

ELEMENTS OF GROUP 13

Group-13 **B** (Boron) Period-2

Latin Name: Borum **Year Of Discovery:** 1808 **Discoverer:** Louis-Josef Gay-Lussac and Louis-Jacques Thenard (Paris, France) and Humphry Davy (London, UK)

Physical Properties

Atomic Number	5	Molar Mass (g mol⁻¹)	10.81
Electronic Configuration	1s ² 2s ² 2p ¹ or [He]2s ² 2p ¹		
Density (g cm⁻³) at 20°C	3.30	Oxidation States	+3
Atomic Radius (pm)	Empirical: 90	Element Category	Metalloid
Covalent Radius (pm)	84 ± 3	Van der Waals Radius (pm)	192
Ionic Radius (trivalent ion) (pm)	20	Ionisation Energy (kJ/mol)	800.6 (1 st), 2427.1 (2 nd), 3659 (3 rd)
Molar Volume (cm³ mol⁻¹)	23.68	Electronegativity	2.04 (Pauling scale)
Melting Point (°C)	2030	Boiling Point (°C)	2550
Phase at STP	Solid	CAS Number	7440-42-8
Electrical Resistivity (nΩm) (293.15 K)	10 ⁶	Magnetic Susceptibility (cm³ mol⁻¹) (298 K)	-6.7.0×10 ⁻⁶
Magnetic Ordering	Diamagnetic	Thermal Conductivity (Wm⁻¹K⁻¹)	27.4
Heat Of Fusion (kJ mol⁻¹)	50.2	Heat Of Vapourization (kJ mol⁻¹)	508
Molar Heat Capacity (J mol⁻¹K⁻¹)	11.087	Vapour Pressure (at 4072 K)	100 kPa
Crystal Structure	Rhombohedral	Heat Of Sublimation (kJ mol⁻¹)	564.8

Chemical Properties

B reacts with air when heated at 700°C but does not react with water. B forms stable B₂O₃. B is oxidised by HNO₃ and H₂SO₄ to boric acid H₃BO₃. With NaOH forms Na₃BO₃. With metals like Mg it forms boride like Mg₃B₂. With non-metals like N₂ and Cl₂ forms nitride BN and halide BCl₃.

Nuclear Properties	Not radioactive
Isotopes	¹⁰ B ((≈20% abundance), ¹¹ B (≈80% abundance).
Ores	Borax (Na ₂ B ₄ O ₇ ·10H ₂ O), Colemanite (Ca ₂ B ₆ O ₁₁ ·5H ₂ O), Panderinite (Ca ₂ B ₆ O ₁₁ ·3H ₂ O), Boracite (2Mg ₃ B ₈ O ₁₅ ·MgCl ₂).
Uses	B is used in the form of salt like calcium boride as deoxidiser.
Compounds	Na ₂ B ₄ O ₇ ·10H ₂ O, B ₃ N ₃ H ₆ , B ₂ H ₆ , H ₃ BO ₃ .

Al (Aluminium)

Group-13 Period-3

Latin Name: Aluminium

Year Of Discovery: 1825

Discoverer: Hans Christian Orsted

Physical Properties

Atomic Number	13	Molar Mass (g mol ⁻¹)	26.98
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ¹ or [Ne]3s ² 3p ¹		
Density (g cm ⁻³)	2.70	Oxidation States	+3
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	577.5 (1 st), 1816.7 (2 nd), 2744.8 (3 rd)
Molar Volume (cm ³ mol ⁻¹)	10	Electronegativity	1.6 (Pauling Scale)
Melting Point (°C)	659	Boiling Point (°C)	2450
Phase at STP	Solid	CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)	10.71	Heat Of Vapourization (kJ mol ⁻¹)	284
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)	24.20	Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

Ga (Gallium)

Group-13

Period-4

Latin Name: Gallium Year Of Discovery: 1875 Discoverer: Paul-Emile Lecoq de Boisbaudran

