

# The Periodic Table

## Special Groups (Families)

Hydrogen (H) does not belong to any chemical group.

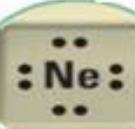
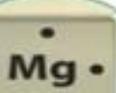
Like all alkali metals, lithium (Li) has just one valence electron.

Like all alkaline earth metals, magnesium (Mg) has two valence electrons.

Like all halogens, iron (Fe) has seven valence electrons.

Like all inert gases, neon (Ne) has eight valence electrons.

	1 (IA)	2 (IIA)	3 (IIB)	4 (IVB)	5 (VB)	6 (VIB)	7 (VIIB)	8 (VIII)	9 (VIII)	10 (VIII)	11 (IB)	12 (IIB)	13 (IIIA)	14 (IVA)	15 (VA)	16 (VIA)	17 (VIIA)	18 (VIIIA)	
1	H																		
2	Li	Be											B	C	N	O	F	Ne	
3	Na	Mg											Al	Si	P	S	Cl	Ar	
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub	Uut	Uuq	Uup				







- In their pure state alkali metals ***must be stored in oil***, because they react on exposure to moisture in the air.



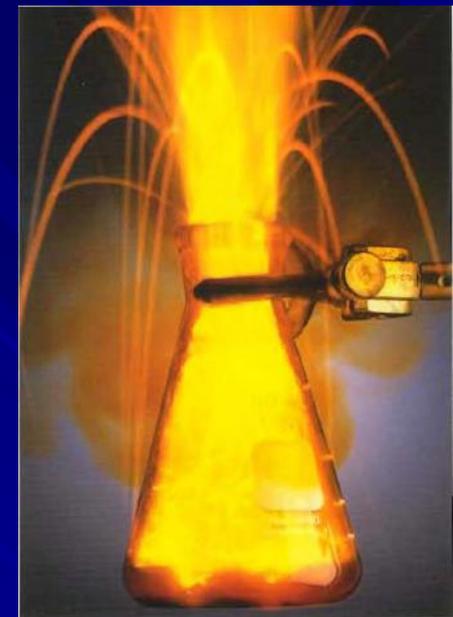
- They react vigorously with acids, water, oxygen and **halogens**.
- Halogens** are elements located second-to-last group of the periodic table.

**Periodic Table of the Elements**

1 11A																	18 VIIIA
1 <b>H</b> Hydrogen 1.0079	2 IIA											13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	2 <b>He</b> Helium 4.00260
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.01218											5 <b>B</b> Boron 10.811	6 <b>C</b> Carbon 12.011	7 <b>N</b> Nitrogen 14.00674	8 <b>O</b> Oxygen 15.9994	9 <b>F</b> Fluorine 18.998403	10 <b>Ne</b> Neon 20.1797
11 <b>Na</b> Sodium 22.989768	12 <b>Mg</b> Magnesium 24.305	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 VIII 8	9 VIII 8	10 VIII 8	11 IB 1B	12 IIB 2B	13 <b>Al</b> Aluminum 26.981539	14 <b>Si</b> Silicon 28.0855	15 <b>P</b> Phosphorus 30.973762	16 <b>S</b> Sulfur 32.066	17 <b>Cl</b> Chlorine 35.4527	18 <b>Ar</b> Argon 39.948
19 <b>K</b> Potassium 39.0983	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.95591	22 <b>Ti</b> Titanium 47.88	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938	26 <b>Fe</b> Iron 55.847	27 <b>Co</b> Cobalt 58.9332	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.39	31 <b>Ga</b> Gallium 69.732	32 <b>Ge</b> Germanium 72.64	33 <b>As</b> Arsenic 74.92159	34 <b>Se</b> Selenium 78.96	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.80
37 <b>Rb</b> Rubidium 85.4678	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.90585	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.90638	42 <b>Mo</b> Molybdenum 95.94	43 <b>Tc</b> Technetium 98.9072	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.9055	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.71	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.6	53 <b>I</b> Iodine 126.90447	54 <b>Xe</b> Xenon 131.29
55 <b>Cs</b> Cesium 132.90543	56 <b>Ba</b> Barium 137.327	57-71	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.9479	74 <b>W</b> Tungsten 183.85	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.22	78 <b>Pt</b> Platinum 195.08	79 <b>Au</b> Gold 196.9665	80 <b>Hg</b> Mercury 200.59	81 <b>Tl</b> Thallium 204.3833	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.98037	84 <b>Po</b> Polonium [208.9824]	85 <b>At</b> Astatine 209.9871	86 <b>Rn</b> Radon 222.0176
87 <b>Fr</b> Francium 223.0197	88 <b>Ra</b> Radium 226.0254	89-103	104 <b>Rf</b> Rutherfordium [261]	105 <b>Db</b> Dubnium [262]	106 <b>Sg</b> Seaborgium [266]	107 <b>Bh</b> Bohrium [264]	108 <b>Hs</b> Hassium [269]	109 <b>Mt</b> Meitnerium [268]	110 <b>Ds</b> Darmstadtium [269]	111 <b>Rg</b> Roentgenium [272]	112 <b>Cn</b> Copernicium [277]	113 <b>Uut</b> Ununtrium unknown	114 <b>Uuq</b> Ununquadium [289]	115 <b>Uup</b> Ununpentium unknown	116 <b>Uuh</b> Ununhexium [298]	117 <b>Uus</b> Ununseptium unknown	118 <b>Uuo</b> Ununoctium unknown

