19-12-15_Sr.IPLCO_Jee-Main_RPTM-15_ Syllabus

MATHS:

Permutations & combinations

PHYSICS

Expansion Of Solids, Liquids & Gases; Calorimetry, Latent Heat; Heat Conduction In One Dimension; Elementary Concepts Of Convection & Radiation; Newton's Law Of Cooling; Ideal Gas Laws; Specific Heats (Cv&Cp For Monoatomic & Diatomic Gases); Isothermal & Adiabatic Processes, Bulk Modulus Of Gases; Equivalence Of Heat & Work; First Law Of Thermodynamics & Its Applications (Only For Ideal Gases); Blackbody Radiation: Absorptive & Emissive Powers; Kirchhoff's Law; Wien's Displacement Law, Stefan's Law.

Experiments:1. Plotting a cooling curve for the relationship between the temperature of a hot body and time

2. Specific heat capacity of a given (i) solid and (ii) liquid by method of mixtures

CHEMISTRY

Thermodynamics and Thermo chemistry

CHEMISTRY

61. The ΔG^0 value for the reaction, $2Mg_{(S)} + O_{2(g)} \longrightarrow 2MgO_{(S)}$ at 25^0C is,

(Given $\Delta S^0_{sys} = -217 JK^{-1}mol^{-1}, \Delta S^0_{surr} = 4kJK^{-1}mol^{-1}$)

1) +3780Jmol^{-1} 2) -1126 kJmol^{-1} 3) -1192 kJmol^{-1} 4) -3780 kJmol^{-1}

62. The correct values of thermodynamic parameters to the reactions to occur spontaneously at 300K are

1) $\Delta G^o = +400 kJ\ mol^{-1}$ 2) $\Delta H^o = 200 kJ\ mol^{-1}, \Delta S^o = -4 JK^{-1}mol^{-1}$

3) $\Delta H^o = -200 kJ\ mol^{-1}, \Delta S^o = 4 JK^{-1}mol^{-1}$ 4) $\Delta H^o = 200 kJ\ mol^{-1}, \Delta S^o = -40 JK^{-1}mol^{-1}$

63. Select the correct statement(s) regarding phosphoric acid.

Given that $\Delta_f H^\circ(H_3PO_4)$ = -1290 kJ mol^{-1}, $\Delta_f H^\circ(H_2PO_4^-)$ = -1302 kJ mol^{-1},

$S^\circ(H_3PO_4)$ = 176 J mol^{-1}K^{-1}, $S^\circ(H_2PO_4^-)$ = 89 J mol^{-1}K^{-1}.

1) It has a pK$_{a1}$ of 2.4

2) pK$_{a2}$ of phosphoric acid is less than pK$_{a1}$.

3) First dissociation of phosphoric acid is endothermic.

4) First dissociation of phosphoric acid is entropy driven.

64. For a hypothetical reaction $A_{(g)} + 3B_{(g)} \rightleftharpoons 2C_{(g)} \Delta H = -100 kJ$ and $\Delta S = -200 JK^{-1}$. Then

the temperature at which the reaction will be more spontaneous.

1) 500K   2) 480 K   3) 520 K   4) 310 K

65. 1 mole of an ideal gas at 25^oC is subjected to expand reversibly ten times of its

initial volume. Then the change in entropy of expansion is

1) $19.15 JK^- mol^{-1}$ 2) $29.15 JK^- mol^{-1}$

3) $9.15 JK^- mol^{-1}$ 4) $39.15 JK^- mol^{-1}$

66. At 300K, ΔH for the reaction $Zn(s) + 2AgCl(s) \longrightarrow ZnCl_2(aq) + 2Ag(s)$ is –218 kJ / mol

while the emf of the cell was 1.015V. $\left(\dfrac{dE}{dT}\right)_p$ of the cell is

