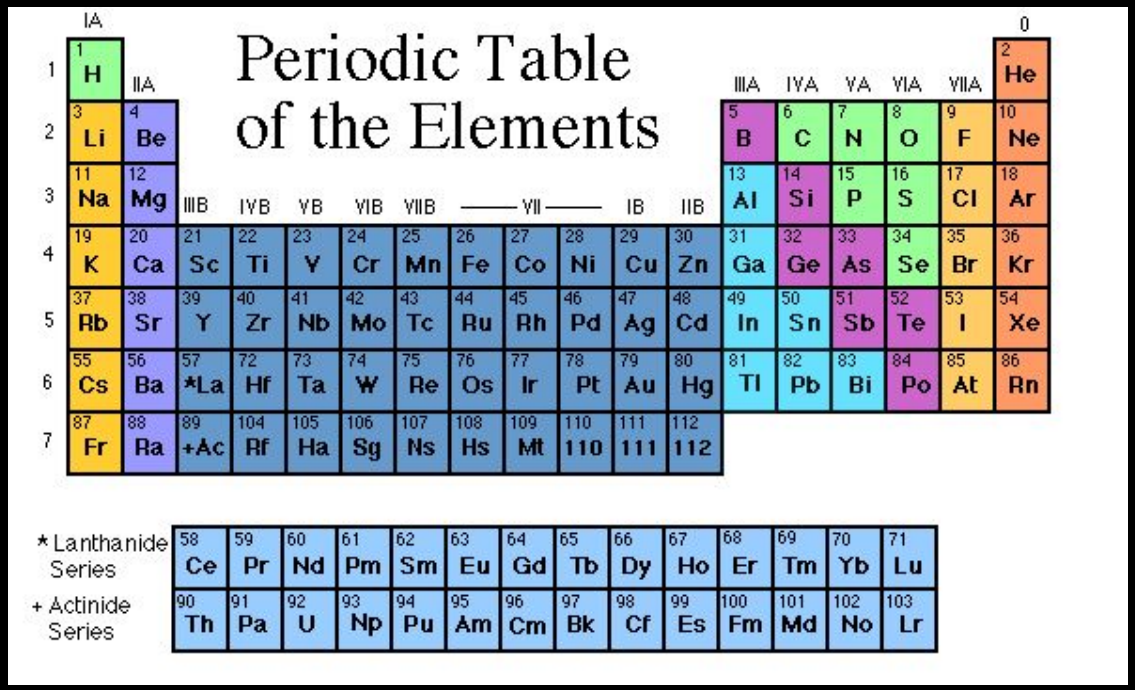
# *Chemistry*


Periodic Table of the Elements
IA
IIA
IIIB
IVB
VB
VIB
VIIB
VII
IB
IIB
IIIA
IVA
VA
VIA
VIIA
0
1 H
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
57 *La
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
89 +Ac
104 Rf
105 Ha
106 Sg
107 Ns
108 Hs
109 Mt
110 110
111 111
112 112
* Lanthanide Series
58 Ce
59 Pr
60 Nd
61 Pm
62 Sm
63 Eu
64 Gd
65 Tb
66 Dy
67 Ho
68 Er
69 Tm
70 Yb
71 Lu
+ Actinide Series
90 Th
91 Pa
92 U
93 Np
94 Pu
95 Am
96 Cm
97 Bk
98 Cf
99 Es
100 Fm
101 Md
102 No
103 Lr

*The sub-atomic particles:*
*protons, neutrons, electrons*

*Элементарные частицы: протоны, нейтроны, электроны*

# *New terms and definitions:*

| | |
|---|---|
| Atomic structure | Строение атома |
| The sub-atomic particles | Элементарные частицы |
| Proton | Протон |
| Neutron | Нейтрон |
| Electron | Электрон |
| The nucleus | Ядра |
| Nucleon | Нуклон |
| Atomic number | Порядковый номер |

