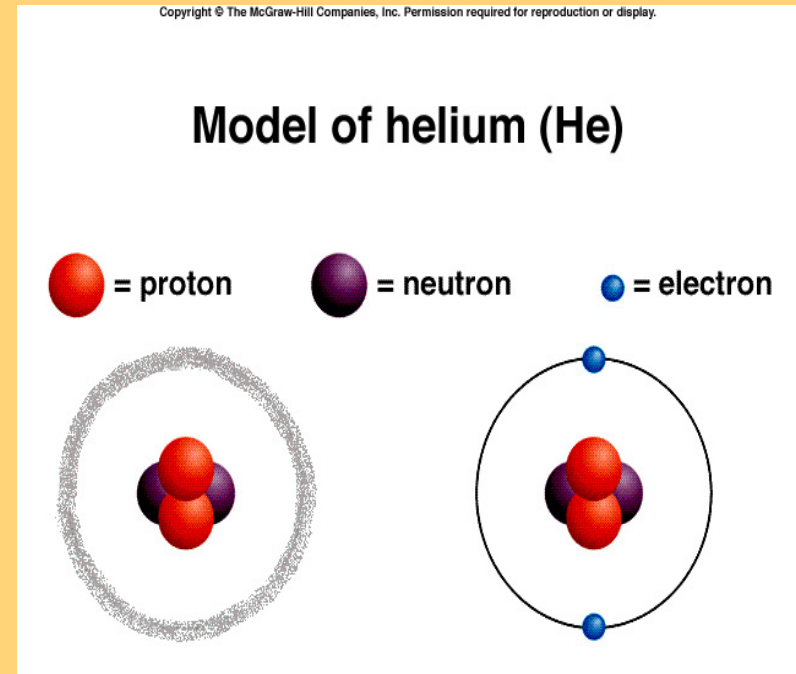
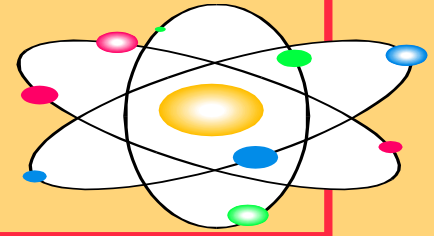


