001 g

c) 0.0002 g d) 0.002 g

153. In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$ is :

a) (molecular weight)/2 b) (molecular weight)/6

c) (molecular weight)/3 d) Same as molecular weight

154. In the equation ,

$CrO_4^{2} + SO_3^{2} \qquad Cr(OH)_4 + SO_4^{2}$

the oxidation number of Cr changes from

a) 6 to 4 b) 6 to 3

c) 8 to 4 d) 4 to 3

155. Oxidation state of nitrogen in nitric oxide is

a) +2 b) +3

c) +2 d) -2

156. Select the correct statement about the following reaction,

$CH_4^{+} + NO_2^{-} \longrightarrow N_2 + 2H_2O$

a) Oxidation number of N has changed from -2 to $+2$

b) Oxidation number of N in NH_4^+ changed from -3 to 0 and that in NO_2^- changed from $+3$ to 0 .

c) Oxidation number of N in in NH_4^+ changed from $+1$ to 0 and that in NO_2^- changed trom -1 to 0.

d) No change in oxidation number.

157. Equivalent mass of oxidizing agent in the reaction is.

$SO_2 + 2H_2S \longrightarrow 3S + 2H_2O$

a) 32 b) 64

c) 16 d) 8

158. During a redox titration involving a solution containing Fe^{2+} ions against MnO_4^- in the presence of excess of H^+ ions, the number of electrons that gets transferred is

a) 6 b) 5

c) 4 d) 2

159. Milliequivalent of a solute in a solution can be given by:

a) $Mz_{eq.} = M \times V_{\text{in mL}}$ b) $M_{eq}. = N \times V_{\text{in mL}}$

c) $Mz_{eq.} = \frac{\text{wt}}{\text{Eq.wt.}} \times 1000$ d) Both (b) and (c)

N.B.Navale

Date : 01.04.2025
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CHEMISTRY

3.REDOX REACTION,REDOX REACTIONS

: ANSWER KEY :

1)	a	2)	a	3)	b	4)	d
5)	d	6)	b	7)	c	8)	b
9)	b	10)	a	11)	c	12)	a
13)	c	14)	d	15)	a	16)	a
17)	b	18)	b	19)	d	20)	b
21)	b	22)	b	23)	b	24)	c
25)	c	26)	d	27)	c	28)	a
29)	b	30)	d	31)	d	32)	d
33)	d	34)	c	35)	a	36)	b
37)	a	38)	a	39)	b	40)	d
41)	a	42)	a	43)	b	44)	c
45)	a	46)	b	47)	b	48)	a
49)	a	50)	b	51)	b	52)	c
53)	d	54)	a	55)	b	56)	b
57)	d	58)	b	59)	a	60)	b
61)	d	62)	d	63)	d	64)	a
65)	a	66)	b	67)	a	68)	b
69)	a	70)	c	71)	a	72)	a
73)	b	74)	a	75)	c	76)	a
77)	a	78)	c	79)	a	80)	c
81)	d	82)	a	83)	b	84)	b
85)	a	86)	a	87)	a	88)	d
89)	a	90)	c	91)	a	92)	c
93)	c	94)	b	95)	b	96)	d
97)	c	98)	b	99)	d	100)	b
101)	d	102)	a	103)	c	104)	a
105)	c	106)	d	107)	a	108)	b
109)	c	110)	d	111)	c	112)	a
113)	d	114)	d	115)	d	116)	d
117)	c	118)	b	119)	d	120)	b
121)	c	122)	b	123)	d	124)	c
125)	a	126)	c	127)	c	128)	b
129)	a	130)	c	131)	d	132)	a
133)	a	134)	d	135)	d	136)	c
137)	a	138)	b	139)	c	140)	b
141)	b	142)	c	143)	a	144)	b
145)	a	146)	c	147)	d	148)	a
149)	c	150)	c	151)	a	152)	c
153)	b	154)	b	155)	a	156)	b
157)	c	158)	b	159)	d		

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CHEMISTRY

3.REDOX REACTION,REDOX REACTIONS

: HINTS AND SOLUTIONS :

Single Correct Answer Type

1 **(a)**

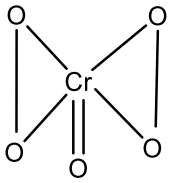
Oxidation number of hydrogen is always +1 is a wrong rule since, it is +1 in hydrogen halides, −1 in hydrides and zero in H_2 molecule.

All the other three statements (b), (c) and (d) are correct.

2 **(a)**

CN^- is reducing and complexing agent.

3 **(b)**



It is chromium peroxide.

Let the oxidation number of Cr is ''''x''''.

$Cr^{x+} + O_2^- + O^{2-} + O_2^- - CrO_5$

$x + (-1)2 + (-1)2 + (-2)1 = 0$

$x - 6 = 0$

$x = +6$

Hence, the oxidation state of Cr is +6.

4 **(d)**

$3e + Mn^{7+} \longrightarrow Mn^{4+}$

$\therefore M = N/\text{Valence factor} = 0.6/3 = 0.2$

5 **(d)**

It is precipitation reaction.

6 **(b)**

Meq. of H_2O_2 = Meq. of $KMnO_4$

$\frac{w}{34/2} \times 1000 = 10 \times 1$

$\therefore w_{H_2O_2} = 0.17$

$\therefore$ Per cent purity $= \frac{0.17}{0.2} \times 100 = 85\%$

7 **(c)**

Let the oxidation number of Cr be x

$\therefore$ For $K_2Cr_2O_7$

$+1 \times 2 + 2x + 7(-2) = 0$

$2 + 2x - 14 = 0$

$2x = 12$

$x = 6$

8 **(b)**

$A^{n-} \longrightarrow A^{a+} + (a+n)e$

$Cr_2^{6+} + 6e \longrightarrow 2Cr^{3+}$

Also, Meq of A = Meq. of $K_2Cr_2O_7$

$3.26 \times 10^{-3}(a+n) = 1.68 \times 10^{-3} \times 6$

Or $a + n = 3$

$\therefore \quad a = 3 - n$

9 **(b)**

Oxidation number of As = +3.

