

Radon (Rn) - Student Datasheet

Atomic number 86 - Radioactive noble gas - Group 18 - Period 6 - p-block

Radon is element 86, a radioactive noble gas produced naturally in uranium-series decay. Because it can migrate from soil and rock into buildings, its most important real-world lesson connects nuclear decay, gas transport and indoor exposure without turning the page into a site-specific risk assessment.

Quick reference

Atomic number	86
Relative atomic mass	[222]
Electron configuration	[Xe] 4f14 5d10 6s2 6p6
State at 20 C	Colorless radioactive gas at 20 deg C
Density	0.009074 g/cm3 - gas reference
Melting point	202 K
Boiling point	211.5 K
Common oxidation state	0 dominant - limited compound chemistry exists
Electronegativity	Unknown / not routinely assigned

Structure & orbitals

At ordinary conditions radon is a monatomic gas. The material viewer therefore shows separated atoms, not a molecule or room-temperature lattice.

The 6s and 6p models are isolated-atom probability distributions. They explain electronic shell closure, not radioactive decay; alpha decay is a nuclear process.

Temperature / phase context

At approximately standard pressure, radon is solid below about 202 K, liquid to about 211.5 K, and gaseous above. The ordinary room-temperature material view is therefore a monatomic gas.

Five things to remember

- Atomic number 86 means every radon nucleus contains 86 protons.
- Neutral radon has a closed-shell [Xe] 4f14 5d10 6s2 6p6 configuration.
- Radon is a noble gas chemically but has no stable isotopes.
- 222Rn has a half-life of about 3.8 days and arises in the uranium-238 decay series through radium-226.
- Radon exposure risk depends on concentration and time; building-specific levels require measurement rather than a generic map.

Radon: Real World & Signature Science

Radon is both a noble gas and radioactive: chemical inertness does not mean nuclear stability. Those are different properties governed by electrons and nuclei respectively.

Why this element matters

Indoor radon Radon can enter buildings from soil and rock. Indoor concentration depends on local geology, building pathways, ventilation and other conditions.	Decay chain ^{222}Rn is generated from radium-226 in the uranium-238 decay chain and decays through radioactive daughters.
Measurement A map cannot tell the radon level in one building. Testing is the appropriate way to determine indoor concentration.	Public health Long-term radon exposure increases lung-cancer risk; public-health agencies provide testing and mitigation guidance.
Noble-gas chemistry Radon's closed-shell electronic structure makes it a noble gas, even though its nuclei are unstable.	

How radon enters indoor environments: a non-operational science path

1. Uranium-238 decay in minerals eventually produces radium-226, which can alpha-decay to radon-222.
2. As a noble gas, radon atoms can move through pore spaces in soil and rock more readily than solid parent nuclides.
3. Pressure differences and building openings can allow soil gas to enter indoor spaces.
4. Indoor concentration is measured with appropriate detectors; public-health agencies provide guidance for interpreting results and mitigation decisions.

Where on Earth?

Natural generation - Global conceptual

Radon can be generated wherever uranium/radium occur in rocks and soils; concentration varies locally and cannot be represented by a few global pins

Indoor entry pathways - Building-specific

Soil gas can enter through cracks, joints and service penetrations; actual indoor concentration must be measured

Discovery context - Halle, Germany - 1900

Friedrich Ernst Dorn observed a radioactive emanation from radium compounds, an important step toward identifying radon

History

1899-1900 - Radioactive 'emanations' from thorium and radium were observed during the rapid early development of radioactivity science.

1900 - Friedrich Ernst Dorn reported the radium emanation later understood as radon.

20th century - Radon was recognized as a noble gas and as an important occupational and environmental exposure.

Today - Indoor radon testing and mitigation are established public-health measures in many countries.

Uses

Public-health measurement Radon is primarily a hazard to measure and manage rather than a material with broad commercial uses.	Earth and groundwater research Radon can be used as a tracer in specialized geoscience and hydrology studies.
Historical medicine Radon and radium were once used in medical contexts that predate modern radiation protection; historical use is not a current recommendation.	Nuclear science Radon isotopes provide examples for teaching radioactive decay chains and noble-gas behavior.

Radon: Isotopes, Questions & Evidence

Isotopes

²²²Rn - Radioactive - half-life about 3.8 days

The most important isotope for indoor-radon exposure and the teaching nucleus on this page.

²²⁰Rn - Radioactive - short-lived

Sometimes called thoron; it belongs to the thorium-232 decay series.

Radon isotope family - No stable isotopes

Every radon isotope is radioactive; isotope identity determines half-life and decay-chain context.

Common questions

What is radon?

Radon is radioactive noble-gas element 86, symbol Rn.

Where does radon come from?

It forms naturally in radioactive decay chains, especially when radium-226 decays in uranium-bearing rocks and soils.

How can radon be a noble gas and radioactive?

Noble-gas chemistry describes the closed electron shell; radioactivity describes an unstable nucleus. The two properties are independent.

Where is radon found?

It can occur in soil gas, groundwater and indoor air. Local concentrations vary and are not predictable from a simple world map.

How do I know the radon level in a building?

Measure it with an appropriate radon test. Element Lookup does not infer building-specific risk from geography.

What is radon's electron configuration?

[Xe] 4f14 5d10 6s2 6p6, a closed-shell noble-gas configuration.

Quick self-check

1. What is radon's atomic number? Answer: 86
2. Why is radon chemically a noble gas? Answer: It has a closed outer electron shell
3. Which isotope is most important for indoor radon? Answer: ²²²Rn
4. Can a world map tell the radon level in one house? Answer: No; the building should be measured
5. What is radon's ordinary state at room temperature? Answer: Monatomic gas

Safety boundary

Radon is a radioactive inhalation hazard. For real buildings, use official local guidance and appropriate testing rather than relying on a generic educational map.

Evidence & provenance

Atomic identity, decay and ordinary phase references are measured/evaluated. Geography modes intentionally avoid 'risk pins' because indoor radon is building-specific. Public-health statements are high-level and should be paired with local official guidance.

Core sources

Royal Society of Chemistry - Radon	https://periodic-table.rsc.org/element/86/radon
US EPA - Radon	https://www.epa.gov/radon
NIST - Atomic Data for Radon	https://physics.nist.gov/PhysRefData/Handbook/Tables/radontable1.htm