SECTION-A

51. Which of the following species can function both as oxidising as well as reducing agent?

(1) Cl^- (2) ClO_4^-

(3) ClO^- (4) MnO_4^-

52. 3.0 moles of an ideal gas is heated at constant pressure from 27°C to 127°C. The work done by the gas in this expansion is:

(1) –2.494 kJ (2) +2.494 kJ

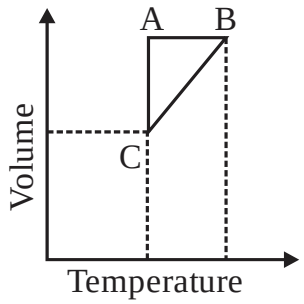
(3) –10.5 kJ (4) +10.5 kJ

53. $2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 5Cl_2 + 8H_2O$ Find n_{factor} of HCl in above reaction.

(1) 1 (2) 16

(3) $\frac{10}{16}$ (4) $\frac{5}{3}$

54. Five moles of a gas is put through a series of changes as shown graphically in a cyclic process the A→B, B →C and C→A respectively are:



(1) Isochoric, isobaric, isothermal

(2) Isobaric, isochoric, isothermal

(3) isothermal, isobaric, isochoric

(4) Isochoric, isothermal, isobaric

55. In which of the following compound, nitrogen exhibits highest oxidation state?

(1) N_2H_4 (2) NH_3

(3) N_3H (4) NH_2OH

56. Match column – I with column – II.

Column-I (Process)		**Column-II (Work done)**	
A	Reversible isothermal process	P	$w = \frac{nR}{\gamma - 1}(T_2 - T_1)$
B	Adiabatic process	Q	$w = -2.303nRT \log\left(\frac{P_1}{P_2}\right)$
C	Irreversible isothermal process	R	$w = -P_{ext}(V_2 - V_1)$
D	Isochoric process	S	w = 0

	A	B	C	D
(1)	Q	P	S	R
(2)	Q	P	R	S
(3)	P	Q	R	S
(4)	S	R	P	Q

57. In the redox reaction,

$MnO_4^- + 8H^+ + 5Br^- \rightarrow Mn^{2+} + 4H_2O + 5/2\,Br_2$

Which one is the reducing agent?

(1) H^+ (2) MnO_4^-

(3) Br^- (4) Mn^{2+}

58. The entropy change in the fusion of one mole of a solid melting at 27°C (latent heat of fusion is 2930 J mol^{-1}) is:

(1) $9.77\,J\,K^{-1}\,mol^{-1}$

(2) $10.73\,J\,K^{-1}\,mol^{-1}$

(3) $2930\,J\,K^{-1}\,mol^{-1}$

(4) $108.5\,J\,K^{-1}\,mol^{-1}$

59. 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: (Mohr's salt - $FeSO_4.(NH_4)_2SO_4.6H_2O$)

(1) 3 (2) 4
(3) 5 (4) 6

60. ΔH° for the reaction $X_{(g)} + Y_{(g)} \rightleftharpoons Z_{(g)}$ is –4.6 kcal, the value of ΔU° of the reaction at 227°C is $\left(R = 2\,cal.mol^{-1}\,K^{-1}\right)$:

(1) –3.6 kcal (2) –5.6 kcal
(3) –4.6 kcal (4) –2.6 kcal

61. The oxidation number of oxygen in KO_3 and Na_2O_2 is:

(1) 3, 2 (2) 1, 0
(3) 0, –1 (4) –0.33, –1

62. In which state matter have highest entropy?

(1) Solid (2) Liquid
(3) Gas (4) Equal in all

63. A metal ion M^{3+} loses 3 electrons, its oxidation number will be:

(1) +3 (2) +6
(3) 0 (4) –3

64. **Assertion:** The heat absorbed during the isothermal expansion of an ideal gas against vacuum is zero**.**

Reason: The volume occupied by the molecules of an ideal gas is zero.

(1) Both assertion and reason are true and reason is the correct explanation of assertion.
(2) Both assertion and reason are true but reason is not the correct explanation of assertion.
(3) Assertion is true statement but reason is false.
(4) Both assertion and reason are false statements.

