NATIONAL SCIENCE EDUCATION STANDARDS

Science Content Standards

Unifying Concepts and Processes

UCP.1 Systems, order, and organization

UCP.2 Evidence, models, and explanation

UCP.3 Change, constancy, and measurement

UCP.4 Evolution and equilibrium

UCP.5 Form and function

Science as Inquiry

A.1 Abilities necessary to do scientific inquiry

A.2 Understandings about scientific inquiry

Physical Science

B.1 Structure of atoms

B.2 Structure and properties of matter

B.3 Chemical reactions

B.4 Motions and forces

B.5 Conservation of energy and increase in disorder

B.6 Interactions of energy and matter

Life Science

C.1 The cell

C.2 Molecular basis of heredity

C.3 Biological evolution

C.4 Interdependence of organisms

C.5 Matter, energy, and organization in living systems

C.6 Behavior of organisms

Earth and Space Science

D.1 Energy in the Earth system

D.2 Geochemical cycles

D.3 Origin and evolution of the Earth system

D.4 Origin and evolution of the universe

Science and Technology

E.1 Abilities of technological design

E.2 Understandings about science and technology

Science in Personal and Social Perspectives

F.1 Personal and community health

F.2 Population growth

F.3 Natural resources

F.4 Environmental quality

F.5 Natural and human-induced hazards

F.6 Science and technology in local, national, and global challenges

History and Nature of Science

G.1 Science as a human endeavor

G.2 Nature of scientific knowledge

G.3 Historical perspectives

CONTENTS IN BRIEF

CHAPTER 13 Gases

BIG IDEA **Gases respond in predictable ways to changes in pressure, temperature, volume, and number of particles.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 **The Gas Laws** 1. What are the relationships between pressure, temperature, and volume of a constant amount of gas? 2. How can you use the gas laws to solve problems involving the pressure, temperature, and volume of a constant amount of gas? 2 sessions 1 block	UCP.2, UCP.3; A.1; B.2, B.4, B.6; G.1, G.3.	**Entry-Level Assessment** Focus Transparency 48 **Progress Monitoring** Formative Assessment, pp. 442, 443, 445, 448, 451 Reading Check, p. 449 Graph Check, pp. 442, 445, 447 Section Review, p. 451
SECTION 2 **The Ideal Gas Law** 1. How does Avogadro's principle relate the number of particles of gas to the gas's volume? 2. How is the amount of gas present related to its pressure, temperature, and volume by the ideal gas law? 3. What are the properties of real gases and of ideal gases? 2 sessions 1 block	UCP.2, UCP.3; B.2, B.4, B.6; G.2.	**Entry-Level Assessment** Focus Transparency 49 **Progress Monitoring** Formative Assessment, pp. 453, 454, 456, 458 Reading Check, pp. 454, 457 Section Review, p. 459
SECTION 3 **Gas Stoichiometry** 1. What stoichiometric relationships can be determined for gaseous reactants and products from balanced chemical equations? 2. How are the amounts of gaseous reactants and products in a chemical reaction calculated? 1 session 0.5 block	UCP.2, UCP.3; A.1; B.2, B.4, B.6; E.1, E.2.	**Entry-Level Assessment** Focus Transparency 50 **Progress Monitoring** Formative Assessment, p. 464 Section Review, p. 464 **Summative Assessment** Chapter Assessment, p. 468 ExamView® *Assessment Suite* CD-ROM

CHAPTER 13 STUDY GUIDE

Vocabulary Practice

BIG IDEA Gases respond in predictable ways to changes in pressure, temperature, volume, and number of particles.

SECTION 1 The Gas Laws

MAIN IDEA For a fixed amount of gas, a change in one variable—pressure, temperature, or volume—affects the other two.

- Boyle's law states that the volume of a fixed amount of gas is inversely proportional to its pressure at constant temperature.

$$P_1V_1 = P_2V_2$$

- Charles's law states that the volume of a fixed amount of gas is directly proportional to its Kelvin temperature at constant pressure.

