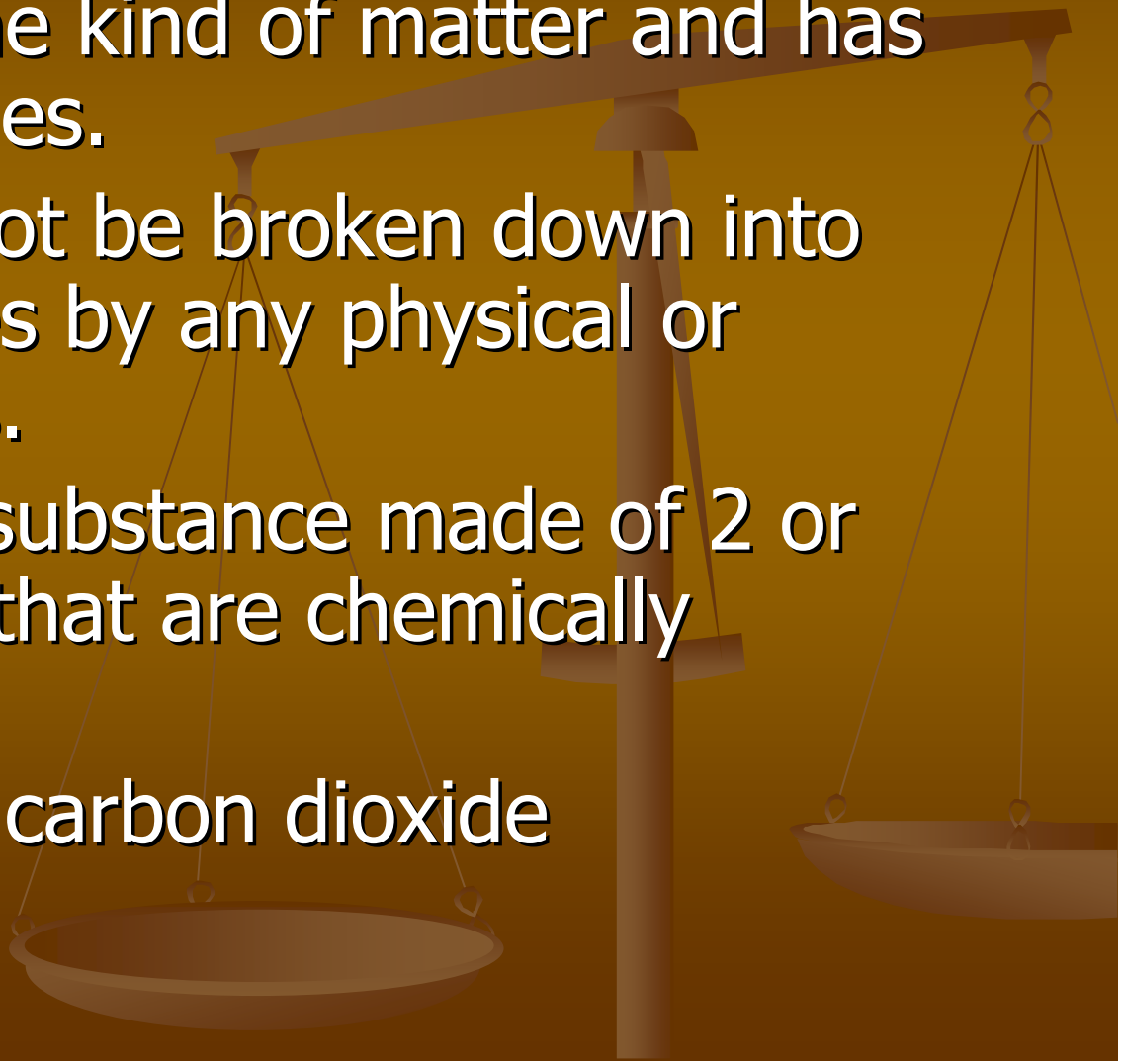
Periodic Table

Pure Substances

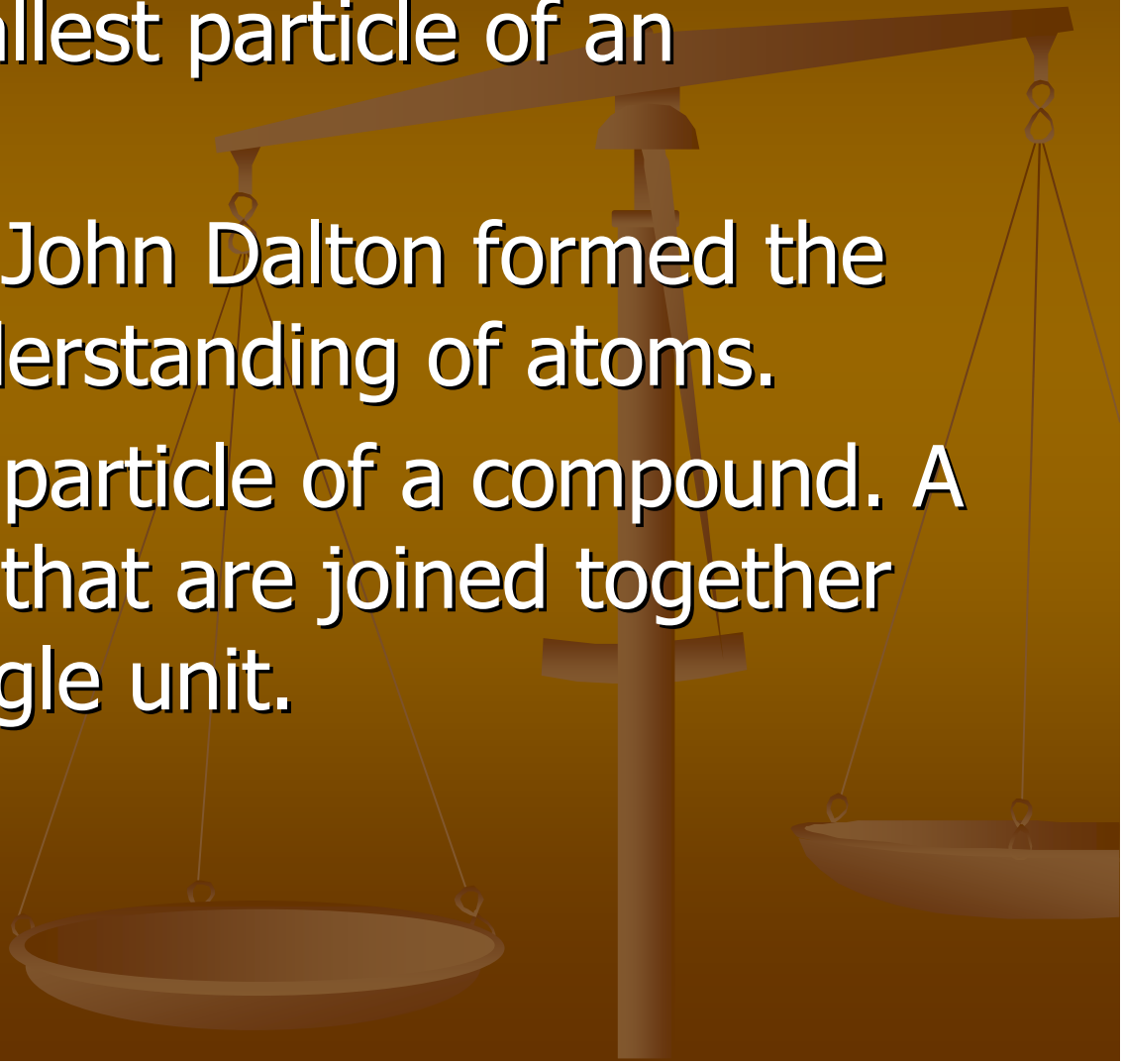
- Made of only one kind of matter and has definite properties.
- Elements: Cannot be broken down into other substances by any physical or chemical means.
- Compounds: A substance made of 2 or more elements that are chemically combined.

