NEET CHEMISTRY PRACITCE PAPER

Time : 60 Mins **12 THERMODYNAMICS 1** **Marks : 200**

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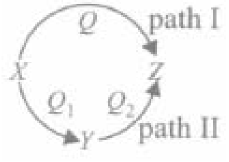
1. For a reaction to be spontaneous at any temperature, the conditions are
   a) $\triangle H = +ve, \triangle S = +ve$ b) $\triangle H = -ve, \triangle S = -ve$ c) $\triangle H = +ve, \triangle S = -ve$
   d) $\triangle H = -ve, \triangle S = +ve$
2. **Assertion:** For the change, $H_2O_{(l)} \longrightarrow H_2O_{(s)}$, $\triangle$H = $\triangle$U.
   Reason: No enthalpy change is involved in this process.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b) If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false
3. Which of the following statements is not correct?
   a) For a spontaneous process, $\triangle$G must be negative.
   b) Enthalpy, entropy, free energy etc. are state variables. c) A spontaneous process is reversible in nature.
   d) Total of all possible kinds of energy of a system is called its internal energy.
4. The enthalpy of formation of ammonia when calculated from the following bond energy data is (B.E. of N - H, H - H, N≡N is 389 kJ mort, 435 kJ mol^{-1}, 945.36 kJ mol^{-1} respectively)
   a) 41.82 kJ mol^{-1} b) + 83.64 kJ mol^{-1} c) - 945.36 kJ mol^{-1} d) - 833 kJ mol^{-1}
5. The statement" The change of enthalpy of a chemical reaction is same whether the reaction takes place in one or several steps" is
   a) Le Chatelier's law b) van't Hoff's law c) first law of thermodynamics d) Hess's law.
6. A reaction having equal energies of activation for forward and reverse reactions has:
   a) $\Delta S = 0$ b) $\Delta G = 0$ c) $\Delta H = 0$ d) $\Delta H = \Delta G = \Delta S = 0$
7. Which of the following statements is correct for the spontaneous absorption of a gas?
   a) ΔS is negative and therefore, ΔH should be highly positive
   b) ΔS is negative and therefore, ΔH should be highly negative.
   c) ΔS is positive and therefore, ΔH should be negative.
   d) ΔS is positive and therefore, ΔH should also be highly positive.
8. **Assertion:** The solubility of must salts in water increases with rise of temperature.
   Reason: For most of the ionic compounds, $\triangle_{sol} H^o$ is positive and the dissociation process is endothermic.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b) If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false
9. Assume each reaction is carried out in an open container. For which reaction will ΔH = ΔE?
   a) $H_{2(g)} + Br_{2(g)} \longrightarrow 2HBr_{(g)}$ b) $C_{(s)} + 2H_2O_{(g)} \longrightarrow 2H_{2(g)} + CO_{2(g)}$ c) $PCl_{5(g)} \longrightarrow PCl_{3(g)} + Cl_{2(g)}$
   d) $2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_{2(g)}$
10. For a reaction,
    $CaCo_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$
    $\triangle \int H^0(CaO) = -635.1 kJmol^{-1}$
    $\triangle \int H^0(CO_2) = -393.5 kJmol^{-1}$ and
    $\triangle \int H^0(CaCO_3) = -1206.9 kJmol^{-1}$
    Which of the following is a correct statement?
    a) A large amount of heat is evolved during the decomposition of $CaCO_3$
    b) Decomposition of $CaCO_3$ is an endothermic process and heat is provided for decomposition.

c) The amount of heat evolved cannot be calculated from the data provided.
d) $\triangle_r H^o = \sum \triangle_f H^o$(reactants) $- \sum \triangle_f H^o$(products)

11. If, ΔE is the heat of reaction for $C_2H_5OH_{(l)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{(l)}$ at constant volume, the ΔH (heat of reaction at constant pressure), then the correct relation is :
a) $\Delta H = \Delta E + RT$ b) $\Delta H = \Delta E - RT$ c) $\Delta H = \Delta E - 2RT$ d) $\Delta H = \Delta E + 2RT$

