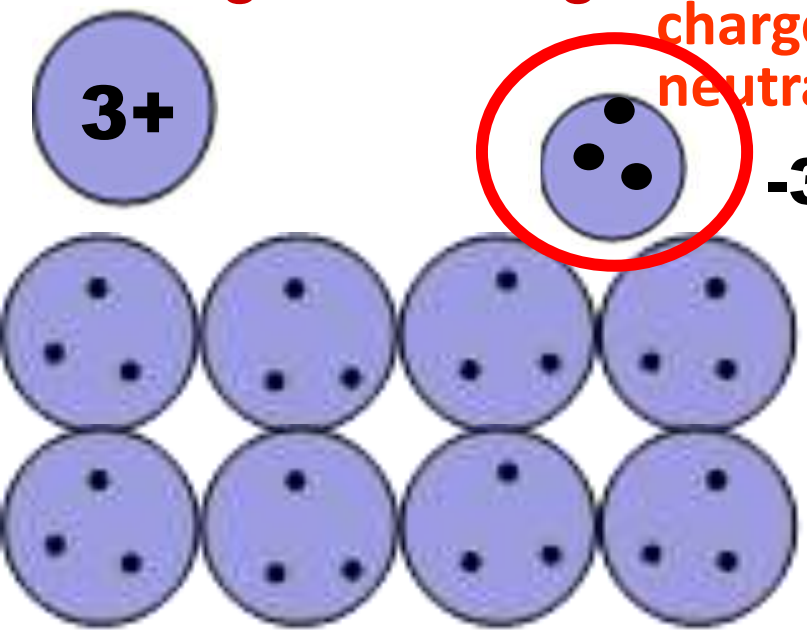
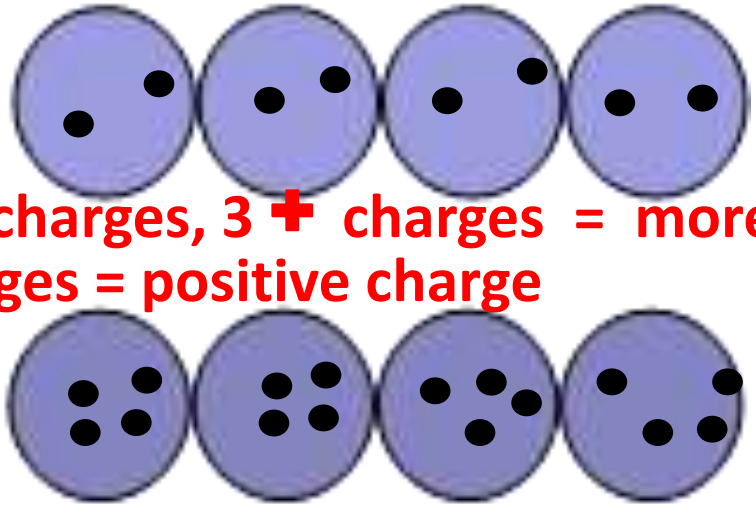
Study Guide # 4

2. To be neutral the atom must have an equal amount of positive and negative charge.

Neutral atoms: equal # of negative & positive charges. In this case, 3- charges needs 3+ charges to be neutral ([3-] + [3+] = 0)



-3 + (+3) =0



Top tape: 2- charges, 3 + charges = more positive charges = positive charge

Bottom tape: 4- charges & 3+ charges = more negatives =negative charge

Before tapes are separated

After tapes are separated

Dots represent mobile negative charges. A blue circle = positve charge.

Negative tape: have more dots (- charge) on the atoms than the neutral atom

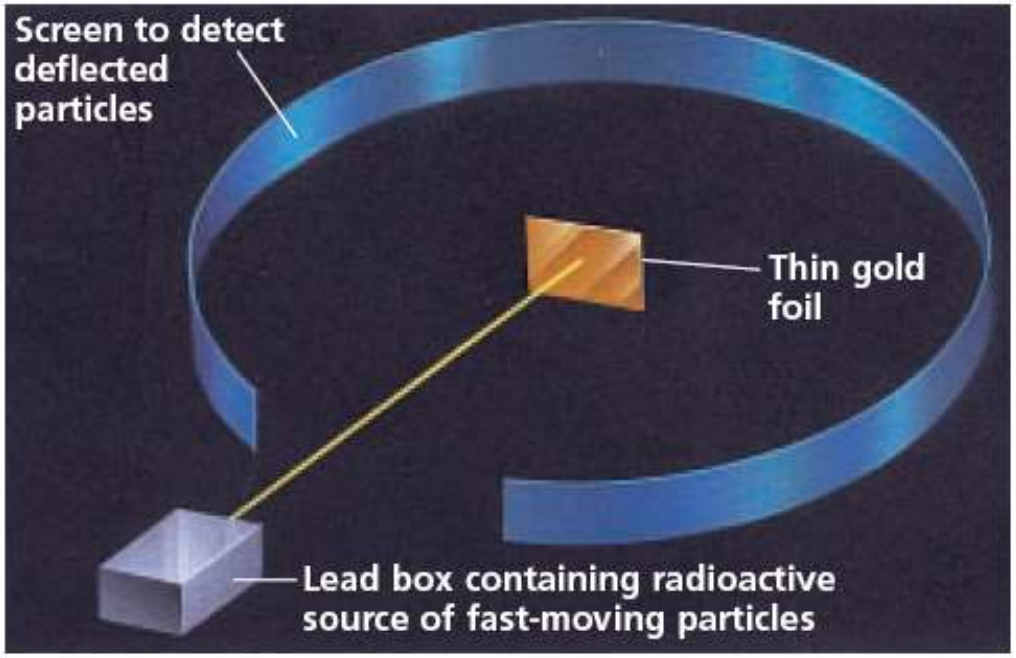
Positive tape: have less dots (- charge) on the atoms than the neutral atom

- **After the tapes separate, atoms of top tape lose charges and the atoms of the bottom tape gains negative charges.**

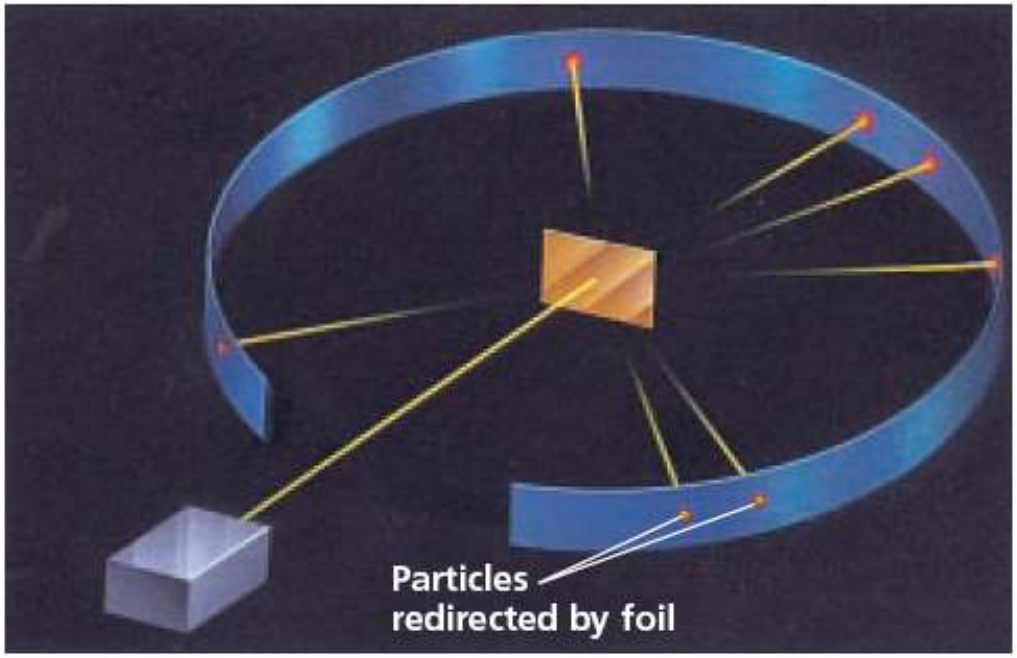
#11

In 1911 Ernest Rutherford decided to test Thompson's theory that states the atom is net neutral at any given point

He did this by shooting positively charged particles, called alpha particles, at atoms.