Examples: water, carbon dioxide



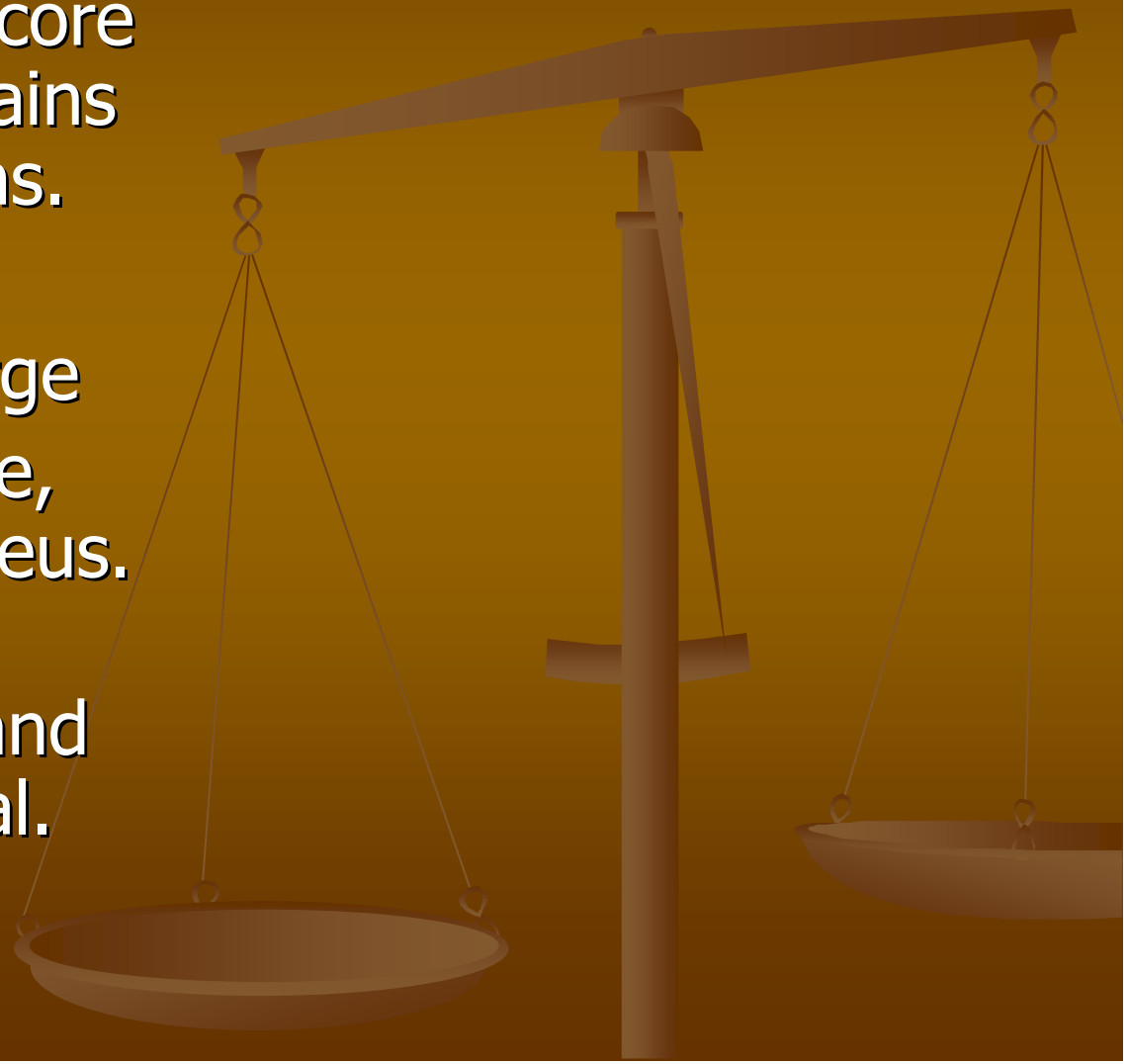
Particles of Matter

- Atom is the smallest particle of an element.
- Atomic Theory: John Dalton formed the basis of our understanding of atoms.
- Molecule: Basic particle of a compound. A group of atoms that are joined together and act as a single unit.



Structure of an Atom

- Nucleus – central core of the atom. Contains protons + neutrons.
- Protons: positive
- Neutrons: no charge
- Electrons: negative, move around nucleus.
- Atoms are neutral because protons and electrons are equal.



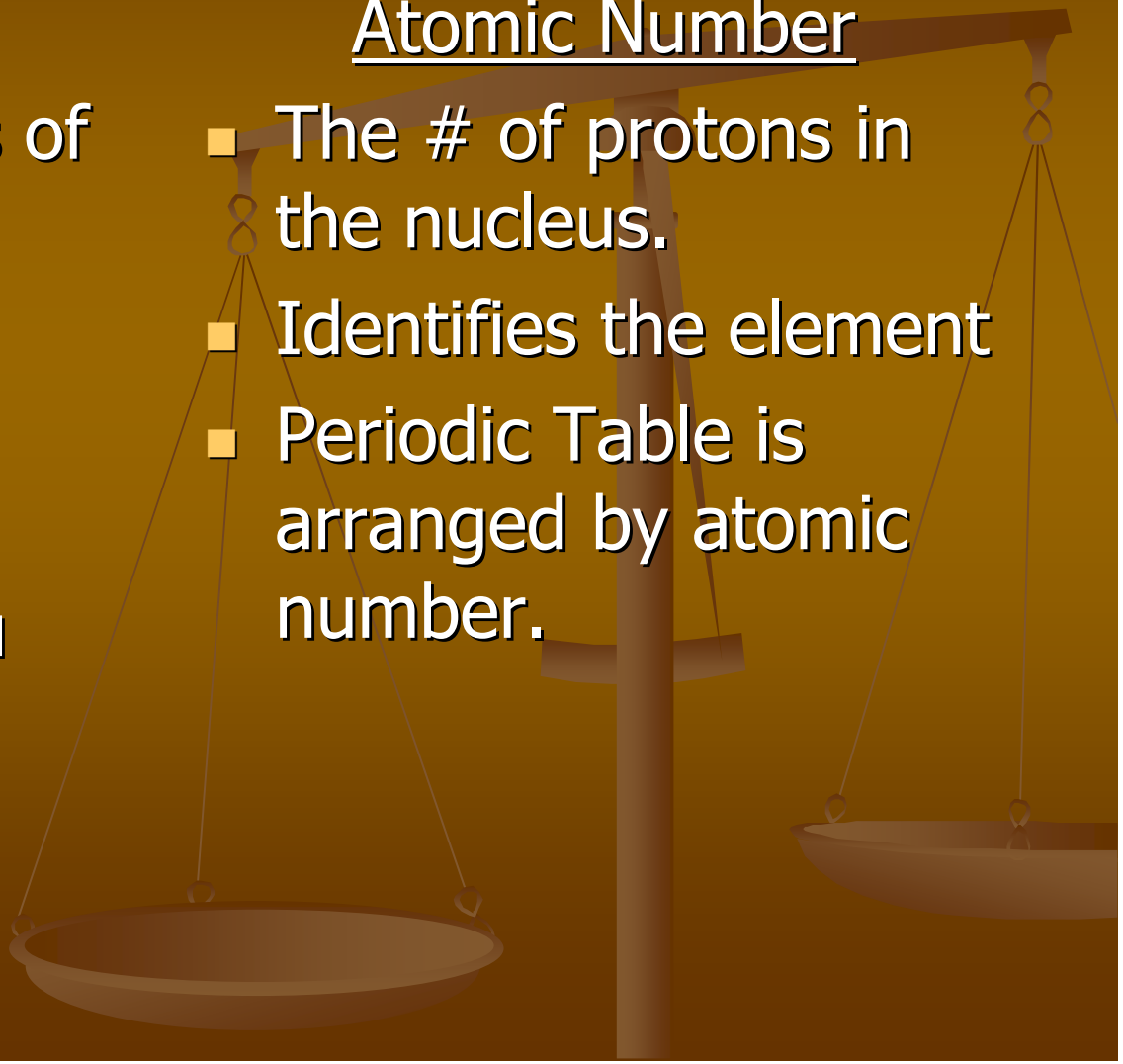
Atoms

- Most of the mass is in the nucleus.
- Most of the volume is in the space where the electrons move.
- Not all electrons are the same distance from the nucleus and don't have equal strength.
- Valence electrons: The electrons that are the farthest away or most loosely held. # of valence electrons determines many properties of the atom (element)

Periodic Table

- Mendeleev – recognized a hidden pattern in the elements. Wrote facts about properties.
- Noticed patterns when elements were arranged in increasing atomic mass.