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

- Gay-Lussac's law states that the pressure of a fixed amount of gas is directly proportional to its Kelvin temperature at constant volume.

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

- The combined gas law relates pressure, temperature, and volume in a single statement.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

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

SECTION 2 The Ideal Gas Law

MAIN IDEA The ideal gas law relates the number of particles to pressure, temperature, and volume.

- Avogadro's principle states that equal volumes of gases at the same pressure and temperature contain equal numbers of particles.
- The ideal gas law relates the amount of a gas present to its pressure, temperature, and volume.

$$PV = nRT$$

- The ideal gas law can be used to find molar mass if the mass of the gas is known or the density of the gas if its molar mass is known.

$$M = \frac{mRT}{PV} \qquad D = \frac{MP}{RT}$$

- At very high pressures and very low temperatures, real gases behave differently than ideal gases.

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

SECTION 3 Gas Stoichiometry

MAIN IDEA When gases react, the coefficients in the balanced chemical equation represent both molar amounts and relative volumes.

- The coefficients in a balanced chemical equation specify volume ratios for gaseous reactants and products.
- The gas laws can be used along with balanced chemical equations to calculate the amount of a gaseous reactant or product in a reaction.

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – 7 Days
Instructor:

Chemistry - Ch. 13

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

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-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

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-

Essential Questions – meant to challenge study to ponder, question and query

-
-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

-
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-

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – 9 Days
Instructor:

Chemistry - Ch. 14

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

-
-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

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Essential Questions – meant to challenge study to ponder, question and query

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-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

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CHAPTER 14 Mixtures and Solutions

BIG IDEA **Nearly all of the gases, liquids, and solids that make up our world are mixtures.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 **Types of Mixtures** 1. How do the properties of suspensions, colloids, and solutions compare? 2. What are the types of colloids and types of solutions? 3. How are the electrostatic forces in colloids described? 2 sessions 1 block	UCP.2; B.2, B.6	**Entry-Level Assessment** Focus Transparency 51 **Progress Monitoring** Formative Assessment, p. 479 Reading Check, p. 477 Section Review, p. 479
SECTION 2 **Solution Concentration** 1. How can concentration be described using different units? 2. How are the concentrations of solutions determined? 3. What is the molarity of a solution and how can it be calculated? 1 session 0.5 block	UCP.2, UCP.3; B.2, B.6; E.2; F.4, F.6	**Entry-Level Assessment** Focus Transparency 52 **Progress Monitoring** Formative Assessment, pp. 485, 487 Reading Check, p. 482 Section Review, p. 488
SECTION 3 **Factors Affecting Solvation** 1. How do intermolecular forces affect solvation? 2. What is solubility? 3. Which factors affect solubility? 1 session 0.5 block	UCP.2, UCP.3; B.2, B.4, B.6; E.2; G.1, G.2, G.3	**Entry-Level Assessment** Focus Transparency 53 **Progress Monitoring** Formative Assessment, pp. 489, 493, 494, 496 Reading Check, p. 492 Graph Check, p. 493 Section Review, p. 497
SECTION 4 **Colligative Properties of Solutions** 1. What are colligative properties? 2. What are four colligative properties of solutions? 3. How are the boiling point elevation and freezing point depression of a solution determined? 2 sessions 1 block	UCP.2, UCP.3; B.2, B.4, B.6	**Entry-Level Assessment** Focus Transparency 54 **Progress Monitoring** Reading Check, p. 499 Formative Assessment, pp. 500, 502 Graph Check, p. 501 Section Review, p. 504 **Summative Assessment** Chapter Assessment, p. 508 ExamView® *Assessment Suite* CD-ROM

CHAPTER 14 STUDY GUIDE

Vocabulary Practice

BIG IDEA Nearly all of the gases, liquids, and solids that make up our world are mixtures.

SECTION 1 Types of Mixtures

MAIN IDEA Mixtures can be either heterogeneous or homogeneous.

