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GROUP OF COLLEGE

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ASSIGNMENT

Q 1 write the function of S block element in biosystem

Q 2 write the complex tendency of S block element

Q 3 what is borazine write the chemical reaction of borazine

Q 4 write the short note on carbide

Q 5 write short note on valden inversion with example

Q 6 Explain the isomerism with example with example

Q 7 write the factor affecting rate of reaction

Q 8 explain the activation energy with example draw the diagram of activation energy

Write the function of S block element

The **S-block elements** are found in **Groups 1 and 2** of the periodic table, plus **hydrogen and helium**. Their outermost electrons are in the **s orbital**, hence the name **S-block**.

Functions / Roles of S-block Elements:

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1. Group 1: Alkali Metals (Li, Na, K, Rb, Cs, Fr)

- **Formation of Salts**: React with halogens to form salts like NaCl, KBr.
- **Electrolyte Balance**: Sodium (Na^+) and potassium (K^+) ions are essential for nerve function and muscle contraction in living organisms.
- **Reducing Agents**: Strong reducing agents

- **Reducing Agents**: Strong reducing agents used in redox reactions.
- **Manufacturing**:
  - Sodium used in street lights and heat exchangers.
  - Lithium used in rechargeable batteries and alloys.
- **Desiccants**: Some alkali metals are used to remove moisture from solvents.

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2. Group 2: Alkaline Earth Metals (Be, Mg, Ca, Sr, Ba, Ra)

- **Biological Importance**:
  - Calcium (Ca^{2+}) is crucial for bones, teeth, and blood clotting.
  - Magnesium (Mg^{2+}) is important for enzymes and chlorophyll in plants.
- **Construction**: Calcium compounds like

- **Construction**: Calcium compounds like $CaCO_3$ (limestone) are used in cement and building materials.
- **Reducing Agents**: Also act as reducing agents in metallurgy.
- **Fireworks & Signals**: Strontium and barium salts give red and green colors in fireworks.

3. Hydrogen (H)

- **Fuel Source**: Used in fuel cells and as a clean energy carrier.
- **Industrial Uses**: Used in ammonia production (Haber process), hydrogenation of fats/oils.

Write the complex tendency of S block element

The **complex formation tendency** of **S-block elements** (which includes **Group 1: alkali metals** and **Group 2: alkaline earth metals**) is **generally low**. Here’s a detailed explanation:

◆ General Trend:

S-block elements have **low tendency to form complex compounds** compared to transition metals. This is due to several key reasons:

◆ Reasons for Low Complex Formation Tendency:

1. **Lack of d-orbitals:**
   - S-block elements do **not have available low-energy d-orbitals** (especially in their valence shell).
   - This limits their ability to accommodate electron pairs from ligands during complexation.

2. **Large Ionic Size & Low Charge Density:**
   - Group 1 metals form **+1 ions**, and Group 2 form **+2 ions.**
   - These cations are relatively large (especially for alkali metals), which leads to **low polarizing power** and **low charge density.**

- These cations are relatively large (especially for alkali metals), which leads to **low polarizing power** and **low charge density**.

- Hence, they interact weakly with ligands, making complex formation less stable.

3. **Ionic Nature of Compounds**:

   - Their compounds are **highly ionic**, favoring electrostatic interactions rather than covalent bonding required in coordination complexes.

4. **High Hydration Energy (especially for small cations)**:

   - Some small S-block ions (e.g., **Be^{2+}**, **Mg^{2+}**) have high hydration energies, which **stabilizes them in aqueous solutions** and somewhat aids in complex formation, but still not significantly.

What mean of borazine write the chemical reaction of borazine

What is Borazine?

Borazine is an inorganic compound with the chemical formula:

> $B_3N_3H_6$

It is also known as:

- **Borazole**
- **Inorganic benzene** (because its structure and bonding are similar to benzene)

Borazine is a **six-membered ring** compound containing alternating **boron (B)** and **nitrogen (N)** atoms, with one **hydrogen atom** attached to each boron and nitrogen atom.