65. In acidic medium, H_2O_2 changes $Cr_2O_7^{2-}$ to CrO_5 which has (–O–O–) bonds. Oxidation state of Cr in CrO_5 is:

(1) +5 (2) +3
(3) +6 (4) +10

66. Find n_f of P_4 in following reaction.

$P_4 + aq.NaOH \rightarrow PH_3 + NaH_2PO_2$

(1) 1 (2) 2
(3) 3 (4) 4

67. The characteristic oxidation number of atoms in free metals is:

(1) –1 (2) +1
(3) any number (4) 0

68. In an isothermal expansion of an ideal gas. Select correct statement:

(A) There is no change in the temperature of the gas.
(B) There is no change in the internal energy of the gas.
(C) The work done by the gas is equal to the heat supplied to the gas.
(D) The work done by the gas is equal to the change in its internal energy.

(1) A, B and D
(2) B and C
(3) A, B and C
(4) C and D

69. The oxidation state of the underlined elements in the given compound is: $\underline{Ba}Cl_2$

(1) +2 (2) –2
(3) 0 (4) none of these

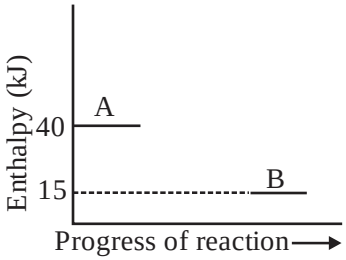
70. Let us consider the solar system as our system and earth is gaining energy from the sun, that energy is called?

(1) Heat
(2) Work
(3) Both heat and work
(4) Neither heat nor work

71. A redox reaction is one in which:

(1) Both the substance are reduced
(2) Both the substance are oxidised
(3) One substance is reduced other is oxidised
(4) All of the above.

72. Look at the following diagram:

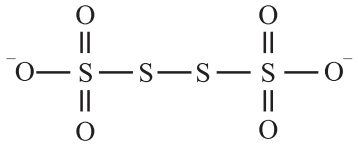


The enthalpy change for the reaction A→B will be:

(1) –25 kJ
(2) –40 kJ
(3) +25 kJ

(4) –65 kJ

73. The oxidation states of S atoms in $S_4O_6^{-2}$ from left to right respectively are:



(1) +6, 0, 0, +6 (2) +3, +1, +1, +3

(3) +5, 0, 0, +5 (4) +4, +1, +1, +4

74. For the isothermal expansion of an ideal gas:
(1) U and H increases.
(2) U increases but H decreases.
(3) H increases but U decreases.
(4) U and H are unaltered.

25. Following reaction describes the rusting of iron,

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

Which the following statements is(are) correct?
(A) This is an example of a redox reaction
(B) Metallic iron is reduced to Fe^{3+}
(C) Fe^{3+} is an oxidizing agent
(D) Metallic iron is reducing agent
(1) A, B and C (2) B, C and D
(3) A, C and D (4) A, B, C and D

76. Find equivalent mass of $KClO_3$ in the following reaction, if M is molar mass of $KClO_3$.

$2KClO_{3(s)} \xrightarrow{\Delta} 2KCl_{(s)}+3O_{2(g)}$

(1) M/2
(2) M/6
(3) M/3
(4) None of these

77. The number of moles of oxalate ions oxidized by one mole of MnO_4^- ion in acidic medium is:
(1) 5/2 (2) 2/5
(3) 3/5 (4) 5/3

78. $S+O_2 \rightarrow SO_2, \quad \Delta H = -298.2\,kJ\,mole^{-1}$

$SO_2+1/2O_2 \rightarrow SO_3, \quad \Delta H = -98.7\,kJ\,mole^{-1}$

$SO_3+H_2O \rightarrow H_2SO_4, \quad \Delta H = -130.2\,kJ\,mole^{-1}$

$H_2+1/2O_2 \rightarrow H_2O, \quad \Delta H = -287.3\,kJ\,mole^{-1}$

the enthalpy of formation of H_2SO_4 at 298 K will be:
(1) $-814.4\,kJ\,mol^{-1}$ (2) $+814.4\,kJ\,mol^{-1}$
(3) $-650\,kJ\,mol^{-1}$ (4) $-433.7\,kJ\,mol^{-1}$

