ATOMIC STRUCTURE

Ch 4

Objectives

- Identify three types of subatomic particles.
- Describe the structure of atoms.
- Explain what makes elements and isotopes different from each other.
- Calculate the atomic mass of an element.

Subatomic Particles

Particle	Charge	Mass (g)	Location
Electron (e⁻)	-1	9.11×10^{-28}	Electron cloud
Proton (p)	+1	1.67×10^{-24}	Nucleus
Neutron (n)	0	1.67×10^{-24}	Nucleus

Atoms

- Atomic number = number of protons
  - Different # protons = different elements
- In a neutral atom, protons = electrons
- Mass number = protons PLUS neutrons
  - Mass number is <u>NOT</u> atomic mass
  - You CANNOT find mass number on periodic table

Symbols

- Contain the symbol of the element, the mass number and the atomic number.

Superscript →   **Mass number**   Charge

$$X$$

Subscript →   Atomic number
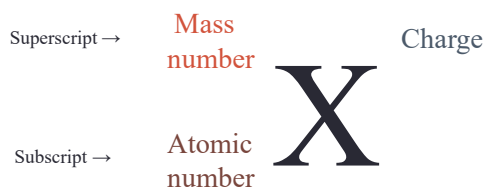
Element	p	n	e⁻	Atomic #	Mass #
Fe		30			
		16		15	
	82				207

Now write the symbols for each of these elements

Isotopes

- Isotope—atoms with same # protons (same element) but different # neutrons
- Behave similarly (neon isotopes behave like neon) because of protons and electrons
- ^1H = hydrogen, ^2H = deuterium, ^3H = tritium

Element	p	n	e⁻	Atomic #	Mass #
^{16}O					
^{18}O					
		12		12	
	12				26

Ions

- Ion—atom with a charge
- Atoms gain or lose e⁻ to become ions
  - Lose e⁻ results in positive charge
  - Gain e⁻ results in negative charge
- Fluorine gains 1 e⁻ to become fluoride ion
  - Written as F^-, F^{-1}, F^{1-}
- Magnesium loses 2 e⁻ to become magnesium ion
  - Written as Mg^{2+}, Mg^{+2}

Ion	Charge	p	n	e⁻	Atomic #	Mass #
Cl⁻			19			
Be²⁺						9
		8		10		16
	+1		48		37	
	-3			10		14
Cr³⁺			26			

Investigation

- Determine the average mass of one vegetable piece.
- Show and label all calculations
- 1 paper per group

Challenge

- If I have a 500.00 g sample of vegetable matter, what mass should be corn?

Atomic Mass Unit (amu)

- 1 amu = $\frac{1}{12}$ carbon-12 atom
- 1 amu ~ 1 proton or 1 neutron
- But not exactly!

Average Atomic Mass Example

- If 90% of the people in this room have $20 and 10% have $0, what is the average amount each person has?
  - Need to calculate weighted average
  - $20•(0.9) + $0•(0.1)
    - $18

Average Atomic Mass Problem 1

- A silver coin is composed of 51.48% silver-107 (^{107}Ag) and 48.16% silver-109 (^{109}Ag). Calculate the average atomic mass.

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Average Atomic Mass Problem 2

- Element X has two natural isotopes. ^{10}X has a mass of 10.012 amu and an abundance of 19.91%. ^{11}X has a mass of 11.009 amu and an abundance of 80.09%. Calculate the average atomic mass of X.

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Average Atomic Mass Problem 3

- Oxygen has three naturally occurring isotopes. ^{16}O has a relative abundance of 99.759%, ^{17}O has an abundance of 0.037%, and ^{18}O has an abundance of 0.204%. Calculate the atomic mass of oxygen.

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