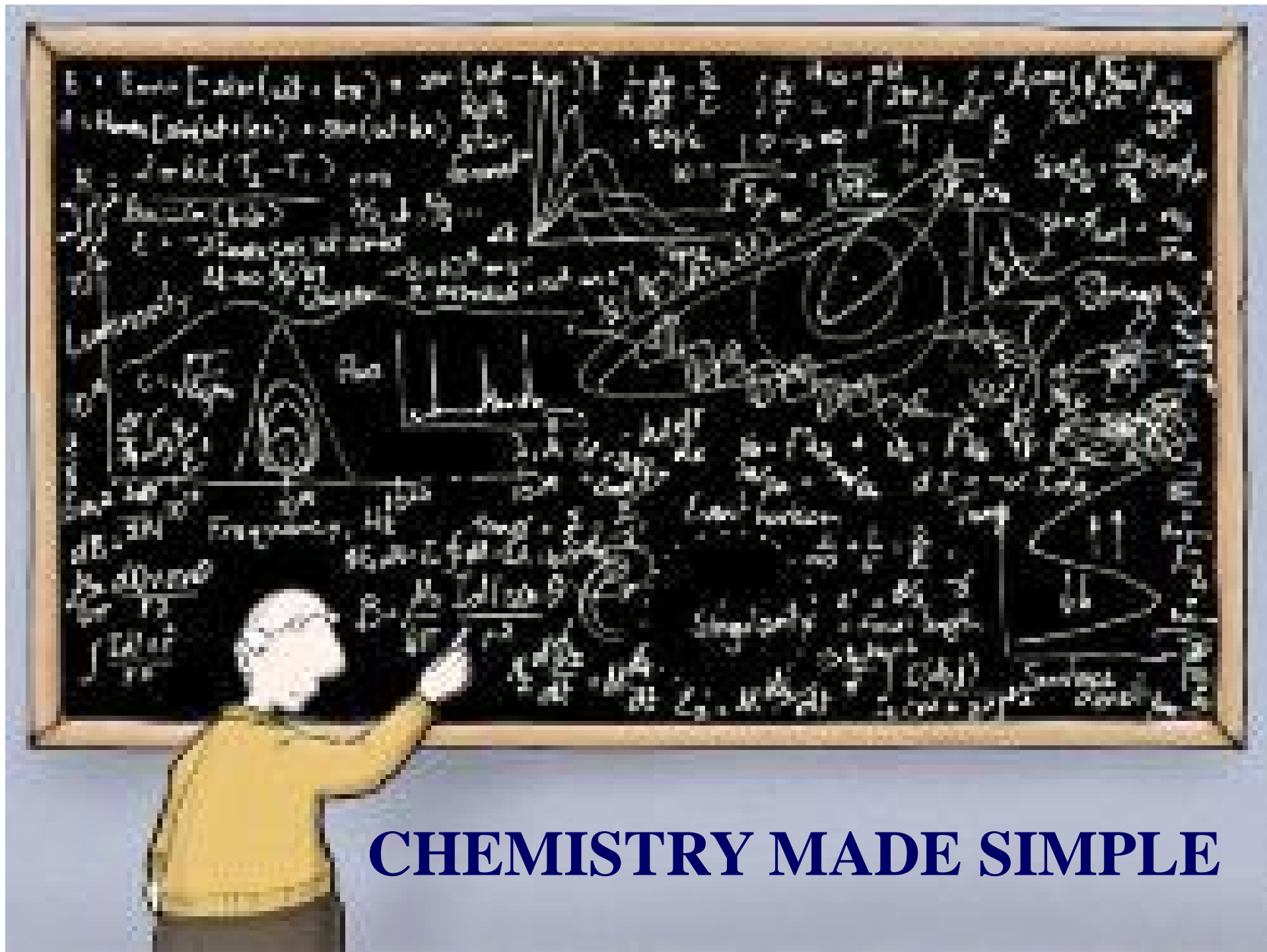


The background features a dark blue gradient with several overlapping circles and lines. The circles are centered in the upper-left, upper-right, and lower-center areas. Some circles have a dotted inner ring. A vertical line runs through the center, and two diagonal lines cross the scene from the bottom-left and top-right corners.