Periodic Table



Atomic Mass

- The average mass of 1 atom of the element.
- Protons = 1amu
- Neutrons = 1amu
- Electrons = 0 amu

Atomic Number

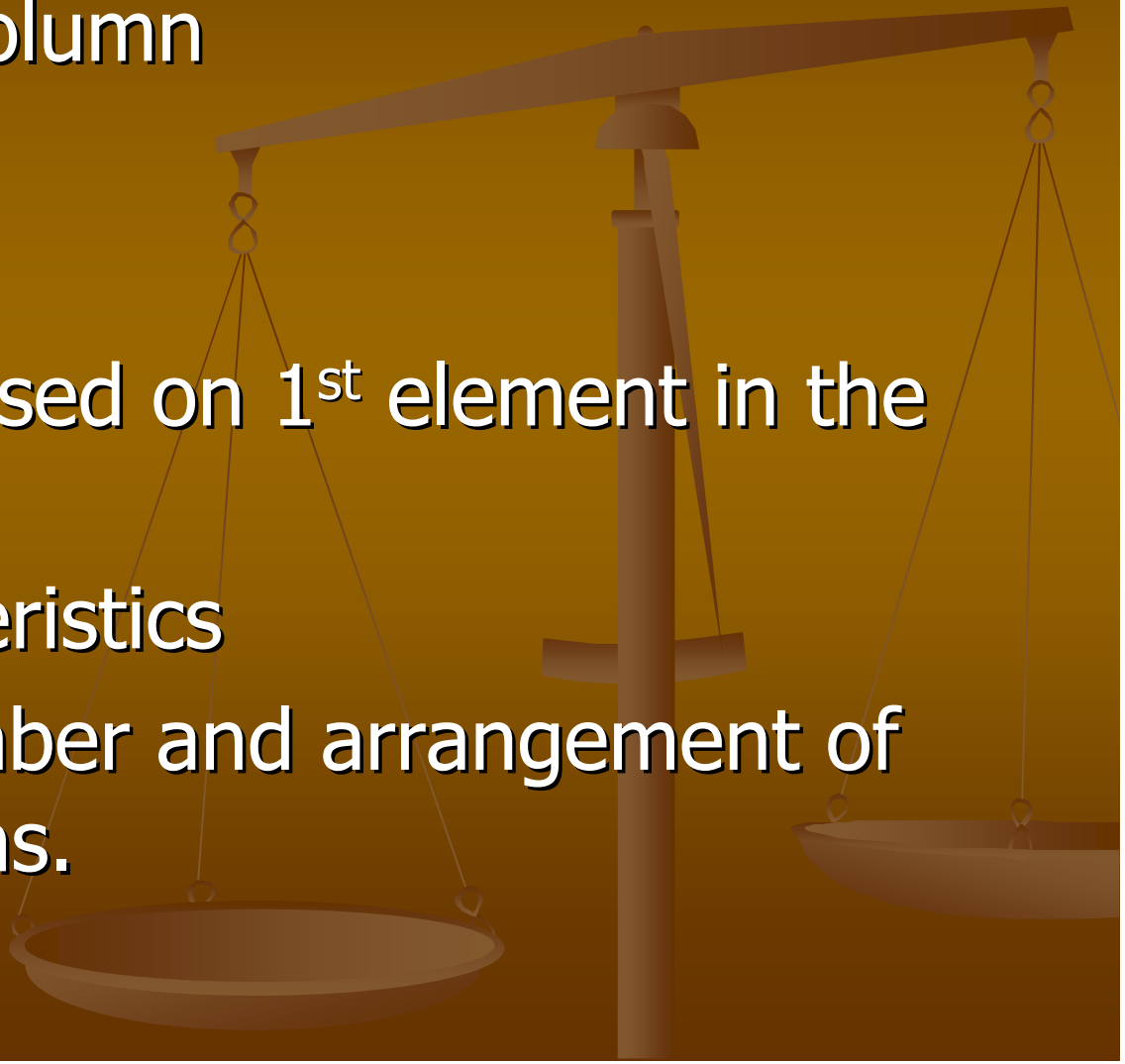
- The # of protons in the nucleus.
- Identifies the element
- Periodic Table is arranged by atomic number.

Periodic Table

- Atomic number
- Chemical Symbol
- Name
- Atomic Mass

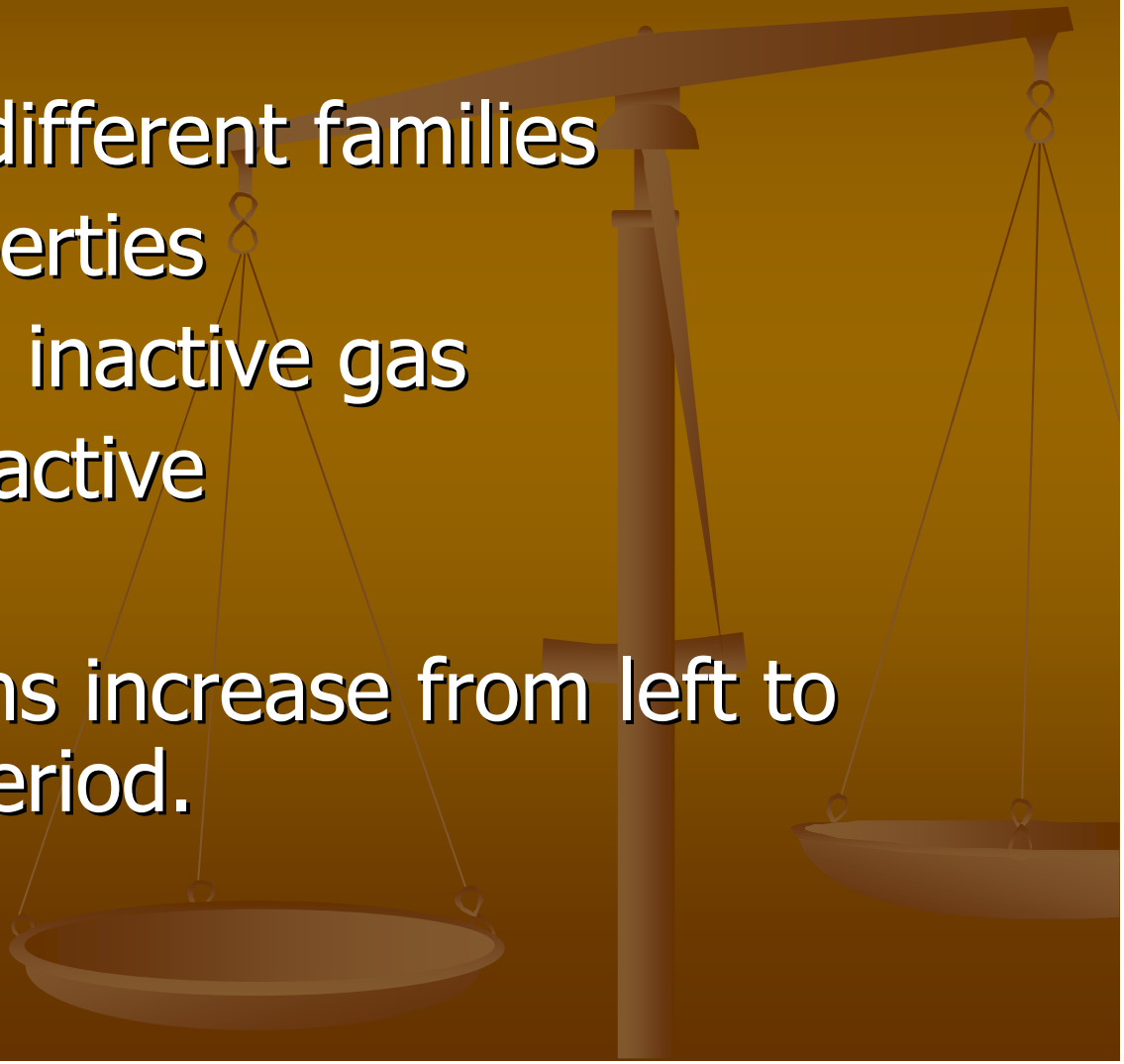
Groups

- Elements in a column
- Families
- Group 1-18
- Family name based on 1st element in the column.
- Similar Characteristics
- Have same number and arrangement of valence electrons.



