# PHYSICAL CHEMISTRY

NEET

CRASH COURSE

## THERMODYNAMIC AND THERMOCHEMISTRY


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# THERMODYNAMIC & THERMOCHEMISTRY

Q.1 Among the following, an intensive property is :
(1) mass (2) volume (3) surface tension (4) enthalpy

Q.2 Out of boiling point (I), entropy (II), pH (III) and e.m.f. of a cell (IV), intensive properties are -
(1) I, II (2) I, II, III (3) I, III, IV (4) All of the above

Q.3 Thermodynamic equilibrium involves
(1) Chemical equilibrium (2) Thermal equilibrium (3) Mechanical (4) All the above

Q.4 A tightly closed thermoflask contains some ice cubes. This constitutes
(1) closed system (2) open system
(3) isolated system (4) Non-thermodynamic system

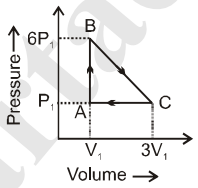
Q.5 An isolated system is that system in which
(1) there is no exchange of energy with the surroundings
(2) there is exchange of mass and energy with the surrounding
(3) There is no exchange of mass and energy with the surrounding
(4) There is exchange of mass with surroundings.

Q.6 The first law of thermodynamics is represented by the equation :
(1) $\Delta E = Q - W$ (2) $\Delta E = Q + W$ (3) $W = Q + \Delta E$ (4) $Q = W + \Delta E$

Q.7 A sample of liquid in a thermally insulated container (a calorimeter) is stirred by a motor. Taking liquid as a system for this process choose the appropriate option:
(1) $w < 0; q = 0; \Delta U = 0$ (2) $w > 0; q > 0; \Delta U > 0$
(3) $w < 0; q > 0; \Delta U = 0$ (4) $w > 0; q = 0; \Delta U > 0$

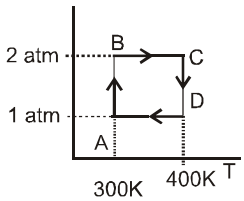
Q.8 As per the First Law of thermodynamics, which of the following statement would be appropriate:
(1) Energy of the system remains constant (2) Energy of the surroundings remains constant
(3) Entropy of the universe remains constant (4) Energy of the universe remains constant

Q.9 An ideal gas is taken around the cycle ABCA as shown in P-V diagram. The net work done by the gas during the cycle is equal to :




(1) $12P_1V_1$ (2) $6P_1V_1$ (3) $5P_1V_1$ (4) $P_1V_1$

Q.10 Two moles of Helium gas undergo a reversible cyclic process as showin in figure. Assuming gas to be ideal. What is the work for the process C to D?




(1) $-800\ R\ell n2$ (2) zero (3) $+200R\ell n2$ (4) $-600R\ell n2$

Q.11 Heat exchanged in a chemical reaction at the constant temprature and pressure is known as :
(1) Internal energy (2) entropy (3) enthalpy (4) free energy

Q.12 A gas expands isothermally against a constant external pressure of 1 atm from a volume of 10- $dm^3$ to a volume of 20 $dm^3$. It absorbs 800 J of thermal energy from its surroundings. The $\Delta U$ is :
(1) – 312 J (2) + 123 J (3) – 213 J (4) + 231 J

Q.13 For the real gases reaction $2CO(g) + O_2(g) \longrightarrow 2CO_2(g)$ ; $\Delta H = -560$ kJ. In 10 litre rigid vessel at 500 K the initial pressure is 70 bar and after the reaction it becomes 40 bar. The change in internal energy is :
(1) – 557 kJ (2) – 530 kJ (3) – 563 kJ (4) None of these

Q.14 The work done in adiabatic process on ideal gas by a constant external pressure would be :
(1) Zero (2) $\Delta E$ (3) $\Delta H$ (4) $\Delta G$

Q.15 The process carried out in perfect insulation is
(1) isothermal (2) isobaric (3) isochoric (4) adiabatic

Q.16 Adiabatic process involves
(1) $Q = 0$ (2) $\Delta E = 0$ (3) $\Delta W = 0$ (4) $\Delta V = 0$

Q.17 Predict which of the following reaction (s) has a positive entropy change ?

I. $Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(s)$

II. $NH_4Cl(s) \longrightarrow NH_3(g) + HCl(g)$

III. $2NH_3(g) \longrightarrow N_2(g) + 3H_2(g)$

(1) I and II (2) III (3) II and III (4) II

Q.18 Which of the following reactions is associated with negative change in entropy ?
(1) $2SO_3(g) \longrightarrow 2SO_2(g) + O_2(g)$ (2) $C_2H_6(g) \longrightarrow C_2H_4(g) + H_2(g)$
(3) $2C(s, \text{graphite}) + O_2(g) \longrightarrow 2CO(g)$ (4) $3C_2H_2(g) \longrightarrow C_6H_6(\ell)$

Q.19 When two mole of an ideal gas $\left(C_{p,m} = \frac{5}{2}R\right)$ heated from 300 K to 600 K at constant pressure. The change in entropy of gas ($\Delta S$) is :
(1) $\frac{3}{2}R \ln 2$ (2) $-\frac{3}{2}R \ln 2$ (3) $5R \ln 2$ (4) $\frac{5}{2}R \ln 2$

