

# THE PERIODIC TABLE, THE ATOM AND BOHR DIAGRAMS

1

## Periodic Table of the Elements

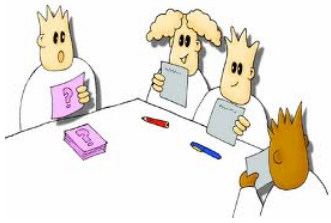
1 1IA 11A																	18 VIIIA 8A
1 H Hydrogen 1.0079	2 He Helium 4.00260																
3 Li Lithium 6.941	4 Be Beryllium 9.01218											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.998403	10 Ne Neon 20.1797
11 Na Sodium 22.989768	12 Mg Magnesium 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 Al Aluminum 26.981539	14 Si Silicon 28.0855	15 P Phosphorus 30.973762	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.95591	22 Ti Titanium 47.88	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.64	33 As Arsenic 74.92159	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium 98.9072	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90543	56 Ba Barium 137.327	57-71 Lanthanide Series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.9665	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98037	84 Po Polonium [208.9824]	85 At Astatine 208.9871	86 Rn Radon 222.0176
87 Fr Francium 223.0197	88 Ra Radium 226.0254	89-103 Actinide Series	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Uuq Ununquadium [289]	115 Uup Ununpentium unknown	116 Uuh Ununhexium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown

Lanthanide Series

Actinide Series

57 La Lanthanum 138.9055	58 Ce Cerium 140.115	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium 144.9127	62 Sm Samarium 150.36	63 Eu Europium 151.9655	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
89 Ac Actinium 227.0278	90 Th Thorium 232.0381	91 Pa Protactinium 231.03588	92 U Uranium 238.0289	93 Np Neptunium 237.0482	94 Pu Plutonium 244.0642	95 Am Americium 243.0614	96 Cm Curium 247.0703	97 Bk Berkelium 247.0703	98 Cf Californium 251.0796	99 Es Einsteinium [254]	100 Fm Fermium 257.0951	101 Md Mendelevium 258.1	102 No Nobelium 259.1009	103 Lr Lawrencium [262]

Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetals	Nonmetals	Halogens	Noble Gas	Lanthanides	Actinides
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- What do periods on the periodic table represent?
- What do columns on the periodic table represent?
- What are properties of metals?
- What are properties of nonmetals?
- What are metalloids? Where are they found on the periodic table?
- Which chemical groups do you remember that our metals?
- Which chemical groups do you remember that are nonmetals?

# Important Features of the Table

- **Groups-** elements with similar chemical properties in a vertical column in the main part of the table;
- **Period** – elements, arranged in a horizontal row, whose properties change from metallic on the left to non-metallic on the right. \*\*\* (*THEY HAVE THE SAME NUMBER ELECTRON SHELLS*)

- **Metals-** left side of the periodic table
- The majority of elements on the periodic table are metals.
- All metals, except for mercury are solids
- Malleable
- Lustre
- Conductors



- **Non-Metals** – Right side of the periodic table
- Solids are Non-conductor
- At room temperature most are gasses or solids
- Solids are brittle
- dull (no lustre)



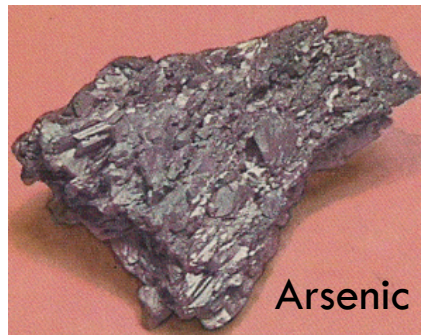
**Carbon**



**Sulphur**

- **Metalloids-** between metals & non-metals.

- They have some properties of metals and some properties of non-metals.



