State	**PARISHRAM ACADEMY** **NAME of Student : _____** **Subject : Chemistry** **Class : XII** **Topic: 4 – Chemical Thermodynamics** **Total Marks :- 35**	

SECTION – A

Q. 1. Select the write the correct answer: **(4 Marks)**

(i) The correct thermodynamic conditions fo6+r the spontaneous reaction at all temperatures are
(a) $\Delta H < 0$ and $\Delta S > 0$(b) $\Delta H > 0$ and $\Delta S < 0$(c) $\Delta H < 0$ and $\Delta S < 0$(d) $\Delta H < 0$ and $\Delta S = 0$

(ii) If the standard enthalpy of formation of methanol is –238.9 kJ mol^{-1} then entropy change of the surroundings will be
(a) –801.7 J K^{-1} (b) 801.7 J K^{-1} (c) 0.8017 J K^{-1} (d) –0.8017 J K^{-1}

(iii) Which of the following are not state functions?
1. Q + W 2. Q 3. W 4. H-TS
(a) 1, 2 and 3 (b) 2 and 3 (c) 1 and 4 (d) 2, 3 and 4

(iv) For the reaction : $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl$; $\Delta H = -44$ kcal
What is the enthalpy of decomposition of HCl?
(a) +44 kcal/mol (b) –44 kcal/mol (c) –22 kcal/mol (d) +22 kcal/mol

Q.2. Answer the following: **(3 Marks)**

(i) Comment on the statement : no work is involved in an expansion of gas in vacuum.

(ii) State the first law of thermodynamics.

(iii) State second law of thermodynamics in terms of entropy.

SECTION – B

Attempt any Four **(8 Marks)**

Q. 3. Obtain the expression for work done in chemical reaction.

Q. 4. How much heat is evolved when 12 g of CO reacts with NO_2? The reaction is
$4CO(g) + 2NO_2(g) \rightarrow 4CO_2(g) + N_2(g)$, $\Delta_r H^o = -1200$ kJ

Q. 5. State the first law of thermodynamics in different ways.

Q. 6. Distinguish between endothermic reaction and exothermic

Q. 7. Estimote the standard enthalpy of combustion of $CH_4(g)$ if $\Delta_f H^o(CH_4) = -74.8$ kJ mol^{-1}, $\Delta_f H^o(CO_2) = -393.5$ kJ mol^{-1} and $\Delta_f H^o(H_2O) = -285.8$ kJ mol^{-1}.

Q. 8. Calculate the work done during synthesis of NH3 in which volume changes from 8.0 dm^3 to 4.0 dm^3 at a constant external pressure of 43 bar. In what direction the work energy flows?

SECTION – C

Attempt any Four **(12 Marks)**

Q. 9. Derive the expression for the maximum work.

Q. 10. State Hess's law of constant heat summation. Illustrate with an example. State its applications.

Q. 11. Calculate the standard enthalpy of formation of $CH_3OH(l)$ from the following data

i. $CH_3OH(l) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$, $\Delta H^o = -726$ kJ mol^{-1}

ii. $C(Graphite) + O_2(g) \rightarrow CO_2(g)$, $\Delta_c H^o = -393$ kJ mol^{-1}

iii. $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$, $\Delta_f H^o = -286$ kJ mol^{-1}

Q. 12. Calculate the work done and comment on whether work is done on or by the system for the decomposition of 2 moles of NH_4NO_3 at 100 °C. $NH_4NO_3(s) \rightarrow N_2O(g) + 2H_2O(g)$

Q. 13. One mole of an ideal gas is compressed from 500 cm^3 against a constant external pressure of 1.2×10^5 Pa. The work involved in the process is 36.0 J. Calculate the final volume.

Q. 14. Define the following term (Any Three)

(i) Enthalpy of fusion

(ii) Enthalpy of atomization

(iii) Enthalpy of vapourization

(iv) Enthalpy of combustion

(v) Enthalpy of sublimation

SECTION – D

Attempt Any Two: **(8 Marks)**

Q. 15. Explain (i) Reversible process (ii) Adiabatic process. Explain, "Internal energy is a state function".

Q. 16. Calculate the standard enthalpy of :

$N_2H_4(g) + H_2(g) \rightarrow 2NH_3(g)$

if $\Delta H^o(N\text{-}H) = 389$ kJ mol^{-1}, $\Delta H^o(H\text{-}H) = 435$ kJ mol^{-1}, $\Delta H^o(N\text{-}N) = 159$ kJ mol^{-1}.

Q. 17. Deduce mathematical equation for the first law of thermodynamics. Justify its expression.