



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Grade: 9 / Teacher: Ms. Amani

### Study Guide

#### Atomic Number, Mass Number, and Isotopes

##### Modeling Atoms

- ☐ Matter is made up of particles called atoms
- ☐ Atoms are made up of smaller particles called subatomic particles
- ☐ Subatomic particles
  - Protons: positively charged subatomic particles
  - Neutrons: subatomic particles with no charge
  - Electrons: negatively charged subatomic particles

##### Electron Cloud

The electron cloud, where the electrons are found, takes up most of an atom's volume. It is mostly empty space.

Electron  
Symbol:  $e^-$   
Charge:  $1-$   
Mass: about 0.0005 amu

##### Nucleus

The nucleus is made of protons and neutrons. It accounts for most of an atom's mass. An atomic mass unit (amu) is the unit used to measure the mass of subatomic particles.

Proton  
Symbol:  $p^+$   
Charge:  $1+$   
Mass: about 1 amu

Neutron  
Symbol:  $n^0$   
Charge: 0  
Mass: about 1 amu

##### Types of Atoms

- ☐ Atomic number: the number of protons in the nucleus of an atom
  - Therefore, for an atom to be neutral, the number of protons (positively charged particles) must equal the number of electrons (negatively charged particles).

**Helium** The element helium is less dense than air, so it is used in balloons.  
Atomic number: 2  
Number of protons: 2  
Number of electrons: 2

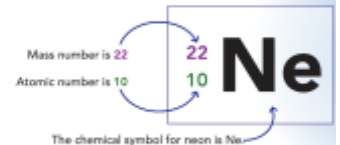
**Silver** The element silver is reflective and resists corrosion, so it is often used in jewelry.  
Atomic number: 47  
Number of protons: 47  
Number of electrons: 47

- ☐ Mass number: the total number of protons plus neutrons in an atom.

- Most of the mass of an atom comes from protons and neutrons.
- If you know the atomic number and mass number of an atom, then you can determine the number of neutrons in the atom.
- You can calculate the number of neutrons from the atomic number and mass number of an atom.

Number of neutrons = mass number - atomic number

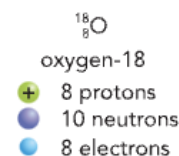
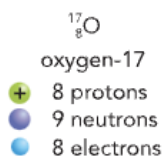
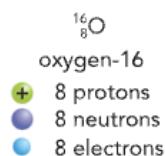
**Representing Atoms** The composition of any atom can be represented in shorthand notation using the element's chemical symbol, atomic number, and mass number.



**Neon-22** You can also represent atoms by using the name of the element and the mass number.

## Isotopes

- ☐ Atoms that have the same number of protons but different numbers of neutrons.



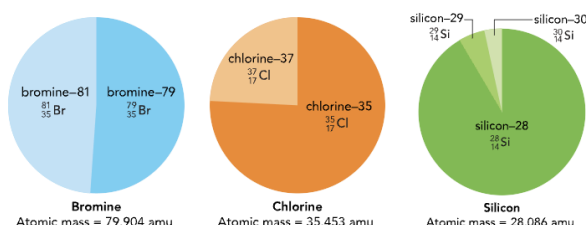
## Isotope Abundance and Atomic Mass

- ☐ Most elements occur as a mixture of two or more isotopes. Each isotope of an element has a fixed mass and a natural percent abundance.

## Calculating Atomic Mass

- ☐ To calculate the atomic mass of an element, multiply the mass of each isotope by its natural abundance, expressed as a decimal, and then add the products.
- ☐ The resulting sum is the weighted average mass of the atoms of the element as they occur in nature.

Comparing Abundances of Bromine, Chlorine, and Silicon Isotopes



## Examples

**Class Grade** Teachers sometimes give a different weight to different types of assignments when calculating your class grade.

First, the teacher determines the types of assignments and assigns each type a weight based on its relative importance.

Assignment Type	Weight		Score		Weighted score
Homework	20%	x	85	=	17.0
Tests	50%	x	75	=	37.5
Labs	30%	x	90	=	27.0
Total:	100%				81.5

As assignments are completed, the weights are used to calculate a student's class grade.

**Atomic Mass** Atomic mass is calculated similarly. You can even set it up in the same table format, if you wish. Here's how to calculate the atomic mass of magnesium.

The percent abundance is like the weight in the class grade table. It's the multiplier factor. The sum of the percent abundances should always be 100%.

Isotope	Percent Abundance		Mass (amu)		Mass Contribution
magnesium-24	79%	x	24	=	19.0
magnesium-25	10%	x	25	=	2.5
magnesium-26	11%	x	26	=	2.9
Total:	100%				24.4

The mass contribution of each isotope is like the weighted score. Add all the contributions to find the atomic mass. It should always be closer to the mass of the most abundant isotope—in this case, 24 amu.