QB365 Question Bank Software Study Materials

Thermodynamics Important 2 Marks Questions With Answers (Book Back and Creative)

11th Standard

Chemistry

Total Marks : 60

2 Marks

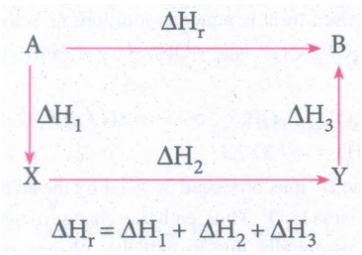
30 x 2 = 60

1) State the first law of thermodynamics.

Answer : The first law of thermodynamics, also known as the law of conservation of energy, states that "The total energy of an isolated system remains constant though it may change from one form to another."
The mathematical statement of the First Law is: $\Delta U=q+w$
Where q - the amount of heat supplied to the system; w - work done on the system

2) Define Hess's law of constant heat summation.

Answer : The enthalpy change of a reaction either at constant volume or constant pressure is the same whether it takes place in a single or multiple steps provided the initial and final states are same.



3) Explain intensive properties with two examples

Answer : The property that is independent of the mass or the size of the system is called an intensive property.
Examples: Refractive index, Surface tension, density, temperature, Boiling point, Freezing point, molar volume, etc.,

4) What is the usual definition of entropy? What is the unit of entropy?

Answer : (i) Entropy is a measure of the molecular disorderliness (randomness) of a system. $dS = dq_{rev}/T$
(ii) The entropy (S) is equal to heat energy exchanged (q) divided by the temperature (T) at which the exchange takes place.
Therefore, The Slunit of entropy is JK^{-1}

5) Predict the feasibility of a reaction when
(i) both ΔH and ΔS positive
(ii) both ΔH and ΔS negative
(iii) ΔH decreases but ΔS increases

Answer : (i) non-spontaneous
(ii) non-spontaneous
(iii) spontaneous

6) Define Gibb's free energy.

Answer : Gibbs free energy is defined as G = H - TS

7) Define enthalpy of combustion.

Answer : The heat of combustion of a substance is defined as "The change in enthalpy of a system when one mole of the substance is completely burnt in excess of air or oxygen". It is denoted by ΔH_C

8) Define molar heat capacity. Give its unit

Answer : Molar heat capacity is defined as "The amount of heat absorbed by one 'mole of the substance to raise its temperature by 1 kelvin". The SI unit of molar heat capacity is JK^{-1} mol^{-1}

9) Define the calorific value of food. What is the unit of calorific value?

Answer : The calorific value is defined as "The amount of heat produced in calories (or joules) when one gram of the substance is completely burnt." The SI unit of calorific value is J kg^{-1}. It is usually expressed in cal g^{-1}.

10) Define enthalpy of neutralization

Answer : The heat of neutralisation is defined as "The change in enthalpy when one gram equivalent of an acid is completely neutralised by one gram equivalent of a base or vice versa in dilute solution"

11) What is lattice energy?

Answer : Lattice energy is defined as "The amount of energy required to completely remove the constituent ions from its crystal lattice to an infinite distance." It is also referred as lattice enthalpy

12) Give Kelvin statement of second law of thermodynamics.

Answer : It is impossible to construct a machine that absorbs heat from a hot source and converts it completely into work by a cyclic process without transferring a part of heat to a cold sink

13) State the third law of thermodynamics.

Answer : (i) The third law of thermodynamics states that the entropy of pure crystalline substance at absolute zero is zero.
(ii) It can also be stated as it is impossible to lower the temperature of an object to absolute zero in a finite number of steps
(iii) Mathematically, $\lim_{T\to 0} S = 0$ for a perfectly ordered crystalline state.

14) Identify the state and path function out of the following:

a) Enthalpy

b) Entropy

c) Heat

d) Temperature

e) Work

f) Free energy.

Answer : **State Function:** Enthalpy, entropy, temperature, free energy

Pat Function: Heat, work.

15) Calculate ΔH_r^0 for the reaction $CO_2(g) + H_2(g) \longrightarrow CO(g) + H_2O(g)$ given that ΔH^f_0 for CO_2 (g), CO (g) and H_2O (g) are - 393.5, - 111.31 and - 242 kJ mol^{-1} respectively.

Answer : ΔH_f^0 CO_2 = -393.5 kJ mol^{-1}

ΔH_f^0 CO = -111.31 kJ mol^{-1}

ΔH_f^0 (H_2O) = - 242 kJ mol^{-1}

$CO_2(g) + H_2(g)$ - $CO(g) + H_2O(g)$

ΔH_f^0 = ?

$\Delta H_f^0 = \Sigma(\Delta H_f^0)_{products} - \Sigma(\Delta H_f^0)_{reactions}$

$\Delta H_f^0 = [\Delta H_f^0(CO) + \Delta H_f^0(H_2O)] - [\Delta H_f^0(CO_2) + \Delta H_f^0(H_2)]$

$\Delta H_f^0 = [-111.31 + (-242)] - [-393.5 + (0)]$

$\Delta H_f^0 = [-353.31] + 393.5$

$\Delta H_f^0 = 40.19$

$\Delta H_f^0 = +40.19$ kJ mol^{-1}.

16) Give examples for extensive and intensive properties.