# *Atomic Structure*

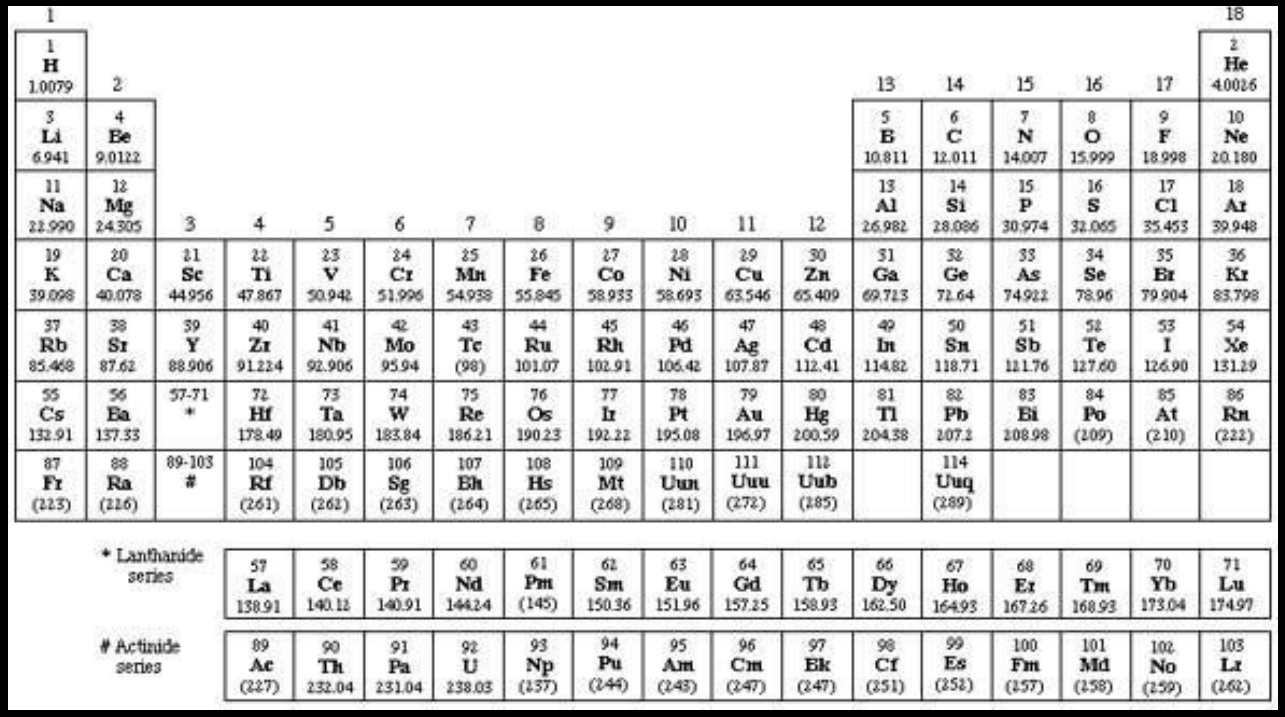
Learning Objectives:

Do I know ..

- The structure of an atom?
- About the relative size of the nucleus?
- That atoms of a given element have the same number of protons in the nucleus?
- The meaning of the terms 'atomic number' and 'mass number'?