# Chapter 2 - Chemistry of Life (part I)



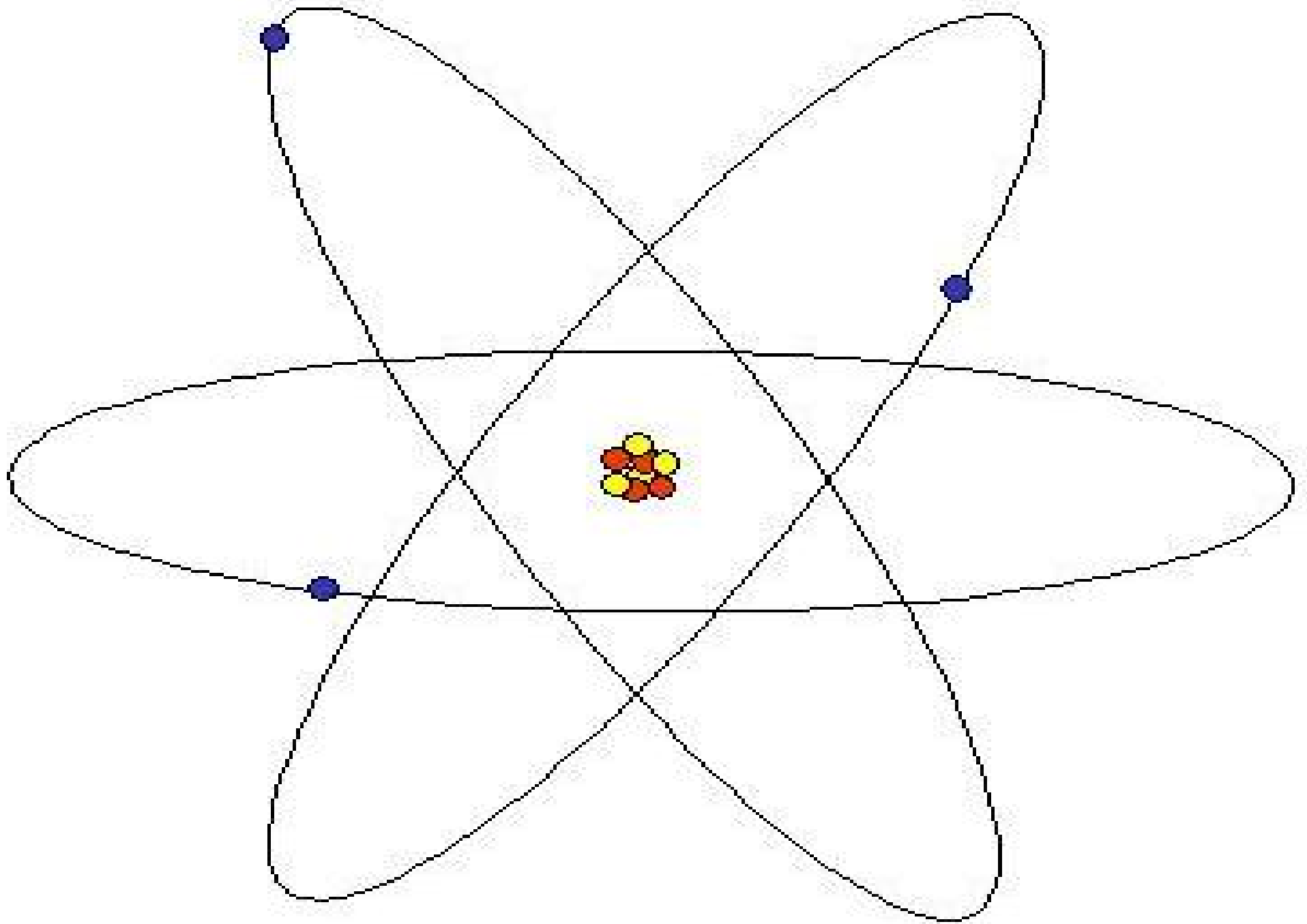
**CHEMISTRY MADE SIMPLE**

# Why Learn Chemistry?

- A basic knowledge of chemistry will help you understand biology better because all organisms, including yourself, are made up of *matter*.
- Matter – anything that has mass and volume.

# I. Matter and Atoms

- Atom – the smallest particle of *matter* that cannot be broken down by chemical means.
- *Atoms* are composed of three particles: electrons, protons, and neutrons.



- Electrons are negatively charged.

(-)

- Protons are positively charged.

(+)

- Neutrons are neutrally charged, that means they have no charge.

(0)

# The Parts of an Atom

## Protons

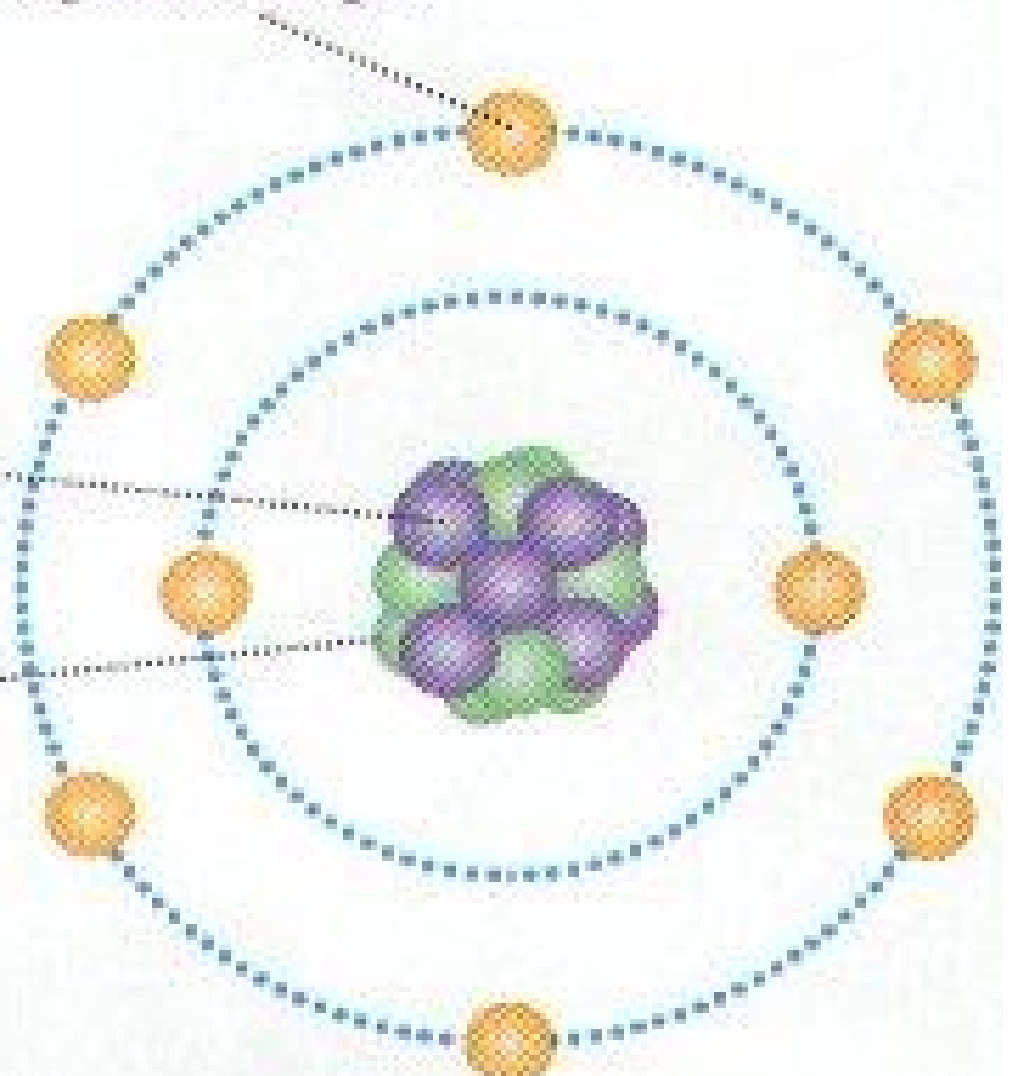
Protons are located in the center, or nucleus, of an atom. Protons have a positive charge.