Physical Properties

Atomic Number	31	Molar Mass (g mol ⁻¹)	60.72
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ¹ or [Ar]3d ¹⁰ 4s ² 4p ¹		
Density (g cm ⁻³)	5.91	Oxidation States	3
Atomic Radius (pm)	Empirical: 135	Element Category	
Covalent Radius (pm)	122 ± 3	Van der Waals Radius (pm)	187
Ionic Radius (pm)	53 (Ge ⁴⁺) 73 (Ge ²⁺)	Ionisation Energy (kJ/mol)	578.8 (1 st), 1979.3 (2 nd), 2963 (3 rd)
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	1.81 (Pauling Scale)
Melting Point (°C)	29.8	Boiling Point (°C)	2237
Phase at STP	Solid (Silvery blue)	CAS Number	7440-55-3
Electrical Resistivity (nΩm) (293.15 K)	270	Magnetic Susceptibility (cm ³ mol ⁻¹) (290 K)	-21.6×10 ⁻⁶
Magnetic Ordering	Diamagnetic	Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)	5.59	Heat Of Vapourization (kJ mol ⁻¹)	256
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)	25.86	Vapour Pressure	
Crystal Structure	orthorhombic	Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties	
Isotopes	⁶⁶ Ga, ⁶⁷ Ga, ⁶⁸ Ga, ⁶⁹ Ga, ⁷⁰ Ga, ⁷¹ Ga, ⁷² Ga, ⁷³ Ga
Ores	
Uses	
Compounds	

In (Indium)

Group-13 Period-5

Latin Name: Indium

Year Of Discovery: 1863

Discoverer: Ferdinand Reich

Physical Properties

Atomic Number	49	Molar Mass (g mol ⁻¹)	114.82
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ¹ or [Kr]4d ¹⁰ 5s ² 5p ¹		
Density (g cm ⁻³)	7.31	Oxidation States	+3, +1
Atomic Radius (pm)	Empirical: 167	Element Category	Post transition metal
Covalent Radius (pm)	142 ± 5	Van der Waals Radius (pm)	193
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	558.3 (1 st), 1820.7 (2 nd), 2704 (3 rd)
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	1.78 (Pauling Scale)
Melting Point (°C)	156.4	Boiling Point (°C)	2000
Phase at STP	Solid (silvery gray)	CAS Number	7440-74-6
Electrical Resistivity (nΩm) (293.15 K)	83.7	Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	-64×10 ⁻⁶
Magnetic Ordering	Diamagnetic	Thermal Conductivity (Wm ⁻¹ K ⁻¹)	81.8
Heat Of Fusion (kJ mol ⁻¹)	3.281	Heat Of Vapourization (kJ mol ⁻¹)	231.8
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)	26.74	Vapour Pressure	
Crystal Structure	tetragonal	Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

¹¹³In, ¹¹⁵In,

Ores

Uses

Compounds

Tl (Thallium)

Group-13

Period-6

Latin Name: Thallium

Year Of Discovery: 1861

Discoverer: William Crookes

Physical Properties

Atomic Number	81	Molar Mass (g mol ⁻¹)	204.37
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹ or [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹		
Density (g cm ⁻³)	11.85	Oxidation States	
Atomic Radius (pm)	Empirical: 170	Element Category	Post transition metal
Covalent Radius (pm)	145 ± 7	Van der Waals Radius (pm)	196
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	589.4 (1 st), 1971 (2 nd), 2878(3 rd)
Molar Volume (cm ³ mol ⁻¹)	17.2	Electronegativity	1.8 (Pauling Scale)
Melting Point (°C)	303	Boiling Point (°C)	1457
Phase at STP	Solid (silvery white)	CAS Number	7440-28-0
Electrical Resistivity (nΩm) (293.15 K)	0.18	Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	-50.9×10 ⁻⁶
Magnetic Ordering	Diamagnetic	Thermal Conductivity (Wm ⁻¹ K ⁻¹)	46.1
Heat Of Fusion (kJ mol ⁻¹)	4.14	Heat Of Vapourization (kJ mol ⁻¹)	231.8
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)	26.32	Vapour Pressure (At 1758 K)	100 kPa
Crystal Structure	hcp	Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

