

## Periodic Table

Today you will learn about the organization of the elements of the periodic table into groups (or families) and periods and the properties of these groups. **Groups (or families)** refer to the **vertical columns** on the periodic table and **periods** refer to the **horizontal rows** on the periodic table.

## Periodic Table – Blocks

Elements can be classified by the last energy level that their electrons fill. The first organization you will look at is by blocks. Last chapter you learned about the 4 types of electron orbitals (s, p, d & f) and where these orbitals are on the periodic table.

- Color the elements in **groups 1 & 2** red. In addition, also color Helium (He) red. These are the **s block** elements. Color the s block key box red.
- Color the **two rows at the bottom of the periodic table**, detached from the table, purple. These are the **f block** elements. Color the f block box in the key purple.
- Color the elements in **groups 13-18 (except Helium)** yellow. These are the p block elements. Color the **p block** box in the key yellow.
- Color the elements in **groups 3-12** blue. These are the d block elements. Color the **d block** box in the key blue.

### Key: Periodic Table Blocks

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- s block  
 p block  
 d block  
 f block

## Periodic Table - State at 298 K

Elements can be classified by their state at room temperature (298 K). Most elements are solid at room temperature but there are 2 elements that are liquid and 11 elements that are gases at 298 K.

- **Hydrogen (H), Helium (He), Nitrogen (N), Oxygen (O), Fluorine (F), Neon (Ne), Chlorine (Cl), Argon (Ar), Krypton (Kr), Xenon (Xe) and Radon (Rn)** are all **gases** at room temperature. Color these elements & the key for gas red.
- **Mercury (Hg) & Bromine (Br)** are **liquid** at room temperature. Color these elements & the key for liquid blue.
- **All remaining elements** are **solid** at room temperature. Color these elements & the key for solid green.

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### Key: Periodic Table State at 298 K

- gas  
 liquid  
 solid

## Periodic Table - Metallic Character

Elements can be classified by their metallic character as being a metal, metalloid (semi-metal) or nonmetal.

- Metals** include all elements that are not considered a metalloid or nonmetal. Metals have the following properties:
  - Shiny metallic appearance.
  - Solid at room temperature (except Mercury).
  - High melting point.
  - High densities.
  - Malleable & ductile.
  - Good conductors of heat & electricity.
- Metalloids** (also known as semi-metals) include **Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te) and Astatine (At)**. Some tables also list Polonium (Po) as a metalloids, we will not. Metalloids have the following properties:
  - Have properties of both metals and nonmetals.
  - Often used as semiconductors.
- Nonmetals** include all elements to the right of the metalloids and **Hydrogen (H)**. Nonmetals have the following properties:
  - Solid nonmetals have little to no metallic luster.
  - Solid nonmetals are brittle.
  - High ionization energy.
  - Poor conductors of heat & electricity.

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- Color the seven metalloids red.
- Color the nonmetals blue.
- Color the remaining elements green.

### Key: Periodic Table Metallic Character

- metal
- metalloid
- nonmetal

## Periodic Table - Groups

The elements of the periodic table can also be classified by groups of similar properties.

- Alkali Metals** include **all elements in group 1 except Hydrogen (H)**. Color the alkali metals red. Alkali metals have the following properties:
  - Lower densities than other metals.
  - React with water & air.
  - Stored in oil.
  - One valence electron.
  - Easily lose their valence electron to form a univalent cation (1+ charge)
- Alkaline Earth** elements include **all elements in group 2**. Color the alkaline earth elements orange. Alkaline earth elements have the following properties:
  - Harder, denser & stronger than alkali metals.
  - Two valence electrons.
  - Easily lose valence electrons to form divalent cations (2+ charge).
- Transition Elements** refer to **groups 3 through 12**. Color the transition elements green. Transition elements have the following properties:
  - Referred to as B group elements.
  - Very Hard.
  - High melting & boiling points.
  - High electrical conductivity.

- **Lanthanides** include **elements 58-71**. Color the lanthanides yellow. Lanthanides are:
  - Known as Rare Earth elements because they are rare on earth.
- **Actinides** include **elements 90-103**. Color the actinides purple. Actinides are:
  - Known as Rare Earth elements because they are rare on earth.
- **Chalcogens** include all elements in **group 16**. Color the chalcogens brown.
- **Halogens** include all elements in **group 17**. Color the halogens blue. Halogens have the following properties:
  - Have 7 valence electrons and only need 1 electron to fill their outer energy level.
  - High electronegativities.
  - Most reactive nonmetals, especially with alkali metals and alkaline earth metals.
- **Noble Gases** include all elements in **group 18**. Color the noble gases grey. Noble gases have the following properties:
  - Known as inert gases.
  - All gases at room temperature.
  - Have full outer energy level.
  - High ionization energies but very low electronegativities.
- **Synthetic elements**
  - There are **90 naturally occurring elements**. The other elements on the periodic table are man-made and referred to as synthetic elements. The synthetic elements are: **Technetium (Tc)**, **Promethium (Pm)** and **all elements with atomic numbers greater than Uranium (U)**. Put a black border around all synthetic elements.

