


# Chapter 2—Atoms and Elements



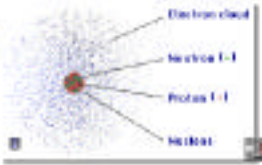
- One of the pieces of evidence for the fact that atoms are made of smaller particles came from the work of **Marie Curie** (1876-1934).
- She discovered **radioactivity**, the spontaneous disintegration of some elements into smaller pieces.

- **Proton**
  - + electrical charge
  - mass =  $1.672623 \times 10^{-24}$  g
  - relative mass = 1.007 atomic mass units (amu)
- **Electron**
  - negative electrical charge
  - relative mass = 0.0005 amu
- **Neutron**
  - no electrical charge
  - mass = 1.009 amu

This slide describes the three major components of the atom.

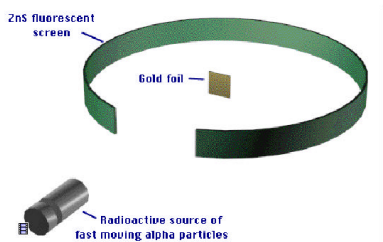
## ATOM COMPOSITION

The atom is mostly empty space



- protons and neutrons in the nucleus.
- the number of electrons is equal to the number of protons.
- electrons in space around the nucleus.
- extremely small. One teaspoon of water has 3 times as many atoms as the Atlantic Ocean has teaspoons of water.

The modern view of the atom was developed by **Ernest Rutherford** (1871-1937).



Describe the view of the atom developed by Ernest Rutherford.

All atoms of the same element have the same number of protons in the nucleus, **Z**

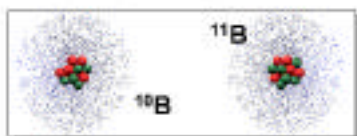
|         |                 |
|---------|-----------------|
| 13      | ← atomic number |
| Al      | ← symbol        |
| 26.9815 | ← atomic weight |

Z is called the \_\_\_\_\_ of the element. Do all Al atoms have the same value of Z?

- C atom with 6 protons and 6 neutrons is the mass standard
- = 12 atomic mass units
- \_\_\_\_\_  
= # protons + # neutrons
- A boron atom can have  
 $A = 5 p + 5 n = 10 \text{ amu}$

A is called the \_\_\_\_\_ of an atom. Do all C atoms have the same value of A?

- Atoms of the same element (same Z) but different mass number (A).
- Boron-10 ( $^{10}\text{B}$ ) has 5 p and 5 n
- Boron-11 ( $^{11}\text{B}$ ) has 5 p and 6 n



Atoms that have the same Z but different A are called \_\_\_\_\_.

- Because of the existence of isotopes, the mass of a collection of atoms has an average value.
- Average mass = \_\_\_\_\_
- Boron is 20%  $^{10}\text{B}$  and 80%  $^{11}\text{B}$ . That is,  $^{11}\text{B}$  is 80 percent abundant on earth.
- For boron  
 $= 0.20 (10 \text{ amu}) + 0.80 (11 \text{ amu}) = 10.8 \text{ amu}$

The average mass of a collection of isotopes of an element is called the \_\_\_\_\_

Which is the more abundant isotope of Cl,  $^{35}\text{Cl}$  or  $^{37}\text{Cl}$ ?

- Dmitri Mendeleev developed the modern periodic table. Argued that element properties are periodic functions of their atomic weights.



- We now know that element properties are periodic functions of their **ATOMIC NUMBERS**.

- See CD-ROM, Screen 2.16.

The vertical columns are \_\_\_\_\_

The horizontal rows are \_\_\_\_\_

Elements labeled 1A are \_\_\_\_\_

Elements labeled 2A are \_\_\_\_\_

Elements labeled 7A are \_\_\_\_\_

Elements labeled 8A are \_\_\_\_\_

Elements in the middle part of the table are \_\_\_\_\_