

Matter

- everything that has mass and occupies space
- pure substances and mixtures
- **The Elements**
 - basic building blocks of matter
 - ancient Greeks - earth, air, fire and water

1.1 Atoms

- Matter - continuous or discontinuous
- Dalton's experiments
 - elements combine in definite proportions
(2g O / 3g Mg), (4g O / 6g Mg)
 - compounds have constant composition

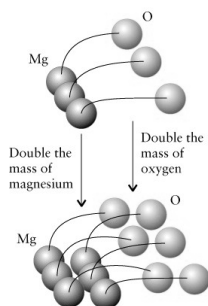


Fig. 1.3

- Atoms - the smallest particles having the identity of an element
- Elements - composed of only one kind of atoms

1.2 Names of the Elements

- Chemical (atomic) symbols
 - H (hydrogen), C (carbon), O (oxygen), Ar (argon), Cl (chlorine)
 - Fe (iron, ferrum), Ag (silver, argentum), Sn (tin, stannum)
- Abundance of elements

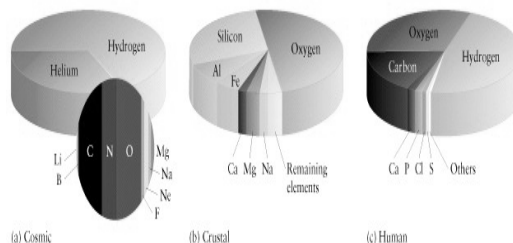


Fig. 1.6

1.3 The Nuclear Atom

- Subatomic particles
 - protons, neutrons and electrons
- Positive nucleus (heavy and compact)
 - protons + neutrons
- Negative electron cloud

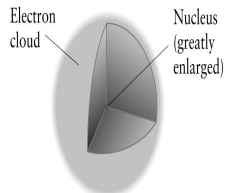


Fig. 1.7

Table 1.1 Properties of subatomic particles

Particle	Symbol	Charge*	Mass, g
electron	e^-	-1	9.109×10^{-28}
proton	p	+1	1.673×10^{-24}
neutron	n	0	1.675×10^{-24}

*Charges are given as multiples of the charge on a proton, which in SI units is 1.602×10^{-19} coulomb.

- Evidence
 - radioactivity (α , β , γ rays)
 - cathode rays (e^-)
 - mass/charge ratio of e^- (J. J. Thomson, 1897)

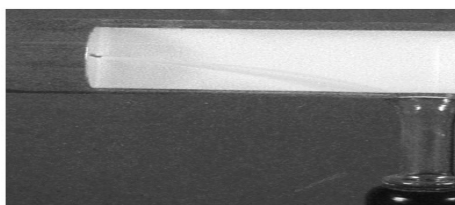


Fig. 1.8

- Charge of e^- (Millikan, 1913)
- atomic nucleus (Rutherford, 1908)

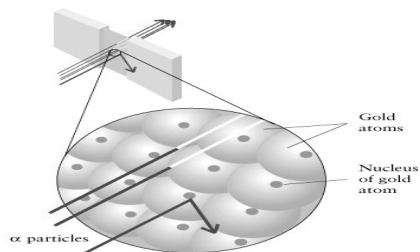
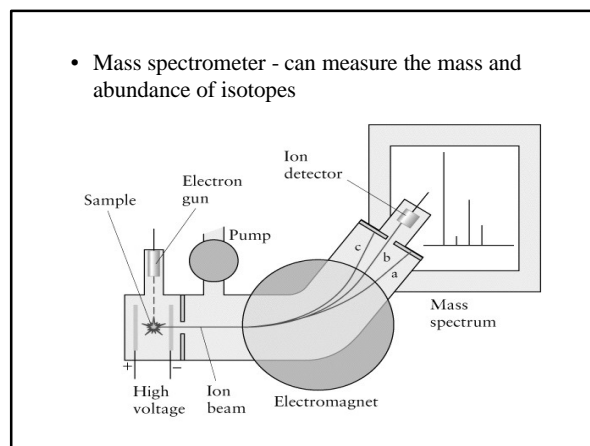
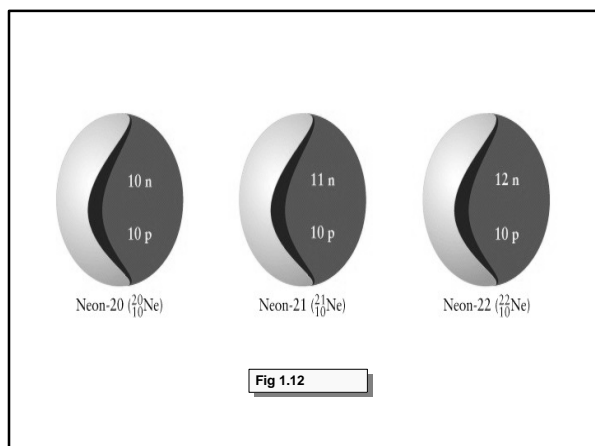


Fig. 1.10

- Protons - positively charged, ~2000 times heavier than the e^-
- Atomic number (**Z**) - number of protons in the atomic nucleus
- Atoms are neutral - $\#e^- = \#p = Z$

1.4 Isotopes

- The **#n** in the nucleus can vary for a given element
- Mass number (**A**) - **A** = **#p** + **#n**
- Isotopes
 - atoms with the same **Z**, but different **A**
 - belong to the same element, but have different atomic mass



Examples:

- How many **p**, **n**, and **e⁻** are present in an atom of Plutonium-239?
- Write the atomic symbol for an isotope with 44 **n** and 32 **e⁻**?