Structure of Borazine

- Cyclic compound: B–N–B–N–B–N (alternating B and N atoms in a ring)
- Similar to benzene in terms of shape and delocalized π electrons, but with polar B–N bonds

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Preparation Reaction of Borazine

Borazine is typically synthesized by the reaction of **boron trichloride (BCl_3)** with **ammonia (NH_3)**, followed by heating.

Stepwise Reaction:

1. First, an adduct forms:

$$3BCl_3 + 6NH_3 \rightarrow 3BCl_3 \cdot 2NH_3$$

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$$3BCl_3 \cdot 2NH_3 \xrightarrow{\Delta} B_3N_3H_6 + 9HCl$$

So the **overall reaction** can be written as:

$$3BCl_3 + 6NH_3 \xrightarrow{\Delta} B_3N_3H_6 + 9HCl$$

Summary

- **Borazine ($B_3N_3H_6$)** is a cyclic compound with alternating B and N atoms.
- It is called **inorganic benzene** due to its structural similarity to benzene.
- It is synthesized by heating a mixture of **boron trichloride and ammonia.**

Write short note on carbide

Carbide – Short Note:

Carbides are compounds composed of carbon and a less electronegative element, typically a metal or metalloid. They are known for their hardness, high melting points, and chemical stability. Carbides are broadly classified into:

1. **Ionic (Salt-like) Carbides** – Formed with highly electropositive elements (e.g., calcium carbide, CaC_2), often react with water to produce hydrocarbons like acetylene.

2. **Covalent Carbides** – Such as silicon carbide (SiC) and boron carbide (B_4C), known for extreme hardness and used as abrasives.

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3. **Interstitial (Metallic) Carbides** – Formed with transition metals (e.g., tungsten carbide, WC), widely used in cutting tools and industrial machinery due to their toughness.

Carbides play a crucial role in metallurgy, tool manufacturing, and high-performance engineering applications.

Valdan inversion explain with example

Walden Inversion is a concept in organic chemistry that refers to the **inversion of configuration** around a **chiral center** during a **nucleophilic substitution reaction**, specifically in an **SN2 reaction**.

🔄 What is Walden Inversion?

It's named after Paul Walden, who observed that during certain chemical reactions, the spatial configuration of a molecule **inverts like an umbrella flipping in the wind**.

In an **SN2 (Substitution Nucleophilic Bimolecular)** reaction:

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- A **nucleophile attacks** a chiral carbon from the **side opposite** the leaving group.
- This results in the **inversion of stereochemistry** (from R to S, or S to R).

This inversion is called **Walden Inversion.**

🧪 Example of Walden Inversion:

Let's take **(R)-2-bromobutane** and perform an SN2 reaction with **hydroxide ion (OH^-)**:

Step 1:

Start with **(R)-2-bromobutane** (a chiral molecule):

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Copy code

```
Br
             |
CH3-CH-CH2CH3
             |
          H
```

This molecule is in the **R configuration.**

Step 2:

React with **OH⁻** (nucleophile) in an SN2 reaction:

- The OH⁻ attacks the carbon from the side **opposite to Br**, pushing Br out (leaving group).
- This happens in **one step** (concerted mechanism).

Step 3:

You get (S)-2-butanol:

Copy code

```
OH
       |
CH3-CH-CH2CH3
       |
      H
```

Now the configuration is **S** — the molecule's chirality has **inverted**.

Explain the isomerism with example

Isomerism is a phenomenon where two or more compounds have the **same molecular formula** but **different structures or spatial arrangements** of atoms, leading to different physical or chemical properties.

There are **two main types** of isomerism:

1. Structural Isomerism (Constitutional Isomerism)

This occurs when compounds have the same molecular formula but different **connectivity** (i.e., the atoms are bonded in different orders).

