QUARTER 1
Unit 1 Intro (3 weeks)
Big Idea 1: The chemical elements are fundamental building materials of matter, and all matter can be
understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions
Learning Objectives: 1.5, 1.6, 1.7, 1.8, 1.12, 1.13, 1.14
1. Introductory and Review
2. Atoms, Molecules, and Ions
3. Periodicity
Laboratory Activities
2. Spectrophotometry: How Can Color Be Used to Determine the Mass Percent of Copper in Brass.
LO 1.16 3 days Science Practices 1-7
9. GUIDED INQUIRY- Physical and Chemical Changes: Can the Individual Components of
Quick Ache Relief Be Used to Resolve Consumer Complaints? LO
3.10 Science Practices 1-7 3 days
4
Student Activity - Students observe a demonstration of light emission and the voltage drop for
various LED lights, then mathematically and graphically determine Plauk's constant. LO 1.7
[CR3a]
Unit 2 Reactions and Stoichiometry (3 weeks)
Big Idea 3: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the
transfer of electrons.
Learning Objectives: 2.1, 3.1, 3.2, 3.8, 3.9, 3.10, 5.10, 1.1, 1.2, 1.3, 1.4, 1.17, 1.18, 1.19, 3.4, 3.5, 3.6
1. Net ionic equations
2. Balancing of equations
3. Mass and volume relations with emphasis on the mole concept, molarity; including
percent composition, empirical formulas and limiting reactants
4. Chemical reactivity and products of chemical reactions
5. Reaction types
Acid-base reactions; complex ions, precipitation
6. Making solutions and calculating various solution concentrations in stoichiometric relations
Laboratory Activities
#1. GUIDED INQUIRY Spectroscopy: What Is the Relationship Between the Concentration of a
Solution and the Amount of Transmitted Light Through the Solution? LO 1.1.5 Science Practices 1-
7, 3 days-
#3. Gravimetric Analysis: What Makes Hard Water Hard? LO 1.16 Science Practices 1-7 3 days
#7. Stoichiometry: Using the Principle That Each Substance Has Unique Properties

to Purify a Mixture: An Experiment in Applying Green Chemistry to Purification LO 3.5 Science

Student Activity - Students observe a series of chemical reactions using video demonstrations from websites. For each they will: 1. Classify the type of reaction, 2. Write a balanced net ionic chemical equation, 3. Write a brief description for each reaction, and 4. Determine the driving force towards thermodynamic favorability for the reaction. LO 3.1 & 3.2 [CR3c]

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Unit 3 - ELECTROCHEMISTRY – 3 weeks

Big Idea 3: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.

Learning Objectives: 3.12, 3.13, 5.14, 5.15, 6.25

1. electrolytic and galvanic cells
2. Faraday's laws
3. standard half-cell potentials
4. prediction of the direction of redox reactions

Laboratory Activities

#8. Redox Titration: How Can We Determine the Actual Percentage of H_2O_2 in a Drugstore Bottle of Hydrogen Peroxide? LO 3.9, Science Practices 1-7, 3 days

QUARTER 2

Unit 4 Electrons - 3 weeks

Big Idea 2: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.

Learning Objectives: 2.7, 5.10

Laboratory Activities - na

Student Activity - Students are given structures of various compounds and must explain why they differ in physical state at various temperatures; then predict the type(s) of bonding present based on the atom’s position on the periodic table. LO 2.1, 2.13, 2.17, & 2.19 [CR3b]

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Unit 5 Chemical Bonds (3 weeks)

Big Idea 2: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.

Learning Objectives: 1.9, 1.10, 1.11, 2.14, 2.17, 2.19, 2.20, 2.22, 2.23, 2.24, 2.25, 2.26, 2.27, 2.28, 2.11, 2.13, 2.18, 2.20, 2.21, 2.22, 2.29, 2.30, 2.31, 2.32, 5.9, 1.16, 2.8, 2.8, 2.9

1. Bonding forces

a. Types: ionic, covalent, metallic, hydrogen bonding, van der Waals (including

London dispersion forces)

b. Nomenclature

c. Relationships to states, structure, and properties of matter

d. Polarity of bonds and electronegativities

2. Molecular models

a. Lewis structures of molecules and ions

b. Valence bonds: hybridization of orbitals, resonance, sigma and pi bonds

c. VSEPR

Laboratory Activities

#5 GUIDED INQUIRY Chromatography: Stick Question: How Do you separate molecules that are Attracted to One Another. LO 2.10, Science Practices 1-7, 3 days

Based on the Kool Aid Chromatography lab, students write an analysis on the GRAS (generally regarded as safe) requirements, the use of, the chemical structure of, and problems associated with certain food dyes. [CR4]

#6. GUIDED INQUIRY Bonding in Solids: What's in That Bottle? LO 2.22, Science Practices 1-7, 3 days

Unit 6 Gases (3 weeks)

Big Idea 2: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.

