CBSE Class 11 Chemistry

NCERT Exemplar Solutions

Chapter 6

Thermodynamics

Multiple Choice Questions (Type-I)

1.Thermodynamics is not concerned about _____.

(i) energy changes involved in a chemical reaction.

(ii) the extent to which a chemical reaction proceeds.

(iii) the rate at which a reaction proceeds.

(iii) the feasibility of a chemical reaction.

Ans. (iii)

Explanation: Thermodynamics is not concerned about how and at what rate these energy transformations are carried out, but is based on initial and final states of a system undergoing the change. Laws of thermodynamics apply only when a system is in equilibrium or moves from one equilibrium state to another equilibrium state.

2.Which of the following statements is correct?

(i) The presence of reacting species in a covered beaker is an example of open system.

(ii) There is an exchange of energy as well as matter between the system and the surroundings in a closed system.

(iii) The presence of reactants in a closed vessel made up of copper is an example of a closed system.

(iv) The presence of reactants in a thermos flask or any other closed insulated vessel is an example of a closed system.

Ans. (iii)

Explanation: The presence of reactants in a closed vessel made of conducting material e.g., copper or steel is an example of a closed system.

3.The state of a gas can be described by quoting the relationship between ____.

(i) pressure, volume, temperature

(ii) temperature, amount, pressure

(iii) amount, volume, temperature

(iv) pressure, volume, temperature, amount

Ans.(iv)

Explanation: Variables like p, V, T are called state variables or state functions because their values depend only on the state of the system and not on how it is reached.

4. The volume of gas is reduced to half from its original volume. The specific heat will ____.

(i) reduce to half

(ii) be doubled

(iii) remain constant

(iv) increase four times

Ans.(iii)

Explanation: Specific heat capacity is the quantity of heat required to raise the temperature of one unit mass of a substance by one degree celsius (or one kelvin). That is why it is an intensive property which does not depend on mass.

5.During complete combustion of one mole of butane, 2658 kJ of heat is released.

The thermochemical reaction for above change is

(i) $2C_4H_{10}(g)+13O_2(g)\rightarrow 8CO_2(g)+10H_2O(l)\ \Delta_cH=-2658.0\ kJ\ mol^{-1}$

(ii) $C_4H_{10}(g)+\frac{13}{2}O_2(g)\rightarrow 4CO_2(g)+5H_2O(g)\ \Delta_cH=-1329.0\ kJ\ mol^{-1}$

(iii) $C_4H_{10}(g)+\frac{13}{2}O_2(g)\rightarrow 4CO_2(g)+5H_2O(l)\ \Delta_cH=-2658.0\ kJ\ mol^{-1}$

(iv) $C_4H_{10}(g)+\frac{13}{2}O_2(g)\rightarrow 4CO_2(g)+5H_2O(l)\ \Delta_cH=+2658.0\ kJ\ mol^{-1}$

Ans.(iii)

Explanation: Standard enthalpy of combustion is defined as the enthalpy change per mole (or per unit amount) of a substance, when it undergoes combustion and all the reactants and products being in their standard states at the specified temperature.

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6. $\Delta_fU^{\ominus}$ of formation of $CH_4(g)$ at certain temperature is -393 kJ mol^{-1}. The value of $\Delta_fH^{\ominus}$ is

(i) zero

(ii) $<\Delta_fU^{\ominus}$

(iii) $>\Delta_fU^{\ominus}$

(iv) equal to $\Delta_fU^{\ominus}$

Ans.(ii)

Explanation: The reaction is $CH_4(g)+2O_2(g)\rightarrow CO_2(g)+2H_2O(l)$

$\Delta n_g=(n_p-n_r)_g=1-3=-2$

$\Delta H^0=\Delta U^0+\Delta n_gRT$

$\Delta n_g=-2$

$\therefore \Delta H^0 < \Delta_f U^0$

7. In an adiabatic process, no transfer of heat takes place between system and surroundings. Choose the correct option for free expansion of an ideal gas under adiabatic condition from the following.

(i) $q = 0,\ \Delta T \neq 0,\ w = 0$

(ii) $q \neq 0,\ \Delta T = 0,\ w = 0$

(iii) $q = 0,\ \Delta T = 0, w = 0$

(iv) $q = 0, \Delta T < 0, w \neq 0$

Ans. (iii)

Explanation: In free expansion, w=0 because volume is constant, as the process is adiabatic q = 0 and from first law of thermodynamics.

$\Delta U = q + w = 0.$ This means that internal energy remains constant.

