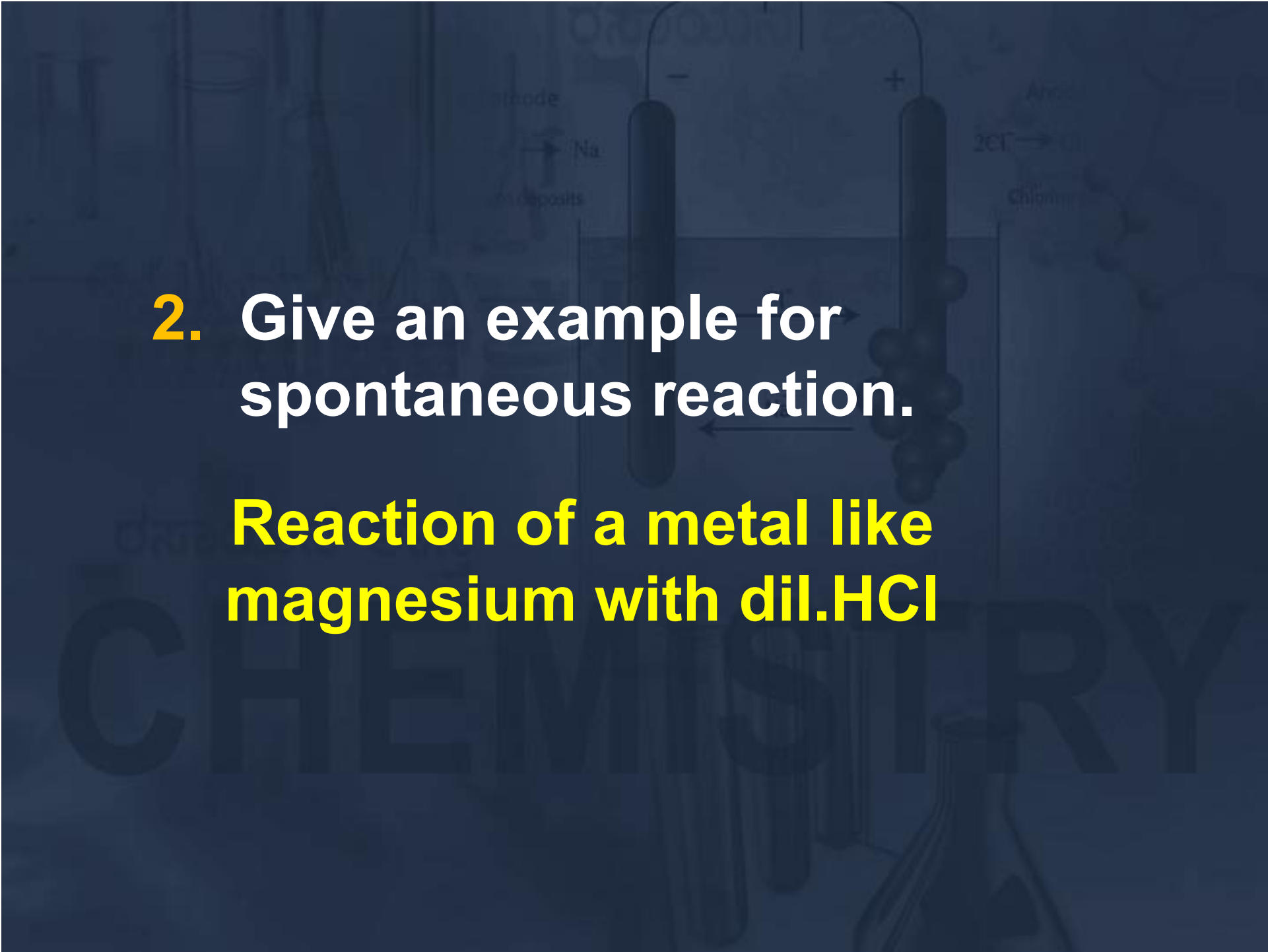# Thermodynamics - 2

## Marks allotted : 04

# Synopsis

❖ **Spontaneous process and non Spontaneous process, Examples.**

❖ **Entropy, unit, second law of thermodynamics.**

❖ **Criteria for spontaneity.**

**Gibb's free energy, Gibb's equation**

❖ **Relation between $\Delta G^0$ and $K_P$**

❖ **Numerical problems**

**Questions carrying one mark**

**1.** What is a spontaneous process ?

A process which takes place on its own under the given conditions is called spontaneous process.

