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Chemistry Class 11 NCERT Solutions: Chapter 6 Thermodynamics Part 1

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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 $-X \text{ kJ mol}^{-1}$. The value of ΔU^θ is

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

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

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

(iv) $= 0$

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

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

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

Therefore, alternative (iii) is correct.

Q: 5. the enthalpy of combustion of methane, graphite and dihydrogen at

298 K are, $-890.3 \text{ kJ mol}^{-1}$, $-393.5 \text{ kJ mol}^{-1}$, and $-285.8 \text{ kJ mol}^{-1}$ respectively. Enthalpy of formation of $\text{CH}_{4(g)}$ will be

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

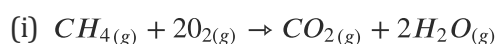
(ii) $-52.27 \text{ kJ mol}^{-1}$

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

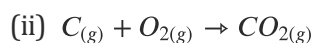
(iv) $+52.26 \text{ kJ mol}^{-1}$

Answer:

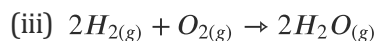
According to the question,



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

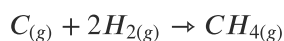


$$\Delta H = -393.5 \text{ kJ mol}^{-1}$$



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

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



$$\Delta_f H_{\text{CH}_4} = \Delta_e H_e + 2 \Delta_e H_{\text{H}_2} - \Delta_e H_{\text{CO}_2}$$

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

$$= -74.8 \text{ kJ mol}^{-1}$$

$$\therefore \text{Enthalpy of formation of } \text{CH}_{4(g)} = -74.8 \text{ kJ mol}^{-1}$$

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.