DREYFOUS & ASSOCIATES

Course Overview

Chemistry

TABLE OF CONTENT

Unit 1. Introduction to Chemistry

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Introduction to Chemistry

Code: C414G0SU01L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. A Story of Two Substances

Code: C414G0S01L01

Essential Questions

- What is a substance?
- How does ozone form and why is it important?
- What are chlorofluorocarbons and how do they get into the atmosphere?

Concepts

- Chemistry
- Chlorofluorocarbons
- ozone
- substance

Lesson 2. Chemistry and Matter

Code: C414G0SU01L02

Essential Questions

- How do mass and weight compare and contrast?
- Why are chemists interested in a submicroscopic description of matter?
- What defines the various branches of chemistry?

Concepts

- mass
- model
- weight

Lesson 3. Scientific Methods

Code: C414G0SU01L03

Essential Questions

- What are the common steps of scientific methods?
- What are the similarities and differences between qualitative data and quantitative data?
- In an experiment, which variable is the independent variable, which is the dependent variable, and which are controls?
- What is the difference between a theory and a scientific law?

Concepts

- conclusion
- control
- dependent variable
- experiment
- Hypothesis
- independent variable
- qualitative data
- quantitative data
- scientific law
- scientific method
- theory

Lesson 4. Scientific Research

Code: C414G0SU01L04

Essential Questions

- How do pure research, applied research, and technology compare and contrast?
- What are some of the important rules for laboratory safety?

Concepts

- applied research
- pure research

Unit 2. Analyzing Data

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Analyzing Data

Code: C414G0SU02L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Units and Measurements

Code: C414G0SU02L01

Essential Questions

- What are the SI base units for time, length, mass, and temperature?
- How does adding a prefix change a unit?
- How are the derived units different for volume and density?

Concepts

- bases unit
- density
- derived unit
- kelvin
- kilogram
- liter
- meter
- second

Lesson 2. Scientific Notation and Dimensional Analysis

Code: C414G0SU02L02

Essential Questions

- Why use scientific notation to express numbers?
- How is dimensional analysis used for unit conversion?

Concepts

- conversion factor
- dimensional analysis
- scientific notation

Lesson 3. Uncertainty in Data

Code: C414G0SU02L03

Essential Questions

- How do accuracy and precision compare?
- How can the accuracy of experimental data be described using error and percent error?

- What are the rules for significant figures and how can they be used to express uncertainty in measured and calculated values?

Concepts

- accuracy
- error
- percent error
- precision
- significant figure

Lesson 4. Representing Data

Code: C414G0SU02L04

Essential Questions

- Why are graphs created?
- How can graphs be interpreted?

Concepts

- bar graphs
- graph

Unit 3. Matter Properties and Changes

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Matter Properties and Changes

Code: C414G0SU03L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Properties of Matter

Code: C414G0SU03L01

Essential Questions

- What characteristics identify a substance?
- What distinguishes physical properties from chemical properties?
- How do the properties of the physical states of matter differ?

Concepts

- chemical property
- extensive property
- gas
- intensive property
- liquid
- physical property
- solid
- states of matter
- vapor

Lesson 2. Changes in Matter

Code: C414G0SU03L02

Essential Questions

- What is a physical change and what are several common examples?
- What defines a chemical change? How can you tell that a chemical change has taken place?
- How does the law of conservation of mass apply to chemical reactions?

Concepts

- chemical change
- law of conservation of mass
- phase change
- physical change

Lesson 3. Mixture of Matter

Code: C414G0SU03L03

Essential Questions

- How do mixtures and substances differ?
- Why are some mixtures classified as homogeneous, while others are classified as heterogeneous?
- What are several techniques used to separate mixtures?

Concepts

- chromatography
- crystallization
- distillation
- filtration
- heterogeneous mixture
- homogeneous mixture
- mixture
- solution
- sublimation

Lesson 4. Elements and Compounds

Code: C414G0SU03L04

Essential Questions

- What distinguishes elements from compounds?
- How is the periodic table organized?
- What are the laws of definite and multiple proportions and why are they important?

Concepts

- compound
- Element
- law of definite proportions
- law of multiple proportions
- percent by mass
- periodic table

Unit 4. The Structure of the Atom

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. The Structure of the Atom

Code: C414G0SU04L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Early Ideas About Matter

Code: C414G0SU04L01

Essential Questions

- What are the similarities and differences of the atomic models of Democritus, Aristotle, and Dalton?
- How was Dalton's theory used to explain the conservation of mass?