**2. Give an example for spontaneous reaction.**

**Reaction of a metal like magnesium with dil.HCl**

**3. Define entropy.**

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

**4.** **Give the SI unit of entropy.**
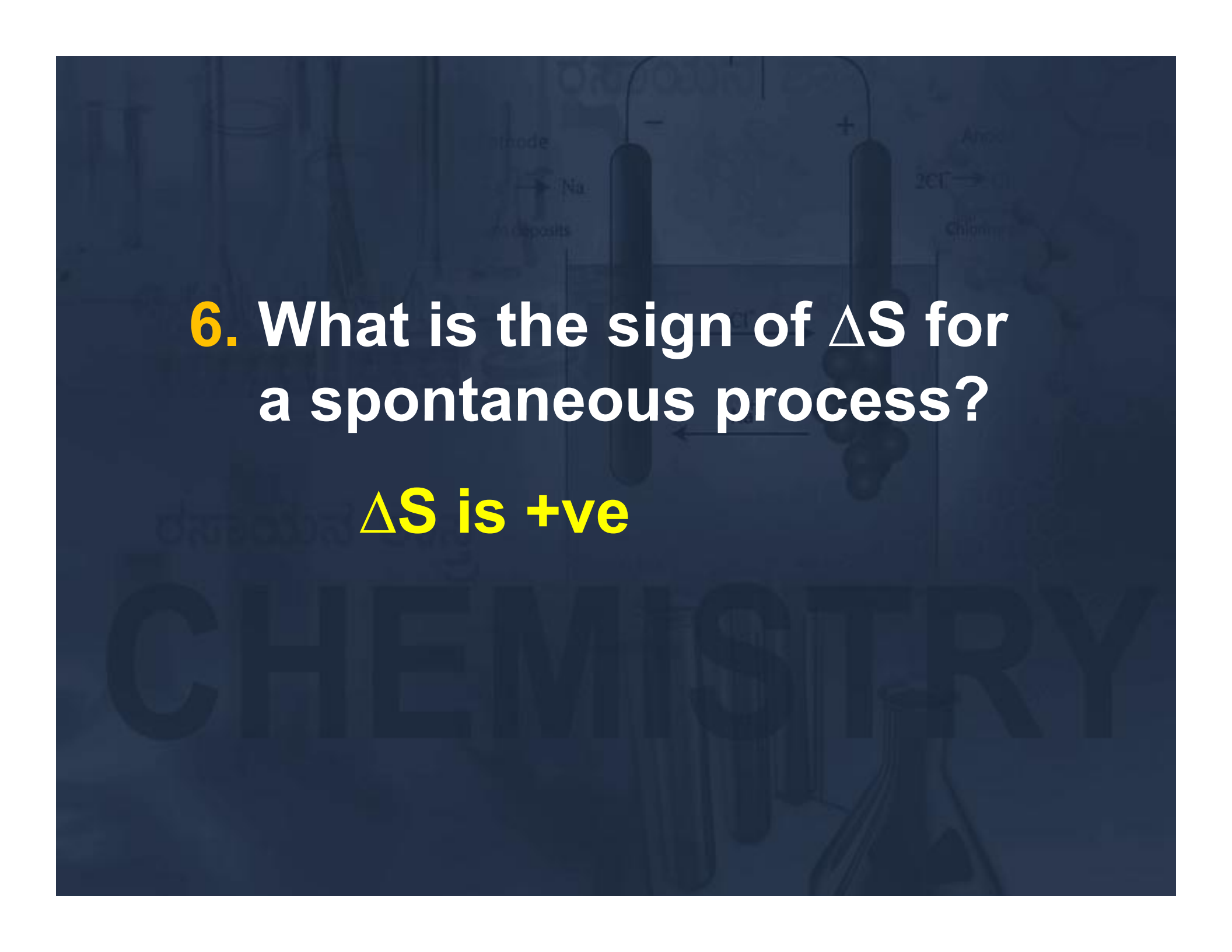
**J/K    or    J K$^{-1}$**

**5.** **How does entropy vary in a spontaneous process?**
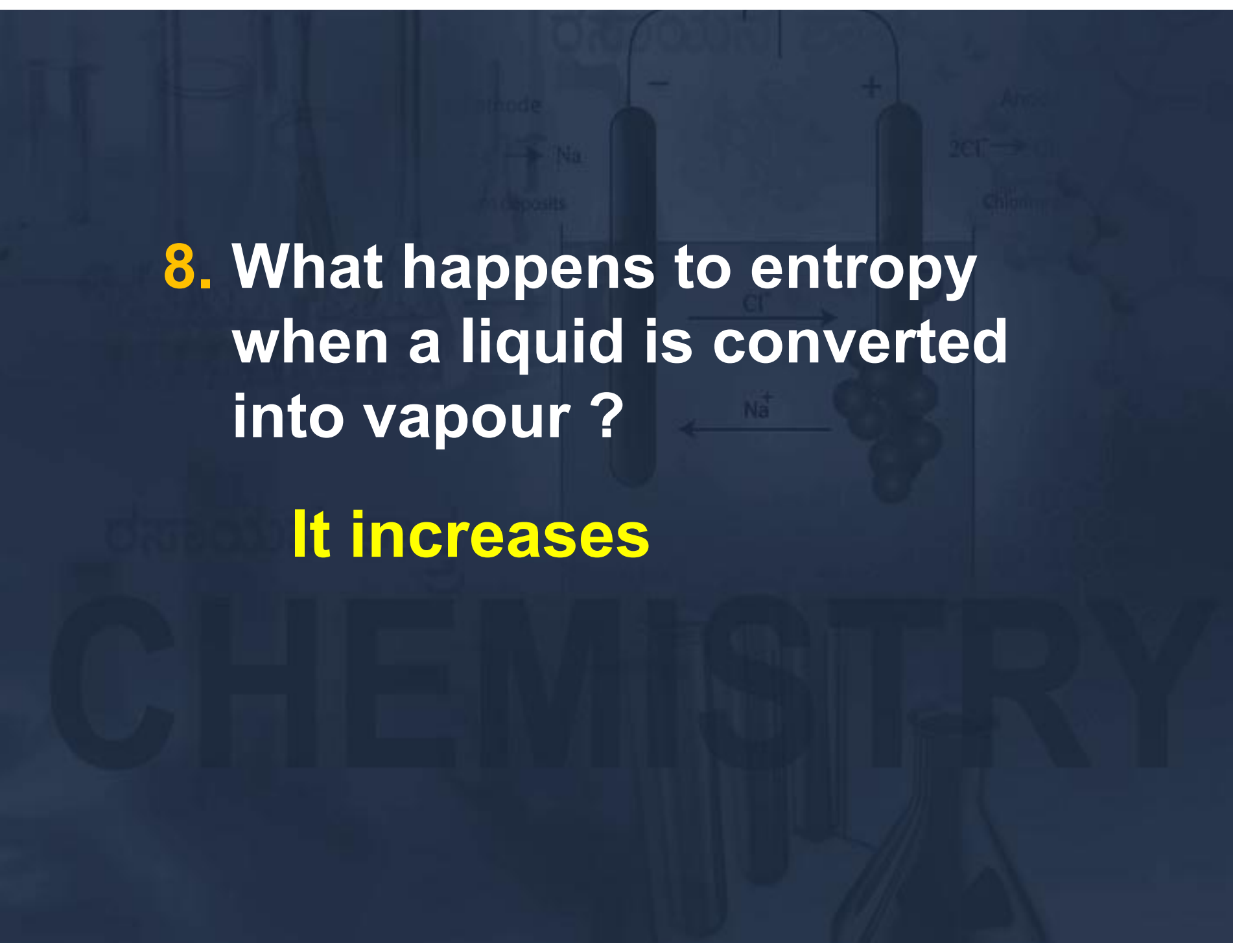
**Entropy increases**