(a)

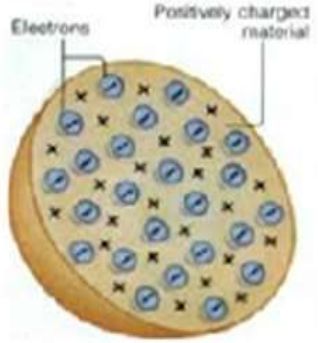


(b)

#11, Study Guide: Atomic Models

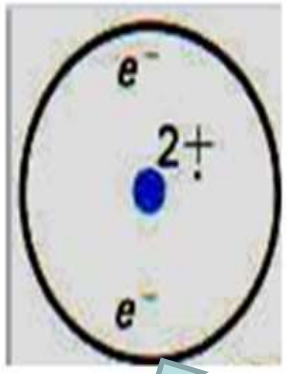
A

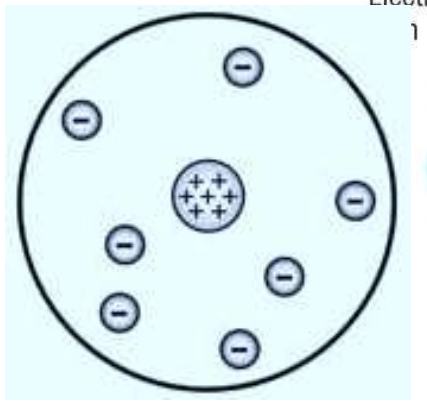
Dalton's Model

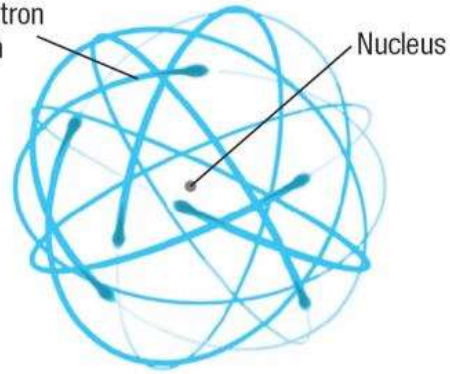


B

Thompson's Model







Rutherford's Models

- **Dalton's model has no components. Just an indestructible neutral atom.**
- **Thompson model is net neutral all through-out the atom with mobile electrons and immobile positive charge**
- **Rutherford' s experiment showed that all the positive charge and almost all the atom's mass is in a tiny nucleus located in the middle of the atom. The rest of the atom is mostly empty with space where electrons are located. Thus the charge is separated and not neutral through-out because the protons are in the nucleus (middle of atom) and the electrons are outside the nucleus.**

Study Guide

13. Nucleus: middle of the atom where the protons (positive charge) and neutrons (neutral particle) are located.

14. See next slide

15. What distinguishes one atom from another atom?

The number of protons determines each element's identity and its properties. Each element has a unique number of protons.

Atoms of different elements have different numbers of protons.

Atom of the same element have the same number of protons.

#14

Study Guide

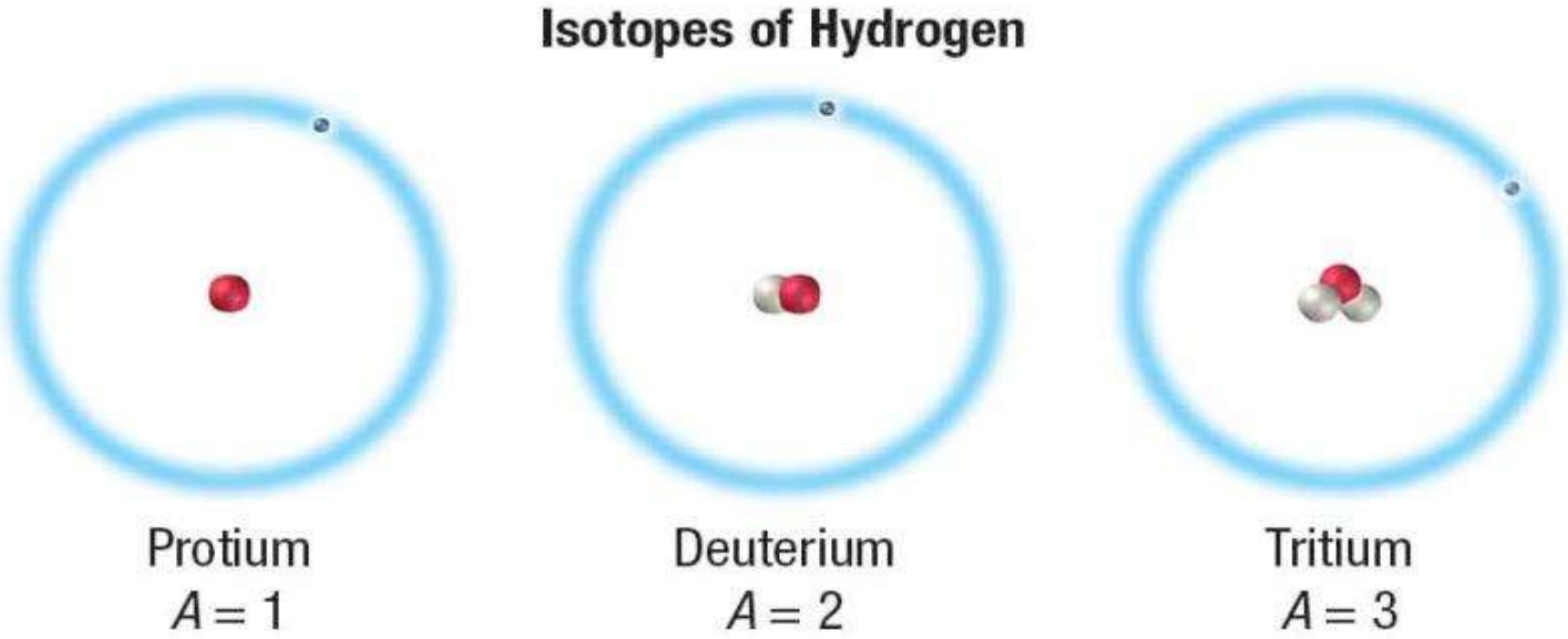
Atomic Number

- Atoms of different elements have different numbers of protons.
- Atoms of the same element all have the same number of protons.
- The atomic number of an element is the number of protons in the nucleus of that element.
- Symbol for atomic number is Z
- Example: Z= 3 means atomic # = 3

Isotopes

- **Isotopes are atoms of the same element that have different masses.**
- **The isotopes of a particular element all have the same number of protons and electrons but different numbers of neutrons.**
- Most of the elements consist of mixtures of isotopes.

