

Chemical Foundations:

Elements, Atoms, and Ions



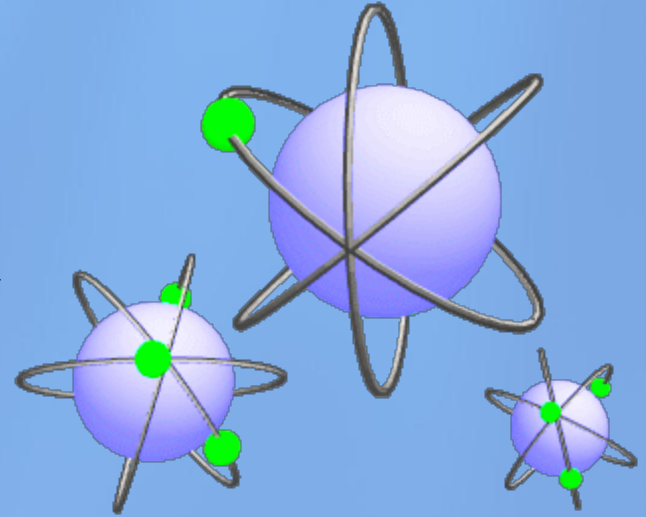
Chemical Foundations: Elements, Atoms, and Ions



**The Abundance and Names of
Elements**

The Elements

- All of Earth's materials can be broken down chemically into 118 (for now) different elements.
- Compounds are made by combining atoms of the various elements, just as words are constructed from the 26 letters of the alphabet.
 - You need to learn the names and symbols of the chemical elements before you can read and write chemistry!



The Elements

Chemistry Explorers: Robert Boyle • 1627 - 1691

- From Ireland
- Performed pioneering work on the properties of gases.
- Defined the term ***element*** based on experiments:
a substance was an element unless it could be broken down into 2 or more simpler substances.



Abundance of Elements

- At present, about 116 elements are known.
 - 88 occur naturally. The others have been made in the lab.
- The number of elements changes regularly as new elements are made in particle accelerators in laboratories.
- Elements vary greatly in their abundance (present in high quantity/ number).
 - Only 9 elements account for most of the compounds found in Earth's crust.

Abundance of Elements

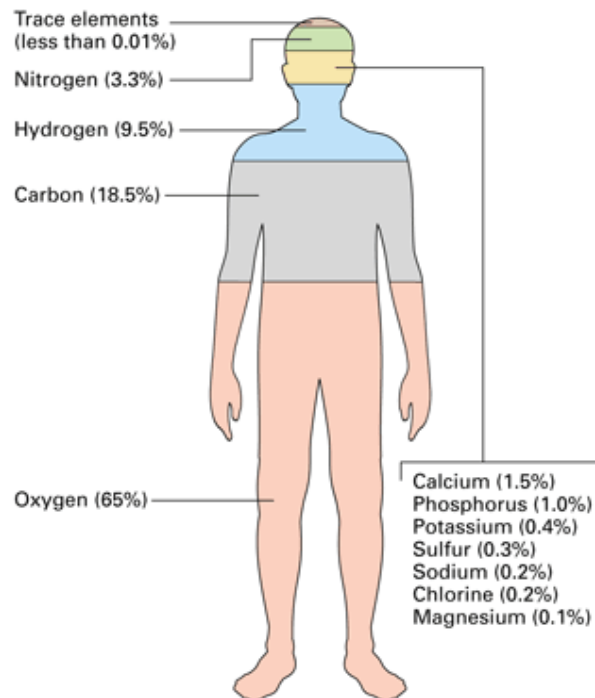
- Oxygen accounts for 20% of the Earth's atmosphere (as O_2).

- Is also found in virtually all rocks, sand, and soil in Earth's crust (as SiO_2 or Al_2O_3 or Fe_2O_3).



- Oxygen, carbon, hydrogen, and nitrogen form the basis for all life!

- Other trace elements are crucial for life.



Names and Symbols for the Elements

- The names of the elements come from many sources: From Greek, Latin, or German words describing a property of the

Element Name	Latin	Meaning
<i>gold</i>	aurum	shining down
<i>lead</i>	plumbum	heavy

Element Name	<i>chlorine</i>	<i>iodine</i>	<i>bromine</i>
Greek meaning	green color	violet color	a stench

Names and Symbols for the Elements

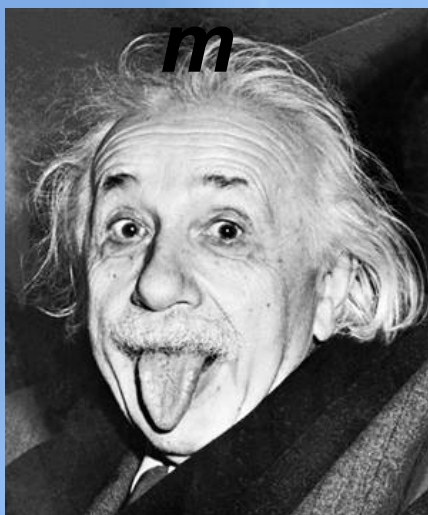
- The place where the element was discovered.
 - *americum* → America
 - *californium* → California
 - *germanium* → Germany
 - *polonium* → Poland
 - *francium* → France



Names and Symbols for the Elements

– In honor of a famous scientist.

einsteinium



Albert
Einstein

nobelium



Alfred Nobel

curium



Marie Curie

Names and Symbols for the Elements

- Chemists use abbreviations called **element symbols** for the chemical elements.
 - Usually consist of the first letter or the first 2 letters of the element's name.
 - **First letter is always capitalized, the second is not!**

fluorine F oxygen O neon Ne
silicon Si carbon C

Names and Symbols for the Elements

- Sometimes the two letters are not the first two letters in the name.

zinc Zn

cadmium Cd

chlorine Cl

platinum Pt

- Other element symbols are based on the original Latin or Greek name.

Current Name	Original Name	Symbol
<i>gold</i>	aurum	Au
<i>lead</i>	plumbum	Pb
<i>sodium</i>	natrium	Na
<i>iron</i>	ferrum	Fe

Common Elements and Symbols:

Table 3.3

The Names and Symbols of the Most Common Elements*

Element	Symbol	Element	Symbol
aluminum	Al	lithium	Li
arsenic	As	mercury (hydrargyrum)	Hg
barium	Ba	neon	Ne
boron	B	nitrogen	N
bromine	Br	oxygen	O
calcium	Ca	platinum	Pt
carbon	C	potassium (kalium)	K
chromium	Cr	silicon	Si
cobalt	Co	silver (argentum)	Ag
copper (cuprum)	Cu	sodium (natrium)	Na
gold (aurum)	Au	sulfur	S
lead (plumbum)	Pb	zinc	Zn

*Where appropriate, the original name is shown in parentheses so that you can see the sources of some of the symbols.

- The End!