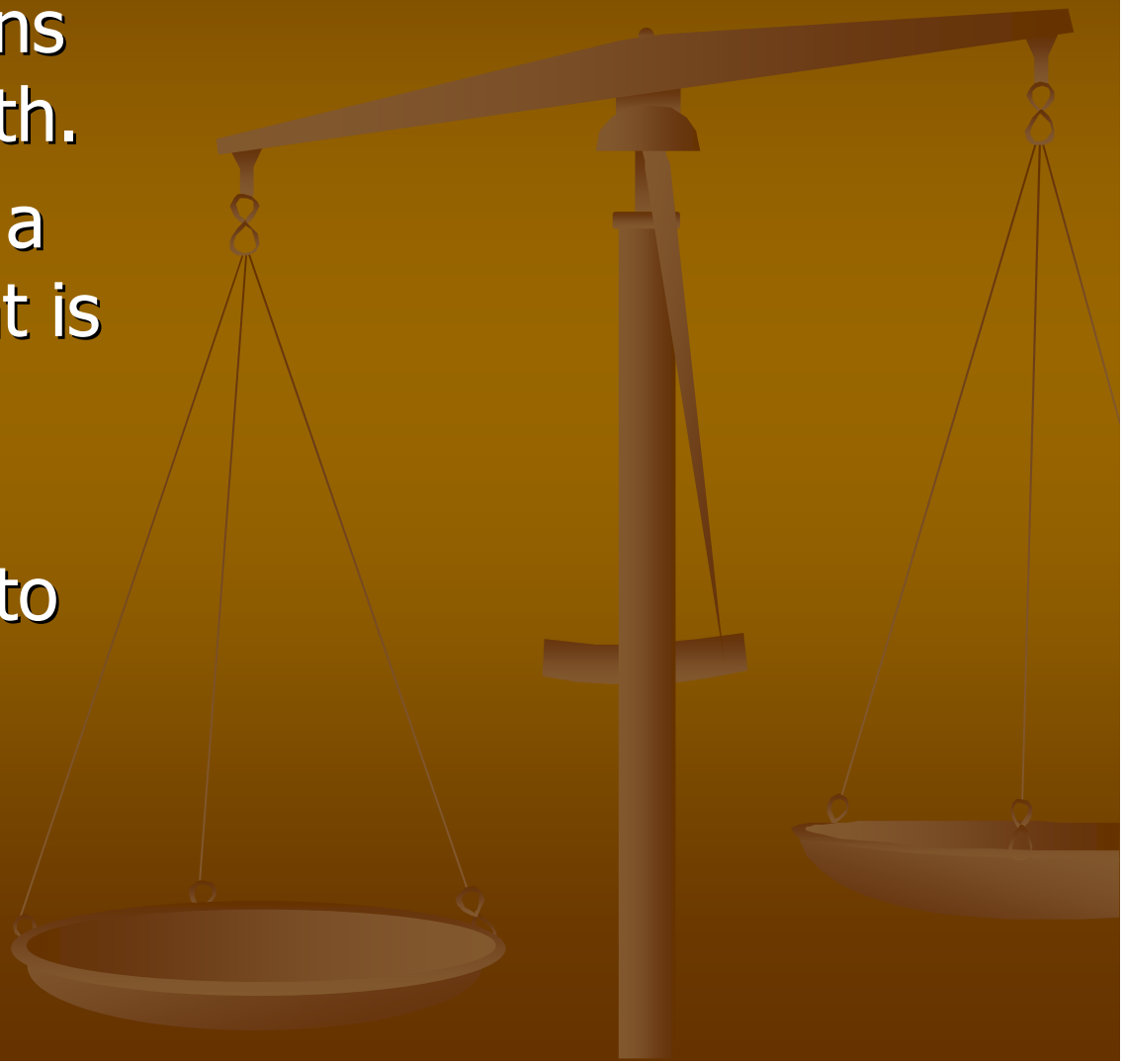
Periods

- Horizontal rows
- Elements from different families
- Not similar properties
- Last element an inactive gas
- Reactive – unreactive
- 7 periods
- Valance electrons increase from left to right across a period.



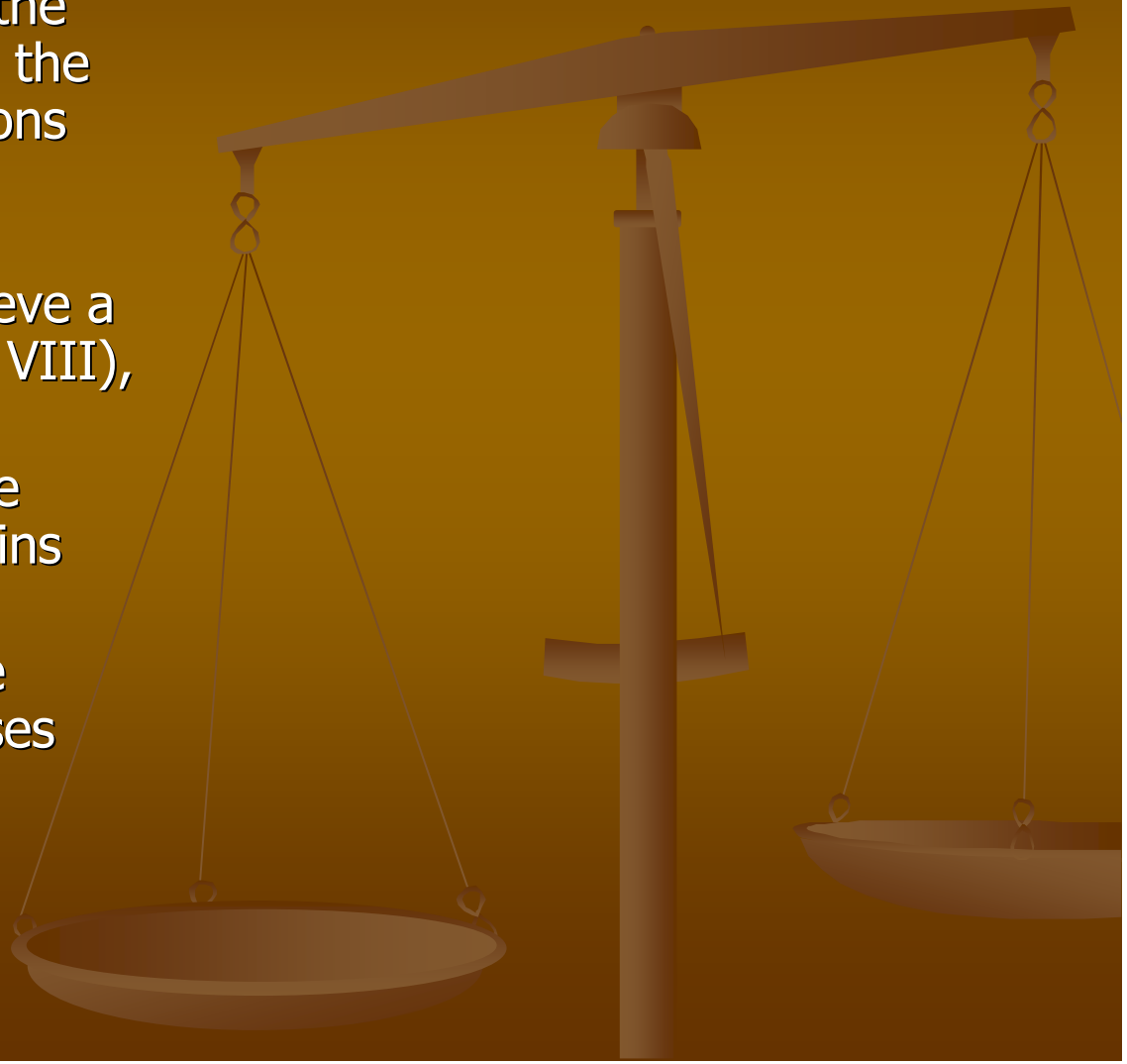
Bohr Diagram

- Suggested electrons moved in a set path.
- Each electron has a certain energy that is determined by its path.
- Must gain energy to move to a higher energy level.