79. The reaction,

$P_4+3NaOH+3H_2O \rightarrow 3NaH_2PO_2+PH_3$

is an example of:
(1) disproportionation reaction
(2) neutralization reaction
(3) double displacement reaction
(4) pyrolytic reaction

80. Predict which of the following reaction (s) has a positive entropy change?
(A) $Ag^+(aq)+Cl^-(aq) \rightarrow AgCl(s)$
(B) $NH_4Cl(s) \rightarrow NH_3(g)+HCl(g)$
(C) $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$
(1) A and B (2) C
(3) B and C (4) B

81. The value of n in the following equation is:

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

(1) 2 (2) 3
(3) 7 (4) 6

82. In which one of the following sets, all the properties belong to same category (all extensive or all intensive)?
(1) Mass, volume, pressure
(2) Temperature, pressure, volume
(3) Heat capacity, density, entropy
(4) Enthalpy, internal energy, volume

83. Which species are oxidized and reduced in the reaction?

$FeC_2O_4 + KMnO_4 \rightarrow Fe^{3+} + CO_2 + Mn^{2+}$

(1) Oxidised: Fe, C; Reduced: Mn
(2) Oxidised: Fe; Reduced: Mn
(3) Reduced: Fe, Mn; Oxidised: C
(4) Reduced: C; Oxidised: Mn, Fe

84. Which selection correctly shows units for specific heat capacity?
(1) $Cal.g.^\circ C$ (2) Cal.g/°C
(3) $J/\left(g.^\circ C\right)$ (4) $g/J.^\circ C$

85. 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 equation are:

	MnO_4^-	$C_2O_4^{2-}$	H^+
(1)	2	5	16
(2)	16	5	2
(3)	5	16	2

(4) 2 16 5

SECTION-B

86. In which of the processes, does the internal energy of the system remain constant?
(1) Adiabatic
(2) Isochoric
(3) Isobaric
(4) Isothermal

87. The values of *x* and *y* in the following redox reaction,

$xCl_2 + 6OH^- \rightarrow ClO_3^- + yCl^- + 3H_2O$, are:

(1) x = 2, y = 4
(2) x = 5, y = 3
(3) x = 3, y = 5
(4) x = 4, y = 2

88. **Assertion:** 0.1 M H_3PO_3(aq) solution has normality equal to 0.3 N when completely reacts with NaOH.
Reason: H_3PO_3 is a tribasic acid.
(1) Both assertion and reason are true and reason is the correct explanation of assertion.
(2) Both assertion and reason are true but reason is not the correct explanation of assertion.
(3) Assertion is true statement but reason is false.
(4) Both assertion and reason are false statements.

89. Assume each of the following reaction to be carried out in an open container. For which reaction will $\Delta H = \Delta U$?
(1) $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$
(2) $H_2(g) + Br_2(g) \rightarrow 2HBr(g)$
(3) $C(s) + 2H_2O(g) \rightarrow 2H_2(g) + CO_2(g)$
(4) $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$

90. **Assertion:** Fe_3O_4 contains iron atoms in two different oxidation numbers.
Reason: Fe^{2+} ions decolourize $KMnO_4$ solution.
(1) Both assertion and reason are true and reason is the correct explanation of assertion.
(2) Both assertion and reason are true but reason is not the correct explanation of assertion.
(3) Assertion is true statement but reason is false.
(4) Both assertion and reason are false statements.

91. The equivalent mass of potassium permanganate in alkaline medium is:
(1) Molar mass/5
(2) Molar mass/3
(3) Molar mass/2
(4) Molar mass itself

92. "The change of enthalpy of a chemical reaction is the same whether the reaction takes place in one step or in several steps". This law was presented by:
(1) Hess (2) Le Chatelier
(3) Kirchhoff (4) Lavoisier and Laplace

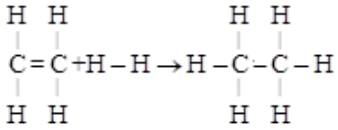
93. Oxidation states of P, in $H_4P_2O_5$, $H_4P_2O_6$, $H_4P_2O_7$ are respectively:
(1) +3, +5, +4 (2) +5, +3, +4
(3) +5, +4, +3 (4) +3, +4, +5