H_3AsO_3

Let oxidation state of As = x

We know that, oxidation number of H = +1, O = −2

Putting the values in formula,

(1) $3 + x + (-2)3 = 0$

$3 + x - 6 = 0$

$\Longrightarrow x = +3$

10 **(a)**

In basic medium

$2KMnO_4 + 2KOH \longrightarrow 2K_2MnO_4 + H_2O + O$

Net reaction is $\overset{+7}{MnO_4^-} \longrightarrow \overset{+6}{MnO_4^{-2}}$

Change in oxidation number

$=7-6 = +1$

So, electrons involved $=1e^-$

11 **(c)**

$I_2^0 \longrightarrow 2I^{5+} + 10e$

$\therefore \quad E = \frac{M}{10} = \frac{254}{10} = 25.4$

13 **(c)**

Let the oxidation number of Cr in $K_2Cr_2O_7$ be x.

Oxidation number of O = −2, K = +1

$\therefore 2 \times 1 + 2x + 7(-2) = 0$

$2x = 12; x = +6$

14 **(d)**

$S \xrightarrow{O_2} SO_2 \xrightarrow{Cl_2} SO_4^{2-} \xrightarrow{BaCl_2} BaSO_4$One mole of S will

give one mole of $BaSO_4$. Thus, mole of $BaSO_4$ formed = mole of S = $\frac{8}{32} = \frac{1}{4}$

15 **(a)**

By using Stock-notation, the given compounds can be represented as,

$FeO \longrightarrow Fe(\text{ (II) } O$

$Fe_2O_3 \longrightarrow Fe_2(\text{ III) } O_3$

$CuO \longrightarrow Cu(II)O$

$MnO_2 \longrightarrow Mn(IV)O_2$

where, II, III, II, IV represent oxidation states of metals,

Fe(in FeO), Fe(in Fe_2O_3), Cu(in CuO) and

Mn (in MnO_2) respectively,

16 **(a)**

Meq. of lime stone = Meq. of CaC_2O_4

= Meq. of $KMnO_4$

= Meq. Of CaO

$\therefore 40 \times 0.250 = \frac{w}{56/2} \times 1000$

$\therefore w_{CaO} = 0.28$

$\therefore$ per cent of CaO = $\frac{0.28 \times 100}{0.518} = 54\%$

17 **(b)**

$I_2^0 \longrightarrow 2I^- + 2e$

18 **(b)**

The oxidation state of Xe in both XeO_2 and XeF_4 is 4.

XeO_2	XeF_4
$x + 2(-2) = 0$	$x + 4(-1) = 0$
$x = 4$	$x = 4$

20 **(b)**

$NO_3^- \longrightarrow NH_4^+$ or $N^{5+} + 8e \longrightarrow N^{3-}$

Thus, Eq. wt. of $NO_3^- = \frac{62}{8}$

21 **(b)**

Let, the oxidation state of sulphur in $H_2\ S_2O_7$ be x.

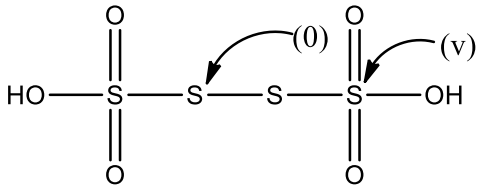
$\therefore\ 2(+1) + 2(x) + 7(-2) = 0$

$2 + 2x - 14 = 0$

$2x = 12, x = +6$

22 **(b)**

$Na_2S_4O_6$ is salt of $H_2S_4O_6$ which has the following structure



⇒ Difference in oxidation number of two types of sulphur = 5

23 **(b)**

$le + Mn^{7+} \longrightarrow Mn^{6+}$

$\therefore E = M/1$

24 **(c)**

$Mn^{7+} + 5e \longrightarrow Mn^{2+}$

$C_2^{3+} \longrightarrow 2C^{4+} + 2e$

25 **(c)**

$Mn^{7+} + 5e \longrightarrow Mn^{2+}$

$FeC_2O_4 \longrightarrow Fe^{3+} + 2CO_2 + 3e$

26 **(d)**

Steam (H_2O) is reduced to hydrogen by iron

27 **(c)**

$6e + Cr_2^{6+} \longrightarrow 2Cr^{3+}$;

Eq. wt. of Cr = $\frac{\text{at. wt.}}{3}$

28 **(a)**

A measuring flask has a definite volume.

29 **(b)**

$BiO_3^- + 6H^+ + 2e^- \longrightarrow Bi^{3+} + 3H_2O$

$x = 2$

30 **(d)**

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

$(2I^- \longrightarrow I_2 + 2e^-) \times 3$

$Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 2Cr^{3+} + 7H_2O + 3I_2$

Hence, number of moles of I_2produced =3

31 **(d)**

Since, charge is not balanced for both the sides, on solving we got :

$14H^+ + Cr_2O_7^{2-} + 6l^- \longrightarrow 3I_2 + 2Cr_2^{3+} + 7H_2O$

Now, charge on LHS = charge on RHS

All ions are balanced.

32 **(d)**

$\overset{+7}{Mn}\ O_4\text{-}1\ (aq) + Br\text{-}1\ (aq) \longrightarrow \overset{+4}{MnO2(s)} + Br\ O_3^{-1}\ (aq)$

In the above reaction, oxidation number of Mn in MnO_4^{-1}(aq) decreases from +7 to +4 in MnO_2(s) and oxidation number of Br increase from −1 (in Br $^-$(aq) to +5 (in BrO_3^{-1}(aq)). Thus, the correct option is (d).

