

Metal Alloy – 16 Marks Answer

1. Introduction

- A **metal alloy** is a **mixture of two or more elements**, where at least one is a metal.
 - Alloys are made to **improve properties** like strength, corrosion resistance, or hardness.
 - Example: **Steel = Iron + Carbon**, **Brass = Copper + Zinc**.
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2. Types of Alloys

1. **Ferrous Alloys** – contain iron
 - Examples: Steel, Stainless Steel, Cast Iron
 2. **Non-Ferrous Alloys** – do not contain iron
 - Examples: Bronze, Brass, Duralumin
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3. Composition and Structure

- Alloys can be:
 - **Substitutional**: Atoms of the added element replace host metal atoms (e.g., Brass).
 - **Interstitial**: Small atoms fit in gaps between host atoms (e.g., Carbon in steel).
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4. Properties of Metal Alloys

- **Stronger** than pure metals.
 - **Corrosion resistant** (e.g., stainless steel).
 - **Better hardness and toughness**.
 - **Can have magnetic, electrical, or thermal improvements**.
 - **Adjustable melting point**.
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5. Common Examples

Alloy	Components	Uses
Steel	Iron + Carbon	Construction, tools
Stainless Steel	Iron + Cr + Ni	Kitchenware, medical tools
Brass	Copper + Zinc	Fittings, musical instruments
Bronze	Copper + Tin	Coins, sculptures
Duralumin	Al + Cu + Mg + Mn	Aircraft, transport

6. Preparation / Making of Alloys

- **Melting method:** Metals are melted together in a furnace and mixed thoroughly.
 - **Casting:** The molten alloy is poured into molds.
 - **Solid-state diffusion** (for certain precise applications).
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7. Applications of Metal Alloys

- **Construction** – bridges, buildings, beams (Steel).
 - **Automobiles & Aircraft** – lightweight, durable parts (Aluminum alloys).
 - **Electrical industry** – wires, connectors (Copper alloys).
 - **Medical tools** – rust-proof surgical instruments (Stainless Steel).
 - **Coins, ornaments** – Brass, Bronze.
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8. Advantages

- **Stronger** than base metals.
 - **Improved durability** and **life span**.
 - **Tailored properties** (e.g., non-corrosive, magnetic).
 - **Wider range of applications** than pure metals.
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9. Disadvantages

- **More expensive** than some pure metals.
 - **Complicated manufacturing process**.
 - Some alloys can still **rust** or **wear out** over time.
 - **Not recyclable easily** compared to pure metals.
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11. Summary

- Metal alloys are **engineered materials** created by combining metals.
 - Used to **enhance mechanical and chemical properties**.
 - Widely used in **construction, transport, electronics, and healthcare**.
 - Offer great **scope for innovation and sustainability**.
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Simple Diagram Description

Flowchart:

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graph TD; A[Metal Alloy] --> B["↓"]; B --> C["+ Metal A + Metal B"]; C --> D["↓"]; D --> E["Improved properties (Strength, Corrosion resistance)"]
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Applications (Construction, Medical, Electrical)