Group***	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period	1A	2A	3B	4B	5B	6B	7B	8	8	8	1B	2B	3A	4A	5A	6A	7A	8A
1	H 1.008																	He 4.003
2	Li 6.941	Be 9.012											B 10.81	C 12.01	N 14.01	O 16.00	F 19.00	Ne 20.18
3	Na 22.99	Mg 24.31											Al 26.98	Si 28.09	P 30.97	S 32.07	Cl 35.45	Ar 39.95
4	K 39.10	Ca 40.08	Sc 44.96	Ti 47.88	V 50.94	Cr 52.00	Mn 54.94	Fe 55.85	Co 58.93	Ni 58.69	Cu 63.55	Zn 65.39	Ga 69.72	Ge 72.64	As 74.92	Se 78.96	Br 79.90	Kr 83.80
5	Rb 85.47	Sr 87.62	Y 88.91	Zr 91.22	Nb 92.91	Mo 95.94	Tc (98)	Ru 101.1	Rh 102.9	Pd 106.4	Ag 107.9	Cd 112.4	In 114.8	Sn 118.7	Sb 121.8	Te 127.6	I 126.9	Xe 131.3
6	Cs 132.9	Ba 137.3	La 138.9	Hf 178.5	Ta 180.9	W 183.8	Re 186.2	Os 190.2	Ir 192.2	Pt 195.1	Au 197.0	Hg 200.6	Tl 204.4	Pb 207.2	Bi 208.9	Po (209)	At (210)	Rn (222)
7	Fr (223)	Ra (226)	**	Rf (261)	Db (262)	Sg (263)	Bh (264)	Hs (265)	Mt (266)	Ds (268)	Rg (269)	CuB (270)	UuB (271)	UuB (272)	UuB (273)	UuB (274)	UuB (275)	UuB (276)

Lanthanide Series* (Lanthanoids)	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
	La (139)	Ce (140)	Pr (141)	Nd (142)	Pm (143)	Sm (150)	Eu (152)	Gd (157)	Tb (159)	Dy (163)	Ho (165)	Er (167)	Tm (169)	Yb (173)	Lu (175)
Actinide Series** (Actinoids)	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
	Ac (227)	Th (232)	Pa (231)	U (238)	Np (237)	Pu (244)	Am (243)	Cm (247)	Bk (247)	Cf (251)	Es (252)	Fm (257)	Md (258)	No (259)	Lr (262)

\*\*\*Groups are by 3 notation conventions.

# Group Names

**Alkali Metals**: First group in the periodic table.

- Soft, Silvery coloured solids.
- React violently with water.
- Most reactive metal family



# Group Names

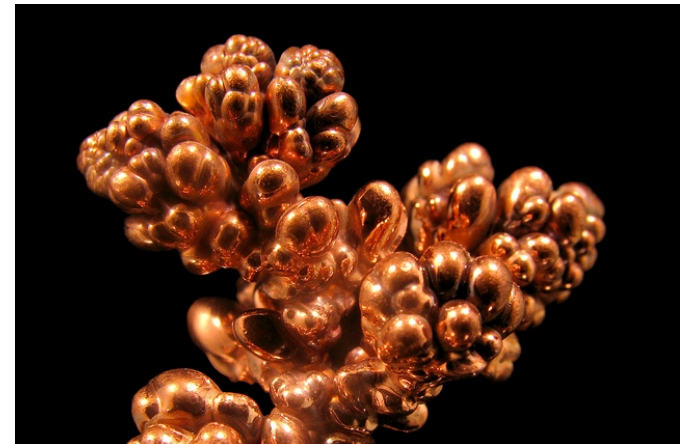
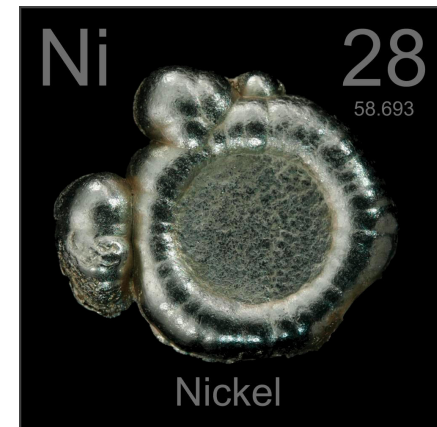
- **Alkaline earth metals**: Second group in the periodic table.
- Light
- Reactive