33 **(d)**

(a) $\overset{+1\ -1}{Na\ Cl} + \overset{+1\ -1}{K\ NO_3} \longrightarrow \overset{+1\ -1}{Na\ NO_3} + \overset{+1-1}{K\ Cl}$

(b) $\overset{+2\ -2}{Ca\ C_2O_4} + \overset{+1\ -1}{2HCl} \longrightarrow \overset{+2\ -1}{Ca\ Cl_2} + \overset{-2}{H_2C_2O_4}$

(c) $\overset{+2\ -1}{Ca(OH)_2} + \overset{-3+1\ -1}{2NH_4Cl} \longrightarrow \overset{+2\ -1}{Ca\ Cl_2} + \overset{-3}{2NH_3} + \overset{+1\ -2}{2H_2O}$

In all these cases during reaction, there is no change in oxidation state of ion or molecule or constituent atom, these are simply ionic reactions.

$2K[Ag(CN)_2] + Zn \rightarrow 2Ag + K_2[Zn(CN)_4]$

$Ag^+ \rightarrow Ag$ gain of e^-, redaction

$Zn \rightarrow Zn^{+2}$ loss of e^-, oxidation.

34 **(c)**

Electrons released at anode = Electrons used at cathode.

35 **(a)**

N_3H (hydrazoic acid)

$+3(x) + 1 = 0$

$3x + 1 = 0$

$x = -\frac{1}{3}$

36 **(b)**

$2I^{7+} + 14e \longrightarrow (I^0)_2$

$E_{IO_4^-} = \frac{M}{7}$

37 **(a)**

Writing the oxidation number of Cr, Cl and Mn on each species in the four set of ions, then,

(a) $CrO_2^{+3}, ClO_3^+, CrO_4^{2-}, MnO_4^{+7}$

(b) $ClO_3^-, CrO_4^{2-}, \overset{+7}{MnO_4^-}, CrO_2^-$

(c) $CrO_2^+, ClO_3^-, MnO_4^-, CrO_4^{2-}$

(d) $CrO_4^{2-}, MnO_4^-, CrO_2^-, ClO_3^{3-}$

38 **(a)**

$N^{3-} \longrightarrow N^{2+} + 5e$

$\therefore E_{NH_3} = \frac{17}{5}$

39 **(b)**

It is definition of volumetric analysis.

41 **(a)**

Recrease in ON (Reduction)

$\overset{1}{Ag_2O} + H_2\overset{-1}{O_2} \rightarrow \overset{0}{2Ag} + \overset{0}{H_2O} + O_2$

Increase in ON (Oxidation)

The oxidation number of O in H_2O_2 increases.

Hence,

H_2O_2 acts as a reducing agent as it is undergoing oxidation.

42 **(a)**

Oxidation number of Mn in MnO_4^{2-} ion is +6.

MnO_4^{2-}

Let, oxidation of Mn $= x$

We know that,

oxidation state of $O = -2$;

Putting the value in formula,

$x + 4(-2) = -2$

$x - 8 = -2$

$x = -2 + 8 = +6$

43 **(b)**

Meq. of K^+ = Meq. of $KMnO_4$

$= \frac{1}{5} \times 1000 = 200$

$\therefore$ Eq. of $K^+ = \frac{200}{1000} = 0.2$

Also, mole of $K^+ = \frac{0.2}{5}\left[\overset{\text{Valence factor} = 5}{Mn^{7+} + 5e \longrightarrow Mn^{2+}}\right] = 0.04$

$\therefore$ No. of $K^+ = \frac{0.2}{5} \times 6.023 \times 10^{23} = 2.4 \times 10^{22}$

44 **(c)**

$\overset{+4}{N}O_2 + OH^- \rightarrow \overset{+5}{N}O_3^- + \overset{+3}{N}O_2^- H_2O$

Increase in ON (Oxidation)

$NO_2(g)$ is oxidised to NO_3^- and reduced to NO_2^-.

45 **(a)**

Meq. of Fe = Meq. of $K_2Cr_2O_7$

$\frac{w}{56/1} \times 1000 = 1 \times 0.1055$

$\therefore \quad w = 5.9 \times 10^{-3}\ g = 5.9\ mg$

46 **(b)**

$2e + 2Fe_3^{(8/3)+} \longrightarrow 3Fe_2^{3+}$

$\therefore E_{Fe_3O_4}$

$= \frac{M}{\text{No. of electrons lost or gained by one molecule}}$

$= \frac{M}{1}$

47 **(b)**

The sum of the oxidation states is always zero in neutral compound.

The oxidation state of X, Y, and Z are +2, +5 and -2 respectively.

1. In X_2YZ_6
$2 \times 2 + 5 + 6(-2) \neq 0$
2. In XY_2Z_6
$2 + 5 \times 2 + 6(-2) = 0$
3. In XY_5
$2+5\times 5 \neq 0$
4. In X_3YZ_4
$3 \times 2 + 5 + 4(-2) \neq 0$

Hence, the formula of the compound is XY_2Z_6.

48 **(a)**

It imparts its colour at end point.

49 **(a)**

$$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O \times 2$$
$$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^- \times 5$$
$$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$$

Thus, the coefficients of $MnO^{-}{}_2$, $C_2O_4{}^{2-}$ and H^+ in the above balance equcues respcitively are 2,5,16.

50 **(b)**

The sum of oxidation states of all atoms in a molecule is zero.

Suppose oxidation state of S in $Na_2S_2O_3$ be x.

$\therefore\ 2 \times 1 + 2x + (-2 \times 3) = 0 \Rightarrow 2 + 2x - 6 = 0$

$2x = +4 \Rightarrow x = +2$

51 **(b)**

Let oxidation state of I in $IPO_4 = 'x'$.