94. Which of the following is not a reducing agent?
(1) SO_2 (2) H_2O_2
(3) CO_2 (4) NO_2

95. The enthalpy and entropy change for the reaction,
$Br_2(l) + Cl_2(g) \rightarrow 2BrCl(g)$ are 30 kJ mol^{-1} and 105 JK^{-1} mol^{-1} respectively. The temperature at which the reaction will be in equilibrium is:
(1) 285.7 K (2) 273 K
(3) 450 K (4) 300 K

96. The oxidation process involves:
(1) Increase in oxidation number.
(2) Decrease in oxidation number.
(3) No change in oxidation number.
(4) None of the above.

97. From the following bond energies,
H–H bond energy: 431.37 kJ mol^{-1}
C=C bond energy: 606.10 kJ mol^{-1}
C–C bond energy: 336.49 kJ mol^{-1}
C–H bond energy: 410.50 kJ mol^{-1}



Calculate the enthalpy of the reaction.
(1) 1523.6 kJ mol^{-1}
(2) –243.6 kJ mol^{-1}
(3) –120.0 kJ mol^{-1}
(4) 553.0 kJ mol^{-1}

98. In which one of the following changes, there is transfer of five electrons?
(1) $MnO_4^- \rightarrow Mn^{2+}$
(2) $CrO_4^{2-} \rightarrow Cr^{3+}$

(3) $MnO_4^- \rightarrow MnO_2$

(4) $Cr_2O_7^{2-} \rightarrow 2Cr^{3+}$

99. Oxygen has an oxidation state of +2 in the compound:

(1) F_2O (2) H_2O

(3) CO_2 (4) None of these

100. How many moles of $KMnO_4$ are needed to oxidise a mixture of 1 mole of each $FeSO_4$ & FeC_2O_4 in acidic medium?

(1) 4/5 (2) 5/4

(3) 3/4 (4) 5/3

53. (3)

$2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 5Cl_2 + 8H_2O$

According to stoichiometry of reaction, 2 mole of $KMnO_4$ reacts with 16 mole of HCl

So, $n_{KMnO_4} = 2$, $n_{HCl} = 16$

By law of equivalence

$$\left(n_{eq}\right)_{KMnO_4} = \left(n_{eq}\right)_{HCl}$$

$$2\times5 = 16\times\left(n_f\right)_{HCl}\left[\left(n_f\right)_{KMnO_4} = 5, \text{in acidic medium}\right]$$

$$\left(n_f\right)_{HCl} = \frac{10}{16}$$

(NCERT Class – 11th, Page – 249)

$$\log\left(\frac{P_1}{P_2}\right)$$

Adiabatic process, $w = \frac{nR}{(\gamma-1)}(T_2 - T_1)$

Irreversible isothermal process $w = -P_{ext}(V_2 - V_1)$

Isochoric process, $w = 0$

(NCERT Class – 11th, Page – 141 – 142)

57. (3)

Br^- is a reducing since it reduces MnO_4^- to Mn^{2+} and itself gets oxidized to Br_2.

(NCERT Class – 11th, Page – 237)

58. (1)

$$\Delta S_f = \frac{\Delta H_f}{T_f}$$

$$\Delta S_f = \frac{2930\ J\,mol^{-1}}{300\ K} = 9.77\ JK^{-1}\ mol^{-1}$$

(NCERT Class – 11th, Page – 158 – 159)

59. (4)

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

n_{factor} of potassium dichromate = 6

Mohr's salt = 1 $FeSO_4.(NH_4)_2\ SO_4.6H_2O$

Only oxidation of Fe^{2+} takes place as,

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

So, n-factor of Mohr's salt = 1

By law of equivalence

$$\left(n_{eq}\right)_{K_2Cr_2O_7} = \left(n_{eq}\right)_{Mohr's\ salt}$$

$$\left(n_{eq}\right)_{K_2Cr_2O_7} \times \left(n_f\right)_{K_2Cr_2O_7} = \left(n\right)_{Mohr's\ salt} \times \left(n_f\right)_{Mohr's\ salt}$$