²⁰³Tl, ²⁰⁴Tl, ²⁰⁵Tl,

Ores

Uses

Compounds

Nh (Nihonium)

Group-13

Period-7

Latin Name: Nihonium

Year Of Discovery: 2003

Discoverer: Kosuke Morita

Physical Properties

Atomic Number	113	Molar Mass (g mol ⁻¹)	226
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 5f ¹⁴ 6d ¹⁰ 7s ² 7p ¹ or [Xe]5f ¹⁴ 6d ¹⁰ 7s ² 7p ¹		
Density (g cm ⁻³)	16	Oxidation States	+3
Atomic Radius (pm)	Empirical: 170	Element Category	Post transition metal
Covalent Radius (pm)	178	Van der Waals Radius (pm)	-
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	704.9 (1 st), 2240 (2 nd), 3020 (3 rd)
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	1.78 (Pauling Scale)
Melting Point (°C)	430	Boiling Point (°C)	1130
Phase at STP	Solid	CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)	7.61	Heat Of Vapourization (kJ mol ⁻¹)	130
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

²⁹⁰Nh, ²⁸⁷Nh, ²⁸⁶Nh, ²⁸⁵Nh, ²⁸⁴Nh, ²⁸³Nh, ²⁸²Nh, ²⁷⁸Nh

Ores

Uses

Compounds

ELEMENTS OF GROUP 14

Group-14 **C** (Carbon) Period-2

Latin Name: Carboneum (Carbonium) **Year Of Discovery:** 3750 BCE **Discoverer:** Egyptians and Sumerians

Physical Properties

Atomic Number	6	Molar Mass (g mol⁻¹)	12.0107
Electronic Configuration	1s ² 2s ² 2p ² or [He]2s ² 2p ²		
Density (g cm⁻³)	Graphite:2.267 Diamond: 3.515	Oxidation States	+4 (mostly), +2
Atomic Radius (pm)		Element Category	-
Covalent Radius (pm)	77	Van der Waals Radius (pm)	170
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	1086.5 (1 st), 2352.6 (2 nd)
Molar Volume (cm³ mol⁻¹)		Electronegativity	2.55 (Pauling Scale)
Melting Point (°C)		Boiling Point (°C)	1457
Phase at STP	Solid	CAS Number	7440-44-0
Electrical Resistivity (nΩm) (293.15 K)	7.837 (Graphite)	Magnetic Susceptibility (cm³ mol⁻¹) (298 K)	-5.9×10 ⁻⁶
Magnetic Ordering	Diamagnetic	Thermal Conductivity (Wm⁻¹K⁻¹)	119-165 (Graphite) 900-2300 (Diamond)
Heat Of Fusion (kJ mol⁻¹)	177 (Graphite)	Heat Of Vapourization (kJ mol⁻¹)	
Molar Heat Capacity (J mol⁻¹K⁻¹)	8.517 (Graphite) 6.155 (Diamond)	Vapour Pressure	
Crystal Structure	Graphite: hexagonal Diamond: fcc	Heat Of Sublimation (kJ mol⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

¹¹C, ¹²C, ¹³C, ¹⁴C,

Ores

Uses

Compounds

Si (Silicon)

Group-14 Period-3

Latin Name: Silicium **Year Of Discovery:** 1824 **Discoverer:** Jons Jacob Berzelius