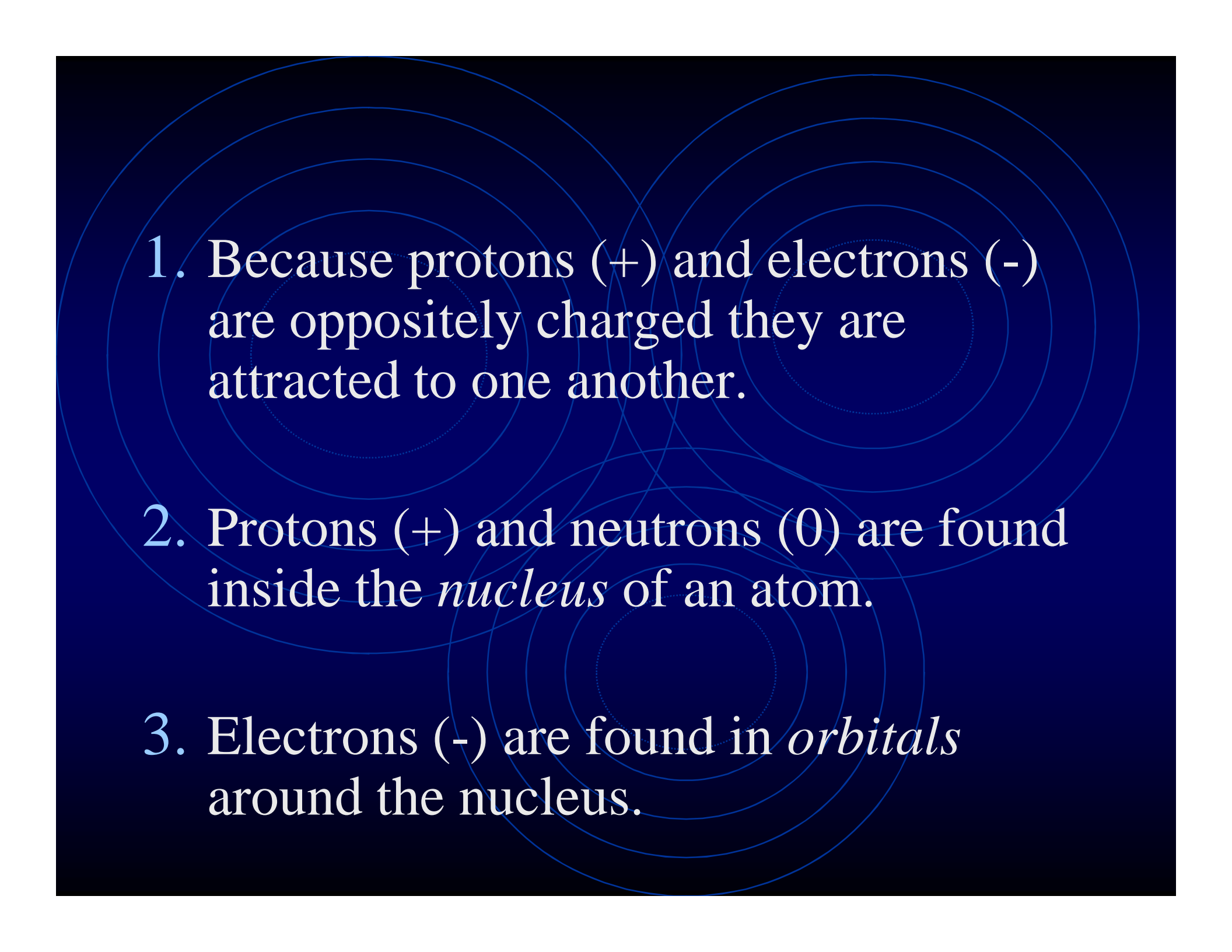
## Neutrons

Neutrons have no charge. They are located in the nucleus of an atom.

## Electrons

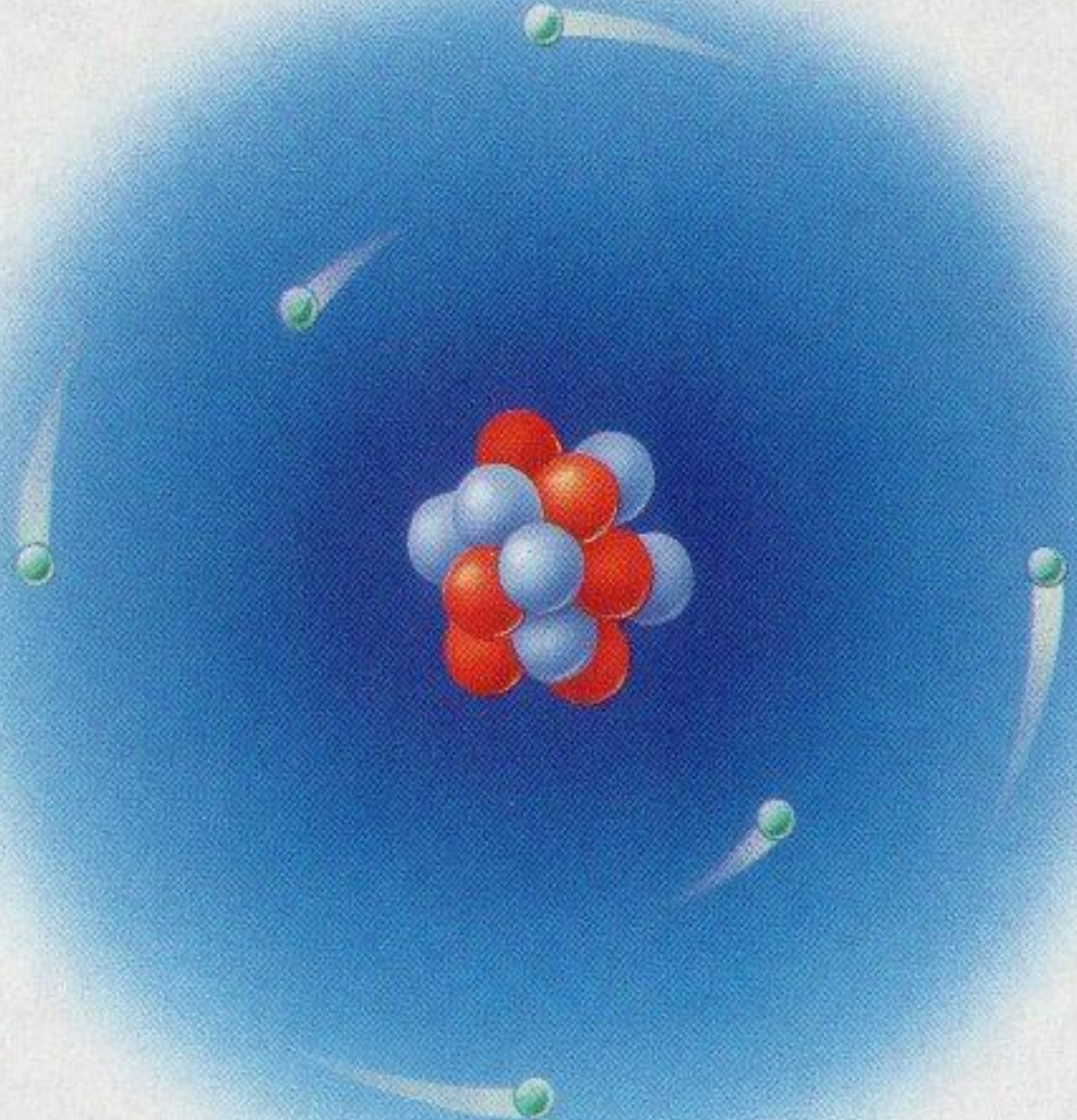
Most of the volume of an atom is occupied by its moving electrons. Electrons have a negative charge.



