

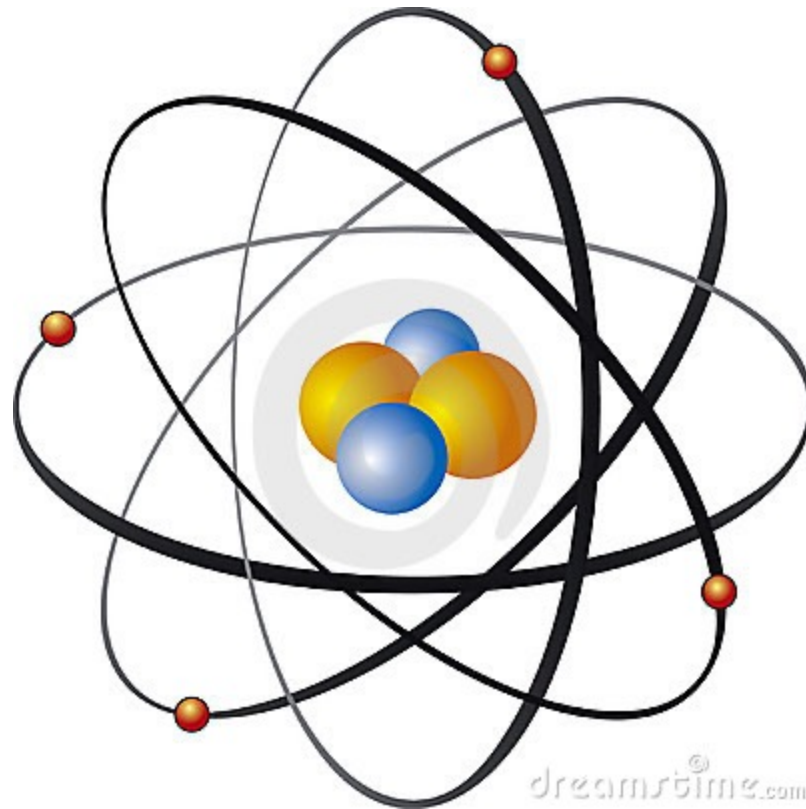
Chapter 2

Chem 121

Lecture 3

Atoms

@chem317phys



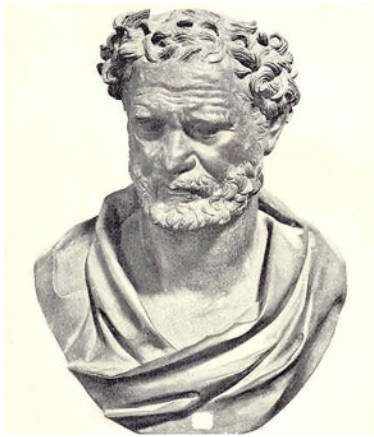


General Chemistry

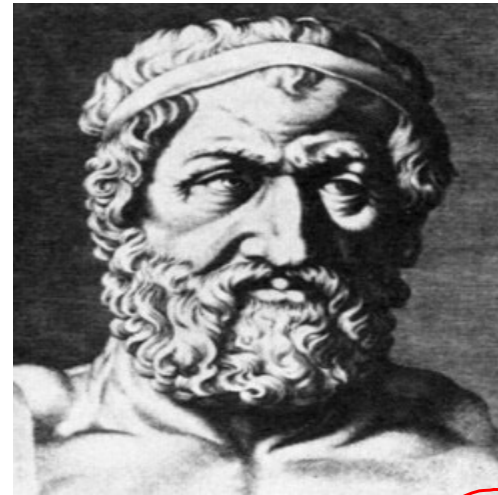
- OUTLINE

- 1 Introduction
- 2 Elements and compounds
- 3 Dalton's theory
- 4 Isotopes

2.1 Introduction



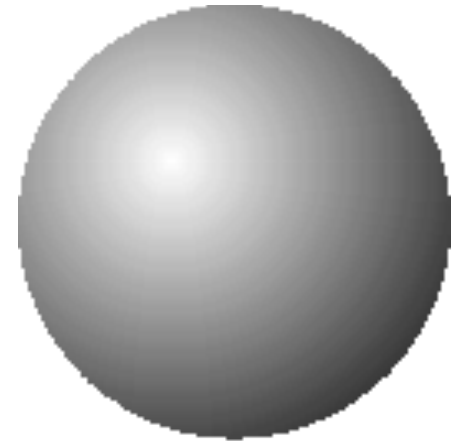
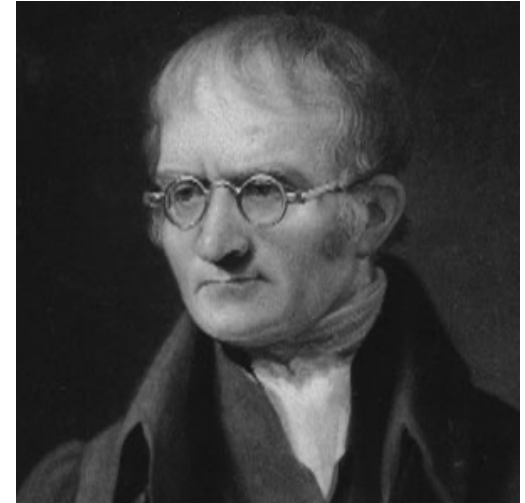
According to Democritus (460 BC) Matter is made up of very small particles called atoms and these atoms can't be divided



According to Zeno Alea he didn't believe in atoms at all and he believed that matter is infinitely divisible.

2.3 Dalton's Atomic theory

- **1.** An element is composed of extremely small, **indivisible particles** called **atoms**.
- **2.** All atoms of a given element have **identical properties** that **differ from those of other elements**.
- **3.** Atoms cannot be **created, destroyed, or transformed** into **atoms of another element**.
- **5.** **The relative numbers and kinds of atoms are constant** in a **given compound**.

