

Chapter 2

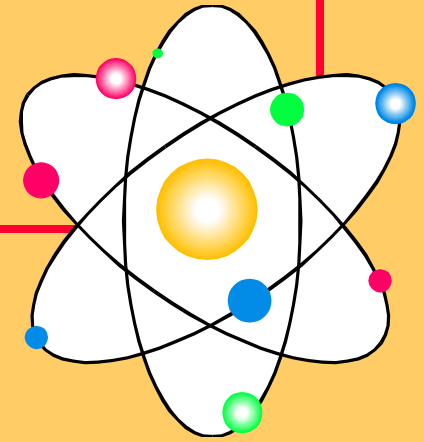
Atoms and Elements

The Atom

Atomic Number and Mass Number

Isotopes

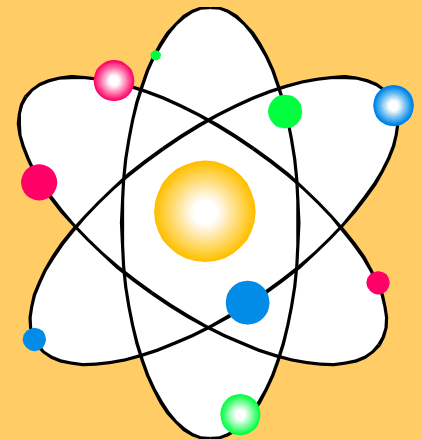
Atomic Theory



- **Atoms are building blocks of elements**
- **Similar atoms in each element**
- **Different from atoms of other elements**
- **Two or more different atoms bond in simple ratios to form compounds**

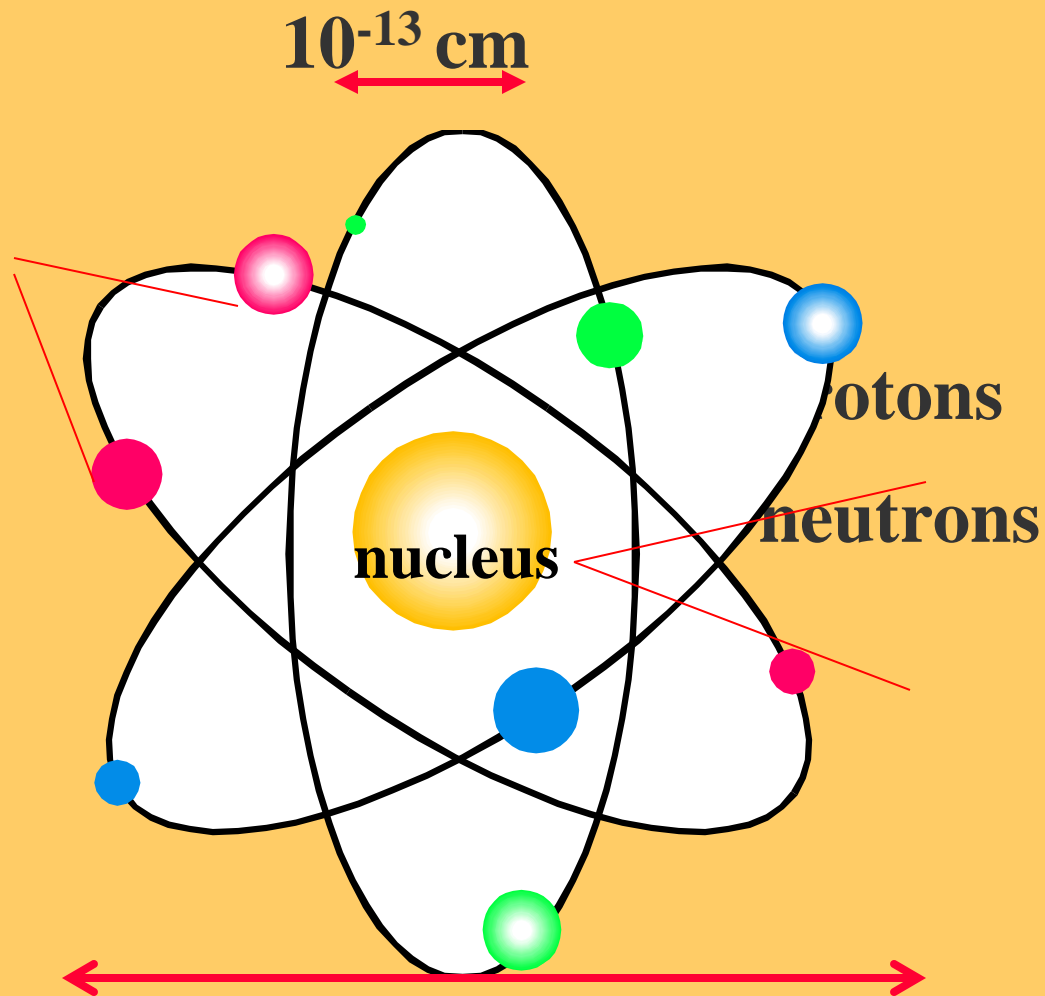
Subatomic Particles

Particle	Symbol	Charge	Relative Mass
Electron	e^-	1-	0
Proton	p^+	+	1
Neutron	n	0	1