Isotopes *of Hydrogen:*

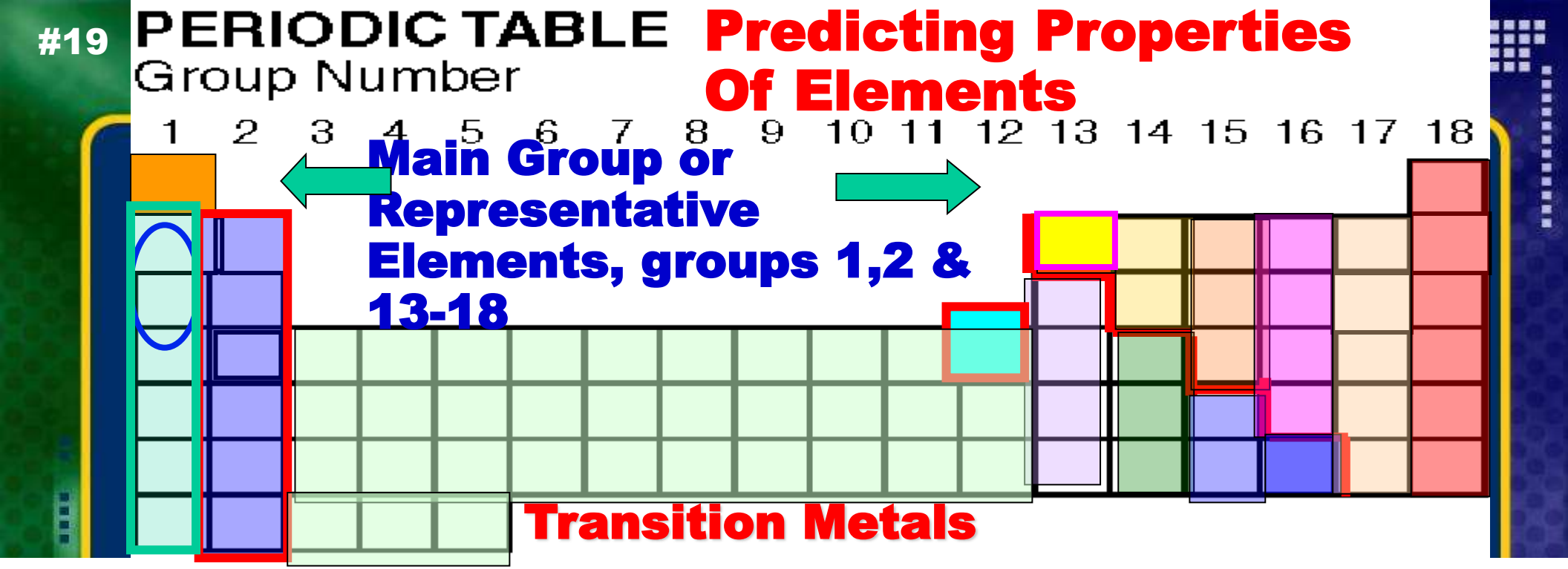


You are breathing in all of these isotopes with every breath you take because hydrogen is in the air and elements exist as mixtures of their isotopes.

#19

PERIODIC TABLE

Predicting Properties Of Elements

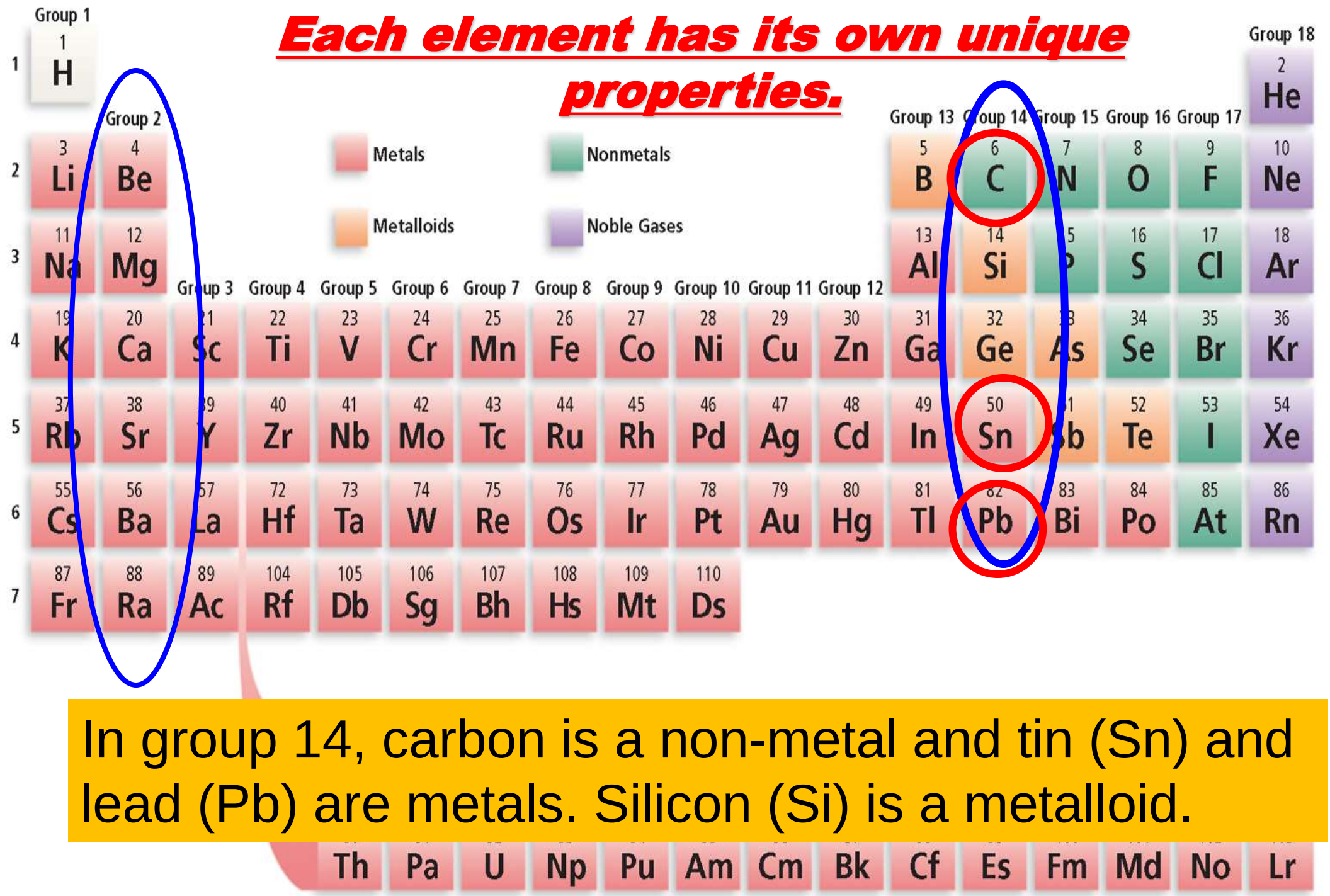


Properties of elements can be predicted from knowing the element's location on the periodic table.

Metals in the same group have the most similar properties as do non-metals in the same group.

If the elements are in different groups their properties can be predicted by knowing if the element is a metal, or non-metal.

Each element has its own unique properties.



In group 14, carbon is a non-metal and tin (Sn) and lead (Pb) are metals. Silicon (Si) is a metalloid.

Study Guide

17. Ionic substance is made up of positive (cations) and negative (anions) ions; usually metals (which are positive ions) and non-metals (which are negative ions). Example: NaCl (table salt, aka- sodium chloride) is made up of the metal ion Na^+ & the non-metal ion Cl^-

18. Molecular compound

Compound made out of non-metals. Ex: H_2O, CO_2

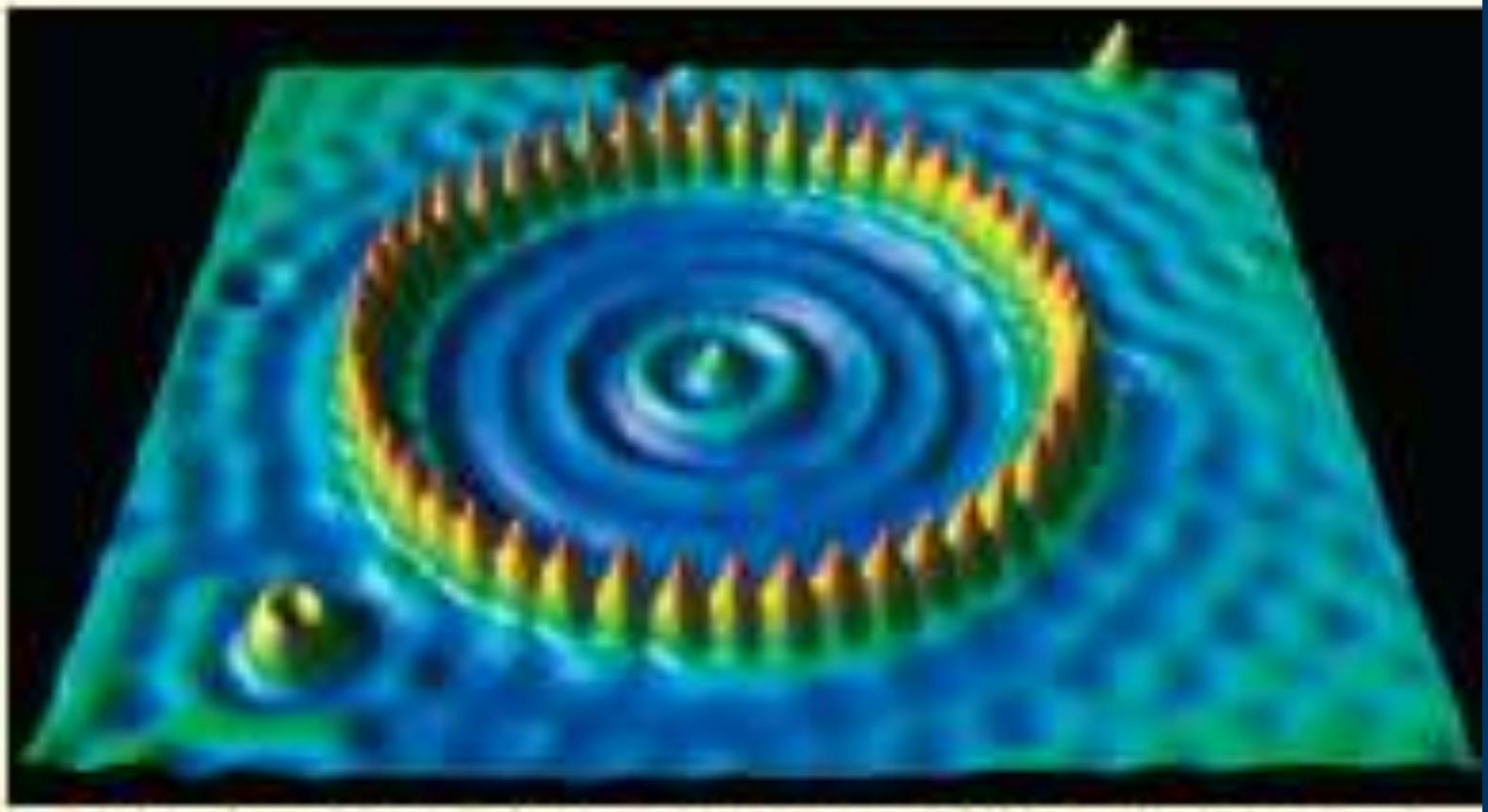
Held together by covalent bonds.