Concept

- Dalton's atomic theory

Lesson 2. Defining the Atom

Code: C414G0SU04L02

Essential Questions

- What is an atom?
- How can the subatomic particles be distinguished in terms of relative charge and mass?
- Where are the locations of the subatomic particles within the structure of the atom?

Concepts

- atom
- cathode ray
- electro
- neutron
- nucleus
- proton

Lesson 3. How Atoms Differ

Code: C414G0SU04L03

Essential Questions

- How is the atomic number used to determine the identity of an atom?
- What is an isotope?
- Why are atomic masses not whole numbers?
- Given the mass number and atomic number, how are the number of electrons, protons, and neutrons in an atom calculated?

Concepts

- atomic mass
- atomic mass unit (amu)
- atomic number
- isotope
- mass number

Lesson 4. Unstable nuclei and Radioactive Decay

Code: C414G0SU04L04

Essential Questions

- What is the relationship between unstable nuclei and radioactive decay?
- How are alpha, beta, and gamma radiation characterized in terms of mass and charge?

Concepts

- alpha particle
- alpha radiation
- beta particle
- beta radiation
- gamma ray
- nuclear equation
- nuclear reaction
- radiation
- radioactive decay
- Radioactivity

Unit 5. Electrons in Atoms

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Electrons in Atoms

Code: C414G0SU05L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Light and Quantized Energy

Code: C414G0SU05L01

Essential Questions

- How do the wave and particle natures of light compare?
- What is a quantum of energy and how is it related to an energy change of matter?
- How do continuous electromagnetic spectra and atomic emission spectra compare and contrast?

Concepts

- electromagnetic radiation
- wavelength
- frequency
- amplitude
- electromagnetic spectrum
- quantum
- Planck's constant
- photoelectric effect
- photon
- atomic emission spectrum

Lesson 2. Quantum theory and the Atom

Code: C414G0SU05L02

Essential Questions

- How do the Bohr and quantum mechanical models of the atom compare?
- What is the impact of de Broglie's wave-particle duality and the Heisenberg uncertainty principle on the current view of electrons in atoms?
- What are the relationships among a hydrogen atom's energy levels, sublevels, and atomic orbitals?

Concepts

- ground state
- quantum number
- de Broglie equation

- Heisenberg uncertainty principle
- quantum mechanical model of the atom
- atomic orbital
- principal quantum number
- principal energy level
- energy sublevel

Lesson 3. Electron Configuration

Code: C414G0SU05L03

Essential Questions

- How are the Pauli exclusion principle, the Aufbau principle, and Hund's rule used to write electron configurations using orbital diagrams and electron configuration notation?
- What are valence electrons, and how do electron-dot structures represent an atom's valence electrons?

Concepts

- Aufbau principle
- electron configuration
- electron-dot structure
- Hund's rule
- Pauli exclusion principle
- valence electron

Unit 6. The Periodic Table and Periodic Law

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. The Periodic Table and Periodic Law

Code: C414G0SU06L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Development of the Modern periodic Table

Code: C414G0SU06L01

Essential Questions

- How was the periodic table developed?
- What are the key features of the periodic table?

Concepts

- actinide series
- alkali metal
- alkaline earth metal
- group
- halogen
- inner transition metal
- lanthanide series
- metal
- metalloid
- noble gas
- nonmetal
- period
- periodic law
- representative element
- transition element
- transition metal

Lesson 2. Classification of the Elements

Code: C414G0SU06L02

Essential Questions

- Why do elements in the same group have similar properties?
- Based on their electron configurations, what are the four blocks of the periodic table?

Concept

- valence electron

Lesson 3. Periodic Trends

Code: C414G0SU06L03

Essential Questions

- What are the period and group trends of different properties?
- How are period and group trends in atomic radii related to electron configuration?

Concepts

- electronegativity
- ion
- ionization energy
- octet rule

Unit 7. Ionic Compounds and Metals

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Ionic Compounds and Metals

Code: C414G0SU07L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Ionic compounds and Metals

Code: C414G0SU07L01

Essential Questions

- What holds atoms together in a chemical bond?
- How do positive and negative ions form?
- How does ion formation relate to electron configuration?