Physical Properties

Atomic Number	14	Molar Mass (g mol⁻¹)	28.0855
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ² or [Ne]3s ² 3p ²		
Density (g cm⁻³)	2.329	Oxidation States	+4 (mostly), +2
Atomic Radius (pm)	Empirical:111	Element Category	Metalloid
Covalent Radius (pm)	111	Van der Waals Radius (pm)	210
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	786.5 (1 st), 1577.1 (2 nd), 3231.6 (3 rd)
Molar Volume (cm³ mol⁻¹)		Electronegativity	1.90 (Pauling Scale)
Melting Point (°C)	1414	Boiling Point (°C)	3265
Phase at STP		CAS Number	7440-21-3
Electrical Resistivity (nΩm) (293.15 K)	2300	Magnetic Susceptibility (cm³ mol⁻¹) (298 K)	-3.9×10 ⁻⁶
Magnetic Ordering	Diamagnetic	Thermal Conductivity (Wm⁻¹K⁻¹)	149
Heat Of Fusion (kJ mol⁻¹)	50.21	Heat Of Vapourization (kJ mol⁻¹)	383
Molar Heat Capacity (J mol⁻¹K⁻¹)	19.789	Vapour Pressure	100 kPa At 3537 K
Crystal Structure	fcc	Heat Of Sublimation (kJ mol⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

²⁸Si, ²⁹Si, ³⁰Si, ³¹Si, ³²Si

Ores

Uses

Compounds

Ge (Germanium)

Group-14

Period-4

Latin Name: Germanium Year Of Discovery: 1875 Discoverer: Clemens Winkler

Physical Properties

Atomic Number	32	Molar Mass (g mol ⁻¹)	72.59
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ² or [Ar]3d ¹⁰ 4s ² 4p ²		
Density (g cm ⁻³)	5.323	Oxidation States	+4, +2
Atomic Radius (pm)	Empirical: 122	Element Category	Metalloid
Covalent Radius (pm)	122	Van der Waals Radius (pm)	211
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	762 (1 st), 1537.5 (2 nd), 3302.1 (3 rd)
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	2.01(Pauling Scale)
Melting Point (°C)	938.25	Boiling Point (°C)	2833
Phase at STP		CAS Number	7440-56-4
Electrical Resistivity (nΩm) (293.15 K)	1	Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	-76.84×10 ⁻⁶
Magnetic Ordering	Diamagnetic	Thermal Conductivity (Wm ⁻¹ K ⁻¹)	60.2
Heat Of Fusion (kJ mol ⁻¹)	36.94	Heat Of Vapourization (kJ mol ⁻¹)	334
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)	23.222	Vapour Pressure	100 kPa At 3537 K
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

⁶⁸Ge, ⁷⁰Ge, ⁷¹Ge, ⁷²Ge, ⁷³Ge, ⁷⁴Ge, ⁷⁶Ge,

Ores

Uses

Compounds

Sn (Tin)

Group-14 Period-5

Latin Name: Stannum **Year Of Discovery: 3500 BC** **Discoverer: -**

Physical Properties

Atomic Number	50	Molar Mass (g mol⁻¹)	118.89
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ² or [Kr]4d ¹⁰ 5s ² 5p ²		
Density (g cm⁻³)	White: 7.265 Gray: 5.769	Oxidation States	+4, +2
Atomic Radius (pm)	Empirical: 140	Element Category	Post transition metal
Covalent Radius (pm)	139 ± 4	Van der Waals Radius (pm)	217
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	708.6 (1 st), 1411.8 (2 nd), 2943 (3 rd)
Molar Volume (cm³ mol⁻¹)		Electronegativity	1.96(Pauling Scale)
Melting Point (°C)	231.93	Boiling Point (°C)	2602
Phase at STP	Solid: white(β) Gray(α)	CAS Number	7440-31-5
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm³ mol⁻¹) (298 K)	-3.1×10 ⁻⁶ (white)
Magnetic Ordering	White: paramagnetic Gray: Diamagnetic	Thermal Conductivity (Wm⁻¹K⁻¹)	66.8
Heat Of Fusion (kJ mol⁻¹)	7.03 (white)	Heat Of Vapourization (kJ mol⁻¹)	296.1 (white)
Molar Heat Capacity (J mol⁻¹K⁻¹)	27.112 (white)	Vapour Pressure	100 kPa At 2893 K
Crystal Structure		Heat Of Sublimation (kJ mol⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