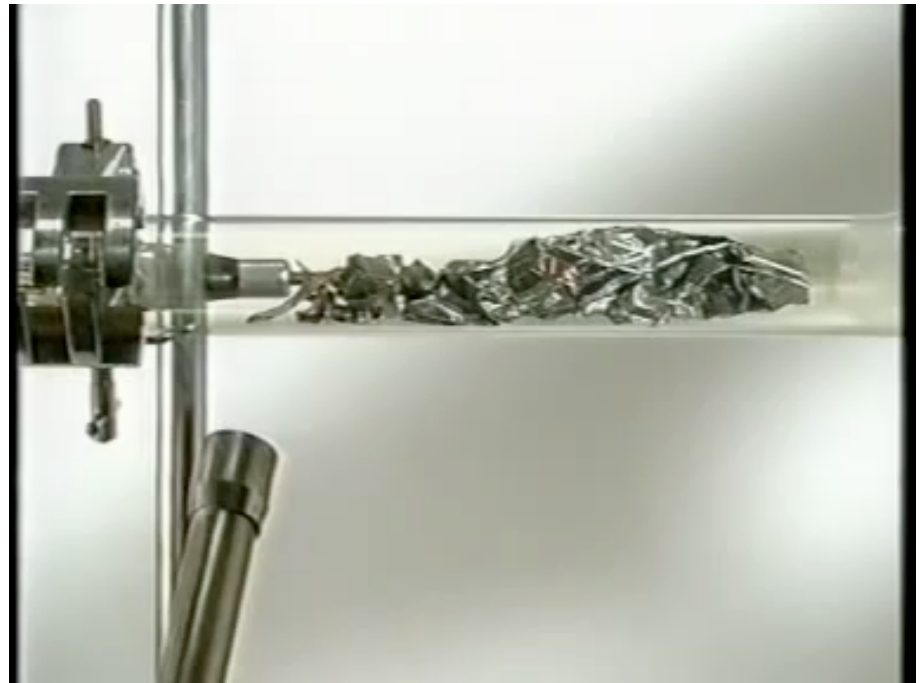
# Group Names

- Transition metals: These metals have a wide variety of properties.
- Hard
- Strong
- Conduct electricity