$6 \times 1 = n \times 1$

$n = 6$

(NCERT Class – 11th, Page – 249)

60. (1)

Using the relation, $\Delta H^o = \Delta U^o + \Delta n_g RT$

Δn_g = Number of gaseous moles

$X(g) + Y(g) \rightleftharpoons Z(g)$

$\Delta n_g = 1 - 1 - 1 = -1$

$$\Delta U^o = \Delta H^o - \Delta n_g RT$$

$$= -4600\,cal - \left(-1 \times 2\,cal\,mol^{-1}K^{-1} \times 500K\right)$$

$$= -4600\,cal + 1000\,cal = -3600\,cal$$

$$\Delta U^o = -3.6\,Kcal$$

(NCERT Class – 11th, Page – 145)

61. (4)

KO_3

Suppose oxidation number of O = x,

$\Rightarrow 1 + 3x = 0$

$3x = -1$

$$x = -\frac{1}{3} = -0.33$$

Na_2O_2

Suppose oxidation number of O = x

$2 \times 1 + 2x = 0$

$2 + 2x = 0$

$2x = -2$

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

$x = -1$

(NCERT Class – 11th, Page – 239)

62. (3)

In a gaseous state, randomness is highest, so entropy will be maximum.

(NCERT Class – 11th, Page – 158 – 159)

63. (2)

$M^{3+} \rightarrow M^{6+} + 3e^-$

(NCERT Class – 11th, Page – 239)

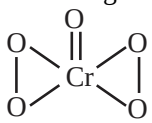
64. (2)

The heat absorbed during the isothermal expansion of an ideal gas against vacuum is zero. This is because there are no forces of attraction between the gas molecules. The volume occupied by the molecules of an ideal gas is zero. For an ideal gas, they are point molecules. It means that both statements are correct, but reason is not the correct explanation of assertion.

(NCERT Class – 11th, Page – 142)

65. (3)

The oxidation numbers of Cr is +6, not +10 in CrO_5 because four oxygen atoms are involved in peroxide linkages.



(NCERT Class – 11th, Page – 239 – 240)

66. (3)

$P_4 + aq.\ NaOH \longrightarrow PH_3 + NaH_2PO_2$

Reduction

Oxidation

$$\left(n_f\right)_{oxidation} = 4(1-0) = 4$$

$$\left(n_f\right)_{reduction} = 4(0-(-3)) = 4 \times 3 = 12$$

$$\left(n_f\right)_{Total} = \frac{\left(n_f\right)_{oxidation} \times \left(n_f\right)_{reduction}}{\left(n_f\right)_{oxidation} + \left(n_f\right)_{reduction}}$$

$$\left(n_f\right)_{Total} = \frac{4 \times 12}{4 + 12} = \frac{48}{16} = 3$$

(NCERT Class – 11th, Page – 244)

67. (4)

By convention, the oxidation number of free metals is zero.

(NCERT Class – 11th, Page – 239 – 240)

68. (3)

There is no change in the temperature of the gas. (Correct)

There is no change in the internal energy of the gas. (Correct)

The work done by the gas is equal to the heat supplied to the gas. (Correct)

(NCERT Class – 11th, Page – 142 – 145)

69. **(1)**

$BaCl_2$

$\Rightarrow x + (-2) = 0$

$\Rightarrow x = 2$

(NCERT Class – 11th, Page – 239 – 240)

70. **(4)**

There is no work done and no heat exchange between the system and surroundings, as both sun and earth are part of the solar system, and we consider the solar system as our system, so no heat is exchanged between system and its surroundings.

(NCERT Class – 11th, Page – 137 – 138)

71. **(3)**

In a redox reaction, both oxidation and reduction is happening together.

(NCERT Class – 11th, Page – 237)

72. **(1)**

$A \rightarrow B$

$\Delta H_{reaction} = \sum (H)_{product} - \sum (H)_{reactant}$

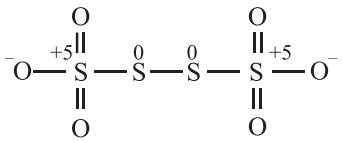
$= 15 - 40$

$= -25\,kJ$

(NCERT Class – 11th, Page – 152)

73. **(3)**

The structure of tetrathionate ion.