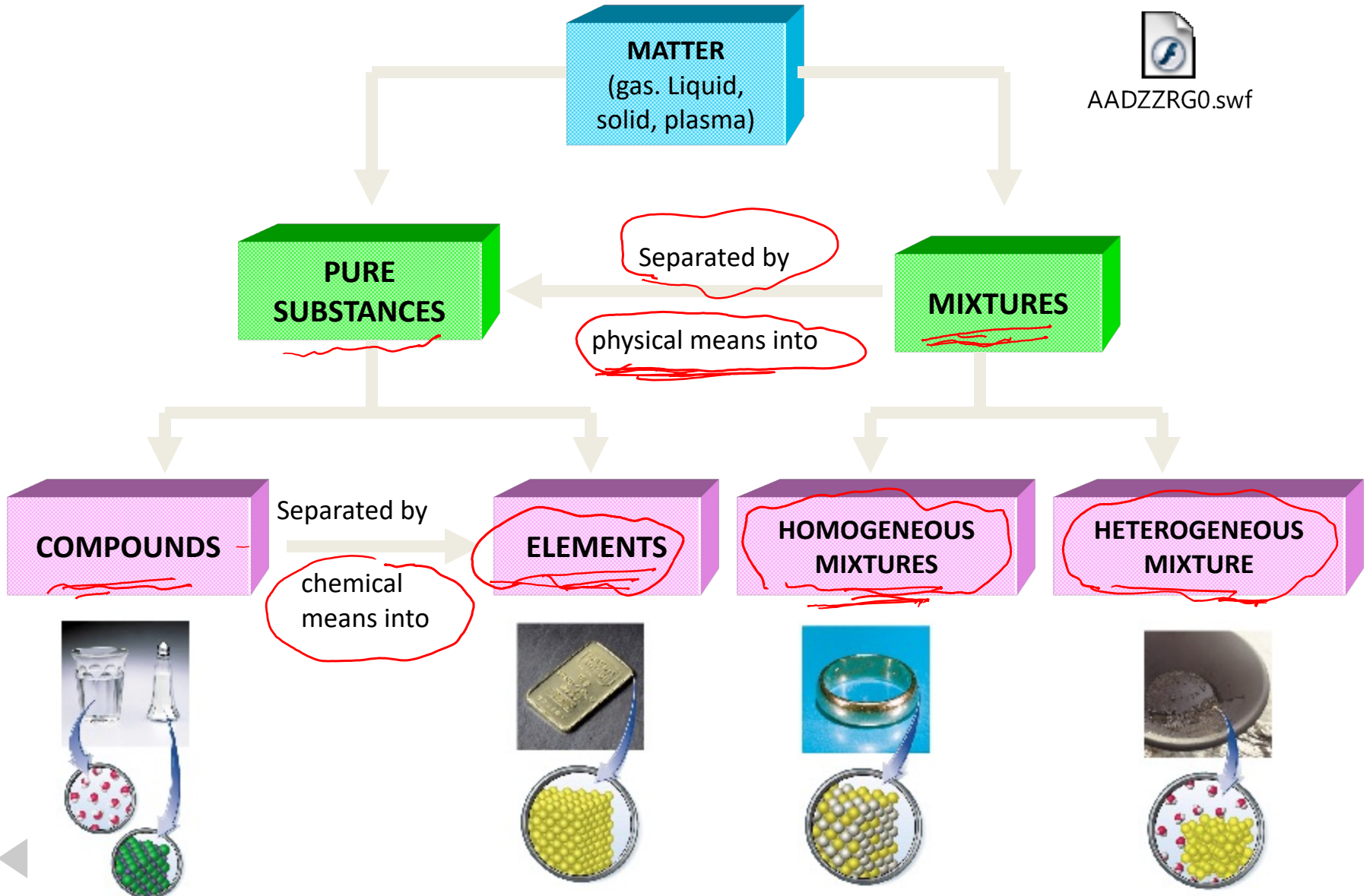


Dalton
1803-1805

2.2 Classification of Matter



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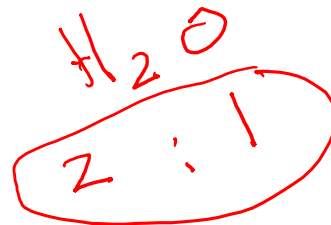


2.2 Classification of Matter

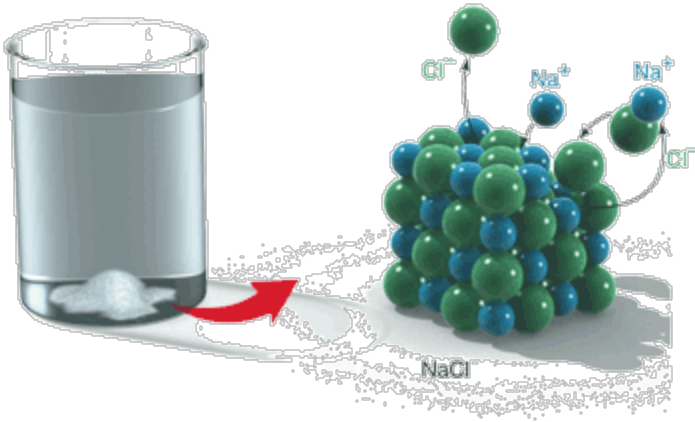
- **1- Element:** is the pure substance that consists of identical atoms.



- **2- Compounds:** is a pure substance made up of 2 or more elements in a fixed ratio by mass.