Location of Subatomic Particles

electrons



10^{-8} cm

Atomic Number

*Counts the number
of
protons
in an atom*

Atomic Number on the Periodic Table

Atomic Number

11

Symbol

Na

All atoms of an element have the same number of protons

11 protons



11

Sodium



Na

Learning Check

State the number of protons for atoms of each of the following:

A. Nitrogen

- 1) 5 protons 2) 7 protons 3) 14 protons

B. Sulfur

- 1) 32 protons 2) 16 protons 3) 6 protons

C. Barium

- 1) 137 protons 2) 81 protons 3) 56 protons

Solution

State the number of protons for atoms of each of the following:

A. Nitrogen

2) 7 protons

B. Sulfur

2) 16 protons

C. Barium

3) 56 protons

Mass Number

*Counts the number
of
protons and neutrons
in an atom*

Atomic Symbols

- *Show the mass number and atomic number*
- Give the symbol of the element

mass number



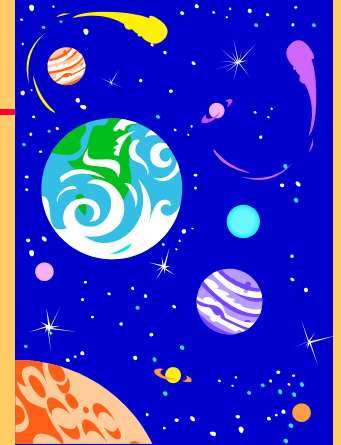
^{23}Na

sodium-23

atomic number 11



Number of Electrons



- **An atom is neutral**
- **The net charge is zero**
- **Number of protons = Number of electrons**
- **Atomic number = Number of electrons**

Subatomic Particles in Some Atoms

16
O

8

8 p⁺

8 n

8 e⁻

31
P

15

15 p⁺

16 n

15 e⁻

65
Zn

30

30 p⁺

35 n

30 e⁻

Isotopes

- Atoms with the same number of protons, but different numbers of neutrons.
- Atoms of the same element (same atomic number) with different mass numbers

Isotopes of chlorine



17

chlorine - 35



17

chlorine - 37



Learning Check

Naturally occurring carbon consists of three isotopes, ^{12}C , ^{13}C , and ^{14}C . State the number of protons, neutrons, and electrons in each of these carbon atoms.



6

6

6

#p

#n

#e

Solution

	^{12}C	^{13}C	^{14}C
	6	6	6
#p	6	6	6
#n	6	7	8
#e	6	6	6

Learning Check

An atom of zinc has a mass number of 65.

A. Number of protons in the zinc atom

1) 30

2) 35

3) 65

B. Number of neutrons in the zinc atom

1) 30

2) 35

3) 65

C. What is the mass number of a zinc isotope with 37 neutrons?

1) 37

2) 65

3) 67

Solution

An atom of zinc has a mass number of 65.

A. Number of protons in the zinc atom

1) 30

B. Number of neutrons in the zinc atom

2) 35

C. What is the mass number of a zinc isotope with 37 neutrons?

3) 67

Learning Check

Write the atomic symbols for atoms with the following:

A. 8 p⁺, 8 n, 8 e⁻ _____

B. 17p⁺, 20n, 17e⁻ _____

C. 47p⁺, 60 n, 47 e⁻ _____

Solution

A. 8 p⁺, 8 n, 8 e⁻

¹⁶O

8

B. 17p⁺, 20n, 17e⁻

³⁷Cl

17

C. 47p⁺, 60 n, 47 e⁻

¹⁰⁷Ag

47

Atomic Mass on the Periodic Table

Atomic Number

11

Symbol

Na

Atomic Mass

22.99

Atomic Mass

Atomic mass is the weighted **average mass** of all the atomic masses of the isotopes of that atom.

Example of an Average Atomic Mass

Cl-35 is about 75.5 % and Cl-37 about 24.5% of natural chlorine.

$$35 \times \frac{75.5}{100} = 26.4$$

$$37 \times \frac{24.5}{100} = 9.07$$

35.5

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