Concepts

- anion
- cation
- chemical bond

Lesson 2. Ionic Bonds and ionic Compounds

Code: C414G0SU07L02

Essential Questions

- How do ionic bonds form and how are the ions arranged in an ionic compound?
- What can you conclude about the strength of ionic bonds based on the physical properties of ionic compounds?
- Is ionic bond formation exothermic or endothermic?

Concepts

- crystal lattice
- electrolyte
- ionic bond
- ionic compound
- lattice energy

Lesson 3. Names and Formulas for Ionic Compounds

Code: C414G0SU07L03

Essential Questions

- What is a formula unit and how does it relate to an ionic compound's composition?
- How do you write the formulas for compounds formed from different ions and oxyanions?

- What are the naming conventions for ionic compounds and oxyanions?

Concepts

- formula unit
- monoatomic ion
- oxyanion
- polyatomic ion

Lesson 4. Metallic Bonds and the properties of Metals

Code: C414G0SU07L04

Essential Questions

- What are the characteristics of a metallic bond?
- How does the electron sea model account for the physical properties of metals?
- What are alloys, and how can they be categorized?

Concepts

- electron sea model
- delocalized electron
- metallic bond
- alloy

Unit 8. Covalent Bonding

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Covalent Bonding

Code: C414G0SU08L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. The Covalent Bond

Code: C414G0SU08L01

Essential Questions

- How does the octet rule apply to atoms that form covalent bonds?
- Why do atoms form single, double, and triple covalent bonds?
- What are sigma and pi bonds and how do they contrast?
- How are the strength of a covalent bond, its bond length, and its bond dissociation energy related?

Concepts

- covalent bond
- endothermic reaction
- exothermic reaction
- Lewis structure
- molecule
- pi bond
- sigma bond

Lesson 2. Naming Molecules

Code: C414G0SU08L02

Essential Questions

- What rules do you follow to name a binary molecular compound from its molecular formula?
- How are acidic solutions named?

Concept

- oxyacid

Lesson 3. Molecular Structures

Code: C414G0SU08L03

Essential Questions

- What are the basic steps used to draw Lewis structures?
- Why does resonance occur, and what are some resonance structures?
- Which molecules are exceptions to the octet rule, and why do these exceptions occur?

Concepts

- coordinate covalent bond
- resonance
- structural formula

Lesson 4. Molecular Shapes

Code: C414G0SU08L04

Essential Questions

- What is the VSEPR bonding theory?
- How can you use the VSEPR model to predict the shape of, and the bond angles in, a molecule?
- What is hybridization?

Concepts

- Hybridization
- VSEPR model

Lesson 5. Electronegativity and Polarity

Code: C414G0SU08L05

Essential Questions

- How is electronegativity used to determine bond type?
- How do polar and nonpolar covalent bonds and polar and nonpolar molecules compare?
- How do they contrast?
- What are the characteristics of covalently bonded compounds?

Concept

- polar covalent bond

Unit 9. Chemical Reactions

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Chemical Reactions

Code: C414G0SU09L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Reactions and Equations

Code: C414G0SU09L01

Essential Questions

- What is evidence of chemical change?
- How are chemical reactions represented?
- Why do chemical equations need to be balanced and how is this accomplished?

Concepts

- chemical equation
- chemical reaction
- coefficient
- product
- reactant

Lesson 2. Classifying Chemical Reactions

Code: C414G0SU09L02

Essential Questions

- How are chemical reactions classified?
- What are the characteristics of different classes of chemical reactions?

Concepts

- combustion reaction
- decomposition reaction
- double-replacement reaction
- precipitate
- single-replacement reaction
- synthesis reaction

Lesson 3. Reactions in Aqueous Solutions

Code: C414G0SU09L03

Essential Questions

- What are aqueous solutions?
- How are complete ionic and net ionic equations written for chemical reactions in aqueous solutions?

- How can you predict whether reactions in aqueous solutions will produce a precipitate, water, or a gas?

Concepts

- aqueous solution
- complete ionic equation
- net ionic equation
- solute
- solvent
- spectator ion

Unit 10. The Mole

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. The Mole

Code: C414G0SU10L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Measuring Matter

Code: C414G0SU10L01

Essential Questions

- How is a mole used to indirectly count the number of particles of matter?
- What is a common everyday counting unit to which the mole can be related?
- How can moles be converted to number of representative particles and vice versa?

Concepts

- Avogadro's number
- mole

Lesson 2. Mass and the Mole

Code: C414G0SU10L02

Essential Questions

- Why can the mass of an atom be related to the mass of a mole of atoms?
- How can the number of moles be converted to the mass of an element and vice versa?
- How can the number of moles be converted to the number of atoms of an element and vice versa?