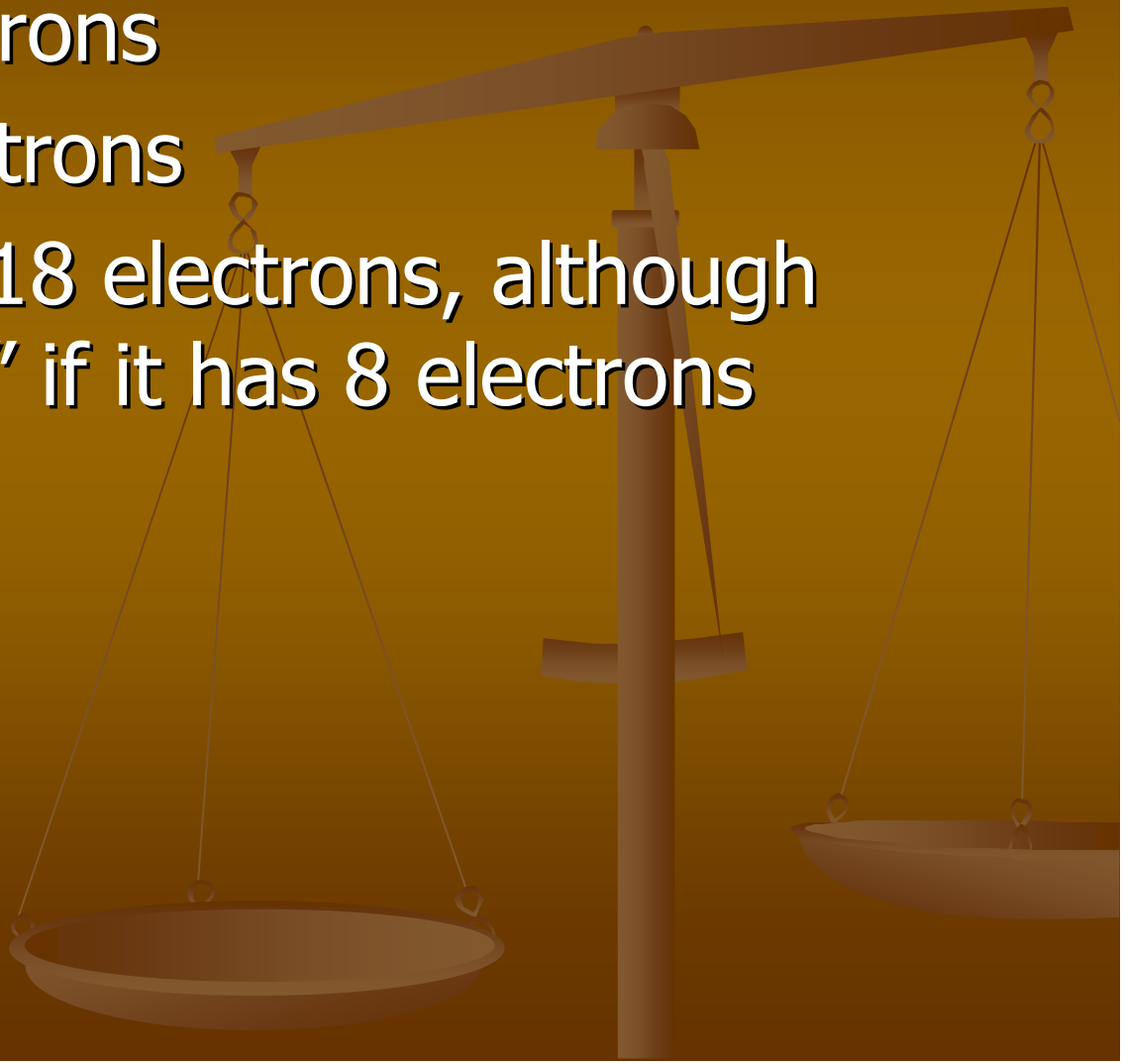
Lewis Structure

- The chemical symbol for the element is surrounded by the number of valence electrons present in the **ion**.
- Atoms will gain or lose electrons in order to achieve a stable, Noble Gas (Group VIII), electronic configuration.
- Negative ions (anions) are formed when an atom gains electrons.
- Positive ions (cations) are formed when an atom loses electrons



Electron Shells

- 1st shell: 2 Electrons
- 2nd Shell: 8 electrons
- 3rd Shell: up to 18 electrons, although considered "full" if it has 8 electrons

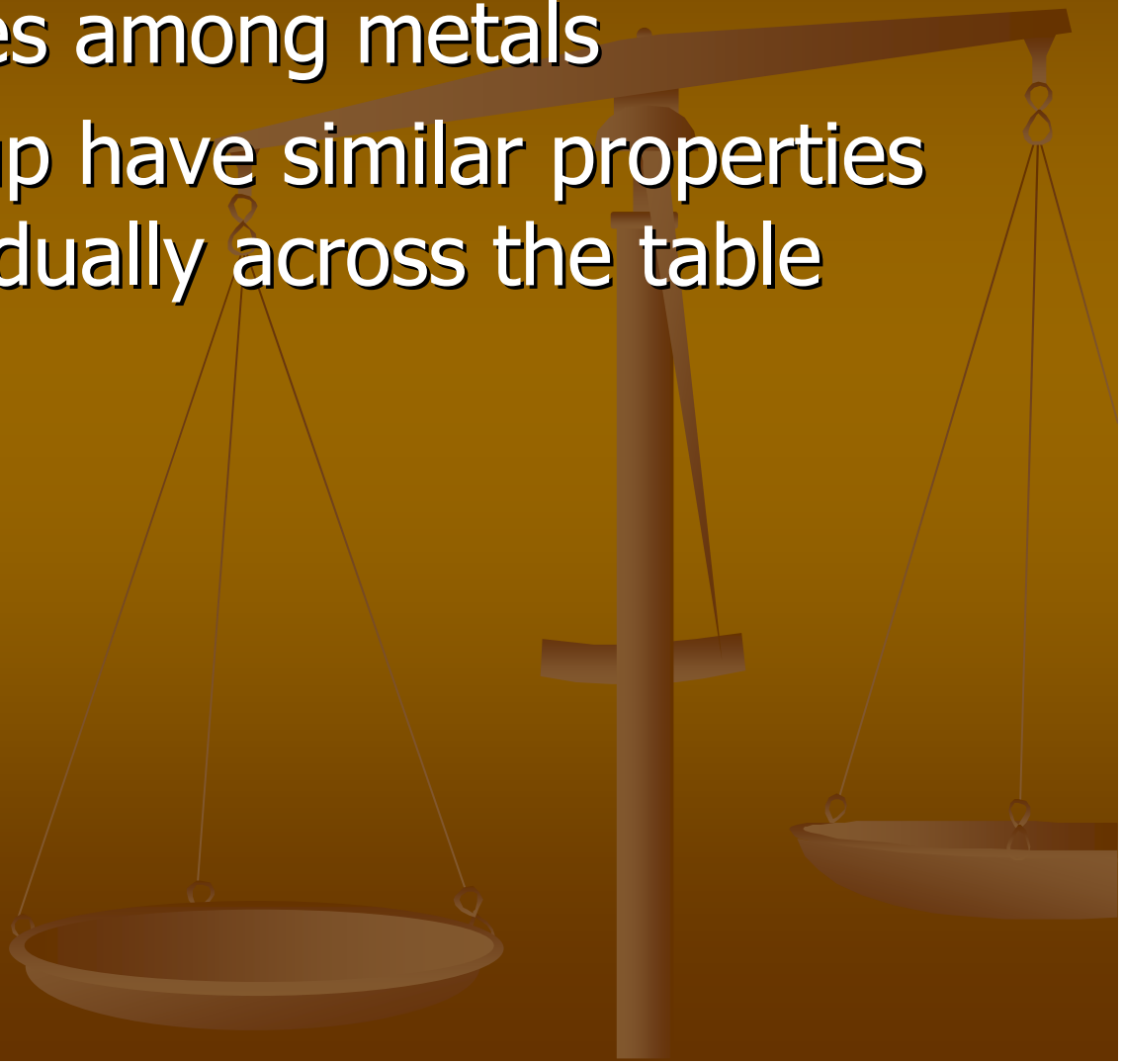


Metals – Physical Properties

- Hardness
- Shiny
- Malleable
- Ductile
- Good Conductors
- Magnetic
- Most solid at room temp.

Metals: Chemical Properties

- Reactivity: Varies among metals
- Metals in a group have similar properties and change gradually across the table

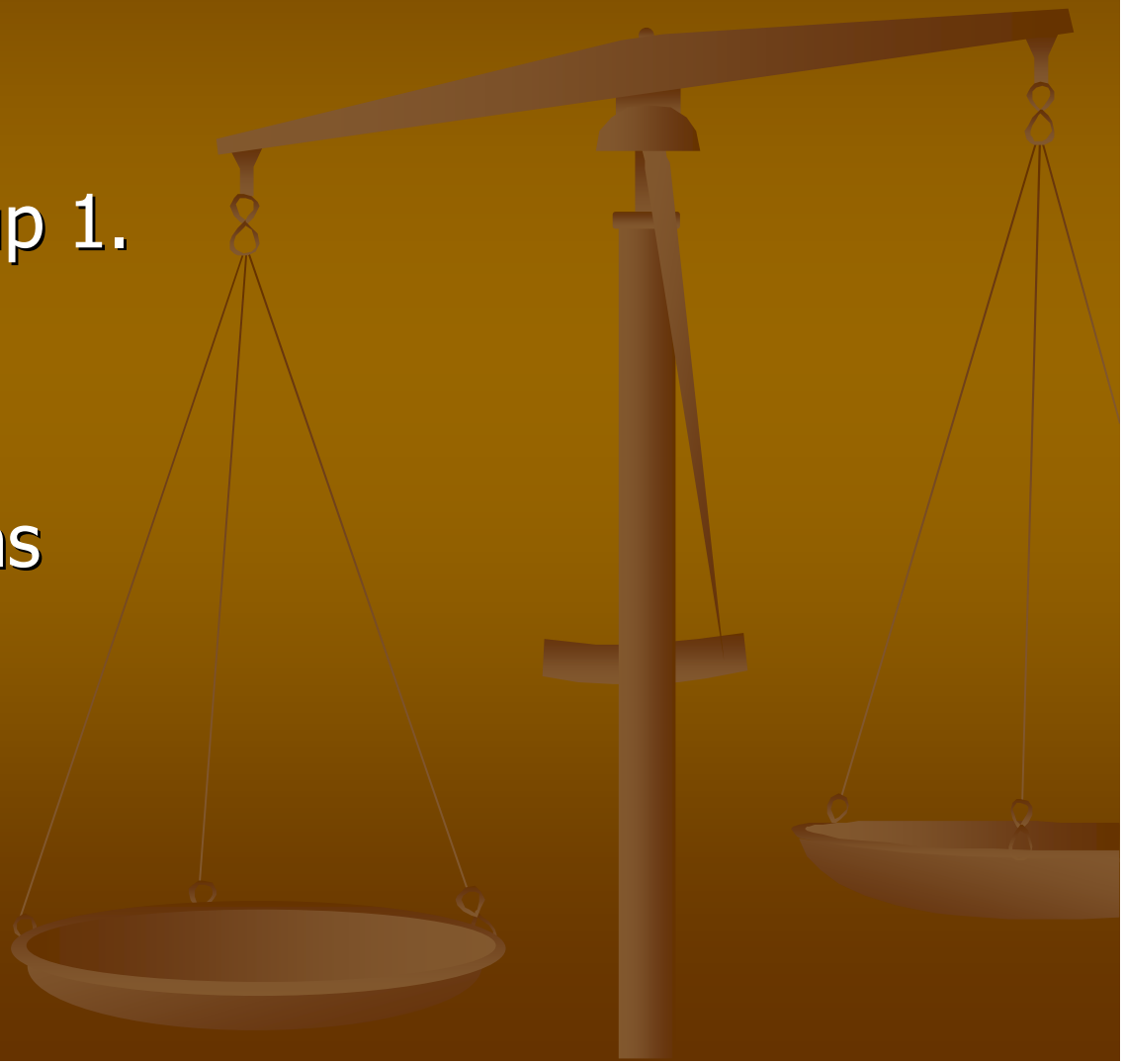


Alkali Metals

- Group 1
- So reactive never found uncombined in nature.
- Soft, shiny
- Only 1 electron in outer shell