$x + (-3) = 0$

(PO_4^{3-} ion has charge equal to -3)

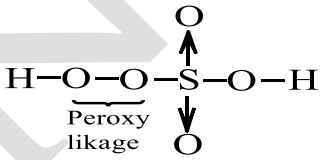
$x = +3$

52 **(c)**

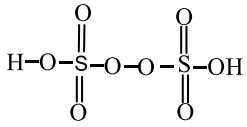
$5I^- + O_3^- + 6H^+ \longrightarrow 3H_2 + 3H_2O$

53 **(d)**

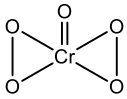
H_2SO_5 (peroxy sulphuric acid)



$H_2S_2O_8$ (peroxy sulphuric acid)



All of the above have oxidation number = 6 in sulphur, peroxy linkage (- o - o -) has -1 oxidation number for oxygen, CrO_5 has two peroxy linkage, thus oxidation number of Cr = +6



$K_2Cr_2O_7$ and CrO_4^{2-} both has +6 oxidation number for Cr.

SO_4^{2-} has +6 oxidation number for S.

54 **(a)**

Meq. of HNO_3 = Meq. of I_2

$$\frac{w}{63/1} \times 1000 = \frac{5}{254/10} \times 1000$$

$\therefore w = 12.4$ g

55 **(b)**

$Sn^{2+} \longrightarrow Sn^{4+} + 2e$

$$\therefore E = M/2 = \frac{119 + 71}{2} = 95$$

56 **(b)**

The balanced equation is

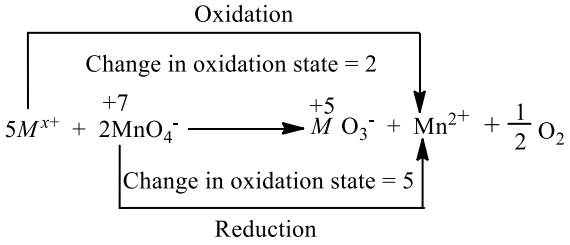
$2C_2H_2 + 5O_2 \longrightarrow 4CO_2 + 6H_2O$

Ratio of the coefficient of CO_2 and H_2O is 4: 6 and 2: 3.

57 **(d)**

Oxidation takes place at anode (c) is not feasible, $i.e.$, Cr^{3+} is not oxidised to $Cr_2O_7^{2-}$ under given conditions. Hence, option (d) is correct.

58 **(b)**



$$x + 2 = 5$$

$\therefore\quad x = 5 - 2 = +3$

59 **(a)**

Meq. of $KMnO_4$ = Meq. of FeC_2O_4

$Fe^{2+}C_2^{2+}O_4 \longrightarrow Fe^{3+} + 2C^{4+}O_2 + 3e$

$$0.1 \times 5 \times V = \frac{100 \times 10^{-3}}{144/3} \times 1000$$

$\therefore\quad V = 4.1$ mL

60 **(b)**

In HNO_2, the oxidation number of N is + 3 which is less than the maximum possible, oxidation number $ie, +5$ and more than the minimum possible oxidation number $ie, -3$, therefore, it can

act both as an oxidizing as well as reducing agent

61 **(d)**

Oxidation number of nitrogen is +5 in HNO_3.

$1 + x + 3(-2) = 0$

$x - 5 = 0$

$x = +5$

62 **(d)**

$[Cr_2^{6+} + 6e \longrightarrow 2Cr^{3+}] \times 1; [Sn^{2+} \longrightarrow Sn^{4+} + 2e] \times 3$

63 **(d)**

Haematite is Fe_2O_3, in which oxidation number of iron is III.

Magnetite is Fe_3O_4 which is infact a mixed oxide ($FeO.Fe_2O_3$.), hence iron is present in both II and III oxidation state.

64 **(a)**

$\overset{-1}{I^-} + \overset{+5}{I}O_3^- + H^+ \longrightarrow \overset{0}{I_2} + H_2O$

$[2I^- \longrightarrow I_2 + 2e^{-2}] \times 5$ ----- (i)

$10e^- + 2\,\overset{+5}{I}O_3^- \longrightarrow \overset{0}{I_2}$ ---------- (ii)

On adding Eqs. (i) and (ii), we get

$10I^- + 2IO_3^- \longrightarrow 6I_2$

To balance O atoms, add $6H_2O$ molecules on RHS and 12 H^+on LHS, then

$10I^- + 2IO_3^- + 12H^+ \longrightarrow 6I_2 + 6H_2O$

or $5I^- + 1O_3^- + 6H^+ \longrightarrow 3I_2 + 3H_2O$

65 **(a)**

Let oxidation state of Cr in $K_2Cr_2O_7 = x$

$(+1 \times 2) + 2x + (-2 \times 7) = 0$

or $+2 + 2x - 14 = 0$

$\therefore \quad x = +6$

Let oxidation state of Cr in $K_2CrO_4 = x$

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

$2 + x - 8 = 0$

$x = 6$

∴ Change in oxidation state of Cr is zero when it changes from

$K_2Cr_2O_7$ to K_2CrO_4.

66 **(b)**

Let x be the oxidation number of gold (Au) in the complex $[AuCl_4]^{-1}$.

$\therefore \quad x + 4(-1) = -1$

$\Rightarrow x = -1 + 4 \Rightarrow x = +3$

Hence, the oxidation number of gold is +3.

67 **(a)**

Reducing agent is one which donates donates electrons

(a) CO_2, oxidation state of carbon in CO_2

is +4 which is the highest oxidation state of carbon.

$\therefore$ CO_2 cannot acts as reducing agent.

(b) SO_2, oxidation state of sulphur in SO_2 is +4.

The highest oxidation state of sulphur is +6.

$\therefore$ SO_2 can acts as reducing agent.

(c) NO_2, oxidation state of nitrogen in NO_2 is +4.

The highest oxidation state of nitrogen is +5.

$\therefore$ NO_2 can acts as reducing agent.

