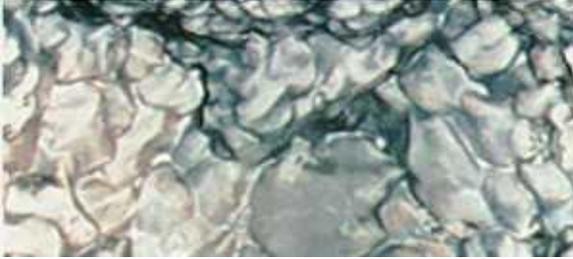


## Chemical information about pure IRON

### Data Zone

Classification:	Iron is a transition metal
Color:	silvery-gray
Atomic weight:	55.847
State:	solid
Melting point:	1535.1 °C, 1808.2 K
Boiling point:	2750 °C, 3023 K
Electrons:	26
Protons:	26
Neutrons in most abundant isotope:	30
Electron shells:	2,8,14,2
Electron configuration:	[Ar] 3d <sup>6</sup> 4s <sup>2</sup>
Density @ 20°C:	7.87 g/cm <sup>3</sup>
Atomic volume:	7.1 cm <sup>3</sup> /mol
Structure:	bcc: body-centered cubic
Hardness:	4.0 mohs
Specific heat capacity	0.44 J g <sup>-1</sup> K <sup>-1</sup>
Heat of fusion	13.80 kJ mol <sup>-1</sup>
Heat of atomization	415 kJ mol <sup>-1</sup>
Heat of vaporization	349.60 kJ mol <sup>-1</sup>
1 <sup>st</sup> ionization energy	759.3 kJ mol <sup>-1</sup>
2 <sup>nd</sup> ionization energy	1561.1 kJ mol <sup>-1</sup>
3 <sup>rd</sup> ionization energy	2957.3 kJ mol <sup>-1</sup>
Electron affinity	15.7 kJ mol <sup>-1</sup>
Minimum oxidation number	-2
Min. common oxidation no.	0
Maximum oxidation number	6
Max. common oxidation no.	3
Electronegativity (Pauling Scale)	01. Sep
Polarizability volume	8.4 Å <sup>3</sup>
Reaction with air	mild, ⇒ Fe <sub>3</sub> O <sub>4</sub>
Reaction with 15 M HNO <sub>3</sub>	passivated
Reaction with 6 M HCl	vigorous, ⇒ H <sub>2</sub> , FeCl <sub>2</sub>
Reaction with 6 M NaOH	–
Oxide(s)	FeO, Fe <sub>2</sub> O <sub>3</sub> (hematite), Fe <sub>3</sub> O <sub>4</sub> (magnetite)
Hydride(s)	none
Chloride(s)	FeCl <sub>2</sub> , FeCl <sub>3</sub>
Atomic radius	140 pm
Ionic radius (1+ ion)	–
Ionic radius (2+ ion)	77 pm
Ionic radius (3+ ion)	63 pm
Ionic radius (1- ion)	–
Ionic radius (2- ion)	–
Ionic radius (3- ion)	–
Thermal conductivity	80.4 W m <sup>-1</sup> K <sup>-1</sup>
Electrical conductivity	11.2 x 10 <sup>6</sup> S m <sup>-1</sup>
Freezing/Melting point:	1535.1 °C, 1808.2 K



Close up of an iron meteorite: Meteorites such as this one were probably our ancestors' first source of iron. This is a fragment of the Sikhote-Alin meteorite – approximately 93% iron, 6% nickel and 1% other elements. The meteorite surface has been melted into thumb-print shapes during its flight through our atmosphere. Photo by Carl Allen, NASA JSC Photo S94-43472



Scrap iron and steel for recycling. How times have changed; iron was once worth eight times more than gold.

### **Discovery of Iron**

Dr. Doug Stewart

Iron has been known since ancient times.

The first iron used by humans is likely to have come from meteorites.

Most objects that fall to earth from space are stony, but a small proportion, such as the one pictured, are 'iron meteorites' with iron contents of over 90 percent.

Iron corrodes easily, so iron artifacts from ancient times are much rarer than objects made of silver or gold.

This makes it harder to trace the history of iron than the less reactive metals.

Artifacts made from meteorite iron have been found dating from about 5000 BC (and so are about 7000 years old) – for example iron beads in graves in Egypt. <sup>(1)</sup>

In Mesopotamia (Iraq) there is evidence people were smelting iron around 5000 BC.

Artifacts made of smelted iron have been found dating from about 3000 BC in Egypt and Mesopotamia. <sup>(1), (2), (3)</sup>

In those times, iron was a ceremonial metal; it was too expensive to be used in everyday life.

Assyrian writings tell us that iron was eight times more valuable than gold. <sup>(1)</sup>

The iron age began about 1300-1200 BC when iron became cheap enough to replace bronze.

Adding carbon to iron to make steel was probably accidental at first – a coming together of molten iron and charcoal from the smelting fire. This probably happened about 1000 BC. <sup>(4)</sup>

Until this happened there were few technological reasons for the bronze age to give way to the iron age; the techniques of improving iron by adding carbon (to make steel) and coldworking were needed before iron would be wholly preferred to bronze. <sup>(5)</sup>

Iron was used commonly in Roman times. In the first century Pliny the Elder said, "It is by the aid of iron that we construct houses, cleave rocks, and perform so many other useful offices in life." <sup>(6)</sup>

The origin of the chemical symbol Fe is from the Latin word 'ferrum' meaning iron.

The word iron itself comes from 'iren' in Anglo-Saxon.