

Elements are the Building Blocks of Matter

Elements:

- The basic building blocks of _____
- Made up of one type of _____ (cannot be broken down further)
- About _____ elements occur naturally (carbon, silver, oxygen)
- Some elements are synthesized in _____
- Have varying _____



Element Names and Symbols

Each element has a

- _____
 - Based on Latin words, countries, names of famous scientists
- _____
 - One or two letters (first letter is capitalized)

Examples:






- Carbon: _____
- Oxygen: _____
- Aluminum: _____
- Gold: _____
- Polonium: _____

Elements can be organized by their properties

1860s: Dmitri Mendeleev

- Russian teacher and chemist
- Looked at different ways to _____ the elements

Table 2.2 Symbols and Names of Selected Elements

Name of Element	Element Symbol	Origin of Symbol or Name
carbon	C	<i>Carbo</i> = Latin for coal and charcoal. Carbon in the form of soot and charcoal has been known to humans for many thousands of years. 
copper	Cu	<i>Cuprum</i> = Latin for cyprium, meaning metal of Cyprus, an island country near Greece. The ancient Romans obtained much of their copper from mines on Cyprus. 
francium	Fr	<i>France</i> = Marguerite Perey discovered this element in France in 1939. 
lead	Pb	<i>Plumbum</i> = Latin for lead. This element's name has the same root as "plumbing" because the ancient Romans used lead in their plumbing systems. Unfortunately, lead is toxic and their pipes poisoned their water. 
sulfur	S	<i>Sulphurium</i> = Latin for sulfur. In Canada, the United States, and Great Britain, there has been some switching back and forth of the name of this element from sulfur to sulphur. The spelling "sulfur" is now considered standard. 

- Wrote _____ of elements on cards so that he could rearrange them and _____ properties (“chemical solitaire”)
- _____ included atomic mass (average mass of an atom of an element), density, and melting point


Dmitri Mendeleev

- Mendeleev Game

The Predictive Power of Mendeleev’s Table

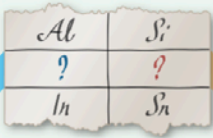
- Mendeleev’s periodic table:
 - Ordered the elements by increasing _____
 - Grouped elements into “families” based on similar _____ (density, melting point)
 - Left _____ in his periodic table to predict the existence of elements not yet found yet
 - These missing elements would have properties similar to other elements in the same _____


Mendeleev’s Table



Properties of Gallium

Property	Mendeleev’s Prediction	Actual Data
Atomic mass	68	69.72
Density (g/cm ³)	6.0	5.904
Melting point (°C)	low	29.78





Properties of Germanium

Property	Mendeleev’s Prediction	Actual Data
Atomic mass	72	72.61
Density (g/cm ³)	5.5	5.32
Melting point (°C)	high	947

Discussion Questions

1. Why did Mendeleev leave gaps in his periodic table?
2. How was Mendeleev able to predict the properties of gallium and germanium?

Modern Periodic Table

Mendeleev's periodic table was ordered by increasing atomic mass:

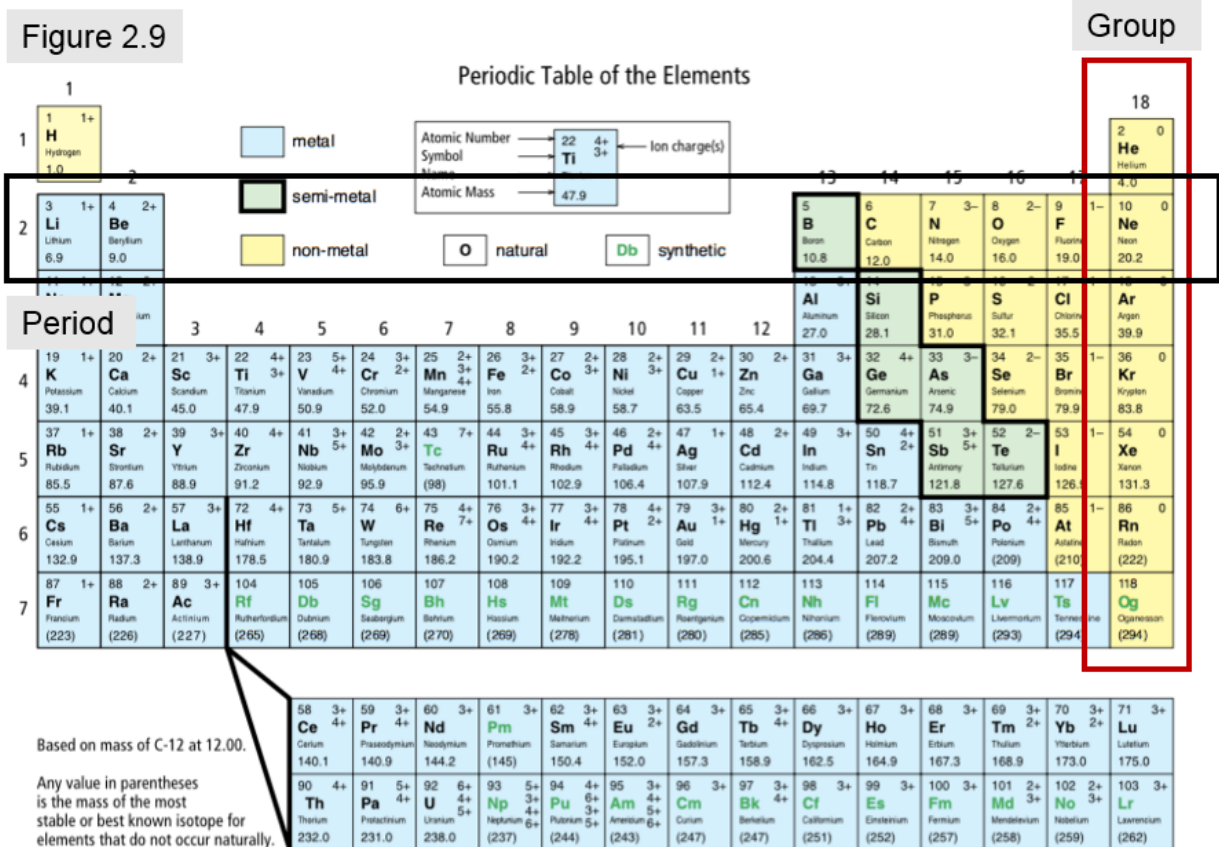
- Did not work perfectly – some elements were _____ so they would fit in a family that had similar properties

