



## DPP-2 [Entropy (Theoretical)]

“Boring lag raha? Samajh le – growth wahi hoti hai jahaan comfort nahi hota.” — *Weird Chemist*

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Q1. **Entropy means –**

- (1) Disorderliness
- (2) Randomness
- (3) Orderliness
- (4) Both 1 & 2

**Logic (Hinglish):** Entropy system ke microscopic arrangements (microstates) ki **randomness/disorder** ko measure karti hai. Zyada possible arrangements  $\Rightarrow$  zyada  $S$ .

**Final Answer: (4)**

Q2. **Which of the following state function is not zero at standard state –**

- (1) Enthalpy
- (2) Entropy
- (3) Free energy
- (4) Work

**Logic:** Elements ke liye standard enthalpy aur standard Gibbs free energy ko **zero reference** set kiya jata hai, but **entropy** standard state (298 K) par generally **non-zero** hoti hai. Work state function hai hi nahi.

**Final Answer: (2)**

Q3. **In any natural process occurring in the universe –**

- (1) Entropy is conserved
- (2) Entropy increases
- (3) Entropy decreases
- (4) Entropy remains unchanged

**Logic:** Second Law: spontaneous (natural) process ke liye  $\Delta S_{\text{univ}} > 0$ . Reversible case me  $= 0$  hota hai.

**Final Answer: (2)**

Q4. **The most random state of  $\text{H}_2\text{O}$  system is –**

- (1) Ice
- (2)  $\text{H}_2\text{O}(l)$  at  $80^\circ\text{C}$  ; 1 atm
- (3) Steam

(4)  $\text{H}_2\text{O}(l)$  at  $25^\circ\text{C}$  ; 1 atm

**Logic:** Gas phase me particles sabse independent aur spread out hote hain  $\Rightarrow$  **maximum disorder**.

**Final Answer:** (3)

**Q5. When you make ice cubes, the entropy of water –**

- (1) Does not change
- (2) Increases
- (3) Decreases
- (4) May either increase or decrease depending on the process used

**Logic:** Water (liquid)  $\rightarrow$  ice (solid) me **ordering** badh jaata hai; system ki  $S$  **kam** hoti hai. (Universe ka  $S$  freezer se heat rejection ki wajah se badhta hai.)

**Final Answer:** (3)

**Q6. The least random state of  $\text{H}_2\text{O}$  is –**

- (1) Ice
- (2) Liquid water
- (3) Steam
- (4) Randomness is same in all states

**Logic:** Solid me fixed lattice  $\Rightarrow$  microstates kam  $\Rightarrow$  **least entropy**.

**Final Answer:** (1)

**Q7. In which case change in entropy is negative?**

*(NEET 2019)*

- (1) Evaporation of water
- (2) Expansion of gas at constant T
- (3) Sublimation of solid to gas
- (4)  $2\text{H}(g) \rightarrow \text{H}_2(g)$

**Logic:** Association (atoms  $\rightarrow$  molecule) se species count/microstates **kam** hote hain  $\Rightarrow \Delta S < 0$ .

**Final Answer:** (4)

**Q8. In which of the following case entropy decreases –**

- (1) Solid changing to liquid
- (2) Expansion of a gas
- (3) Crystals dissolve
- (4) Polymerisation

**Logic:** Polymerisation me chhote monomers **orderly long chains** banate hain  $\Rightarrow$  disorder  $\downarrow$ .

Final Answer: (4)

Q9. Which has the least entropy –

- (1) Graphite
- (2) Diamond
- (3)  $\text{N}_2(\text{g})$
- (4)  $\text{N}_2\text{O}(\text{g})$

**Logic:** Gases  $\gg$  solids. Solids me **diamond** zyada ordered (tetrahedral network) than graphite. Hence least  $S$ .

Final Answer: (2)

Q10. When two gases are mixed, the entropy –

- (1) Remains constant
- (2) Decreases
- (3) Increases
- (4) Becomes zero

**Logic:** Mixing  $\rightarrow$  microstates bada jate hain (mixing entropy)  $\Rightarrow S$  increase.

Final Answer: (3)

Q11. Change in entropy is negative for –

- (1)  $\text{Br}_2(\text{l}) \rightarrow \text{Br}_2(\text{g})$
- (2)  $\text{C}(\text{s}) + \text{H}_2(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{H}_2(\text{g})$
- (3)  $\text{Mg}(\text{g}, 10 \text{ atm}) \rightarrow \text{Mg}(\text{s}, 1 \text{ atm})$
- (4)  $\text{Fe}(\text{at } 400\text{K}) \rightarrow \text{Fe}(\text{at } 300\text{K})$

**Logic:** Gas  $\rightarrow$  solid ya cooling se disorder **kam**. Dono (c) aur (d) me  $\Delta S < 0$ ; exam single-choice me **dominant negative** (phase change gas $\rightarrow$ solid) ko pick karte hain.

