

H Home Background Color: He
 Li Be Black White Gray B C N O F Ne
 NaMg Al Si P S Cl Ar
 K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
 Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
 Cs Ba La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
 Fr Ra Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr Rf Db Sg Bh Hs Mt Ds Rg Uub Uut Uuq Uup Uuh Uus Uuo

Boiling Point of the elements

Text lists sorted by: [Value](#) | [Atomic Number](#) | [Alphabetical](#)

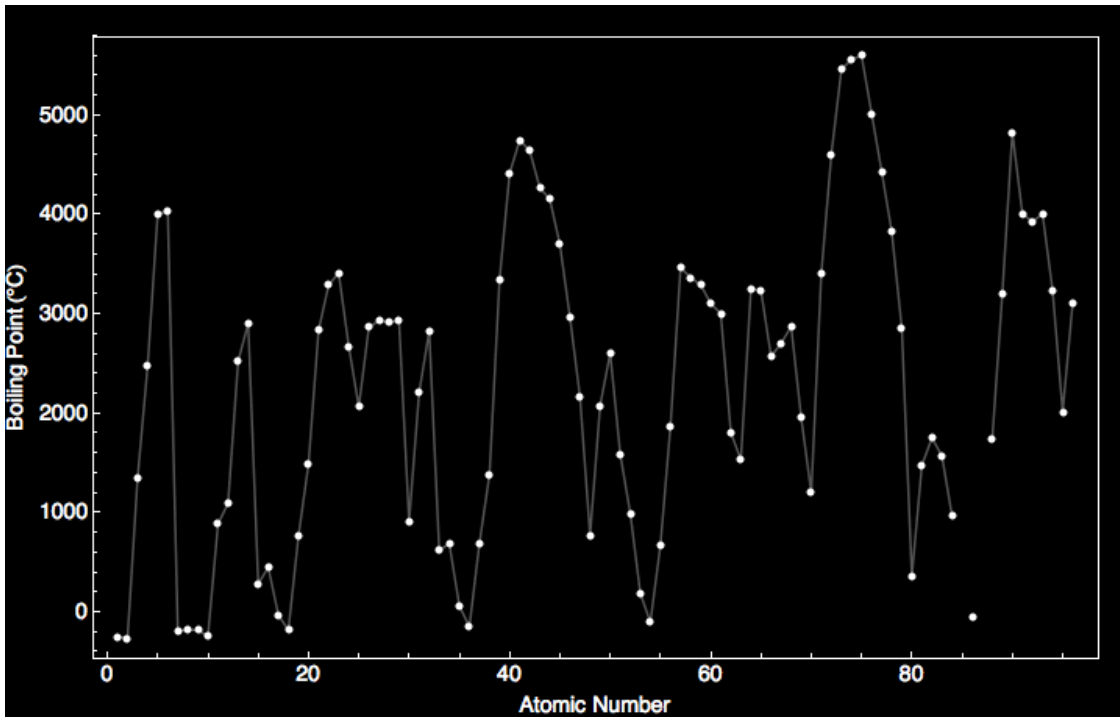
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Log scale plots: [3D Live](#) | [Shaded](#) | [Ball](#) | [Crossed Line](#) | [Scatter](#) | [Sorted Scatter](#)

Good for this property: [Scatter](#)



Point to the graph to see details, or click for full data on that element.



Notes on the Boiling Point of particular elements:

Carbon: Value given for diamond form.

Phosphorus: Value given for yellow phosphorus form.

Arsenic: Arsenic sublimates at this temperature.