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### Key: Periodic Table Groups

- alkali metals
- alkaline earth elements
- transition elements
- lanthanides
- actinides
- chalcogens
- halogens
- noble gases
- synthetic elements

### Homework:

1. **Si** What is the third period metalloid?
2. **At** What is the halogen element with the greatest atomic weight?
3. **Sr** What is the fifth period alkaline earth element?
4. **He** What is the group 18 s block element?
5. **At** What is the metalloid element with the greatest number of protons?
6. **O** What is the group 16 gas?
7. **Tc** What is the synthetic element with the fewest protons?
8. **Lr** What is the actinide with the greatest atomic weight?
9. **Hg** What is the liquid d block element?
10. **Sc** What is the d block element with the smallest atomic number?
11. **At** What is the metalloid with 7 valence electrons?
12. **Be** What is the alkaline earth element with the smallest atomic weight?
13. **Th** What is the actinide with the smallest atomic number?

14. **Np** What is the synthetic actinide with the smallest atomic weight?
15. **He** What is the noble gas with two valence electrons?
16. **F** What is the halogen with the smallest atomic weight?
17. **Te** What is the chalcogen metalloid?
18. **Sc** What is the transition element with the smallest atomic weight?
19. **Si** What is the third period element with 4 valence electrons?
20. **As** What is the fourth period element with 5 valence electrons?
21. **Ne** What is the second period element with 8 valence electrons?
22. **H** What is the first period element with the smallest atomic weight?
23. **Xe** What is the fifth period element the greatest atomic number?
24. **Mg** What is the third period element with 2 valence electrons?
25. **As** What is the fourth period element whose electron configuration ends in  $4p^3$ ?
26. **B** What is the second period element with an oxidation number of 3+?
27. **S** What is the third period element with an oxidation number of 2-?
28. **Sb** What is the fifth period metalloid with the smallest atomic weight?
29. **S** What is the third period chalcogen?
30. **Te** What is the element that is both a chalcogen and a metalloid?
31. **2+** What is the oxidation number of all alkaline earth elements?
32. **7** How many valence electrons do halogens have?
33. **1+** What is the charge of an alkali element when it forms an ion?
34. **3+** What is the oxidation number of the second period metalloid?
35. **Po** What element is both a chalcogen and a metal?
36. **Cd** What is the fifth period transition element with the greatest atomic number?
37. **Tc** What is the fifth period synthetic element?
38. **3+** What is the oxidation number for gallium?
39. **6** How many valence electrons does polonium have?
40. **2+** What is the oxidation number of barium?
41. **8** How many valence electrons does krypton have?
42. **0** What is the oxidation number of radon?
43. **Pm** What is the only synthetic lanthanide?
44. **Ba** What do you do with dead people?
45. **Rn** What is the sixth period noble gas?
46. **He** What is the first period s block element with the greatest atomic weight?
47. **3+** What is the oxidation number for boron?
48. **7** How many valence electrons does astatine have?
49. **H** What is the group 1 gas?
50. **Br** What is the fourth period liquid?
51. **H** What is the nonmetal with a 1+ oxidation number?
52. **Y** What is the fifth period transition element with the fewest protons?

53. **Br** What is the halogen that is a liquid at room temperature?
54. **2+** What is the oxidation number of alkaline earth elements?
55. **Rn** What is the nonmetal with the greatest atomic weight?
56. **O** What is the chalcogen with the fewest protons?
57. **Te** What is the period 5 element with the second greatest atomic weight?

For each of the following statements, determine which term it best describes. Use: **alkali, alkaline-earth, chalcogen, halogen, metalloid, lanthanide, actinide, transition elements, noble gas, or synthetic**. You will use some terms more than once.

- |  |  |
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| 58. <b>chalcogen</b>                   | This group contains a metal, metalloid and non-metals.                           |
| 59. <b>alkaline-earth</b>              | The elements in this group are harder and denser than the alkali metals.         |
| 60. <b>metalloids</b>                  | This term refers to elements that have properties of both metals and non-metals. |
| 61. <b>alkali</b>                      | This group has a one valence electron.   |
| 62. <b>halogens</b>                    | This group contains solid, liquid & gaseous elements at room temperature.        |
| 63. <b>alkaline-earth</b>              | This group of elements loses 2 electrons when they form ions.                    |
| 64. <b>transition elements</b>         | These elements are metals with high electrical conductivity.                     |
| 65. <b>alkali</b>                      | This group reacts with water and air.  |
| 66. <b>halogens</b>                    | This group contains the most reactive non-metals.                                |
| 67. <b>noble gases</b>                 | The elements in this group are inert.  |
| 68. <b>noble gases</b>                 | All of the members in this family are gases.                                     |
| 69. <b>lanthanides &amp; actinides</b> | These two series of elements are known as Rare Earth elements.                   |
| 70. <b>actinides</b>                   | This group of elements contains mostly synthetic elements.                       |
| 71. <b>alkali</b>                      | These elements are stored in oil.  |
| 72. <b>synthetic</b>                   | These elements are man-made.   |
| 73. <b>transition elements</b>         | These elements are referred to as B group elements.                              |
| 74. <b>alkaline-earth</b>              | This group has an oxidation number of 2+.  |
| 75. <b>halogens</b>                    | These elements have the highest electronegativities in their period.             |