■ This photo shows the explosive reaction that occurs when sodium comes into contact with chlorine.

■ Click the picture to play video.



Group →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
↓ Period	1																	2
1	H																	He
2	3	4											5	6	7	8	9	10
3	Li	Be											B	C	N	O	F	Ne
4	11	12											13	14	15	16	17	18
5	Na	Mg											Al	Si	P	S	Cl	Ar
6	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
7	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
8	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
9	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
10	55	56	*	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
11	Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
12	87	88	**	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
13	Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Uuq	Uup	Uuh	Uus	Uuo

■ Alkali metal's reaction with water generates *hydrogen gas and a base*.

■ Click on the picture to play the video.



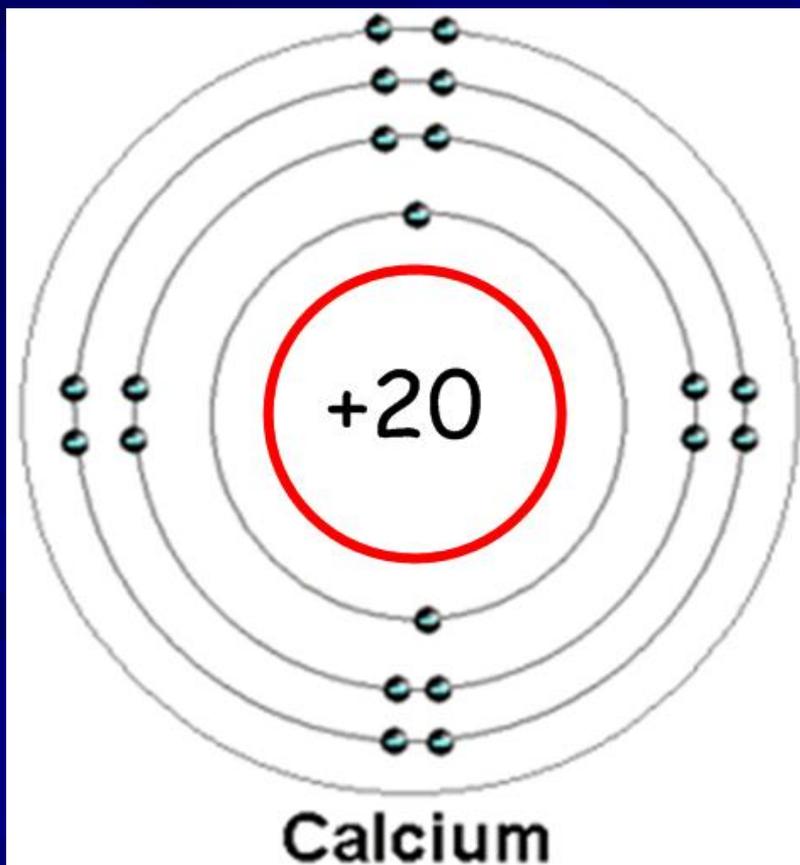


- Alkaline earth metals are *Be, Mg, Ca, Sr, Ba, Ra*.
- They are *harder* than alkali metals and have higher melting points.

Group

	1A	2A	3B	4B	5B
1	1 H 1.00794 Hydrogen				
2	3 Li 6.941 Lithium	4 Be 9.01218 Beryllium			
3	11 Na 22.9898 Sodium	12 Mg 24.305 Magnesium			
4	19 K 39.0983 Potassium	20 Ca 40.078 Calcium	21 Sc 44.9559 Scandium	22 Ti 47.867 Titanium	23 V 50.9415 Vanadium
5	37 Rb 85.4678 Rubidium	38 Sr 87.62 Strontium	39 Y 88.9059 Yttrium	40 Zr 91.224 Zirconium	41 Nb 92.9064 Niobium
6	55 Cs 132.90545 Cesium	56 Ba 137.327 Barium	57-71 La-Lu *	72 Hf 178.49 Hafnium	73 Ta 180.9479 Tantalum
7	87 Fr [223] Francium	88 Ra [226] Radium	89-103 Ac-Lr **	104 Rf [261] Rutherfordium	105 Db [262] Dubnium

- These properties are due largely to the presence of two valence electrons on each atom, which leads to stronger metallic bonding than occurs in Group 1.