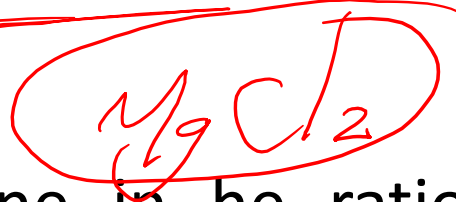


A . Compounds



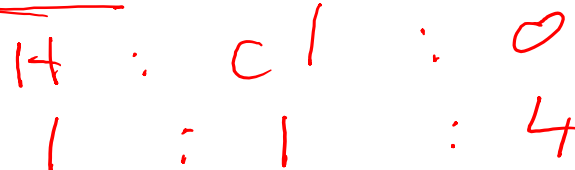
The formula of the compound gives the ratios of the compounds constituent elements and identify each element by its atomic symbols.

- **Example 1:**

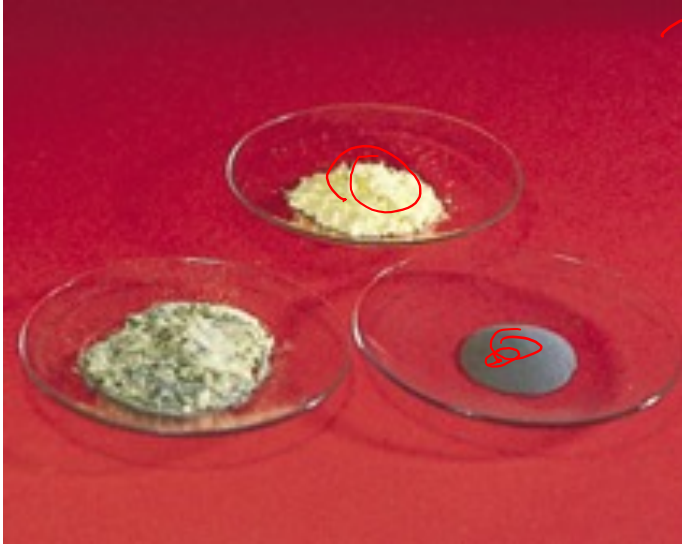


- Mg and Cl combine in the ratio 1:2 to form magnesium fluoride? what is the formula of the compound? MgCl₂