12. If the heat change at constant volume for decomposition of silver oxide is 80.25 kJ, what will be the heat change at constant pressure?
a) 80.25 kJ b) > 80.25 kJ c) < 80.25 kJ d) 160.50 kJ

13. A reaction proceeds through two paths I and II to convert X → Z.



What is the correct relationship between Q, Q_1 and $Q_{2?}$
a) $Q = Q_1 X Q_2$ b) $Q = Q_1 + Q_2$ c) $Q = Q_2 - Q_1$ d) $Q = Q_1/Q_2$

14. The amount of heat evolved when 0.50 mole of HCl is mixed with 0.30 mole of NaOH solution is
a) 57.1 kJ b) 28.55 kJ c) 11.42 kJ d) 17.13 kJ

15. For the reactions, $N_2 + 3H_2 \longrightarrow 2NH_3$, $\Delta H = ?$
a) $\Delta E + 2RT$ b) $\Delta E - 2RT$ c) $\Delta H = RT$ d) $\Delta E - RT$

16. Which of the following expressions is correct to calculate enthalpy of a reaction?
a) $\triangle H_{reaction} = \sum B.E_{reactants} - \sum B.E_{products}$ b) $\triangle H_{reaction} = \triangle H_1 x \triangle H_2 x \triangle H_3 ...$
c) $\triangle H_{reaction} = \sum \triangle_f H_{reactants} - \sum \triangle_f H_{products}$ d) $\triangle H_{reaction} = \sum B.E_{products} - \sum B.E_{reactants}$

17. Read the following statements regarding spontaneity of a process and mark the appropriate choice.
(i) When enthalpy factor is absent then randomness factor decides spontaneity of a process.
(ii) When randomness factor is absent then enthalpy factor decides spontaneity of a process.
(iii) When both the factors take place simultaneously, the magnitude of both of factors decide spontaneity of a process.
a) Statements (i) and (ii) are correct and (iii) is incorrect. b) Statement (iii) is correct, (i) and (ii) are incorrect.
c) Statements (i), (ii) and (iii) are correct. d) Statements (i), (ii) and (iii) are incorrect

18. The factor of ΔG values is important in metallurgy. The ΔG values for the following reactions at 800° C are given as
$S_2(g) + 2O_2(g) \longrightarrow 2SO_2(g); \Delta G = -544kJ$
$2Zn(S) + S_2(g \longrightarrow 2Z_nS_{(s)}; \Delta G = -293kJ$
$2Zn(s) + O_2(g) \longrightarrow 2ZnO(s); \Delta G = -480kJ$
The ΔG for the reaction,
$2ZnS(g) + 3O_2(g) \longrightarrow 2ZnO(g) + 2SO_2(g)$ Will be:
a) -357 kJ b) -731 kJ c) -773 kJ d) - 229 kJ

19. For the gas phase reaction, $PCl_{5(g)}\ {}^{-}PCl_{3(g)} + Cl_{2(g)}$ Which of the following conditions are correct?
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 $\Delta S < 0$

20. For the reaction, $C_3H_{8(g)} + 5O_{2(g)} \longrightarrow 3CO_{2(g)}\ 4H_2O_{(l)}$ at constant temperature, $\Delta H - \Delta E$ is :
a) + 3RT b) - RT c) + RT d) - 3RT

21. A gas is allowed to expand in a well insulated container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal energy $\triangle U$ of the gas in joules will be:
a) -500 J b) -505 J c) +505 J d) 1136.25 J

22. Which of the following does not represent enthalpy change during phase transformation?

a) Standard enthalpy of fusion b) Standard enthalpy of vaporisation c) Standard enthalpy of sublimation
d) Standard enthalpy of formation

23. The value of ΔH and ΔS for the reaction, $C_{(graphite)} + CO_{2(g)} \longrightarrow 2CO_{(g)}$ are 170 kJ and 170 JK^{-l}, retpectively. This reaction will be spontaneous at:
a) 710 K b) 910 K c) 1010 K d) 510 K