1	<b>H</b>	2 IIa		
2	<b>Li</b>	<b>Be</b>		
3	<b>Na</b>	<b>Mg</b>	3 IIIb	4 IVb
4	<b>K</b>	<b>Ca</b>	<b>Sc</b>	<b>Ti</b>
5	<b>Rb</b>	<b>Sr</b>	<b>Y</b>	<b>Zr</b>

- Alkaline earth metals also *conduct heat and electricity.*



- They too react with acids, water, oxygen and halogens, ***but not as violently*** as alkali metals.
- Click picture to play video.



- The reaction with water also generates ***hydrogen gas and a base*** (an alkali).
- Click picture to play video.



■ Alkaline earth metals are mainly found *in rocks*.





■ Halogens are *F, Cl, Br, I, At*

■ They are *very reactive* and *form compounds*;

■ Click the table to view the video.

			8A	18			
5A	15	6A	16	7A	17		
						2	He
						4.00260	Helium
7	N	8	O	9	F	10	Ne
14.0067		15.9994		18.9984		20.1797	
Nitrogen		Oxygen		Fluorine		Neon	
15	P	16	S	17	Cl	18	Ar
30.9738		32.065		35.453		39.948	
Phosphorus		Sulfur		Chlorine		Argon	
33	As	34	Se	35	Br	36	Kr
74.9216		78.96		79.904		83.798	
Arsenic		Selenium		Bromine		Krypton	
51	Sb	52	Te	53	I	54	Xe
121.760		127.60		126.9045		131.293	
Antimony		Tellurium		Iodine		Xenon	
83	Bi	84	Po	85	At	86	Rn
208.9804		[209]		[210]		[222]	
Bismuth		Polonium		Astatine		Radon	

- Several halogens are powerful *disinfectants*;
- *Chlorine*, for example is used to treat water in the swimming pools.



	7A	17	8A	18
			2	He
			4.00260	Helium
9		F	10	Ne
18.9984		Fluorine	20.1797	Neon
17		Cl	18	Ar
35.453		Chlorine	39.948	Argon
35		Br	36	Kr
79.904		Bromine	83.798	Krypton
53		I	54	Xe
126.9045		Iodine	131.293	Xenon
85		At	86	Rn
[210]		Astatine	[222]	Radon

At room temperature **halogens** can be found in all three states: gaseous  $F_2$  and  $Cl_2$ , liquid  $Br_2$  and solids  $I_2$ , At.

State at room temperature																	
Solid  Gaseous  Liquid 																	
1																	2
1A																	2A
1	2	3A	4A	5A	6A	7A											8A
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
<b>H</b> Hydrogen 1.00794																	<b>He</b> Helium 4.00260
<b>Li</b> Lithium 6.941	<b>Be</b> Beryllium 9.01218											<b>B</b> Boron 10.811	<b>C</b> Carbon 12.011	<b>N</b> Nitrogen 14.0067	<b>O</b> Oxygen 15.9994	<b>F</b> Fluorine 18.998403	<b>Ne</b> Neon 20.1797
<b>Na</b> Sodium 22.98977	<b>Mg</b> Magnesium 24.305											<b>Al</b> Aluminum 26.98154	<b>Si</b> Silicon 28.0855	<b>P</b> Phosphorus 30.97376	<b>S</b> Sulfur 32.066	<b>Cl</b> Chlorine 35.4527	<b>Ar</b> Argon 39.948
<b>K</b> Potassium 39.0983	<b>Ca</b> Calcium 40.078	<b>Sc</b> Scandium 44.9559	<b>Ti</b> Titanium 47.88	<b>V</b> Vanadium 50.9415	<b>Cr</b> Chromium 51.9961	<b>Mn</b> Manganese 54.9380	<b>Fe</b> Iron 55.847	<b>Co</b> Cobalt 58.9332	<b>Ni</b> Nickel 58.6934	<b>Cu</b> Copper 63.546	<b>Zn</b> Zinc 65.39	<b>Ga</b> Gallium 69.723	<b>Ge</b> Germanium 72.61	<b>As</b> Arsenic 74.9216	<b>Se</b> Selenium 78.96	<b>Br</b> Bromine 79.904	<b>Kr</b> Krypton 83.80
<b>Rb</b> Rubidium 85.4678	<b>Sr</b> Strontium 87.62	<b>Y</b> Yttrium 88.9059	<b>Zr</b> Zirconium 91.224	<b>Nb</b> Niobium 92.9064	<b>Mo</b> Molybdenum 95.94	<b>Tc</b> Technetium [98]	<b>Ru</b> Ruthenium 101.07	<b>Rh</b> Rhodium 102.9055	<b>Pd</b> Palladium 106.42	<b>Ag</b> Silver 107.8682	<b>Cd</b> Cadmium 112.411	<b>In</b> Indium 114.82	<b>Sn</b> Tin 118.710	<b>Sb</b> Antimony 121.757	<b>Te</b> Tellurium 127.60	<b>I</b> Iodine 126.9045	<b>Xe</b> Xenon 131.29
<b>Cs</b> Cesium 132.9054	<b>Ba</b> Barium 137.327	<b>*La</b> Lanthanum 138.9055	<b>Hf</b> Hafnium 178.49	<b>Ta</b> Tantalum 180.9479	<b>W</b> Tungsten 183.85	<b>Re</b> Rhenium 186.207	<b>Os</b> Osmium 190.2	<b>Ir</b> Iridium 192.22	<b>Pt</b> Platinum 195.08	<b>Au</b> Gold 196.9665	<b>Hg</b> Mercury 200.59	<b>Tl</b> Thallium 204.3833	<b>Pb</b> Lead 207.2	<b>Bi</b> Bismuth 208.9804	<b>Po</b> Polonium (209)	<b>At</b> Astatine (210)	<b>Rn</b> Radon (222)
<b>Fr</b> Francium (223)	<b>Ra</b> Radium 226.0254	<b>†Ac</b> Actinium 227.0278	<b>Rf</b> Rutherfordium (261)	<b>Db</b> Dubnium (262)	<b>Sg</b> Seaborgium (263)	<b>Bh</b> Bohrium (262)	<b>Hs</b> Hassium (265)	<b>Mt</b> Meitnerium (268)	(269)	(272)	(277)						