Answer :

EXTENSIVE PROPERTIES	**INTENSIVE PROPERTIES**
volume, mass, amount of substance. (mole), energy, enthalpy, entropy, free energy, heat capacity.	molar volume, density, molar mass, molarity mole fraction, molality, specific heat capacity.

17) At 0°C, ice and water are in equilibrium and the enthalpy change for the process, $H_2O(s) \rightleftharpoons H_2O(l)$ is 6 KJ mol^{-1} Calculate the entropy change for the conversion ice into water.

Answer : For the process, $H_2O(s) \rightleftharpoons H_2O(l)$

$\triangle S(fusion) = \frac{\Delta H(fusion)}{Freezingtemperature}$

$= \frac{6 \times 1000}{273} = 21.98$ JK^{-1} mol^{-1}

18) For the reaction, $2A(g) + B(g) \longrightarrow 2D(g)$ ΔU^0 = -10.5 kJ and ΔS^0 = - 44.1 JK^{-1}. Calculate ΔG^0 for the reaction and predict whether the reaction is spontaneous or not.

Answer : $\Delta H^0 = \Delta U^0 + RT(\Delta n)$

= -10.5 + 8.314 x 10^{-3} x 298 x (-1)

= -12.978 kJ

We know, $\Delta G^0 = \Delta H^0 - T\Delta S^0$

= -12.978 - 298 (- 44.1 x 10^{-3})

= 0.164 kJ

Hence, the reaction is non spontaneous.

19) Calculate the entropy change in surroundings when 1 mol of $H_20_{(l)}$ is formed under standard conditions. Given $\Delta H^{\ominus}$ = - 286 kJ mol^{-1}.

Answer : $q_{rev} = (-\Delta_f H^{\ominus}) = -286kJ\ mol^{-1} = 286000\ J\ mol^{-1}$

$\Delta S_{(Surroundmgs)} = \frac{q_{rev}}{T} = \frac{286000\ J\ mol^{-1}}{298\ K}$ = 959 J K^{-1} mol^{-1}.

20) Define heat of solution.

Answer : The heat of solution is defined as "the change in enthalpy of the system when one mole of a substance is dissolved in a specified quantity of solvent at a given temperature".

21) Define molar heat of vapourisation?

Answer : The molar heat of vapourisation is defined as the change in enthalpy when one mole of liquid is converted into vapour or gaseous state at its boiling point.

22) Define Zeroth law of thermodynamics (or) Law of thermal equilibrium.

Answer : Zeroth law of thermodynamics states that 'If two systems at different temperatures are separately in thermal equilibrium with a third one, then they tend to be in thermal equilibrium with themselves'.

23) What is entropy of Vapourisation?

Answer : When one mole of liquid is boiled at its boiling point reversibly, the heat absorbed is called as molar heat of vapourisation. The entropy change is given by

$\Delta S_v = \frac{\Delta H_v}{T_b}$

Where ΔH_v is molar heat of transition and T_b = transition temperature.

24) Many thermodynamically feasible reactions do not occur under ordinary conditions. Why?

Answer : Under ordinary conditions, the average energy of the reactants may be less than threshold energy. They require some activation energy to initiate the reaction.

25) What are the scope of thermodynamics?

Answer : The scope of thermodynamics:

(i) To derive feasibility of a given process.

(ii) It also helps in predicting how far a physical (or) chemical change can proceed, until the equilibrium conditions are established.

26) What do you mean by Internal energy? (or) What are the components of internal energy?

Answer : The internal energy is a characteristic property of a system which is denoted by the symbol U. The internal energy of a system is equal to the energy possessed by all its constituents namely atoms, ions and molecules. The total energy of all molecules in a system is equal to the sum of their translational energy (U_t), vibrational energy (U_v), rotational energy (U_r), bond energy (U_b), electronic energy (U_e) and energy due to molecular interactions (U_i).

Thus:

$U = U_t + U_v + U_r + U_b + U_e + U_i$

The total energy of all the molecules of the system is called internal energy

27) Zeroth law of thermodynamics was put forward much after the establishment of the first and second laws. Yet it is placed before first and second law. Why?

Answer : Because it provides a logical basis for the concept of temperature of the system.

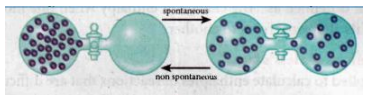
28) Give some common examples for spontaneous and non - spontaneous reactions.

Answer : 1. A waterfall runs downhill, but never uphill, spontaneously.

2. A lump of sugar dissolves spontaneously in a cup of coffee, but never reappears in its original form spontaneously.

3. Heat flows from hotter object to a colder one, but never flows from colder to hotter object spontaneously.

4. The expansion of a gas into an evacuated bulb is a spontaneous process, the reverse process that is gathering of all molecules into one bulb is not. spontaneous.



29) Define: Enthalpy of transition.

Answer : The heat change, when one mole of a solid changes reversibly from one allotropic form to another at its transition temperature is called enthalpy of transition.

30) Define: Enthalpy of vapourisation.

Answer : The heat absorbed, when one mole of liquid is boiled at its boiling point reversibly, is called molar heat of vapourisation.

$$\Delta S_v = \frac{\Delta H_v}{T_b}$$