24. What will be the work done when one mole of a gas expands isothermally from 15 L to 50 L against a constant pressure of 1 atm at 25°C?
a) - 3542 cal b) - 843.3 cal c) - 718 cal d) - 60.23 cal

25. Consider the following reaction:
$\text{(i) } \mathrm{H^+}_{(\mathrm{aq})} + \mathrm{OH^-}_{(\mathrm{aq})} = \mathrm{H_2O}(l)$
$\Delta \mathrm{H} = -\mathrm{X}_1 \text{ kJ mol}^{-1}$
$\text{(ii) } \mathrm{H}_{2(\mathrm{g})} + \frac{1}{2}\mathrm{O}_{2(\mathrm{g})} = \mathrm{H_2O}(l)$
$\Delta \mathrm{H} = -\mathrm{X}_2 \text{ kJ mol}^{-1}$
$\text{(iii) } \mathrm{CO}_{2(\mathrm{g})} + \mathrm{H}_{2(\mathrm{g})} = \mathrm{CO}_{(\mathrm{g})} + \mathrm{H_2O_2}$
$\Delta \mathrm{H} = -\mathrm{X}_3 \text{ kJ mol}^{-1}$
$\text{(iv) } \mathrm{C_2H}_{2(\mathrm{g})} + \frac{5}{2}\mathrm{O}_{2(\mathrm{g})} = 2\mathrm{CO}_{2(\mathrm{g})} + \mathrm{H_2O}(l)$
$\Delta \mathrm{H} = +4\mathrm{X}_4 \text{ kJ mol}^{-1}$
Enthalpy of formation of H_2On is
a) $+\mathrm{X}_3 \text{ kJ mol}^{-1}$ b) $-X_4 kJmol^{-1}$ c) $+X_1 kJmol^{-1}$ d) $-X_2 kJmol^{-1}$

26. For the cell reaction
$2\mathrm{Fe}^{3+}(\mathrm{aq})2\mathrm{I}^-(\mathrm{aq}) \rightarrow 2\mathrm{Fe}^{2+}(\mathrm{aq})\mathrm{I}_2(\mathrm{aq})\mathrm{E}^{-}_{\text{cell}} = 0.24 \text{ V}$ at 298 k The standard Gibbs energy $(\Delta_r G^-)$ of the cell reaction is:
[Given that Faraday constant F = 96500 C mol^{-1}]
a) $-23.16 \text{ kJ mol}^{-1}$ b) $46.32 \text{ kJ mol}^{-1}$ c) $23.16 \text{ kJ mol}^{-1}$ d) $-46.32 \text{ kJ mol}^{-1}$

27. Identify the correct statement for change of Gibbs energy for a system $(\Delta \mathrm{G}_{\text{system}})$ at constant temperature and pressure :
a) If $\Delta \mathrm{G}_{\text{system}} = 0$, the system has attained equilibrium.
b) If $\Delta \mathrm{G}_{\text{system}} = 0$ the system is still moving in a particular direction
c) If $\Delta \mathrm{G}_{\text{system}} < 0$, the process is not spontaneous d) If $\Delta \mathrm{G}_{\text{system}} > 0$, the process is not spontaneous

28. For a sample of perfect gas when its pressure is changed isothermally from P_i to P_f the entropy change is given by :
a) ΔS = nR In $\left(\frac{p_f}{p_i}\right)$ b) ΔS = nR In $\left(\frac{p_i}{p_f}\right)$ c) ΔS = nRT In $\left(\frac{p_f}{p_i}\right)$ d) ΔS = RT In $\left(\frac{p_i}{p_f}\right)$

29. A reaction is at equilibrium at 100°C and the enthalpy change for the reaction is 42.6 kJ mol^{-1}. What will be the value of $\triangle$S in J K^{-1} mol^{-1}.
a) 120 b) 426.2 c) 373.1 d) 114.2

30. Which of the following are not state functions?
(I) q + W, (II) q, (III) W, (IV) H - TS
a) I and IV b) II, III and IV c) I, II and III d) II and III