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Absolute Boiling Point	Isotope Abundances
Absolute Melting Point	Known Isotopes
Abundance in Earth's Crust	Lattice Angles
Abundance in Humans	Lattice Constants
Abundance in Meteorites	Lifetime
Abundance in the Ocean	Liquid Density
Abundance in the Sun	Magnetic Type
Abundance in the Universe	Mass Magnetic Susceptibility
Adiabatic Index	Melting Point
Allotrope Names	Memberships
Alternate Names	Mohs Hardness
Atomic Number	Molar Magnetic Susceptibility
Atomic Radius	Molar Volume
Atomic Weight	Name
Autoignition Point	Neel Point
Block	Neutron Cross Section
Boiling Point	Neutron Mass Absorption
Brinell Hardness	NFPA Fire Rating
Bulk Modulus	NFPA Hazards
CAS Number	NFPA Health Rating
CID Number	NFPA Label
Color	NFPA Reactivity Rating
Covalent Radius	NSC Number
Critical Pressure	Period
Critical Temperature	Phase
Crystal Structure	Poisson Ratio
Curie Point	Quantum Numbers
Decay Mode	Radioactive
Density	Refractive Index
Discovery Year	Resistivity
DOT Hazard Class	RTECS Classes
DOT Numbers	RTECS Number
Electrical Conductivity	Shear Modulus
Electrical Type	Space Group Name
Electron Affinity	Space Group Number
Electron Configuration	Specific Heat
Electronegativity	Speed of Sound
EU Number	Stable Isotopes
Flash Point	Superconducting Point
Gas Atomic Multiplicities	Symbol
Gmelin Number	Thermal Conductivity
Group	Thermal Expansion
Half Life	Valence
Heat of Combustion	Van Der Waals Radius
Heat of Fusion	Vickers Hardness

H Home
 Li Be Background Color: Black White Gray He
 NaMg B C N O F Ne
 K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
 Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
 Cs Ba La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
 Fr Ra Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr Rf Db Sg Bh Hs Mt Ds Rg Uub Uut Uuq Uup Uuh Uus Uuo


Bulk Modulus of the elements

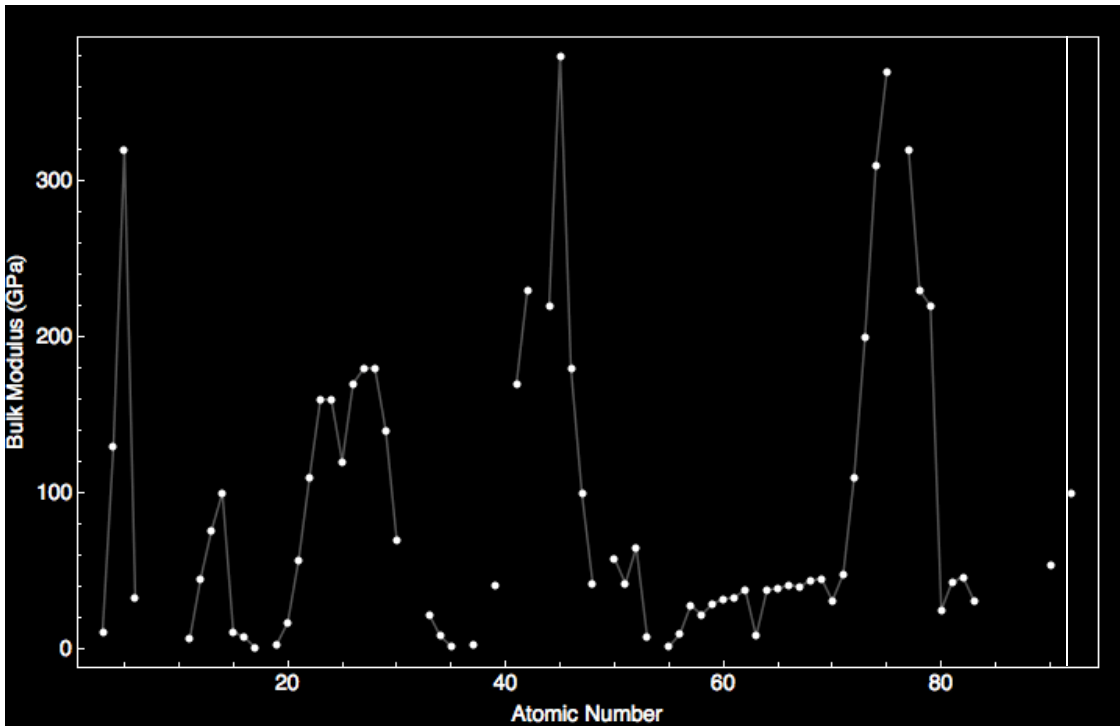
Text lists sorted by: Value | Atomic Number | Alphabetical

Plots: 3D Live | Shaded | Ball | Crossed Line | Scatter | Sorted Scatter

Log scale plots: 3D Live | Shaded | Ball | Crossed Line | Scatter | Sorted Scatter

