



Introductory Chemistry

Customizable Lab Kits and Digital Curriculum for Online Learners

- 24 Labs Available
- LMS Integration
- Teacher Resources
- Interactive Periodic Table



Lab 1: Introduction to Laboratory and Safety Procedures

Time: 1 hour

Learning Objectives: Understand the importance of safety in the chemistry laboratory; Learn the chemistry safety rules; Understand what to do in case of a chemistry laboratory accident; Demonstrate the safety rules by creating a safe chemistry laboratory environment

Exercises:

Exercise 1: Safety Contract

- Students complete a safety contract in order to eliminate, prevent, and be aware of possible hazards.

Experiments:

Experiment 1: Neutralization of Acids and Bases

- Students will learn how to properly neutralize and dispose of acidic and basic solutions.

Lab 2: Thinking like a Chemist: The Scientific Method

Time: 1 hour

Learning Objectives: Demonstrate how to safely and effectively conduct independent laboratory experiments; Distinguish between statements that are testable by science and those that are not; Write a testable hypothesis; Carry out a controlled, repeatable experiment to test the hypothesis

Experiments:

Experiment 1: Using the Scientific Method

- Students demonstrate their understanding of the scientific method.

Exercise 2: Using the Scientific Method to Write a Lab Report

- Students will develop a formalized hypothesis, conduct a hypothetical experiment using the scientific method, and write up their experiment in a formal lab report.

Lab 3: Data Analysis and Graphing

Time: 2 hours + 1 day for observations

Learning Objectives: Collect measurement data such as mass, volume, and density, using the most appropriate tools; Demonstrate the impact of unit conversions and significant figures during data analysis; Review data and construct corresponding graphs; Apply the scientific method to determine what happens to a gummy bear after soaking in water

Experiments:

Experiment 1: Metric Measurement Lab

- Students will learn to make measurements using the metric system.

Experiment 2: Density of a Gummy Bear

- Students will learn how to measure length, mass, and volume using gummy bears.

Lab 4: Types of Matter

Time: 2 hours

Learning Objectives: Classify matter as either a pure substance or a mixture; Separate a mixture of an insoluble material from one which is soluble; Use the laboratory technique of gravity filtration to separate the components of a mixture; Quantitatively determine the percent recovery of each component in a mixture

Experiments:

Experiment 1: Classification of Matter

- Students classify matter as either a pure substance or a mixture.

Experiment 2: Separation of a Mixture of Sand and Salt

- Students separate the components of a mixture and determine the percent of each substance.

Lab 5: Exploring Solubility

Time: 2 hours

Learning Objectives: Calculate the molarity of a solution from the molecular weight; Perform a serial dilution using a concentrated solution; Explain how solutes can be separated by chromatography based on intermolecular interactions

Experiments:

Experiment 1: Kool-Aid® Molarity

- Students will prepare a solution by dissolving a known mass of a solid solute (sucrose, $C_{12}H_{22}O_{11}$) into a specific amount of a solvent. Then they will perform a serial dilution of the solution.

Experiment 2: Slime Time

- Students will identify slime and silly putty as polar or non-polar. They will also use paper chromatography to verify if the given inks are polar or non-polar.

Lab 6: Examination of Physical and Chemical Properties

Time: 2 hours

Learning Objectives: Understand the difference between a physical and chemical change and physical and chemical properties; Examine the density of household solutions; Determine the identity of an unknown substance based upon its physical and chemical properties

Experiments:

Experiment 1: Density of a Substance

- Students determine the density of several liquids and compare the physical properties of those liquids.

Experiment 2: Solubility and Reactivity

- Students determine the identity of an unknown substance by observing the physical property (solubility) and chemical property (reactivity) of different substances.

Lab 7: Measuring Heats of Reactions

Time: 2 hours

Learning Objectives: Calculate thermal energy based on the equation $Q = C \times m \times \Delta T$; Construct and use a calorimeter to experimentally determine the change in enthalpy; Determine the identity of an unknown metal by investigating its specific heat

Experiments:

Experiment 1: Determination of Specific Heat of a Metal

- Students will identify an unknown metal by investigating its specific heat.