22. An ionic bond is a bond that forms between ions with opposite charges (positive & negative ions).

22. Describe a covalent bond.

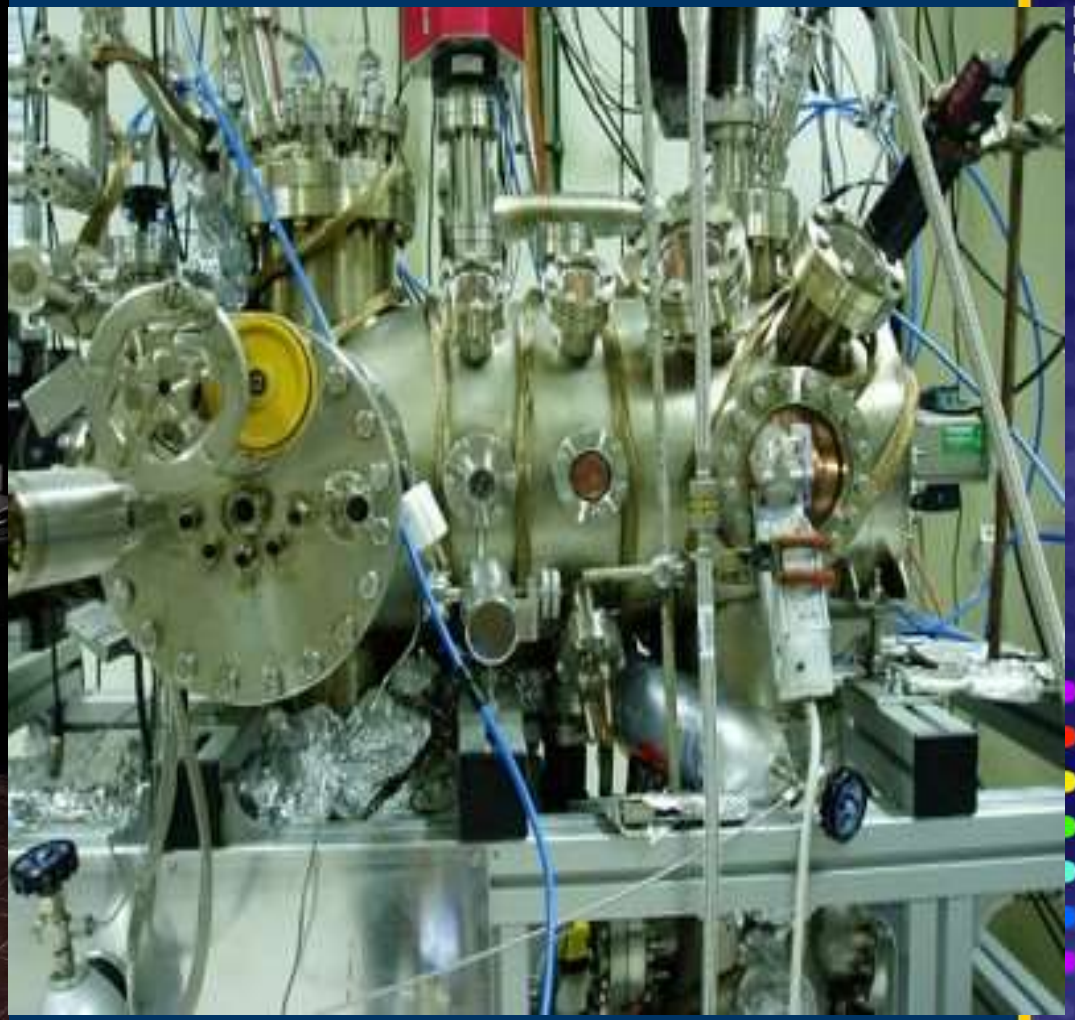
Electrons are shared by neutral elements.

• Can we see atoms?



▲ This STM image shows a "corral" of iron atoms on a copper surface.

