

URANIUM	U	92
Element Lookup student datasheet	238.02891	Actinide Period 7 f-block

Uranium is a dense, radioactive actinide. This sheet focuses on atomic identity, natural isotopes, radioactive decay, temperature-dependent solid phases, core chemistry, uses, geology and safe scientific context.

1. Quick facts

Property	Reference value / description	Source note
Atomic number	92 - 92 protons; 92 electrons in a neutral atom	NIST / RSC
Standard atomic weight	238.02891(3)	NIST
Electron configuration	[Rn] 5f3 6d1 7s2	NIST
State at 20 C	Solid; alpha-uranium is the low-temperature crystal phase	RSC + materials references
Density	19.1 g/cm3	RSC reference
Melting / boiling	1408 K / 4404 K	RSC
1st ionization energy	6.19405 eV	NIST
Natural isotopes	U-234, U-235 and U-238; all are radioactive	NIST isotopic composition

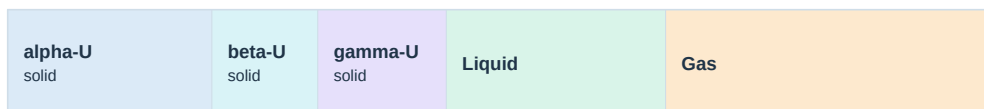
2. Natural isotopes and radioactivity

Isotope	Natural atom fraction	Approx. half-life	Learning point
U-238	0.992742 (about 99.2742%)	about 4.47 billion years	Most abundant natural isotope; alpha-decay chain ultimately reaches stable lead.
U-235	0.007204 (about 0.7204%)	about 704 million years	Naturally occurring fissile isotope; distinguish neutron-induced fission from spontaneous radioactive decay.
U-234	0.000054 (about 0.0054%)	about 246,000 years	A much less abundant member of the U-238 decay series.

Half-life does not mean an atom has a timer. Half-life is a statistical population measure: after one half-life, about half of a very large initial population of radioactive nuclei remains. Individual decay events are unpredictable.

3. Temperature path: uranium changes crystal structure before it melts

At approximately standard pressure, heating uranium crosses three solid crystal phases before the ordinary liquid and gas states. A state-of-matter slider therefore needs more detail than just Solid / Liquid / Gas.



Approx. interval	Phase	Structure / note
below ~942 K	alpha-U solid	Orthorhombic low-temperature phase
~942-1049 K	beta-U solid	Complex tetragonal phase
~1049-1408 K	gamma-U solid	Body-centred cubic phase
1408-4404 K	Liquid	Reference one-pressure teaching interval
above 4404 K	Gas	Reference boiling boundary

Safety context

Radiological: Uranium isotopes emit alpha radiation. Alpha particles have low external penetration, but radioactive material can be important if taken into the body.	Chemical: Uranium is also a heavy-metal toxicant; kidney toxicity is an important chemical-health concern. Handling belongs in regulated professional settings.
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URANIUM - STUDENT REVISION SHEET

Page 2: chemistry, geography, uses, history and review

4. Chemistry and bonding

Topic	What to remember
Common oxidation states	+3, +4, +5 and +6 are important. Uranium(VI) commonly appears in the linear uranyl ion, UO_2^{2+} .
5f electrons	Uranium is an actinide. 5f, 6d and 7s electronic states contribute to chemistry; heavy-element relativistic effects and strong spin-orbit interactions make simple orbital pictures only qualitative.
Oxides	Uranium forms several oxides, including UO_2 and U_3O_8 . Oxidation state and oxygen content strongly affect composition and properties.
Source disagreement	Some tabulated properties differ by source or definition. The website records provenance rather than forcing one unsupported number.

5. Where uranium is mined and where resources occur

Modern mine production is not the same as natural abundance or identified resources. The element occurs broadly in Earth materials, while economic production is concentrated in particular deposits and countries.

2024 mine production	tonnes U	Context
Kazakhstan	23,270	Largest producer
Canada	14,309	Second largest
Namibia	7,333	Third largest
Australia	4,598	Major producer and major resource holder
Uzbekistan	4,000 (est.)	Estimated production
World total	60,213	World Nuclear Association, updated Jan 2026

Identified resources (selected): In the Uranium 2024 / 2023 resource base below USD 130/kgU, Australia is about 28% of the world total, Kazakhstan about 14%, and Canada about 10%. Resource estimates are economic/geological datasets and can change with price, exploration and methodology.

6. Uses and significance

Area	Why uranium matters
Nuclear energy	Uranium-based fuels provide heat through controlled fission in nuclear reactors. This sheet intentionally omits operational fuel-cycle or reactor-design instructions.
Geochronology	Uranium-lead isotope systems are major tools for dating minerals and reconstructing Earth history.
Geology / environment	Uranium minerals, decay products and redox chemistry matter in ore geology, groundwater studies and environmental monitoring.
Materials / research	Dense uranium materials and actinide compounds have specialized regulated applications and are central to heavy-element chemistry research.

7. Short history

1789 Klaproth identifies a new element in pitchblende and names it after Uranus.	1841 Peligot isolates metallic uranium.	1896 Becquerel discovers radioactivity using uranium compounds.	20th century Nuclear physics establishes uranium as central to fission, power and isotope science.
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8. Review questions

1. Why does a neutral uranium atom contain 92 electrons?
2. Which natural uranium isotope is most abundant?
3. Explain why half-life is a statistical property rather than an individual-atom countdown.
4. What changes at the alpha-U to beta-U transition even though the material remains solid?
5. Why should a uranium map separate mine production from natural occurrence and identified resources?
6. State one radiological and one chemical-health reason uranium requires controlled handling.

Reference backbone

NIST: atomic identity, ionization and isotopic composition. **RSC:** physical properties and classification. **NEA/IAEA Uranium 2024:** resources. **World Nuclear Association:** 2024 mine production. **NRC / EPA / ATSDR:** radiation and health context. **DOE / materials literature:** alpha, beta and gamma phase boundaries.