31. **Assertion:** $\triangle$H for an exothermic reaction is negative and for an endothermic reaction is positive.
Reason: Enthalpy is an extensive property.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

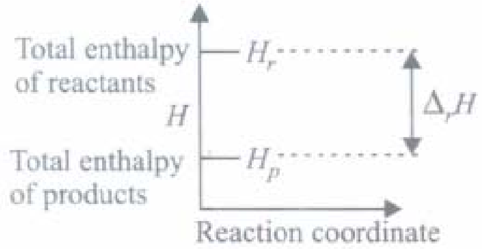
32. Bond energies of some bonds are given below:
Cl- Cl = 242.8 kJ mol^{-1}, H - Cl = 431.8 kJ mol^{-1},
O- H = 464 kJ mol^{-1},O = O = 442 kJ mol^{-1}
Using the B.E., calculate tlH for the following reactoin, $2Cl_2+2H_2O \longrightarrow 4HCl+O_2$
a) 906 kJ mol^{-1} b) 172.4 kJ mol^{-1} c) 198.8 kJ mol^{-1} d) 442 kJ mol^{-1}

33. The entropy change can be calculated by using the expression, $\triangle S = \frac{q_{rev}}{T}$. When water freezes in a glass beaker, choose the correct statement amongst the following:
a) Δ S (system) decreases but Δ S (surroundings) remains the same
b) Δ S (system) increases but Δ S (surroundings) decreases
c) Δ S (system) decreases but Δ S (surroundings) increases
d) $\triangle$ S (system) decreases but $\triangle$ S (surroundings) also decreases

34. The enthalpy of hydrogenation of cyclohexane is - 119.5 kJ mol^{-1}. If resonance energy of benzene is -150.4 kJ mol^{-l}, its enthalpy of hydrogenation would be:
a) -208.1 kJ mol^{-1} b) -269.9 kJ mol^{-1} c) -358.5 kJ mol^{-1} d) -508.9 kJ mol^{-1}

35. For the gas phase reaction,
$\mathrm{PCl_5}(g) \rightleftharpoons \mathrm{PCl_3}(g) + \mathrm{Cl_2}(g)$
which of the following conditions are correct?
a) $\Delta \mathrm{H} = 0 \text{ and } \Delta \mathrm{S} < 0$ b) $\Delta \mathrm{H} > 0 \text{ and } \Delta \mathrm{S} > 0$ c) $\Delta \mathrm{H} < 0 \text{ and } \Delta \mathrm{S} < 0$
d) $\Delta \mathrm{H} > 0 \text{ and } \Delta \mathrm{S} < 0$

36. The given enthalpy diagram represents which of the following reactions?



a) Enthalpy diagram for endothermic reaction b) Enthalpy diagram for exothermic reaction
c) Enthalpy diagram for reversible reaction d) Enthalpy diagram for non-spontaneous reaction

37. Which of the following pairs of a chemical reaction is certain to result in a spontaneous reaction?
a) Exothermic and decreasing disorder b) Endothermic and increasing disorder
c) Exothermic and increasing disorder d) Endothermic and decreasing disorder

38. For a given reaction, $\Delta \mathrm{H} = 35.5 \mathrm{~kJ~mol}^{-1} \text{ and } \Delta \mathrm{S} = 83.6 \mathrm{JK}^{-\ 1} \mathrm{~mol}^{-1}$. The reaction is spontaneous at : (Assume that $\Delta \mathrm{H} \text{ and } \Delta \mathrm{S}$ do not vary with temperature:
a) T > 425 K b) All temperatures c) T > 298 K d) T < 425 K

39. For the reaction,
$\mathrm{N_2} + 3\mathrm{H_2} \rightleftharpoons 2\mathrm{NH_3}, \quad \Delta \mathrm{H} = ?$
a) $\Delta E + 2RT$ b) $\Delta E - 2RT$ c) $\Delta H = RT$ d) $\Delta E - RT$

40. The heat of combustion of carbon to CO_2 is - 393.5 kJ/mol. The heat released upon formation of 35.2 g of CO_2 from carbon and oxygen gas is :
a) + 315 kJ b) - 630 kJ c) - 3.15 kJ d) - 315 kJ

