Shiksha Classes Bhandara

Subject : Chemistry **Topic : Thermochemistry** **M.M. : 100**

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 The difference between heats of reaction at constant pressure and constant volume for the reaction,

$2C_6H_6(\ell) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(\ell)$

at 25°C in kJ is –

(A) – 7.43 (B) + 3.72

(C) – 3.72 (d) + 7.43

Q.2 100 ml of 0.3 M HCl solution is mixed with 100 ml of 0.35 M NaOH solution. The amount of heat liberated is

(A) 7.3 kJ (B) 5.71 kJ

(C) 10.42 kJ (D) 1.713 kJ

Q.3 The bond energies of C = C and C – C at 298 K are 590 and 331 kJ.mol^{-1} respectively. The enthalpy of polymerization per mole of ethylene is

(A) – 70 kJ (B) – 72 kJ

(C) 72 kJ (D) – 68 kJ

Q.4 If a process is both endothermic and spontaneous, then :

(A) $\Delta S > 0$ (B) $\Delta S < 0$

(C) $\Delta H < 0$ (D) $\Delta G > 0$

Q.5 State which of the following statements is true ?

(A) First law of thermodynamics is not adequate in predicting the direction of the process .

(B) In an exothermic reaction ,the total enthalpy of the products is greater than that of reactants .

(C) The standard enthalpy of diamond is zero at 298K and 1 atm pressure .

(D) It is possible to calculate the value of ΔH for the reaction $H_2(g) + Br_2(\ell) \rightarrow 2HBr(g)$ from the bond enthaly data.

Q.6 The standard heat of combustion of a hydrocarbon compound is an/a-

(A) Extensive property

(B) Colligative property

(C) Intensive property

(D) Constitutive property

Q.7 44.0 kJ of heat is required to evaporate one mole of water at 298 K. If ΔH_f of $H_2O(\ell)$ is –286 kJ mol^{-1}, ΔH^0_f of $H_2O(g)$ is

(A) – 330 kJ mol^{-1} (B) + 242 kJ mol^{-1}

(C) –242 kJ mol^{-1} (D) –198 kJ mol^{-1}

Q.8 If 1.00 kcal of heat is added to 1.2 L of oxygen in a cylinder at constant pressure of 1.000 atm, the volume increases to 1.5 L, Hence ΔE for this process is:

(A) 0.993 kcal (B) 1.0073 kcal

(C) 0.0993 kcal (D) 1.00073 kcal

Q.9 Heats of combustion of CH_4, C_2H_4, C_2H_6 are – 890, – 1411 and – 1560 kJ/mole respectively. Which has the lowest fuel value in kJ/gm ?

(A) CH_4 (B) C_2H_4

(C) C_2H_6 (D) All same

Q.10 The heat of neutralisation of HCl by NaOH is –55.9 kJ/mole. If the heat of neutralization of HCN by NaOH is –12.1 kJ/mole, then energy of dissociation of HCN is-

(A) – 43.8 kJ (B) 43.8 kJ

(C) 68 kJ (D) – 68 kJ

Q.11 For an endothermic reaction were ΔH represents the enthalpy of the reaction, the minimum value for the energy of activation will be –

(A) less than ΔH (B) zero

(C) more than ΔH (D) equal to ΔH

Q.12 One mole of a real gas is subjected to heating at constant volume from (P_1, V_1, T_1) state to (P_2,V_1,T_2) state. Then it is subjected to irreversible adiabatic compression against constant external pressure of P_3 atm till system reaches the final state (P_3, V_3, T_3). If the constant volume molar heat capacity of real gas is C_V. Find out correct expression for ΔH from state 1 to state 3 –

(A) $C_v(T_3 - T_1) + (P_3V_1 - P_1V_1)$

(B) $C_v(T_2 - T_1) + (P_3V_2 - P_1V_1)$

(C) $C_v(T_2 - T_1) + (P_3V_1 - P_1V_1)$

(D) $C_p(T_2 - T_1) + (P_3V_1 - P_1V_1)$

Q.13 $C_P - C_v = R$. This R is :

(A) Change in K.E.

(B) Change in rotational energy

(C)work done which system can do on expanding the gas per mol per degree increase in temperature

(D) All correct

Q.14 Temperature of 1 mol of a gas is increased by 1º at constant pressure. Work done is-

(A) R (B) 2R

(C) R/2 (D) 3R

Q.15 The molar heat capacity, C_v of an ideal gas whose energy is that of translational motion only is

(A) 2.98 J deg^{-1} mol^{-1} (B) 12.47J deg^{-1} mol^{-1}

(C) 6.43 J deg^{-1} mol^{-1} (D) 9.41 J deg^{-1} mol^{-1}

Q.16 When 0.16 g of glucose was burnt in a bomb calorimeter, the temperature rise by 4 deg. Calculate the calorimeter constant (water equivalent of the calorimeter) given that $\Delta H^o = -2.8 \times 10^6$ J mol^{-1}. [molar enthalpy of combustion].

Molar mass of glucose = 180 mol^{-1}.

(A) 5.73×10^2 J/deg (B) 7.53×10^2 J/deg

(C) 6.22×10^2 J/deg (D) 3.57×10^2 J/deg

Q.17 The heat of combustion of ethylene at 17ºC and at constant volume is –332.19 kcals. What is the value at constant pressure, given that water is in liquid state?

(A) – 131.25 k cals (B) – 412.23 k cals
(C) – 534.12 k cals (D) – 333.35 k cals

Q.18 Which of the following reaction defines $\Delta_f H°$?

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

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

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

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

Q.19 In a process the pressure of a gas is inversely proportional to the square of the volume. If temperature of the gas is increases, then work done by the gas –

(A) is positive (B) is negative
(C) is zero (D) may be positive

Q.20 The species which by definition has zero standard molar enthalpy of formation at 298 K is –

(A) $Br_2(g)$ (B) $Cl_2(g)$
(C) $H_2O(g)$ (D) $CH_4(g)$

For Q.21-Q.25 :

The answer to each question is a NUMERICAL VALUE.

Q.21 Heat of neutralisation of oxalic acid is –25.4 Kcal mol^{-1} using strong base, NaOH. Hence enthalpy change (in kcal) of the process is

$H_2C_2O_4 \rightarrow 2H^+ + C_2H_4^{2-}$ is-

Q.22 The molar entropy of vaporisation of acetic acid is 14.4 cal K^{-1} mol^{-1} at its boiling point 118ºC. The latent heat (in cal g^{-1}) of vaporisation of acetic acid is –

Q.23 Enthalpy of fusion of a liquid is 1.435 $kcalmol^{-1}$ and molar entropy change is 5.26 cal mol^{-1} K^{-1}. Hence melting point (in °C) of liquid is :

Q.24 The gas absorbs 100 J heat and is simultaneously compressed by a constant external pressure of 1.50 atm from 8 lit. to 2 lit. in volume. Hence ΔE (in J) will be-

Q.25 The temperature of 5 ml of a strong acid increases by 5º when 5 ml of a strong base is added to it. If 10 ml of each is mixed, temperature should increase by-