Experiment 2: Determining the Energy in Food

- Students will use calorimetric calculations to experimentally determine the energy content of a marshmallow.

Lab 8: Distinguishing Between Endothermic and Exothermic Reactions

Time: 3 hours

Learning Objectives: Apply the Law of Conservation of Energy; Understand Le Châtelier's Principle in terms of heats of reaction; Identify endothermic and exothermic reactions associated with chemical changes; Understand colligative properties and the effect of salt on the freezing point of water

Experiments:

Experiment 1: Conservation of Heat Energy

- Students will use a calorimeter to collect data on a system and determine the amount of energy exchanged between two bodies.

Experiment 2: Cold Packs vs. Hand Warmers

- Students will observe the temperature changes for cold packs and hand warmers.

Experiment 3: Chemistry of Ice Cream

- Students will use salt and ice to start an endothermic reaction that will produce ice cream.

Lab 9: Electron Configuration

Time: 1 hour

Learning Objectives: Identify elements using a flame test; Determine the electron configuration of known elements; Apply the concepts of quantized atomic energy; Interpret the relationship between color and wavelength

Experiments:

Experiment 1: Chemistry of Fireworks

- Students will perform a flame test on various substances and make observations.

Lab 10: Electromagnetic Radiation

Time: 2 hours

Learning Objectives: Observe the various wavelengths of the electromagnetic spectrum; Understand the principles of diffraction grating; Calculate the wavelength of the laser light; Justify the association between color and wavelength

Experiments:

Experiment 1: Measuring the Wavelength of Laser Light

- Students will first compare the spectrum that results from shining light onto the surface of a CD and from shining light through a diffraction grating. Second, they will analyze the spectra formed by shining a laser pointer through diffraction gratings with different groove separations.

Lab 11: Molecular Geometry: The VSEPR Model

Time: 1 hour

Learning Objectives: Draw Lewis Dot Structures of main group elements; Predict the geometries of simple polyatomic molecules using the VSEPR bonding theory; Draw sketches of molecules using the correct geometric angles for bonds

Experiments:

Experiment 1: Molecular Models of Neutral Molecules

- Students predict the three dimensional geometry of a series of neutral molecules using the VSEPR theory.

Lab 12: Types of Chemical Bonds

Time: 2 hours

Learning Objectives: Explain how ionic and covalent bonds are formed; Understand the role of valence electrons in forming bonds; Correlate the melting points of various elements with their bond type; Explore the differences in solubility between ionic and covalent bonds

Experiments:

Experiment 1: Building Models of Ionic and Covalent Bonds using Valence Electrons

- Students will build models of ionic and covalent bonds.

Experiment 2: Correlate the Melting Points of Various Elements with their Bond Type

- Students will examine the relationship between bond type and melting points.

Experiment 3: Solubility Characteristics of Chemical Bonds

- Students will examine the relationship between bond type and solubility.

Lab 13: Bond Polarity and Dipole Moments

Time: 2 hours

Learning Objectives: Understand bond polarity and how it is related to dipole moments; Understand colligative properties; Calculate the freezing point depression

Experiments:

Experiment 1: Determining Molar Mass from Freezing Point

- Students will determine the molar mass of a known substance using its freezing point depression in a solution.

Lab 14: Evaluating Precipitation Reactions

Time: 2 hours

Learning Objectives: Identify the solid that forms in a precipitation reaction; Calculate the theoretical, actual, and percent yield from the precipitation reaction

Experiments:

Experiment 1: Testing for Calcium Ion, Ca^{2+}

- Students will be performing a precipitate of calcium.

Lab 15: Discovering the Five Types of Chemical Reactions

Time: 3 hours

Learning Objectives: State observations that are evidence for a chemical reaction; Classify a chemical reaction as one of the following types: combustion, decomposition, single replacement, double replacement, or synthesis; Use saponification to produce a bar of soap

Experiments:

Experiment 1: Types of Chemical Reactions

- Students will investigate different types of chemical reactions.

