

PART 0: THE PERIODIC TABLE

History of Atomic Theory

→ Alchemists

- The ancient Greeks believed that there were four types of matter: earth, air, fire, water
- Democritus (400BC) proposed the idea of atom and that they are invisible. Science though, rejected this idea and it took hundreds of years to pass before Democritus' idea was accepted.
- Skipping ahead to the 1800s, scientists had identified 63 elements but there was no way of organizing them.



chemical property ←

- Some tried to classify them based on physical properties or by how they reacted with other elements.
- None of these worked for ALL elements

The Periodic Table of Elements

- In 1867, Dmitri Mendeleev wrote down the characteristics of all the known elements on cards and arranged them into a pattern that made sense.
 - When elements were listed by increasing mass he noticed that certain other properties seemed to repeat with a regular pattern. ⇒ "periodicity" = repeat within a period



* He put them in order of mass, and when properties repeated he started a new row
↳ "period" (row)

The Early Periodic Table

increasing mass

- Horizontal rows (Periods) has masses increasing left to right
- Vertical columns groups/families have common properties
- Gaps were left when properties did not match properties in the column.
- Elements were predicted to fill the gaps

• mendeleev correctly predicted the future discovery of elements that would fit the pattern.

The Periodic Table: Crash Course Chemistry #4



Atomic number = # of protons

The Current Periodic Table

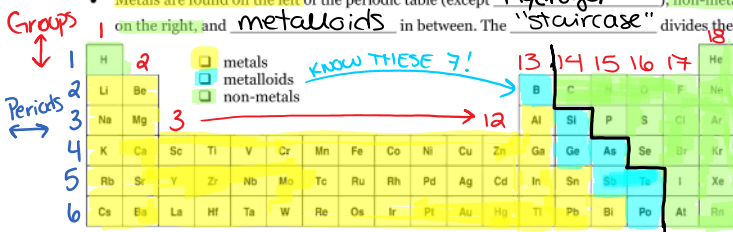
- Mendeleev's table had errors + inconsistencies
 - His periodic table evolved through the work of others
- * Now, elements are ordered by ATOMIC NUMBER not by atomic mass
- The table in use today reached its current form in the 1940's

Properties of Elements

- All elements are different from each other, and have different properties
 - These properties can be used in identifying different elements
- Elements with similar properties are often grouped together (same ↓ family)
- One common grouping is metal, non-metal, metalloid.

Metals, Non-Metals and Metalloids

- Metals are found on the left of the periodic table (except Hydrogen), non-metals on the right, and metalloids in between. The "staircase" divides them.



Metals:

- Hard, shiny, ductile, malleable, magnetic, and good conductors of both heat + electricity
- Most are solids at room temperature (exception: mercury, Hg (l))

Metalloids:

- can be shiny or dull, often conduct electricity poorly, but do not conduct heat (low melting point) (soft)
- most are solids at room temperature

Non-Metals:

- Dull, not ductile, brittle, non-magnetic, and poor conductors of heat and electricity
- Some are solids, some are liquids and some are gases at room temperature

HW:

Homework

ASSIGNMENT #3: Getting to know The Periodic Table

This assignment is to be completed below in the space provided.

You will need to research the names and locations of these periodic table groups/families

You will also learn where the metals, non-metals and metalloids are on your periodic table.