Good for this property: Scatter

Th 90 90 Thorium
 54.GPa




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- Absolute Boiling Point
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- Abundance in the Universe
- Adiabatic Index
- Allotrope Names
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- Atomic Weight
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- CAS Number
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- Color
- Covalent Radius
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- Crystal Structure
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- Discovery Year
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- DOT Numbers
- Electrical Conductivity
- Electrical Type
- Electron Affinity
- Electron Configuration
- Electronegativity
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- Flash Point
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- Group
- Half Life
- Heat of Combustion
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- Known Isotopes
- Lattice Angles
- Lattice Constants
- Lifetime
- Liquid Density
- Magnetic Type
- Mass Magnetic Susceptibility
- Melting Point
- Memberships
- Mohs Hardness
- Molar Magnetic Susceptibility
- Molar Volume
- Name
- Neel Point
- Neutron Cross Section
- Neutron Mass Absorption
- NFPA Fire Rating
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- NSC Number
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- RTECS Classes
- RTECS Number
- Shear Modulus
- Space Group Name
- Space Group Number
- Specific Heat
- Speed of Sound
- Stable Isotopes
- Superconducting Point
- Symbol
- Thermal Conductivity
- Thermal Expansion
- Valence
- Van Der Waals Radius
- Vickers Hardness

Heat of
Vaporization

Ionization
Energies

Volume
Magnetic
Susceptibility

Young Modulus

H Home Background Color: He
 Li Be Black White Gray B C N O F Ne
 NaMg Al Si P S Cl Ar
 K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
 Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
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 Fr Ra Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr Rf Db Sg Bh Hs Mt Ds Rg Uub Uut Uuq Uup Uuh Uus Uuo


Heat of Fusion of the elements

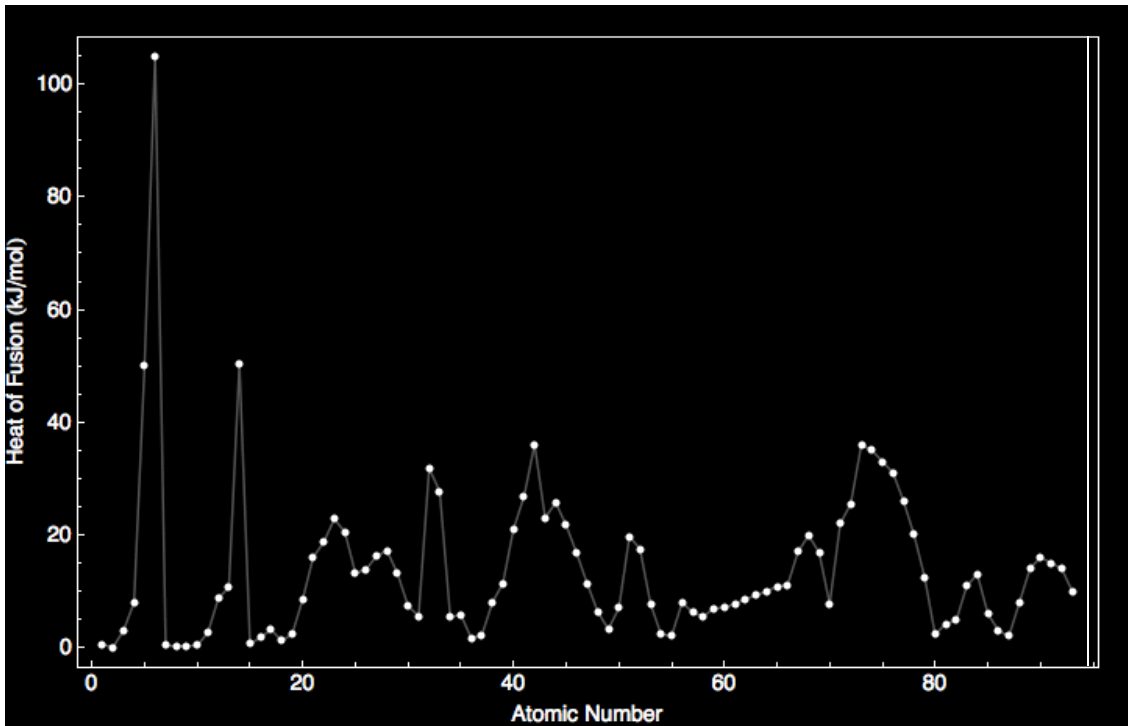
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Log scale plots: [3D Live](#) | [Shaded](#) | [Ball](#) | [Crossed Line](#) | [Scatter](#) | [Sorted Scatter](#)

