

# Class 12 Chemistry – Surface Chemistry | Study Guide

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## 1. Theory in Simple Words with Visuals

### 1.1 What is Surface Chemistry?

- **Definition:** Surface chemistry deals with **phenomena that occur at the surfaces or interfaces** of substances.
  - **Analogy:** Think of molecules at the surface as “**people at the edge of a swimming pool**”—they behave differently from those inside.
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### 1.2 Key Concepts

Concept	Meaning	Visual / Analogy
Adsorption	Accumulation of molecules on a surface	Molecules “sticking” like magnets on a fridge
Absorption	Penetration of molecules into the bulk	Sponge soaking water
Adsorbate	Molecule getting adsorbed	Magnet sticking to fridge
Adsorbent	Surface that adsorbs	Fridge surface
Types of Adsorption	Physical (van der Waals), Chemical (covalent/ionic bonding)	Pasting sticker (physical) vs gluing (chemical)
Catalysis	Substances speeding up reaction without being consumed	Coach helping players win faster
Colloids	Particles dispersed in another medium	Milk: tiny fat droplets in water

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### 1.3 Factors Affecting Adsorption

1. **Nature of adsorbent & adsorbate** → Porous solids adsorb more
2. **Temperature** → Physisorption ↓ with ↑T, Chemisorption ↑ with ↑T
3. **Surface area** → More area → more adsorption
4. **Pressure** → For gases, ↑pressure → ↑adsorption

Visual:

Gas Molecules → collide → stick on solid surface → adsorption occurs

1.4 Catalysis

- **Homogeneous:** Catalyst & reactants in same phase
- **Heterogeneous:** Catalyst & reactants in different phases
- **Promoters / Poisons:** Substances that enhance or inhibit catalyst activity

Analogy: Catalyst is like a "speed coach" for molecules.

1.5 Colloids

Type	Dispersed Phase	Dispersion Medium	Example
Sol	Solid in liquid	Liquid	Paint, mud
Gel	Liquid in solid	Solid	Jelly
Emulsion	Liquid in liquid	Liquid	Milk, butter
Foam	Gas in liquid	Liquid	Whipped cream
Aerosol	Solid/gas in gas	Gas	Smoke, fog

Important Properties: Tyndall effect, Brownian motion, Electrophoresis, Coagulation

2. Key Concepts & Formulas

Concept	Formula / Fact	Tip / Mnemonic
Adsorption Isotherm	Langmuir: $\frac{x}{m} = \frac{abP}{1+bP}$	"x adsorbed per gram = fraction × pressure"
Freundlich Adsorption	$x/m = kP^{1/n}$	Empirical relation, easy to remember
Surface Area & Adsorption	$S = \frac{mN_Aa}{M}$	S = total surface area
Catalysis	Rate ↑, Ea ↓	Catalyst = speed coach
Colloid Stability	Protected by electrolytes	DLVO theory

Mnemonic for Types of Adsorption: "Physis sticks softly, Chemis glues strongly."

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### 3. Solved Numerical Problems

#### Example 1: Langmuir Adsorption

**Problem:** Adsorption of gas on 2 g of solid:  $a = 0.5$ ,  $b = 0.1 \text{ atm}^{-1}$ ,  $P = 2 \text{ atm}$ . Find  $x/m$ .

$$x/m = \frac{abP}{1 + bP} = \frac{0.5 \times 0.1 \times 2}{1 + 0.1 \times 2} = 0.1/1.2 \approx 0.0833$$

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#### Example 2: Surface Area Calculation

**Problem:** 0.2 g of a substance with particle area  $10^{-18} \text{ m}^2$ . Number of particles =  $0.2 \times N_a / M$ ?

**Solution:** Use formula  $S = \frac{mN_a a}{M}$ .

**Tip:** Always check units of area & mass.

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### 4. Previous Years' Board Questions (Solved)

- Adsorption & factors affecting it (2015–2022)
- Langmuir and Freundlich adsorption numericals
- Catalysis examples & types (2016, 2019, 2021)
- Colloids & properties questions

**Pattern:** Adsorption, catalysis, and colloids are **frequently tested**, often numerically.

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### 5. Quick Revision Notes / Important Points

- Adsorption  $\neq$  Absorption
- Catalysis: Homogeneous & heterogeneous
- Colloids: Sol, gel, emulsion, foam, aerosol
- Adsorption formulas: Langmuir & Freundlich
- Key properties: Tyndall effect, Brownian motion, coagulation

Flowchart Visual:

Surface Chemistry

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Adsorption → Types → Factors

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Catalysis → Homogeneous / Heterogeneous



Colloids → **Types** → Properties

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## 6. Predicted / Likely Questions

1. Numerical on **Langmuir adsorption**
  2. Adsorption vs absorption differences
  3. Types of catalysis with examples
  4. Properties of colloids (Tyndall effect, coagulation)
  5. Surface area calculations
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## 7. Exam Tips & Tricks

- Draw **simple diagrams** for adsorption & catalysis
  - Memorize **types of colloids & examples** with visual cues
  - Shortcut: Adsorption increases with surface area, decreases with temperature (physisorption)
  - Use **mnemonics** for remembering colloid types:  
“**Some Good Elephants Fly Around**” → Sol, Gel, Emulsion, Foam, Aerosol
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## 8. Visual & Kid-Friendly Learning Style

- **Adsorption:** Think of **molecules sticking to wall**
- **Colloids:** Tiny particles suspended like **dust in air**
- Color-code **tables, formulas, and diagrams** for quick recall
- Use **flowcharts** for stepwise understanding