Types of Structural Isomerism:

- **Chain isomerism**: Different carbon chain structures.
  - *Example*: Butane (C_4H_{10})
    - **n-Butane**: $CH_3-CH_2-CH_2-CH_3$
    - **Isobutane**: $(CH_3)_2CH-CH_3$
- **Position isomerism**: Same chain and functional group, but in different positions.
  - *Example*: Butanol ($C_4H_{10}O$)
    - **1-Butanol**: $CH_3-CH_2-CH_2-CH_2OH$
    - **2-Butanol**: $CH_3-CH_2-CHOH-CH_3$
- **Functional group isomerism**: Same formula, different functional groups.
  - *Example*: C_2H_6O
    - **Ethanol**: CH_3CH_2OH (alcohol)
    - **Dimethyl ether**: CH_3OCH_3 (ether)
- **Metamerism**: Different alkyl groups around a functional group (usually in ethers, esters, etc.)

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- **Metamerism**: Different alkyl groups around a functional group (usually in ethers, esters, etc.)
  - *Example*: $C_4H_{10}O$
    - **Methoxypropane**: $CH_3OCH_2CH_2CH_3$
    - **Ethoxyethane**: $CH_3CH_2OCH_2CH_3$
- **Tautomerism**: Dynamic equilibrium between two isomers, typically involving proton transfer.
  - *Example*: Keto-enol tautomerism
    - **Acetone (keto form) $\rightleftharpoons$ Enol form**

Explain the factor affecting rate of reaction

The **rate of a chemical reaction** refers to how quickly reactants are converted into products. Several **factors affect the rate of a reaction**, either increasing or decreasing how fast the reaction occurs. Here are the main factors:

1. Concentration of Reactants

- **Explanation**: Increasing the concentration of reactants (in a solution) means more particles are present in a given volume.
- **Effect**: More particles → more frequent collisions → **faster reaction**.

2. Temperature

- **Explanation**: Raising the temperature gives particles more kinetic energy.
- **Effect**: Particles move faster → collide more often and with more energy → **faster reaction.**

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3. Surface Area (for solids)

- **Explanation**: Breaking a solid into smaller pieces increases the surface area exposed to reactants.
- **Effect**: More surface area → more collisions at the surface → **faster reaction.**

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4. Catalysts

- **Explanation**: Catalysts are substances that speed up a reaction without being used up.
- **Effect**: They provide an **alternative pathway** with a lower activation energy → **faster reaction**.

5. Pressure (for gases)

- **Explanation**: Increasing pressure forces gas particles closer together (if volume is constant).
- **Effect**: Higher pressure → more collisions between gas particles → **faster reaction.**

Explain the activation energy with example and draw the diagram

Sure! Here's an explanation of **activation energy** along with an example and a diagram.

What is Activation Energy?

Activation energy (Ea) is the minimum amount of energy required for a chemical reaction to occur. It represents the energy barrier that reactants must overcome to be transformed into products.

Think of it as the "push" needed to get a reaction started. Even if the overall reaction is exothermic (releases energy), the reactants need to gain some energy initially to break bonds and form an intermediate state before the products are made.

Example:

Consider the reaction of hydrogen gas (H_2) reacting with iodine gas (I_2) to form hydrogen iodide (HI):

$$H_2 + I_2 \rightarrow 2HI$$

Although the overall reaction releases energy, the molecules first need to collide with enough energy to break the H-H and I-I bonds. This energy needed for the collision to be effective is the activation energy.

```
Potential Energy
     ↑                                 ______________
     |                                /              \
     |
     |  Activation Energy (Ea)                        \
  ←  Activation Energy (Ea)
                    Reactants /
     |
Products                   /
     |
\
     |_______________________/
     ____________\__________→  Reaction
_________________________
Progress
```

- The curve starts at the energy level of the **reactants**.
- It rises to a **peak** representing the **transition state** (activated complex), which requires the activation energy.
- Then it drops to the energy level of the **products**.
- The difference between reactants and the peak is the **activation energy (Ea)**.