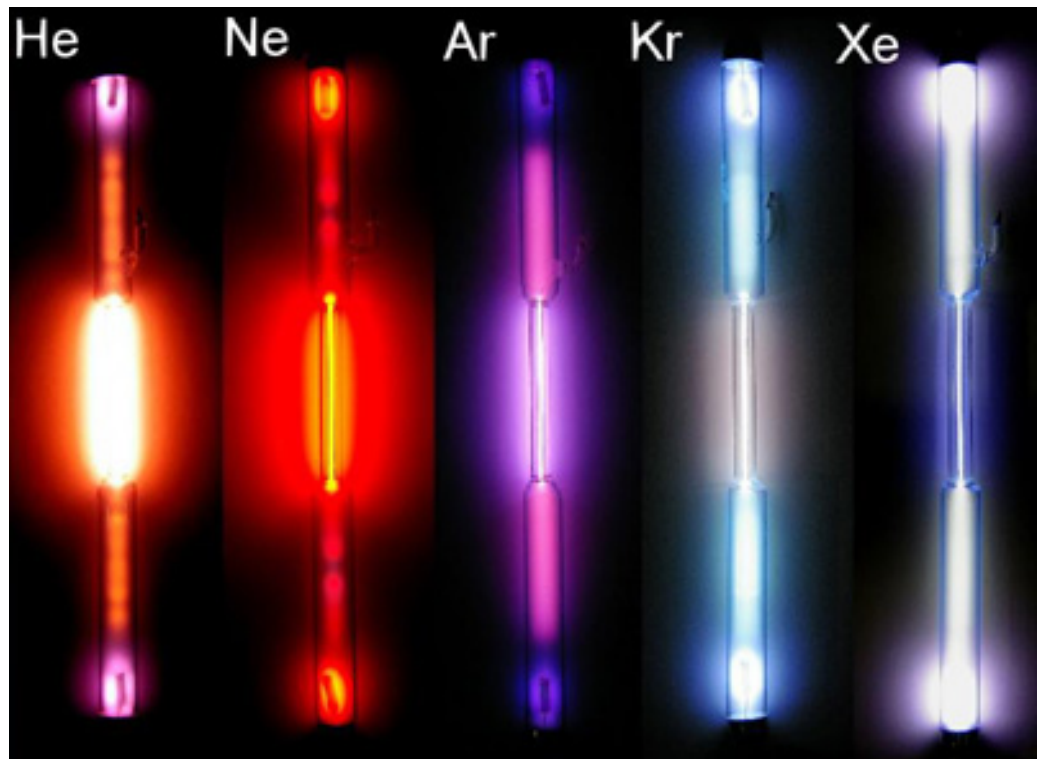
# Group Names

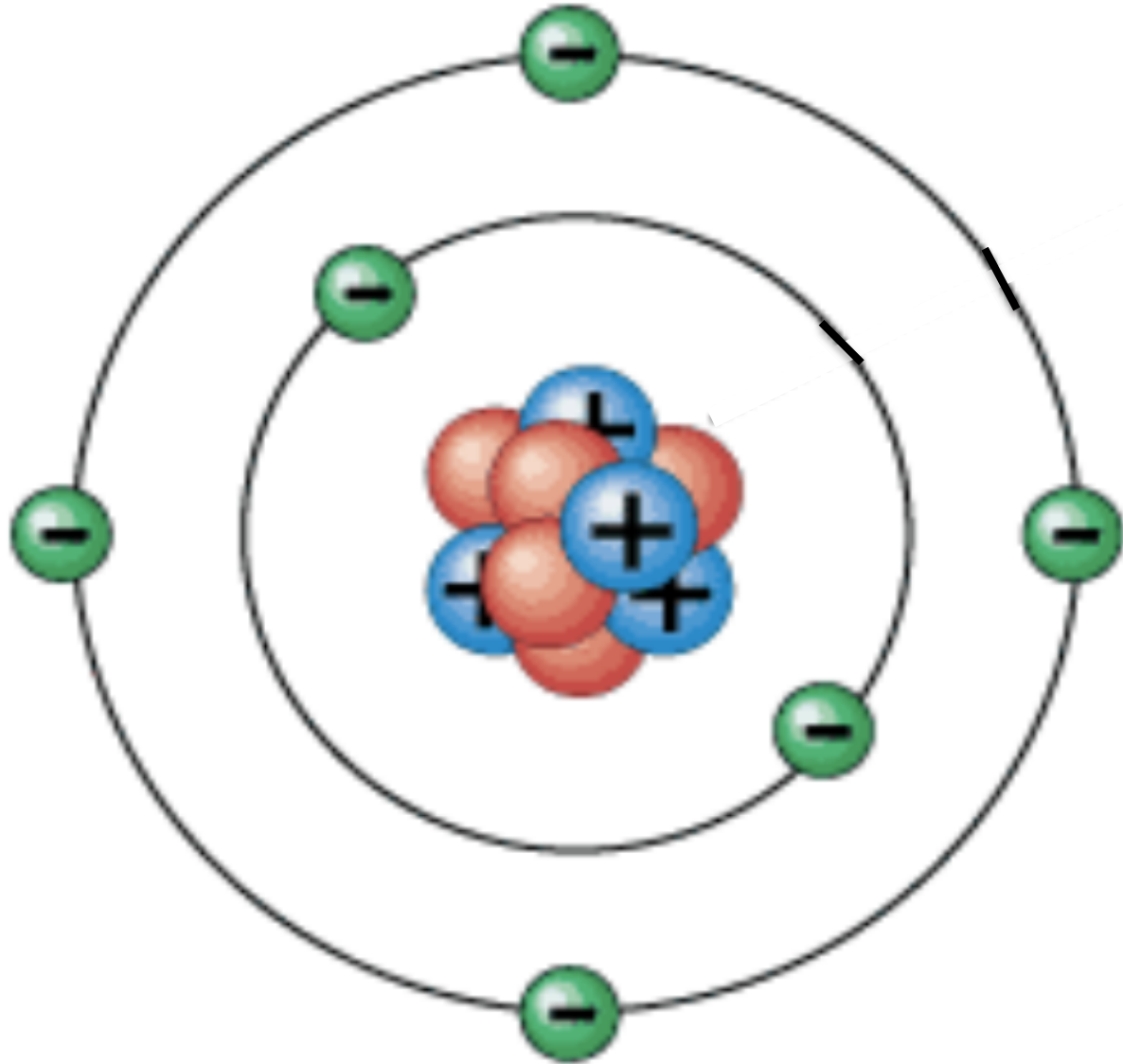
- Halogens: Non-metals in group 17.
- Solids, liquids and gases
- Extremely reactive.