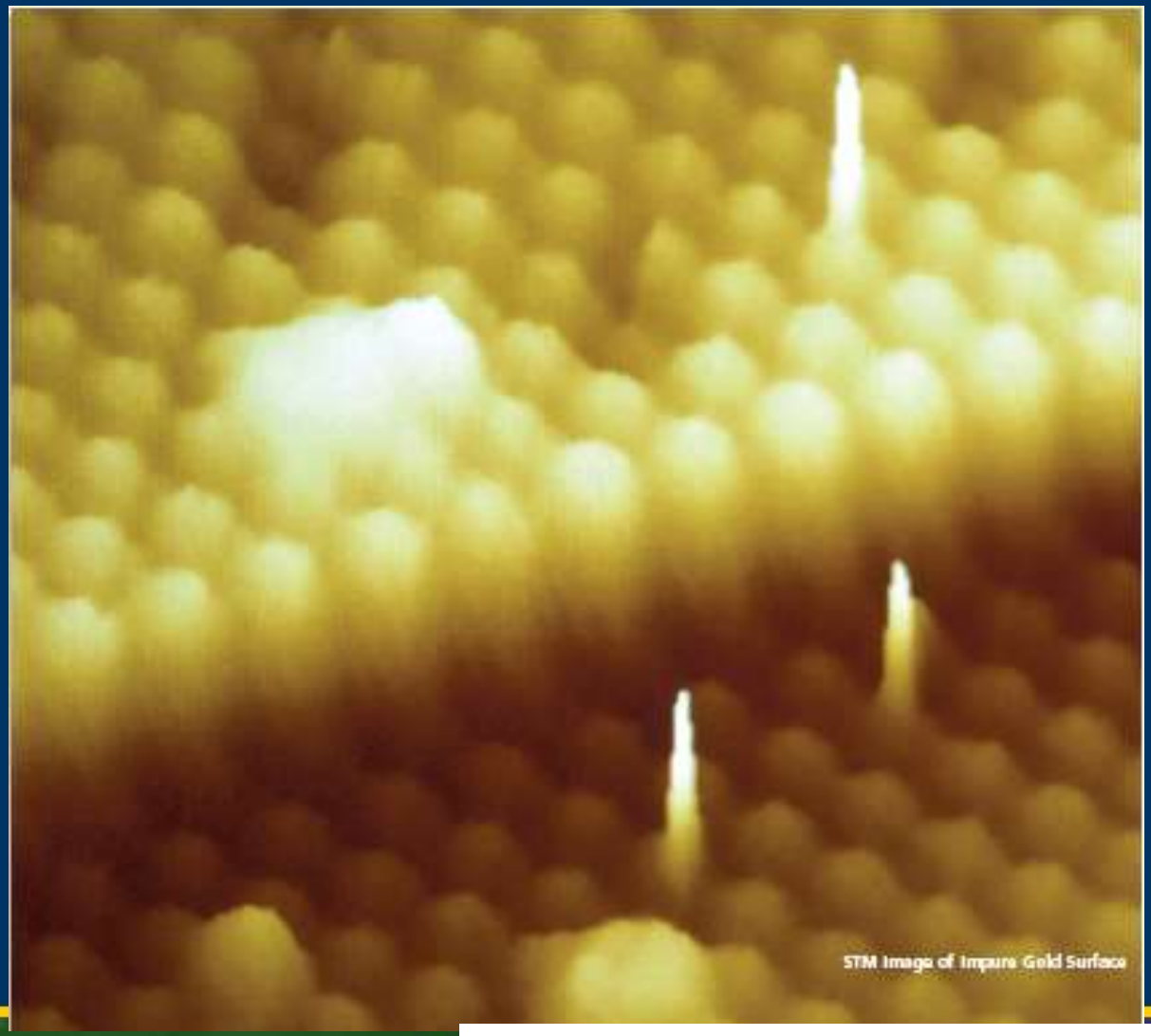
Scanning Electron Microscope



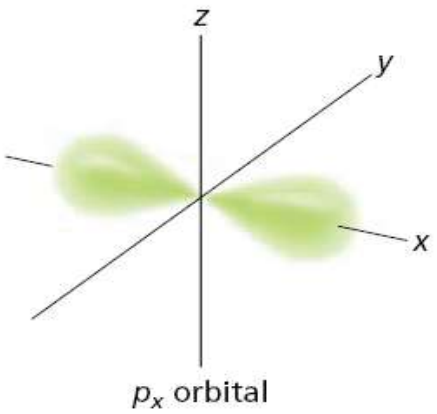
Chapter menu

Resources

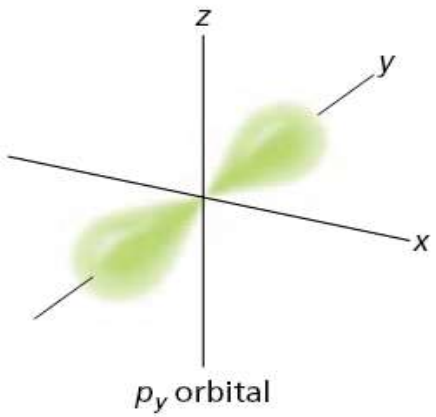
Do atoms really exist?



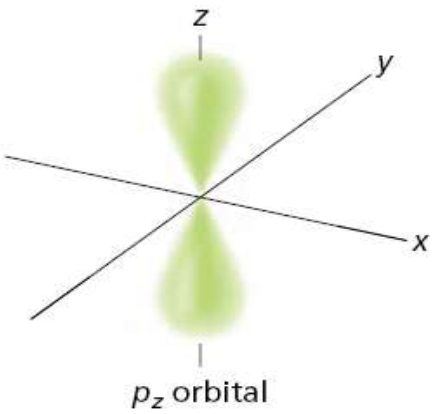
What does neon look like?