■ Noble gases are He, Ne, Ar, Kr, Xe, Rn, Uuo.

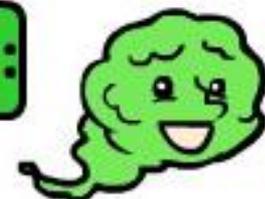
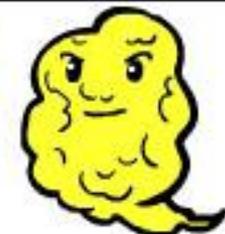
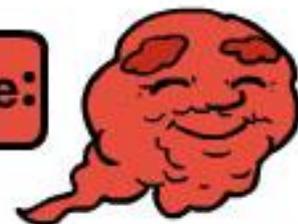
# Periodic Table of the Elements

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1 <b>H</b> Hydrogen 1.0079		2 IIA 2A		13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	2 <b>He</b> Helium 4.00260	
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.01218			5 <b>B</b> Boron 10.811	6 <b>C</b> Carbon 12.011	7 <b>N</b> Nitrogen 14.00674	8 <b>O</b> Oxygen 15.9994	9 <b>F</b> Fluorine 18.998403	10 <b>Ne</b> Neon 20.1797	
11 <b>Na</b> Sodium 22.989768	12 <b>Mg</b> Magnesium 24.305			13 <b>Al</b> Aluminum 26.981539	14 <b>Si</b> Silicon 28.0855	15 <b>P</b> Phosphorus 30.973762	16 <b>S</b> Sulfur 32.066	17 <b>Cl</b> Chlorine 35.4527	18 <b>Ar</b> Argon 39.948	
19 <b>K</b> Potassium 39.0983	20 <b>Ca</b> Calcium 40.078			31 <b>Ga</b> Gallium 69.732	32 <b>Ge</b> Germanium 72.64	33 <b>As</b> Arsenic 74.92159	34 <b>Se</b> Selenium 78.96	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.80	
37 <b>Rb</b> Rubidium 85.4678	38 <b>Sr</b> Strontium 87.62			49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.71	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.6	53 <b>I</b> Iodine 126.90447	54 <b>Xe</b> Xenon 131.29	
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87 <b>Fr</b> Francium 223.0197	88 <b>Ra</b> Radium 226.0254			113 <b>Uut</b> Ununtrium unknown	114 <b>Uuq</b> Ununquadium [289]	115 <b>Uup</b> Ununpentium unknown	116 <b>Uuh</b> Ununhexium [298]	117 <b>Uus</b> Ununseptium unknown	118 <b>Uuo</b> Ununoctium unknown	

- Generally, not chemically active, they do not react with other elements.
- Click the picture to view the video.

## Noble Gases

Not Reactive  
Valence Electron  
Structure



- None of the noble gases are *flammable*.
- For this reason, they can mostly be found in their elemental state in nature.
- Click the picture to play the video.

He

Ne

Ar

Kr

Xe

- The noble gases glow brightly when an electric discharge is passed through them.
- They are used as *advertising signs*