- The individual substances in a heterogeneous mixture remain distinct.
- Two types of heterogeneous mixtures are suspensions and colloids.
- Brownian motion is the erratic movement of colloid particles.
- Colloids exhibit the Tyndall effect.
- A solution can exist as a gas, a liquid, or a solid, depending on the solvent.
- Solutes in a solution can be gases, liquids, or solids.

VOCABULARY

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

SECTION 2 Solution Concentration

MAIN IDEA Concentration can be expressed in terms of percent or in terms of moles.

- Concentrations can be measured qualitatively and quantitatively.
- Molarity is the number of moles of solute dissolved per liter of solution.

$$\text{molarity } (M) = \frac{\text{moles of solute}}{\text{liters of solution}}$$

- Molality is the ratio of the number of moles of solute dissolved in 1 kg of solvent.

$$\text{molality } (m) = \frac{\text{moles of solute}}{\text{kilograms of solvent}}$$

- The number of moles of solute does not change during a dilution.

$$M_1V_1 = M_2V_2$$

VOCABULARY

- concentration
- molarity
- molality
- mole fraction

SECTION 3 Factors Affecting Solvation

MAIN IDEA Factors such as temperature, pressure, and polarity affect the formation of solutions.

- The process of solvation involves solute particles surrounded by solvent particles.
- Solutions can be unsaturated, saturated, or supersaturated.
- Henry's law states that at a given temperature, the solubility (S) of a gas in a liquid is directly proportional to the pressure (P) of the gas above the liquid.

$$\frac{S_1}{P_1} = \frac{S_2}{P_2}$$

VOCABULARY

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

SECTION 4 Colligative Properties of Solutions

MAIN IDEA Colligative properties depend on the number of solute particles in a solution.

- Nonvolatile solutes lower the vapor pressure of a solution.
- Boiling point elevation is directly related to the solution's molality.

$$\Delta T_b = K_b m$$

- A solution's freezing point depression is always lower than that of the pure solvent.

$$\Delta T_f = K_f m$$

- Osmotic pressure depends on the number of solute particles in a given volume.

VOCABULARY

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

CHAPTER 15 Energy and Chemical Change

BIG IDEA **Chemical reactions usually absorb or release energy.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 **Energy** 1. What is energy? 2. How do potential and kinetic energy differ? 3. How can chemical potential energy be related to the heat lost or gained in chemical reactions? 4. How is the amount of heat absorbed or released by a substance calculated as its temperature changes? 1 session 0.5 block	UCP.1, UPC.3; A.1; B.3, B.4, B.5, B.6; F.4, F.6	**Entry-Level Assessment** Focus Transparency 55 **Progress Monitoring** Formative Assessment, pp. 517, 519 Reading Check, p. 517 Section Review, p. 522
SECTION 2 **Heat** 1. How is a calorimeter used to measure energy that is absorbed or released? 2. What do enthalpy and enthalpy change mean in terms of chemical reactions and processes? 2 sessions 1 block	UCP.1, UPC.3; B.3, B.5; F.1	**Entry-Level Assessment** Focus Transparency 56 **Progress Monitoring** Formative Assessment, pp. 524, 525, 5 Reading Check, p. 524 Section Review, p. 528
SECTION 3 **Thermochemical Equations** 1. How are thermochemical equations for chemical reactions and other processes written? 2. How is energy lost or gained during changes of state? 3. How is the heat that is absorbed or released in a chemical reaction calculated? 1 session 0.5 block	UCP.1, UPC.3; A.1; B.6; E.2;	**Entry-Level Assessment** Focus Transparency 57 **Progress Monitoring** Formative Assessment, p. 532 Reading Check, p. 531 Section Review, p. 533
SECTION 4 **Calculating Enthalpy Change** 1. How is Hess's law applied to calculate the enthalpy change for a reaction? 2. What is the basis for the table of standard enthalpies of formation? 3. How is ΔH_{rxn} calculated using thermochemical equations? 4. What is the enthalpy change for a reaction using standard enthalpies of formation data? 2 sessions 1 block	UCP.1, UPC.3; B.3, B.5; E.2	**Entry-Level Assessment** Focus Transparency 58 **Progress Monitoring** Formative Assessment, pp. 539, 54 Reading Check, p. 536 Section Review, p. 541
SECTION 5 **Reaction Spontaneity** 1. What is the difference between spontaneous and nonspontaneous processes? 2. How do changes in entropy and free energy determine the spontaneity of chemical reactions and other processes? 1 session 0.5 block	UCP.1, UPC.3; A.1, A.2; B.3, B.4, B.5, B.6; E.1, E.2	**Entry-Level Assessment** Focus Transparency 59 **Progress Monitoring** Formative Assessment, pp. 546, 5 Section Review, p. 548 **Summative Assessment** Chapter Assessment, p. 552 ExamView® Assessment Suite CD

