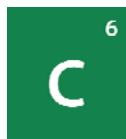


Stable isotopes of carbon available from ISOFLEX

Isotope	Z(p)	N(n)	Atomic Mass	Natural Abundance	Enrichment Level	Chemical Form
C-13	6	7	13.00335484	1.10%	>99.00%	Gas



Carbon has been known since ancient times, most familiarly as coal, charcoal, soot and diamond. Its name derives from the Latin word *carbo*, meaning "coal" or "charcoal." Carbon exists in three allotropic forms — diamond, graphite and fullerenes — each differing distinctly from others in physical and chemical properties:

Diamond [7782-40-0] is one of the hardest substances known. It has a Mohs hardness of 10.0, a density of 3.513 g/cm³, and a melting point of about 3700 °C. Carbon atoms in diamonds are arranged in cubic form, having stacking layers perpendicular to the diagonals of the cube. The diamond also occurs in hexagonal form, which is less stable than the cubic form. The hexagonal form of diamond is found in meteorites and can be synthesized.

Graphite [7440-44-0] is a black hexagonal crystal. The hexagonal layer has each carbon atom surrounded by three other carbon atoms. The C-C bond length is 1.415 Å. Because of the very weak van der Waal forces between the hexagonal layers, graphite is one of the softest solids, with a high lubricity and a density of 2.25 g/cm³. Graphite exhibits two manifestations: the stable *hexagonal form* that commonly occurs at ambient conditions, and a less stable *rhombohedral form*. Graphite can be converted to diamond under high temperatures (about 1400 °C) and very high pressures (in the range of 4000-5000 atm) in the presence of a metal catalyst such as iron or nickel.

Fullerenes [99685-96-8] are polyhedral carbon allotropes consisting of large carbon molecules containing 60 to 120 carbon atoms. They are found in soot, charcoal, carbon black and many other carbonaceous matters, and they have high electrical conductivity and chemical reactivity.

Carbon is also produced and used in other forms — such as activated carbon, carbon black and coke — that have many commercial applications: purification of water and air, air analysis, waste treatment, removal of sulfur dioxide from stack gases, and decolorization of sugar. *Carbon black* includes several forms of artificially prepared carbon, such as furnace black, channel black, lamp black and animal charcoal, and is commonly used in typewriter ribbons, printing inks, carbon paper, paint pigments, and as an absorber for solar energy and UV radiation. *Elemental carbon* has many important applications: the diamond is a precious gem; graphite is used as an electrode and has numerous other applications; the isotope Carbon-14 is used in carbon dating; and the isotope Carbon-13 is used in tracer studies and nuclear magnetic resonance (NMR) imaging.

Properties of Carbon

Name	Carbon
Symbol	C
Atomic number	6
Atomic weight	12.0107

Properties of Carbon (continued)

Standard state	Solid at 298 °K
CAS Registry ID	7440-44-0 (graphite)
Group in periodic table	14
Group name	None
Period in periodic table	2
Block in periodic table	p-block
Color	Graphite is black; diamond is colorless
Classification	Non-metallic
Melting point	3500 °C
Boiling point	4027 °C
Thermal conductivity	140 W/(m·K)
Electrical resistivity	About 1000 - direction dependent - $10^{-8} \Omega \text{ m}$
Electronegativity	2.55
Heat of vaporization	715 (sublimation) $\text{kJ}\cdot\text{mol}^{-1}$
Heat of fusion	117 (per mol carbon atoms) $\text{kJ}\cdot\text{mol}^{-1}$
Density of solid	2.267 g/cm^3
Atomic radius	0.77 Å
Electron configuration	[He]2s ² 2p ²
Oxidation state	+4