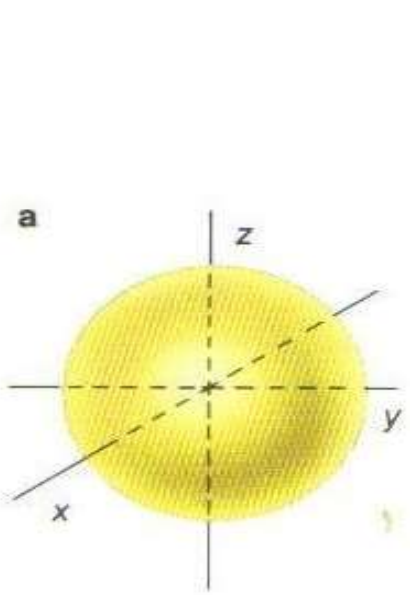
p_x orbital

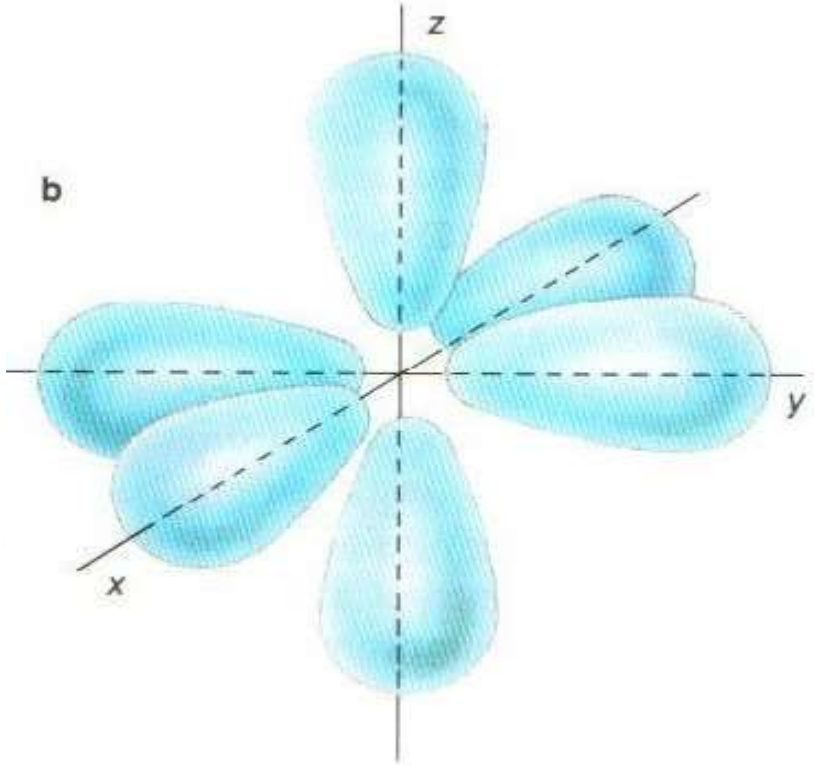


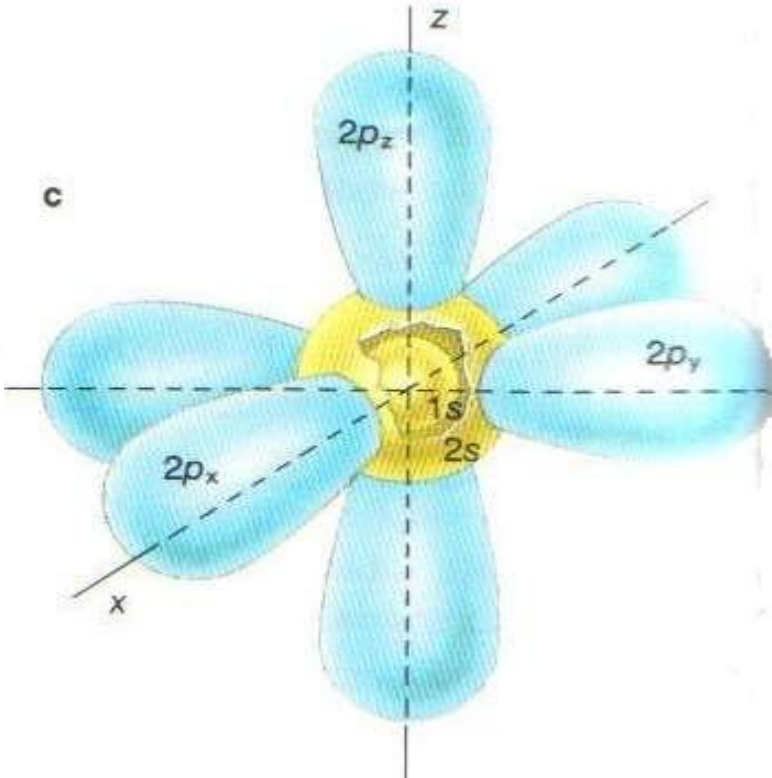
p_y orbital



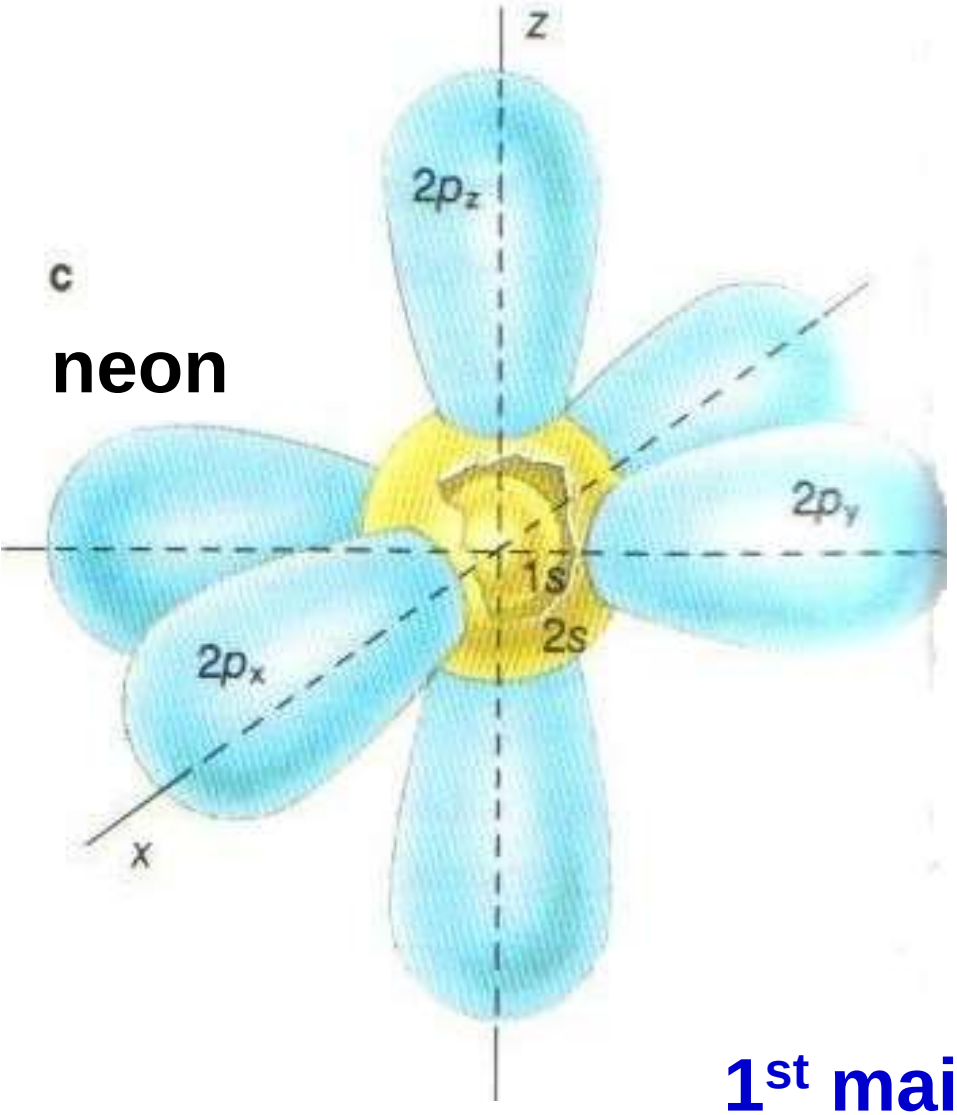
p_z orbital

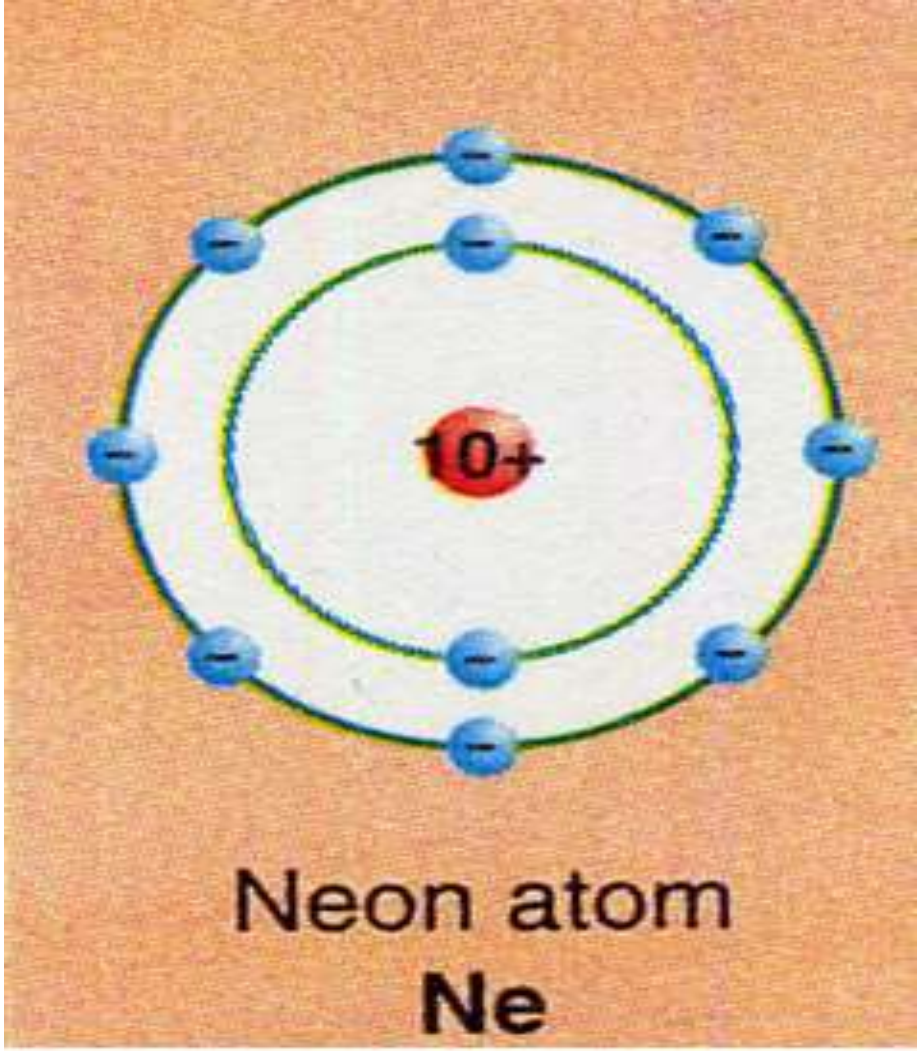






s orbital





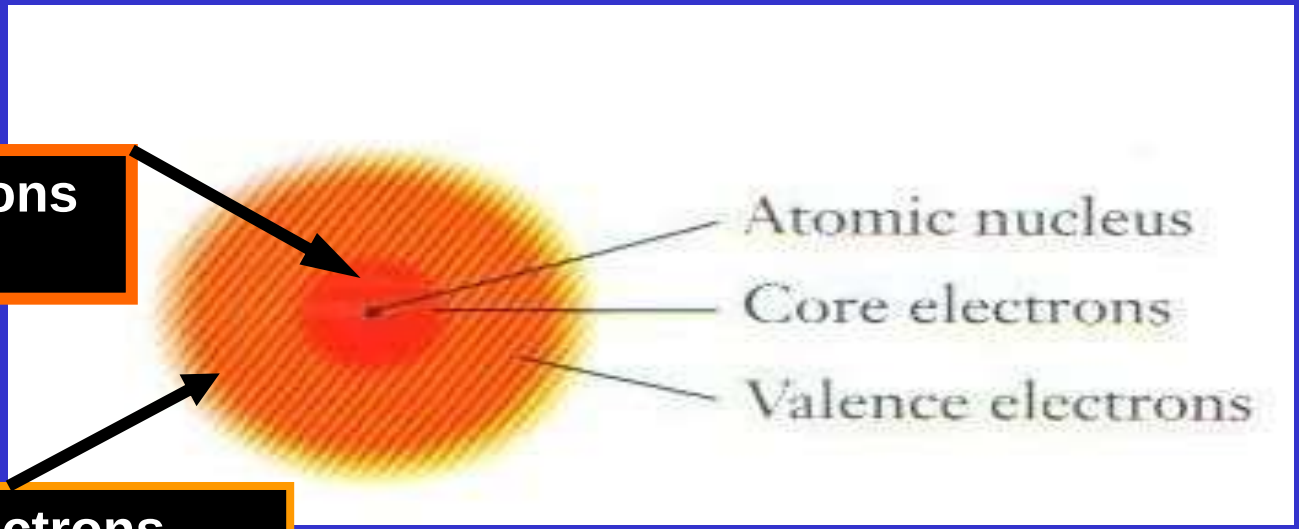
1st main energy level – 2 electrons

2nd main energy level – 8 electrons

2nd

#20 Shell Model

Electrons are filled in successive layers, from lower energy levels to higher levels.



