

Thorium (Th)

Thorium is a naturally occurring radioactive actinide. Its very long-lived Th-232 isotope dominates natural thorium, while its metallic crystal changes from FCC to BCC before melting.

90	Th	232.038
Atomic number	Thorium	Relative atomic mass / mass display

1. Quick facts

Property	Value	Meaning for a student
Atomic number	90	90 protons
Electrons	90	neutral Th atom
Electron configuration	[Rn] 6d2 7s2	RSC ground-state shorthand
Relative atomic mass	232.038	reference atomic mass
Key isotope	Th-232	dominant natural thorium
Period / block	7 / f	actinide

2. Atomic structure and electron configuration

Atomic feature	Value	How to read it
Protons	90	Atomic number fixes identity.
Th-232 nucleus	90 p / 142 n	Long-lived radioactive isotope.
Room-temperature crystal	FCC	Lower-temperature alpha-thorium.
High-temperature solid	BCC	Beta-thorium above about 1630 K at ambient pressure.

3. Signature idea

Why is thorium radioactive if its half-life is so long?

A long half-life means each nucleus has a small probability of decaying in a given time interval; it does not mean the decay probability is zero. A large sample still contains many nuclei and therefore remains radioactive.

Solid-state exception

At approximately ambient pressure, thorium changes from FCC to BCC near 1630 K (about 1357 C), then melts at 2023 K. The solid-solid transition and melting transition are separate events.

4. Properties, phase behavior and evidence

Property	Value	Meaning for a student
Density	11.7 g/cm ³	RSC reference value.
Electronegativity	1.3	Pauling scale.
1st ionization energy	608.504 kJ/mol	Gaseous atom.
Melting point	2023 K	Reference value; conditions matter.

Evidence context

Use values with their stated definitions, conditions and evidence status. Phase-transition temperatures describe a chosen pressure path; predicted or unknown properties are never presented as direct measurements.

5. Where on Earth?

Thorium occurs naturally in minerals, but resource context varies

Thorium is found in minerals such as monazite. Resource and production estimates depend on definitions and reporting programs; the interactive page therefore treats country markers as contextual rather than timeless abundance rankings.

Geography rule

The full interactive guide distinguishes natural occurrence from modern production, reserves or research locations. A map layer is labeled by what it actually represents.

6. Representative compounds / forms

Thorium dioxide / ThO ₂	A refractory thorium(IV) oxide.
Monazite minerals	Rare-earth phosphate minerals can contain thorium as a minor or significant component.

7. Isotope snapshot

Isotope	Nucleus	Natural abundance / status
Th-232	90 p / 142 n	dominant natural isotope - half-life about 1.4e10 y
Th-230	90 p / 140 n	radioactive - half-life about 7.56e4 y

8. Questions to ask next

Why is thorium radioactive if its half-life is so long? Long half-life means slow statistical decay, not no decay.

Why does thorium change crystal structure before it melts? The FCC-to-BCC transition is a solid-solid phase change.

Sources

Royal Society of Chemistry - Thorium element data

IAEA Nuclear Data Services - isotope/decay context

OECD/NEA and reviewed materials data - thorium phase transition context

Full interactive guide: <https://elementlookup.com/thorium/>