Concept

- molar mass

Lesson 3. Moles of Compounds

Code: C414G0SU10L03

Essential Questions

- What are the mole relationships shown by a chemical formula?
- How is the molar mass of a compound calculated?
- How can the number of moles be coverted to the mass of a compound and vice versa?
- What conversion factors are applied to determine the number of atoms or ions in a known mass of a compound?

Concept

- representative particle

Lesson 4. Empirical and Molecular Formulas

Code: C414G0SU10L04

Essential Questions

- What is meant by the percent composition of a compound?
- How can the empirical and molecular formulas for a compound be determined from mass percent and actual mass data?

Concepts

- empirical formula
- molecular formula
- percent composition

Lesson 5. Formulas of Hydrates

Code: C414G0SU10L05

Essential Questions

- What is a hydrate and how does its name relate to its composition?
- How is the formula of a hydrate determined from laboratory data?

Concept

- hydrate

Unit 11. Stoichiometry

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Stoichiometry

Code: C414G0SU11L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Defining Stoichiometry

Code: C414G0SU11L01

Essential Questions

- Which relationships can be derived from a balanced chemical equation?
- How are mole ratios written from a balanced chemical equation?

Concepts

- mole ratio
- Stoichiometry

Lesson 2. Stoichiometry Calculations

Code: C414G0SU11L02

Essential Questions

- What is the sequence of steps used in solving stoichiometric problems?
- How are these steps applied to solve stoichiometric problems?

Concept

- chemical reactions

Lesson 3. Limiting Reactants

Code: C414G0SU11L03

Essential Questions

- In a chemical reaction, which reactant is the limiting reactant?
- How much of the excess reactant remains after the reaction is complete?
- How do you calculate the mass of a product when the amounts of more than one reactant are given?

Concepts

- excess reactant
- limiting reactant

Lesson 4. Percent Yield

Code: C414G0SU11L04

Essential Questions

- What is the theoretical yield of a chemical reaction?

- How do you calculate the percent yield for a chemical reaction?

Concepts

- actual yield
- percent yield
- theoretical yield

Unit 12. States of Matter

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. States of Matter

Code: C414G0SU12L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Gases

Code: C414G0SU12L01

Essential Questions

- How is the kinetic-molecular theory used to explain the behavior of gases?
- Why does mass affect the rates of diffusion and effusion?
- How is gas pressure measured and how is the partial pressure of a gas calculated?

Concepts

- atmosphere
- barometer
- Dalton's law of partial
- diffusion
- elastic collision
- Graham's law of effusion
- kinetic-molecular theory
- pascal
- pressure
- temperature

Lesson 2. Forces of Attraction

Code: C414G0SU12L02

Essential Questions

- What are intramolecular forces?
- How do intermolecular forces compare? How do they contrast?

Concepts

- dipole-dipole force
- dispersion force
- hydrogen bond

Lesson 3. Liquids and Solids

Code: C414G0SU12L03

Essential Questions

- How do the arrangements of particles in liquids and solids differ?
- What are the factors that affect viscosity?
- How are the unit cell and crystal lattice related?

Concepts

- allotrope
- amorphous solid
- crystalline solid
- surface tension
- surfactant
- unit cell
- viscosity

Lesson 4. Phase Changes

Code: C414G0SU12L04

Essential Questions

- How can the addition and removal of energy cause a phase change?
- What is a phase diagram?

Concepts

- boiling point
- condensation
- deposition
- evaporation
- freezing point
- melting point
- phase diagram
- triple point
- vapor pressure
- vaporization

Unit 13. Gases

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Gases

Code: C414G0SU13L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. The Gas Law

Code: C414G0SU13L01

Essential Questions

- What are the relationships between pressure, temperature, and volume of a constant amount of gas?
- How can you use the gas laws to solve problems involving the pressure, temperature, and volume of a constant amount of gas?

Concepts

- absolute zero
- Boyle's law
- Charles's law
- combined gas law
- Gay-Lussac's law

Lesson 2. The Ideal Gas Law

Code: C414G0SU13L02

Essential Questions

- How does Avogadro's principle relate the number of particles of gas to the gas's volume?
- How is the amount of gas present related to its pressure, temperature, and volume by the ideal gas law?
- What are the properties of real gases and of ideal gases?