(d) ClO_2, oxidation state of chlorine in ClO_2 is +4.

The highest oxidation state of chlorine is +7.

$\therefore$ ClO_2 can acts as reducing agent.

68 **(b)**

$\mathbf{2\,\overset{+2}{N}O + 3I_2 + 4H_2O \longrightarrow 2\,\overset{+5}{N}O_3^- + 6I^- + 8H^+}$

Hence, NO acts as a reducing agent and reduces I_2 to r^- since,

the oxidation number of nitrogen changes from +2 in NO to +5 in NO_3^-

69 **(a)**

Meq. of HNO_3 = Meq. of I_2

$\frac{w}{63/3} \times 1000 = \frac{5}{254/10} \times 1000$

$\therefore \quad w_{HNO_3} = 4.13$ g

71 **(a)**

Mn has +7 oxidation state in $KMnO_4$.

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

$1 + x - 8 = 0$

$x = +7$

72 **(a)**

$Cu^{2+} + 2I^- \longrightarrow CuI_2 \longrightarrow Cu_2I_2 + I_2$

$I_2 + Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + 2NaI$ (Redox change)

73 **(b)**

Meq. of $K_2Cr_2O_7$ = Meq. of H_2S

$2 \times V = \frac{0.81}{34/2} \times 1000$

$\therefore V = 23.8$ mL

74 **(a)**

Corrosion involves oxidation of species.

75 **(c)**

∵ In this reaction phosphorus is simultaneously oxidised and reduced.

∴ It is disproportionation reation.

$$\overset{0}{P_4} + 3NaOH + 3H_2O \longrightarrow 3Na\overset{+}{H_2}P\overset{-3}{O_2} + PH_3$$

76 **(a)**

$$\overset{0}{Li} + H_2 \longrightarrow 2\overset{+1\ -1}{LiH}$$

Oxidation number of hydrogen is decreasing from 0 to -1. So, H_2 is acting as oxidising agent in this reaction.

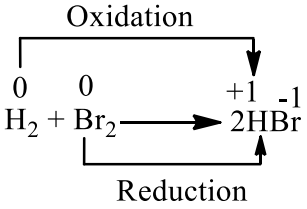
77 **(a)**

$Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 2Cr^{3+} + 7H_2O + 3I_2$

$Cr_2O_7^{2-}$ is reduced to Cr^{3+}.

Thus, final state of Cr is +3. Hence, (a)

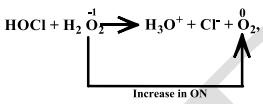
78 **(c)**



Only this reaction involves oxidation and reduction.

79 **(a)**

In the reaction,



Oxidation number of oxygen increases from -1 to 0.

Hence, H_2O_2 acts as reducing agent.

Decrease in ON (reduction)

80 **(c)**

Corner S-atom, +2 each from (= O), +1 from (O^-)

and zero from $-$S. Therefore, its oxidation number is +5.

Middle S atoms has 0 oxidation number.

81 **(d)**

An oxidising agent is a species, which oxidises the other species and gets itself reduced.

(a) $Cu + 2H_2SO_4 \longrightarrow Cu^{+2}SO_4 + SO_2 + 2H_2O$

(b) $3\overset{0}{S} + 2H_2SO_4 \longrightarrow 3\overset{+4}{S}O_2 + 2H_2O$

(c) $\overset{0}{C} + H_2SO_4 \longrightarrow \overset{+4}{C}O_2 + 2SO_2 + 2H_2O$

(d) $Ca^{+2}F_2 + H_2SO_4 \longrightarrow \overset{+2}{C}aSO_4 + 2HF^{-1}$

In reaction (d), oxidation number of elements remains unchanged. Thus, in this reaction, H_2SO_4 does not act as an oxidising agent.

82 **(a)**

Fe_2O_3

∴ Total charge on cation or anion = +6

$Fe_2^{3+}O_3^{2-}$

$\therefore E = \frac{112}{6}\ or \frac{56}{3}$

83 **(b)**

Let the oxidation number of oxygen in following compounds is x.

In OF_2

$x + (-1)2 = 0$

$x = +2$

In KO_2

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

$2x = -1$

$x = -\frac{1}{2}$

In BaO_2

$+2 + (x \times 2) = 0$

$2x = -2$

$x = -1$

In O_3, oxidation number of oxygen is zero because ox free state or in any of its allotropic form is always zero.

Thus, the increasing order of oxidation number is

$BaO_2 < KO_2 < O_3 < OF_2$

$-1 \quad -\frac{1}{2} \quad 0 \quad +2$

84 **(b)**

$4Zn + NO_3^- + 7H_2O \longrightarrow 4Zn^{2+} + NH_4^+ + 10OH^-$

85 **(a)**

$Fe^{2+} + Ce^{4+} \longrightarrow Fe^{3+} + Ce^{3+}$

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

$\therefore \frac{\text{Moles of cerric ammonium sulphate}}{\text{Moles of potassium permanganate}} = \frac{1}{1/5}$

$= 5.0$

86 **(a)**

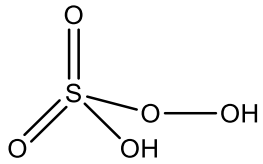
$\overset{-2}{H_2S} \longrightarrow \overset{0}{S}$

The oxidation number of S increases from -2 to 0 in elemental sulphur and hence, H_2S gets oxidized

87 **(a)**
The couple having oxidised and reduced forms of a substances taking part in an oxidation or reduction half-reaction is called a redox couple.