# Group Names

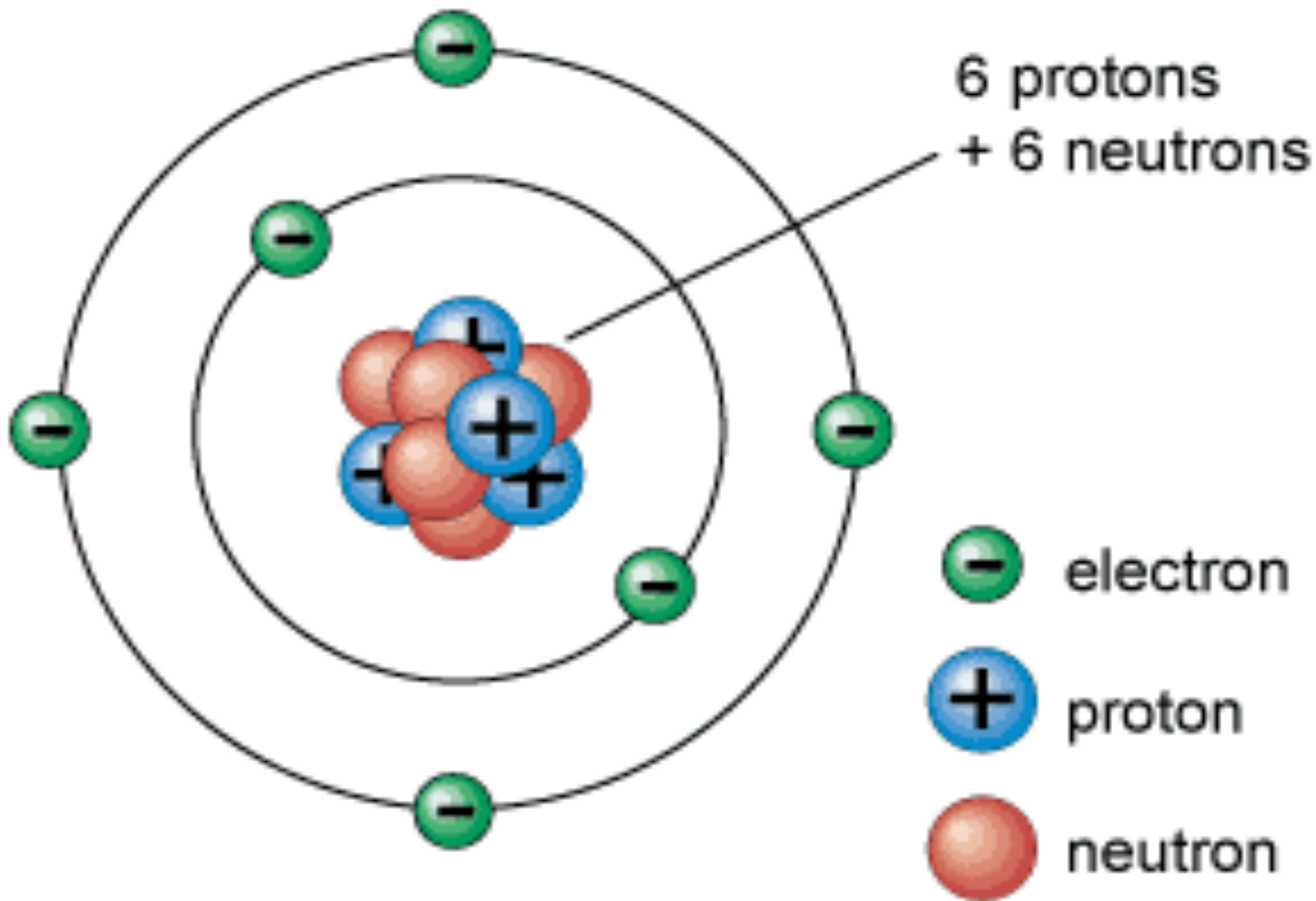
- Noble gasses:
- Gasses at room temperature.
- Low MP and BP
- Un-reactive



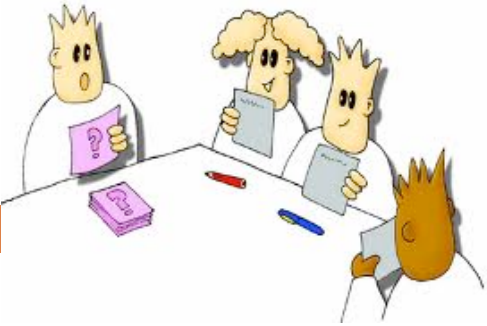


# Elements and Atomic Structure

- Atoms are composed of three subatomic particles
- **Protons-** Heavy positively charged particle found in the nucleus
- **Neutrons** -are neutral particles that have the same mass as protons and are located in the nucleus
- **Electrons-** Negatively charged particles with almost no mass. They circle the nucleus at different energy levels.

