

## Stable isotopes of germanium available from ISOFLEX

Isotope	Z(p)	N(n)	Atomic Mass	Natural Abundance	Enrichment Level	Chemical Form
Ge-70	32	38	69.924249	20.38%	95.30-97.60%	Metal
Ge-70	32	38	69.924249	20.38%	95.30-97.60%	Oxide
Ge-72	32	40	71.922076	27.31%	96.40-98.20%	Metal
Ge-72	32	40	71.922076	27.31%	96.40-98.20%	Oxide
Ge-73	32	41	72.923460	7.76%	95.60-99.40%	Metal
Ge-73	32	41	72.923460	7.76%	>95.50%	Oxide
Ge-74	32	42	73.921178	36.72%	97.50-99.80%	Metal
Ge-74	32	42	73.921178	36.72%	≥95.20%	Oxide
Ge-76	32	44	75.921403	7.83%	>99.90%	Metal
Ge-76	32	44	75.921403	7.83%	88.00-99.90%	Oxide



Germanium was discovered in 1886 by Clemens Winkler. Its name originates with the Latin name *Germania*, meaning "Germany."

Germanium is a grayish-white cubic crystal. Elemental germanium can be prepared in extreme purification with a high degree of crystalline perfection, so as to yield highly-characterized surfaces. Its conductivity depends largely on added impurities. It is attacked by nitric acid and *aqua regia*, but it is stable in water, acids and alkalis in the absence of dissolved oxygen. It is insoluble in water, dilute acids and dilute alkalis. The chemical properties of germanium fall between those of silicon and tin. It forms both the divalent and tetravalent compounds, the oxidation state +4 being more stable than the oxidation state +2. The metal is stable in air and water at ambient temperatures. However, it reacts with oxygen at elevated temperatures, forming divalent and tetravalent oxides.

The most important uses of germanium are in electronic industries. It is a semiconductor material exhibiting an exponential increase of conductivity with increasing temperature. Other applications include infrared detectors, microscopes, various optical instruments, as a phosphor in fluorescent lamps, as an alloying agent, and as a catalyst. The activity of some germanium compounds against certain bacteria makes them of interest as chemotherapeutic agents.

## Properties of Germanium

<b>Name</b>	Germanium
<b>Symbol</b>	Ge
<b>Atomic number</b>	32
<b>Atomic weight</b>	72.61
<b>Standard state</b>	Solid at 298 °K
<b>CAS Registry ID</b>	7440-56-4
<b>Group in periodic table</b>	14
<b>Group name</b>	None
<b>Period in periodic table</b>	4
<b>Block in periodic table</b>	p-block
<b>Color</b>	Grayish-white
<b>Classification</b>	Semi-metallic
<b>Melting point</b>	938.2 °C
<b>Boiling point</b>	2830 °C
<b>Thermal conductivity</b>	60.2 W/(m·K) at 302.93 °K
<b>Electrical resistivity</b>	47 μΩ·cm at 20 °C
<b>Electronegativity</b>	1.8
<b>Specific heat</b>	0.322 J/g mol at 20 °C
<b>Heat of vaporization</b>	334 kJ·mol <sup>-1</sup> at 2830 °C
<b>Heat of fusion</b>	31.8 kJ·mol <sup>-1</sup>
<b>Density of liquid</b>	5.60 g/cm <sup>3</sup>
<b>Density of solid</b>	5.32 g/cm <sup>3</sup>
<b>Electron configuration</b>	[Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>2</sup>
<b>Oxidation states</b>	+2, +4
<b>Electronegativity</b>	1.9
<b>Covalent radius</b>	(Tetrahedral, sp <sup>3</sup> ) 1.22 Å
<b>Ionic radius</b>	Ge <sup>2+</sup> : 0.93 Å, Ge <sup>4+</sup> : 0.53 Å