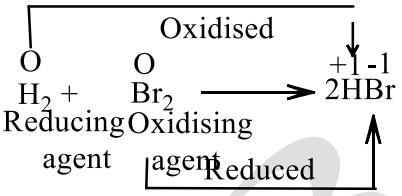
88 **(d)**
HCl is also oxidised along with oxalic acid by $KMnO_4$.
$2KMnO_4 + 16HCl \longrightarrow 2KCl + 2MnCl_2 + 5Cl_2 + 8H_2O$
$2KMnO_4 + 3H_2SO_4 + 5H_2C_2O_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 10CO_2$

89 **(a)**
Caro's acid is H_2SO_5. It has a peroxide linkage so, oxidation state of S is



Let the oxidation state of S is x.
H_2SO_5(one peroxide bond)
$+2 + x + 3(-2) + 1(-2) = 0$
$2 + x - 6 - 2 = 0$
$x - 6 = 0$
$x = 6$

90 **(c)**



H_2 - reducing agent, Br_2 – oxidizing agent agent

91 **(a)**
$Cr_2^{6+} + 6e \longrightarrow 2Cr^{3+}$; $Fe^{2+} \longrightarrow Fe^{3+} + e$

92 **(c)**
Meq. of salt = Meq. Of Na_2SO_3
$50 \times 0.1 \times n = 25 \times 0.1 \times 2$
$\therefore n = 1$ (change in ox. no.)
$\therefore \ M^{3+} + e \longrightarrow M^{2+}$

93 **(c)**
Meq. of $HNO_3 = 1000 \times 2 = 2000$
$\therefore \frac{w}{63/3} \times 1000 = 2000$
$\therefore w = 42$ g

94 **(b)**
Starch + $I_2 \longrightarrow$ Blue

95 **(b)**
$Sn^{2+} \longrightarrow Sn^{4+} + 2e$
$\therefore E = M/2 = \frac{190}{2} = 95$

96 **(d)**
These are characteristics of indicator.

97 **(c)**
Let the oxidation number of Xe is x in $XeOF_2$.
$x + (-2) + 2(-1) = 0$
$x - 2 - 2 = 0$
$x = +4$

98 **(b)**
Meq. of $H_2O_2 = 25 \times 0.5 \times 2 = 25$;
Meq. of $KMnO_4 = 50 \times 0.2 \times 5 = 50$;
$\therefore$ 25 Meq. or 5 milli mole of $KMnO_4$ are left.

99 **(d)**
Addition of KI to $CuSO_4$ makes it dark brown.

100 **(b)**
Oxidation number of P(in P_4) is 0 which is the intermediate of -3 (in PH_3) and $+1$ (in NaH_2PO_2). So, that P_4 is reduced to PH_3 and oxidised to NaH_2PO_2.

101 **(d)**
$Cr_2O_7^{2} + 14H + 6Fe^{2+} \longrightarrow 2Cr^{3+} + 6Fe^{3-} + 7H_2O$

102 **(a)**
$2S_2^{2+} \longrightarrow S_4^{(5/2)+} + 2e \therefore$ Eq. wt. of $Na_2S_2O_3 = \frac{M}{1}$
$I_2^0 + 2e \longrightarrow 2I^-$

103 **(c)**
Eq. of Cl_2 = eq. of chloride
$1 \times 2 = \frac{111}{E + 35.5}$
$\therefore E = 40$
$\therefore M = 40 \times 2 = 80$ (Metal is bivalent.)

104 **(a)**
Milliequivalent $[(W/\text{Eq. wt.}) \times 1000]$ or millimole $\left[\left(\frac{W}{M}\right) \times 1000\right]$ do not change on dilution.

105 **(c)**
The oxidation state of a metal in a compound is represented according to the notation which is known as Stock notation.

106 **(d)**
All terms have same meaning.

107 **(a)**
$Fe^{2+} \longrightarrow Fe^{3+} + e$
$Mn^{7+} + 5e \longrightarrow Mn^{2+}$
5 mole $FeSO_4$ = 1 mole $KMnO_4$
$'X' = \frac{2}{3}$ mole
Or $Fe^{2+} \longrightarrow Fe^{3+} + e$
$(C^{3+})_2 \longrightarrow 2C^{4+} + 2e$

$FeC_2O_4 \longrightarrow Fe^{3+} + 2C^{4+} + 3e$

$Mn^{7+} + 5e \longrightarrow Mn^{2+}$

5 mole FeC_2O_4 = 3 mole $KMnO_4$

$\therefore\ 'Y' = \dfrac{3 \times 2}{5}$

108 **(b)**

Compound formed from A, B and C is that for which sum of oxidation number is zero.

$\underset{+6}{A_3}\ (\underset{+10}{B}\ \underset{-16}{C_4})_2$ correct

109 **(c)**

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

110 **(d)**

(a) $NaCl + KNO_3 \rightarrow NaNO_3^{+1-1} + KCl$

(b) $CaC_2O_4 + 2HCl^{+2} \longrightarrow CaCl_2 + H_2^+C_2O_4$

(c) $Ca(OH)_2 + 3NH_4Cl \longrightarrow CaCl_2 + 2NH_3 + 2H_2O$

In all these cases, during reaction there is no change in oxidation state of ion or molecule or constituent atom, these are simple ionic reactions,

(d) $2\,K[Ag(CN)_2] + Zn \longrightarrow 2Ag + K_2[Zn(CN)_4]$

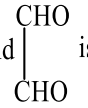
$Ag^+ \longrightarrow Ag$, gain of electron, reduction

$Zn \longrightarrow Zn^2$, loss of electron, oxidation

111 **(c)**

One CHO is oxidised to COO^- and one CHO is reduced to CH_2OH.

Thus, it is a disproportionation reaction. Thus, (a) and (b)

are true and  is reducing as well as oxidising agent

Thus, (d) is also true. Thus, (c) is incorrect.

112 **(a)**

Oxidation state of oxygen in H_2O_2 is -1. -1 is the intermediate oxidation state of oxygen.

