Atomic Structure

- Element
  - Cannot be broken down into simpler substances
  - Example: Au = Gold

- Atom
  - Smallest part of an element
  - Multiple atoms of Au make up the element Gold

- Atomic Number
  - Number of protons in an element
  - If you change the number of protons it changes to a different element
  - Can also indicate number of electrons but the number of electrons can change without changing the atomic number

- Atomic Mass
  - Number of protons and neutrons in an atom
  - To find the number of neutrons subtract
    - \[ \text{Atomic Mass} - \text{Atomic Number} \]
  - Round to nearest whole number

- Valence Electrons
  - Number of electrons in the outer most shell of an atom
  - Based on the column the element is in on the periodic table

- Energy Levels
  - Number of electron shells in the atom
  - Based on the row the element is in on the periodic table

- Isotopes
  - When the number of neutrons in an atom changes
  - When an element loses or gains neutrons

- Ion
  - When the number of electrons in an atom changes
  - When an element loses or gains electrons

- Where are the particles located?
  - Protons and Neutrons
    - Nucleus
  - Electrons
    - Shells around the Nucleus
      - 1st shell maximum of 2 electrons
      - 2nd shell maximum of 8 electrons
      - 3rd shell maximum of 8 electrons
  - 2nd column
    - All have a full outer shell of electrons
  - Noble gases
    - Don’t typically bond with other elements

- How many valence electrons does Helium have?
  - 2

- Why is Helium placed in the 8th column?
  - It has a full outer shell of electrons
  - The first shell can only have a maximum of 2 electrons

- 8th column
  - All have full outer shell of electrons
  - Noble gases
  - Don’t typically bond with other elements
Atomic Structure
- Columns - Groups
- Row – Periods

Atomic Structure
- Drawing Atoms
  - Bohr Diagram
    - Electrons placed in pairs
    - Phosphorus
    - Only valence electrons (pattern)
    - He
    - O
    - P

Atomic Structure
- Bonding
  - Atoms look to complete their outer shell of electrons
  - Covalent Bond
    - When elements share electrons
    - Ionic Bond
      - When elements lose or gain electrons

Atomic Structure
- Covalent Bond
  - Single bonds
    - Share 1 pair of electrons (2 electrons)
  - Double bonds
    - Share 2 pair of electrons (4 electrons)

Atomic Structure
- Ionic Bond
  - When elements bond by gaining or losing electrons

Atomic Structure
- Formulas
  - \( \text{CCl}_4 \)
    - 1 Carbon and 4 Chlorine’s
  - \( \text{Na}_2\text{O} \)
    - 2 Sodium’s and 1 Oxygen
  - \( \text{CaCl}_2 \)
    - 1 Calcium and 2 Chlorine’s
Atomic Structure

- **Compound**
  - 2 or more different elements combined
  - Water H₂O
  - Salt NaCl

- **Molecule:**
  - 2 or more elements combined with a covalent bond
  - Water H₂O

Atomic Structure

- **Chemical Reaction**
  - Change of one or more substances into other substances
  - 2H₂ + O₂ → 2H₂O
  - Hydrogen + Oxygen = Water

Air
Atomic Structure

**pH Scale**
- 0-14
- 7 neutral
- Water

**Acids**
- 0-6
- Contain H+ ions
- Lower the number
- Higher concentration of H+ ions
- Stronger acid

**Bases**
- 8-14
- Contain OH- ions
- Higher the number
- Higher concentration of OH
- Stronger base

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Atomic Structure

**States of Matter**
- Solid
  - Atoms are tightly packed and vibrating
- Liquid
  - Atoms are close together but they can slip around each other
- Gas
  - Atoms are far apart and moving fast
- Plasma
  - Atoms are very far apart and moving extremely rapidly
  - Atoms smash into each other – lose electrons
  - Ionized gas

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Atomic Structure

**Change of State**
- Add heat
  - Endothermic
  - Solid → Liquid
  - Liquid → Gas
  - Solid → Gas
- Take away heat
  - Exothermic
  - Gas → Liquid
  - Liquid → Solid
  - Gas → Solid