Inner-shell (core) electrons or core electrons

Highest energy level electrons or outer level electrons

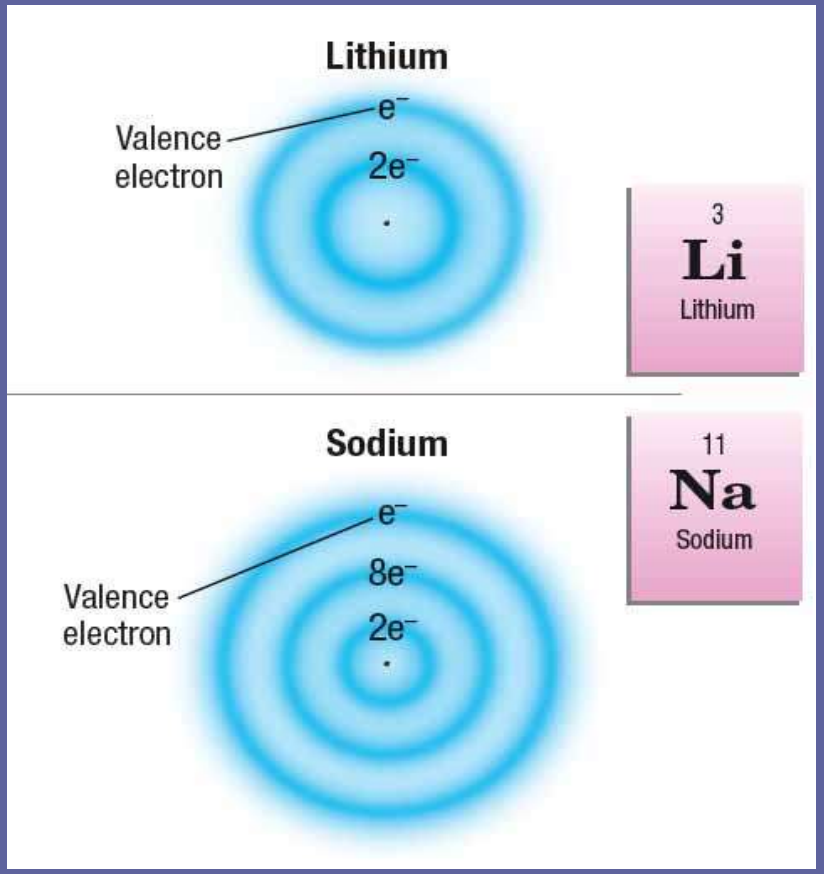
Inner-shell electrons are called **core electrons**.

Electrons at the highest occupied energy level are called valence electrons.

Valence electrons are responsible for almost all chemical properties of an element.

The Role of Electrons, *continued*

- Valence electrons account for similar properties.
- An element's location in the periodic table is related to electron arrangement.
  - Example: Lithium and sodium, in Group 1, each have one valence electron.



