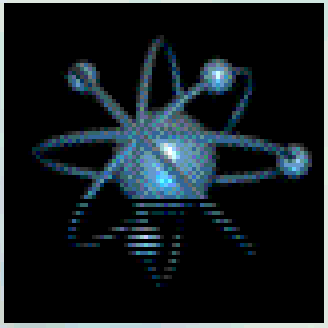
Chemistry

Starting at the Beginning



What is Chemistry?

- Chemistry is the study of the composition and structure of **matter** and the **changes** that matter undergoes.
  - Matter is anything that has **mass** and takes up **space**.
  - The building blocks of matter are called **atoms**.

Classification of Matter

Pure Substances vs. Mixtures

Elements

- 1 type of **atom**
- Found on **periodic table**
- Represented by **symbols**

Compounds

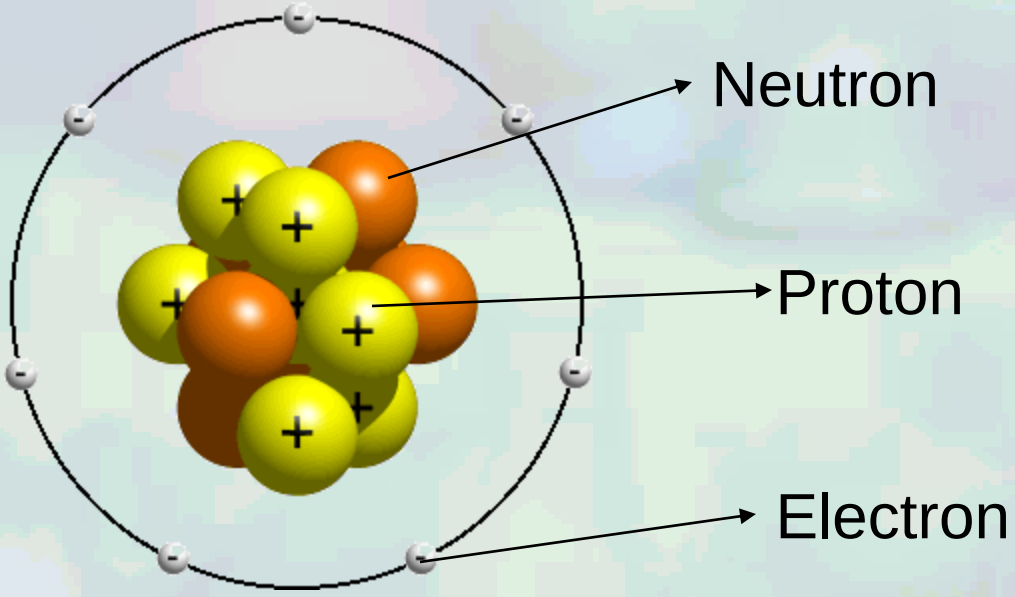
- **More than** one type of element
- **Chemically** combined
- Represented by **formulas**

Mixtures

Physical combination of more than one **element** and/or **compound**

Atoms

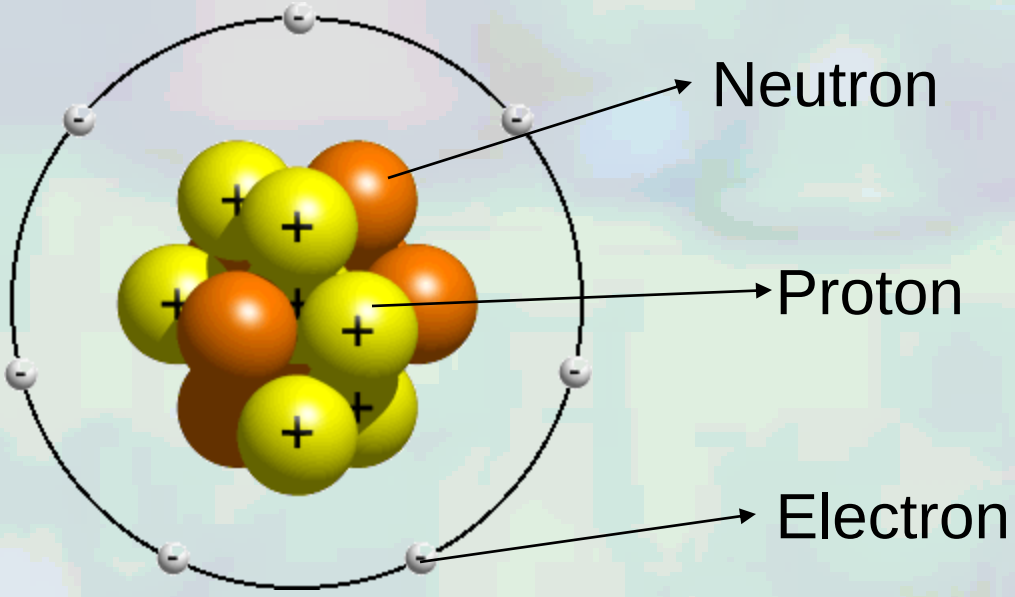
Atoms can exist either **alone** or in **combination** with other atoms



Images taken from http://education.jlab.org/qa/atom_model.html

Atoms

The **protons** and **neutrons** are found within the **nucleus** of the atom.