**6.** **What is the sign of ∆S for a spontaneous process?**

**∆S is +ve**
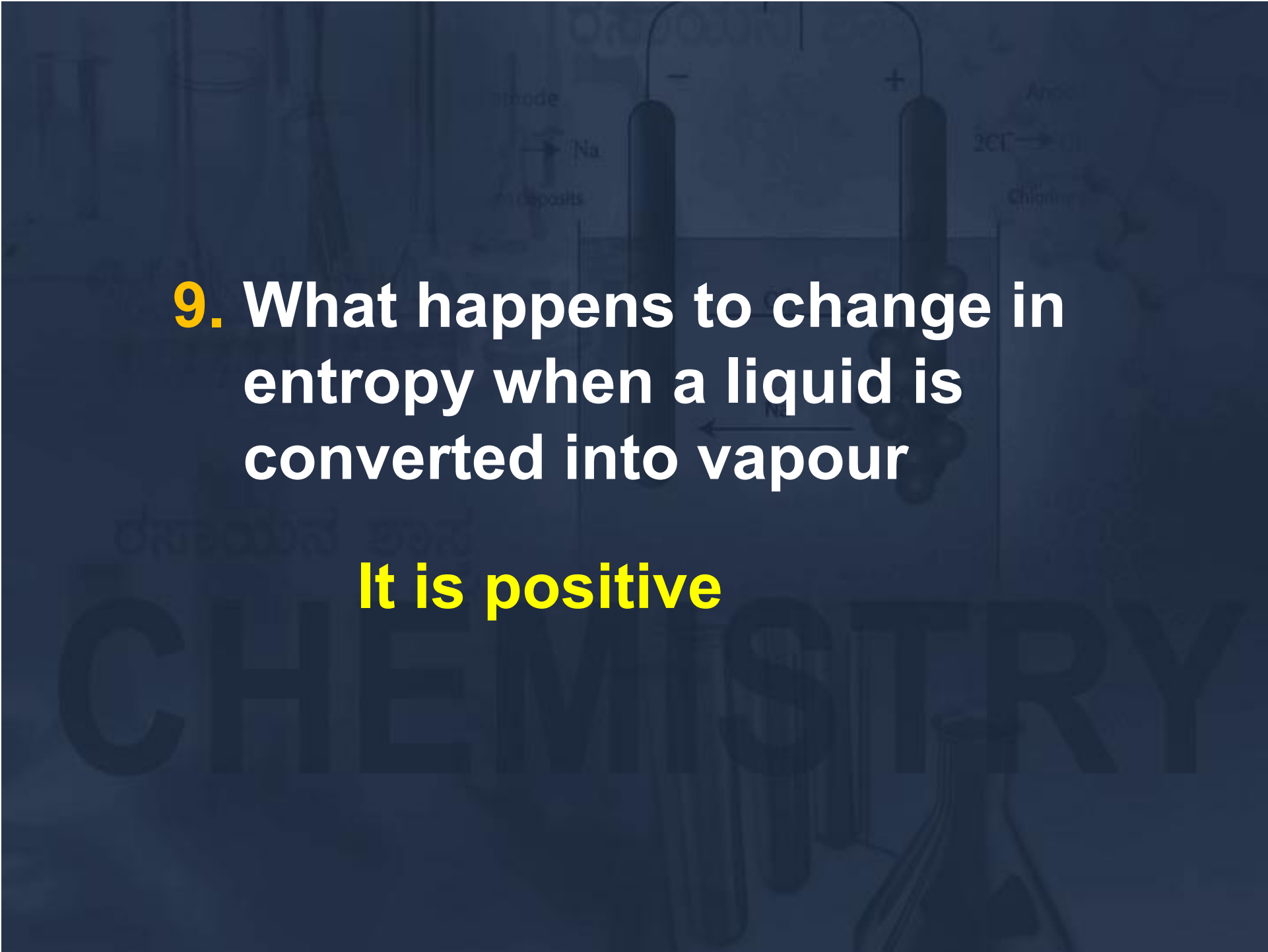
**7. What happens to Free energy in a spontaneous reaction?**

**Free energy decreases**
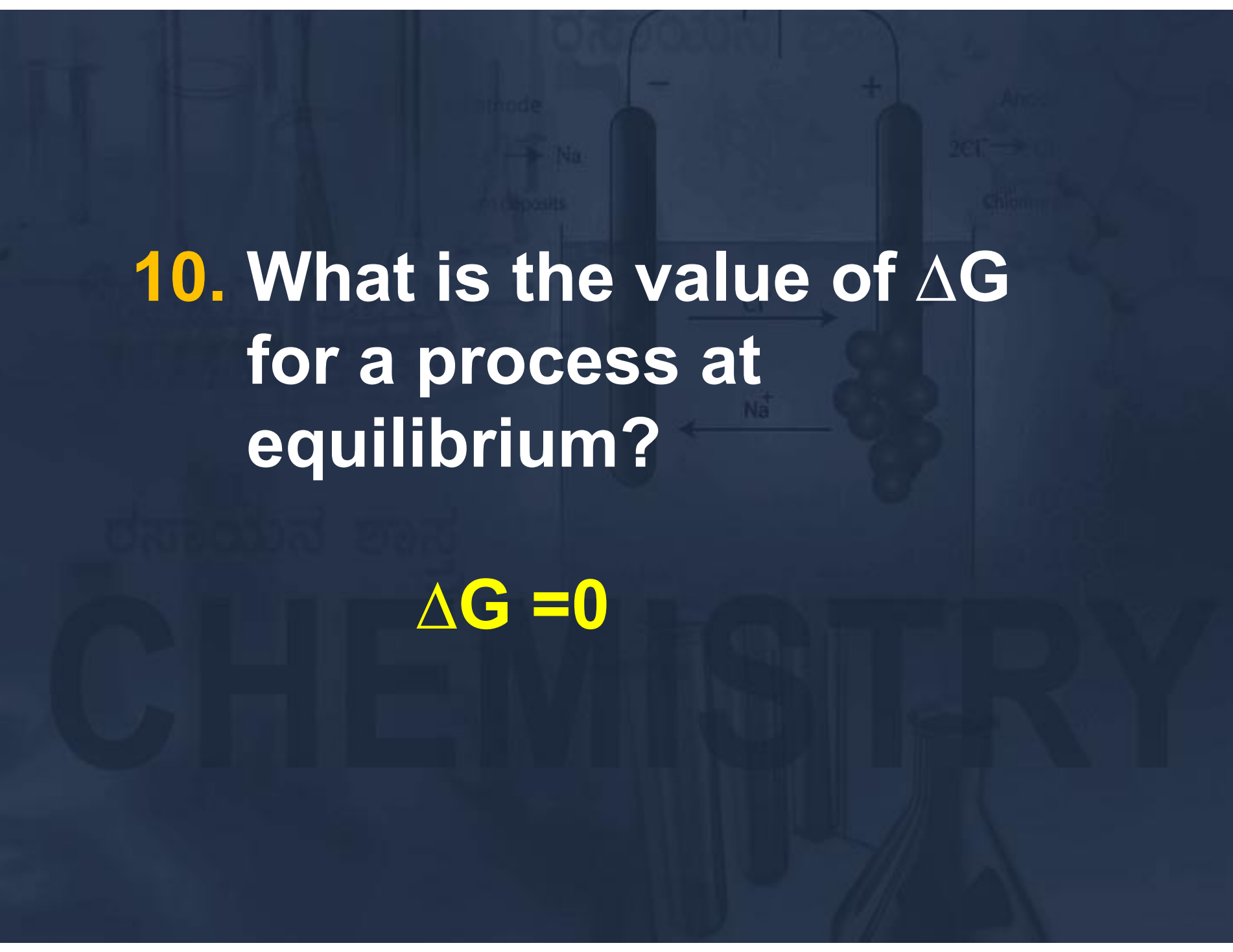