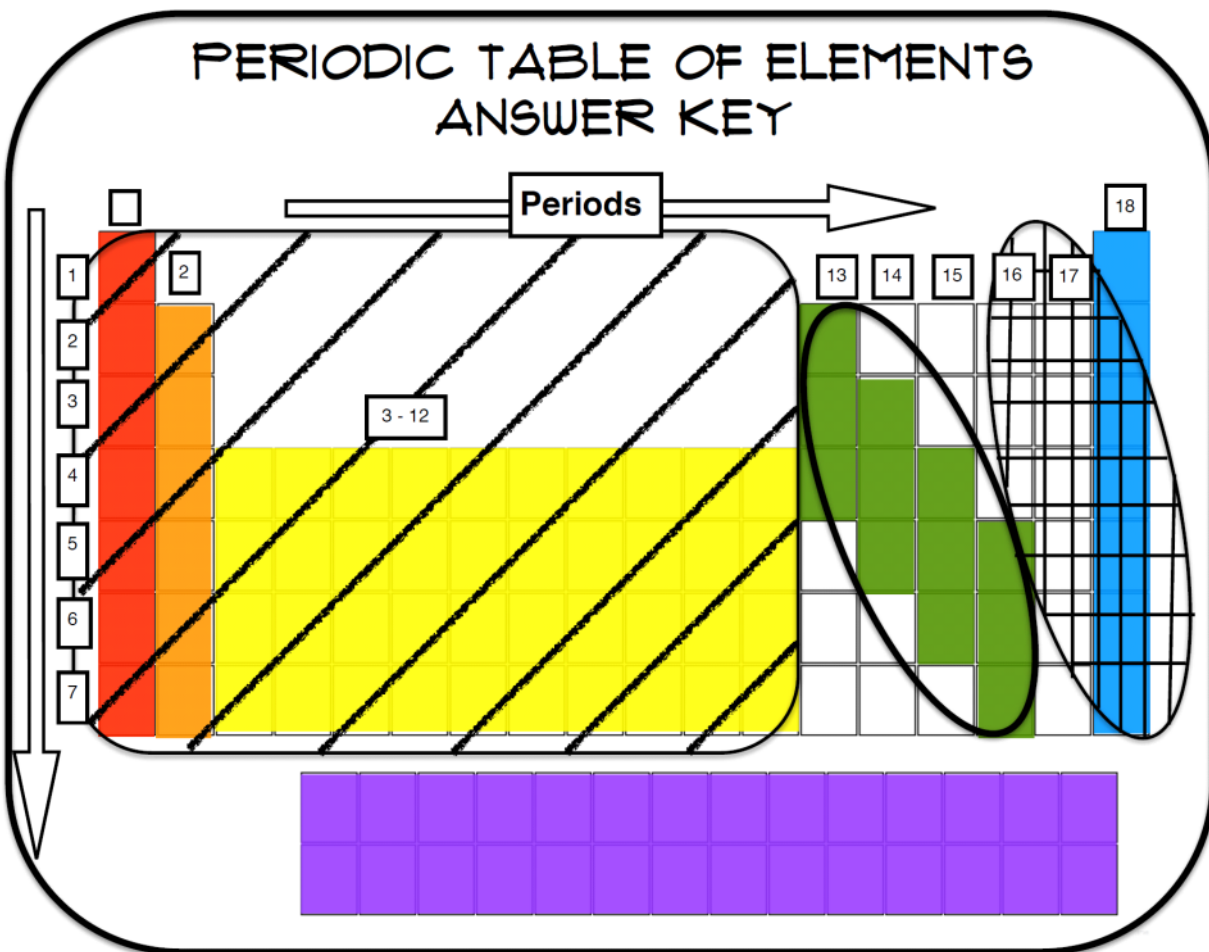
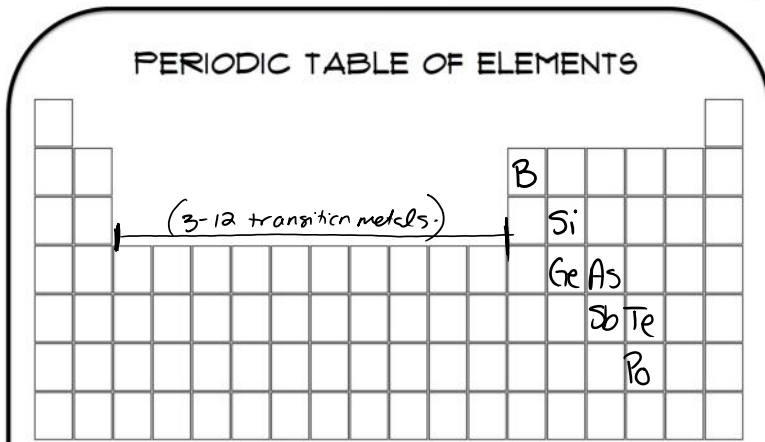
Be sure to use **ARROWS** to show the direction of Groups & Periods!

*You **DO NOT** have to write in elements symbols or atomic numbers.

LABEL THE PERIODIC TABLE

Identify the different parts of the Periodic Table:

- Alkali Metals: Red
- Alkali Earth Metals: Orange
- Transition Metals: Yellow
- Metalloids: Green
- Halogens: Blue
- Actinides/Lanthanides: Purple
- Metals: Stripe
- Metalloids: Outline Black
- Non-Metals: Checkered
- Arrow showing direction of the Periods
- Arrow showing direction of Groups
- Number the Groups
- Number the Periods



HW



Fill in the following table.

Property	Metals	Non-Metals	Metalloids
Colour/Lustre	Shiny/gray	Dull/iridescent colors	Shiny or Dull
Ductile (spread into wires)	Yes	No	No
Malleable (hammer into sheets)	Yes	No	No
Magnetic	Yes	No	No
Conductor	Heat & Electricity	No	Electricity (poor) NO HEAT

Other Important Groups to Know

- You should be able to **SHOW ME** these groups on the periodic table, and know their properties.