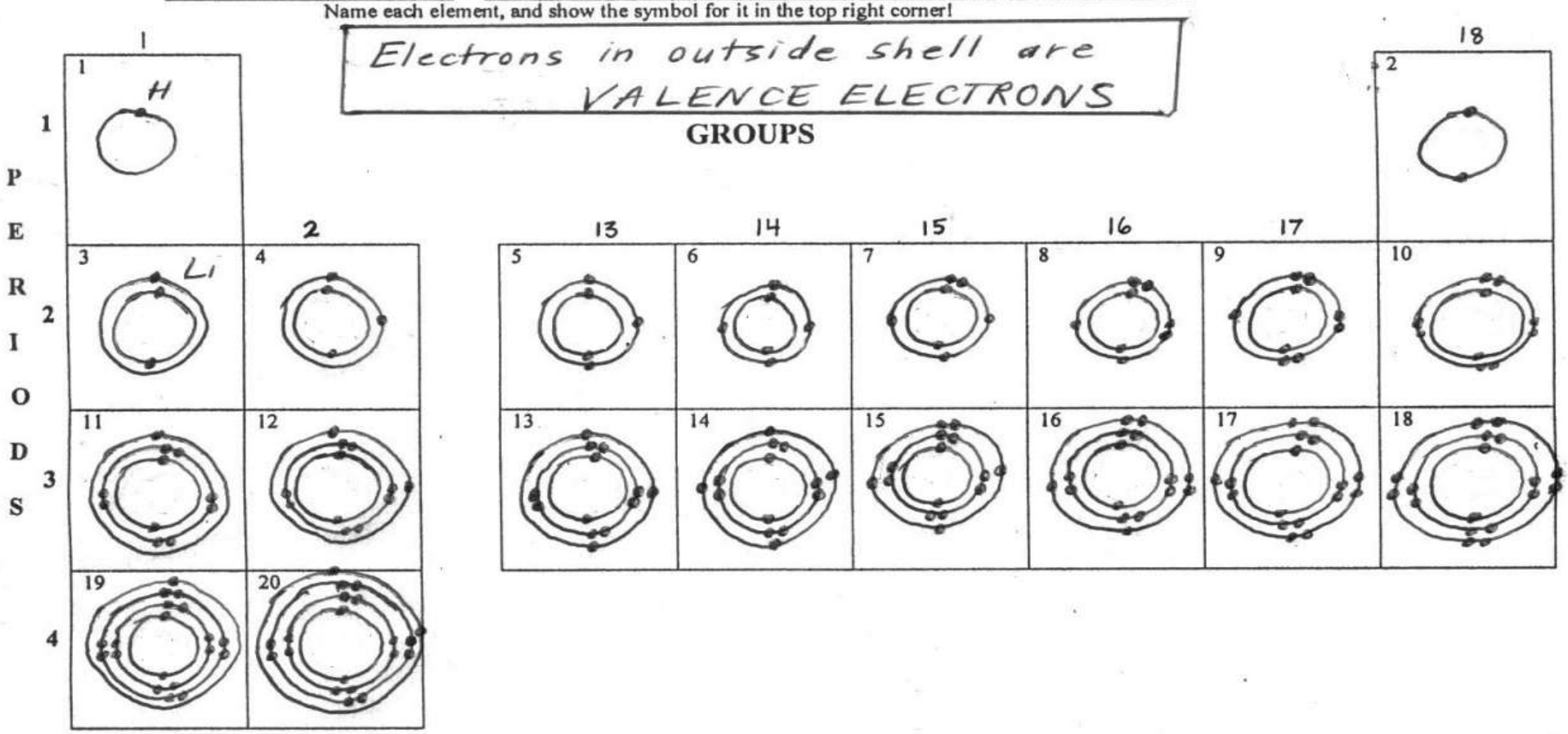
#21

BOHR ORBITAL ACTIVITY: COMPLETE THE BOHR DIAGRAMS FOR THE FIRST 20 ELEMENTS

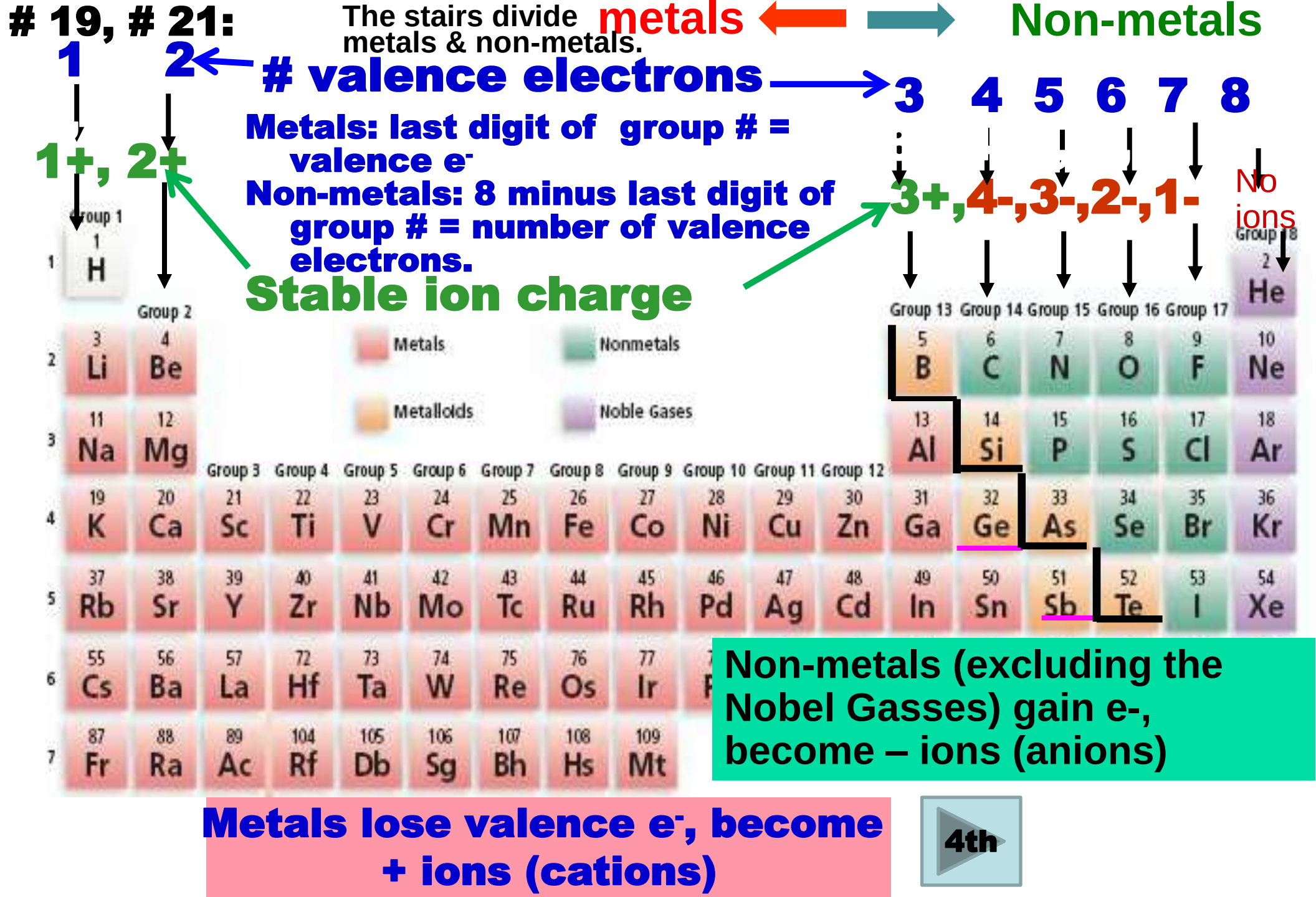
Name each element, and show the symbol for it in the top right corner!

Electrons in outside shell are VALENCE ELECTRONS

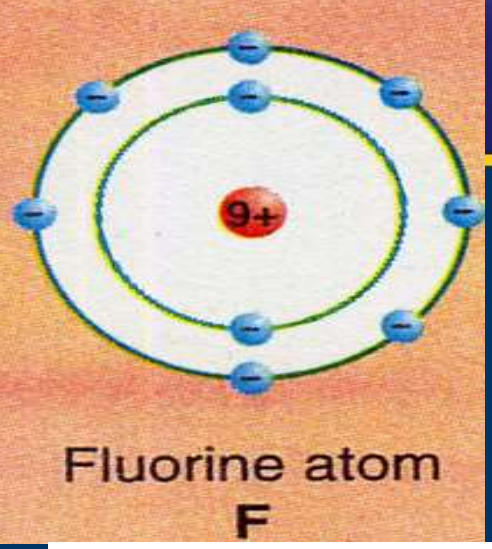
GROUPS



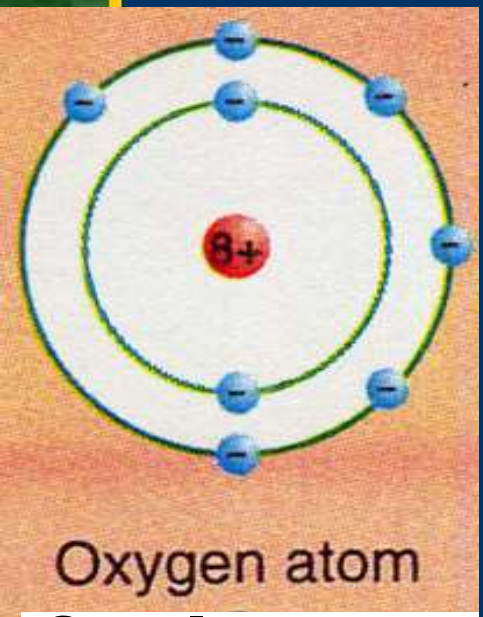
The reason the periodic table predicts the properties of element in the same group (column) is that elements in the same group all have the same number of valence electrons (outer electrons).


19, # 21:
The stairs divide metals & non-metals.
metals
Non-metals
1
2
valence electrons
3 4 5 6 7 8
Metals: last digit of group # = valence e-
Non-metals: 8 minus last digit of group # = number of valence electrons.
1+, 2+
3+,4-,3-,2-,1-
No ions
Stable ion charge
Group 1
Group 2
Group 13 Group 14 Group 15 Group 16 Group 17
Group 18
Metals
Nonmetals
Metalloids
Noble Gases
Group 3 Group 4 Group 5 Group 6 Group 7 Group 8 Group 9 Group 10 Group 11 Group 12
H He
Li Be B C N O F Ne
Na Mg Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
Cs Ba La Hf Ta W Re Os Ir
Fr Ra Ac Rf Db Sg Bh Hs Mt
Non-metals (excluding the Nobel Gasses) gain e-, become – ions (anions)
Metals lose valence e-, become + ions (cations)
4th

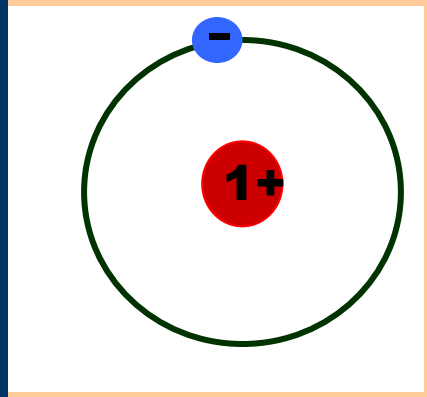
22: Covalent Bonds - non-metals sharing electrons



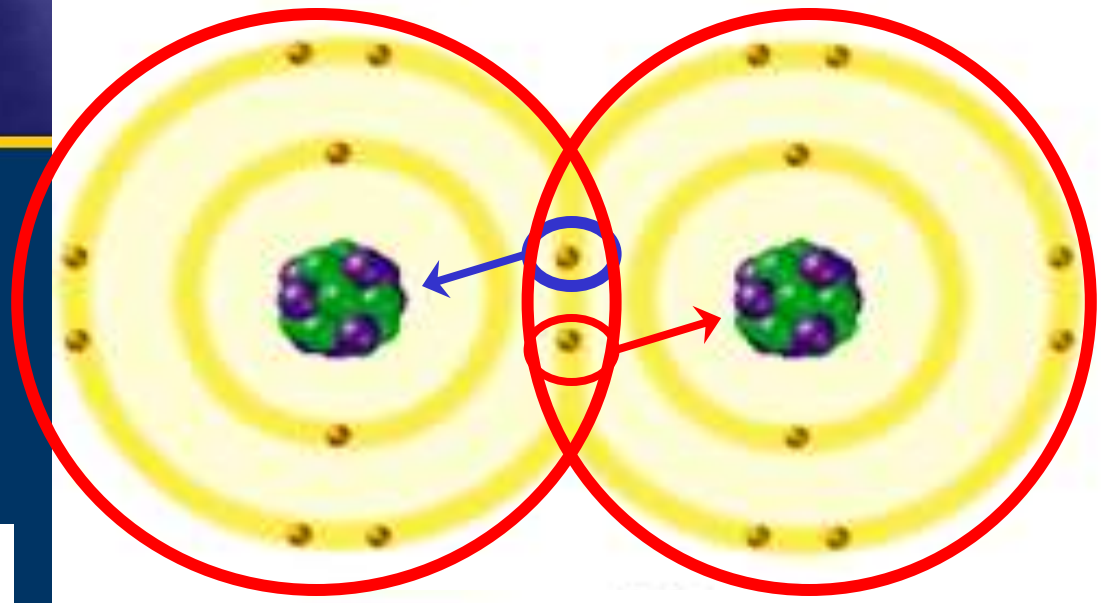
Fluorine has 7 valence electrons



6 valence electrons



1 valence electrons



F_2, fluorine