Experiment 2: Synthesis of Soap

- Students will use the process of saponification to make their own bar of soap.

Lab 16: Oxidation-Reduction Reactions

Time: 2 hours

Learning Objectives: Oxidize an iron compound; Perform an oxidation-reduction reaction; Observe and record characteristics of an oxidation-reduction reaction

Experiments:

Experiment 1: Preparation of Iron (II) acetate and Iron (III) acetate

- Students will perform and observe an oxidation-reduction reaction.

Lab 17: Molar Mass

Time: 2 hours

Learning Objectives: Identify and understand the relevance of Avogadro's number; Experimentally determine the grams of a substance and convert to moles

Experiments:

Experiment 1: Percent Sugar in Bubble Gum

- Students determine the number of sugar moles in bubble gum.

Lab 18: Periodic Trends in Atomic Properties

Time: 2 hours

Learning Objectives: Apply the periodic law by arranging elements in the periodic table; Classify elements according to their groups and periods in the periodic table; Describe the trends that occur in the periodic table

Exercise:

Exercise 1: Construction of a Periodic Table

- Students will construct their own periodic table of elements.

Lab 19: Stoichiometric Calculations: Reactants and Products

Time: 2 hours

Learning Objectives: Calculate quantitative relationships in chemical reactions (stoichiometry); Calculate the theoretical yield of a product in a reaction; Weigh the actual mass of a product collected in a reaction; Predict the products and write a balanced equation for the reaction

Experiments:

Experiment 1: Double Displacement Precipitation Reaction between Calcium Chloride and Sodium Carbonate

- Students will precipitate calcium carbonate from the reaction; as a result of the reaction between sodium carbonate and calcium chloride.

Lab 20: Using the Ideal Gas Law

Time: 2 hours

Learning Objectives: Determine the relationship between pressure and temperature; Understand how to use Charles's Law; Understand how to use the Ideal Gas Law

Experiments:

Experiment 1: Charles's Law

- Students explore the relationship between temperature and volume, and connect this to Charles's Law.

Experiment 2: Using the Ideal Gas Law

- Students will use a catalyst to demonstrate the Ideal Gas Law.

Lab 21: Exploring Variables that Affect Reaction Rates

Time: 1 hour

Learning Objectives: Determine how temperature affects the rate of a chemical reaction; Understand how the concentration of reactants affect the reaction rate; Use the scientific method to describe the variables that affect reaction rates

Experiments:

Experiment 1: Temperature and the Rate of Chemical Reactions

- Students will investigate the effect of temperature on the rate of a chemical reaction.

Lab 22: Chemical Kinetics and Catalysis

Time: 2 hours

Learning Objectives: Examine the presence of amylase in food using iodine-potassium iodide; Examine the effects of temperature on catalase activity

Experiments:

Experiment 1: Enzymes in Food

- Students will examine the presence of amylase in food by using iodine-potassium iodide (IKI).

Experiment 2: Effect of Temperature on Enzyme Activity

- Students examine the effects of temperature on catalase activity based on the amount of oxygen produced.

Lab 23: The Nature of Acids and Bases: Exploring the pH Scale

Time: 2 hours

Learning Objectives: Understand the differences between acids and bases; Use the Henderson-Hasselbalch equation to determine the pH of a buffer solution

Experiments:

Experiment 1: Preparing a Buffer

- Students will learn how to prepare a buffer.

Experiment 2: Preparing a Buffer Solution with Borax

- Students will prepare a buffer solution with borax.

Lab 24: Titrations and Equivalence Points

Time: 2 hours

Learning Objectives: Utilize the laboratory method of titration; Quantitatively choose an indicator for a titration; Determine the end point and the equivalence point of a titration

Experiments:

Experiment 1: Getting Acquainted with Indicators

- Students will determine the pH of a solution at the equivalence point by graphing a titration curve.