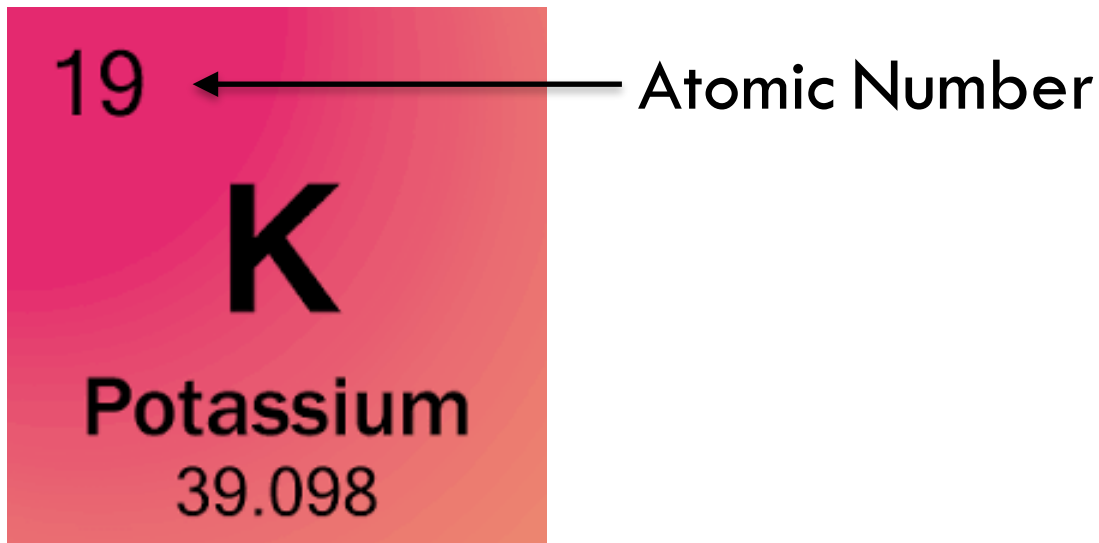


Carbon atom



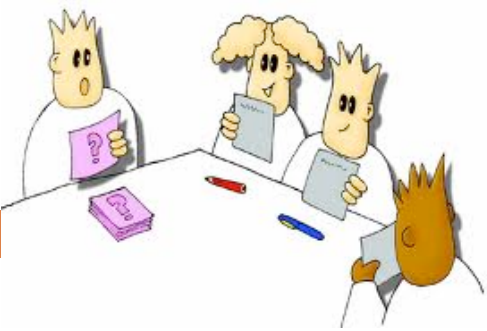
- What term represents the number of protons in an Atom?
- What term represents the number of protons and neutrons in an atom?

- The **atomic number** refers to the number of protons that are located in the nucleus of the atom.



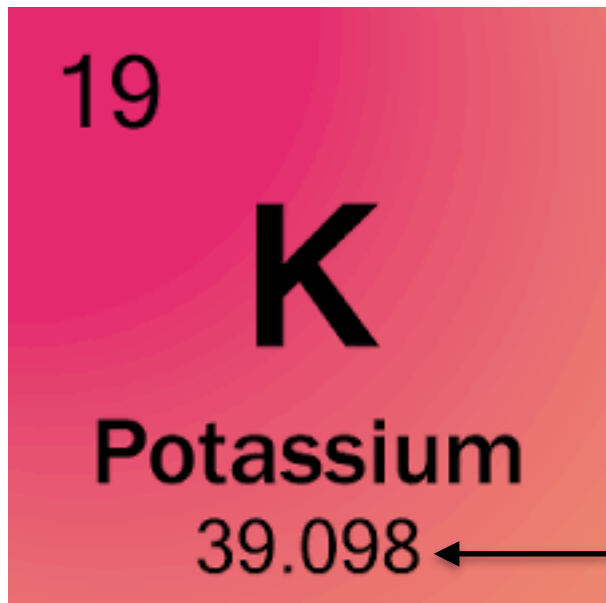
- If the atom is electronically neutral it will also contain the same number of electrons.