# *Elements* *one of the 100+ pure substances*

*that make up everything in the universe*



| 1 | | | | | | | | | | | | | | | | | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 H 1.0079 | 2 | | | | | | | | | | | 13 | 14 | 15 | 16 | 17 | 2 He 4.0026 |
| 3 Li 6.941 | 4 Be 9.0122 | | | | | | | | | | | 5 B 10.811 | 6 C 12.011 | 7 N 14.007 | 8 O 15.999 | 9 F 18.998 | 10 Ne 20.180 |
| 11 Na 22.990 | 12 Mg 24.305 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 Al 26.982 | 14 Si 28.086 | 15 P 30.974 | 16 S 32.065 | 17 Cl 35.453 | 18 Ar 39.948 |
| 19 K 39.098 | 20 Ca 40.078 | 21 Sc 44.956 | 22 Ti 47.867 | 23 V 50.942 | 24 Cr 51.996 | 25 Mn 54.938 | 26 Fe 55.845 | 27 Co 58.933 | 28 Ni 58.693 | 29 Cu 63.546 | 30 Zn 65.409 | 31 Ga 69.723 | 32 Ge 72.64 | 33 As 74.922 | 34 Se 78.96 | 35 Br 79.904 | 36 Kr 83.798 |
| 37 Rb 85.468 | 38 Sr 87.62 | 39 Y 88.906 | 40 Zr 91.224 | 41 Nb 92.906 | 42 Mo 95.94 | 43 Tc (98) | 44 Ru 101.07 | 45 Rh 102.91 | 46 Pd 106.42 | 47 Ag 107.87 | 48 Cd 112.41 | 49 In 114.82 | 50 Sn 118.71 | 51 Sb 121.76 | 52 Te 127.60 | 53 I 126.90 | 54 Xe 131.29 |
| 55 Cs 132.91 | 56 Ba 137.33 | 57-71 * | 72 Hf 178.49 | 73 Ta 180.95 | 74 W 183.84 | 75 Re 186.21 | 76 Os 190.23 | 77 Ir 192.22 | 78 Pt 195.08 | 79 Au 196.97 | 80 Hg 200.59 | 81 Tl 204.38 | 82 Pb 207.2 | 83 Bi 208.98 | 84 Po (209) | 85 At (210) | 86 Rn (222) |
| 87 Fr (223) | 88 Ra (226) | 89-103 # | 104 Rf (261) | 105 Db (262) | 106 Sg (263) | 107 Bh (264) | 108 Hs (265) | 109 Mt (268) | 110 Uun (281) | 111 Uuu (272) | 112 Uub (285) | | 114 Uuq (289) | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * Lanthanide series | 57 La 138.91 | 58 Ce 140.12 | 59 Pr 140.91 | 60 Nd 144.24 | 61 Pm (145) | 62 Sm 150.36 | 63 Eu 151.96 | 64 Gd 157.25 | 65 Tb 158.93 | 66 Dy 162.50 | 67 Ho 164.93 | 68 Er 167.26 | 69 Tm 168.93 | 70 Yb 173.04 | 71 Lu 174.97 |
| # Actinide series | 89 Ac (227) | 90 Th 232.04 | 91 Pa 231.04 | 92 U 238.03 | 93 Np (237) | 94 Pu (244) | 95 Am (243) | 96 Cm (247) | 97 Bk (247) | 98 Cf (251) | 99 Es (252) | 100 Fm (257) | 101 Md (258) | 102 No (259) | 103 Lr (262) |

# *Examples of Elements*

***C = Carbon***

***O = Oxygen***

***H = Hydrogen***

***N = Nitrogen***

***S = Sulfur***

***P = Phosphorus***

***Na = Sodium***

***Ca = Calcium***

***K = Potassium***

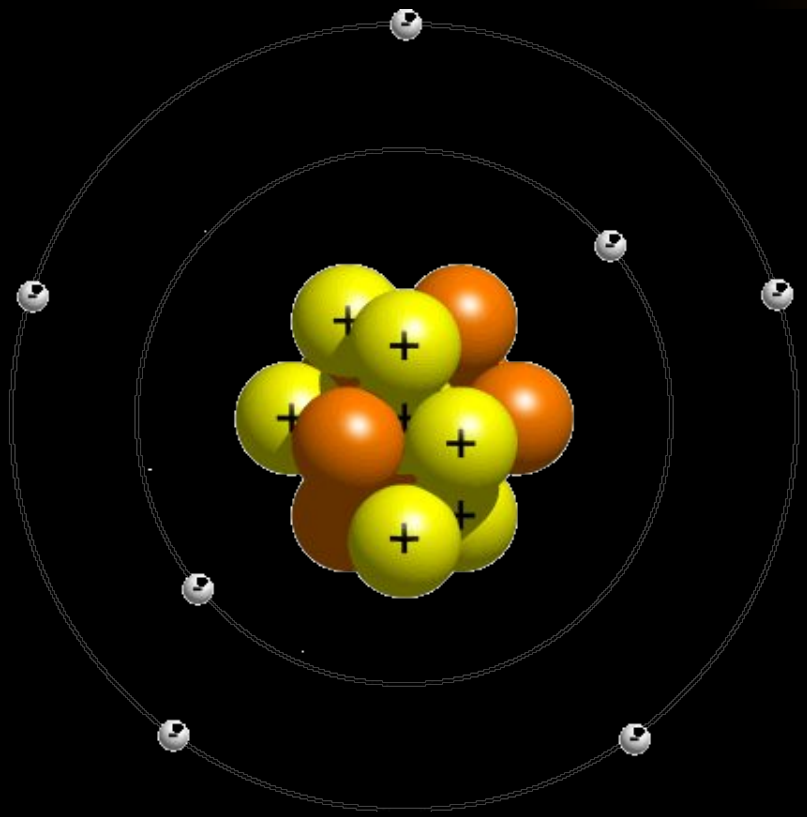
***I = Iodine***

***Cl = Chlorine***

# *Working in pairs complete the following:*

- Draw an atom
  - It must include all the subatomic particles, their charges and locations.
  - Try to answer the following questions
- ***The structure of an atom?***
- ***About the relative size of the nucleus?***
- ***That atoms of a given element have the same number of protons in the nucleus?***
- ***The meaning of the terms 'atomic number' and 'mass number'?***

