EngineeringRise

Inner transition elements: lanthanoids and actinoids

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
f electrons of Ln3+	n = Z - 3 - 54 Valid when: Tripositive lanthanoid ion; xenon core of 54 electrons	number
f electrons of An3+	n = Z - 3 - 86 Valid when: Tripositive actinoid ion; radon core of 86 electrons	number
Unpaired f electrons	n = f for f up to 7; n = 14 - f above 7 Valid when: f electrons in separate orbitals first (Hund's rule); 7 f orbitals	number
Spin-only moment	mu = sqrt(n(n + 2)) Valid when: Spin-only value; matches Gd3+, La3+, Lu3+ but fails for most Ln3+ (orbital contribution); n = unpaired electrons	BM
Gd3+ (f7)	mu = sqrt 63 = 7.94 Valid when: Gd3+ ion, 4f7, seven unpaired electrons; spin-only	BM
Stable f counts	f0, f7, f14: Ce4+, Eu2+, Gd3+, Tb4+, Yb2+, Lu3+	n/a (configuration)
Uniform contraction	r(n) = r(La) - n (r(La) - r(Lu)) / 14 Valid when: Simple model: radius falls by equal steps from La3+ to Lu3+	pm
Series ranges	lanthanoids Z = 58 to 71; actinoids Z = 90 to 103	atomic number

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/chemistry/d-and-f-block-elements/inner-transition-elements-lanthanoids-and-acti

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