CHAPTER 15 STUDY GUIDE

Vocabulary Practice

BIG IDEA Chemical reactions usually absorb or release energy.

SECTION 1 Energy

MAIN IDEA Energy can change form and flow, but it is always conserved.

- Energy is the capacity to do work or produce heat.
- Chemical potential energy is energy stored in the chemical bonds of a substance by virtue of the arrangement of the atoms and molecules.
- Chemical potential energy is released or absorbed as heat during chemical processes or reactions.

$$q = c \times m \times \Delta T$$

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

SECTION 2 Heat

MAIN IDEA The enthalpy change for a reaction is the enthalpy of the products minus the enthalpy of the reactants.

- In thermochemistry, the universe is defined as the system plus the surroundings.
- The heat lost or gained by a system during a reaction or process carried out at constant pressure is called the change in enthalpy (ΔH).
- When ΔH is positive, the reaction is endothermic. When ΔH is negative, the reaction is exothermic.

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

SECTION 3 Thermochemical Equations

MAIN IDEA Thermochemical equations express the amount of heat released or absorbed by chemical reactions.

- A thermochemical equation includes the physical states of the reactants and products and specifies the change in enthalpy.
- The molar enthalpy (heat) of vaporization, ΔH_{vap}, is the amount of energy required to evaporate one mole of a liquid.
- The molar enthalpy (heat) of fusion, ΔH_{fus}, is the amount of energy needed to melt one mole of a solid.

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

SECTION 4 Calculating Enthalpy Change

MAIN IDEA The enthalpy change for a reaction can be calculated using Hess's law.

- The enthalpy change for a reaction can be calculated by adding two or more thermochemical equations and their enthalpy changes.
- Standard enthalpies of formation of compounds are determined relative to the assigned enthalpy of formation of the elements in their standard states.

$$\Delta H^\circ_{rxn} = \Sigma\, \Delta H^\circ_f(\text{products}) - \Sigma \Delta H^\circ_f(\text{reactants})$$

VOCABULARY
- Hess's law
- standard enthalpy (heat) of formation

SECTION 5 Reaction Spontaneity

MAIN IDEA Changes in enthalpy and entropy determine whether a process is spontaneous.

- Entropy is a measure of the disorder or randomness of a system.
- Spontaneous processes always result in an increase in the entropy of the universe.
- Free energy is the energy available to do work. The sign of the free energy change indicates whether the reaction is spontaneous.

$$\Delta G_{system} = \Delta H_{system} - T\Delta S_{system}$$

VOCABULARY
- spontaneous process
- entropy
- second law of thermodynamics
- free energy

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – 8 Days
Instructor:

Chemistry - Ch. 15

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

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Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

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-

Essential Questions – meant to challenge study to ponder, question and query

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Assessments- Assessments should be directly related to the objectives identified for students in this unit.