- 
1. Because protons (+) and electrons (-) are oppositely charged they are attracted to one another.
  2. Protons (+) and neutrons (0) are found inside the *nucleus* of an atom.
  3. Electrons (-) are found in *orbitals* around the nucleus.



**The nucleus of a carbon atom contains six neutrons, shown here in red, and six protons, shown here in blue. Six electrons move around the nucleus, traveling at very high speeds.**



## II. Different Types of Atoms

- Different amounts of electrons (-), protons (+), and neutrons (0) create different types of atoms.
- “The Periodic Table of Elements” lists over 110 different types of atoms.
- Element – a substance made of only one type of atom.

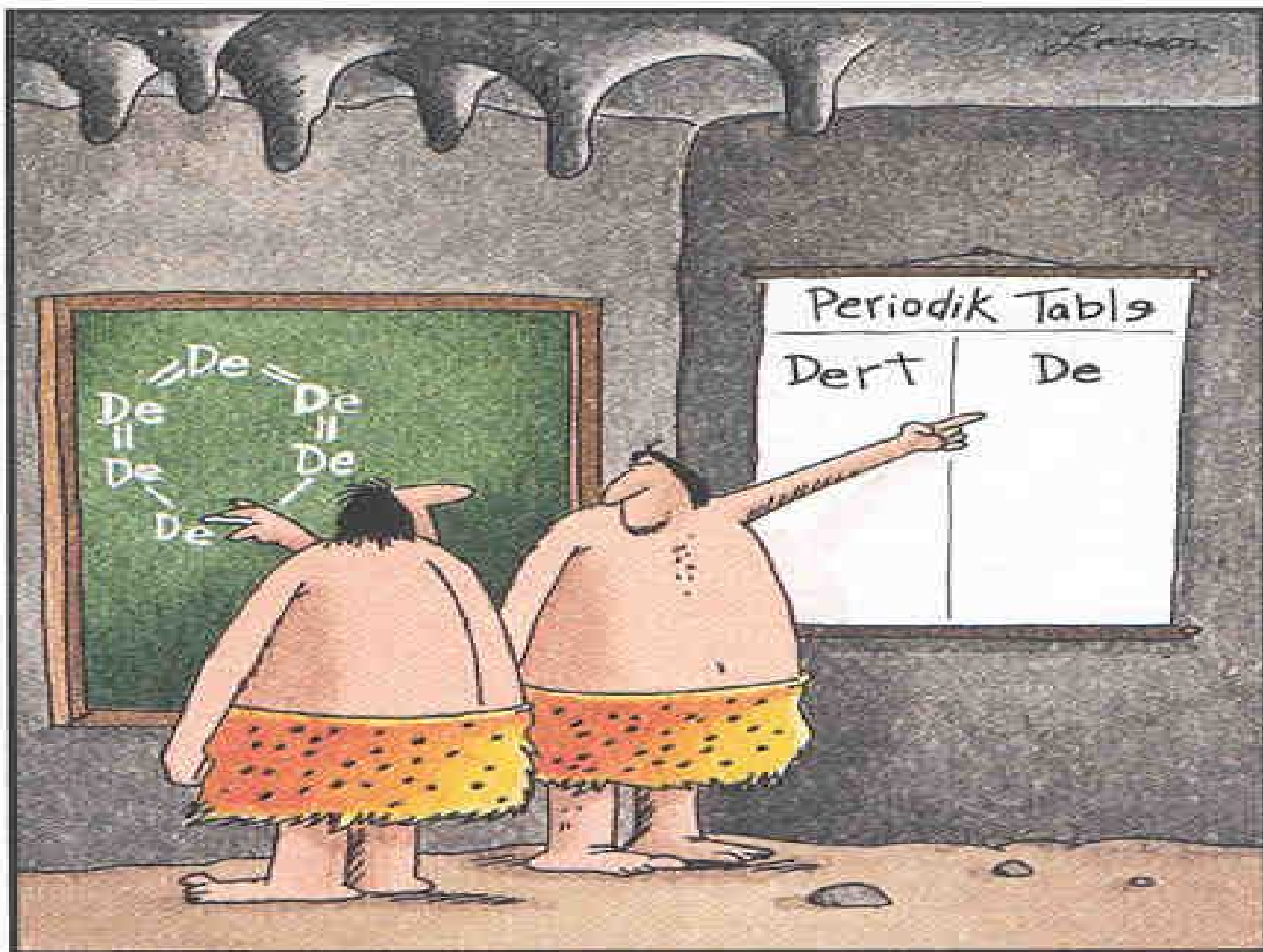
# Periodic Table

1 <b>H</b> Hydrogen 1.0																	2 <b>He</b> Helium 4.0
3 <b>Li</b> Lithium 6.9	4 <b>Be</b> Beryllium 9.0											5 <b>B</b> Boron 10.8	6 <b>C</b> Carbon 12.0	7 <b>N</b> Nitrogen 14.0	8 <b>O</b> Oxygen 16.0	9 <b>F</b> Fluorine 19.0	10 <b>Ne</b> Neon 20.2
11 <b>Na</b> Sodium 23.0	12 <b>Mg</b> Magnesium 9.0											13 <b>Al</b> Aluminum 27.0	14 <b>Si</b> Silicon 28.1	15 <b>P</b> Phosphorus 31.0	16 <b>S</b> Sulfur 32.1	17 <b>Cl</b> Chlorine 35.5	18 <b>Ar</b> Argon 40.0
19 <b>K</b> Potassium 39.1	20 <b>Ca</b> Calcium 40.2	21 <b>Sc</b> Scandium 45.0	22 <b>Ti</b> Titanium 47.9	23 <b>V</b> Vanadium 50.9	24 <b>Cr</b> Chromium 52.0	25 <b>Mn</b> Manganese 54.9	26 <b>Fe</b> Iron 55.9	27 <b>Co</b> Cobalt 58.9	28 <b>Ni</b> Nickel 58.7	29 <b>Cu</b> Copper 63.5	30 <b>Zn</b> Zinc 65.4	31 <b>Ga</b> Gallium 69.7	32 <b>Ge</b> Germanium 72.6	33 <b>As</b> Arsenic 74.9	34 <b>Se</b> Selenium 79.0	35 <b>Br</b> Bromine 79.9	36 <b>Kr</b> Krypton 83.8
37 <b>Rb</b> Rubidium 85.5	38 <b>Sr</b> Strontium 87.6	39 <b>Y</b> Yttrium 88.9	40 <b>Zr</b> Zirconium 91.2	41 <b>Nb</b> Niobium 92.9	42 <b>Mo</b> Molybdenum 95.9	43 <b>Tc</b> Technetium 99	44 <b>Ru</b> Ruthenium 101.0	45 <b>Rh</b> Rhodium 102.9	46 <b>Pd</b> Palladium 106.4	47 <b>Ag</b> Silver 107.9	48 <b>Cd</b> Cadmium 112.4	49 <b>In</b> Indium 114.8	50 <b>Sn</b> Tin 118.7	51 <b>Sb</b> Antimony 121.8	52 <b>Te</b> Tellurium 127.6	53 <b>I</b> Iodine 126.9	54 <b>Xe</b> Xenon 131.3
