Chemistry Class 11 NCERT Solutions: Chapter 6 Thermodynamics Part 1

Q: 1. Choose the correct answer. A thermodynamic state function is a quantity

(i) Used to determine heat changes

(ii) Whose value is independent of path

(iii) used to determine pressure volume work

(iv) Whose value depends on temperature only

Answer:

A thermodynamic state function is a quantity whose value is independent of a path. Functions like p, V, T etc. depend only on the state of a system and not on the path. Hence, alternative (ii) is correct.

Q: 2. For the process to occur under adiabatic conditions, the correct condition is:

$(i)\ \Delta T = 0$

$(ii)\ \Delta p = 0$

$(iii)\ q = 0$

$(iv)\ w = 0$

Answer:

A system is said to be under adiabatic conditions if there is no exchange of heat between the system and its surroundings. Hence, under adiabatic conditions, q = 0,

Therefore, alternative (iii) is correct.

Q: 3. The enthalpies of all elements in their standard states are:

(i) Unity

(ii) Zero

(iii) < 0

(iv) Different for each element

Answer:

The enthalpy of all elements in their standard state zero

Therefore, alternative (ii) is correct.

Q: 4. ΔU^{θ} of combustion of methane is $-X\ kj\ mol^{-1}$ .The value of $\Delta\ U^{\theta}$ is

(i) $= \Delta U^{\theta}$

(ii) $> \Delta U^{\theta}$

(iii) $< \Delta U^{\theta}$

(iv) $= 0$

Since $\Delta H^{\theta} = \Delta U^{\theta} + \Delta n_g \mathrm{RT}$ and $\Delta\ U^{\theta} = -X\ kj\ mol^{-1}$,

$\Delta H^{\theta} = (-X) + \Delta n_g RT.$

$\Rightarrow \Delta H^{\theta} < \Delta U^{\theta}$

Therefore, alternative (iii) is correct.

Q: 5. the enthalpy of combustion of methane, graphite and dihydrogen at $298K$ are, $-890.3\ kj\ mol^{-1} - 393.5\ kj\ mol^{-1}$, and $-285.8\ kj\ mol^{-1}$ respectively. Enthalpy of formation of $CH_{4(g)}$ will be

(i) $-74.8\ kj\ mol^{-1}$

$(ii) - 52.27\ kj\ mol^{-1}$

(iii) $+74.8\ kj\ mol^{-1}$

(iv) $+52.26\ kj\ mol^{-1}$

Answer:

According to the question,

(i) $CH_{4(g)} + 20_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$

$\Delta H = -890.3 kj\ mol^{-1}$

(ii) $C_{(g)} + O_{2(g)} \rightarrow CO_{2(g)}$

$\Delta H = -393.5\ kj\ mol^{-1}$

(iii) $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$

$\Delta H = -285.8\ kj\ mol^{-1}$

Thus, the desired equation is the one that represents the formation of $CH_{4(g)}$ i.e.. ,

$C_{(g)} + 2H_{2(g)} \rightarrow CH_{4(g)}$

$\Delta_f H_{CH_4} = \Delta_e H_e + 2\ \Delta_e\ H_{H2} - \Delta_e H_{CO_2}$

$= [-393.5 + 2\,(-285.8) - (-890.3)]\ kj\ mol^{-1}$

$= -74.8\ kj\ mol^{-1}$

$\therefore$ Enthalpy of formation of $CH_{4(g)} = -74.8\ kj\ mol^{-1}$

Hence, alternative (i) is correct.

Q: 6. A reaction, $A + B \rightarrow C + D + q$ is found to have positive entropy change. The reaction will be

(i) Possible at high temperature

(ii) Possible only at low temperature

(iii) Not possible at any temperature

(iv) Possible at any temperature

Answer:

For a reaction to be spontaneous, ΔG should be negative.

$$\Delta G = \Delta H - T\,\Delta\, S$$

According to the question, for the given reaction,

$$\Delta S = \text{positive}$$

$$\Delta H = \text{negative (since heat is evolved)}$$

$$\Rightarrow \Delta G = \text{negative}$$

Therefore, the reaction is spontaneous at any temperature.

Hence, alternative (iv) is correct.