Group 1 (without H) - Alkali Metals

- Highly reactive **metals** (reactivity increases with **size**, so as you move **DOWN** the group they become more reactive)
- Burn spontaneously in oxygen and in **water**
- soft** solids at room temperature
- Lithium (Li)** is part of many batteries, **potassium (K)** is part of fertilizers

not included in "Alkali Metals" → **H** #1

small low reactivity

large high reactivity

Group 2 - Alkaline Earth Metals

- Reactive metals that will burn in oxygen and water if heated (ignited)
- Solids at room temperature ($\approx 21^{\circ}\text{C}$)

#2

Groups 3-12 "Transition Metals"

Groups 13-16 - made of metals, metalloids + non-metals. No consistent properties.

#17

Group 17 - Halogens

- All are highly reactive non-metals
- Fluorine and chlorine are gases, bromine is a liquid, and iodine is a solid at room temperature
- Widely used in cleaning/sterilization (water, household, medical) and bleaching (clothes, paper)

Br is the only liquid non-metal.

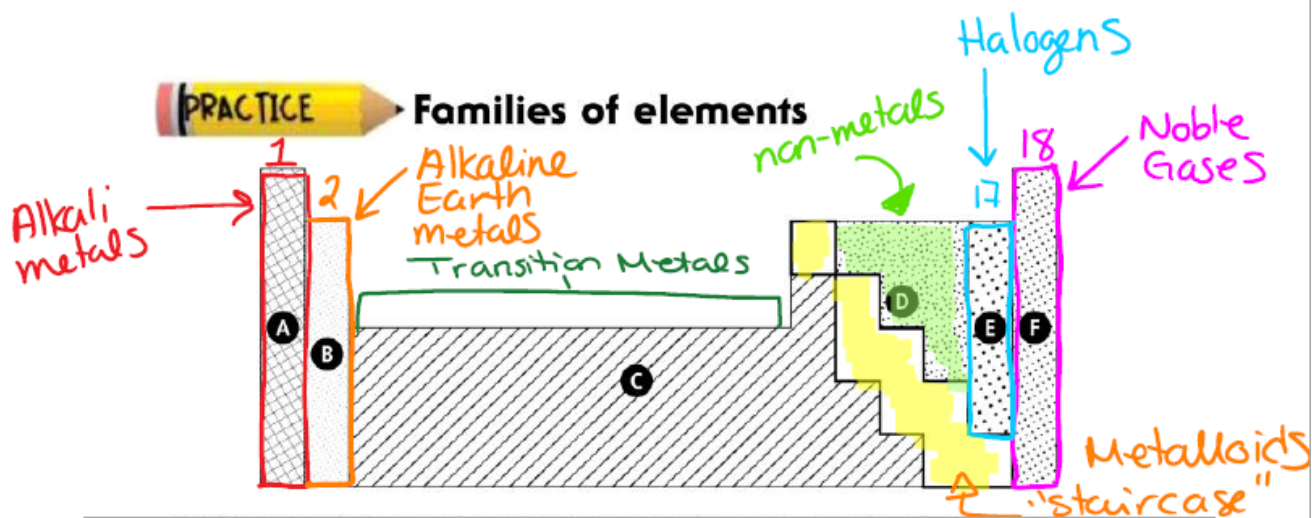
Family 18 - Noble Gases

- Are the most stable and inert elements in the table
- All are colourless gases at room temperature
- They are used inside lights to produce different colours (e.g. neon signs)

▶ Noble Gases are "inert gases"
 • will NOT be part of a compound
 • will NOT be part of a chemical reaction.

#18

HW



Use the simplified periodic table shown above to answer questions 1 to 12. To which region does each element or family belong? Place the letter corresponding to the shaded region on the blank line. You can use regions more than once.

You can use the periodic table on page 201 to help you answer these questions.

1. helium F
2. lithium A
3. fluorine E
4. beryllium B
5. halogens E
6. noble gases F
7. alkali metals A
8. alkaline earth metals B
9. non-metallic elements that are strongly reactive E
10. metallic elements that are strongly reactive A
11. metallic elements that are reactive B
12. non-metallic elements that are very unreactive F

Homework

ASSIGNMENT #4: Periodic Table Review pg 26-29

This assignment is to be completed below in the space provided.

1. The left-hand column in the chart below contains statements about various elements. Write the name and symbol for the element each statement refers to.