Good for this property: [Scatter](#)


93 Neptunium
 10.KJ/mol



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Abundance in the Universe	Mass Magnetic Susceptibility
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CAS Number	NFPA Health Rating
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Color	NFPA Reactivity Rating
Covalent Radius	NSC Number
Critical Pressure	Period
Critical Temperature	Phase
Crystal Structure	Poisson Ratio
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Electron Affinity	Space Group Number
Electron Configuration	Specific Heat
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Flash Point	Superconducting Point
Gas Atomic Multiplicities	Symbol
Gmelin Number	Thermal Conductivity
Group	Thermal Expansion
Half Life	Valence
Heat of Combustion	Van Der Waals Radius
Heat of Fusion	Vickers Hardness

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 Fr Ra Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr Rf Db Sg Bh Hs Mt Ds Rg Uub Uut Uuq Uup Uuh Uus Uuo

Heat of Vaporization of the elements

Text lists sorted by: Value | Atomic Number | Alphabetical

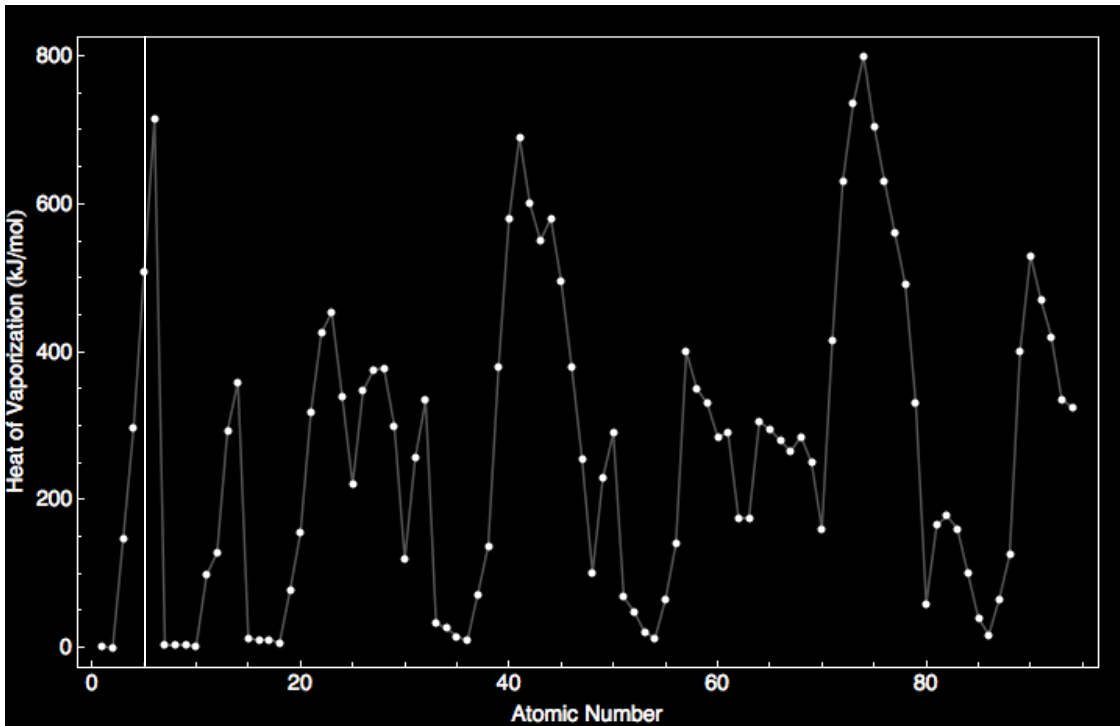
Plots: 3D Live | Shaded | Ball | Crossed Line | Scatter | Sorted Scatter

Log scale plots: 3D Live | Shaded | Ball | Crossed Line | Scatter | Sorted Scatter