55 <b>Cs</b> Caesium 132.9	56 <b>Ba</b> Barium 137.4	57-71 Lanthanides	72 <b>Hf</b> Hafnium 178.5	73 <b>Ta</b> Tantalum 181.0	74 <b>W</b> Tungsten 183.9	75 <b>Re</b> Rhenium 186.2	76 <b>Os</b> Osmium 190.2	77 <b>Ir</b> Iridium 192.2	78 <b>Pt</b> Platinum 195.1	79 <b>Au</b> Gold 197.0	80 <b>Hg</b> Mercury 200.6	81 <b>Tl</b> Thallium 204.4	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 209.0	84 <b>Po</b> Polonium 210.0	85 <b>At</b> Astatine 210.0	86 <b>Rn</b> Radon 222.0
87 <b>Fr</b> Francium 223.0	88 <b>Ra</b> Radium 226.0	89-103 Actinides	104 <b>Rf</b> Rutherfordium 261	105 <b>Db</b> Dubnium 262	106 <b>Sg</b> Seaborgium 263	107 <b>Bh</b> Bohrium 262	108 <b>Hs</b> Hassium 265	109 <b>Mt</b> Meitnerium 266	110 <b>Uun</b> Ununnilium 272								

Types of Elements Key:

	Alkali metals
	Alkaline earth metals
	Transition metals
	Lanthanides
	Actinides
	Poor metals
	Semi-metals
	Non-metals
	Noble gases

57 <b>La</b> Lanthanum 138.9	58 <b>Ce</b> Cerium 140.1	59 <b>Pr</b> Praseodymium 140.9	60 <b>Nd</b> Neodymium 144.2	61 <b>Pm</b> Promethium 147.0	62 <b>Sm</b> Samarium 150.4	63 <b>Eu</b> Europium 152.0	64 <b>Gd</b> Gadolinium 157.3	65 <b>Tb</b> Terbium 158.9	66 <b>Dy</b> Dysprosium 162.5	67 <b>Ho</b> Holmium 164.9	68 <b>Er</b> Erbium 167.3	69 <b>Tm</b> Thulium 168.9	70 <b>Yb</b> Ytterbium 173.0	71 <b>Lu</b> Lutetium 175.0
89 <b>Ac</b> Actinium 132.9	90 <b>Th</b> Thorium 232.0	91 <b>Pa</b> Protactinium 231.0	92 <b>U</b> Uranium 238.0	93 <b>Np</b> Neptunium 237.0	94 <b>Pu</b> Plutonium 242.0	95 <b>Am</b> Americium 243.0	96 <b>Cm</b> Curium 247.0	97 <b>Bk</b> Berkelium 247.0	98 <b>Cf</b> Californium 251.0	99 <b>Es</b> Einsteinium 254.0	100 <b>Fm</b> Fermium 253.0	101 <b>Md</b> Mendelevium 256.0	102 <b>No</b> Nobelium 254.0	103 <b>Lr</b> Lawrencium 257.0



Early chemists describe the first dirt molecule.

## Interesting Facts:

- More than 90% of the atoms in your body are either nitrogen (N), oxygen (O), carbon (C), or hydrogen (H).
- Only 30 elements are important for living organisms.

# A. Periodic Table Information

The image shows three periodic table tiles. The top tile is for Helium (He), with labels pointing to its atomic number (2), chemical symbol (He), and atomic mass (4). Below it are two more tiles: Fluorine (F) with atomic number 9 and atomic mass 19.00, and Neon (Ne) with atomic number 10 and atomic mass 20.18.

