

## Atomic Elements

An **element** is the most basic form of an atom based on the number of protons ( $p^+$ )

The number of  $p^+$  is also known as the **atomic number** of an atom

The **atomic number** is the number of protons ( $p^+$ ) and electrons ( $e^-$ ) in atom

The **element** is identified by **element symbol** (H), and **element name** (Hydrogen) as shown in the element

1	← group # (modern)
1A	← group # (traditional)
1	← Element # (Atomic #)
<b>H</b>	← Element Symbol
Hydrogen	← Element Name
1.01	← Average Atomic Mass
1	← period # (modern)

A **periodic square** from a table of elements (*Periodic Table*) showing all the element info

2

## Element Arrangement on Periodic Table

**Groups** are the up and down rows with elements based on the **number of valence electrons** (val.  $e^-$ ), and are numbered 1 – 18, or 1A – 8A and 1B – 10B

**Periods** are the left to right rows based on the number of **energy levels**, or the size of the atom, and are numbered 1 – 7.

1	1A
1	<b>H</b> Hydrogen 1.01
2	2A
3	<b>Li</b> Lithium 6.94
4	<b>Be</b> Beryllium 9.01
11	<b>Na</b> Sodium 22.99
12	<b>Mg</b> Magnesium 24.31
19	<b>K</b> Potassium 39.10
20	<b>Ca</b> Calcium 40.08
37	<b>Rb</b> Rubidium 85.47
38	<b>Sr</b> Strontium 87.62
55	<b>Cs</b> Cesium 132.91
56	<b>Ba</b> Barium 137.33
87	<b>Fr</b> Francium (223)
88	<b>Ra</b> Radium (226)

group

13	14	15	16	17	18
3A	4A	5A	6A	7A	8A
5	6	7	8	9	10
<b>B</b> Boron 10.81	<b>C</b> Carbon 12.01	<b>N</b> Nitrogen 14.01	<b>O</b> Oxygen 16.00	<b>F</b> Fluorine 19.00	<b>Ne</b> Neon 20.18

period

groups: up and down  
(18 groups\*, 1-18)

\* Traditional: 1A-8A, 1B-10B

periods: left to right  
(7 periods, 1-7)

3

## Counting Subatomic Particles

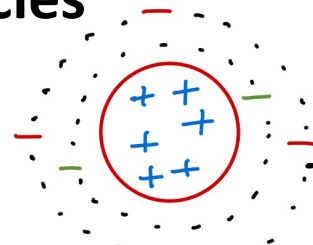
### Proton and Electron Relationships

Atoms must remain neutral due to the relationships between electrons ( $e^-$ ) and protons ( $p^+$ )

Carbon:  $6p^+$  (+6) and  $6e^-$  (-6) = 0

The number of electrons ( $e^-$ ) or protons ( $p^+$ ) in an atom is called the **Atomic Number**.

Protons ( $p^+$ ) = Electrons ( $e^-$ ) is a **neutral atom**



Carbon:  $6p^+ + 6e^-$

Neutral Atom	$\#p^+ = \#e^-$
Atomic # = $\#p^+ = e^-$	

4

## Counting Subatomic Particles

### Proton and Neutron Relationships

An atom's nucleus contains both protons ( $p^+$ ) and neutrons ( $n^0$ ).

Smaller atoms often have vbeing equal to neutrons ( $n^0$ ). Larger atoms more neutrons ( $n^0$ ) than protons ( $p^+$ ) due to the need to minimize protons ( $p^+$ ) repulsion

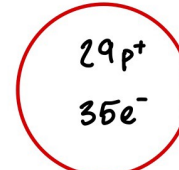
The **Mass Number** is the sum of the protons ( $p^+$ ) and to neutrons ( $n^0$ ) in an atom's nucleus

Carbon-12



small atoms  
 $p^+ = n^0$

Copper-65



large atoms  
 $p^+ < n^0$

Mass #	$= p^+ + n^0$
Atomic Mass = Particles in Nucleus	

5

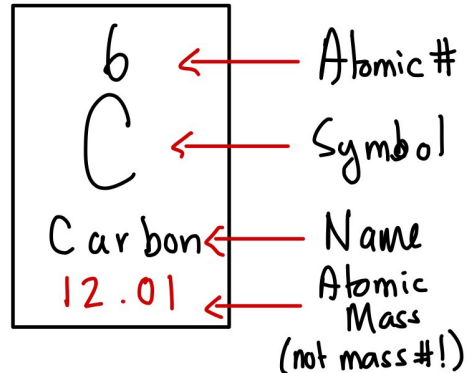
## Counting Subatomic Particles

### Understanding Periodic Table Squares

The square on the periodic table include the following parts:

- **Atomic Number** ( $p^+$  and  $e^-$ )
- **Element Symbol**
- **Element Name**
- **Average Atomic Mass**

The **average atomic mass** is the average mass of all forms of an element, the **element isotopes**, and is not the **mass number** ( $p^+ + n^0$ )



$6p^+$ ,  $6e^-$ , C, Carbon  
 $n^0$  and mass # not given!

6

## Counting Subatomic Particles

### Determining Atomic Isotope Parts

Elements may contain multiple **isotopes**, the form of an atom based on the protons ( $p^+$ ) and neutrons ( $n^0$ ). The number of neutrons ( $n^0$ ) and mass number (**mass #**) are not on the periodic table

### Isotope Notation

Scandium - 45  
 Element                  Mass #



Overall Subatomic Particle Relationships

$$\text{Atomic \#} = p^+ = e^-$$

= Element Name  
 = Element Symbol

$$\text{Mass \#} = p^+ + n^0$$

$$n^0 = \text{Mass \#} - \text{Atomic \#}$$

$n^0$  not on periodic table

7