- The formula of perchloric acid is HClO₄. what are the combining ratios of the elements in perchloric acid:



C. Mixture



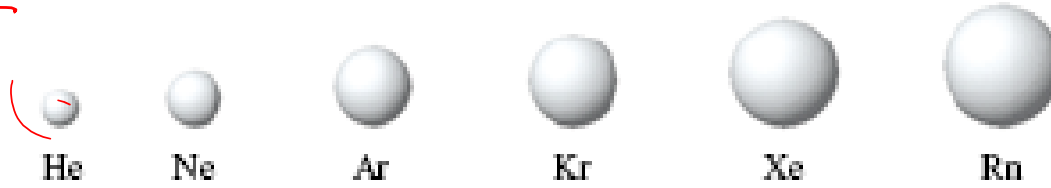
- A mixture is a combination of two or more pure substance. (e.g. blood, butter, gasoline, soap and the metal in wedding ring)
- The difference between a compound and the mixture is that the ratios by mass of the elements in a compound are fixed, whereas in a mixture the substance can be present in any mass ratio.

<u>Compound</u>	<u>Mixture</u>
<u>Fixed composition</u>	<u>Variable composition</u>
<u>Properties do not vary</u>	<u>Components</u> retain their <u>characteristic properties</u>
Cannot be separated into simpler substances by <u>physical methods</u>	May be separated into pure substances by <u>physical methods</u>
Can only be changed in identity and properties by <u>chemical methods</u>	Mixtures of <u>different compositions</u> may <u>have widely different properties</u>

B. Monatomic, Diatomic and Poly atomic Elements

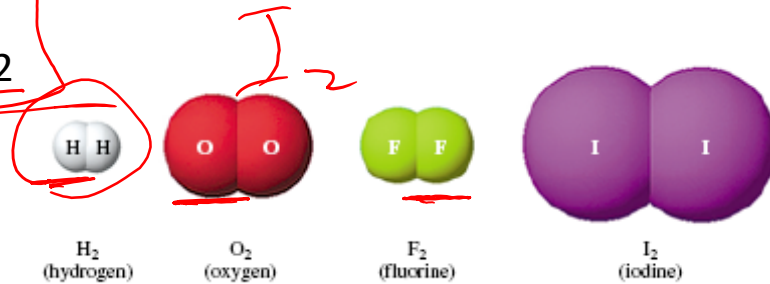
- Monatomic elements:

- Noble gases He, Ne, Ar, Kr, Xe, and radon



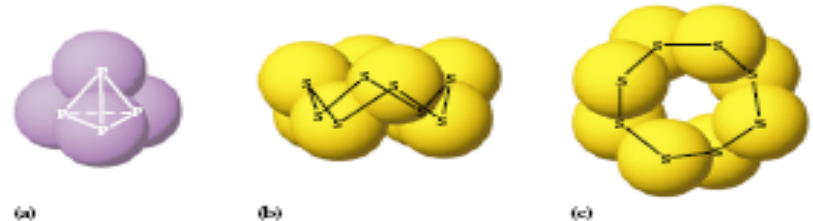
- Diatomic elements:

- H₂, N₂, O₂, F₂, Cl₂, Br₂ and I₂



- Polyatomic elements:

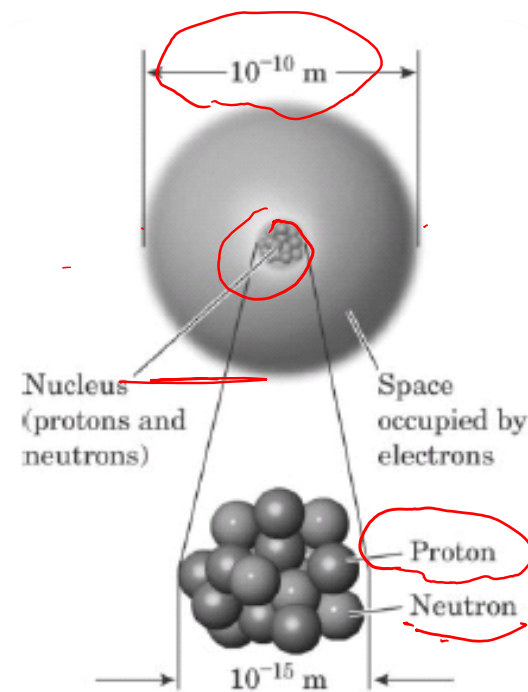
- O₃, P₄ and S₈ and diamond millions of carbon atoms bonded together.



2.4 Inside an Atom

- A Three Subatomic particles

Table 2.1		Selected Properties of the Three Basic Subatomic Particles	
Name	Charge	Mass (amu)	
Electron (e)	-1	5.4×10^{-4}	
Proton (p)	+1	1.00	
Neutron (n)	0	1.00	



$1 \text{ amu} = 1.6605 \times 10^{-24} \text{ g}$ (amu = atomic mass unit)

Protons and neutrons are found in the nucleus, and electrons are found as cloud outside the nucleus



B Mass Number and Atomic Number

- Mass number = number of protons + number of neutrons
- The number of electrons are not counted in the mass no. because there is very small.
- Atomic number = number of protons in the nucleus

136
58 e

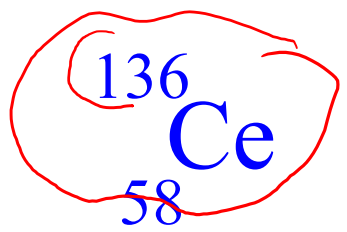
Example 2.2

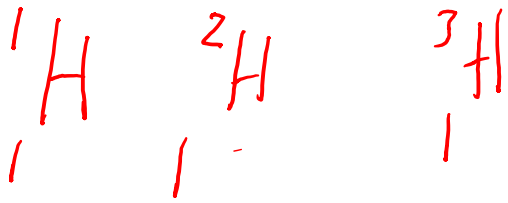
- What is the mass number of an atom containing:
- a- 58 protons, 58 electrons and 78 neutrons.
- b- 17 protons, 17 electrons and 20 neutrons.

136
- 78
= 136

37
- 17
= 20

137





D- Isotopes

- Isotopes are atoms having the same number of protons but different number of neutrons.
- The isotopes have the same chemical properties.
- Isotopes differ in the radioactivity properties.
- Most elements are found in nature as isotopes.
- The atomic masses and isotopic abundance are determined by mass spectrometer.



Examples

- How many neutrons are in each isotope of oxygen? Write the symbol of each isotope. 8
- a- Oxygen-16 b- Oxygen-17 c- Oxygen-18

→ Solution:

n 8

$$\begin{array}{c} 16 \\ 8 \end{array} \text{O} \quad \begin{array}{c} p \quad 8 \\ n \quad 9 \end{array} \quad \text{neutrons} = 16 - 8 = \underline{8}$$

$$\begin{array}{c} 17 \\ 8 \end{array} \text{O} \quad \text{neutrons} = 17 - 8 = \underline{9}$$

$$\begin{array}{c} 18 \\ 8 \end{array} \text{O} \quad \text{neutrons} = 18 - 8 = \underline{10}$$



16O

E. Atomic Weight

- Atomic weight is the weighted average of the masses of the naturally occurring isotopes.
- The units of atomic weight are amu.
- To calculate the weighted average of the masses of the isotopes, multiply each atomic mass by its abundance and then add.

Example:

0.25

Given that the percentage abundance of Cl-35 is 75% and that of Cl-37 is 25%, calculate the relative mass of chlorine.

Solution:

35.5
g m u

$$= \frac{35 \times 75 + 37 \times 25}{100}$$

$$\begin{aligned} A_r &= \left(\frac{75}{100} \times 35 \right) + \left(\frac{25}{100} \times 37 \right) \\ &= 26.25 + 9.25 \\ &= 35.5 \end{aligned}$$

$$\frac{\boxed{} \times \boxed{} + \boxed{} \times \boxed{} + \boxed{} \times \boxed{}}{100}$$

@chem31phys

End of The Lecture

مبارك الله بمرور هذا اليوم
وكل يومنا بالحق والبر