

**Interactive Classroom**

**Glencoe Science**

# CHEMISTRY

MATTER AND CHANGE

## Chapter 6

The Periodic Table and  
Periodic Law

**Mc  
Graw  
Hill** Glencoe

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## Section 6.1 Development of the Modern Periodic Table

### Objectives

- **Trace** the development of the periodic table.
- **Identify** key features of the periodic table.

### Review Vocabulary

**atomic number:** the number of protons in an atom

#### MAIN Idea

The periodic table evolved over time as scientists discovered more useful ways to compare and organize the elements.



## Section 6.1 Development of the Modern Periodic Table (cont.)

### New Vocabulary

periodic law

group

period

representative elements

transition elements

metal

alkali metals

alkaline earth metals

transition metal

inner transition metal

lanthanide series

actinide series

nonmetals

halogen

noble gas

metalloid



## Development of the Periodic Table

- In the 1700s, Lavoisier compiled a list of all the known elements of the time.

<b>Table 6.1</b>	<b>Lavoisier's Table of Simple Substances (Old English Names)</b>
Gases	light, heat, dephlogisticated air, phlogisticated gas, inflammable air
Metals	antimony, silver, arsenic, bismuth, cobalt, copper, tin, iron, manganese, mercury, molybdena, nickel, gold, platina, lead, tungsten, zinc
Nonmetals	sulphur, phosphorus, pure charcoal, radical muriatique*, radical fluorique*, radical boracique*
Earths	chalk, magnesia, barote, clay, siliceous earth

\* no English name



## Development of the Periodic Table (cont.)

- The 1800s brought large amounts of information and scientists needed a way to organize knowledge about elements.
- John Newlands proposed an arrangement where elements were ordered by increasing atomic mass.



## Development of the Periodic Table (cont.)

- Newlands noticed when the elements were arranged by increasing atomic mass, their properties repeated every eighth element.

Elements with similar properties are in the same row.

1 octave	A	<b>H</b>	1	A	<b>F</b>	8	— and so on →
	B	<b>Li</b>	2	B	<b>Na</b>	9	→
	C	<b>G</b>	3	C	<b>Mg</b>	10	→
	D	<b>Bo</b>	4	D	<b>Al</b>	11	→
	E	<b>C</b>	5	E	<b>Si</b>	12	→
	F	<b>N</b>	6	F	<b>P</b>	13	→
	G	<b>O</b>	7	G	<b>S</b>	14	→



## Development of the Periodic Table (cont.)

- Meyer and Mendeleev both demonstrated a connection between atomic mass and elemental properties.
- Moseley rearranged the table by increasing atomic number, and resulted in a clear periodic pattern.
- Periodic repetition of chemical and physical properties of the elements when they are arranged by increasing atomic number is called **periodic law**.



# Development of the Periodic Table (cont.)

## Table 6.2

### Contributions to the Classification of Elements

#### John Newlands (1837–1898)

- arranged elements by increasing atomic mass
- noticed the repetition of properties every eighth element
- created the law of octaves

#### Lothar Meyer (1830–1895)

- demonstrated a connection between atomic mass and elemental properties
- arranged the elements in order of increasing atomic mass

#### Dmitri Mendeleev (1834–1907)

- demonstrated a connection between atomic mass and elemental properties
- arranged the elements in order of increasing atomic mass
- predicted the existence and properties of undiscovered elements