Concepts

- and pressure (STP)
- Avogadro's principle
- ideal gas constant (R)
- ideal gas law
- molar volume
- standard temperature

Lesson 3. Gas Stoichiometry

Code: C414G0SU13L03

Essential Questions

- What stoichiometric ratios can be determined for gaseous reactants and products from balanced chemical equations?
- How are the amounts of gaseous reactants and products in a chemical reaction calculated?

Concept

- coefficient

Unit 14. Mixtures and Solutions

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Mixtures and Solutions

Code: C414G0SU14L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Types of Mixtures

Code: C414G0SU14L01

Essential Questions

- How do the properties of suspensions, colloids, and solutions compare?
- What are the types of colloids and types of solutions?
- How are the electrostatic forces in colloids described?

Concepts

- Brownian motion
- colloid
- immiscible
- insoluble
- miscible
- soluble
- suspension
- Tyndall effect

Lesson 2. Solution Concentration

Code: C414G0SU14L02

Essential Questions

- How can the concentration be described using different units?
- How are the concentrations of solutions determined?
- What is the molarity of a solution and how can it be calculated?

Concepts

- concentration
- molality
- molarity
- mole fraction

Lesson 3. Factors Affecting Solvation

Code: C414G0SU14L03

Essential Questions

- How do intermolecular forces affect solvation?
- What is solubility?

- Which factors affect solubility?

Concepts

- heat of solution
- Henry's law
- saturated solution
- solvation
- supersaturated solution
- unsaturated solution

Lesson 4: Colligative Properties of Solutions

Code: C414G0SU14L04

Essential Questions

- What are colligative properties?
- What are four colligative properties of solutions?
- How are the boiling point elevation and freezing point depression of a solution determined?

Concepts

- boiling point elevation
- colligative property
- freezing point depression
- osmosis
- osmotic pressure
- vapor pressure lowering

Unit 15. Energy and Chemical Change

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Energy and Chemical Change

Code: C414G0SU15L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Energy

Code: C414G0SU15L01

Essential Questions

- What is energy?
- How do potential and kinetic energy differ?
- How can chemical potential energy be related to the heat lost or gained in chemical reactions?
- How is the amount of heat absorbed or released by a substance calculated as its temperature changes?

Concepts

- calorie
- chemical potential energy
- energy
- heat
- joule
- law of conservation of energy
- specific heat

Lesson 2. Heat

Code: C414G0SU15L02

Essential Questions

- How is a calorimeter used to measure energy that is absorbed or released?
- What do enthalpy and enthalpy change mean in terms of chemical reactions and processes?

Concepts

- calorimeter
- enthalpy
- enthalpy (heat) of reaction
- surroundings
- system
- thermochemistry
- universe

Lesson 3. Thermochemical Equations

Code: C414G0SU15L03

Essential Questions

- How are thermochemical equations for chemical reactions and other processes written?
- How is energy lost or gained during changes of state?
- How is the heat that is absorbed or released in a chemical reaction calculated?

Concepts

- enthalpy (heat) of combustion
- molar enthalpy (heat) of fusion
- molar enthalpy (heat) of vaporization
- thermochemical equation

Lesson 4. Calculating Enthalpy Change

Code: C414G0SU15L04

Essential Questions

- How is Hess's law applied to calculate the enthalpy change for a reaction?
- What is the basis for the table of standard enthalpies of formation?
- How is Δ H rxn calculated using thermochemical equations?
- What is the enthalpy change for a reaction using standard enthalpies of formation data?

Concepts

- Hess's law
- Stormwater runoff

Lesson 5. Reaction Spontaneity

Code: C414G0SU15L05

Essential Questions

- What is the difference between spontaneous and non spontaneous processes?
- How do changes in entropy and free energy determine the spontaneity of chemical reactions and other processes?

Concepts

- entropy
- free energy's
- second law of thermodynamics
- spontaneous process

Unit 16. Reaction Rates

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Reaction Rates

Code: C414G0SU16L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. A Model for Reaction Rates

Code: C414G0SU16L01

Essentials Questions

- How can average rates of chemical reactions be calculated from experimental data?
- How are the rates of chemical reactions related to collisions between reacting particles?

Concepts

- activated complex
- activation energy
- collision theory
- reaction rate

Lesson 2. Factors Affecting Reaction Rates

Code: C414G0SU16L02

Essentials Questions

- What are the factors that affect the rates of chemical reactions?
- What is the role of a catalyst?