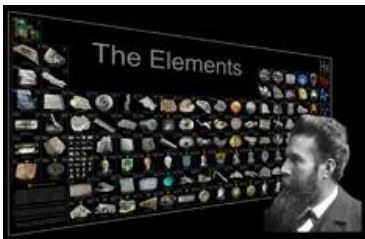
Good for this property: Scatter



5 Boron
507.KJ/mol



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- Allotrope Names
- Alternate Names
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- Atomic Radius
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- Autoignition Point
- Block
- Boiling Point
- Brinell Hardness
- Bulk Modulus
- CAS Number
- CID Number
- Color
- Covalent Radius
- Critical Pressure
- Critical Temperature
- Crystal Structure
- Curie Point
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- DOT Numbers
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- Electron Configuration
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- Speed of Sound
- Stable Isotopes
- Superconducting Point
- Symbol
- Thermal Conductivity
- Thermal Expansion
- Valence
- Van Der Waals Radius
- Vickers Hardness

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[H](#) [Li](#) [Be](#) [Na](#) [Mg](#) [K](#) [Ca](#) [Rb](#) [Sr](#) [Cs](#) [Ba](#) [La](#) [Ce](#) [Pr](#) [Nd](#) [Pm](#) [Sm](#) [Eu](#) [Gd](#) [Tb](#) [Dy](#) [Ho](#) [Er](#) [Tm](#) [Yb](#) [Lu](#) [Hf](#) [Ta](#) [W](#) [Re](#) [Os](#) [Ir](#) [Pt](#) [Au](#) [Hg](#) [Tl](#) [Pb](#) [Bi](#) [Po](#) [At](#) [Rn](#)

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Melting Point of the elements

Text lists sorted by: [Value](#) | [Atomic Number](#) | [Alphabetical](#)

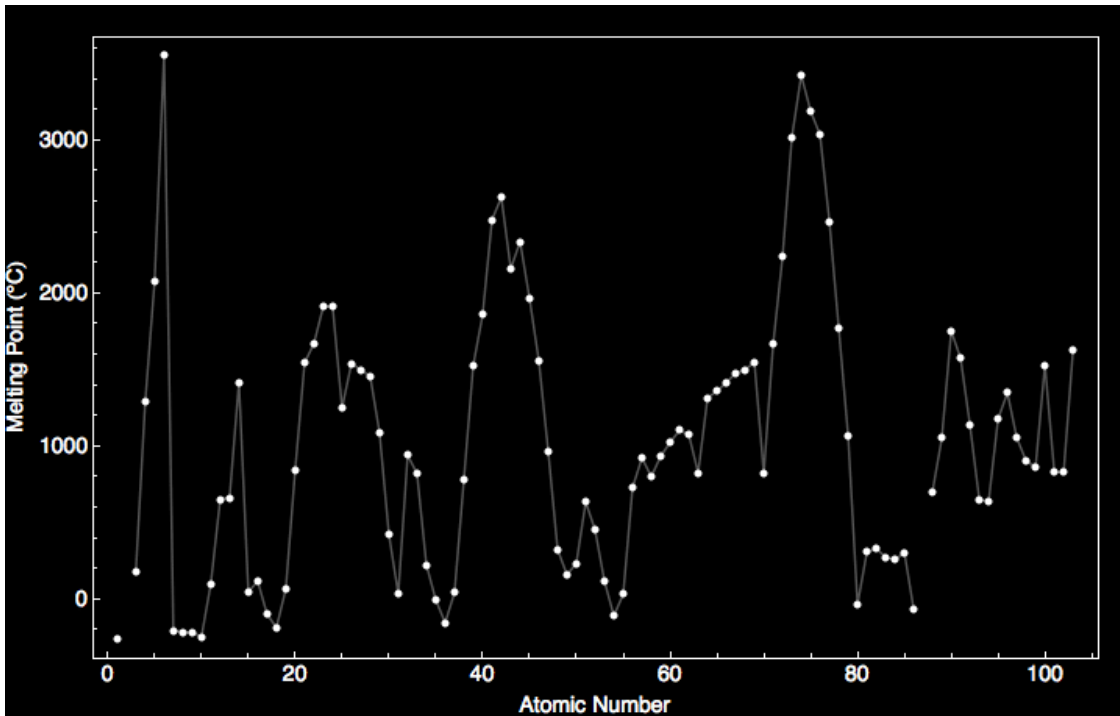
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Log scale plots: [3D Live](#) | [Shaded](#) | [Ball](#) | [Crossed Line](#) | [Scatter](#) | [Sorted Scatter](#)

Good for this property: [Scatter](#)



Point to the graph to see details, or click for full data on that element.