Final Answer: (3)

Q12. For which reaction from the following,  $\Delta S$  will be maximum?

- (1)  $\text{Ca}(\text{s}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{CaO}(\text{s})$
- (2)  $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
- (3)  $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$
- (4)  $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}(\text{g})$

**Logic:** Jab solid se **gas generate** ho, entropy jump sabse zyada. (2) me 1 mol  $\text{CO}_2(\text{g})$  banta hai.

Final Answer: (2)

Q13.  $\Delta S$  for  $\text{MgCO}_3(\text{s}) \rightarrow \text{MgO}(\text{s}) + \text{CO}_2(\text{g})$  will be –

- (1) 0

- (2) -ve
- (3) +ve
- (4)  $\infty$

**Logic:** Gas formation  $\Rightarrow$  microstates  $\uparrow \Rightarrow \Delta S > 0$ .

**Final Answer:** (3)

**Q14. Change in entropy is negative for –**

- (1) Bromine (l)  $\rightarrow$  Bromine (g)
- (2)  $C(s) + H_2O(g) \rightarrow CO(g) + H_2(g)$
- (3)  $N_2(g, 10 \text{ atm}) \rightarrow N_2(g, 1 \text{ atm})$
- (4) Fe (at 400K)  $\rightarrow$  Fe (at 300K)

**Logic:** Cooling (400 K  $\rightarrow$  300 K) me randomness **ghatti** hai  $\Rightarrow \Delta S < 0$ .

**Final Answer:** (4)

**Q15. In which reaction  $\Delta S$  is positive –**

- (1)  $H_2O(l) \rightarrow H_2O(g)$
- (2)  $3O_2(g) \rightarrow 2O_3(g)$
- (3)  $2H_2O(l) \rightarrow 2H_2O(g)$
- (4)  $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

**Logic:** Liquid  $\rightarrow$  gas entropy **positive**. (1) & (3) dono positive; single-choice me standard pick (1) hota hai.

**Final Answer:** (1)

**Q16. Ammonium chloride when dissolved in water leads to cooling sensation. The dissolution of  $NH_4Cl$  at constant temperature is accompanied by –**

- (1) Increase in entropy
- (2) Decrease in entropy
- (3) No change in entropy
- (4) No change in enthalpy

**Logic:** Dissolution se ions disperse  $\Rightarrow$  randomness **increase**. Cooling shows endothermicity, par  $S$  **badhta** hai.

**Final Answer:** (1)

**Q17. For  $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$  which condition is correct?**

- (1)  $\Delta H < 0$  and  $\Delta S < 0$
- (2)  $\Delta H > 0$  and  $\Delta S > 0$
- (3)  $\Delta H < 0$  and  $\Delta S > 0$
- (4)  $\Delta H > 0$  and  $\Delta S < 0$

**Logic:** Decomposition: bonds break (heat absorbed)  $\Rightarrow \Delta H > 0$ ; moles  $1 \rightarrow 2 \Rightarrow \Delta S > 0$ .

**Final Answer:** (2)

**Q18. Correct option for an endothermic gaseous reaction  $A + B \rightarrow 3C$  –**

- (1)  $\Delta H > 0, \Delta S > 0$
- (2)  $\Delta H > 0, \Delta S < 0$
- (3)  $\Delta H < 0, \Delta S > 0$
- (4)  $\Delta H < 0, \Delta S < 0$

**Logic:** Endothermic  $\Rightarrow \Delta H > 0$ ; particles  $2 \rightarrow 3 \Rightarrow$  disorder  $\uparrow \Rightarrow \Delta S > 0$ .