**8.** **What happens to entropy when a liquid is converted into vapour ?**

**It increases**

**9.** **What happens to change in entropy when a liquid is converted into vapour**

**It is positive**
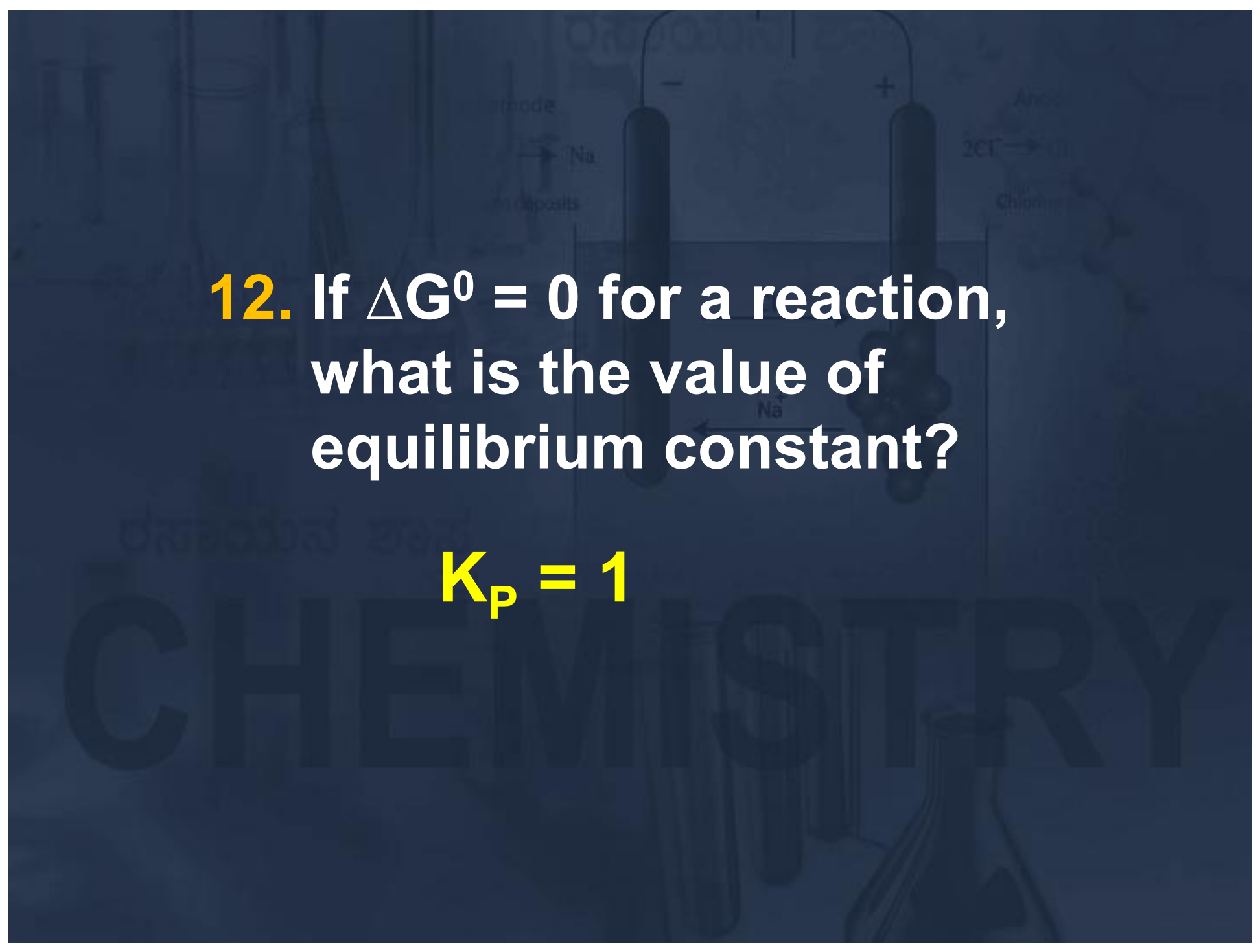
**10.** **What is the value of ΔG for a process at equilibrium?**

