

Atomic Structure & the Periodic Table

Periodic Table of the Elements

A standard periodic table showing elements from Hydrogen (H) to Oganesson (Og). The table is organized into groups and periods, with the Lanthanide and Actinide series shown as separate rows at the bottom.

Basic Definitions

- _____ – smallest unit of an element that retains the properties of that element
- Atoms are made up of several subatomic particles called _____, _____, and _____

Protons, Neutrons, & Electrons

- **Protons** – have a _____ charge and are found in the _____ of the atom
- **Neutrons** – have _____ charge and are also found in the _____ of an atom
- **Electrons** – have a _____ charge and are found _____ of the nucleus
- **Nucleus** – made up of _____ and _____, has an overall _____ charge

Atomic Structure

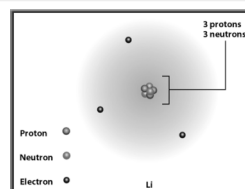


TABLE 2.1. Comparison of the Proton, Neutron, and Electron

Particle	Charge	Mass (amu)
Proton	Positive (1+)	1.0073
Neutron	None (neutral)	1.0087
Electron	Negative (1-)	5.486×10^{-4}

Atomic Numbers

- The **atomic number** of an element is the number of _____ in the nucleus of an atom of that element.
- It is the number of protons that determines the identity of an element.
- The number of _____ for an element **CANNOT** be changed.

Atomic Numbers

- Because atoms have no overall charge, the number of _____ must equal the number of _____.
- So, the atomic number of an element also tells the number of _____ in a _____ atom.
- The number of _____ can be changed when determining the charge of an _____.

Masses

- The sum of the _____ and _____ in the nucleus is the **mass number**.
- _____ of an element have different mass numbers because they have different numbers of neutrons.

Isotopes

$$\begin{array}{l} \text{mass number} \\ \text{atomic number} \end{array} \quad \mathbf{X}$$

- The different number of neutrons has **NO** bearing on chemical reactivity

Writing the Names of Isotopes

- When writing the name of an isotope, you will write the name of the element – the mass number

Try the following

Name	Symbol	# Protons	# Neutrons	# Electrons	Mass #
Carbon - 11					
	¹⁹⁷ Au				
		1	2		
				25	55
Oxygen - 15					

Try this one

Name	Symbol	# Protons	# Neutrons	# Electrons	Mass #
Iodine -1 - 130					

Atomic Mass

- _____ –the weighted average mass of all the naturally occurring isotopes of that element.
- The number is usually located at the bottom of the periodic table and has decimal places

Element	Chlorine	State of Matter
Atomic Number	17	
Symbol	Cl	
Atomic Mass	35.453	

Calculating Atomic Mass

Abundance and Mass Data for Copper

	Isotope	
	Copper-63	Copper-65
Number of protons	29	29
Number of neutrons	34	36
Atomic mass	62.930 amu	64.928 amu
Abundance	69.17%	30.83%

Try this one...

Calculate the atomic mass of germanium.

Isotope	Abundance (%)	Atomic Mass (amu)
Germanium-70	21.23	69.924
Germanium-72	27.66	71.922
Germanium-73	7.73	72.923
Germanium-74	35.94	73.921
Germanium-76	7.44	75.921

You can tell many things from an isotope formula

- Hydrogen has three naturally occurring isotopes in nature: Hydrogen – 1, Hydrogen – 2, and Hydrogen – 3.
 - Which is the most abundant in nature?
 - Which is the heaviest?

Periodic Table

- Periodic Table – arrangement of elements in order of increasing _____ with elements having similar properties in vertical columns
 - _____ – vertical columns
 - _____ – horizontal rows

Group Names

<u>Group</u>	<u>Name</u>
1A	Alkali Metals
2A	Alkaline Earth Metals
6A	Chalcogens
7A	Halogens
8A	Noble Gases

Groups

- The group tell you the number of _____ that the element has
- Valence electrons are electrons in the _____ shell of the atom

Characteristics

- Elements in the same group exhibit similar chemical characteristics due to the fact that they all have the same number of _____.
- The most stable number of valence electrons is _____
- This is called an _____

Charges

- Every element wants 8 valence electrons to become stable. They will gain or lose valence electrons to form an octet

Physical States and Classes of the Elements

- The majority of the elements are _____
- They occupy the entire _____ side and center of the periodic table.
- _____ occupy the upper-right-hand corner.
- _____ are located along the boundary between metals and nonmetals.

Metals

- **Metals** are elements that have _____, _____ heat and electricity, and usually bend without breaking.
- All metals except _____ are solids at room temperature.

Transition Metals

- The elements in Groups 3 through 12 of the periodic table are called the _____ **elements**.
- All transition elements are _____.
- Many transition metals can have more than one charge

Inner Transition Metals

- Atomic numbers 58-71 and 90-103, are known as _____ transition metals
- These elements are separated from the main table because putting them in their proper position would make the table very wide.

Non Metals

- Most **nonmetals** don't conduct electricity, are much poorer conductors of heat than metals, and are _____ when solid.
- Many are _____ at room temperature
- Those that are solids lack the luster of metals.

Properties of Metals and Nonmetals

Properties of Metals and Nonmetals

Metals	Nonmetals
Bright metallic luster	Non-lustrous, various colors
Solids are easily deformed	Solids may be hard or soft, usually brittle
Good conductors of heat and electricity	Poor conductors of heat and electricity
Loosely held valence electrons	Tightly held valence electrons

Metalloids

- **Metalloids** have some chemical and physical properties of metals and other properties of nonmetals.
- In the periodic table, the metalloids lie along the border between metals and nonmetals.