Notes on the Melting Point of particular elements:

Helium: Helium does not solidify at standard pressure.

Carbon: Value given for diamond form.

Phosphorus: Value given for yellow phosphorus form.

Sulfur: Value given for monoclinic, beta form.

Selenium: Value given for hexagonal, gray form.

Berkelium: Value given for alpha form.

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Absolute Boiling Point	Isotope Abundances
Absolute Melting Point	Known Isotopes
Abundance in Earth's Crust	Lattice Angles
Abundance in Humans	Lattice Constants
Abundance in Meteorites	Lifetime
Abundance in the Ocean	Liquid Density
Abundance in the Sun	Magnetic Type
Abundance in the Universe	Mass Magnetic Susceptibility
Adiabatic Index	Melting Point
Allotrope Names	Memberships
Alternate Names	Mohs Hardness
Atomic Number	Molar Magnetic Susceptibility
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Boiling Point	Neutron Mass Absorption
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Color	NFPA Reactivity Rating
Covalent Radius	NSC Number
Critical Pressure	Period
Critical Temperature	Phase
Crystal Structure	Poisson Ratio
Curie Point	Quantum Numbers
Decay Mode	Radioactive
Density	Refractive Index
Discovery Year	Resistivity
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Gas Atomic Multiplicities	Symbol
Gmelin Number	Thermal Conductivity
Group	Thermal Expansion
Half Life	Valence
Heat of Combustion	Van Der Waals Radius
Heat of Fusion	Vickers Hardness

				H 1				He 2										
O	I	II	III	IV	V	VI	VII	O										
He 2	Li 3	Be 4	B 5	C 6	N 7	O 8	F 9	Ne 10										
Ne 10	Na 11	Mg 12	Al 13	Si 14	P 15	S 16	Cl 17	Ar 18										
O	I(a)	II(a)	IIIa	IVa	Va	VIa	VIIa	VIII	Ib	IIb	IIIb	IV(b)	V(b)	VI(b)	VII(b)	O		
Ar 18	K 19	Ca 20	Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30	Ga 31	Ge 32	As 33	Se 34	Br 35	Kr 36
Kr 36	Rb 37	Sr 38	Y 39	Zr 40	Nb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48	In 49	Sn 50	Sb 51	Te 52	I 53	Xe 54
Xe 54	Cs 55	Ba 56	La 57	* Hf 72	Ta 73	W 74	Re 75	Os 76	Ir 77	Pt 78	Au 79	Hg 80	Tl 81	Pb 82	Bi 83	Po 84	At 85	Rn 86
Rn 86	Fr 87	Ra 88	Ac 89	* Th 90	Pa 91	U 92												

* Rare-earth metals

** Uranium metals

Ce 58	Pr 59	Nd 60	Pm 61	Sm 62	Eu 63	Gd 64	Tb 65	Dy 66	Ho 67	Er 68	Tm 69	Yb 70	Lu 71
Th 90	Pa 91	U 92	Np 93	Pu 94	Am 95	Cm 96	Bk 97	Cf 98	E 99	Fm 100	Mv 101	No 102	Lw 103

FIG. 2-15.—The periodic system of the elements.

Pauling "The Chemical Bond"