**ΔG =0**

**11. How is standard free energy change of a reaction related to equilibrium constant ?**

$$\Delta G^O = -2.303RT \log K_P$$

**12.** **If $\triangle G^0 = 0$ for a reaction, what is the value of equilibrium constant?**

**$K_P = 1$**
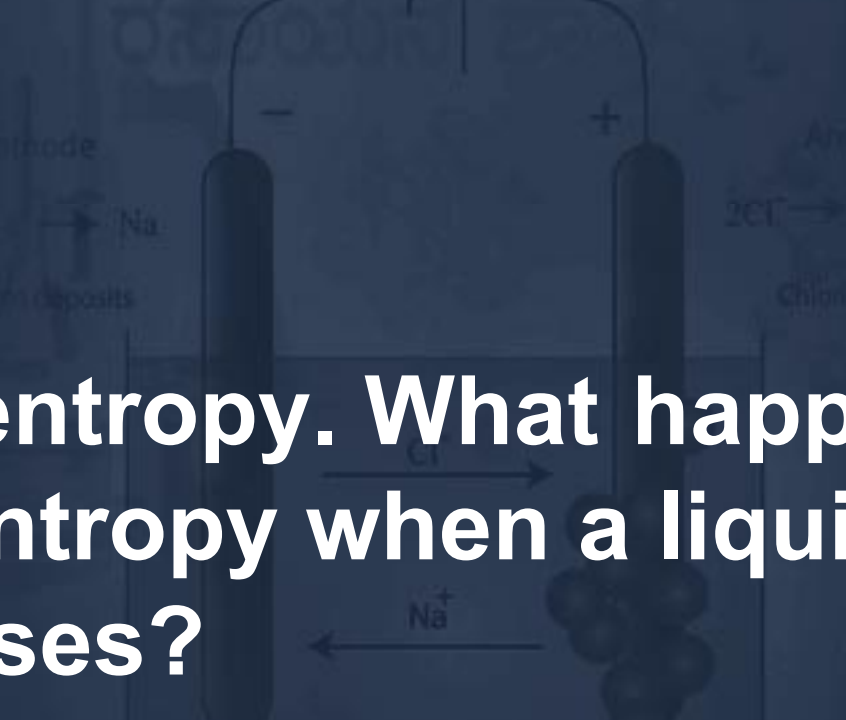
# 13. State second law of thermodynamics.

**"The total enthalpy of the universe increases continuously".**

# Questions carrying Two marks

**14. Define entropy. What happens to the entropy when a liquid vapourises?**

**Entropy is the measure of disorder.**

**The entropy increases.**

**15.** **Define entropy. What happens to the entropy when a gas undergoes expansion?**

**Entropy is the measure of disorder.**

**The entropy increases.**

**16.** **What is free energy? Write Gibbs equation.**

**Free energy is a part of total enthalpy available to do a useful work.**

**Gibbs equation : $\Delta G = \Delta H - T\Delta S$**

**17.** **Name any two factors which determine the spontaneity of a reaction. How do they change during a spontaneous process?**

