



In Fascinating Chemistry, you will learn the four ways that atoms bond to each other to create molecules, and how each bond helps determine the properties of the resulting molecule. You will learn how these special molecular properties explain our everyday world from water freezing to nuclear energy to food to metals to weather, and more.

Lesson 1: Intramolecular Bonding

- Everything is made of Atoms
- The first 20 elements of the periodic table
- Adding electrons to elements
- Electrons
- The nucleus
- Defining an element
- Proton repulsion
- The Strong Force
- Neutrons
- Isotopes
- Why atoms bond
- Intramolecular bonding
- Intermolecular bonding
- Properties of molecules

Lesson 2: The Ionic Bond

- The atomic number
- Valence electrons
- How Ionic bonds form molecules
- Reaching a lower energy level

- Lattice energy
- Melting ionic crystals
- Cracking a salt crystal
- Ionic bonding between rows of the periodic table
- Ionic bonds involving two electrons
- Giving electrons without ionic bonding
- Pauling's electronegativity chart
- Atomic size
- Ionization energy
- Electron affinity

Lesson 3: The Covalent Bond

- Covalent Bonds
- Gases
- Oxygen and nitrogen molecules
- Electronegativity difference in covalent bond
- Nonpolar hydrocarbons
- London dispersion forces
- Triglycerides

Lesson 4: The Polar Covalent Bond

- Giving away electrons
- Pauling's electronegativity chart
- Hydrogen bond
- Intramolecular and intermolecular bonds
- Nonpolar molecules with polar bonds
- Electrons travel in pairs
- Unshared and shared electrons
- Polarity strength
- Polarity of molecules
- Spectrum of intermolecular bonds

Lesson 5: The Metallic Bond

- The Metallic Bond
- Metals in the Periodic Table
- Transition metals
- Electron shells
- Arrangement of subshells
- Rearranging the periodic table
- Energy levels
- Electron configuration

Lesson 6: Metallic Bond Properties

- Metallic density
- Metallic strength
- Improving metallic strength
- Metallic hardness
- Metallic hardness
- Magnetism
- Heat conduction
- Electrical conduction
- Metallic shininess

Lesson 7: Heat

- Types of energy
- Heat versus temperature
- Absolute Zero
- Ice's specific heat capacity
- Water's heat of fusion
- Water's specific heat capacity
- Water's heat of vaporization
- Steam's specific heat capacity
- Water's ability to absorb heat
- The energy of steam
- Water's boiling point
- Heat Transfer
- Electromagnetic energy
- Photons
- Carbon dioxide and global warming
- Hypothermia
- Heat insulation
- The Leidenfrost Effect

Lesson 8: Properties of Water

- Oil and water
- Micelles and soap
- Viscosity
- Surface tension
- Ice
- Lowering the freezing point of water
- Melting frozen ice
- Density of water versus ice
- Staying afloat
- Density
- Salt water versus fresh water

Lesson 9: Mass, Density, Weight, Pressure, and the Mole

- Determining Atomic Mass Weights Air
- Determining the weight of one atomic mass unit
- The concept of a mole
- Deriving molecular and empirical formulas
- Mass, density, weight, and pressure
- Measuring gas pressure with a barometer
- Measuring gas pressure with a manometer
- Measuring gas pressure with a non-mercury manometer

Lesson 10: The Ideal Gas Law and the Behavior of Confined Gases

- The Ideal Gas Law
- The kinetic energy of a gas
- Temperature's effect on molecular velocity
- Energy expressed in the ideal gas law
- Using the ideal gas law
- Electrolysis of water
- Standard temperature and pressure
- Partial pressure of gases
- Vapor Pressure

Lesson 11: The Behavior of Unconfined Gases in the Atmosphere

- Gases dissolved in water
- The boiling point
- Air pressure
- Demonstrating the weight of air
- Barometer

- Changing the boiling point
- Boiling water in Denver
- Measuring altitude by measuring air pressure
- Changes in air pressure under water
- Pressure and density
- Atmospheric gas density vs gas pressure
- The dew point
- Sweat

Lesson 12: Solutions

- Molarity
- Molality
- Mixtures
- Freezing point depression
- Colligative property
- Phase diagram
- Boiling point elevation
- Acids and bases
- Types of acids
- Neutralization of acids and bases
- Calculating PH

Lesson 13: Chemical Reactions

- Activation energy
- Catalysts
- Balancing equations
- Stoichiometry
- Coefficients
- Equilibrium state
- LeChatelier's principle
- Phase diagram
- Equilibrium constant
- Solubility product constant

Lesson 14: Orbitals

- Subshells
- Slots within subshells
- Energy levels within slots
- Probability clouds
- Aufbau Principle
- Hund's Rule
- Pauli Exclusion Principle
- Ionization energy
- Lewis Diagrams
- Hybrid bonds
- VSEPR (Valence Shell Electron Pair Repulsion)
- Molecular shapes

Lesson 15: Molecular Geometry

- Lewis Dot Diagrams
- Lewis Dot Diagram Predictions
- Filling the Valence Shell
- Formal Charges
- Forming sp^3 Hybrid Bonds
- Carbon sp^2 Hybrid Orbitals Current
- Sigma and Pi bonds
- Nitrogen sp^3 Hybrid Orbitals
- Oxygen sp^3 Hybrid Orbitals
- Beryllium difluoride
- Boron trifluoride
- VSEPR
- Molecular shapes
- Diamonds
- Isomers

Lesson 16: Electrochemistry

- Oxidation State
- Redox
- Voltage Cells
- Reduction Potential
- Calculating Potentials
- Voltage
- Current
- Car Battery
- Electroplating

- Aluminum Oxide
- Iron Rust
- Fuel Cells

Lesson 17: Polymers

- Formaldehyde, Phenol, and Bakelite
- Ethylene and Polyethylene
- Strengthening Polyethylene
- Natural Polymers
- Nylon
- Rubber

Lesson 18: The Nucleus

- Solar energy
- The Strong Force
- Neutrons
- Making helium
- Making heavy elements
- Binding energy
- The Sun's fuel

Final Problems