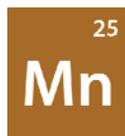


Stable Isotopes of Manganese

Isotope	Z(p)	N(n)	Atomic Mass	Natural Abundance	Nuclear Spin
Mn-55	25	30	54.938049	100.00%	5/2-



Manganese was discovered in 1774 by Johann Gahn. Its name originates with the Latin word *magnes*, meaning “magnet,” or *magnesia nigri*, meaning “black magnesia.”

There are four allotropic forms of manganese: The *alpha form* has a cubic crystal structure and a density of 7.43 g/cm³ and is brittle. It transforms to beta form at 720 °C. *Beta manganese* is brittle and has a cubic lattice structure with a density of 7.29 g/cm³ and transforms to gamma form at 1100 °C, or back to alpha form on cooling. The *gamma form* exists as a face-centered cubic crystal with a density of 7.18 g/cm³ and converts to the delta form at 1136 °C. *Delta manganese* consists of body-centered cubic crystals with a density of 6.30 g/cm³ and is stable up to 1244 °C, above which it melts to liquid.

Manganese decomposes in water and dissolves readily in dilute mineral acids. Many chemical properties of manganese are similar to those of iron. Manganese burns in air or oxygen at elevated temperatures, forming trimanganese tetroxide. Reactions with concentrated acids are slow at room temperature but rapid when heated. No hydrogen forms in concentrated acids, but sulfur dioxide and nitric oxide form with concentrated sulfuric and nitric acids. Manganese combines with several metals at elevated temperatures, forming binary compounds in varying compositions.

Manganese is distributed broadly in nature — mostly as oxide, silicate, and carbonate ores — and does not occur naturally in its native form. Manganese is used widely in industry, most importantly in ferrous metallurgy. It is also used in chemical, electrochemical, food and pharmaceutical applications. Almost all aluminum and magnesium alloys contain manganese. It is an essential element for all plants and animals; its shortage in soil can cause *chlorosis*, or lack of chlorophyll, in plants. Its shortage in animals can cause bone deformities. In chemical industries, manganese is used to prepare several compounds. It is also used as a catalyst. Its salts have numerous applications in oxidation, catalysis and medicine.

Properties of Manganese

Name	Manganese
Symbol	Mn
Atomic number	25
Atomic weight	54.938
Standard state	Solid at 298 °K
CAS Registry ID	7439-96-5
Group in periodic table	7

Properties of Manganese

Group name	None
Period in periodic table	4
Block in periodic table	d-block
Color	Silvery metallic
Classification	Metallic
Melting point	1244 °C
Boiling point	1962 °C
Thermal conductivity	7.81 W/(m·K) at 298.2 °K
Electrical resistivity	185.00 μΩ·cm at 25 °C
Electronegativity	1.5
Specific heat	0.48 kJ/kg K
Heat of vaporization	220.00 kJ·mol ⁻¹
Heat of fusion	13.20 kJ·mol ⁻¹
Density of solid	7.21-7.44 g/cm ³
Electron configuration	[Ar]4s ² 3d ⁷
Atomic radius	1.27 Å
Oxidation states	0, +1, +2, +3, +4, +5, +6, +7
Most common oxidation states	+2, +4, +7