

Silicon (Si)

Silicon is a Group 14 metalloid whose four valence electrons form a tetrahedral diamond-cubic network. Its finite electronic band gap makes conductivity controllable rather than permanently metallic or insulating.

14	Si	28.085
Atomic number	Silicon	Relative atomic mass / mass display

1. Quick facts

Property	Value	Meaning for a student
Atomic number	14	14 protons
Electrons	14	neutral Si atom
Electron configuration	[Ne] 3s ² 3p ²	four valence electrons
Relative atomic mass	28.085	natural isotope-weighted value
Key isotope	Si-28	dominant natural isotope
Group / period	14 / 3	p-block

2. Atomic structure and electron configuration

Atomic feature	Value	How to read it
Protons	14	Atomic number fixes identity.
Electron configuration	[Ne] 3s ² 3p ²	Four valence electrons.
Crystal	Diamond cubic	Tetrahedral covalent network.
Band gap	about 1.12 eV	Room-temperature teaching reference for crystalline Si.

3. Signature idea

Why is silicon a semiconductor?

Silicon has a finite band gap between filled and available electronic states. Temperature, light and carefully introduced dopants can change the number and type of mobile charge carriers.

Structure connection

Four valence electrons support tetrahedral bonding. The repeating diamond-cubic network is structurally related to diamond carbon, but silicon has its own bond energies and electronic properties.

4. Properties, phase behavior and evidence

Property	Value	Meaning for a student
Non-bonded radius	2.10 Å	RSC reference definition.
Electron affinity	134.068 kJ/mol	Gaseous neutral-atom reference.
Electronegativity	1.90	Pauling scale.
1st ionization energy	786.518 kJ/mol	Gaseous atom.

Evidence context

Use values with their stated definitions, conditions and evidence status. Phase-transition temperatures describe a chosen pressure path; predicted or unknown properties are never presented as direct measurements.

5. Where on Earth?

Silicon is a major crustal element

RSC lists about 282,000 ppm by mass in Earth's crust. It is usually chemically bound in silica (SiO₂) and silicate minerals, not present as pools of pure elemental silicon.

Geography rule

The full interactive guide distinguishes natural occurrence from modern production, reserves or research locations. A map layer is labeled by what it actually represents.

6. Representative compounds / forms

Silicon dioxide / SiO ₂	Quartz and silica-rich materials are major geological reservoirs.
Silicates	Si-O frameworks combined with metal cations build many rock-forming minerals.

7. Isotope snapshot

Isotope	Nucleus	Natural abundance / status
Si-28	14 p / 14 n	92.223% - stable
Si-29	14 p / 15 n	4.685% - stable
Si-30	14 p / 16 n	3.092% - stable

8. Questions to ask next

Why is silicon a semiconductor? A finite band gap lets carrier density be changed by temperature, light and doping.

Why does silicon form a diamond-cubic crystal? Four valence electrons support tetrahedral covalent bonding.

Sources

Royal Society of Chemistry - Silicon element data

NIST - Silicon atomic/isotopic data

RSC semiconductor reference - silicon band gap context

Full interactive guide: <https://elementlookup.com/silicon/>