Q.20 The entropy change when two moles of ideal monoatomic gas is heated from 200ºC to 300 ºC reversibly and isochorically ?
(1) $\frac{3}{2} R \ln\left(\frac{300}{200}\right)$ (2) $\frac{5}{2}R \ln\left(\frac{573}{273}\right)$ (3) $3R \ln\left(\frac{573}{473}\right)$ (4) $\frac{3}{2} R \ln\left(\frac{573}{473}\right)$

Q.21 If one mole of an ideal gas $\left(C_{p,m} = \frac{5}{2}R\right)$ is expanded isothermally at 300 K until it's volume is tripled, then change in entropy of gas is :
(1) zero (2) infinity (3) $\frac{5}{2}R \ln 3$ (4) $R \ln 3$

Q.22 Which of the following conditions regarding a chemical process ensures its spontanlity at all temperature?
(1) $\Delta H > 0, \Delta G < 0$ (2) $\Delta H < 0, \Delta S > 0$ (3) $\Delta H < 0, \Delta S < 0$ (4) $\Delta H > 0, \Delta S < 0$

Q.23 For isothermal expansion in case of an ideal gas :
(1) $\Delta G = \Delta S$ (2) $\Delta G = \Delta H$ (3) $\Delta G = -T.\Delta S$ (4) None of these

Q.24 For the gas - phase decomposition, $PCl_5(g) \rightleftharpoons^{\Delta} PCl_3(g) + Cl_2(g)$ :
(1) $\Delta H < 0, \Delta S < 0$ (2) $\Delta H > 0, \Delta S > 0$
(3) $\Delta H > 0, \Delta S < 0$ (4) $\Delta H < 0, \Delta S > 0$

Q.25 In the exothermic reaction the enthalpy of reaction is always : **[AIIMS 2001]**
(1) zero (2) positive (3) negative (4) none of these

Q.26 Which of the reaction defines molar $\Delta H_f°$?
(1) $CaO(s) + CO_2(g) \longrightarrow CaCO_3(s)$
(2) $\frac{1}{2} Br_2(g) + \frac{1}{2} H_2(g) \longrightarrow HBr(g)$
(3) $N_2(g) + 2H_2(g) + \frac{3}{2} O_2(g) \longrightarrow NH_4NO_3(s)$
(4) $I_2(s) + H_2(g) \longrightarrow 2HI(g)$

Q.27 Enthalpy of formation of $NH_3(g)$ is equal to:
(1) Sum of the enthalpy contents of 0.5 mol $N_2(g)$ and 1.5 mol $H_2(g)$
(2) Enthalpy content of $NH_3(g)$
(3) Sum of the enthalpy contents of 1.0 mol $N_2(g)$ and 3.0 mol $H_2(g)$
(4) None of the above

Q.28 The enthalpy of formation of ammonia is = 46.0 kJ $mol^{-1}$. The enthalpy change for following reaction is:
$2NH_3 \longrightarrow N_2 + 3H_2$ **[AIIMS 2002]**
(1) 42.0 kJ (2) 64.0 kJ (3) 86.0 kJ (4) 92.0 kJ

Q.29 If heat of dissociation of $CHCl_2COOH$ is 0.7 kcal/mole then $\Delta H$ for the reaction :
$CHCl_2COOH + KOH \longrightarrow CHCl_2COOK + H_2O$
(1) – 13 kcal (2) + 13 kcal (3) – 14.4 kcal (4) – 13.7 kcal

Q.30 When a certain amount of ethylene was combusted, 6226 kJ heat was evolved. If heat of combustion of ethylene is 1411 kJ/mole, the volume of $O_2$ (at NTP) that entered into the reaction is -
(1) 296.5 ml (2) 296.5 litres (3) 6226 × 22.4 litres (4) 22.4 litres

Q.31 The bond dissociation energy of gaseous $H_2$, $Cl_2$ and HCl are 104, 58 and 103 kcal $mol^{-1}$ respectively. The enthalpy of formation for HCl gas will be
(1) – 44.0 kcal (2) – 22.0 kcal (3) 22.0 kcal (4) 44.0 kcal

Q.32 AB, $A_2$ and $B_2$ are diatomic molecules. If the bond enthalpies of $A_2$, AB & $B_2$ are in the ratio 1 : 1 : 0.5 and enthalpy of formation of AB from $A_2$ and $B_2$ is – 100 kJ/$mol^{-1}$. What is the bond enthalpy of $A_2$.
(1) 400 kJ/mol (2) 200 kJ/mol (3) 100 kJ/mol (4) 300 kJ/mol

## ASSERTION & REASON

**Directions :** Each of these questions contains an Assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

*(1) If both assertion and reason are true and reason is the correct explanation of assertion.*
*(2) If both assertion and reason are true but reason is not the correct explanation of assertion.*
*(3) If Assertion is true but reason is false.*
*(4) If both assertion and reason are false.*

Q.33 **Assertion :** The enthalpy of formation of $H_2O(\ell)$ is greater than of $H_2O$ (g) in magnitude.
**Reason :** Enthalpy change is negative for the condensation reaction

$$H_2O\,(g) \longrightarrow H_2O(\ell)$$

Q.34 **Assertion :** In the following reaction : $C(s) + O_2(g) \longrightarrow CO_2(g)$ ; $\Delta H = \Delta U - RT$
**Reason :** $\Delta H$ is related to $\Delta U$ by the equation, $\Delta H = \Delta U - \Delta n_g RT$.

Q.35 **Assertion :** Enthalpy and entropy of any elementary substance in the standard states are taken as zero.
**Reason :** At absolute zero, entropy of the perfectly crysalline substance is not equal to zero.