

You have mastered this topic when you can:

- 1) state the **PERIODIC TABLE LAW**.
 - 2) define or describe **OBSERVABLE PROPERTY**, **PHYSICAL PROPERTY** and **CHEMICAL PROPERTY**.
 - 3) identify the **REPRESENTATIVE**, the **TRANSITION ELEMENTS**, and these **GROUPS** of elements: **ALKALI METALS**, **ALKALINE EARTH METALS**, **HALOGENS** and **NOBLE GASSES**.
 - 4) describe some of the chemical and physical properties of the **ALKALI METALS**, **ALKALINE EARTH METALS**, **HALOGENS** and **NOBLE GASSES**.
 - 5) predict the properties of an element knowing the characteristics of another element in its **GROUP**.
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THE PERIODIC TABLE LAW

- 1) *The PERIODIC TABLE LAW states that when elements are arranged in order of increasing atomic number (Z), a pattern is seen in which similar observable properties occur at regular intervals.* ← **MEMORIZE IT!!** The *periodic table law* allowed chemists to organize the elements that shared similar *observable properties* into *columns*. Study your periodic table while reading the following:
 - A) *Rows* are called **PERIODS**. The number of the *period* is equal to the number of *occupied orbitals* found within the atoms in the *period* and the *principle quantum number* of the *valence orbital*.
 - B) *Columns* are called **GROUPS**. Elements within a *group* share *similar OBSERVABLE PROPERTIES*. **OBSERVABLE PROPERTIES are characteristics that can be seen and or measured.**
 - 1) **PHYSICAL PROPERTIES** are characteristics such as hardness, state at SATP or STP, melting point, boiling point, density, volume of gasses at SATP or STP, electrical conductivity, etc.
 - 2) **CHEMICAL PROPERTIES** are characteristics relating to the chemical reactivity of a substance. Elements within a *group* are most similar in their **CHEMICAL PROPERTIES** because they react with other substances the same way.
 - 3) **Number the top of each group (column) of your periodic table from 1 to 18 moving left to right.** The *groups* of the periodic table are organized into two main categories: **REPRESENTATIVE ELEMENTS** and **TRANSITION ELEMENTS**.
 - a) **REPRESENTATIVE ELEMENTS** are those in *groups 1, 2 & 13 to 18*. They are the **TALL GROUPS** of your *periodic table*.
 - b) **TRANSITION ELEMENTS** are those in *groups 3 to 12*. They are the **SHORT GROUPS** of your *periodic table*.
 - c) The two series of elements located at the bottom of the periodic table, the lanthanides and actinides, will not be discussed in this course.
 - C) You must know the names, location and *observable properties* of these **five groups** of elements.
 - 1) **Group 1** is named the **ALKALI METALS**. Elements within *group 1* have these *observable properties*.
 - a) **Physical properties:** soft, silver-coloured, solid at SATP, have high melting points (between 27°C & 181°C), high boiling points (between 677°C & 1342°C), and they conduct electricity well.
 - b) **Chemical properties:** they react violent with water producing basic solutions and hydrogen gas, they react quickly with air so they are stored in oil or in a vacuum, and they react with **halogens** creating compounds having a 1 to 1 atomic ratio: **e.g.** LiCl, NaCl, KCl, RbCl, CsCl & FrCl.
 - 2) **Group 2** is named the **ALKALINE EARTH METALS**. Elements located within *group 2* have these *observable properties*.
 - a) **Physical properties:** solid at SATP, have high melting points (between 649°C & 1278°C), high boiling points (between 1107°C & 2970°C), and they conduct electricity well.
 - b) **Chemical properties:** are very reactive, they react readily with water producing basic solutions and hydrogen gas, they react quickly with oxygen producing compounds having a 1 to 1 ratio of atoms: **e.g.** BeO, MgO, CaO, SrO, BaO & RaO; and they react with hydrogen to produce compounds having a 1 to 2 atomic ratio: **e.g.** MgH₂, CaH₂, SrH₂, BaH₂ & RaH₂ (Be is the exception to this rule.)

- 3) **Group 17** is named the **HALOGENS**. Elements located within **group 17** have these **observable properties**.
- Physical properties:** at SATP $I_{(s)}$ & $At_{(s)}$ are solids, $Br_{(l)}$ is a liquid and $F_{(g)}$ & $Cl_{(g)}$ are gasses, they have low melting points (between $-220^{\circ}C$ & $302^{\circ}C$), low boiling points (between $-188^{\circ}C$ & $337^{\circ}C$), do not conduct electricity well, and the solids are dull and brittle.
 - Chemical properties:** are extremely reactive with hydrogen, extremely reactive with metals.
- 4) **Group 18** is named the **NOBLE GASSES**. Elements located within **group 18** have these **observable properties**.
- Physical properties:** are gasses at SATP, have extremely low melting points (between $-272^{\circ}C$ & $-71^{\circ}C$), and low boiling points (between $-269^{\circ}C$ & $-61.8^{\circ}C$).
 - Chemical properties:** are non-reactive, however, under extremely special conditions however, krypton, xenon & radon will form molecules with fluorine.
 - Noble gasses** are neither metals nor non-metals and are often called **INERT** because they are non-reactive under all but the most extreme conditions.
- 5) **HYDROGEN** is considered a **group** of its own because sometimes it behaves like an **alkali metal**, sometimes it behaves like a **halogen** and other times it behaves in its own unique way. **FOR PURPOSES OF THIS COURSE, HYDROGEN IS CONSIDERED TO BE A NON-METAL!!** Hydrogen has these properties.
- Physical properties:** is a gas at SATP, has an extremely low melting point ($-272^{\circ}C$) and boiling point ($-253^{\circ}C$).
 - Chemical properties:** it is extremely reactive with both metals and non-metals.

D) Required Practice 1: Answer these questions on your own paper. {Answers are on page 3.}

- State the periodic table law.
- What do all the elements within a period have in common?
- What do all the elements within a group have in common?
- How do the elements within a group react with another substance?
- List the group numbers of the representative and transition elements.
- Name five representative elements and five transition elements.
- Elements from which group must be stored in oil or a vacuum?
- Complete this table.

Name	Z	Group	Period
Hydrogen			
		13	2
	51		
		10	6
Tin			

BE SURE YOU MEMORIZE THE NAMES AND OBSERVABLE PROPERTIES OF GROUPS 1, 2, 17, 18 & HYDROGEN.

ANSWERS TO THE REQUIRED PRACTICE**Required Practice 1 from page 2**

1. When elements are arranged according to increasing atomic number a pattern is seen in which similar observable properties occur at regular intervals. 2. Elements within a period have the same number of occupied orbits. 3. Elements within a group share similar observable properties. 4. All elements within a group react with another substance the same way forming particles having the same ratio of atoms. 5. Representative elements are found in groups 1, 2 & 13 through 18. Transition elements are found in groups 3 through 12. 6. Answers will vary. 7. The Alkali metals must be stored in oil or a vacuum. 8. See the table below.

Name	Z	Group	Period
Hydrogen	1	1	1
Boron	5	13	2
Antimony	51	15	5
Platinum	78	10	6
Tin	50	14	5