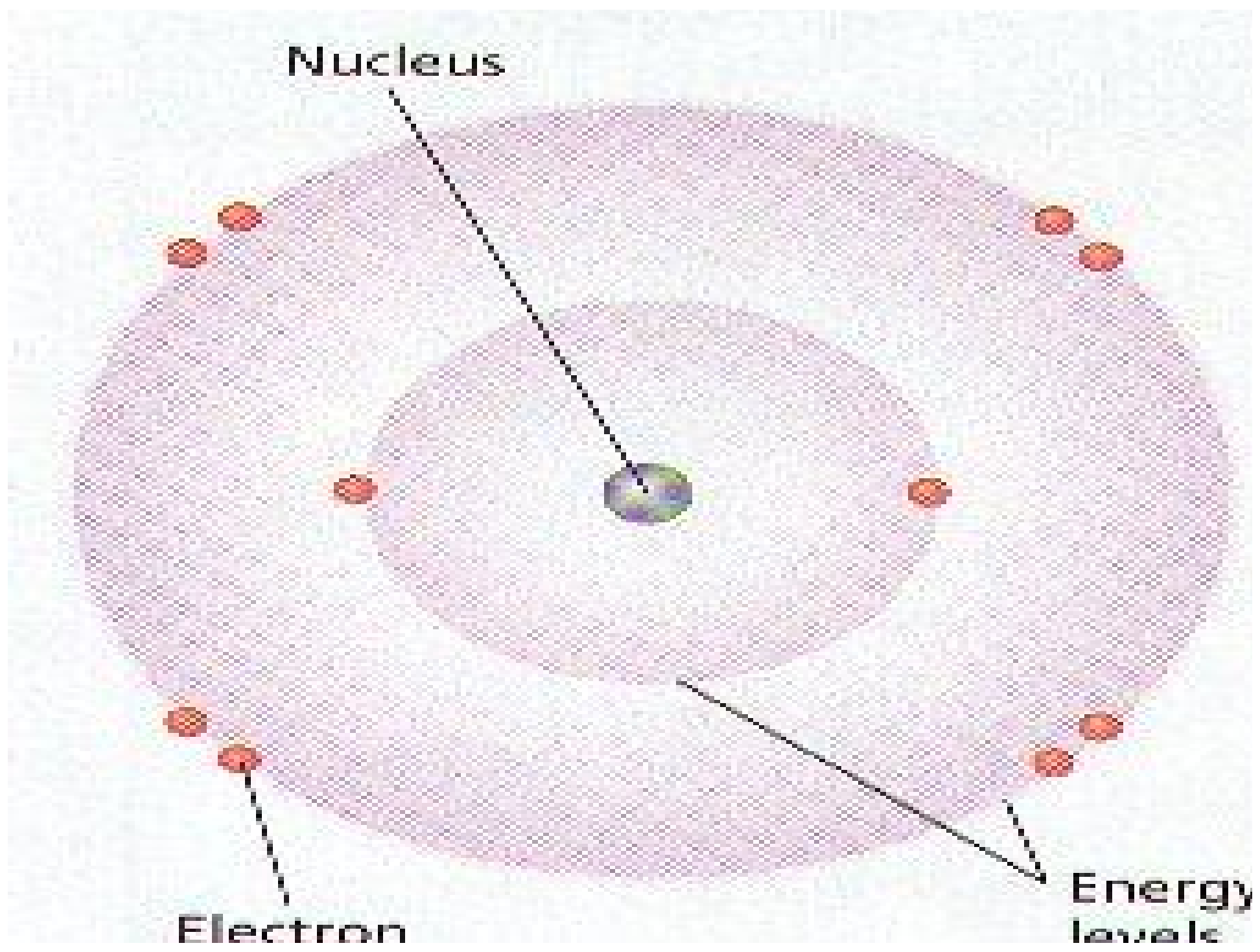
Atomic number	2
Chemical symbol	He
Atomic mass	4