1) -4.2×10^{-4} VK^{-1} 2) -3.81×10^{-4} VK^{-1}

3) 0.11VK^{-1} 4) $+3.81 \times 10^{-4}$ VK^{-1}

67. Which of the following is extensive property

     1) vapour pressure   2) pressure

     3) free energy   4) molar heat of combustion

68. One mole of N_2 is mixed with 3 moles of O_2 gas at 25^0 C form a mixture at final

     pressure of one atmosphere, initial pressure of each being also 1 atmosphere . the

     molar entropy of mixing is

     1) – 2.303 x 8.314 (1 log ¼ + 3 log ¾) jouls
     2) – 2.303 x 8.314 (0.25 log ¼ + 0.75 log ¾) jouls
     3) – 2.303 x 8.314 (0.75 log ¼ + 0.25 log ¾) jouls
     4) – 2.303 x 8.314 (3 log ¼ + 1 log ¾)jouls

69. An ideal gas expands from 1 litre to 3 litres in reversible process in which
     $P = KV^2$. where K = 6. What is work done by gas (calculate without change in
     units given)

     1) -52   2) -12   3) -48   4) – 24

70. Which of the following statement is incorrect

    1) entropy of glass solid is not zero at zero Kelvin

    2) entropy of acetic acid in benzene decreases

    3) standard molar entropy of diamond is less than that of graphite

    4) after mixing of two ideal gases entropy increases

71. False statement of following

    1) both W and Q appears at boundaries of system

    2) heat given to a system positive

    3) sum of W and Q is state function

    4) heat given to system is used only for work in isochoric process

72. Which is example for work done by system

    1) $N_{2(g)} + 2O_{2(g)} \rightarrow 2NO_{2(g)}$ 　　　 2) $PCl_{5(g)} \rightarrow PCl_{3(g)} + Cl_{2(g)}$

    3) $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ 　　　 4) $2HI_{(g)} \rightarrow H_{2(g)} + I_{2(g)}$

73. The heat capacity ratio 'γ' can be determined by a method based on adiabatic expansion of the gas. For a gas initial temperature, pressure and volume are T_1, P_1 and V_1, while the same in final state are T_2, P_2 and V_2. Which of the following is correct expression for the determination of γ.

    1) $\gamma = \dfrac{\log T_1 - \log T_2}{\log V_2 - \log V_1}$ 2) $\gamma = \dfrac{\log V_2 - \log V_1}{\log T_1 - \log T_2}$

    3) $\gamma = \dfrac{\log P_1 - \log P_2}{\log V_2 - \log V_1}$ 4) $\gamma = 1 + \dfrac{\log P_1 - \log P_2}{\log V_2 - \log V_1}$

74. What is the change in molar entropy (in cal mol^{-1} K^{-1}) of helium gas $\left(C_{V,m} = \dfrac{3}{2}R\right)$ in the process, $He(400\,K, 1\,bar) \longrightarrow He(100K, 10\,bar)$

    (Given : $\ln 2 = 0.7,\ \ln 5 = 1.6$)

    1) – 8.8   2) 8.8   3) – 11.6   4) – 4.4

75. The standard enthalpy of formation of octane (C_8H_{18}) is $-250\,kJ/mole$. The enthalpy of formation of $CO_2(g)$ and $H_2O(\ell)$ are $-394\,kJ/mole$ and $-286kJ/mole$ respectively. The enthalpy of combustion of $C_8H_{18}(g)$ is

    1) – 5200 kJ/ mole   2) –5726 kJ/ mole
    3) – 5476 kJ/mole   4) – 5310 kJ/ mole

76.   The correct relationship between standard free energy change in a reaction and the

corresponding equilibrium constant K_c is

1) $\Delta G^o = RT \ln K_c$ 2) $-\Delta G^o = RT \ln K_c$

3) $\Delta G = RT \ln K_c$ 4) $-\Delta G = RT \ln K_c$

77.   For a perfectly crystalline solid $C_{p,m} = a\, T^3$ where a is constant. If

$C_{p,m}$ is 0.42 J/K/Mole at 10 K. molar entropy at 20 K is

1) 1.12 J/K/mole   2) 0.42 J/K/mole

3) 2.4 J/K/mole   4) 4.2 x 10^{-4} J/K/mole

78.   1 g sample of NH_4NO_3 is heated in bomb calorimeter. The temperature of the
calorimeter increases by 6.32 K. the heat capacity of the system is 1.23 kJ/g-deg.
The molar heat of decomposition for NH_4NO_3 is