(NCERT Class – 11th, Page – 245)

74. **(4)**

For the isothermal expansion of gas, internal energy and enthalpy both are functions of temperature, so both will remain same because temperature is constant.

(NCERT Class – 11th, Page – 142 – 145)

75. **(3)**

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

This is an example of a redox reaction. (Correct)

Fe^{3+} is an oxidizing agent. (Correct)

Metallic iron is a reducing agent. (Correct)

(NCERT Class – 11th, Page – 241)

76. **(2)**

$2\overset{+5}{K}ClO_3 \xrightarrow{\Delta} 2\overset{-1}{K}Cl_{(s)} + 3O_{2(g)}$

$(n_f)_{KClO_3}$ = change in oxidation state

$= 5 - (-1) = 6$

So, Equivalent mass of $KClO_3 = \dfrac{M}{6}$

(NCERT Class – 11th, Page – 249)

77. **(1)**

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

So, n-factor of $KMnO_4$ in acidic medium will be 5.

$C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-$

n-factor of $C_2O_4^{2-}$ (oxalate) = 2

By law of equivalence

$(n_{eq})_{KMnO_4} = (n_{eq})_{C_2O_4^{2-}}$

$n_{KMnO_4} \times (n_f)_{KMnO_4} = n_{C_2O_4^{2-}} \times (n_f)_{C_2O_4^{2-}}$

$1 \times 5 = n_{C_2O_4^{2-}} \times 2$

$n_{C_2O_4^{2-}} = \dfrac{5}{2}$

(NCERT Class – 11th, Page – 249)

78. **(1)**

$S + O_2 \rightarrow SO_2,\ \Delta H = -298.2$ kJ/mole

$SO_2 + \dfrac{1}{2}O_2 \rightarrow SO_3,\ \Delta H = -98.7$ kJ/mole

$SO_3 + H_2O \rightarrow H_2SO_4,\ \Delta H = -130.2$ kJ/mole

$H_2 + \dfrac{1}{2}O_2 \rightarrow H_2O,\ \Delta H = -287.3$ kJ/mole

The formation of H_2SO_4

$H_2 + S + 2O_2 \rightarrow H_2SO_4$

can be calculated by adding the above four equations

$\Delta H = -(298.2 + 98.7 + 130.2 + 287.3)$

$= -814.4$ kJ/mole

(NCERT Class – 11th, Page – 151)

79. **(1)**

$\overset{0}{P_4} + 3NaOH + 3H_2O \rightarrow 3NaH_2\overset{1+}{P}O_2 + \overset{-3}{P}H_3$

In this reaction, same substance undergoes oxidation and reduction. Hence, it is an example of disproportionation reaction.

(NCERT Class – 11th, Page – 244)

80. (3)

Entropy change for any reaction can be calculated as,

$\Delta S^{o}\text{reaction} = \sum\left(S_m^o\right)_{\text{product}} - \sum\left(S_m^o\right)_{\text{reactant}}$

S_m^o = standard molar entropy

So, ΔS^{o}reaction = will be positive, only when $\left(S_m^o\right)_{\text{product}}$ will greater than $\left(S_m^o\right)_{\text{reactant}}$

(B) and (C) will have positive entropy.

(NCERT Class – 11th, Page – 158 – 159)

81. (4)

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

n = 6

(NCERT Class – 11th, Page – 246 – 248)

82. (4)

An intensive property is one that does not depend on the mass of the substance or system. An extensive property of a system depends on the size of the system or the amount of matter in the system. Enthalpy, internal energy and volume all are examples of extensive properties.

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83. (1)

Fe and C ⇒ Oxidised

Mn ⇒ Reduced

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84. (3)

$Q = mC\Delta T$

Therefore, $C = \frac{Q}{m\Delta T}$

$\Rightarrow \frac{J}{g \times {}^{\circ}C}$

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85. (1)

The balanced equation is

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

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86. (4)

For an ideal gas, in an isothermal process the change in internal energy is 0, an internal energy is function of temperate, but temperature remains constant.