- What is the atomic number
  - Hydrogen?
  - Ba?
  - P?
- Which element has...
  - 18 protons?
  - 63 protons?

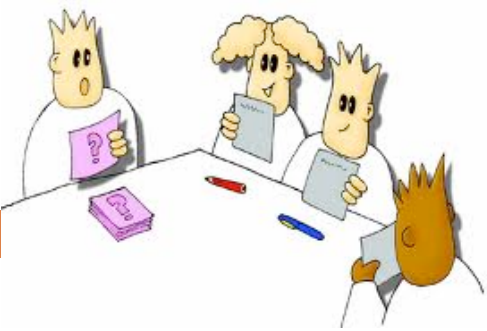
- The **Atomic Mass** refers to the number of protons and neutrons in the nucleus of the atom.



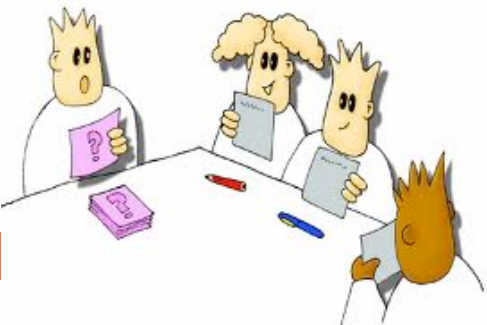
How many neutrons does Potassium have?

$$\begin{aligned}\text{Neutron} &= \text{Atomic Mass} - \text{Atomic Number} \\ &= 39 - 19 \\ &= 20 \text{ neutrons}\end{aligned}$$

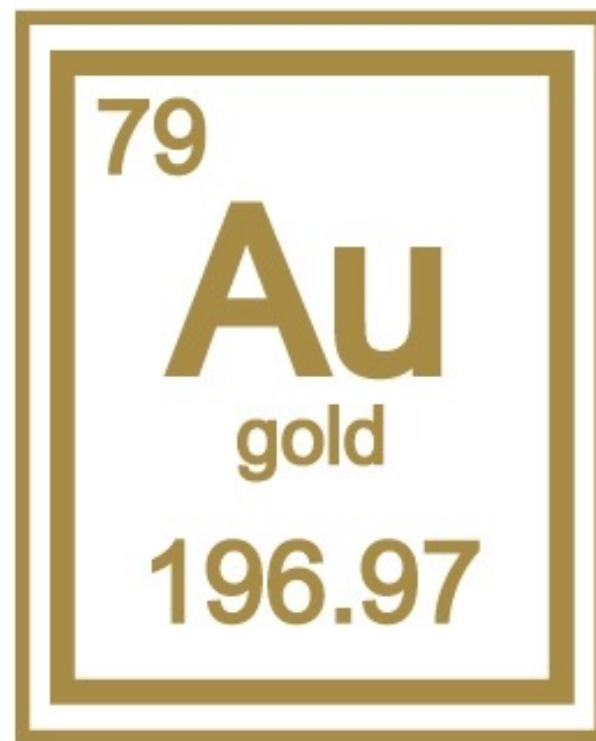
← Atomic Mass



- How many neutrons do the following items have
  - Hydrogen?
  - Ba?
  - P?
- Which element has...
  - 17 protons and 18 neutrons?
  - 11 protons in 12 neutrons?
- An element has 60 neutrons in an atomic mass of 107. Which element is it?



- How many neutrons does gold have?



# Bohr-Rutherford Diagrams

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- To represent electron arrangements at various orbits we use Bohr diagrams. Each orbit has a set number of electrons.

Orbit #

# of Electrons

1

2

2

8

3

8

4

18

- Every row in the period contains a shell. The farther you move down the table the more shells you added to the diagram. H = 1 shell, Li = 2 shells, K = 3 shells.
- Moving left to right on the periodic table adds valence electrons to the shells of that row. Na has 1 valence e-, Mg has 2 valence e-, Al has 3 valence e-, etc.

# Drawing Bohr-Rutherford Diagrams

Draw the Bohr Rutherford diagram of Hydrogen

Draw the Bohr Rutherford diagram of Helium

Draw the Bohr Rutherford diagram of Lithium

Draw the Bohr Rutherford diagram of Beryllium

Draw the Bohr Rutherford diagram of Aluminum

Draw the Bohr Rutherford diagram of Argon