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1. General Information

- Symbol: Si
 - Atomic Number: 14
 - Atomic Mass: 28.09 u
 - Group: 14 (Carbon Group)
 - Period: 3
 - Block: p-block
 - Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^2$
 - Valence Electrons: 4
 - Phase at Room Temperature: Solid
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2. Isotopes of Silicon

Isotope	Protons	Neutrons	Abundance	Notes
²⁸ Si	14	14	92.23%	Most abundant.
²⁹ Si	14	15	4.67%	Stable.
³⁰ Si	14	16	3.1%	Stable.

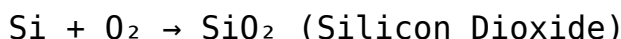
3. Physical Properties

- Color: Gray with metallic luster
 - Odor: Odorless
 - Density: 2.33 g/cm³
 - Melting Point: 1,414°C
 - Boiling Point: 3,265°C
 - State at STP: Solid
 - Hardness: Brittle, crystalline structure (like glass).
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4. Chemical Properties

- Moderately Reactive:
 - Forms silicon dioxide (SiO₂) in air.
 - Resists corrosion by water and acids but reacts with halogens.
- Forms Covalent Bonds:
 - Tetravalent (can form four bonds).
- Semiconductor Properties:
 - Conducts electricity better than non-metals but worse than metals.

Reaction with Oxygen (Oxidation):



Reaction with Hydrofluoric Acid:



5. Occurrence and Abundance

- Second most abundant element in Earth's crust (after oxygen).
 - Found in:
 - Rocks and Sand: Quartz, granite, feldspar.
 - Silicates: Form the majority of Earth's minerals.
 - Not found in Free State: Always in compounds (e.g., SiO₂).
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6. Industrial Production of Silicon

- Extracted from Quartz (SiO₂):
$$\text{SiO}_2 + 2\text{C} \rightarrow \text{Si} + 2\text{CO}$$
 (Reduction with carbon in electric arc furnaces)
 - Refined Further for Electronics:
 - Zone Refining: Produces ultra-pure silicon.
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7. Uses of Silicon

Application	Description
Semiconductors	Microchips, transistors, solar cells.
Construction	Concrete, glass, and bricks.
Alloys	Aluminium-silicon alloys for automotive parts.
Cosmetics and Sealants	Silicone-based products.
Glass and Ceramics	Silica (SiO ₂) used in glassmaking.
Aerospace and Defense	High-strength silicon carbide (SiC).
Medical Implants	Silicone for surgical implants.

8. Important Silicon Compounds

Compound	Formula	Use
Silicon Dioxide	SiO_2	Glass, sand, concrete.
Silicones	$(\text{R}_2\text{SiO})_n$	Lubricants, sealants, medical devices.
Silicon Carbide	SiC	Abrasives, cutting tools.
Silicon Tetrachloride	SiCl_4	Optical fibers, semiconductors.
Sodium Silicate	Na_2SiO_3	Detergents, water treatment.

9. Biological Importance of Silicon

- Trace Element in Humans and Plants:
 - Supports bone strength and connective tissue.
 - Promotes plant growth and cell wall strength.
 - Essential for Diatoms: Microscopic algae use silica to form protective shells.
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10. Silicon in Technology

- Key Material in Electronics:
 - Used in transistors and microchips for computers and phones.
 - Solar Panels:
 - Photovoltaic cells are made from silicon wafers.
 - Silicon Valley:
 - Named after the use of silicon in the tech industry.
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11. Environmental Role of Silicon

- Rock Cycle:
 - Forms minerals that shape Earth's crust and geological processes.
- Silica Dust:
 - Can cause lung diseases (silicosis) if inhaled.

- Sustainable and Abundant:
 - Silicon-based materials are widely recyclable.
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12. Safety and Hazards

- Inert in Pure Form:
 - Does not pose direct health risks.
- Silica Dust (SiO_2):
 - Prolonged exposure can lead to respiratory issues.
- Silicon Compounds:
 - Some are corrosive (e.g., SiCl_4 reacts with moisture to form HCl).

Handling Precautions:

- Ventilation when working with silica dust.
 - Use respirators and safety goggles during cutting or grinding.
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Fun Facts About Silicon:

- Named after the Latin word “silex” meaning flint or hard stone.
- Silicon makes up 27% of Earth’s crust.
- Silicon-based life forms are a common science fiction trope!
- The first transistor was made from silicon and germanium.