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Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – 8 Days
Instructor:

Chemistry - Ch. 16

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

-
-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

-
-

Essential Questions – meant to challenge study to ponder, question and query

-
-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

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CHAPTER 16 Reaction Rates

BIG IDEA **Every chemical reaction proceeds at a definite rate, but can be speeded up or slowed down by changing the conditions of the reaction.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 **A Model for Reaction Rates** 1. How can average rates of chemical reactions be calculated from experimental data? 2. How are the rates of chemical reactions related to collisions between reacting particles? 2 sessions 1 block	UCP.2, UPC.3; A.1; B.3, B.4, B.5, B.6; E.2; F.1	**Entry-Level Assessment** Focus Transparency 60 **Progress Monitoring** Formative Assessment, p. 560, 561, 565, 566 Reading Check, p. 563 Graph Check, p. 565 Section Review, p. 567
SECTION 2 **Factors Affecting Reaction Rates** 1. What are the factors that affect the rates of chemical reactions? 2. What is the role of a catalyst? 2 sessions 1 block	UCP.2, UPC.3; A.1; B.3, B.4, B.6; E.2; F.1, F.4, F.6	**Entry-Level Assessment** Focus Transparency 61 **Progress Monitoring** Formative Assessment, pp. 569, 572, 573 Reading Check, p. 569 Graph Check, pp. 570, 572 Section Review, p. 573
SECTION 3 **Reaction Rate Laws** 1. What is the relationship between reaction rate and concentration? 2. How are reaction orders determined using the method of initial rates? 1 session 0.5 block	UCP.2, UPC.3; A.1; B.3	**Entry-Level Assessment** Focus Transparency 62 **Progress Monitoring** Formative Assessment, pp. 574, 577 Reading Check, pp. 575, 576 Graph Check, p. 575 Section Review, p. 577
SECTION 4 **Instantaneous Reaction Rates and Reaction Mechanisms** 1. How are instantaneous rates of chemical reactions calculated? 2. What substances and steps are involved in a reaction mechanism? 3. How is the instantaneous rate of a complex reaction related to its reaction mechanism? 1 session 0.5 block	UCP.2, UPC.3; A.1; B.2, B.3, B.4, B.6; E.2; F.4, F.5, F.6	**Entry-Level Assessment** Focus Transparency 63 **Progress Monitoring** Formative Assessment, pp. 581, 582 Reading Check, p. 581 Graph Check, pp. 578, 582 Section Review, p. 582 **Summative Assessment** Chapter Assessment, p. 586 ExamView® *Assessment Suite* CD-ROM

CHAPTER 16 STUDY GUIDE

Vocabulary Practice

BIG IDEA Every chemical reaction proceeds at a definite rate, but can be speeded up or slowed down by changing the conditions of the reaction.

SECTION 1 A Model for Reaction Rates

MAIN IDEA Collision theory is the key to understanding why some reactions are faster than others.

- The rate of a chemical reaction is expressed as the rate at which a reactant is consumed or the rate at which a product is formed.

$$\text{average reaction rate} = -\frac{\Delta[\text{reactant}]}{\Delta t} = \frac{\Delta[\text{product}]}{\Delta t}$$

- Reaction rates are generally calculated and expressed in moles per liter per second (mol/(L • s)).
- In order to react, the particles in a chemical reaction must collide.
- The rate of a chemical reaction is unrelated to the spontaneity of the reaction.

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

SECTION 2 Factors Affecting Reaction Rates

MAIN IDEA Factors such as reactivity, concentration, temperature, surface area, and catalysts affect the rate of a chemical reaction.

- Key factors that influence the rate of chemical reactions include reactivity, concentration, surface area, temperature, and catalysts.
- Raising the temperature of a reaction generally increases the rate of the reaction by increasing the collision frequency and the number of collisions that form an activated complex.
- Catalysts increase the rates of chemical reactions by lowering activation energies.

VOCABULARY
- catalyst
- inhibitor
- heterogeneous catalyst
- homogeneous catalyst

SECTION 3 Reaction Rate Laws

MAIN IDEA The reaction rate law is an experimentally determined mathematical relationship that relates the speed of a reaction to the concentrations of the reactants.