**Final Answer:** (1)

**Q19. In which of the following there is decrease in entropy –**

- (1) When temperature is raised from 30K to 150K
- (2)  $\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3(\text{s}) + \text{CO}_2(\text{g})$
- (3)  $\text{H}_2(\text{g}) \rightarrow 2\text{H}(\text{g})$
- (4) Liquid crystallises into a solid

**Logic:** Crystallisation me ordering  $\uparrow$  (liquid  $\rightarrow$  solid)  $\Rightarrow S \downarrow$ .

**Final Answer:** (4)

**Q20. If equal moles of following gases are taken at constant T and P then gas of highest entropy is –**

- (1) He(g)
- (2) H<sub>2</sub>(g)
- (3) CO<sub>2</sub>(g)
- (4) PCl<sub>5</sub>(g)

**Logic:** Molar entropy complexity/mass ke sath badhta hai. PCl<sub>5</sub> sabse heavy & polyatomic  $\Rightarrow$  highest S.

**Final Answer:** (4)

**Q21. Which of the following statement is correct –**

- (1) Entropy of egg decreases on boiling
- (2) Entropy of rubber band decreases on stretching
- (3) Entropy decreases during fusion of ice
- (4) All of these

**Logic (careful):** Rubber band stretch  $\Rightarrow$  chains align  $\Rightarrow$  order  $\uparrow \Rightarrow S \downarrow$  (true). Boiled egg: cooking is irreversible; molecular level pe denaturation + gel network—exam keys often mark entropy **increase**, isliye (1) false. Fusion me S badhta hai, to (3) false. Hence only (2).

Final Answer: (2)

Q22. A boiled egg shows a/an ---- in entropy –

- (1) Increase
- (2) Decrease
- (3) No change
- (4) None of these

**Logic:** Cooking is irreversible; microstate accessibility overall **increase** maana jata hai in standard exam logic.

Final Answer: (1)

Q23. Considering entropy (S) as a thermodynamic parameter, the criterion for the spontaneity of any process is –

- (1)  $\Delta S_{system} + \Delta S_{surroundings} > 0$
- (2) = 0
- (3)  $\Delta S_{system} > 0$  only
- (4)  $\Delta S_{surroundings} > 0$  only

**Second Law (universe):** Spontaneous  $\Rightarrow \Delta S_{univ} = \Delta S_{sys} + \Delta S_{surr} > 0$ .

Final Answer: (1)

Q24. For a spontaneous process the correct statement is –

- (1) Entropy of the system always increases
- (2) Free energy of the system always increases
- (3) Total entropy change is always negative
- (4) Total entropy change is always positive

**Logic:** System ki S kabhi kabhi ghat bhi sakti (exothermic ordering), par **total** (system+surroundings) **positive** hoti hai.

Final Answer: (4)

Q25. In a spontaneous irreversible process the total entropy of the system and surroundings –

- (1) Remains constant
- (2) Increases
- (3) Decreases
- (4) Zero

**Second Law:** Irreversible spontaneous ke liye  $\Delta S_{univ} > 0$ .

Final Answer: (2)

Q26. The total entropy change for a system & its surroundings increases if the process is –

- (1) Reversible
- (2) Irreversible
- (3) Exothermic
- (4) Endothermic

**Core:** Irreversibility entropy production laati hai; heat sign se nahi, *path* se decide hota hai.

**Final Answer:** (2)

**Q27. In an irreversible process, the value of  $\Delta S_{system} + \Delta S_{surr}$  is –**

- (1) +ve
- (2) -ve
- (3) Zero
- (4) All of these

**Logic:** Irreversible me entropy production  $> 0$ ; sum **positive**.

**Final Answer:** (1)

**Q28. Entropy of an adiabatic reversible process is –**

- (1) Positive
- (2) Negative
- (3) Zero
- (4) Constant

**Logic:** Adiabatic reversible me  $q_{rev} = 0 \Rightarrow \Delta S = 0$ . (Entropy *remains constant*.)

**Final Answer:** (3)

**Q29. Entropy change in spontaneous adiabatic process is –**

- (1) Zero
- (2)  $< 0$
- (3)  $> 0$
- (4) None of these

**Logic:** Adiabatic **irreversible** (spontaneous) me system ki entropy **badhti** hai:  $\Delta S_{sys} > 0$ .

**Final Answer:** (3)

**Q30. In a reversible process, the value of  $\Delta S_{sys} + \Delta S_{surr}$  is –**

- (1)  $> 0$
- (2)  $< 0$
- (3)  $= 0$
- (4) All of these

**Logic:** Reversible limit me universe ka entropy change **zero** hota hai.

**Final Answer: (3)**