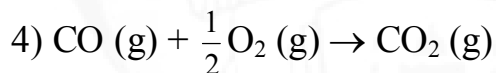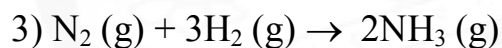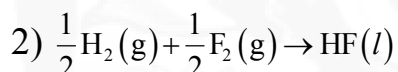1) -16.1 kJ mol^{-1} 2) -7.53 kJmol^{-1}
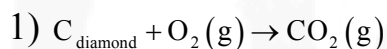
3) 621.89 kJmol^{-1} 4) -498.1 kJ mol^{-1}

79.   Bond energy of N–H, H–H and N≡N are a, b, c respectively. The ΔH for the

reaction $2NH_3 \rightarrow N_2 + 3H_2$ is

1) $6a - 3b - c$ 2) $6a + 3b + c$ 3) $a + 6b - c$ 4) $6a + b - 3c$

80.   Which of the reaction defines ΔH_f° of the product?

1) $C_{diamond} + O_2(g) \rightarrow CO_2(g)$

2) $\frac{1}{2}H_2(g) + \frac{1}{2}F_2(g) \rightarrow HF(l)$

3) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

4) $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$

81.   When 1 mole of an ideal gas is compressed to half of its volume, its temperature

becomes double, then the change in entropy (ΔS) would be

1) $C_V \ln 2$ 2) $C_P \ln 2$ 3) $C_V R2$ 4) $(C_V - R) \ln 2 \times C_P$

82.   Which of the following may be positive or negative?

   1) Enthalpy of hydration   2) Enthalpy of neutralization

   3) Enthalpy of combustion   4) Enthalpy of solution

83.   When a gas is subjected to adiabatic expansion, it gets cooled due to

   1) Fall in temperature   2) Loss in kinetic energy

   3) Decrease in velocity   4) Energy spent in doing work

84.   An ideal gas undergoing expansion in vacuum posses

   1) $\Delta U = 0$ 2) $W = 0$

   3) $q = 0$ 4) All of these

85.   In which process net work is zero:

   1) Cyclic   2) Isobaric

   3) Free expansion   4) Adiabatic

86. Which of the following statements is/are correct:

1) water in a beaker be made to boil by placing it in a bath of boiling water

2) water can be made to boil without heating

3) $\left(\dfrac{\Delta H_{vap}}{T_{boiling}}\right)_{liquid} = 88 JK^{-1}$ for all liquids

4) All of these

87. For reaction $2NO_2(g) \rightleftharpoons N_2O_4(g)$, $C_{p(N_2O_4)} = 2x + 6xT$, $C_{p(NO_2)} = x + 2xT$,

$\Delta H^0_{(1)}$ at $T_1 = +x$ kcal / mole, where $T = \dfrac{T_1 + T_2}{2}$ then $\Delta H^\circ_{(2)}$ at $T_2 = ?$

1) $x (1 + 2T_2 - 2T_1)$ 2) $x + xT_2 - xT_1$

3) $x (1 + T_2^2 - T_1^2)$ 4) $x (1 - T_2 - T_1)$

88. Which one of the following is correct at 298K?

1) ΔG^0_f elements = -ve   2) ΔH^0_f elements = 0

3) ΔS^0_f elements = 0   4) ΔG^0_f compound = 0

89. A solution of 500 ml of 2M KOH is added to 500 ml of 2M HC*l* solution, the

     mixture is shaken well and the rise in temperature T_1 is noted. The experiment is

     repeated with 250 ml of each of 0.5M solutions of KOH and HC*l* and rise in

     temperature T_2 is again noted. Assume that all heat is taken by the solution.

     Which of the following is correct?

     1) $T_1 = 4T_2$ 2) $T_1 = T_2$ 3) $2T_1 = T_2$ 4) $4T_1 = T_2$

90. Solid $CaCO_3$ is heated in a closed container to 900K. When equilibrium is

     reached, the pressure becomes 500 torr. Similarly, the equilibrium pressure at

     1000K was found to be 2000 torr. Hence ΔH for the given reaction.

     $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
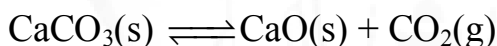
     At this temperature range is

     1) $9000 \times R \times \ln 4$ 2) $9000 \times R \times \ln\dfrac{1}{4}$

     3) $100 \times R \times \ln 4$ 4) $100 \times R \times \ln\dfrac{1}{4}$