Modern periodic table is ordered by increasing _____:

- Henry Moseley: scientist that determined an element's atomic number (the number of _____ in an atom)
- When elements are arranged according to increasing atomic number, the elements fit perfectly and do not require re-ordering

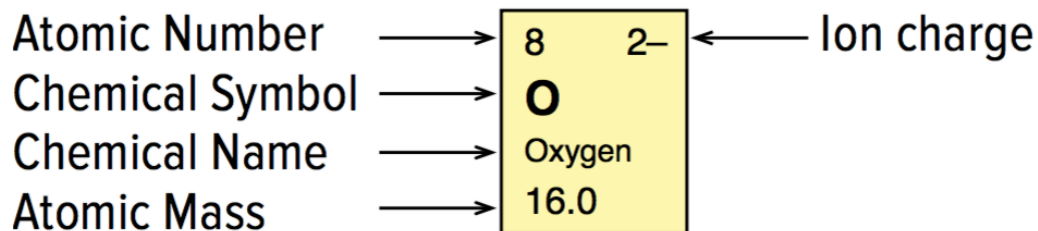
The modern periodic table consists of

- **Groups** (1-18): A vertical column of elements; also called a _____
 - Elements of common _____
- **Periods** (1-7): A horizontal _____ of elements
 - _____ increasing from left to right



Discussion Questions

1. What was Moseley's contribution to the periodic table and what problem did it resolve?
2. Give the symbol and atomic number for each of the following elements:
 - a) manganese
 - b) magnesium
 - c) arsenic
 - d) astatine

**Elements are classified as metals, non-metals, or semi-metals.**

Three broad categories of elements shown on the periodic table

- _____ (blue)
- _____ (yellow)
- _____ (metalloids) (green)
- Elements of Groups 1, 2, and 13 to 18 are called *main-group elements* or *representative elements*
- Elements in Groups 3 to 12 are called _____ *elements*

Metals

- _____ and hard (typically)
- _____ and ductile (can be made into sheets and drawn out into wires)
- _____ electricity and heat
- Typically _____ at room temperature
- Found to the left of the zigzag line on the periodic table

Alkali Metals

- Found in Group _____ (all elements, except hydrogen)
- Shiny and soft
- Highly _____ with water and oxygen (often stored in a non-reactive liquid such as oil)

Alkaline-earth metals:

- Found in Group _____
- Shiny and soft (but not as soft as alkali metals)
- Highly reactive (but not as reactive as alkali metals)

Non Metals

- _____ shiny, malleable, or ductile
- _____ conductor of electricity and heat
- Found to the right of the zigzag line on the periodic table
- Generally _____ or brittle, dull solids

Non metals: Hydrogen:

- Usually on the left side of the periodic table
- _____ element
- Colourless, odourless, tasteless
- Highly _____
- Makes up over _____ of atoms in the universe
- On Earth: Most hydrogen is found combined with oxygen as _____

Non metals: Halogens:

- Found in Group _____
- Highly reactive (therefore usually found in nature as part of compounds)
- Non-metals: Noble Gases

1 H																	2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne										
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar										
19 K	20 Ca	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr										
37 Rb	38 Sr	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe										
55 Cs	56 Ba	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn										
87 Fr	88 Ra																

alkali metals alkaline-earth metals

1 H																	18 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne										
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37 Rb	38 Sr	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe										
55 Cs	56 Ba	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn										
87 Fr	88 Ra																

hydrogen

halogens noble gases

Noble gases:

- Found in Group _____
- Odourless, colourless gases
- _____ reactive of all of the elements
 - Helium and neon _____ form compounds
 - Other noble gases form compounds with great difficulty

Semi-metals

- Also known as _____
- Found in the green boxes in a staircase shape
- Have physical and chemical properties of _____ metals and non-metals
 - Shiny (like metals)
 - Brittle and not ductile (like non-metals)
 - Poor conductors of heat and electricity (like non-metals)

Semi metals: Silicon:

- _____-most abundant element in Earth's crust (after oxygen)
- Used in many _____ devices (computers, smartphones)
- Used to make silicone (material used in cookware, contact lenses, prosthetics)

1												18					
1 H																	2 He
2		semi-metals										17					
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne	11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar		
19 K	20 Ca	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	37 Rb	38 Sr	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe		
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Discussion Questions

1. **Make a table to summarize the characteristic properties of metals, non-metals, and semi-metals.**

	Appearance	State at room temperature	Conductivity	Malleability /Ductility	Location on Periodic Table
Metals					
Non metals					
Semi Metals					

2. **What makes hydrogen an unusual element?**
3. **What characteristics define semi-metals?**