Alkaline Earth Metals

- Group 2
- Reactive but less reactive than group 1.
- Hard
- Good Conductors
- 2 Valence electrons

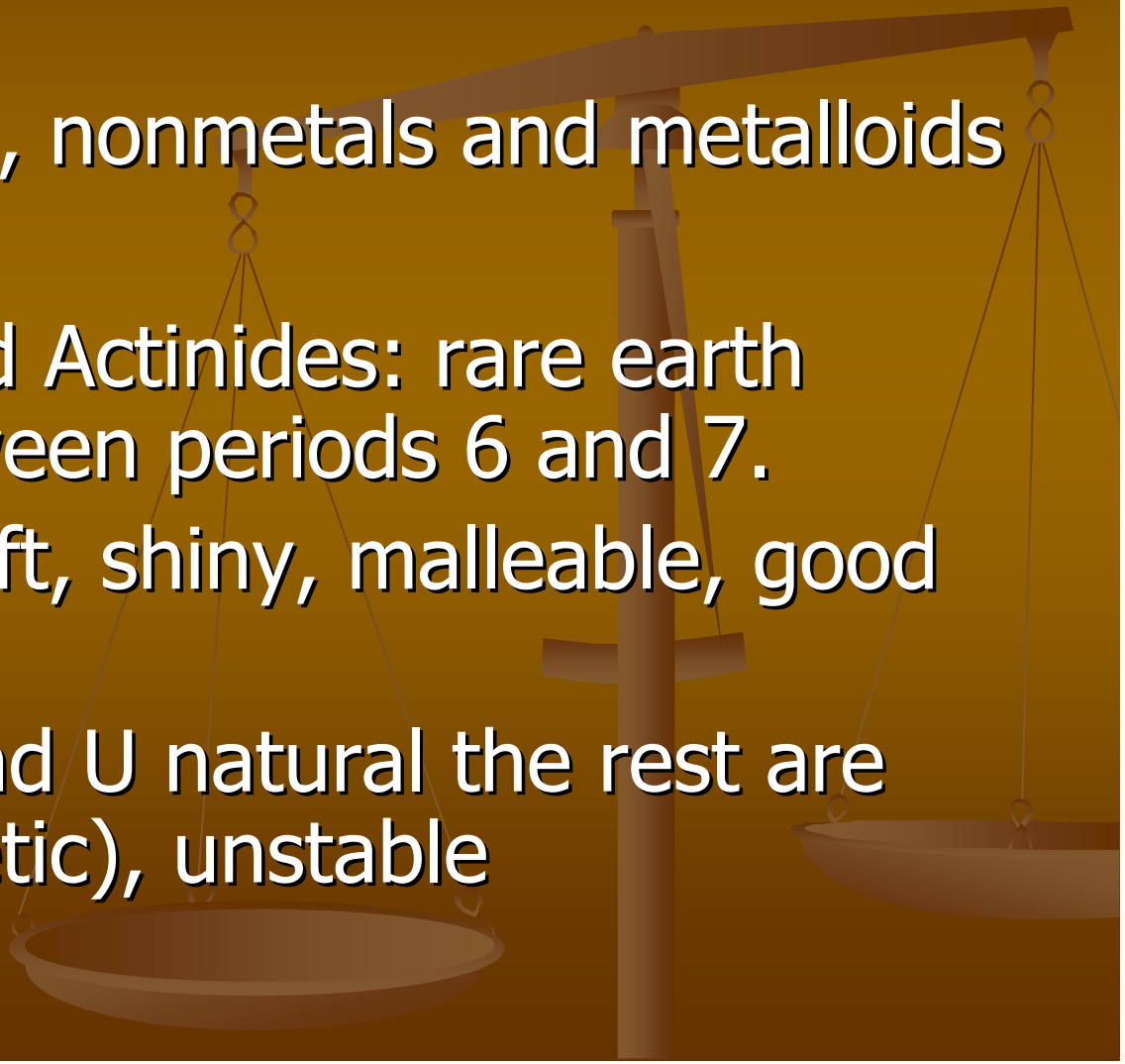


Transition Metals

- Group 3-12
- So similar to each other that the difference between columns is hard to detect.
- Hard. Shiny
- Good conductors
- Fairly Stable

Metals in Mixed Groups

- Group 13-16
- Contains metals, nonmetals and metalloids
- Not as reactive
- Lanthanides and Actinides: rare earth metals. Fit between periods 6 and 7.
- Lanthanides: soft, shiny, malleable, good conductors
- Actinides: Th and U natural the rest are artificial (synthetic), unstable

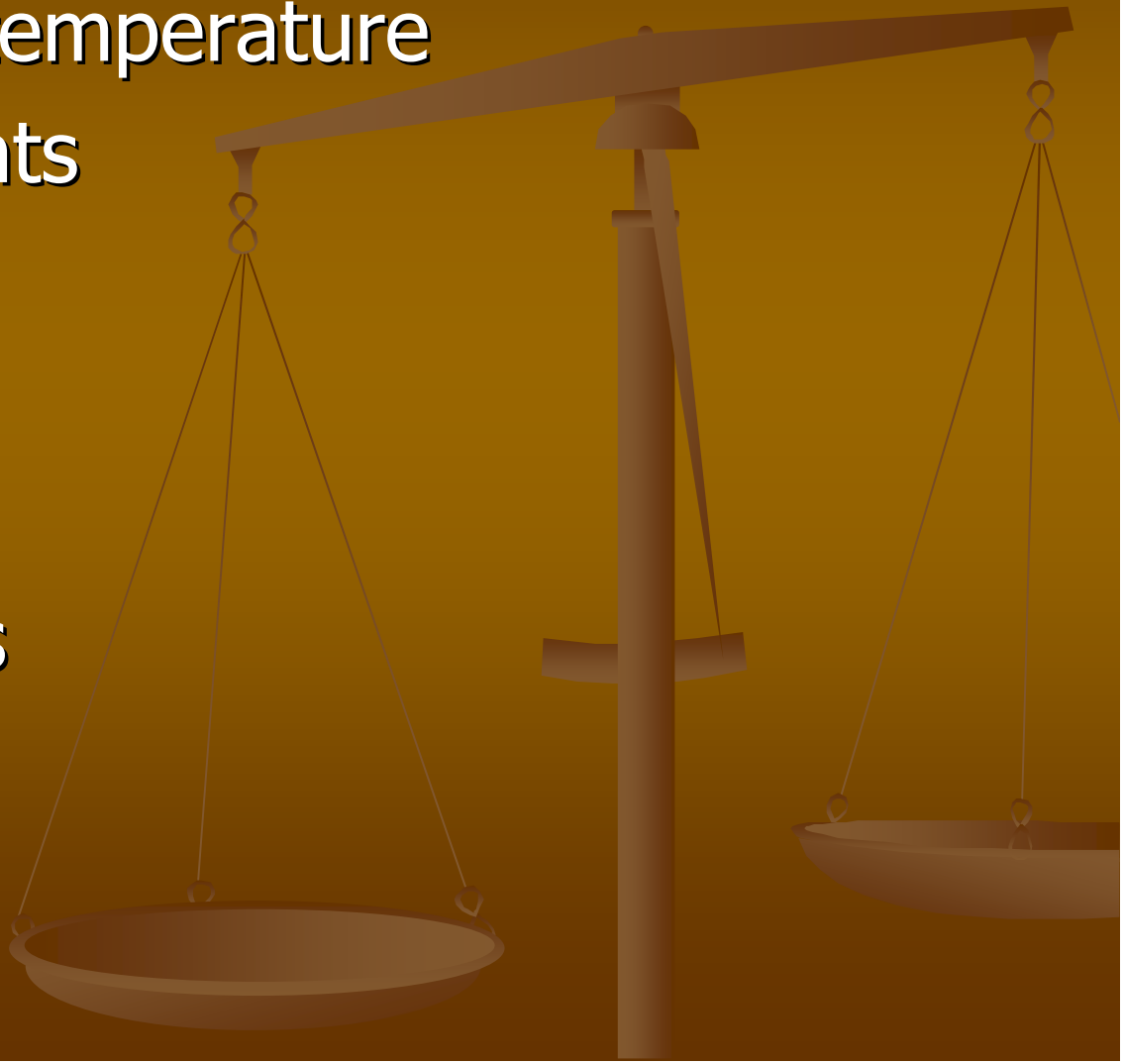


Nonmetals

- Lack properties of most metals.
- Located to the right of the zig zag line in table.