Learning Objectives: 2.3, 2.4, 2.5, 2.6, 2.12, 2.16, 2.22, 2.29, 2.31

1. Laws of ideal gases

a. Equation of state for an ideal gas

b. Partial pressures

2. Kinetic-molecular theory

a. .Interpretation of ideal gas laws on the basis of this theory

b. Avogadro's hypothesis and the mole concept

c. Dependence of kinetic energy of molecules on temperature

d. Deviations from ideal gas laws

QUARTER 3

Unit 7 - Equilibrium 4.5 weeks

Big Idea 6: Any bond or intermolecular attraction that can be formed can be broken. These two processes are in a dynamic competition, sensitive to initial conditions and external perturbations.

1. Concept of dynamic equilibrium, physical and chemical; Le Chatelier's principle; equilibrium constants

2. Quantitative treatment
3. Equilibrium constants for gaseous reactions: Kp, Kc
4. Equilibrium constants for reactions in solution (2) Solubility product constants and their
application to precipitation and the dissolution of slightly
Laboratory Activities
#13. Equilibrium: Can We Make the Colors of the Rainbow? An Application of LeChâtelier's
Principle LO 6.9 , Science Practices 1-7, 3 days
Unit 8 Thermochemistry (4.5 weeks)
Big Idea 5: The laws of thermodynamics describe the essential role of energy and explain and
predict the direction of changes in matter.
Learning Objectives: 3.11, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.12, 5.13, 5.14
1. State functions
2. First law: change in enthalpy; heat of formation; heat of reaction; Hess's law; heats of
vaporization and fusion; calorimetry
3. Second law: entropy; free energy of formation; free energy of reaction; dependence of
change in free energy on enthalpy and entropy changes
4. Relationship of change in free energy to equilibrium constants and electrode potentials
Laboratory Activities
#12 GUIDED INQUIRY Calorimetry: The Hand Warmer Design Challenge: Where Does the Heat
Come From? 3 days
Student Activity - Students calculate the needed volume of oxygen to react with given volume of
gases in a reaction, determine the heat of the reaction, and then determine the amount of work
produced using the distance the rocket traveled and heat produced from the reaction. LO 5.3 & 5.4
[CR3e]
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QUARTER 4
Unit 9 Acids (4 weeks)
Big Idea 6: Any bond or intermolecular attraction that can be formed can be broken. These two
processes are in a dynamic competition, sensitive to initial conditions and external perturbations.
Learning Objectives: 5.16, 5.17, 5.18, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10, 6.21, 6.22, 6.23,
6.24, 6.25, 1.20, 3.7, 6.11, 6.12, 6.13, 6.14, 6.15, 6.16, 6.17, 6.18, 6.19, 6.20
Acids and Bases
1. Nature of acids and bases
2. Acid strength
3. The pH scale

4. Calculating pH of strong and weak acid solutions
5. Nature of bases and pOH calculations
6. Polyprotic acids
7. Acid-base properties of salts
Applications of Aqueous Equilibria
1. Common ion effect
2. Buffered solutions
3. Buffer capacity
4. Titrations and pH curves
5. Acid-base indicators
6. Solubility equilibria and the solubility product
Laboratory Activities
#14 Acid Base Titration How do Structure and the Initial Concentration of an Acid and a Base
Influene#15. Buffering Activity: To What Extent Do Common Household Products Have
Buffering Activity? LO 6.20, Science Practices 1-7, 3 days
#4. GUIDED INQUIRY- Titration: How Much Acid Is in Fruit Juice and Soft Drinks? LO 1.20
Science Practices 1-7, 3 days
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16. Buffer Design: The Preparation and Testing of an Effective Buffer. LO 6.18, Science
Practices 1-7, 3 days
Student Activity - Students determine the concentration of species at equilibrium given the
equilibrium constant and the concentration of other species in the reaction at equilibrium. Students
will apply Le Chatelier's Principle quantitatively to equilibrium systems that are altered. LO 6.8
[CR3f]
Unit 10 Kinetics 3 weeks
Big Idea 4: Rates of chemical reactions are determined by details of the molecular collisions.
Learning Objectives: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9
1. Entropy, Gibbs Free Energy, and reaction spontaneity.
2. Rate of reaction
3. The order of reaction and the rate constant from experimental data.
4. Activation energy and catalysts.
5. Review rate determining step and reaction mechanism and determine the possible
mechanism for a reaction given the rate determining step.
Laboratory Activities
#10. GUIDED INQUIRY Kinetics: Rate of Reaction: How Long Will That Marble Statue Last? LO
4.2, Science Practices 1-7, 3 days
#11. Kinetics: Rate Laws: What Is the Rate Law of the Fading of Crystal Violet Using
Beer's Law? LO 6.18, Science Practices 1-7, 3 days
Student Activity - Students orally present the solution to a problem given a set of data of the change

of concentration versus time to the class, indicating the order of the reaction and the rate constant
with appropriate units. LO 4.2 [CR3d]
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