113 **(d)**

$\overset{0}{3\,Br_2} + 6CO_2^{2-} + 3H_2O \longrightarrow \overset{-1}{5\,Br^-} + \overset{+5}{BrO_3^-} + 6HCO_3^-$

Br_2 is reduced to Br^- (oxidation number decreases from zero to - 1) and Br_2 is oxidised to BrO_3^- (axidation number increases from zero to +5).

114 **(d)**

Following are the examples of redox reaction,

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

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

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

Option (d) is not an example of redox reaction.

115 **(d)**

$NaNO_2$ (Sodium nitrite) acts both as oxidising as well as reducing agent because in it N-atom is in +3 oxidation state (intermediate oxidation state).

Oxidising property

$2NaNO_2 + 2KI + 2H_2SO_4 \longrightarrow Na_2SO_4 + K_2SO_4 + 2NO + 2H_2O + I_2$

Reducing property

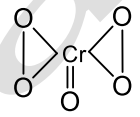
$H_2O_2 + NaNO_2 \longrightarrow NaNO_3 + H_2O$

116 **(d)**

$\overset{-1}{H_2O_2} + \overset{+2\ +4\ -2}{Na_2C\,O_3} \longrightarrow \overset{+1\ -1}{Na_2O_2} + \overset{+4\ -2}{CO_2} + \overset{-2}{H_2O}$

None of the elements changes its oxidation number

117 **(c)**



ie, it has four peroxide bonds each having an oxidation number of -1 and one double bond in which oxidation number of O is -2

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

$\therefore\ x = \times\ 6$

118 **(b)**

. Oxidation state of Mn in $Mn^{2+} = +2$

. Let oxidation state of Mn in $MnO_2 = x$

: $x + (2 \times -2) = 0$

: $x = +4$

(iii) Let the oxidation state of Mn in $KMnO_4 = x$

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

$\therefore\ x = +7$

iv) Let oxidation state of Mn in $K_2MnO_4 = x$

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

$\therefore\ x = +6$

$\therefore$ Increasing order of oxidation states is

(i) < (ii) < (iv) < (*iii*)

119 **(d)**

$[Mn^{7+} + 5e \longrightarrow Mn^{2+}] \times 3$

$[Fe^{2+}C_2^{3+}O_4 \longrightarrow Fe^{3+} + 2C^{4+}O_2 + 3e] \times 5$

120 **(b)**

Meq. of $Na_2S_2O_3$ = Meq. of $CuSO_4$

$\therefore V \times 0.4 \times 1 = 50 \times 0.2 \times 1$

$\therefore V = 25$ mL

121 **(c)**

$[Mn^{7+} + 5e \longrightarrow Mn^{2+}] \times 2$

$[C_2^{3+} \longrightarrow 2C^{4+} + 2e] \times 5$

122 **(b)**

Meq. of I_2 = Meq. of $Na_2S_2O_3 = 40 \times 0.11$

$\therefore \frac{w}{254/2} \times 1000 = 40 \times 0.11$

$w_{I_2} = 0.558$ g

123 **(d)**

The reaction involves :

$H_2O_2 + 2I^- + 2H^+ \longrightarrow I_2 + 2H_2O(l)$

$2Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + 2NaI$

The reaction gives blue colour only after all the $Na_2S_2O_3$ is used. The reaction is carried out with adjusted amount of $Na_2S_2O_3$ so that only a fraction of H_2O_2 and KI reaction occurs before the blue colour of starch—I_2 appears, however the slow redox reaction of H_2O_2—I_2 continues. The appearance of blue colour is like clock alarm and in such reactions time for the appearance of blue colour is noticed. The phenomenon is used in studying rate of reaction. If time taken for blue colour appearance is longer, the reaction is slow and $vice - versa$.

124 **(c)**

$2V^{2+} \longrightarrow V_2^{5+} + 6e$

125 **(a)**

Let oxidation state of P in $Ba(H_2PO_2)_2$ is x, then

$2(+1) + 2[2(+1) + x + 2(-2)] = 0$

$2 + 2(2 + x - 4) = 0$

$2 + 4 + 2x - 8 = 0$

$2 + 2x - 4 = 0$

$2x = 2$

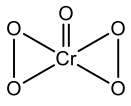
$x = +1$

126 **(c)**

When H_2O_2 is added to an acidified solution of a dichromate, $Cr_2O_7^{2-}$, a deep blue coloured complex, chromic peroxide, CrO_5 [or $CrO(O_2)_2$] is formed.

$$Cr_2O_7^{2-} + 2H^+ + 4H_2O_2 \longrightarrow \underset{\text{Chromic peroxide}}{2CrO(O_2)_2} + 5H_2O$$

This deep blue colored complex has the following structure:



Oxidation state of Cr is +6 due to the presence of two peroxide linkages, which can be calculated as In $CrO(O_2)_2$, let the oxidation state of Cr be x.

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

$x - 6 = 0$

$\Rightarrow x = +6$

127 **(c)**

$\overset{+7}{MnO_4} \longrightarrow Mn^{2+}$ change in oxidation number 5

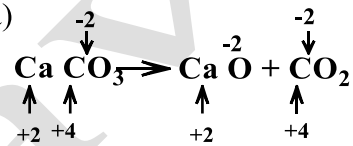
$\longrightarrow MnO_4^{2-}$ change in oxidation number 1

$\longrightarrow \overset{+4}{MnO_2}$ change in oxidation number 3

$\longrightarrow \overset{+3}{Mn_2O_3}$ change in oxidation number 4

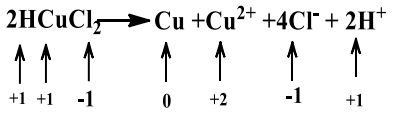
128 **(b)**

(a)



No change in oxidation states.

(b)



Thus, Cu^+ disproportionates to Cu Cu^{2+}.

(c) P is reduced and CI is oxidized.

(d) H_2S is oxidized and SO_2 is reduced.