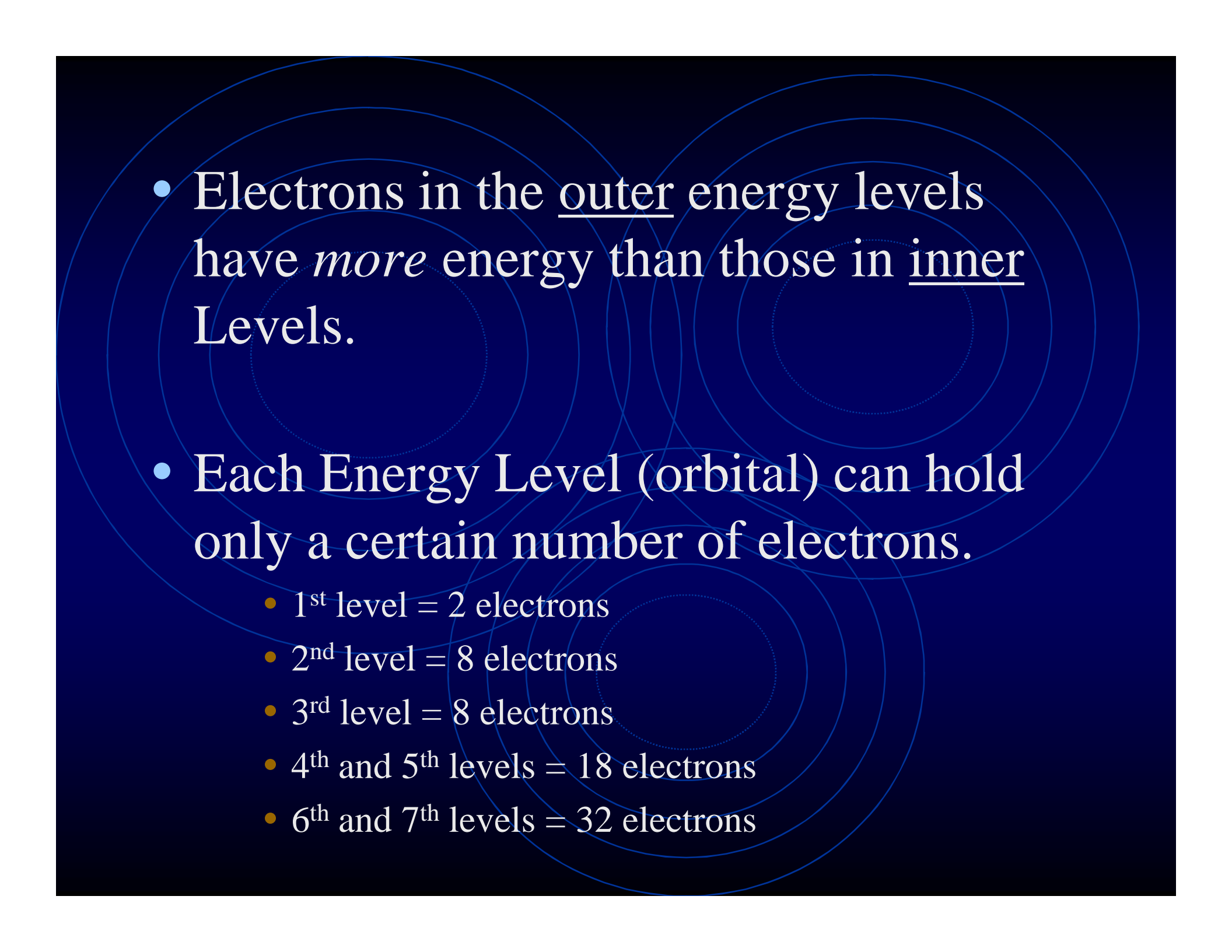
9	10
F	Ne
Fluorine	Neon
19.00	20.18

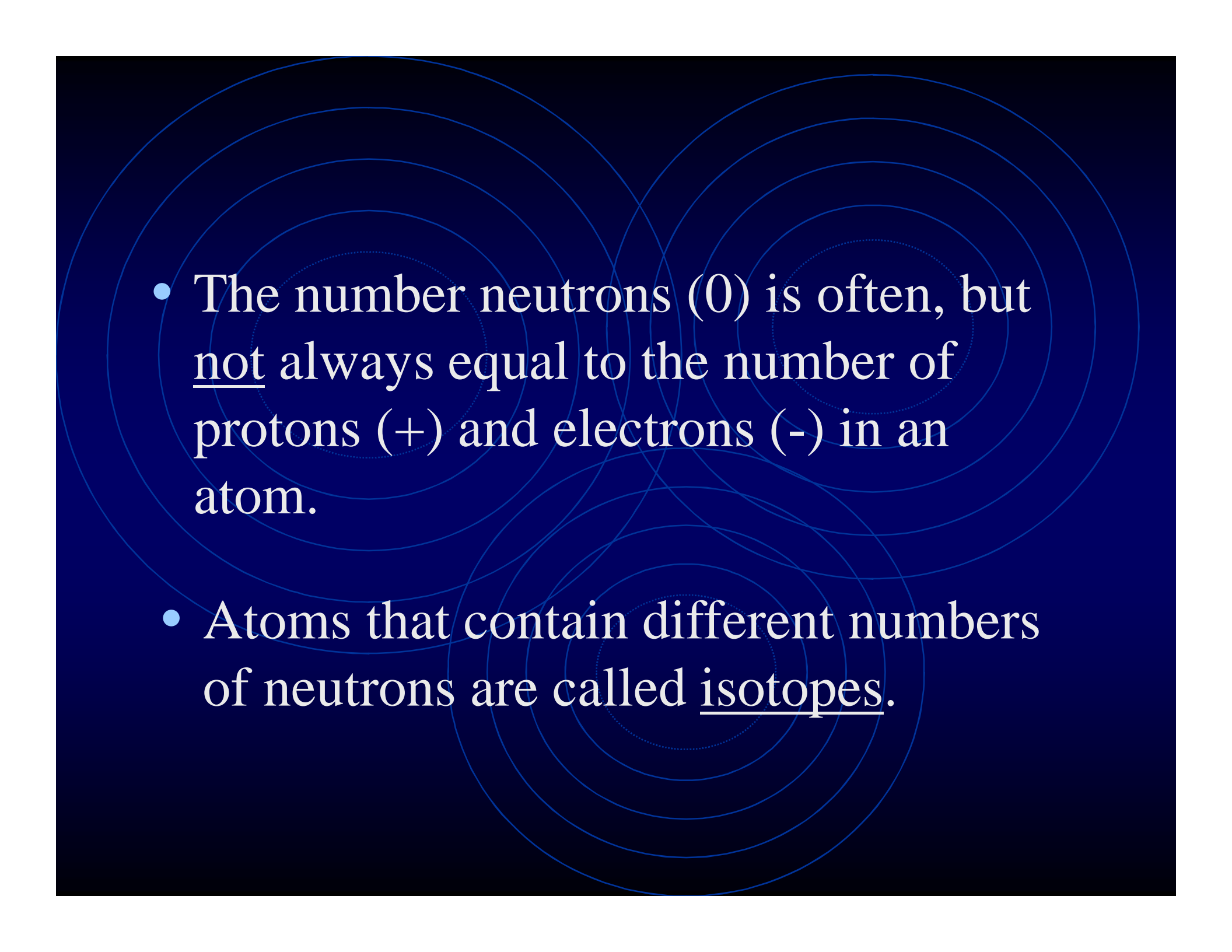
- 1. Atomic Number**  
(# of protons)
- 2. Chemical Symbol**  
(1-3 letter abbreviations)
- 3. Atomic Mass**  
(# of protons & neutrons)

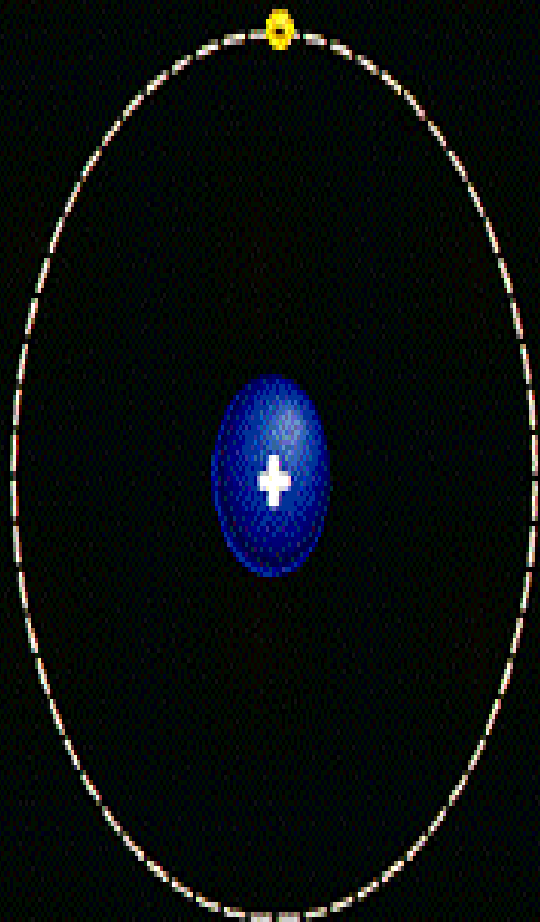
- Most of the time the number of protons (+) and electrons (-) are equal in the atom so it has a net charge of 0.
- When an atom gains an electron it is called a negative ion and when an atom loses an electron it is called a positive ion.
- Electrons move around the nucleus at very high speeds in one of seven different Energy Levels.