#### Henry Moseley (1887–1915)

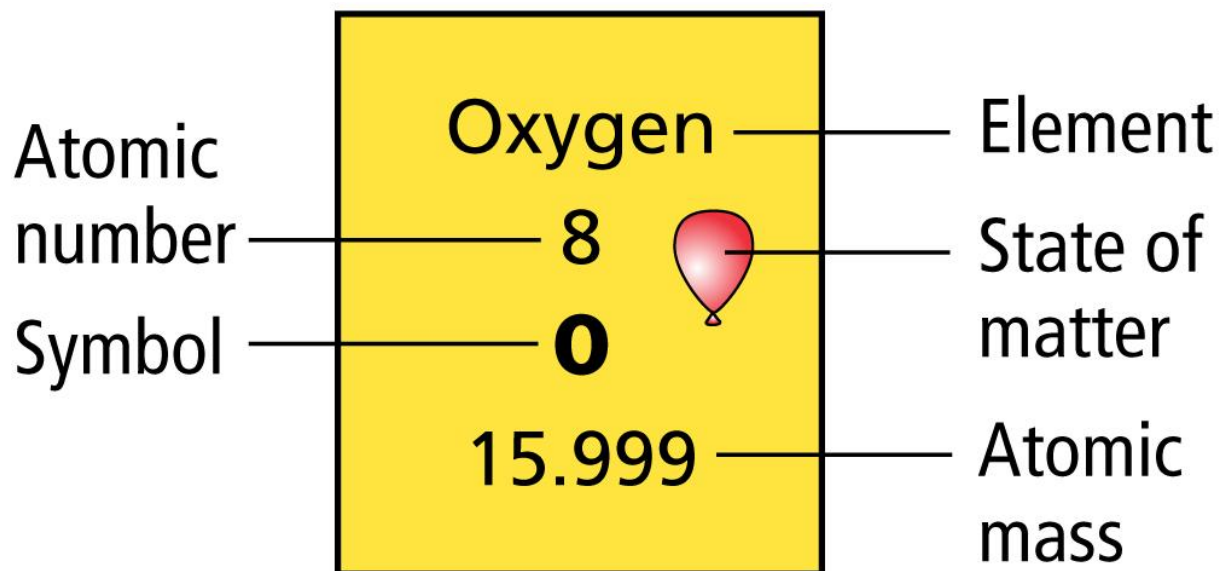
- discovered that atoms contain a unique number of protons called the atomic number
- arranged elements in order of increasing atomic number, which resulted in a periodic pattern of properties





## The Modern Periodic Table

- The modern periodic table contains boxes which contain the element's name, symbol, atomic number, and atomic mass.



## The Modern Periodic Table (cont.)

- Columns of elements are called groups.
- Rows of elements are called periods.
- Elements in groups 1,2, and 13-18 possess a wide variety of chemical and physical properties and are called the representative elements.
- Elements in groups 3-12 are known as the transition metals.



## The Modern Periodic Table (cont.)

- Elements are classified as metals, non-metals, and metalloids.
- **Metals** are elements that are generally shiny when smooth and clean, solid at room temperature, and good conductors of heat and electricity.
- **Alkali metals** are all the elements in group 1 except hydrogen, and are very reactive.
- **Alkaline earth metals** are in group 2, and are also highly reactive.



## The Modern Periodic Table (cont.)

- The transition elements are divided into transition metals and inner transition metals.
- The two sets of inner transition metals are called the lanthanide series and actinide series and are located at the bottom of the periodic table.



## The Modern Periodic Table (cont.)

- **Non-metals** are elements that are generally gases or brittle, dull-looking solids, and poor conductors of heat and electricity.
- Group 17 is composed of highly reactive elements called **halogens**.
- Group 18 gases are extremely unreactive and commonly called **noble gases**.



## The Modern Periodic Table (cont.)

- **Metalloids** have physical and chemical properties of both metals and non-metals, such as silicon and germanium.



- Valance Electrons = electrons in the outer energy shell.
- Increasing number that matches the family number of the element (minus the teen value)

Symbol	Li	Be	B	C	N	O	F	Ne
Family	1	2	13 (3A)	14 (4A)	15 (5A)	16 (6 A)	17 (7A)	18 (8A)
Valence E's	1	2	3	4	5	6	7	8



- Valence Number = Number of electrons lost, shared or gained in chem. rxns
- Number increases to the center of the table, then decreases to the right of the table.

Symbol	Li	Be	B	C	N	O	F	Ne
Valence E's	1	2	3	4	5	6	7	8
Number	+1	+2	+3	+4	-3	-2	-1	0