Physical Properties - NonMetals

- Gases at room temperature
- Low boiling points
- Dull
- Brittle
- Lower densities
- Poor conductors

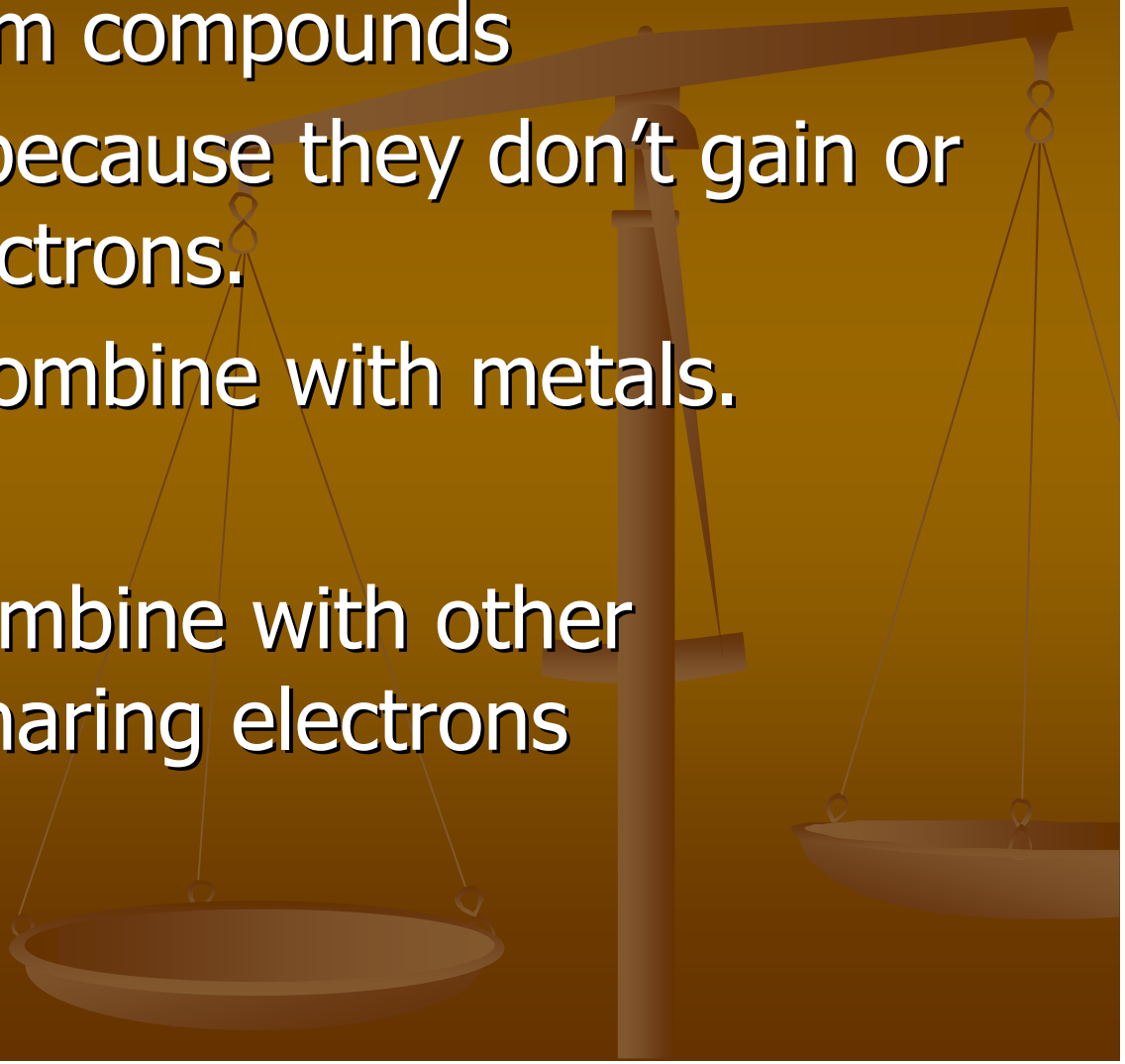


Chemical Properties - NonMetals

- Most readily form compounds
- Group 18 – no because they don't gain or lose valance electrons.
- Nonmetal can combine with metals.