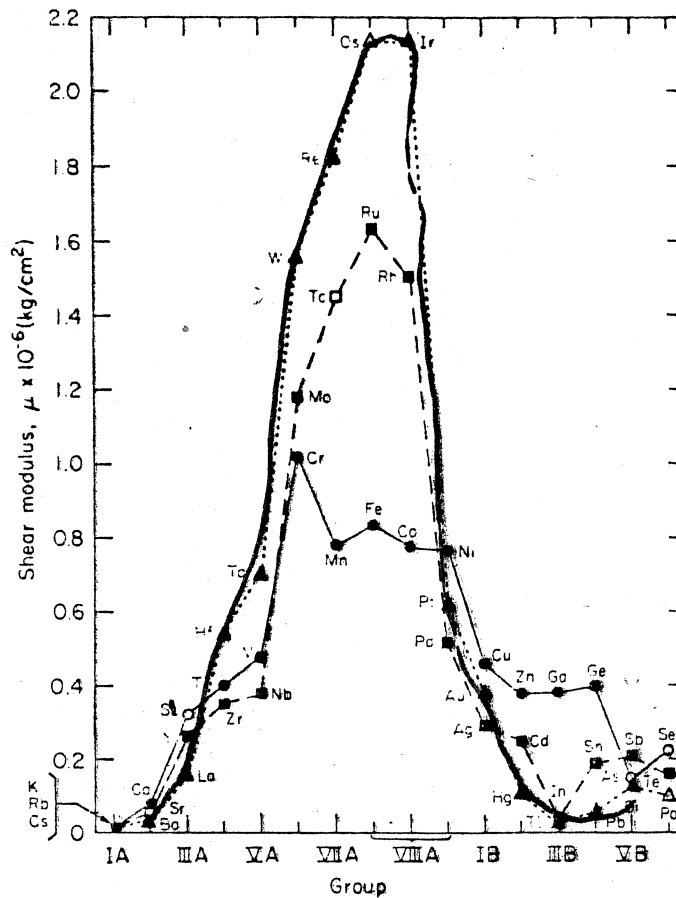
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2-9. THE FORMAL

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SHEAR
MODULUS

FIG. 3. Shear modulus of the elements of the fourth, fifth, and sixth periods of the Periodic Table. Open points are estimated values.

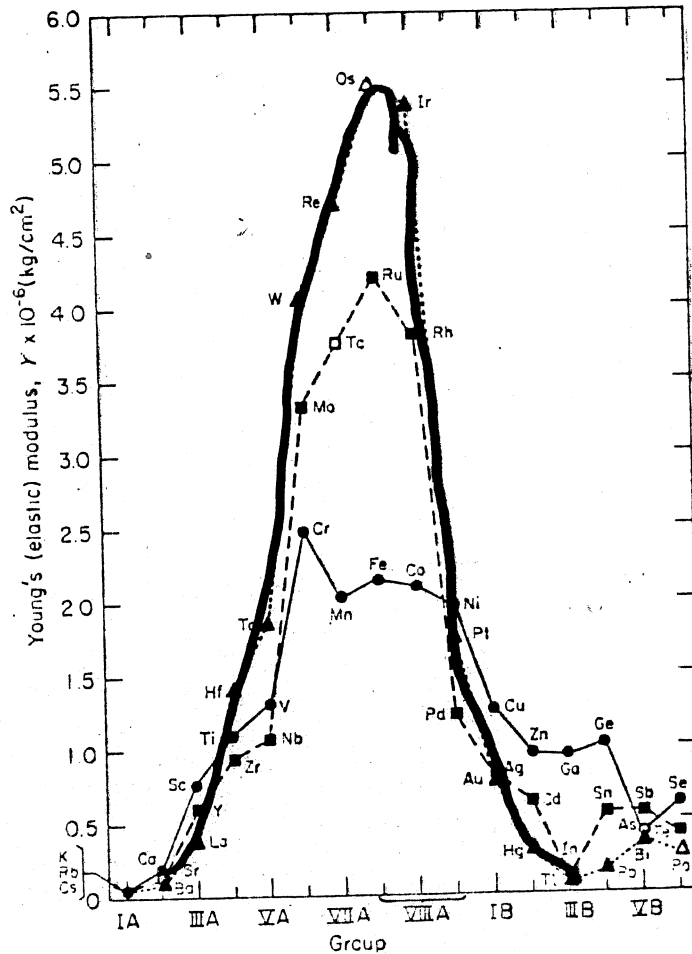
series and barium and ytterbium are, respectively, the first and last members of this series.¹³

5. POISSON'S RATIO

The values of Poisson's ratio are listed in Table III, and are shown in Fig. 4 for all the elements. Köster and Franz¹² recently reviewed this subject quite thoroughly.

