

Fig. 1.14

1.5 The Origin of the Elements

- H and He ($Z=1,2$) - formed in the Big Bang
- Heavier elements ($Z>2$) - made inside stars
 - formation of stars
 - collisions and merging of H atoms
 - formation of new elements - intense heat

- H - fuels the stars
- stars run out of H - cool down and collapse
- supernova explosions - very high temperatures
- formation of even heavier elements (U, Au,...)

- Formation of planets - stardust

1.6 The Periodic Table

- Periodicity in the properties of elements
 - arrangement by atomic number (atomic mass)
 - families of elements
- Groups - columns in the table
 - main (A) groups (1, 2, 13-18)
 - secondary (B) groups (3-12)
- Periods - horizontal rows in the table

- Elements in a group have similar properties
- Properties change gradually down in a group
 - Group 1 (IA) - alkali metals (Li, Na, K, Rb,...)
 - soft, easy melting metals; react violently with water
 - reactivity increases down in the group
 - Group 2 - alkaline earth metals (Be, Mg, Ca, ...)
 - similar but less reactive than Group 1
 - reactivity increases down in the group

- Group 17 (VIIA) - halogens (F, Cl, Br, I,...)
 - very reactive - reactivity increases up in the group
 - gradual change in physical properties - F, Cl (yellow gases), Br (red-brown liquid), I (purple-black solid)
- Group 18 (VIIIA) - noble gases (He, Ne, Ar,...)
 - very low reactivity - inert gases
 - colorless, odorless gases
- Groups 3-12 (IB-VIIIB) - transition metals
 - Inner transition metals - lanthanides, actinides
- Hydrogen - special place in the table

1.7 Metals, Nonmetals, and Metalloids

- Metals
 - good electrical and heat conductivity, malleable, ductile
- Nonmetals
 - poor electrical and heat conductivity, neither malleable nor ductile, often gases or liquids
- Metalloids
 - semiconductors, intermediate properties

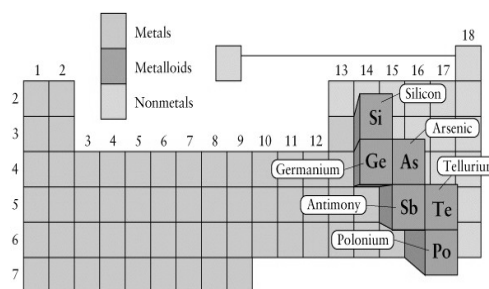


Fig. 1.19

Examples:

- Classify the following elements by their position in the periodic table and give their group and period numbers.
 - Hafnium, Antimony, Phosphorus

1.8 Compounds

- Combination of two or more elements in some definite proportion
 - organic - containing C and/or H
 - propane, glucose, hemoglobin, polyethylene,...
 - inorganic - all other compounds
 - water, ammonia, table salt, sulfuric acid,...
 - chemical bonding

- Molecules - el. neutral groups of atoms bonded together
- Ions - el. charged atoms or groups of atoms
- Molecular compounds
 - gases, liquids or solids with low melting points
- Ionic compounds
 - solids with high melting points
- Chemical formula - shows the composition of a compound

1.9 Molecular Compounds

- Structural formula - gives the type and number of atoms in a molecule and how they are bonded (H-O-H)
- Molecular models - give also the molecular geometry
 - ball-and-stick models
 - tube structures
 - space-filling models