Example: Salt

Nonmetals can combine with other nonmetals by sharing electrons



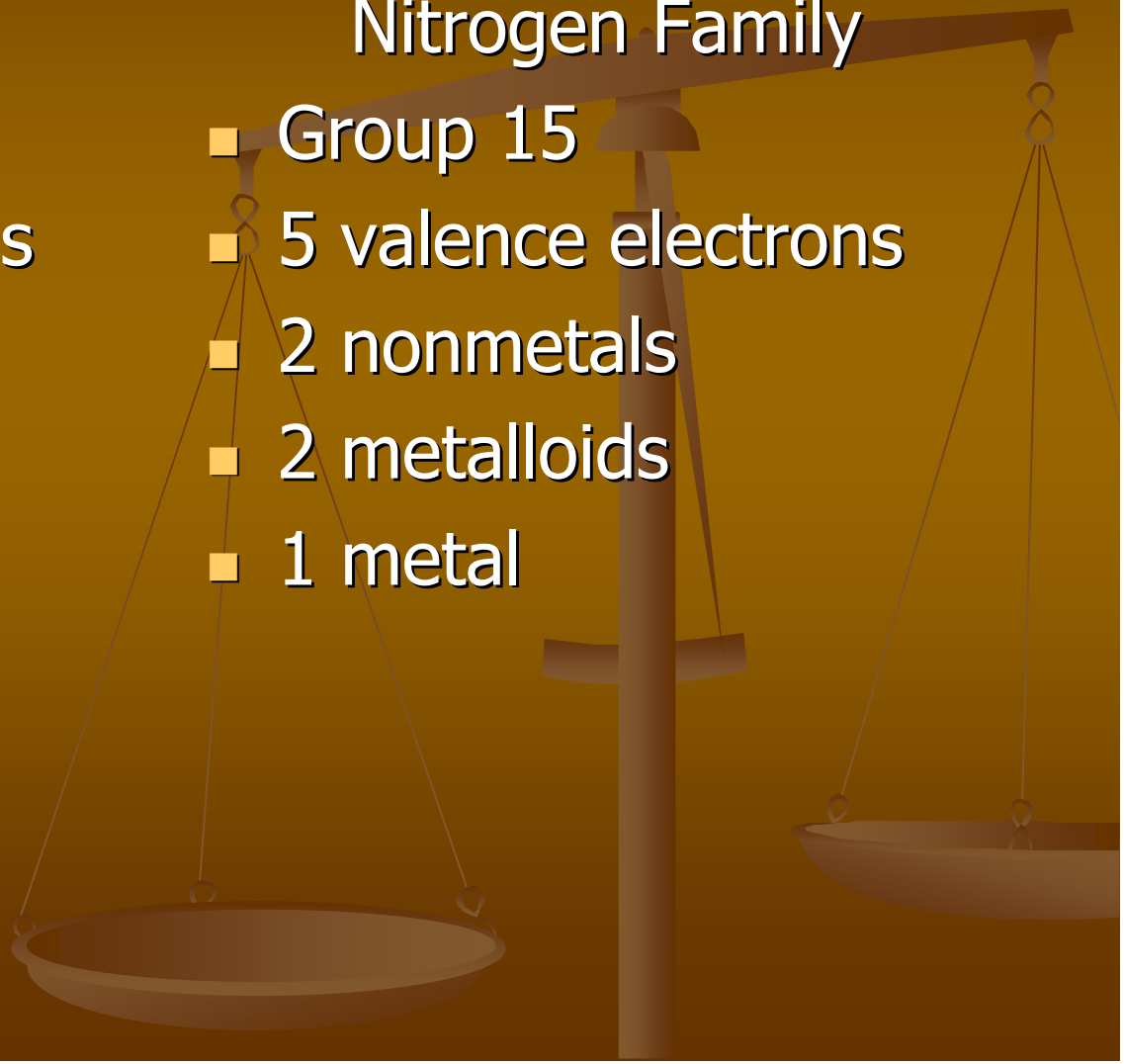
Families of Nonmetals

Carbon Family

- Group 14
- 4 valence electrons
- 1 nonmetal
- 2 metalloids
- 2 metals

Nitrogen Family

- Group 15
- 5 valence electrons
- 2 nonmetals
- 2 metalloids
- 1 metal



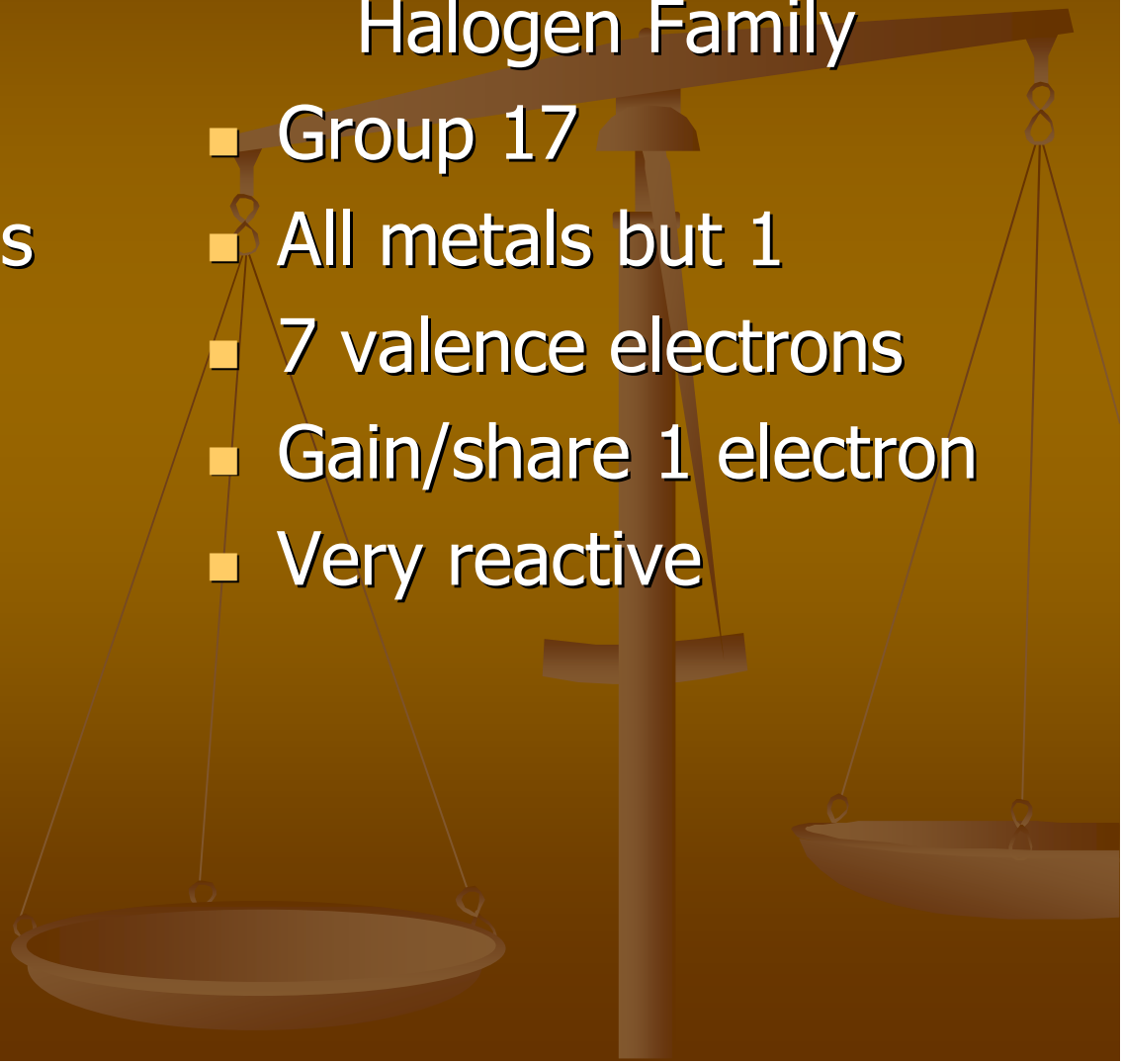
Families of Nonmetals

Oxygen Family

- Group 16
- 6 valence electrons
- Gains/shares 2 electrons when it reacts
- 3 nonmetals
- 1 metalloid
- 1 metal

Halogen Family

- Group 17
- All metals but 1
- 7 valence electrons
- Gain/share 1 electron
- Very reactive



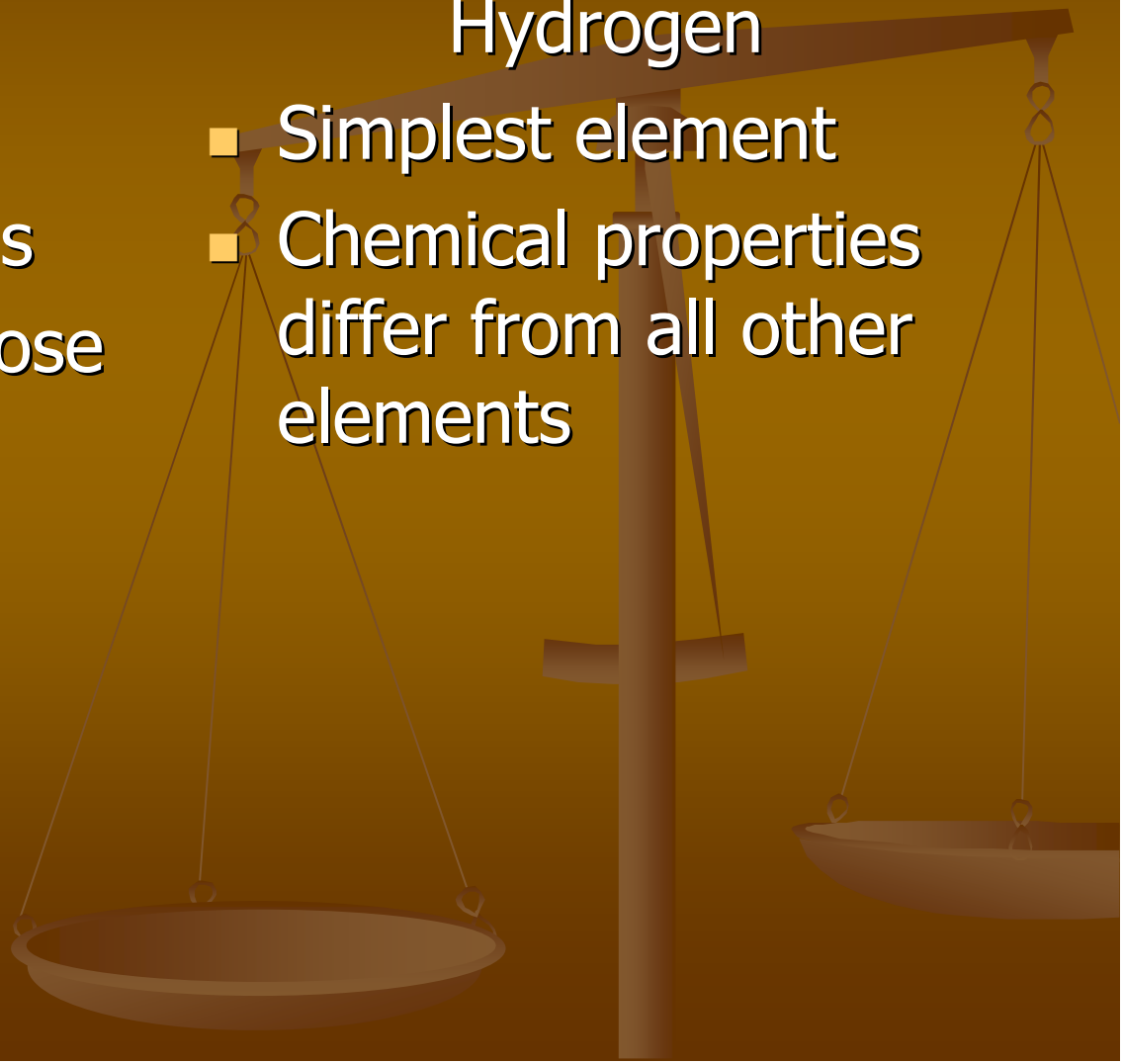
Families of Nonmetals

Noble Gases

- Group 18
- 8 valence electrons
- Don’t gain/share/lose electrons
- Chemically stable
- Unreactive

Hydrogen

- Simplest element
- Chemical properties differ from all other elements



Metalloids

- On the border between metals and nonmetals
- Some characteristics of metals and nonmetals
- Si the most common
- Vary in conducting electricity