Concepts

- catalyst
- heterogeneous catalyst
- homogeneous catalyst
- inhibitor

Lesson 3. Reaction Rates Laws

Code: C414G0SU16L03

Essentials Questions

- What is the relationship between reaction rate and concentration?
- How are reaction orders determined using the method of initial rates?

Concepts

- method of initial rates
- rate law
- reaction order

- specific rate constant

Lesson 4. Instantaneous Reaction Rates and Reaction Mechanisms

Code: C414G0SU16L04

Essential Questions

- How are instantaneous rates of chemical reactions calculated?
- What substances and steps are involved in a reaction mechanism?
- How is the instantaneous rate of a complex reaction related to its reaction mechanism?

Concepts

- complex reaction
- instantaneous rate
- intermediate
- rate-determining
- reaction mechanism

Unit 17. Chemical Equilibrium

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Chemical Equilibrium

Code: C414G0SU17L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. A State of Dynamic Balance

Code: C414G0SU17L01

Essential Questions

- What are the characteristics of chemical equilibrium?
- How are equilibrium expressions written for systems that are at equilibrium?
- How are equilibrium constants calculated from concentration data?

Concepts

- chemical equilibrium
- equilibrium constant
- heterogeneous equilibrium
- homogeneous equilibrium
- law of chemical equilibrium
- reversible reaction

Lesson 2. Factors Affecting Chemical Equilibrium

Code: C414G0SU17L02

Essential Questions

- Which various factors affect chemical equilibrium?
- How does Le Châtelier's principle apply to equilibrium systems?

Concept

- Le Châtelier's principle

Lesson 3. Using Equilibrium Constants

Code: C414G0SU17L03

Essential Questions

- How are the equilibrium concentrations of reactants and products determined?
- How is the solubility of a compound calculated from its solubility product constant?
- Why is the common ion effect important?

Concepts

- common ion

- common ion effect
- solubility product constant

Unit 18. Acids and Bases

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Acids and Bases

Code: C414G0SU18L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Introduction to Acids and Bases

Code: C414G0SU18L01

Essential Questions

- What are the physical and chemical properties of acids and bases?
- How are solutions classified as acidic, basic, or neutral?
- How do the Arrhenius, Brønsted- Lowry, and Lewis models of acids and bases compare?

Concepts

- acidic solution
- amphoteric
- Arrhenius model
- basic solution
- Brønsted-Lowry model
- conjugate acid
- conjugate acid-base pair
- conjugate base
- Lewis model

Lesson 2. Strengths of Acids and Bases

Code: C414G0SU18L02

Essential Questions

- How is the strength of an acid or base related to its degree of ionization?
- How does the strength of a weak acid compare with the strength of it conjugate base?
- What is the relationship between the strengths of acids and bases and the values of their ionization constants?

Concepts

- acid ionization constant
- base ionization constant
- strong acid
- strong base
- weak acid
- weak base

Lesson 3. Hydrogen Ions and pH

Code: C414G0SU18L03

Essential Questions

- What are pH and pOH?
- How are pH and pOH related to the ion product constant for water?
- How are the pH and pOH of aqueous solutions calculated?

Concepts

- ion product constant for water
- pH
- pOH

Lesson 4: Neutralization

Code: C414G0SU18L04

Essential Questions

- What do chemical equations of neutralization reactions look like?
- How are neutralization reactions used in acid-base titrations?
- How do the properties of buffered and unbuffered solutions compare?

Concepts

- acid-base indicator
- buffer
- buffer capacity
- end point
- equivalence point
- neutralization reaction
- salt
- salt hydrolysis
- titrant
- titration

Unit 19. Redox Reactions

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Redox Reactions

Code: C414G0SU19L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Oxidation and Reduction

Code: C414G0SU19L01

Essential Questions

- What are oxidation and reduction?
- How can oxidizing and reducing agents be identified?
- How is the oxidation number of an element in a compound determined?

Concepts

- oxidation
- oxidation number
- oxidation-reduction reaction
- oxidizing agent
- redox reaction
- reducing agent
- reduction

Lesson 2. Development of Environmental Policy in the United States

Code: C414G0SU19L02

Essential Questions

- How are changes in oxidation number related to the transfer of electrons?
- How can changes in oxidation numbers be used to balance redox equations?
- What are half-reactions and how can they be used to balance redox equations?