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Atoms

Easter Egg Isotopes

With your partner, choose an "atomic nucleus" (plastic egg). Carefully open the nucleus and record the requested information in the following table:

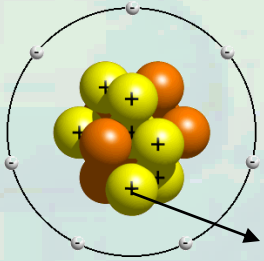
Color	Number of White Marbles	Number of Blue Marbles	Total Number of Marbles

Isotopes

1. What did the eggs of the same color have in common? (besides color)
2. What 2 things were different between the eggs of the same color?

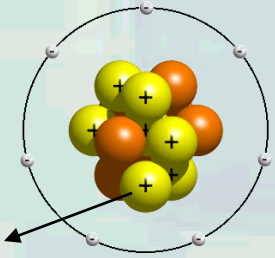
*White marbles represent **protons,** blue marbles represent **neutrons**, total marbles represent **mass number**.*

3. What do atoms of the same element have in common?
4. What can be different for atoms of the same element?

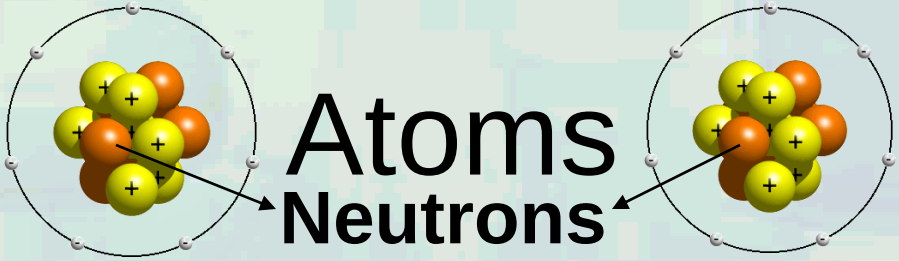


Atoms

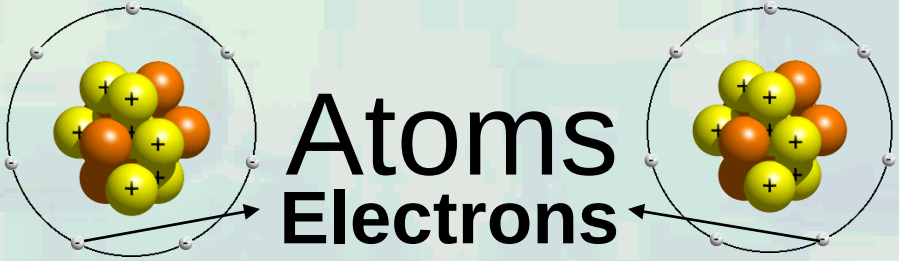
Protons



- All atoms of the same element must contain the same number of **protons** in the **nucleus**
- The number of **protons** identifies the atom
- This number is known at the **atomic number**
- This is abbreviated by the letter "**Z**"
- Elements are arranged on the **periodic table** by atomic number



- The nucleus of the atom also contains the **neutrons**
- The number of neutrons in an atom may vary within the same element; these variances are known as **isotopes**
- The number of neutrons does not significantly affect **chemical properties**



- The electrons are found **outside** the nucleus
- All atoms of the **same** element contain the same number of electrons
- The **number** of and **arrangement** of electrons significantly affects chemical properties
- In a chemical reaction, atoms **gain**, **lose**, or **share** electrons
- In a neutral atom, the number of electrons equals the number of **protons**

Nuclear Symbols

A: **Mass Number**

- The sum of the **protons** and **neutrons** found in the nucleus

Z: **Atomic Number**

- The total number of **protons** found in the nucleus

X: **Chemical Symbol**

- The abbreviation found on the **periodic table**
- The first letter is always **capitalized**
- The second letter (if there) is **lower case**
- Only **block-styled** letters may be used
  - Exception: lower case **L = l**

Chemical Symbols

$^{23}_{11}Na$ = (if neutral)

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Mass Number	Atomic Number	Protons	Neutrons	Electrons	Hyphenated Notation
23	11	11	12	11	**Sodium - 23**

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Chemical Symbols

$$^{27}_{13}Al$$

Mass Number	Atomic Number	Protons	Neutrons	Electrons	Hyphenated Notation
27	13	13	14	13	**Aluminum-27**

Chemical Symbols

$$^{40}_{20}Ca$$

Mass Number	Atomic Number	Protons	Neutrons	Electrons	Hyphenated Notation
40	20	20	20	20	**Calcium-40**

Chemical Symbols

$$^{12}_{6}C$$

Mass Number	Atomic Number	Protons	Neutrons	Electrons	Hyphenated Notation
12	6	6	6	6	**Carbon-12**

Chemical Symbols

$$^{13}_{6}C$$

Mass Number	Atomic Number	Protons	Neutrons	Electrons	Hyphenated Notation
13	6	6	7	6	**Carbon-13**

Chemical Symbols

Chemical Symbol	Mass Number	Atomic Number	Protons	Neutrons	Electrons	Hyphenated Notation
	133	55			55	
		12		12	12	
			81	123	81	
	28			14	14	

Chemical Symbols

Chemical Symbol	Mass Number	Atomic Number	Protons	Neutrons	Electrons	Hyphenated Notation
$^{133}_{55}Cs$	133	55	55	78	55	Cesium -133
$^{24}_{12}Mg$	24	12	12	12	12	Magnesium -24
$^{204}_{81}Tl$	204	81	81	123	81	Thallium -204
$^{28}_{14}Si$	28	14	14	14	14	Silicon -28