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87. (3)

The balance equation,

$3Cl_2 + 6OH^- \rightarrow ClO_3^- + 5Cl^- + 3H_2O$

$\therefore$ x = 3, y = 5

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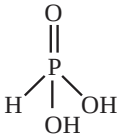
88. (4)

$H_3PO_3 \Rightarrow$ 

n-factor = 2

So, 0.1 M H_3PO_3 (aq) solution has normality equal to 0.2 N.

H_3PO_3 is a dibasic acid.

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89. (2)

$\Delta H = \Delta U + \Delta n_g RT$; $\Delta H = \Delta U$ when $\Delta n_g = 0$

In the first reaction $\Delta n_g = 2 - (2 + 1) = -1$

In the second reaction $\Delta n_g = 2 - (1 + 1) = 0$

In the third reaction $\Delta n_g = 3 - 2 = 1$

In the fourth reaction $\Delta n_g = 2 - 1 = 1$

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90. (2)

The composition of Fe_3O_4 is $FeO.Fe_2O_3$, which has iron in +2 and +3 oxidation states respectively. Fe^{2+} ion being a reducing agent decolourise $KMnO_4$ solution and itself converts into Fe^{3+} ions.

Both assertion and reason are correct but reason is not a correct explanation of assertion.

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91. (2)

$MnO_4^- + 2H_2O + 3e^- \rightarrow MnO_2 + 4OH^-$

In the alkaline medium, conversion of MnO_4^- to MnO_2 involves 3 electron change.

$\therefore$ Eq. wt. of $KMnO_4$ = Molar mass/3

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92. (1)

According to Hess's law of constant heat summation, even if a chemical reaction takes place by several different routes, the change in enthalpy of the reaction will be same for all the routes.

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93. (4)

O.N. of P in $H_4P_2O_5 = 4(+1) + 2x + 5(-2) = 0$

or x = + 3

O.N. of P in $H_4P_2O_6 = 4(+1) + 2x + 6(-2) = 0$

or x = +4

O.N. of P in $H_4P_2O_7 = 4(+1) + 2x + 7(-2) = 0$

or x = +5

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94. (3)

CO_2 is not a reducing agent.

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95. (1)

At equilibrium, ΔG is equal to zero.

As, $\Delta G = \Delta H - T\Delta S$

$$0 = 30\times10^3\left(\text{J mol}^{-1}\right) - T\times105\left(\text{JK}^{-1}\text{mol}^{-1}\right)$$

$$\therefore\ T = \frac{30\times10^3}{105}K = 285.71K$$

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96. (1)

The oxidation is a process in which an increase in oxidation number of the element happens with the loss of electrons.

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97. (3)

$$\Delta H_r = \sum BE_{(\text{reactant})} - \sum BE_{(\text{product})}$$

$$\Delta H_r = \left[4\times BE_{(C-H)} + 1\times BE_{(C=C)} + 1\times B_{(H-H)}\right]$$

$$-\left[6\times BE_{(C-H)} + 1\times BE_{(C-C)}\right]$$

$$= \left[(4\times410.50) + (1\times606.10) + (1\times431.37)\right]$$

$$-\left[(6\times410.50) + (1\times336.49)\right]\text{kJ mol}^{-1}$$

$$= -120.0\ \text{kJ mol}^{-1}$$

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98. (1)

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

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99. (1)

In F_2O

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

$\Rightarrow x = +2$

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100. (1)

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

So, n-factor of potassium permanganate = 5

$FeSO_4$

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

n-factor of $FeSO_4 = 1$

FeC_2O_4

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

$C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-$

n-factor of $FeC_2O_4 = 3$

By law of equivalence

$$\left(n_{eq}\right)_{KMnO_4} = \left(n_{eq}\right)_{FeSO_4} + \left(n_{eq}\right)_{FeC_2O_4}$$

$$n_{KMnO_4}\times\left(n_f\right)_{KMnO_4} = n_{FeSO_4}\times\left(n_f\right)_{FeSO_4} + n_{FeC_2O_4} \times \left(n_f\right)_{FeC_2O_4}$$

$$n_{KMnO_4}\times 5 = 1\times1 + 1\times3$$

$$n_{KMnO_4} = \frac{4}{5}$$

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