Concepts

- half-reaction
- oxidation-number method
- species

Unit 20. Electrochemistry

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Electrochemistry

Code: C414G0SU20L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Voltaic Cells

Code: C414G0SU20L01

Essential Questions

- How is electrical energy obtained from a redox reaction?
- What are the parts of a voltaic cell, and how does each part operate?
- How are cell potentials calculated and the spontaneity of redox reactions determined?

Concepts

- anode
- cathode
- electrochemical cell
- half-cell
- reduction potential
- salt bridge
- standard hydrogen electrode
- voltaic cell

Lesson 2. Batteries

Code: C414G0SU20L02

Essential Questions

- What are the structure, composition, and operation of the typical carbonzinc dry-cell battery?
- What is the difference between primary and secondary batteries and what are two examples of each type?
- What is the structure of the hydrogen-oxygen fuel cell and how does it operate?
- What is the process of corrosion of iron and what are methods to prevent corrosion?

Concepts

- battery
- corrosion
- dry cell
- fuel cell

- galvanization
- primary battery
- secondary battery

Lesson 3. Electrolysis

Code: C414G0SU20L03

Essential Questions

- How is it possible to reverse a spontaneous redox reaction in an electrochemical cell?
- How does the molten sodium chloride electrolysis reaction compare with those in the electrolysis of brine?
- What is the importance of electrolysis in the smelting and purification of metals?

Concepts

- electrolysis
- electrolytic cell

Unit 21. Hydrocarbons

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Hydrocarbons

Code: C414G0SU21L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Introduction to Hydrocarbons

Code: C414G0SU21L01

Essential Questions

- What do the terms organic compound and organic chemistry mean?
- How are hydrocarbons and the models used to represent them identified?
- How are saturated and unsaturated hydrocarbons distinguished?
- Where are hydrocarbons obtained and how are they separated?

Concepts

- cracking
- fractional distillation
- hydrocarbon
- organic compound
- saturated hydrocarbon
- unsaturated hydrocarbon

Lesson 2. Alkanes

Code: C414G0SU21L02

Essential Questions

- How are alkanes named when given their structures?
- How are alkane structures drawn when given their names?
- What are the properties of alkanes?

Concepts

- alkane
- cyclic hydrocarbon
- cycloalkane
- homologous series
- parent chain
- substituent group

Lesson 3. Alkanes and Alkynes

Code: C414G0SU21L03

Essential Questions

- How do the properties of alkenes and alkynes compare with those of alkanes?
- How are the molecular structures of alkenes and alkynes described?
- How are alkenes and alkynes named when given their structures?
- How are alkenes and alkynes drawn when given their names?

Concepts

- alkane
- alkene

Lesson 4. Hydrocarbon Isomers

Code: C414G0SU21L04

Essential Questions

- How can the two main categories of isomers—structural isomers and stereoisomers—be distinguished?
- How are cis- and trans- geometric isomers different?
- What is the structural variation in molecules that results in optical isomers?

Concepts

- asymmetric carbon
- chirality
- geometric isomer
- isomer
- optical isomer
- optical rotation
- stereoisomer
- structural isomer

Lesson 5. Aromatic Hydrocarbons

Code: C414G0SU21L05

Essential Questions

- How do the properties of aromatic and aliphatic hydrocarbons compare and contrast?
- What is a carcinogen and what are some examples?

Concepts

- aliphatic compound
- aromatic compound

Unit 22. Substituted Hydrocarbons and Their Reactions

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Substituted Hydrocarbons and Their Reactions

Code: C414G0SU22L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Alkyl Halides and Aryl Halides

Code: C414G0SU22L01

Essential Questions

- What are functional groups, and what are some examples?
- How do alkyl and aryl halide structures compare and contrast?
- What factors affect the boiling points of organic halides?

Concepts

- alkyl halide
- aryl halide
- functional group
- halocarbon
- halogenation
- plastic
- substitution reaction

Lesson 2. Alcohols, Ethers, and Amines

Code: C414G0SU22L02

Essential Questions

- Which functional groups define alcohols, ethers, and amines?
- How are the structures of alcohols, ethers, and amines drawn?
- What are some properties and uses of alcohols, ethers, and amines?

Concepts

- alcohol
- amine
- denatured alcohol
- ether
- hydroxyl group

Lesson 3. Carbonyl Compounds

Code: C414G0SU22L03

Essential Questions

- Which structures identify various carbonyl compounds?
- What are the properties of compounds containing the carbonyl group?

