CHM 123

Dr. Cindy Harwood BRWN 1153 <u>charwood@purdue.edu</u>

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Purdue University

Atoms & Elements

Chapter 2

Modern View of Atomic Structure

- · electrons negatively charged particles
 - charge e = -1.6021773 x 10⁻¹⁹ C
 - mass m_e = 9.109390 x 10⁻³¹ kg
 - determine how elements combine to form chemical compounds

Modern View of Atomic Structure

- protons positively charged particles
 - charge = 1.6021773 x 10⁻¹⁹ C
 - mass m_p = 1.67262158 x 10⁻²⁷ kg
 - fundamental unit of positive charge in nucleus
 - determines chemical identity of atom (atomic number - Z)

Modern View of Atomic Structure

- · neutrons neutral particles
 - mass $m_n = 1.674928716 \times 10^{-27} \text{ kg}$
 - contribute to mass of atom (along with protons)
 - essential for stability of nucleus
 - # protons + # neutrons in an atoms equals mass number (Z + N = A)

Modern View of Atomic Structure

nucleus

- center of atom
- positively charged
- compact
- heavy
- charge = +Ze
- composed of protons and neutrons





Example 1

An isotope detected in a mass spectrometer has atomic number 82 and relative mass 205. Write the symbol for this isotope and list the subatomic particles composing it.

²⁰⁵₈₂Pb



Isotopes and Atomic Weight

- many elements have more than one naturally occurring isotope
- atomic weight is an average mass for all the naturally occurring isotopes

atomic weight = (fractional abundance isotope 1 * isotopic mass of 1) + (fractional abundance isotope 2 * isotopic mass of 2) + . . .

The Mole

- · chemical counting unit
- defined as amount of substance that contains as many atoms, molecules, etc. as there are atoms in *exactly* 12 g of carbon-12
- 1 mol = 6.02214199 x 10²³ particles

1 mol Cu = 63.546 g

1 mol H₂ = 2.01058 g

Molar Mass and Problem Solving

- Molar Mass sum of atomic masses represented by formula Molar Mass of CO₂ = 44.0098 g/mol
 - Use Molar Mass to convert between grams and moles
 - Use Molar Mass and Avogadro's Number to convert between grams and numbers of atoms/molecules