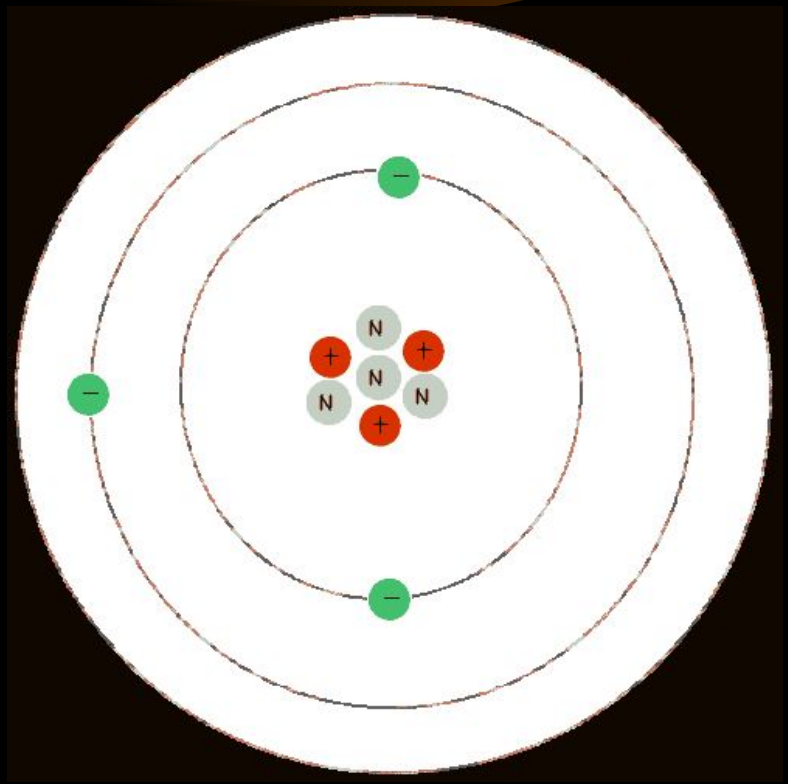
# *Atom* *the smallest particle making up elements*



# *Sub-atomic Particles*

***Protons $p^+$ - positive charge, in nucleus***

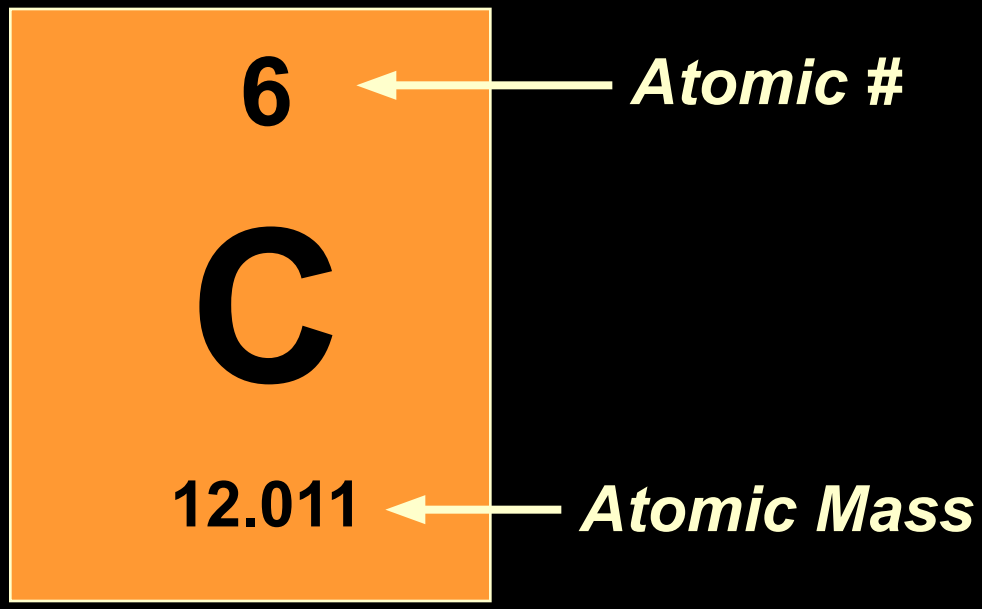
***Neutrons $n^0$ – no charge, in nucleus***