¹¹²Sn, ¹¹⁴Sn, ¹¹⁵Sn, ¹¹⁶Sn, ¹¹⁷Sn, ¹¹⁸Sn, ¹¹⁹Sn, ¹²⁰Sn, ¹²²Sn, ¹²⁴Sn, ¹²⁶Sn,

Ores

Uses

Compounds

Pb (Lead)

Group-14 Period-6

Latin Name: Plumbum

Year Of Discovery: 4000 BC

Discoverer: -

Physical Properties

Atomic Number	82	Molar Mass (g mol⁻¹)	207.19
Electronic Configuration	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^6 4f^{14} 5d^{10} 6s^2 6p^2$ or [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ²		
Density (g cm⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm³ mol⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm³ mol⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm⁻¹K⁻¹)	
Heat Of Fusion (kJ mol⁻¹)		Heat Of Vapourization (kJ mol⁻¹)	
Molar Heat Capacity (J mol⁻¹K⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol⁻¹)	

Chemical Properties

Nuclear Properties	
Isotopes	
Ores	
Uses	
Compounds	

Group-14

Fl (Flerovium)

Period-7

Latin Name: Flerovium

Year Of Discovery: 1998

Discoverer: -

Physical Properties

Atomic Number	114	Molar Mass (g mol ⁻¹)	289
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 5f ¹⁴ 6d ¹⁰ 7s ² 7p ² or [Xe]5f ¹⁴ 6d ¹⁰ 7s ² 7p ²		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

ELEMENTS OF GROUP 15

N (Nitrogen)

Group-15 Period-2

Latin Name: Nitrogenium

Year Of Discovery: 1772

Discoverer: Daniel Rutherford

Physical Properties

Atomic Number	7	Molar Mass (g mol ⁻¹)	14.0007
Electronic Configuration	1s ² 2s ² 2p ³ or [He]2s ² 2p ³		
Density (g cm ⁻³) at 20°C		Oxidation States	+5, +3
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)	71	Van der Waals Radius (pm)	155
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	1402.3 (1 st), 2856 (2 nd), 4578 (3 rd)
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	3.04 (Pauling Scale)
Melting Point (°C)	-210	Boiling Point (°C)	-195.795
Phase at STP	Gas	CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering	Diamagnetic	Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)	0.72 N ₂	Heat Of Vapourization (kJ mol ⁻¹)	5.56
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)	29.124	Vapour Pressure	
Crystal Structure	hexagonal	Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

P (Phosphorus)

Group-15

Period-3

Latin Name: Phosphorus

Year Of Discovery: 1669

Discoverer: Hennig Brand

Physical Properties

Atomic Number	15	Molar Mass (g mol ⁻¹)	30.973762
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ³ or [Ne]3s ² 3p ³		
Density (g cm ⁻³)	1.823 (white), 2.3 (red), 2.36 (violet)	Oxidation States	+5, +3
Atomic Radius (pm)		Element Category	Polyatomic nonmetal
Covalent Radius (pm)	107 ± 3	Van der Waals Radius (pm)	180
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	1011.8 (1 st), 1907 (2 nd), 2914.1 (3 rd)
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	1.96(Pauling Scale)
Melting Point (°C)	317	Boiling Point (°C)	554
Phase at STP	Solid	CAS Number	7723-14-0 (red) 12185-10-3 (white)
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (293 K)	-20.8×10 ⁻⁶ (white)
Magnetic Ordering	White, red, violet, black: Diamagnetic	Thermal Conductivity (Wm ⁻¹ K ⁻¹)	0.236 (white)
Heat Of Fusion (kJ mol ⁻¹)	0.66 (white)	Heat Of Vapourization (kJ mol ⁻¹)	51.9 (white)
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)	23.824 (white)	Vapour Pressure	100 kPa At 549 K (for white) And 704 K (for red)
Crystal Structure	bcc	Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

