

OGANESSON	Og	118
Element Lookup student datasheet	[294]	Group 18 Period 7 p-block

Oganesson is the heaviest named element and a special case for scientific literacy: only tiny numbers of atoms have been made, so some facts are observed or evaluated while many bulk properties remain predictions or unknown.

1. Evidence status - read the label before the number

OBSERVED	Element 118 was produced in superheavy-element experiments and identified through radioactive decay chains.
EVALUATED	Atomic number 118, symbol Og, placement in Group 18, and the mass-number label [294] are accepted reference facts.
PREDICTED	Electron behavior, bulk phase behavior and many chemical properties rely heavily on relativistic quantum calculations because macroscopic samples do not exist.
UNKNOWN	No measured ordinary density, melting point, boiling point or bulk crystal structure is established.

2. Quick facts

Property	Value / description	Status
Atomic number	118 - 118 protons; 118 electrons in a neutral atom	Evaluated
Relative atomic mass	[294] - bracket notation indicates no standard atomic weight	Evaluated / isotope-based
Electron configuration	[Rn] 5f14 6d10 7s2 7p6	Predicted ground-state configuration
Group / period / block	Group 18 / Period 7 / p-block	Evaluated classification
Natural occurrence	None known; artificially produced for research	Observed context
Melting / boiling	Not measured. High-level theory predicts about 325 +/- 15 K and 450 +/- 10 K.	Prediction only

3. 294Og nucleus and radioactive decay

Item	Learning value
294Og nucleus	118 protons + 176 neutrons. The packed-ball picture used on the website is explicitly an educational model, not a literal image of a quantum nucleus.
Half-life	About 0.7 milliseconds for 294Og in evaluated isotope data; the uncertainty is large because very few decay events exist.
Main decay mode	Alpha decay: 294Og -> 290Lv + alpha particle (simplified decay-chain teaching step).
Why it matters	Decay chains are how researchers identify nuclei that exist too briefly for ordinary bulk-property measurements.

4. Prediction-only temperature path

This is not a measured phase diagram. Calculations predict that Oganesson may be a condensed solid near room temperature even though it is in Group 18. The shaded boundaries below represent prediction uncertainty, not measured transition ranges.

Predicted solid below ~310 K	melt band 310-340 K	Predicted liquid ~340-440 K	boil band 440-460 K	Predicted gas above ~460 K
Region	How Element Lookup should describe it			
Below ~310 K	Predicted solid region			
310-340 K	Predicted melting-transition uncertainty band; central prediction 325 K			
~340-440 K	Predicted liquid region			
440-460 K	Predicted boiling-transition uncertainty band; central prediction 450 K			
Above ~460 K	Predicted gas/vapor region			

OGANESSON - STUDENT REVISION SHEET

Page 2: discovery, relativistic effects, periodic trends and uncertainty

5. Discovery and naming timeline

2002 & 2005 The Dubna-Livermore experiment records three element-118 decay chains in total: one event in the 2002 run and two more in 2005.	2006 The JINR-LLNL collaboration publishes the element-118 results.	2015 IUPAC/IUPAP recognize the JINR-LLNL team as fulfilling the discovery criteria.	2016 IUPAC approves the name Oganesson (Og), honoring Yuri Oganessian.
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6. Why Oganesson may not behave like an ordinary noble gas

Concept	Explanation
Very large nuclear charge	With 118 protons, inner electrons move in an exceptionally strong nuclear electric field. Relativistic effects become crucial to accurate calculations.
Strong spin-orbit splitting	Theory predicts very large splitting of the outer p-derived electronic levels; a simple nonrelativistic shell picture is no longer enough.
Smeared valence localization	High-level calculations predict a more uniform, less shell-like valence-electron localization than in lighter noble gases.
Greater polarizability / attraction	Predicted strong dispersion interactions help explain why modern calculations can place bulk Oganesson in a condensed state near room temperature.
Chemical caution	Group 18 placement is real, but "noble gas" should not be read as "chemically identical to neon, argon or xenon." Many Og chemical properties remain theoretical.

7. Group 18 comparison

Feature	Xenon (Xe)	Radon (Rn)	Oganesson (Og)
Evidence base	Bulk measurements	Bulk + radioactive measurements	Few-atom nuclear data + theory
20 C phase	Gas	Gas	Predicted condensed/solid in modern theory; not measured
Chemistry	Known compounds exist	Limited but experimentally studied chemistry	Largely theoretical
Scientific lesson	Heavy noble gas	Radioactive heavy noble gas	Relativity and uncertainty can reshape periodic trends

8. Where on Earth? Research geography, not mining geography

JINR, Dubna, Russia Superheavy-element synthesis experiments that produced the discovery decay chains.	LLNL, Livermore, USA Partner laboratory in the credited discovery collaboration and nuclear-data interpretation.	Natural deposits None known. Oganesson has no ore deposits, reserves, mine-production map or practical commodity supply chain.
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9. Evidence ladder

Most secure	What belongs here
Direct / evaluated	Atomic number, decay-chain observations, credited discovery, naming, isotope mass-number identification.
Theory constrained by known physics	Electron configuration, relativistic electronic structure, polarizability, predicted condensed-state behavior.
High-level bulk predictions	Predicted melting and boiling temperatures; these require visible "prediction only" labels.
Unknown / not measured	Ordinary density, measured crystal structure, direct macroscopic chemistry, practical physical-property tables. Do not invent values.

10. Review questions

1. Why does [294] appear in brackets rather than as an ordinary standard atomic weight?	2. How many neutrons are in the educational 294Og nucleus model?
3. Why can decay chains identify Oganesson even though no bulk sample exists?	4. Why must the Oganesson temperature explorer say "prediction only"?
5. Give one reason relativistic effects are unusually important for element 118.	6. Why would a mine-production map for Oganesson be scientifically misleading?

Reference backbone: IUPAC/IUPAP - discovery and naming; PubChem/evaluated isotope data - identity and 294Og decay; RSC - classification and unknown bulk-property context; LLNL/JINR - 2002/2005 decay-chain observations and discovery history; Jerabek et al. (2018) - relativistic electron localization; Smits et al. (2020) - high-level predicted phase behavior. Predictions are labeled as predictions throughout.