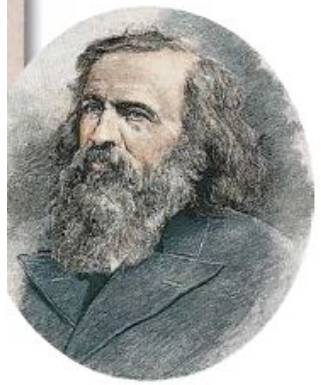
NOTES ON CHAPTER 4: ELEMENTS AND THE PERIODIC TABLE

4.2 Organizing the Elements

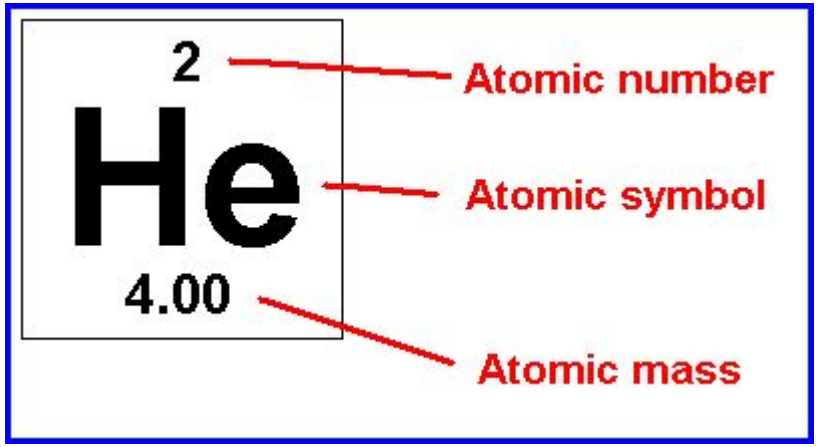
By 1869, 63 elements had been discovered. A Russian scientist named Dmitri Mendeleev discovered a set of patterns that applied to all the elements.

FIGURE 13
Mendeleev's Periodic Table
When Mendeleev published his first periodic table, he left question marks in some places. Based on the properties and atomic masses of surrounding elements, he predicted that new elements with specific properties would be discovered.



He wrote each element's melting point (M.P.), density, and color on individual cards. He also included the element's atomic mass.

The atomic mass is the average mass of all the isotopes of an element.



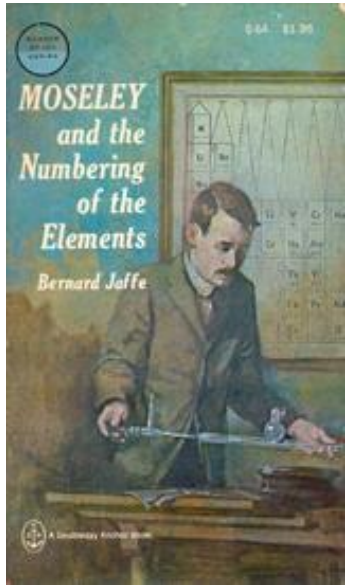
Mendeleev noticed a pattern of properties when he arranged the elements in order of increasing atomic mass.

Mendeleev found that by arranging the elements just by atomic mass, however, did not always group similar elements together. So, he moved a few around to where they did.

When he did that, there were three blank spaces left. He predicted the properties of those elements and felt confident that they would be discovered.

In 1869, Mendeleev published the first periodic table of elements. Within 16 years, the 3 missing elements were discovered: scandium, gallium, and germanium.

In 1913, a British scientist, Henry Moseley, discovered a way to measure the positive charge on an atom's nucleus – the atomic number. The periodic table was the rearranged in order of the atomic number, not atomic mass.



ORGANIZATION OF THE PERIODIC TABLE

"Periodic" means "in a regular, repeated pattern."

1. The atomic number increases from left to right.
2. The table is organized in horizontal rows called periods. 
   a. Elements on the left side are highly reactive metals.
   b. In the middle are less reactive metals.
   c. Then, come the metalloids, followed by the nonmetals on the right.
   d. This pattern is repeated in each period.
3. Because of the repeating pattern of properties, the elements fall into 18 vertical columns, or groups or families  having similar characteristics.
   a. Elements in Group 1 are metals that react violently with water.
   b. Elements in Group 2 react with water slowly or not at all.
   c. Group 17 elements react violently with elements in Group 1, whereas the elements in Group 18 rarely react at all.
4. Lanthanides and actinides are part of Periods 6 and 7, but are printed below the others. They are not part of the 18 groups. If they were inserted into the table according to their atomic numbers, it would be difficult to fit that version into the book.

<u>atomic number</u>: number of protons in the nucleus

<u>chemical symbol:</u> 1-2 letters that represent the element

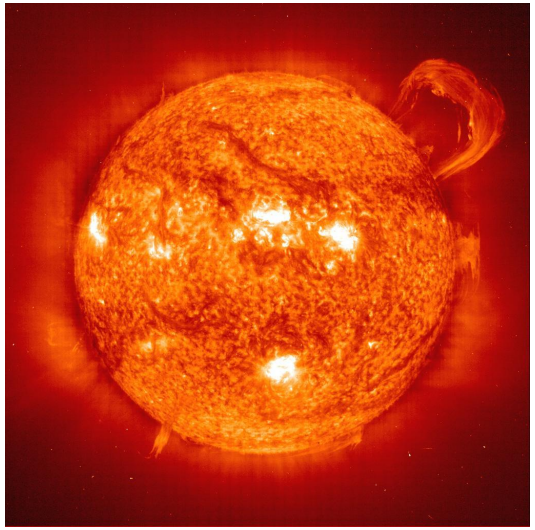
<u>element</u>: may have English or Latin roots.

<u>average atomic mass</u>: most elements have a number of isotopes (mass of protons and neutrons)

Zn = zinc Ca= calcium Si= silicon He= helium H= hydrogen O= oxygen

Na= sodium (natrium) K= potassium (kalium) Au= gold (aurum)

Fe= iron (ferrum) Pb= lead (plumbum)



Like most stars, the sun is made from mainly one element

hydrogen.

This hydrogen exists at extremely high temperatures – 15 MILLION degree Celsius. When temperatures are this high, there is no solid, liquid, or gas! Instead, there is the 4th state of matter called <u>plasma</u>.

In plasma, the atom has been stripped of its electrons, leaving it positively charged. Usually, positive charges repel each other, but in stars, the pressure is so high that the nuclei are squeezed close together and collide.

Nuclear fusion, which happens in stars, combines smaller nuclei into larger nuclei, creating heavier elements. On the sun, hydrogen nuclei fuse, producing helium. Other fusion reactions occur, forming nuclei of heavier elements such as carbon, nitrogen, and oxygen. The sun isn't large enough to form heavier elements, but other stars are, and can form elements such as magnesium and silicon. This fusion can continue until the core is almost all iron.

Scientists believe that heavier elements are formed when a star explodes, creating a supernova. Temperatures can be as high as a BILLION degrees Celsius.
As the star explodes, these heavier elements are blown out into space.

Astronomers and other scientists believe that a gigantic supernova occurred billions of years ago, forming the sun and the planets.

If this is true, then all matter on Earth is a form of