³¹P, ³²P, ³³P

Ores

Uses

Compounds

As(Arsenic)

Group-15 Period-4

Latin Name: Arsenicum **Year Of Discovery:** 1250 **Discoverer:** -

Physical Properties

Atomic Number	33	Molar Mass (g mol⁻¹)	74.922
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ³ or [Ar]3d ¹⁰ 4s ² 4p ³		
Density (g cm⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm³ mol⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm³ mol⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm⁻¹K⁻¹)	
Heat Of Fusion (kJ mol⁻¹)		Heat Of Vapourization (kJ mol⁻¹)	
Molar Heat Capacity (J mol⁻¹K⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol⁻¹)	

Chemical Properties

Nuclear Properties	
Isotopes	
Ores	
Uses	
Compounds	

Sb (Antimony)

Group-15

Period-5

Latin Name: **Stibium**

Year Of Discovery: **3000 BC**

Discoverer: -

Physical Properties

Atomic Number	51	Molar Mass (g mol ⁻¹)	121.750
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ³ or [Kr]4d ¹⁰ 5s ² 5p ³		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

Bi (Bismuth)

Group-15

Period-6

Latin Name: Bisemutum (Bismutum)

Year Of Discovery: 1400

Discoverer: -

Physical Properties

Atomic Number	83	Molar Mass (g mol ⁻¹)	208.980
Electronic Configuration	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^6 4f^{14} 5d^{10} 6s^2 6p^3$ or [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ³		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties	
Isotopes	
Ores	
Uses	
Compounds	

Mc (Moscovium)

Group-15

Period-7

Latin Name: **Moscovium**

Year Of Discovery: **2004**

Discoverer: -

Physical Properties

Atomic Number	115	Molar Mass (g mol ⁻¹)	288
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 5f ¹⁴ 6d ¹⁰ 7s ² 7p ³ or [Xe]5f ¹⁴ 6d ¹⁰ 7s ² 7p ³		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

ELEMENTS OF GROUP 16

Group-16 **O** (Oxygen) Period-2

Latin Name: **Oxygenium**

Year Of Discovery: **1774**

Discoverer: **Carl Wilhelm Scheele**

Physical Properties

Atomic Number	8	Molar Mass (g mol ⁻¹)	15.999
Electronic Configuration	1s ² 2s ² 2p ⁴ or [He]2s ² 2p ⁴		
Density (g cm ⁻³)	1.429	Oxidation States	+2, +1, -1, -2
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	1313.9 (1 st), 3388.3 (2 nd), 5300.5 (3 rd)
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	3.44 (Pauling Scale)
Melting Point (°C)	-218.79	Boiling Point (°C)	-182.962
Phase at STP	Gas	CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)	0.444 O ₂	Heat Of Vapourization (kJ mol ⁻¹)	6.82
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)	29.378	Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties	
Isotopes	¹⁶ O (99.76%), ¹⁷ O(0.04%), ¹⁸ O(0.20%)
Ores	
Uses	
Compounds	

S (Sulphur)

Group-16

Period-3

Latin Name: Sulfur

Year Of Discovery: 500BC

Discoverer: -

Physical Properties

Atomic Number	16	Molar Mass (g mol ⁻¹)	32.064
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁴ or [Ne]3s ² 3p ⁴		
Density (g cm ⁻³) at 20°C	2.07	Oxidation States	+6, +4, +3, +2, -1-2
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)	105±3	Van der Waals Radius (pm)	180
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	999.6 (1 st), 2252 (2 nd), 3357 (3 rd)
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	2.58 (Pauling Scale)
Melting Point (°C)	115.21	Boiling Point (°C)	444.6
Phase at STP	Solid	CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)	1.727	Heat Of Vapourization (kJ mol ⁻¹)	45
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)	22.75	Vapour Pressure	
Crystal Structure	orthorhombic	Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

Se (Selenium)