Concepts

- aldehyde
- amide
- carbonyl group
- carboxyl group
- carboxylic acid
- condensation reaction
- ester
- ketone

Lesson 4. Other Reactions of Organic Compounds

Code: C414G0SU22L04

Essential Questions

- How are organic reactions classified?
- Why is it useful to draw structural formulas when writing equations for reactions of organic compounds?
- How can classifying a reaction help you predict the reaction's products?

Concepts

- addition reaction
- dehydration reaction
- dehydrogenation reaction
- elimination reaction
- hydration reaction
- hydrogenation reaction

Lesson 5. Polymers

Code: C414G0SU22L05

Essential Questions

- How does drawing a diagram help you understand the relationship between a polymer and the monomers from which it forms?
- What distinguishes addition and condensation polymerization reactions?
- How can you use molecular structures and the presence of functional groups to predict the properties of polymers?

Concepts

- addition polymerization
- condensation polymerization
- monomer
- polymer
- polymerization reaction
- thermoplastic
- thermosetting

Unit 23. The Chemistry of Life

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. The Chemistry of Life

Code: C414G0SU23L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Proteins

Code: C414G0SU23L01

Essential Questions

- How can the structures of amino acids and proteins be described?
- What are the roles of proteins in cells?

Concepts

- active site
- amino acid
- denaturation
- enzyme
- peptide
- peptide bond
- protein
- substrate

Lesson 2. Carbohydrates

Code: C414G0SU123L02

Essential Questions

- How can the structures of monosaccharides, disaccharides, and polysaccharides be described?
- What are the functions of carbohydrates in living things?

Concepts

- carbohydrate
- disaccharide
- monosaccharide
- polysaccharide

Lesson 3. Lipids

Code: C414G0SU23L03

Essential Questions

- How can the structures of fatty acids, triglycerides, phospholipids, and steroids be described?
- What are the functions of lipids in living organisms?

- What are some reactions that fatty acids undergo?
- How are the structure and function of cell membranes related?

Concepts

- fatty acid
- lipid
- phospholipid
- saponification
- steroid
- triglyceride
- wax

Lesson 4. Nucleic Acids

Code: C414G0SU23L04

Essential Questions

- What are the structural components of nucleic acids?
- How is the function of DNA related to its structure?
- What are the structure and function of RNA?

Concepts

- nucleic acid
- nucleotide

Lesson 5: Metabolism

Code: C414G0SU23L05

Essential Questions

- How do anabolism and catabolism compare?
- What is the role of ATP in metabolism?
- How can the processes of photosynthesis, cellular respiration, and fermentation be compared and contrasted?

Concepts

- anabolism
- ATP
- catabolism
- cellular respiration
- fermentation
- metabolism
- photosynthesis

Unit 24. Nuclear Chemistry

At the end of this unit the student will have answered the essential questions found in the following lessons.

Lesson 0. Nuclear Chemistry

Code: C414G0SU01L00

Unit Documents: Assessment, Chemical & Careers, ChemLab, Safety Symbols, Standardized Test Practice and Study Guide.

Lesson 1. Nuclear Radiation

Code: C414G0SU24L01

Essential Questions

- How was radioactivity discovered and studied?
- What are the key properties of alpha, beta, and gamma radiations?

Concepts

- radioisotope
- X-ray
- penetrating power

Lesson 2. Radioactive Decay

Code: C414G0SU24L02

Essential Questions

- Why are certain nuclei radioactive?
- How are nuclear equations balanced?
- How can you use radioactive decay rates to analyze samples of radioisotopes?

Concepts

- band of stability
- electron capture
- half-life
- nucleon
- positron
- positron emission
- radioactive decay series
- radiochemical dating
- strong nuclear force
- transmutation

Lesson 3. Nuclear Reactions

Code: C414G0SU24L03

Essential Questions

- How are mass and energy related?

- How do nuclear fission and nuclear fusion compare and contrast?
- What is the process by which nuclear reactors generate electricity?

Concepts

- breeder reactor
- critical mass
- induced transmutation
- mass defect
- nuclear fission
- nuclear fusion
- thermonuclear reaction
- transuranium element

Lesson 4. Applications and Effects of Nuclear Reactions

Code: C414G0SU24L04

Essential Questions

- What are several methods used to detect and measure radiation?
- How is radiation used in the treatment of disease?
- What are some of the damaging effects of radiation on biological systems?

Concepts

- ionizing radiation
- radiotracer