130 **(c)**

$Cr^{6+} + 3e \longrightarrow Cr^{3+}$

$\therefore E = M/3$

131 **(d)**

$3Fe \rightarrow Fe_3O_4 + 8e^-$ oxidation

$4H_2O + 8e^- \rightarrow 4H_2$

Thus, there are lose of 8 electrons in the reaction

132 **(a)**

Meq. of $FeSO_4$ = Meq. of $KMnO_4 = 200 \times 1$

$\therefore \frac{w}{152/1} \times 1000 = 200$

$\therefore w = 30.4$ g

133 **(a)**

Following is balanced redox reaction.

$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

So, coefficients of
$MnO_4^-, C_2O_4^{2-}$ and H^+ are 2,5, and 16 respectively.

134 **(d)**

$$N = \frac{15.8 \times 1000}{158/5 \times 100} = 5$$

135 **(d)**

$S_2^{2+} \longrightarrow 2S^{6+} + 8e$

136 **(c)**

Indicators are the substances which indicates the completion of a reaction.

137 **(a)**

$2e + Cl^+ \longrightarrow Cl^-$

$$N = \frac{15}{74.5/2 \times 1} = 0.40$$

138 **(b)**

Oxidation number of sulphur is zero in S_8 molecule as it is a monoatomic molecule.

139 **(c)**

$Mn^{7+} + 5e \longrightarrow Mn^{2+}$

$\therefore \ E = M/5$

140 **(b)**

NH_3 is oxidised to N_2 by O_2. Thus, O_2 is an oxidising agent and not a reducing agent.

141 **(b)**

Let the oxidation state of Fe in $Fe_3O_4 = x$

$\therefore 3x + 4 \times (-2) = 0$

Or $\quad 3x - 8 = 0$

$\therefore \quad x = \frac{8}{3}$

142 **(c)**

$3Na_2HAsO_3 + NaBrO_3 + 6HCl \longrightarrow NaBr + 3H_3AsO_4 + 6NaCl$

143 **(a)**

The formula for Eq. wt. of reductant or oxidant.

144 **(b)**

It is definition of iodimetric titrations.

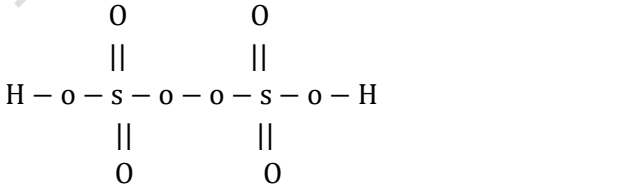
145 **(a)**

$Mn^{7+} + 1e \longrightarrow Mn^{6+}$

$\therefore \ E = M/1$

146 **(c)**

The chemical structure of $H_2S_2O_8$ is as follows



$2 \times (+1) + 2 \times x + 6 \times (-2) + 2 \times (-1) = 0$

(for H, for S, for O, for O—O)

$+2+2x - 12 - 2 = 0$

$2x = +12$

$x = +6$

147 **(d)**

KO_3	**Na_2O_2**
Suppose O.N. of O $= x$	suppose O.N. of O $= x$
$+1 + 3x = 0$	$2 \times 1 + 2x = 0$
$3x = -1$	$2 + 2x = 0$
$x = -\frac{1}{3}$	$2x = -2$
$x = -0.33$	$x = -\frac{2}{2}$
	$x = -1$

148 **(a)**

Meq. of $AgNO_3 = 100 \times 1 - 100$

Meq. of $CuSO_4 = 100 \times 1 \times 2 = 200$

Thus, H_2S is needed in the same Meq. ratio.

149 **(c)**

$Mn^{7+} + e \longrightarrow Mn^{6+} \quad (MnO_4^{2-})$

$Mn^{7+} + 3e \longrightarrow Mn^{4+} \quad (MnO_2)$

$2Mn^{7+} + 8e \longrightarrow (Mn^{3+})_2 \quad (Mn_2O_3)$

$Mn^{7+} + 5e \longrightarrow Mn^{2+} \quad (MnO_2)$

150 **(c)**

The oxidation state of iodine in HIO_4 is + 7 as

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

$x = +7$

The oxidation state of iodine in H_3IO_5 is +7 as

$3 + x + 5(-2) = 0$

$x = +7$

The oxidation state of iodine in H_5IO_6 is +7 as

$5 + x + 6(-2) = 0$

$x = +7$

151 **(a)**

$(N^0)_2 + 6e \longrightarrow 2(N^{3-})$

$3(H^0)_2 \longrightarrow 2(H^{+1})_3 + 6e$

$E_{N_2} = \frac{28}{6}; E_{NH_3} = \frac{17}{3}$

152 **(c)**

The weight of rider used is 0.0002 g.

153 **(b)**

$Cr_2^{6+} + 6e \longrightarrow 2Cr^{3+};$

$$\therefore \text{Eq. wt.} = \frac{\text{mol. wt.}}{6}$$

154 **(b)**

$CrO_4^{2-} + SO_3^{2-} \longrightarrow Cr(OH)_4^- + SO_4^{2-}$

Let the oxidation number of Cr is x in CrO_4^{2-}

$x + 4(-2) = -2$

$x = 6$

and in $Cr(OH)_4^-$ the oxidation number of Cr is y

$y + 4(-2) + 4(1) = -1$

$y - 8 + 4 = -1$

$y = 3$

Hence, oxidation number of Cr changes from +6 to +3.

155 **(a)**

Oxidation state of nitrogen in nitric oxide (NO) is +2.

Molecular formula of nitric oxide = NO

$x - 2 = 0$

$x = +2$

157 **(c)**

$4e + S^{4+} \longrightarrow S^0$

$\therefore \quad E_{SO_2} = \frac{64}{4} = 16$

158 **(b)**

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

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

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

$\therefore$ Five electrons gets transferred.

159 **(d)**

These are formulae of Meq.