Group ↓
Period →

Description of Element	Name of Element	Symbol
It is the only gas in group 1.	hydrogen	H
This inert gas is in period 3.	argon	Ar
There is no heavier member of group 2.	radium	Ra
This element is the lightest of the halogens.	fluorine	F
Group 16 contains this reactive non-metal gas.	oxygen	O
The atomic mass of this metal is about 56.	iron	Fe
Period 6 contains this group 2 metal.	barium	Ba
This is the only liquid halogen.	bromine	Br
This metallic element is liquid at room temperature.	mercury	Hg
Photosynthesis produces this element.	oxygen	O
This is the lightest element in period 2.	lithium	Li

2. For each group, decide **which element does not belong** with the rest. Explain why.

- a. Si Ge Sn P Different Group
- b. Ti S Pt Pr Non-Metal
- c. N C Sn Xe Metal
- d. Sr F Cd I Different Period

3. Which one of the elements **does not** have the properties held by the rest of the group?

- a. Cs Ba K Na Alkaline Earth Metal
- b. Ca Cd Hg Zn Alkaline Earth Metal

Review Questions.

1. What is a family? vertical column \updownarrow
2. What is a period? horizontal row \leftrightarrow
3. What is the **symbol** for the following elements?
 - a. Magnesium Mg
 - b. Potassium K
 - c. Iron Fe
 - d. Copper Cu
4. What are the **names** of the following elements?
 - a. C Carbon
 - b. Cl Chlorine
 - c. Au gold
 - d. Sr strontium
5. In what **period** are the following elements found?
 - a. He 1
 - b. Ge 4
 - c. Rb 5
 - d. I 5
6. In what **group** (family name) are the following elements found?
 - a. Sulfur 16 (no name)
 - b. Ca 2 (alkaline earth metals)
 - c. Iodine 17 (halogens)
 - d. Fe 8 (no name)
7. List two atoms from each of the following groups:
 - a. Halogen F, Cl, Br, I, At
 - b. Noble Gas He, Ne, Ar, Kr, Xe, Rn
 - c. Alkali metal Li, Na, K, Rb, Cs, Fr
 - d. Alkaline Earth Metal Be, Mg, Ca, Sr, Ba, Ra
8. What is the symbol for silver? Ag
9. Ni is the symbol for what element? Nickel
10. State the period number(s) that contain only eight elements: 2 & 3

Using the periodic table

Vocabulary	
average atomic mass	metalloids
atomic number	multiple ion charge
electrons	noble gases
families	non-metals
good	periodic table
halogens	periods
ions	poor
ion charge	properties
metals	

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. The periodic table organizes the elements according to their physical and chemical properties.
2. The periodic table is divided into seven horizontal rows called periods and 18 vertical columns called groups / families.
3. metals appear on the left side of the periodic table. These elements are good conductors of heat and electricity.
4. Non metals appear on the right side of the periodic table. These elements are poor conductors of heat and electricity.
5. The metalloids (semi-metals) form a zigzag staircase arrangement on the periodic table. These elements have properties similar to both metals and non-metals.
6. The atomic # refers to the number of protons that an atom has in the nucleus.
7. The average atomic mass is the weighted average of the masses of the atoms of an element.
8. A(n) ion charge is an electric charge that forms on an atom when it gains or loses electrons.
9. Some metals, like platinum and cobalt, form ions in more than one way. In other words, they have a(n) multiple ion charge.

Use with textbook pages 52–57.

The periodic table and chemical properties

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. <u>B</u> halogens	A. most reactive metals
2. <u>D</u> noble gases	B. most reactive non-metals
3. <u>A</u> alkali metals	C. have properties of both metals and non-metals
4. <u>E</u> alkaline earth metals	D. most unreactive elements
	E. includes beryllium and magnesium

Circle the letter of the best answer.

5. What is the name of a horizontal row in the periodic table?

- A. column
- B. family
- C. period
- D. group

6. Which of the following are metalloids?

I.	silicon
II.	boron
III.	neon

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II, and III

Use the following diagram to answer questions 7 and 8.

30	2+
Zn	
Zinc	
65.4	

7. What does the “30” refer to?

- A. ion charge
- B. average atomic mass
- C. atomic number
- D. family number

8. What does the “2+” refer to?

- A. ion charge
- B. average atomic mass
- C. atomic number
- D. family number

9. To which of the following groups does oxygen belong?

- A. gas
- B. metal
- C. metalloid
- D. non-metal

10. Which of the following is the same as the atomic number of an element?

- A. number of protons
- B. number of neutrons
- C. number of electrons
- D. number of ion charges