Group-16

Period-4

Latin Name: Selenium Year Of Discovery: 1817 Discoverer: -

Physical Properties

Atomic Number	34	Molar Mass (g mol ⁻¹)	78.96
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁴ or [Ar]3d ¹⁰ 4s ² 4p ⁴		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

Te(Tellurium)

Group-16

Period-5

Latin Name: Tellurium

Year Of Discovery: 1783

Discoverer: -

Physical Properties

Atomic Number	52	Molar Mass (g mol ⁻¹)	127.60
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁴ or [Kr]4d ¹⁰ 5s ² 5p ⁴		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

PO (Polonium)

Group-16

Period-6

Latin Name: Polonium

Year Of Discovery: 1898

Discoverer: -

Physical Properties

Atomic Number	84	Molar Mass (g mol ⁻¹)	208.9824
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴ or [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties	
Isotopes	
Ores	
Uses	
Compounds	

Group-16

LV (Livermorium)

Period-7

Latin Name: Livermorium

Year Of Discovery: 2000

Discoverer: -

Physical Properties

Atomic Number	116	Molar Mass (g mol ⁻¹)	292
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁴ or [Xe]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁴		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

ELEMENTS OF GROUP 17

Group-17 **F (Fluorine)** Period-2

Latin Name: **Fluorum**

Year Of Discovery: **1886**

Discoverer: **Andre-Marie Ampere**

Physical Properties

Atomic Number	9	Molar Mass (g mol ⁻¹)	18.9984032
Electronic Configuration	1s ² 2s ² 2p ⁵ or [He]2s ² 2p ⁵		
Density (g cm ⁻³)	1.696	Oxidation States	-1
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)	64	Van der Waals Radius (pm)	135
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	1681 (1 st), 3374 (2 nd), 6147 (3 rd)
Melting Point (°C)	-219.67	Boiling Point (°C)	3.98 (Pauling Scale)
Phase at STP	Gas	CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	6.51
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure	cubic	Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

Cl (Chlorine)

Group-17

Period-3

Latin Name: Chlorum

Year Of Discovery: 1774

Discoverer: -Carl Wilhelm Scheele

Physical Properties

Atomic Number	17	Molar Mass (g mol ⁻¹)	35.453
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁵ or [Ne]3s ² 3p ⁵		
Density (g cm ⁻³)	3.2	Oxidation States	+7, -1
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)	102±4	Van der Waals Radius (pm)	175
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	1251.2 (1 st), 2298 (2 nd), 3822 (3 rd)
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	3.16 (Pauling Scale)
Melting Point (°C)	-101.5	Boiling Point (°C)	-34.04
Phase at STP	Gas	CAS Number	7782-50-5
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

³⁵Cl (76%), ³⁶Cl(trace), ³⁷Cl (24%)

Ores

Uses

Compounds

Br (Bromine)

Group-17

Period-4

Latin Name: **Bromum** Year Of Discovery: **1826** Discoverer: -

Physical Properties

Atomic Number	35	Molar Mass (g mol ⁻¹)	79.904
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁵ or [Ar]3d ¹⁰ 4s ² 4p ⁵		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

I (Iodine)

Group-17 Period-5

Latin Name: Iodum

Year Of Discovery: 1811

Discoverer: -

Physical Properties

Atomic Number	53	Molar Mass (g mol⁻¹)	126.90447
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁵ or [Kr]4d ¹⁰ 5s ² 5p ⁵		
Density (g cm⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm³ mol⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm³ mol⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm⁻¹K⁻¹)	
Heat Of Fusion (kJ mol⁻¹)		Heat Of Vapourization (kJ mol⁻¹)	
Molar Heat Capacity (J mol⁻¹K⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol⁻¹)	

Chemical Properties

Nuclear Properties	
Isotopes	
Ores	
Uses	
Compounds	

At (Astatine)

Group-17 Period-6

Latin Name: Astatium

Year Of Discovery: 1940

Discoverer: -

Physical Properties

Atomic Number	85	Molar Mass (g mol ⁻¹)	209.9871
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵ or [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties	
Isotopes	
Ores	
Uses	
Compounds	