8. The pressure-volume work for an ideal gas can be calculated by using the expression $w = \int_{V_i}^{V_f} P_{ex} dV$ **. The work can also be calculated from the pV-plot by using the area under the curve within the specified limits. When an ideal gas is compressed (a) reversibly or (b) irreversibly from volume V_i to V_f, choose the correct option.**

(i) w(reversible) = w(irreversible)

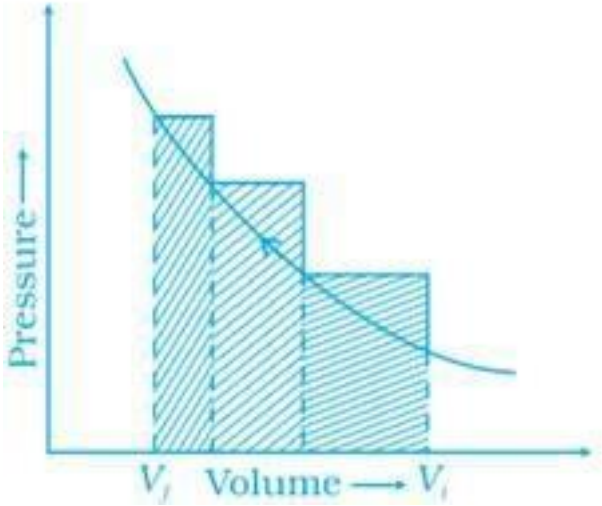
(ii) w(reversible) < w(irreversible)

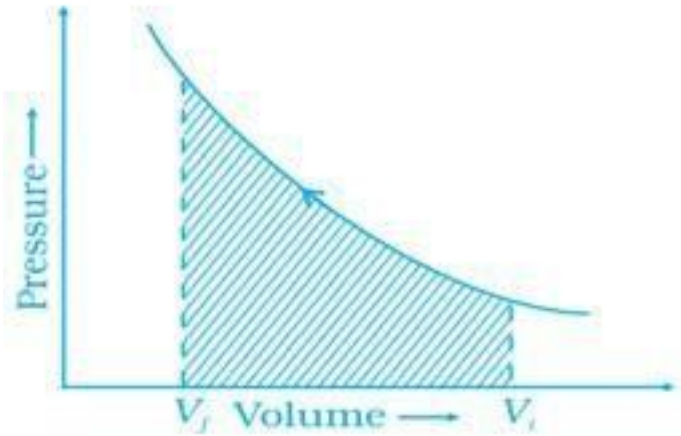
(iii) w(reversible) > w(irreversible)

(iv) w(reversible) = w(irreversible)+ $p_{ex} \cdot \Delta V$

Ans. (ii)

Explanation: Area under the curve is always more in irreversible compression.





9. The entropy change can be calculated by using the expression $\Delta S = \frac{q_{rev}}{T}$. When water freezes in a glass beaker, choose the correct statement amongst the following:

(i) ΔS (system) decreases but ΔS (surroundings) remains the same.

(ii) ΔS (system) increases but ΔS (surroundings) decreases. (iii) ΔS (system) decreases but ΔS (surroundings) increases. (iv) ΔS (system) decreases and ΔS (surroundings) also decreases. **Ans. (iii)**

Explanation: Freezing is an exothermic process thus heat is released and entropy of the surrounding increases whereas entropy of the system decreases.

10. On the basis of thermochemical equations (a), (b) and (c), find out which of the algebric relationships given in options (i) to (iv) is correct.

(a) C (graphite) + $O_2(g) \rightarrow CO_2(g); \Delta_r H = x\ kJ\ mol^{-1}$

(b) $C(graphite) + \frac{1}{2} O_2(g) \rightarrow CO(g); \Delta_r H = y\ kJ\ mol^{-1}$

(c) $CO(g) + \frac{1}{2} O_2(g) \rightarrow CO_2(g); \Delta_r H = z\ kJ\ mol^{-1}$

(i) z = x + y

(ii) x = y - z

(iii) x =y + z

(iv) y = 2z-x

Ans. (iii)

Explanation: Algebraic sum of y and z will give x, x =y + z.

11. Consider the reactions given below. On the basis of these reactions find out which of the algebric relations given in options (i) to (iv) is correct?

(i) $\Delta_r H = x\ kJ\ mol^{-1}\ C(g) + 4H(g) \rightarrow CH_4(g);$

(ii) $C(graphite) + 2H_2(g) \rightarrow CH_4(g); \Delta_r H = y\ kJ\ mol^{-1}$

(i) x = y

(ii) x = 2y

(iii) x > y

(iv) $x < y$

Ans. (iii)

Explanation: Same bonds are formed in reaction (a) and (b) but bonds between the reactant molecules are broken only in reaction (b).

12.The enthalpies of elements in their standard states are taken as zero. The enthalpy of formation of a compound

(i) is always negative

(ii) is always positive

(iii) may be positive or negative

(iv) is never negative

Ans. (iii)

Explanation: Reaction could be exothermic or endothermic.

13.Enthalpy of sublimation of a substance is equal to

(i) enthalpy of fusion + enthalpy of vapourisation

(ii) enthalpy of fusion

(iii) enthalpy of vapourisation

(iv) twice the enthalpy of vapourisation

Ans. (i)

Explanation: Enthalpy of sublimation can be shown as

Solid $\rightarrow$ Liquid $\rightarrow$ Vapour

14.Which of the following is not correct?

(i) ΔG is zero for a reversible reaction

(ii) ΔG is positive for a spontaneous reaction (iii)

ΔG is negative for a spontaneous reaction (iii)

ΔG is positive for a non-spontaneous reaction

Ans. (ii)

Explanation: ΔG is positive for a spontaneous reaction.