EXPERIENCE CHEMISTRY

Scope & Sequence

This honors-level high school chemistry course provides an in-depth exploration of fundamental chemical principles and their applications. Through a structured series of lessons, students will engage in hands-on activities, laboratory experiments, and problem-solving activities to develop a robust understanding of matter, measurements, atomic structure, the periodic table, chemical bonding, reactions, stoichiometry, gases, and thermodynamics. This curriculum prepares students for continued study in chemistry and related fields at the college level.

Lesson 1: Introduction to Chemistry

- What is Chemistry?
- The Five Branches of Chemistry
- The Scientific Method

Lesson 2: Matter, Measurements, and Unit Conversions

- Matter and mass
- SI Unit System: base units and prefixes
- Unit Conversions between metric units using the factor label method
- Units of temperature and conversion

Lesson 3: Accurate and Precise Measurements in Science

- Accuracy and precision
- Understanding and using significant digits
- Scientific Notation
- Density Problems

Lesson 4: The Atom

- Scientific models
- The history of atomic models and influential scientists
- Physical and chemical properties
- Physical and chemical changes

Lesson 5: Energy!

Energy and chemistry
Exothermic and endothermic reactions
States of matter and molecular energy
Compare and contrast pure substances and mixtures
Pure substances: elements and compounds
Mixtures: Homogeneous and heterogeneous
Suspensions and colloidal dispersions

Lesson 6: Introduction to the Periodic Table

History of the Periodic Table
Mendeleev
Elements and their symbols
How we use the periodic table: chemical symbols, mass numbers, atomic numbers, and element name
Atomic Mass Units
Defining Periods and Groups
Valence electrons
Finding the number of protons, neutrons and electrons for elements
Isotopes

Lesson 7: Periodic Chemical Properties

Identifying periods, families and series on the Periodic Table
In-depth Look at the Periodic Table
Unique Family Trends on the Periodic Table
Unique Period Trends on the Periodic Table
How periodic trends help predict reactivity

Lesson 8: Electrons (part 1)

Relating electrons to sublevels and energy levels
Electron orbital notation and configurations
Electron Orbital Notations and Configurations
Valence Electrons and Why they are Important
Writing Electron Dot Structures

Lesson 9: Electrons (part 2)

Valence Electrons and Why they are Important
Writing Electron Dot Structures
The Octet Rule
The 3 Types of Chemistry Bonds: Ionic, Covalent, and Metallic
Electronegativity and Bonding
Polarity

Lesson 10: Introduction to Chemical Formulas

- Molecular chemical formulas
- Subscripts and coefficients in formulas
- Counting atoms
- Hydrogen: a unique element
- Water and its unique properties

Lesson 11: Exam 1

Lesson 12:

- Defining oxidation numbers
- Assigning oxidation numbers using the 6 Rules
- Polyatomic Ions
- Multiple oxidation numbers
- Comparing structural, molecular, and empirical formulas

Lesson 13:

- Naming compounds from their formulas
- Writing formulas of compounds from their names
- Using greek prefixes in chemical names
- Multiple oxidation states when naming
- Identifying and naming acids

Lesson 14: Balancing Chemical Equations

- Examining chemical equations
- What is a balanced equation?
- How to balance chemical equations

Lesson 15: Chemical Reactions

- Identifying reactions: combination, decomposition, single replacement, and double replacement
- Combustion reactions
- Acid-base neutralization reactions
- Oxidation-reduction reactions

Lesson 16:

- Moles in chemistry
- Avogadro's number
- Converting units with moles and stoichiometry

Lesson 17:

Empirical formulas
Percent composition
Gram atomic mass and gram molecular mass

Lesson 18:

More stoichiometry: finding more values with the mole
Convert from moles of one substance to moles of another
Convert mass to moles for given substances
Convert from mass of one substance to mass of another substance
Limiting reactant
Theoretical and percent yield

Lesson 19: Exam #2

Lesson 20: Kinetic-Molecular Theory

Kinetic-molecular theory and properties of gases
Physical properties of gases
How temperature and pressure affect the volume of a gas
Standard temperature and pressure

Lesson 21: States of Matter

Characteristics of solids at the atomic level
Characteristics of liquids at the atomic level
Characteristics of gases at the atomic level
Plasma
Phase changes and reading phase change diagrams

Lesson 22: Gas Laws (part 1)

Boyle's Law to find pressure or volume of a gas
Charles' Law to find volume or temperature
Avogadro's Law and kinetic-molecular theory

Lesson 23: Gas Laws (part 2)

Dalton's Law of Partial Pressure and related equations
Molar volume relationships and gas volume at STP
Finding the gram-molecular mass of gas using density
Ideal gas law to find pressure, volume, moles and temperature

Lesson 24: Phase Transitions

Factors affecting the rate of evaporation
Diffusion
Vapor pressure
Plasmas
Using a phase diagram to make predictions about the states of matter
Concepts of heat capacity, Heat of Fusion, and Heat of Vaporization

Lesson 25:

Dipole-dipole forces, hydrogen bonds, and dispersion forces
Predicting types of forces between molecules
Differences in physical properties in types of bonding and forces present
Using kinetic theory to explain properties of solids
Crystalline and amorphous solids
Kinetic Theory and state changes of melting, freezing, boiling, evaporation, sublimation and condensation

Lesson 26: Exam #3

Lesson 27:

Kinetic theory and properties of liquids
Solutes and solvents
Surface tension, viscosity, capillary action diffusibility and permeability
Process of dissolving
Why certain solutes do not dissolve in certain solvents
Electrolytes
How pressure affects boiling

Lesson 28:

Identifying types of solutions by their descriptions
Techniques that increase solubility
Defining concentration
Concentration calculations

Lesson 29:

Explain how solutes affect the colligative properties of a solution
Concentration increases and vapor pressure, freezing point and boiling point of a solution
Calculating boiling point elevation and freezing point depression problems

Lesson 30:

Process of of osmosis
Colloids
Differences between suspensions, solutions, and colloids
The Tyndall effect

Lesson 31:

How thermodynamics impacts chemistry
Understanding calorimeters
Distinguishing between temperature and heat
How states of matter relate to sensible heat and latent heat
Exothermic and endothermic reactions
Defining specific heat
Enthalpy and Entropy

Lesson 32:

Using energy diagrams
Understanding the kinetics of reactions
How activation energy affects reactions
Applying the collision theory to reaction rates
Different factors that influence reaction rates
How enzymes work

Lesson 33: Acids & Bases

Classifying acids and bases using Arrhenius, Bronsted-Lowry, or Lewis definitions
Properties of acids, bases, and salts
Classifying solutions as acidic, basic or neutral
Convert between pH, pOH, (H_3O^+), and (OH^-)
Acid-base indicators

Lesson 34:

Equations for neutralization reactions between acids and bases
Complete equations for neutralization reactions between acids and bases
Performing titrations and the information they provide
Calculating concentration of a solution from given titration data
Buffer systems

Lesson 35: Exam #4