

## CH8 FACT SHEET

# THE PERIODIC TABLE OF THE ELEMENTS

---

### CLASSWORK AGENDA FOR THE WEEK

- (1) Explain how elements are arranged on The Periodic Table.
  - (2) Compare and contrast the physical and chemical properties of families on The Periodic Table.
  - (3) Prepare a group report on the elements of a chemical family.
  - (4) Present a group report on the elements of a chemical family.
- 

In 1864, an English industrial chemist named **John Alexander Newlands** (b. 1837; d. 1898) made a list of the chemical elements known to him. He listed the elements by their mass from the lightest to the heaviest. Upon studying his list he noticed something interesting. Every eighth element—starting from any element on the list—had many of the same chemical and physical characteristics as the first in the series of eight. This “periodicity” reminded him of the way musical notes sound on a piano. The middle “c” on a piano scale sounds much the same as the eighth note one octave away from it. Newlands noted that the element sodium (Na) reacts violently when mixed with water as does potassium (K). On Newland’s list, potassium was listed eight elements away from sodium. The element magnesium (Mg) has many of the same properties as calcium (Ca) which is eight elements away from magnesium. Two years later Newlands proposed his **Law of Octaves** to the Chemical Society of London and was told that his idea was silly. Three years after Newland’s disastrous presentation at the Chemical Society, a Russian chemist named **Dmitri Mendeleev** (b. 1834; d. 1907) showed that Newlands’ idea was exactly correct. The chemical elements could be grouped into **families of chemical elements** having similar physical and chemical properties. Mendeleev also showed that the order of the arrangement of the chemical elements followed a definite pattern just as Newlands had discovered.

Mendeleev published his own chart in 1869. He arranged the elements just as Newlands had done according to their increasing atomic mass. Then, he put them in rows according to the way they “reacted” when mixed with other elements. Today, the modern **Periodic Table of the Elements** is arranged in horizontal rows called **periods** and vertical columns called **families**. From the “gaps” in his chart Mendeleev predicted the properties of gallium, scandium, and germanium which had not yet been discovered. All three elements were found within the next 20 years and had exactly the properties Mendeleev predicted they would. Since Mendeleev’s time, other elements have been added to the chart and the **periodic law of chemistry** remains a valuable tool for understanding how elements behave. The periodic law states that all of the elements are related according to their atomic masses in a single orderly system. Since Mendeleev’s *Periodic Table of the Elements* was first published, many more elements have been discovered and added to include more than one hundred chemical elements.

Elements in the same family have very similar chemical properties. For example, the element sodium (Na) is a highly reactive “light metal.” It produces a violent chemical reaction when mixed with water. Lithium (Li) is in the same family as sodium. Lithium also reacts violently when mixed with water. Sodium and lithium are both **alkali metals** in Family IA (or 1). Chlorine (Cl), bromine (Br), and iodine (I) are in a different family called the **halogens**: Family VIIB (or 17). All three substances are poisonous and react violently when mixed with any of the alkali metals. The **noble gases** in Family VIIIB (or 18) are unreactive gases. It is extremely difficult to get any of the elements in this family to react with other chemical substances.

## CH8 Fact Sheet (cont'd)

In the unit entitled Atomic Structure, you learned that atoms have a positively charged **nucleus** and negatively charged **electrons** that orbit it. Today we know that the manner in which an atom reacts with other atoms depends on the number of electrons in the "outermost" electron-shell of that atom. If you draw electron-shell diagrams of atoms in *The Periodic Table* you will notice that elements in the same chemical families have the same number of electrons in their outer shell. These outer shell electrons are called **valence electrons**.

### Homework Directions

1. Copy the dictionary definition of the following terms: metal, brittle, ductile, boiling, and inert.
2. Refer to *The Periodic Table* given to you by your instructor and to the box titled "Physical Properties." Write a paragraph that contrasts the properties of the elements in the listed families **without using** the following terms: metal, brittle, ductile, boiling, or inert.

Assignment due: \_\_\_\_\_

\_\_\_\_\_  
Student's Signature

\_\_\_\_\_  
Parent's Signature

\_\_\_\_/\_\_\_\_/\_\_\_\_  
Date