Atoms and Elements

- The Atom
- Atomic Number and Mass Number
 - Isotopes



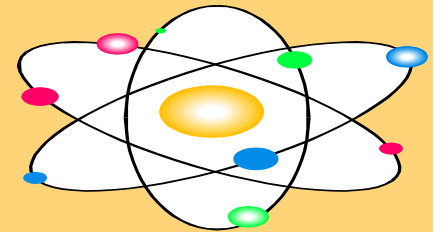
Atomic Theory



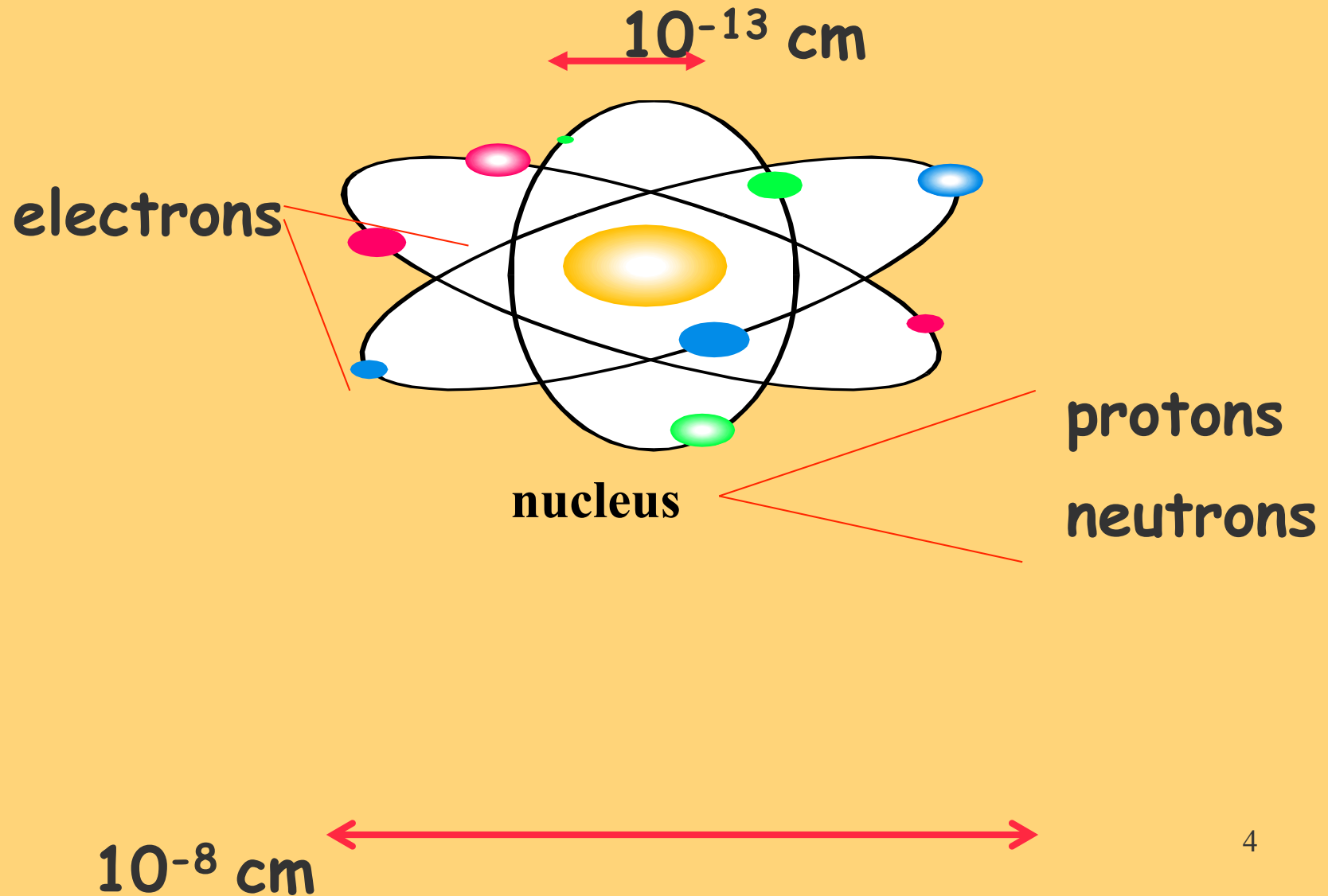
- Atoms are building blocks of elements
- Similar atoms in each element
- Different from atoms of other elements
- Two or more different atoms bond in simple ratios to form compounds

Subatomic Particles

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



Location of Subatomic Particles



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

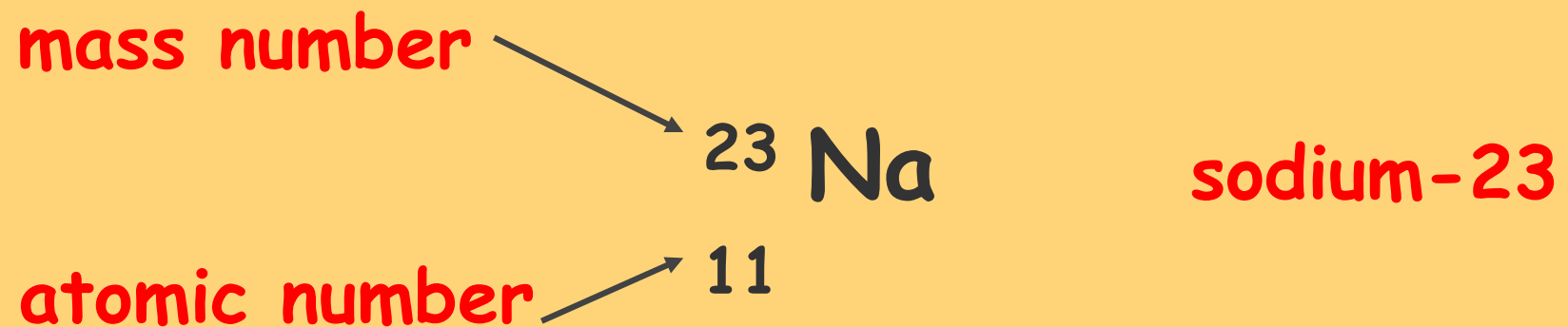
3) 56 protons

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*



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

31
15

P 65
30

Zn

8 p⁺

8 n

8 e⁻

15 p⁺

16 n

15 e⁻

30 p⁺

35 n

30 e⁻

Extension only - 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

	${}^{12}\text{C}$	${}^{13}\text{C}$	${}^{14}\text{C}$
	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⁻ _____

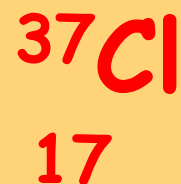
C. 47p⁺, 60 n, 47 e⁻ _____

Solution

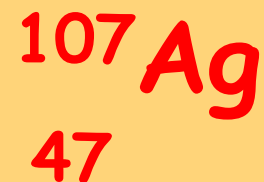
A. 8 p⁺, 8 n, 8 e⁻



B. 17p⁺, 20n, 17e⁻



C. 47p⁺, 60 n, 47 e⁻



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