**Two factors:**

**1.** **enthalpy** **2.** **entropy**

**During a spontaneous process,**

**Enthalpy decreases or $\Delta H$ = -ve**

**Entropy increases or $\Delta S$ = +ve**

**18.** **The value of equilibrium constant for a reaction is found to be 20 at 25⁰c. Calculate $\Delta G^0$ of the reaction at the same temperature.**

$$\Delta G^0 = -2.303 RT \log K_P$$

$$= -2.303 \times 8.314 \times 298 \log 20$$

$$= -7423.3 J$$

**19.** The standard free energy change for a reaction is -115kJ at 298K. Calculate the equilibrium constant.

$$\triangle G^0 = -2.303RT\log K_P$$

$$\log K_P = -\triangle G^0 / 2.303RT$$

$$= 20.16$$

$$K_P = 1.445 \times 10^{20}$$

**20.** **The standard free energy change for a reaction is 62kJ/mol. Calculate the equilibrium constant at $27^0$c.**

$$\triangle G^0 = -2.303RTlogK_P$$

$$logK_P = -\triangle G^0/2.303RT$$

$$= -10.7936$$

$$K_P = 1.608 \times 10^{-11}$$

# Remember………

- $\Delta$G decides the spontaneity.
- G or $\Delta$G is the only 'Driving Force'
- Criteria for spontaneity:

$$\Delta H = -ve$$

$$\Delta S = +ve$$

$$\Delta G = -ve$$

# Colloids

## Marks allotted: 05

# Synopsis

- Colloidal system and partical size
- Types of colloids
- Preparation and purification of sol
- Properties of sol
- Hardy-Schulze rule
- Protective action of sol,gold number
- Application of colloids

# Questions

# carrying

# One mark

**1. Mention the size range of colloidal particles**

**1nm to 100nm**

**2.** **What is  dispersed phase?**

**The particles which disperse in the dispersion medium in a colloidal solution are called dispersed phase.**

**3. Name the dispersion medium in sol.**

**Liquid**

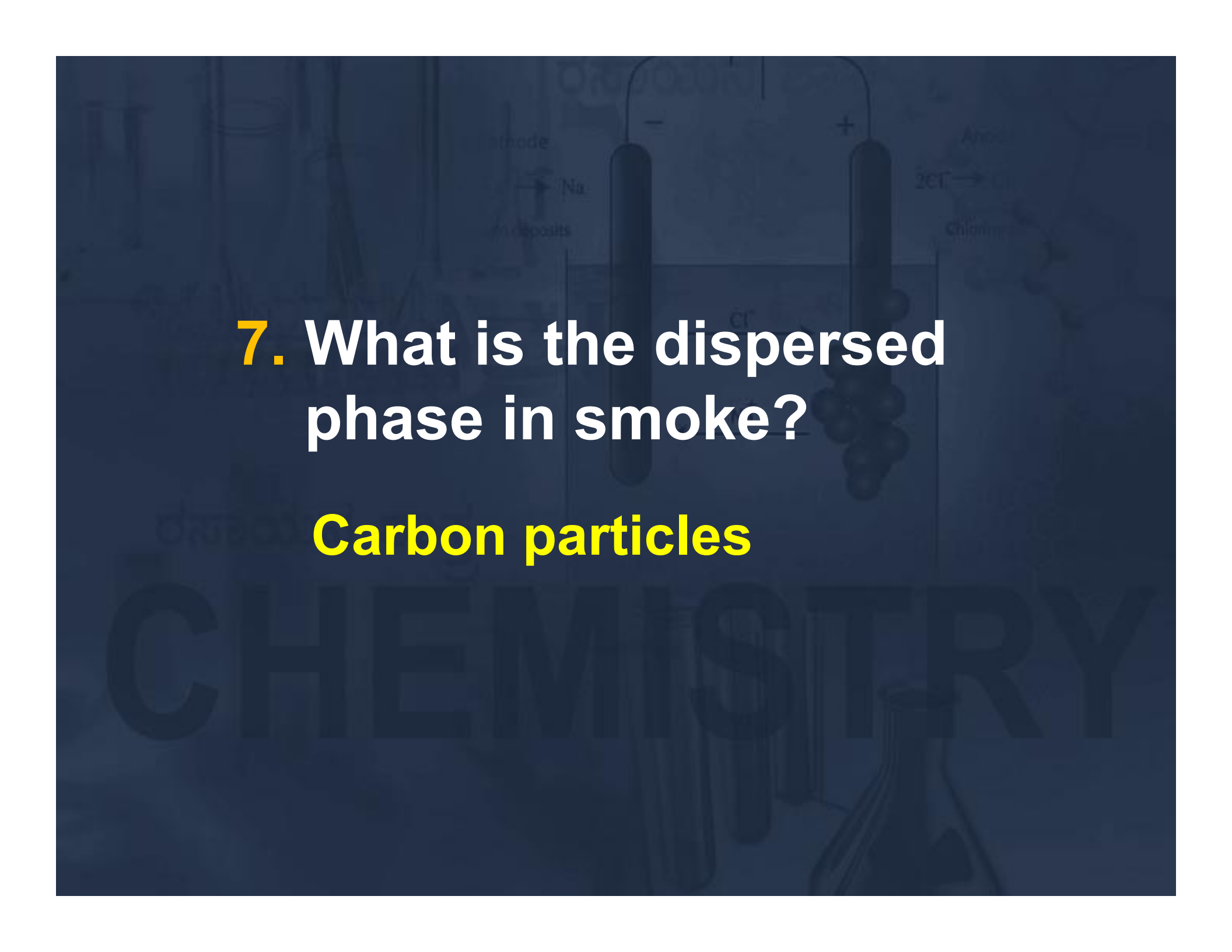**4.** **Name the dispersion medium in hydrosol.**

**Water**

## 5. What is a gel?

Gel is a colloid in which liquid dispersed phase is present in solid dispersion medium.