**+ = lose e's**

**- = gains e's**

**0=no reaction**





# The Modern Periodic Table (cont.)

## PERIODIC TABLE OF THE ELEMENTS

1 Hydrogen H 1.008																		18 Helium He 4.003
2 Lithium Li 6.941	3 Beryllium Be 9.012																	
3 Sodium Na 22.990	4 Magnesium Mg 24.305																	
4 Potassium K 39.098	5 Calcium Ca 40.078	6 Scandium Sc 44.956	7 Titanium Ti 47.867	8 Vanadium V 50.942	9 Chromium Cr 51.996	10 Manganese Mn 54.938	11 Iron Fe 55.847	12 Cobalt Co 58.933										
5 Rubidium Rb 85.468	6 Strontium Sr 87.62	7 Yttrium Y 88.906	8 Zirconium Zr 91.224	9 Niobium Nb 92.906	10 Molybdenum Mo 95.94	11 Technetium Tc (98)	12 Ruthenium Ru 101.07	13 Rhodium Rh 102.906										
6 Cesium Cs 132.905	7 Barium Ba 137.327	8 Lanthanum La 138.905	9 Hafnium Hf 178.49	10 Tantalum Ta 180.948	11 Tungsten W 183.84	12 Rhenium Re 186.207	13 Osmium Os 190.23	14 Iridium Ir 192.217										
7 Francium Fr (223)	8 Radium Ra (226)	9 Actinium Ac (227)	10 Rutherfordium Rf (261)	11 Dubnium Db (262)	12 Seaborgium Sg (266)	13 Bohrium Bh (264)	14 Hassium Hs (277)	15 Meitnerium Mt (268)										

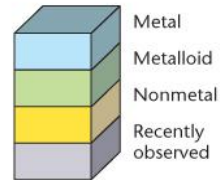
The number in parentheses is the mass number of the longest lived isotope for that element.

Lanthanide series

Cerium Ce 140.115	Praseodymium Pr 140.908	Neodymium Nd 144.242	Promethium Pm (145)	Samarium Sm 150.36	Europium Eu 151.965
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Actinide series

Thorium Th 232.038	Protactinium Pa 231.036	Uranium U 238.029	Neptunium Np (237)	Plutonium Pu (244)	Americium Am (243)
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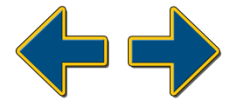


			13 Boron B 10.811	14 Carbon C 12.011	15 Nitrogen N 14.007	16 Oxygen O 15.999	17 Fluorine F 18.998	18 Neon Ne 20.180
			13 Aluminum Al 26.982	14 Silicon Si 28.086	15 Phosphorus P 30.974	16 Sulfur S 32.066	17 Chlorine Cl 35.453	18 Argon Ar 39.948
10 Nickel Ni 58.693	11 Copper Cu 63.546	12 Zinc Zn 65.39	13 Gallium Ga 69.723	14 Germanium Ge 72.61	15 Arsenic As 74.922	16 Selenium Se 78.96	17 Bromine Br 79.904	18 Krypton Kr 83.80
5 Palladium Pd 106.42	6 Silver Ag 107.868	7 Cadmium Cd 112.411	8 Indium In 114.82	9 Tin Sn 118.710	10 Antimony Sb 121.757	11 Tellurium Te 127.60	12 Iodine I 126.904	13 Xenon Xe 131.290
6 Platinum Pt 195.08	7 Gold Au 196.967	8 Mercury Hg 200.59	9 Thallium Tl 204.383	10 Lead Pb 207.2	11 Bismuth Bi 208.980	12 Polonium Po 208.982	13 Astatine At 209.987	14 Radon Rn 222.018
Darmstadtium Ds (281)	Roentgenium Rg (272)	Ununbium * 112 Uub (285)	Ununtrium * 113 Uut (284)	Ununquadium * 114 Uuq (289)	Ununpentium * 115 Uup (288)	Ununhexium * 116 Uuh (291)		Ununoctium * 118 Uuo (294)

\* The names and symbols for elements 112, 113, 114, 115, 116, and 118 are temporary. Final names will be selected when the elements' discoveries are verified.

Gadolinium Gd 157.25	Terbium Tb 158.925	Dysprosium Dy 162.50	Holmium Ho 164.930	Erbium Er 167.259	Thulium Tm 168.934	Ytterbium Yb 173.04	Lutetium Lu 174.967
Curium Cm (247)	Berkelium Bk (247)	Californium Cf (251)	Einsteinium Es (252)	Fermium Fm (257)	Mendelevium Md (258)	Nobelium No (259)	Lawrencium Lr (262)

**Concepts In Motion**  
Click here to view an animated version of this graphic.

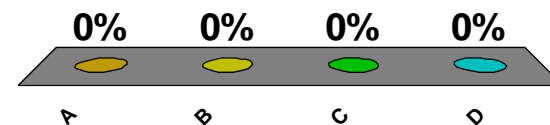


## Section 6.1 Assessment



What is a row of elements on the periodic table called?

- A. octave
- B. period**
- C. group
- D. transition



## Section 6.1 Assessment



What is silicon an example of?

- A. metal
- B. non-metal
- C. inner transition metal
- D. metalloid**