41. The value for $\triangle$U for the reversible isothermal evaporation of 90 g water at 100°C will be ($\triangle H_{evap}$ of water = 40.8 kJ mol^{-1} , R = 8.314 J K^{-l} mol^{-1})
a) 125.03 kJ b) 4800 kJ c) 188.494 kJ d) 40.8 kJ

42. Bond dissociation enthalpies of $H_{2(g)}$ and $N_{2(g)}$ are 436.0 kJ mol^{-1} and 941.8 kJ mol^{-1}, respectively, and enthalpy of formation of $NH_{3(g)}$ is -46 kJ mol^{-1} . What are the enthalpy of atomisation of $NH_{3(g)}$ and the average bond enthalpy of N - H bond respectively (in kJ mol^{-1})?
a) 1170.9,390.3 b) 117,300 c) 300,200 d) 2000,1975

43. Which of the following statements is correct?
a) The presence of reacting species in a covered beaker is an example of open system.
b)
There is an exchange of energy as well as matter between the system and the surroundings in a closed system.
c) The presence of reactants in a closed vessel made up of copper is an example of a closed system.
d)
The presence of reactants in a thermos flask or any other closed insulated vessel is an example of a closed system.

44. **Assertion:** There is no change in internal energy in a cyclic process.
Reason: Internal energy is a state function.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

45. What is the enthalpy change for ,
$2\mathrm{H}_2\mathrm{O}_2(\mathrm{l}) \rightarrow 2\mathrm{H}_2\mathrm{O}(\mathrm{l})+\mathrm{O}_2(\mathrm{~g})$ if heat of formation of $\mathrm{H}_2\mathrm{O}_2(\mathrm{l})$
$\text{and } \mathrm{H}_2\mathrm{O}(\mathrm{l}) \text{ are } -188 \text{ and } -286\ \mathrm{kJ/mol} \text{ respectively?}$
a) $-196\ \mathrm{kJ/mol}$ b) $+948\ \mathrm{kJ/mol}$ c) $+196\ \mathrm{kJ/mol}$ d) $-948\ \mathrm{kJ/mol}$

46. Bond energies of H - H and Cl-Cl are 430 kJ mol^{-1} and 242 kJ mol^{-1} respectively. $\triangle H_f$ for HCl is 91 kJ mol^{-1}. What will be the bond energy of H - Cl?
a) 672 kJ b) 182 kJ c) 245 kJ d) 88 kJ

47. **Assertion:** Third law of thermodynamics is confined to pure crystalline solids.
Reason: Theoretical arguments and practical evidences have shown that entropy of solutions and super cooled liquids is not zero at 0 K.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

48. The equilibrium constant for a reaction is 10. What will be the value of $\triangle G^{\theta}$?
R = 8.314 JK^{-1} mol^{-1}T = 300K.
a) -5.744 kJ b) -574 kJ c) + 11.48 kJ d) + 5.74 kJ

49. Standard.entropies of $\mathrm{X2}, \mathrm{Y2} \text{ and } \mathrm{XY3} \text{ are}$ 60,40 and $50 \mathrm{JK}^{-1}\ \mathrm{mol}^{-1}$ respectively. For the reaction $\frac{1}{2} X_2+\frac{3}{2} Y_2 \rightleftharpoons XY_3, \Delta H=-30\ \mathrm{kJ}$ to be at equilibriurn, at temperature should be:
a) 750 K b) 1000 K c) 1250 K d) 500 K

50. Consider the following reaction occurring in an automobile
$2\mathrm{C}_8\mathrm{H}_{18}(\mathrm{~g})+25\mathrm{O}_2(\mathrm{~g}) \rightarrow 16\mathrm{CO}_2(\mathrm{~g})+18\mathrm{H}_2\mathrm{O}(\mathrm{g})$ The sign of $\Delta\mathrm{H}, \Delta\mathrm{S} \text{ and } \Delta\mathrm{G}$ would be
a) +, -, + b) -, +, - c) -, +, + d) +, +, -