

Technetium (Tc) - Student Datasheet

Element 43 · Radioactive transition metal · source-reviewed learning reference

Technetium is element 43, the first element produced artificially before its trace natural occurrence was established. Every technetium isotope is radioactive, and the key learning distinction is between long-lived ^{99}Tc and short-lived metastable $^{99\text{m}}\text{Tc}$ used in diagnostic nuclear medicine.

Quick reference

Atomic number	43
Relative atomic mass	[98]
Electron configuration	[Kr] 4d ⁵ 5s ²
Period / group / block	5 / 7 / d
State context	Silvery-gray radioactive metal; no stable isotopes
Density	11 g/cm ³
Melting / transition	2430 K
Boiling / gas reference	4535 K
Oxidation states	+7 common; multiple lower states occur
Electronegativity	2.10

Structure & orbitals

Bulk technetium metal has an HCP structure. The viewer is a conventional hexagonal teaching model; radioactive identity is a nuclear property and does not erase ordinary solid-state structure.

Representative 4d/5s clouds are isolated-atom models; they do not describe Tc complexes, metal bands or nuclear metastable states.

Phase behavior

At approximately standard pressure, technetium metal is solid below about 2430 K, liquid to about 4535 K, and gaseous above the boiling reference.

Five things to remember

- Atomic number 43 means 43 protons.
- Technetium has no stable isotopes.
- ^{99}Tc and $^{99\text{m}}\text{Tc}$ are different nuclear states with radically different half-lives.
- Trace technetium can occur naturally from uranium fission, despite its primarily synthetic association.
- The page gives medical context without production, dosing or handling instructions.

Technetium: Real World & Signature Science

Element-specific science, uses and history

Big idea

“Technetium-99” and “technetium-99m” are not interchangeable labels. ^{99m}Tc is a metastable nuclear state with a roughly six-hour half-life used for imaging; ^{99}Tc is the much longer-lived ground state with a half-life of about 2.1×10^5 years.

Why this element is scientifically distinctive

Explore Tc across the teaching nucleus, isolated-atom orbitals, evidence-aware material structure and temperature/evidence views, then connect those models to uses, isotopes and source-backed context.

Diagnostic imaging	^{99m}Tc is widely used as a gamma-emitting tracer in diagnostic nuclear medicine.
Nuclear waste science	Long-lived ^{99}Tc is important in fission-product and environmental transport studies.
Coordination chemistry	Technetium forms many complexes and oxidation states, important in tracer chemistry.
Trace natural occurrence	Tiny quantities can arise naturally through spontaneous fission and related nuclear processes.
Safety boundary	Medical context is conceptual; this guide does not provide isotope production, radiopharmacy preparation, dose or handling procedures.

How technetium knowledge is used: high-level nuclear and chemical context

1. Technetium isotopes arise in nuclear processes; operational production parameters are outside this guide.
2. Nuclear state and isotope identity determine half-life and radiation behavior.
3. Chemical coordination allows technetium tracers to be incorporated into diagnostic compounds under regulated specialist practice.
4. Long-lived ^{99}Tc is treated separately in environmental and waste-form science.

History checkpoints

1937	Carlo Perrier and Emilio Segrè identified element 43 in molybdenum material that had been irradiated in a cyclotron.
1947	The name technetium, from Greek for “artificial,” was adopted.
20th century	^{99m}Tc became a cornerstone of diagnostic nuclear medicine.
Modern science	Trace natural technetium and long-lived ^{99}Tc are studied in nuclear and environmental contexts.

Technetium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

^{99m} Tc	Metastable state · ~6 h half-life	Widely used in diagnostic imaging; decays to ⁹⁹ Tc.
⁹⁹ Tc	Long-lived ground state · ~2.1 × 10 ⁵ y	Important fission product and reference teaching nucleus.
⁹⁸ Tc	Long-lived radioisotope	One of technetium's longest-lived isotopes; no technetium isotope is stable.

Common questions

What is technetium?

Technetium is radioactive chemical element 43, a transition metal with no stable isotopes.

Why is technetium radioactive?

No combination of 43 protons and known neutron counts produces a stable technetium nucleus.

Is technetium naturally occurring?

It is primarily associated with artificial production, but trace technetium can occur naturally through uranium fission and related nuclear processes.

What is technetium used for?

The best-known use is ^{99m}Tc in diagnostic nuclear medicine; technetium also has tracer and nuclear-research roles.

Quick self-check

Q: What is technetium's atomic number? | Answer: 43. Atomic number equals proton count.

Q: Are any technetium isotopes stable? | Answer: No. Every known Tc isotope is radioactive.

Q: Which state is widely used in imaging? | Answer: ^{99m}Tc. The metastable state has a convenient short half-life and gamma emission.

Evidence & safety

Atomic and phase references are evaluated. The HCP metal structure is separate from isotope/nuclear-state identity. Medical and production context is intentionally non-operational.

Technetium isotopes are radioactive materials used under specialized regulatory and clinical controls. No preparation, dose, acquisition, handling or disposal instructions are provided.

Core sources

Royal Society of Chemistry - Technetium

<https://periodic-table.rsc.org/element/43/technetium>

Los Alamos National Laboratory - Technetium

<https://periodic.lanl.gov/43.shtml>