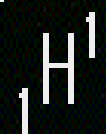


- 
- Electrons in the outer energy levels have *more* energy than those in inner Levels.
  - Each Energy Level (orbital) can hold only a certain number of electrons.
    - 1<sup>st</sup> level = 2 electrons
    - 2<sup>nd</sup> level = 8 electrons
    - 3<sup>rd</sup> level = 8 electrons
    - 4<sup>th</sup> and 5<sup>th</sup> levels = 18 electrons
    - 6<sup>th</sup> and 7<sup>th</sup> levels = 32 electrons

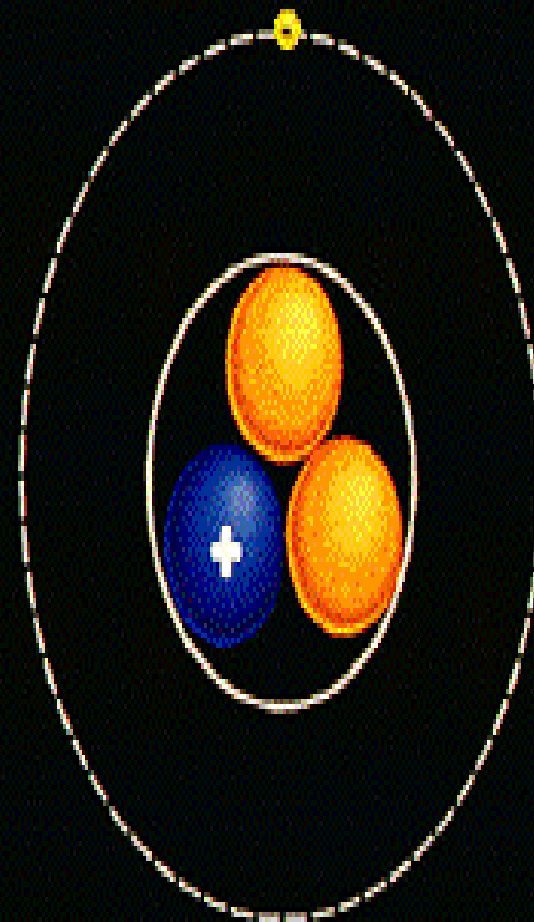
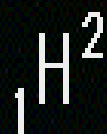
- 
- The number neutrons (0) is often, but not always equal to the number of protons (+) and electrons (-) in an atom.
  - Atoms that contain different numbers of neutrons are called isotopes.



Hydrogen



Deuterium



Tritium



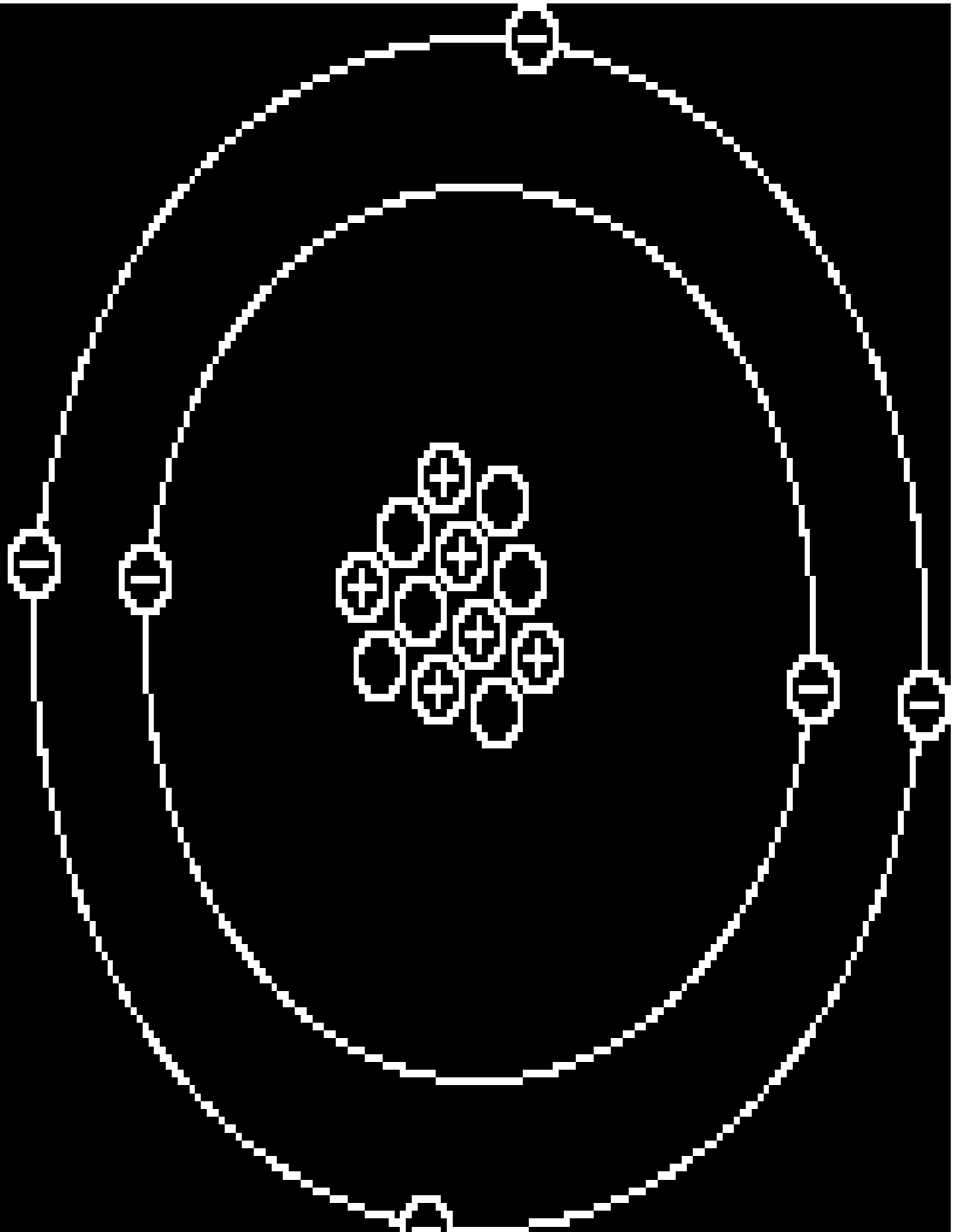
## Examples:

- Complete an atom diagram of *Carbon*.
- Complete an atom diagram of *Oxygen*.
- Complete an atom diagram of *Sodium*.
- Complete an atom diagram of *Chlorine*.

⊕ Proton

○ Neutron

⊖ Electron



# Any Questions?

“What’s the hardest task in the world? To think.”  
--Ralph Waldo Emerson

“Failure after long perseverance is much grander than never to have a striving good enough to be called a failure.”  
--George Eliot