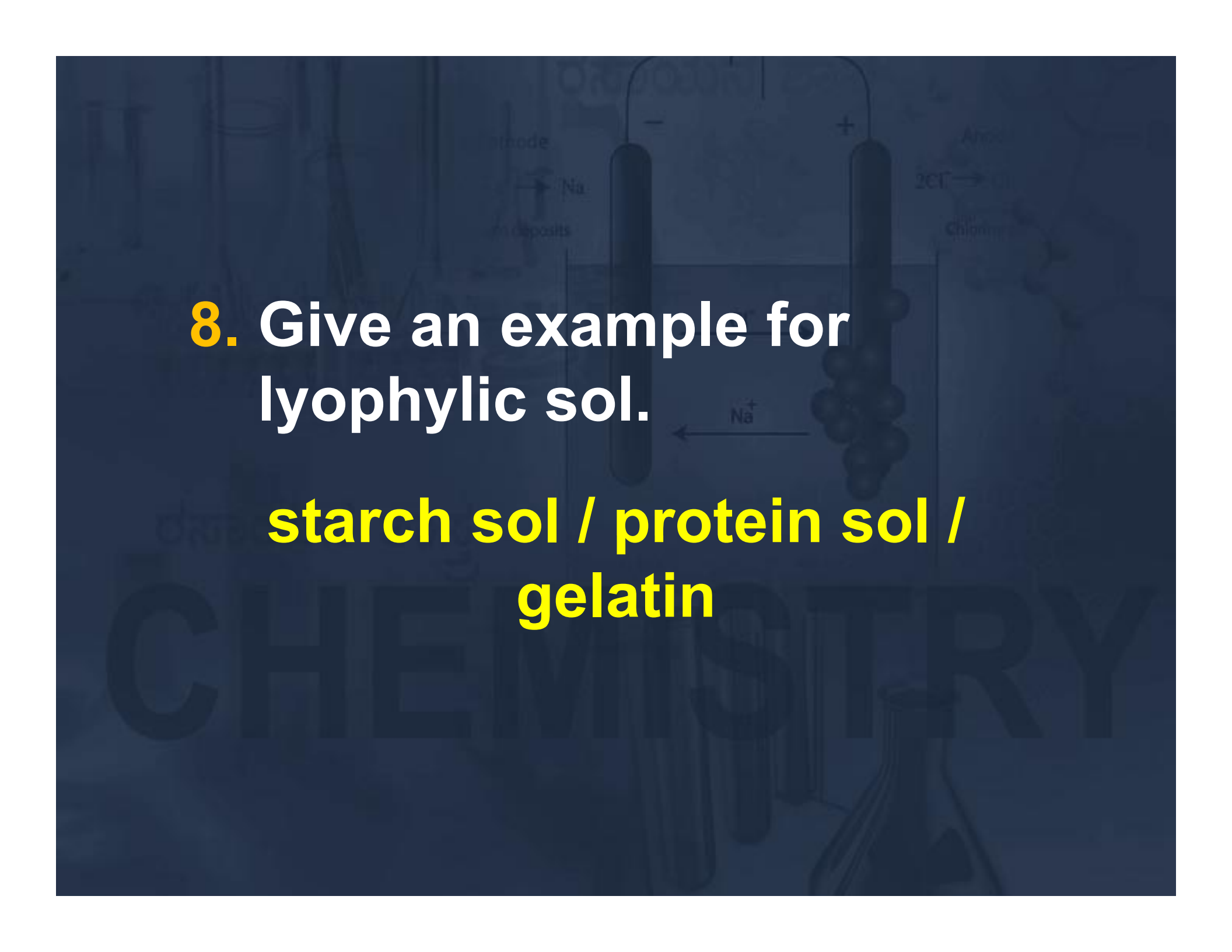**6.** **Give an example for emulsion?**

**Milk**

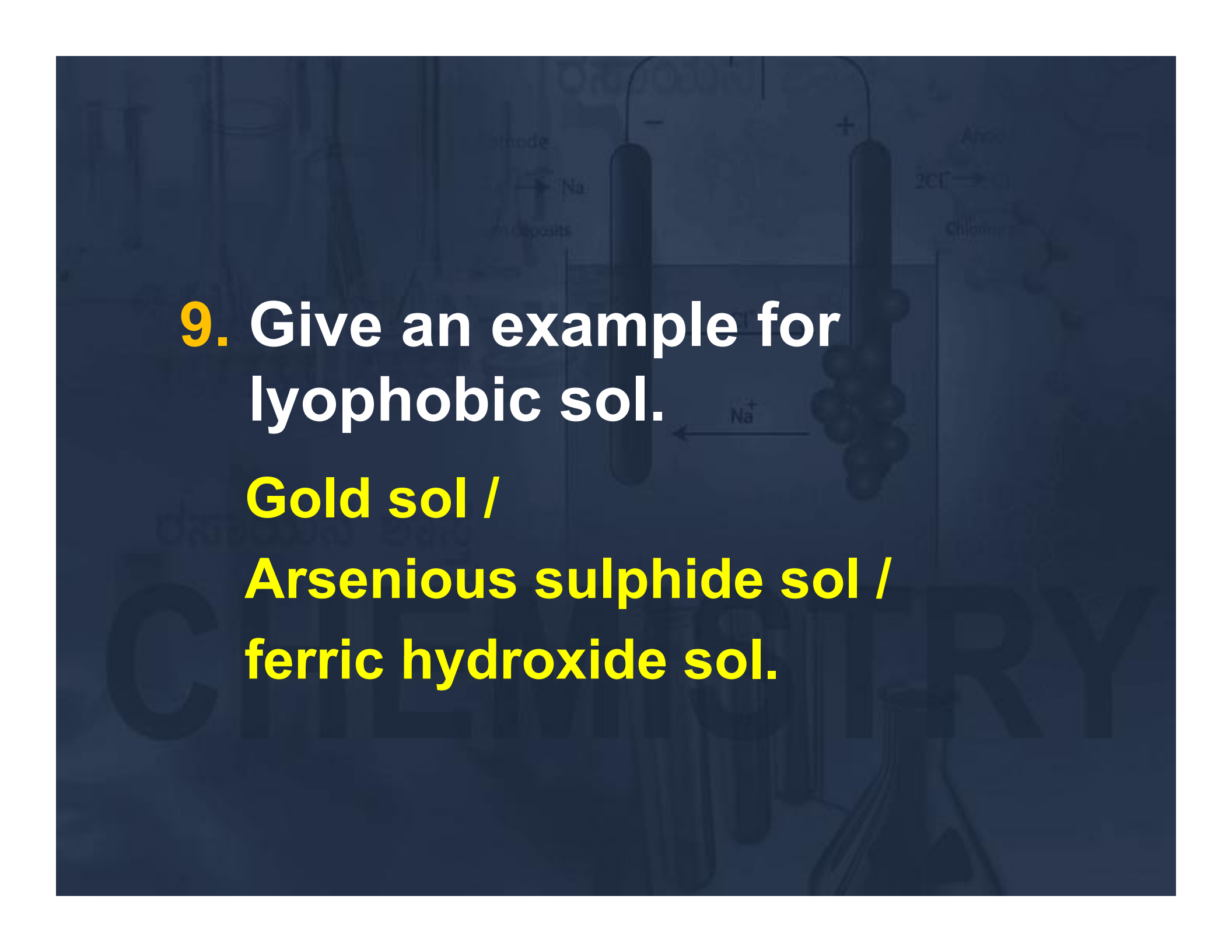**7.** **What is the dispersed phase in smoke?**