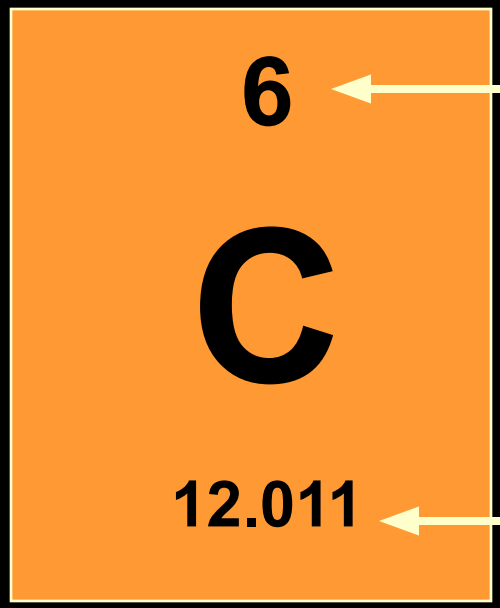

***Electrons - $e^-$ negative charge, orbiting nucleus***

http://www.pil-network.com/resources/tools

# *Drawing an Atom of Carbon*



# *Drawing an Atom of Carbon*



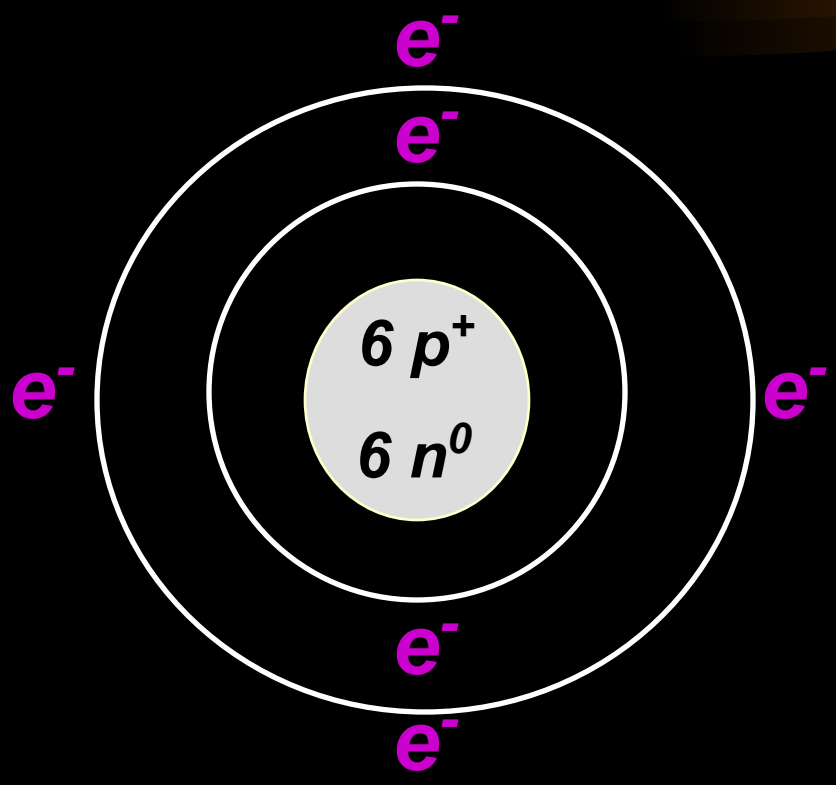

***Atomic # = # of $p^+$ and # of $e^-$***

***Carbon has 6 $p^+$ and 6 $e^-$***

***Atomic Mass minus Atomic # = # of $n^0$***

***Carbon has 6 $n^0$***

# *Drawing an Atom of Carbon*



# *exercises*

- Task 1. Determine the number of protons and electrons in the atoms of iron and mercury

# *exercises*

- Task 2. An atom of an element has 10 neutrons in the nucleus of an atom and the atomic weight of 19. Determine what is an element?

*Complete the handout in pairs*

# *Assessment for learning….*

- Using the mini white board answer the following questions individually

*How many protons does Silicon have?*

*What makes up the atomic weight of an atom?*

*How many electrons does a neutral Calcium atom have?*

*What element has one less proton than Boron?*

*What is the atomic number and Atomic mass of Argon?*

# *Chemistry*

***Diga, diga, diga, diga,***
***that's all folks!***