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4. Metals—
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mith, M.
t. Energy,
Reading,
M.M. 1957

- Geneva, 1955 Vol. 9, p. 14. Columbia Univ. Press, New York, 1961.
41. H. H. Chiswick, *Prog. Nucl. Energy, Ser. V* Vol. 3, p. 23. Pergamon Press, New York, 1961.
42. H. A. C. McKay, J. S. Nairn, and M. B. Waldron, *Proc. 2nd Intern. Conf. Peaceful Uses At. Energy, Geneva, 1957* Vol. 28, p. 299. Columbia Univ. Press, New York, 1958.
43. W. N. Miner, A. S. Coffinberry, F. W. Schonfeld, J. T. Waber, R. N. R. Mulford, and R. E. Tate, in "Rare Metals Handbook" (C. A. Hampel, ed.), 2nd ed., p. 336. Reinhold, New York, 1961.



YOUNG'S
MODULUS

FIG. 1. Young's modulus of the elements of the fourth, fifth, and sixth periods of the Periodic Table. Open points are estimated values.

in many of their physical properties and in their alloying behaviors. Although the values for the elements in the second and third periods are not shown in Fig. 1, Young's modulus increases as one proceeds from lithium to beryllium to boron (or sodium to magnesium to aluminum) and

$$C_{1111} = 15.0(0 + 1) - 10.0 \frac{12r_0^4}{12r_0^4}$$

(2.48)

modulus
change

(2.49)

(2.50)

tribution

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known as
er $\partial^2\Phi_{mn}/$
have the

with $\delta = r_0/\rho$. Table 2.3 shows that values calculated on t very well with experimental measurements.

Equations (2.51) indicate that the shear stiffness dep parameter e^2/r_0^4 . Therefore, a plot of the logarithm of logarithm of r_0 should yield a linear correlation with slop 2.12 shows that this is indeed the case. All the data ch-

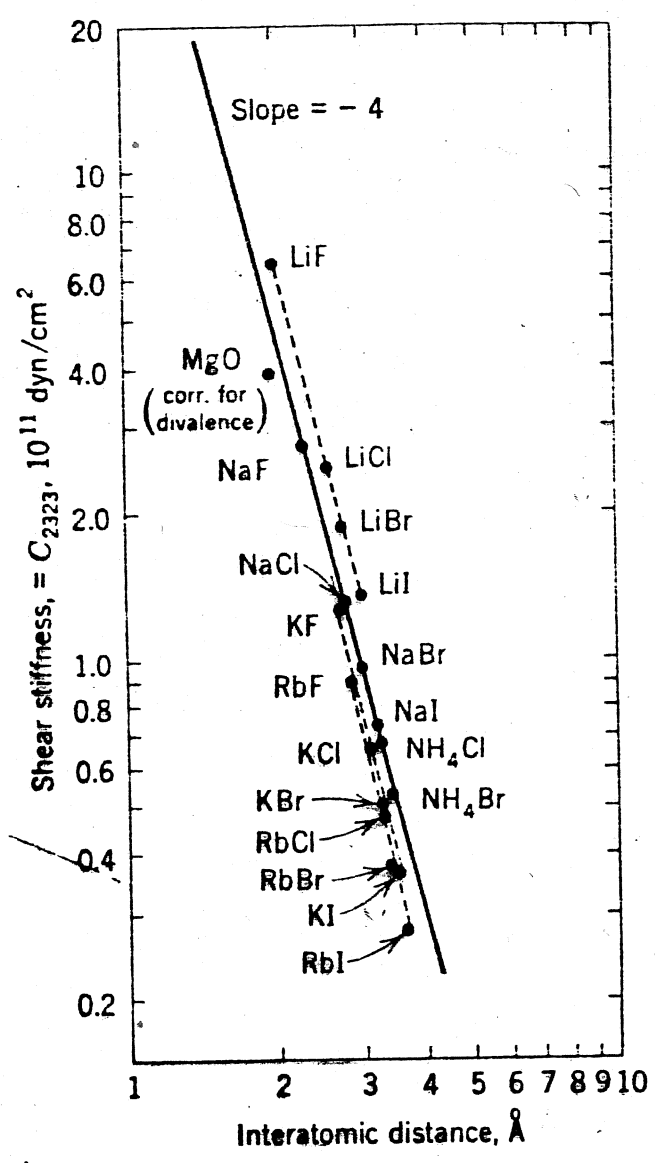


Fig. 2.12 Dependence of the shear stiffnesses of ionic crystals on interionic distances.

by the fourth power of the interatomic spacing.

ln U_i vs. ln BΩ

U_i and BΩ are in ergs/atom