**Carbon particles**

**8.** **Give an example for lyophylic sol.**

**starch sol / protein sol / gelatin**

**9.** **Give an example for lyophobic sol.**

**Gold sol /**

**Arsenious sulphide sol /**

**ferric hydroxide sol.**

**10.** **What is Tyndall effect?**

**The phenomenon of scattering of light by the colloidal particles is called Tyndall effect.**

**11. Define dialysis.**

The process of removing the true solution particles from a colloid using a suitable membrane is called dialysis.

**12.** State Hardy-Schulze rule.

"The higher the valence of the active ion, the greater is its coagulation action".

**13.** **Between sodium chloride and sodium phosphate which is required in minimum quantity to coagulate ferric hydroxide sol.**

**sodium phosphate**

**14.** Define electrophoresis.

The movement of colloidal particles under the influence of electric field.

**15. Name the process employed to determine the charge on colloidal particles.**

**electrophoresis**

# Questions carrying two marks

**16.** **Give any two differences between lyophilic sol and lyophobic sol**

**Lyophilic sol**

- **Can be easily prepared.**
- **It is reversible.**

**Lyophobic sol**

- **Can not be easily prepared.**
- **It is irreversible.**

**17.** **What is Brownian movement? How is it caused?**

❑ **The random or zig-zag movement of colloidal particles is called Brownian movement.**

❑ **Due to the collision of moving molecules of dispersion medium with colloidal particles.**

**18.** **What is peptisation? Give an example.**

❑ **The process of converting a freshly prepared precipitate in to colloidal state by adding a suitable electrolyte is called peptisation.**

▪ **A freshly prepared precipitate of AgI can be converted into colloid by treating with KI solution.**

**19.** **Define gold number. Mention gold number of gelatin.**

- **The number of milligrams of the protective colloid which just prevents the coagulation of 10ml gold sol on adding 1ml 0f 10% NaCl to it.**

- **Gold number of gelatin is 0.005**

**20. How is delta region formed?**

- **River water during rainy season carry sand and clay particles and are colloidal.**

- **At the place where river joins the sea, electrolytes of sea water cause coagulation of river water.**

- **The mud scatters into delta region.**

# SOLIDS

# Marks allotted : 03

# Synopsis

- **Types of crystalline solids, space lattice, unit cell and coordination number.**

- **Types of cubic lattice, calculation of number of particles.**

- **Ionic crystals, radius ratio, structure of NaCl and CsCl.**

# Questions carrying one mark

**1.** **What type of crystalline solid is ice?**

**Molecular crystal.**

**2. Give an example for covalent crystal.**

**Diamond**

**3.** **Name the crystal lattice in NaCl.**

**Face Centred cubic (FCC)**

**4.** **How many lattice points are present in a unit cell of CsCl?**

**9 lattice points.**

**5.** **Define unit cell.**

It is the smallest structural repeating unit of a crystalline solid.

**6.** **What is the coordination of sodium in sodium chloride crystal?**

**6**

**7.** **Give an example of a compound containing body centred cubic lattice.**

**CsCl**

**8.** The coordination number of a crystal is 8. What is its crystal lattice?

**Body Centred Cube (BCC)**

# Questions carrying two marks

**9.** **Define radius ratio. Mention its significance.**

❑ **It is the ratio of size of cation to the size of anion present in an ionic crystal.**

▪ **The geometry of the crystal can be predicted.**

**10. Calculate the number of particles present per unit cell of FCC.**

Number of particles present per unit cell of FCC = 1/8x8(at corners)

+ 1/2x6(at face centre)

= 1+3

= 4 particles.

**11.** **What is the coordination number and geometry if the radius ratio is between o.414 to 0.732?**

**coordination number is 6**

**Geometry is octahedral**

**12.** Write any two differences between amorphous solids and crystalline solids.

❑ **crystalline solids**

1. Definite geometry
2. Anisotropic

❑ **amorphous solids**

1. No Definite geometry
2. Isotropic