

Chapter 9: Carbon and Its Compounds

Carbon is a unique element that forms a vast number of compounds. It exists in different forms called **allotropes** and is essential for life and industry.

1. Allotropes of Carbon

- **Definition:** Different forms of the same element with different physical properties but the same chemical properties.
- **Types:**
 - **Crystalline Allotropes:** Diamond, Graphite
 - **Amorphous Allotropes:** Coal, Coke, Soot, Charcoal

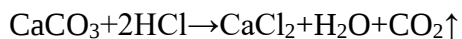
2. Crystalline and Amorphous Forms of Carbon

Allotrope	Structure	Properties	Uses
Diamond	Strong 3D network	Hardest natural substance, does not conduct electricity	Jewelry, cutting tools, drilling
Graphite	Layers of carbon atoms	Soft, slippery, conducts electricity	Lubricants, pencil leads, electrodes
Coal	Amorphous form	Burns to produce energy	Fuel, electricity generation
Coke	Purified coal	Burns at high temperatures	Used in iron extraction
Soot	Fine black carbon particles	Pollutant, absorbs light	Used in ink, black pigments

3. Carbon Dioxide (CO₂)

a) Laboratory Preparation of CO₂

- **Reaction of acid with carbonate:**



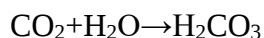
- CO₂ is collected by **downward displacement of air** as it is heavier than air.

b) Physical Properties of CO₂

- ✓ Colorless, odorless gas
- ✓ Heavier than air
- ✓ Soluble in water, forms **carbonic acid (H₂CO₃)**

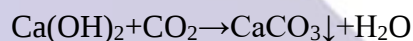
c) Chemical Properties of CO₂

- **Acidic Nature:** CO₂ dissolves in water to form a weak acid:



- **Reaction with Lime Water:**

- When CO₂ is bubbled through lime water (**Ca(OH)₂ solution**), it turns **milky** due to calcium carbonate formation:



- Excess CO₂ dissolves the precipitate, making the solution clear again.

d) Uses of CO₂

- ✓ Fire extinguishers (does not support combustion)
- ✓ Carbonated drinks (adds fizz)
- ✓ Used in photosynthesis by plants

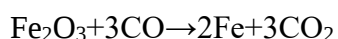
4. Carbon Monoxide (CO)

a) Properties of Carbon Monoxide

- ✗ Colorless, odorless but **highly poisonous** gas
- ✗ Does not support life
- ✓ Acts as a **reducing agent**

b) Use as a Reducing Agent

- CO is used in the **extraction of iron** from iron ore in the blast furnace:



c) Harmful Effects of CO (Asphyxia)

- **Binds with hemoglobin** in the blood to form **carboxyhemoglobin**, preventing oxygen transport.
 - **Leads to suffocation and death** if inhaled in high amounts.
 - **Common sources:** Incomplete combustion of fuel in cars, heaters, and industries.
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