



Blue Print (As per PU Board)

Topic	1 mark questions	2 marks questions	3 marks questions	5 marks questions	Total Marks
Thermodynamics	1	-	-	1	10

One mark questions

1. **What is an open system? Give one example.**

Answer: A system is said to be open if both matter and energy can be exchanged with the surroundings. Example: Water kept in an open beaker.

2. **What is an isolated system? Give one example.**

Answer: system is said to be isolated if it neither exchanges matter nor energy. Example: Coffee taken in a thermos flask.

3. **What is isothermal process?**

Answer: A process is said to be isothermal if the temperature of the system remains constant. ($dT = 0$)

4. **Define entropy.**

Answer: Entropy is a measure of randomness or disorder of a system.

Two marks questions

5. **Define standard enthalpy of fusion or molar enthalpy of fusion.**

Answer: The enthalpy change that accompanies melting of one mole of a solid substance in standard state is called standard enthalpy of fusion or molar enthalpy of fusion. $\Delta_{\text{fus}}H^\ominus$

6. **Explain the spontaneity of endothermic reactions using Gibb's equation.**

Answer: Gibb's equation is $\Delta G = \Delta H - T\Delta S \rightarrow (1)$

For endothermic reaction, ΔH is +ve

(i) If ΔS is +ve according to equation (1)

ΔG is -ve, at high temperature

such that $T\Delta S > \Delta H$. Reaction is spontaneous

(ii) If ΔS is -ve, according to equation (1)

ΔG is always +ve. Reaction is nonspontaneous at all temperature.

7. **Define standard enthalpy of sublimation.**

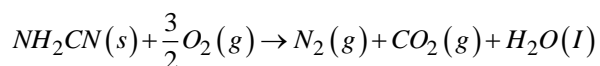
Answer: Standard enthalpy of sublimation, $\Delta_{\text{sub}}H^\ominus$ is the change in enthalpy when one mole of a solid substance sublimates at a constant temperature and under standard pressure. (1 bar)

8. **Define : specific heat capacity, Molar heat capacity.**

Answer: Specific heat capacity : It is defined as the quantity of heat required to raise the temperature of 1 gram of a substance by 1°C or 1 K. Molar heat capacity: It is defined as the quantity of heat required to raise the temperature of 1 mol of a substance by one degree celsius or one Kelvin.

Three marks questions

9. **The reaction of cyanamide, $\text{NH}_2\text{CN}(s)$ with oxygen was affected in a bomb calorimeter and ΔU was found to be $-742.7 \text{ kJ mol}^{-1}$ of cyanamide at 298K. Calculate the enthalpy change for the reaction at 298 K.**



Answer: $\Delta U = -742.7 \text{ kJ mol}^{-1}$; $\Delta^{ng} = 2 - \frac{3}{2} = +\frac{1}{2} \text{ mol}$



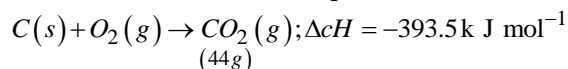
$$R = 8.314 \times 10^{-3} \text{ kJ k}^{-1} \text{ mol}^{-1}; T = 298 \text{ K}$$

According to the relation, $\Delta H = \Delta U + \Delta^{ng} RT$

$$\begin{aligned} \Delta H &= (-742.47 \text{ kJ}) + \left(\frac{1}{2} \text{ mol}\right) \times \left(8.314 \times 10^{-3} \text{ kJ k}^{-1} \text{ mol}^{-1}\right) \times 298 \text{ K} \\ &= -742.7 \text{ kJ} + 1.239 \text{ kJ} = -741.5 \text{ kJ} \end{aligned}$$

10. **Enthalpy of combustion of carbon to carbon-di-oxide is $393.5 \text{ kJ mol}^{-1}$. Calculate the heat released upon formation of 35.2g of CO_2 from carbon and oxygen gas.**

Answer: The combustion equation is



Heat released in the formation of 44 g of

$$CO_2 = 393.5 \text{ kJ}$$

Heat released in the formation of 35.2 g of

$$CO_2 = \frac{(393.5 \text{ kJ}) \times (35.2 \text{ g})}{(44 \text{ g})} = 314.8 \text{ kJ}$$

11. **The equilibrium constant for the reaction is 10. Calculate the value of ΔG^\ominus ; given**

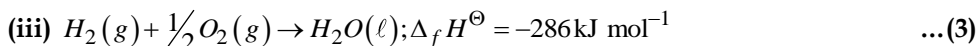
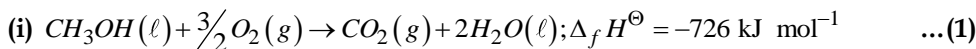
$$R = 8 \text{ J k}^{-1} \text{ mol}^{-1}; T = 300 \text{ K}$$

Answer: $\Delta G^\ominus = -RT \ln K = -2.303RT \log K$

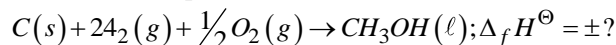
$$R = 8.0 \text{ J k}^{-1} \text{ mol}^{-1}; T = 300 \text{ K}; k = 10$$

$$\begin{aligned} \Delta G^\ominus &= -2.303 \times (8 \text{ J k}^{-1} \text{ mol}^{-1}) \times (300 \text{ K}) \times \log 10 \\ &= -5527 \text{ J mol}^{-1} = -5.527 \text{ kJ mol}^{-1} \end{aligned}$$

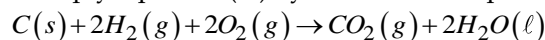
12. Calculate the standard enthalpy of formation of $\text{CH}_3\text{OH}(\ell)$ from the following data.



Answer: The equation we aim at:



Multiply equation (iii) by 2 and add to equation (ii)



$$\Delta H = -(393 + 522) = -965 \text{ kJ mol}^{-1}$$

Subtract equation (i) from equation (iv)

