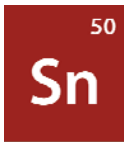
Stable isotopes of tin available from ISOFLEX

Isotope	Z(p)	N(n)	Atomic Mass	Natural Abundance	Enrichment Level	Chemical Form
Sn-112	50	62	111.904826	0.97%	99.60%	Metal
Sn-114	50	64	113.902782	0.65%	71.00-87.10%	Metal
Sn-115	50	65	114.903347	0.34%	51.00-69.00%	Metal
Sn-116	50	66	115.901745	14.54%	96.60-99.50%	Metal
Sn-117	50	67	116.902955	7.68%	87.00-97.50%	Metal
Sn-118	50	68	117.901608	24.22%	99.50%	Metal
Sn-119	50	69	118.903311	8.59%	90.50-97.40%	Metal
Sn-119	50	69	118.903311	8.59%	90.30%	Oxide
Sn-120	50	70	119.902198	32.59%	98.80-99.70%	Metal
Sn-122	50	72	121.903441	4.63%	93.40-99.30	Metal
Sn-124	50	74	123.905274	5.79%	99.90%	Metal



Tin was known in ancient times and is mentioned in the Old Testament. Early metal workers found it too soft for most purposes, but when mixed with copper, it produced bronze, which was suitable for many handcrafted items, especially tools and weapons. Tin takes its name from the Anglo-Saxon word *tin,* and the symbol *Sn* derives from the Latin word *stannum,* meaning “tin.”

Tin is a silvery-white metal at ordinary temperatures, slowly changing to gray below 13.20 ºC; it is soft, malleable and somewhat ductile. Tin has two allotropic forms: *white tin,* the beta form, which has a tetragonal structure and a density of 7.28 g/cm^3, its color slowly changing from white to gray when cooled below 13.20 º C, converts to *gray tin*, the alpha form, with a density of 5.75 g/cm^3. The presence of small amounts of antimony or bismuth prevents this transformation from white to gray tin.

Tin is insoluble in water; soluble in HCl, H_2SO_4, *aqua regia* and alkalis; and slightly soluble in dilute nitric acid. At ordinary temperatures, tin is stable in air, actually forming a very thin protective oxide film. In powder form, and especially in the presence of moisture, it oxidizes. When heated with oxygen, it forms tin oxide. Tin reacts with all halogens to form their halides. Tin is attacked by concentrated acids; with dilute acids, the reaction may be slow or very slow. The metal readily reacts with hot concentrated hydrochloric acid and *aqua regia,* but more slowly with cold dilute hydrochloric acid. The reaction also is slow with hot dilute sulfuric acid, which dissolves the metal, particularly in the presence of an oxidizing agent. The reaction with nitric acid is also generally slow. Hot concentrated acid converts the metal to an insoluble hydrate tin oxide. Reactions are more rapid with moist sulfur dioxide or sulfurous acid, chlorosulfonic or pyrosulfuric acids. Organic acids — such as acetic, oxalic and citric acids — react slowly with the metal, particularly in the presence of air or an oxidizing agent. The metal is stable in dilute solutions of ammonia or sodium carbonate. Tin dissolves in solutions of oxidizing salts such as potassium chlorate or potassium persulfate. The metal does not react with neutral salts in aqueous solutions; however, it reacts slowly with neutral salts in air. The metal does not combine directly with hydrogen, nitrogen or ammonia gas.

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Today, tin is used for plating steel to make “tin” cans for preserving food. Also, tin coats other metals to prevent corrosion. An important application of tin is to produce "float glass" (made by floating molten glass on molten tin) for windows. A number of tin alloys have wide industrial applications and include bronze, solder, Babbit metal, White metal, type metal, fusible metal and phosphor bronze. A tin-niobium alloy that is superconducting at low temperatures is used in the construction of super magnets. Tin is also used in wrapping foil and collapsible tubes.

All organic tin compounds are toxic.

Properties of Tin

Name	Tin
Symbol	Sn
Atomic number	50
Atomic weight	118.69
Standard state	Solid at 298 °K
CAS Registry ID	7440-31-5
Group in periodic table	14
Group name	None
Period in periodic table	5
Block in periodic table	p-block
Color	Silvery lustrous gray
Classification	Metallic
Melting point	231.90 °C
Boiling point	2270 °C
Vaporization point	2602 °C
Thermal conductivity	66.8 W/(m·K) at 298.2 °K
Electrical resistivity	11.0 μΩ·cm at 0 °C; 15.5 μΩ·cm at 100 °C
Electronegativity	1.7
Specific heat	0.21 kJ/kg K
Heat of vaporization	290 $kJ \cdot mol^{-1}$

Properties of Tin (continued)

Heat of fusion	7.00 $kJ \cdot mol^{-1}$
Density of liquid	6.99 g/cm^3 at 231.9 °C
Density of solid	7.31 g/cm^3
Electron configuration	$[Kr]4d^{10}5s^25p^2$
Atomic radius	1.41 Å
Oxidation states	+2, +4

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