Group-17

Ts (Tennessine)

Period-7

Latin Name: Tennessine

Year Of Discovery: 2010

Discoverer: -

Physical Properties

Atomic Number	117	Molar Mass (g mol ⁻¹)	294
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁵ or [Xe]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁵		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

ELEMENTS OF GROUP 18

Group-18

He(Helium)

Period-1

Latin Name: Helium

Year Of Discovery: 1895

Discoverer: -

Physical Properties

Atomic Number	2	Molar Mass (g mol ⁻¹)	4.002602
Electronic Configuration	1s ²		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

Group-18

Ne(Neon)

Period-2

Latin Name: Neon

Year Of Discovery: 1898

Discoverer: -

Physical Properties

Atomic Number	10	Molar Mass (g mol ⁻¹)	20.1797
Electronic Configuration	1s ² 2s ² 2p ⁶		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

Chemical Properties

Nuclear Properties

Isotopes

Ores

Uses

Compounds

Ar (Argon)

Group-18 Period-3

Latin Name: Argon

Year Of Discovery: 1894

Discoverer: -

Physical Properties

Atomic Number	18	Molar Mass (g mol ⁻¹)	39.948
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

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Group-18

Kr (Krypton)

Period-4

Latin Name: Krypton Year Of Discovery: 1898 Discoverer: -

Physical Properties

Atomic Number	36	Molar Mass (g mol ⁻¹)	83.798
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

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Xe (Xenon)

Group-18 Period-5

Latin Name: Xenon

Year Of Discovery: 1898

Discoverer: -

Physical Properties

Atomic Number	54	Molar Mass (g mol⁻¹)	131.293
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶		
Density (g cm⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm³ mol⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm³ mol⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm⁻¹K⁻¹)	
Heat Of Fusion (kJ mol⁻¹)		Heat Of Vapourization (kJ mol⁻¹)	
Molar Heat Capacity (J mol⁻¹K⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol⁻¹)	

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Rn (Radon)

Group-18 Period-6

Latin Name: Radon **Year Of Discovery:** 1900 **Discoverer:** -

Physical Properties

Atomic Number	86	Molar Mass (g mol⁻¹)	222.0176
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶		
Density (g cm⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm³ mol⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm³ mol⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm⁻¹K⁻¹)	
Heat Of Fusion (kJ mol⁻¹)		Heat Of Vapourization (kJ mol⁻¹)	
Molar Heat Capacity (J mol⁻¹K⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol⁻¹)	

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Group-18

Og (Oganesson)

Period-7

Latin Name: Oganesson

Year Of Discovery: 2006

Discoverer: -

Physical Properties

Atomic Number	118	Molar Mass (g mol ⁻¹)	296
Electronic Configuration	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ² 4p ⁶ 4d ¹⁰ 5s ² 5p ⁶ 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁶		
Density (g cm ⁻³) at 20°C		Oxidation States	
Atomic Radius (pm)		Element Category	
Covalent Radius (pm)		Van der Waals Radius (pm)	
Ionic Radius (trivalent ion) (pm)		Ionisation Energy (kJ/mol)	
Molar Volume (cm ³ mol ⁻¹)		Electronegativity	
Melting Point (°C)		Boiling Point (°C)	
Phase at STP		CAS Number	
Electrical Resistivity (nΩm) (293.15 K)		Magnetic Susceptibility (cm ³ mol ⁻¹) (298 K)	
Magnetic Ordering		Thermal Conductivity (Wm ⁻¹ K ⁻¹)	
Heat Of Fusion (kJ mol ⁻¹)		Heat Of Vapourization (kJ mol ⁻¹)	
Molar Heat Capacity (J mol ⁻¹ K ⁻¹)		Vapour Pressure	
Crystal Structure		Heat Of Sublimation (kJ mol ⁻¹)	

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