- The mathematical relationship between the rate of a chemical reaction at a given temperature and the concentrations of reactants is called the rate law.

$$\text{rate} = k[\text{A}]$$

$$\text{rate} = k[\text{A}]^m[\text{B}]^n$$

- The rate law for a chemical reaction is determined experimentally using the method of initial rates.

VOCABULARY
- rate law
- specific rate constant
- reaction order
- method of initial rates

SECTION 4 Instantaneous Reaction Rates and Reaction Mechanisms

MAIN IDEA The slowest step in a sequence of steps determines the rate of the overall chemical reaction.

- The reaction mechanism of a chemical reaction must be determined experimentally.
- For a complex reaction, the rate-determining step limits the instantaneous rate of the overall reaction.

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

CHAPTER 17 Chemical Equilibrium

BIG IDEA **Many reactions and processes reach a state of chemical equilibrium in which both reactants and products are formed at equal rates.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 **A State of Dynamic Balance** 1. What are the characteristics of chemical equilibrium? 2. How are equilibrium expressions written for systems that are at equilibrium? 3. How are equilibrium constants calculated from concentration data? 1 session 0.5 block	UCP.3, UCP.4; A.1; B.3, B.4; E.2; G.3	**Entry-Level Assessment** Focus Transparency 64 **Progress Monitoring** Formative Assessment, pp. 595, 599, 605 Reading Check, pp. 597, 604 Graph Check, p. 595 Section Review, p. 605
SECTION 2 **Factors Affecting Chemical Equilibrium** 1. Which factors affect chemical equilibrium? 2. How does Le Châtelier's principle apply to equilibrium systems? 2 sessions 1 block	UCP.3, UCP.4; A.1; B.3, B.4, B.6; E.2; G.3	**Entry-Level Assessment** Focus Transparency 65 **Progress Monitoring** Formative Assessment, pp. 607, 609, 610 Reading Check, p. 608 Section Review, p. 611
SECTION 3 **Using Equilibrium Constants** 1. How are the equilibrium concentrations of reactants and products determined? 2. How is the solubility of a compound calculated from its solubility product constant? 3. Why is the common ion effect important? 2 sessions 1 block	UCP.3, UCP.4; A.1, A.2; B.2, B.3, B.4, B.6; E.1, E.2; F.1, F.6	**Entry-Level Assessment** Focus Transparency 66 **Progress Monitoring** Formative Assessment, pp. 612, 614, 618, 620, 621 Reading Check, p. 618 Graph Check, p. 620 Section Review, p. 622 **Summative Assessment** Chapter Assessment, p. 626 Exam*View*® *Assessment Suite* CD-ROM

CHAPTER 17 STUDY GUIDE

Vocabulary Practic

BIG IDEA **Many reactions and processes reach a state of chemical equilibrium in which both reactants and products are formed at equal rates.**

SECTION 1 A State of Dynamic Balance

MAIN IDEA Chemical equilibrium is described by an equilibrium constant expression that relates the concentrations of reactants and products.

- A reaction is at equilibrium when the rate of the forward reaction equals the rate of the reverse reaction.
- The equilibrium constant expression is a ratio of the molar concentrations of the products to the molar concentrations of the reactants with each concentration raised to a power equal to its coefficient in the balanced chemical equation.

$$K_{eq} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

- The value of the equilibrium constant expression, K_{eq}, is a constant for a given temperature.

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

SECTION 2 Factors Affecting Chemical Equilibrium

MAIN IDEA When changes are made to a system at equilibrium, the system shifts to a new equilibrium position.

- Le Châtelier's principle describes how an equilibrium system shifts in response to a stress or a disturbance.
- When an equilibrium shifts in response to a change in concentration or volume, the equilibrium position changes but K_{eq} remains constant. A change in temperature, however, alters both the equilibrium position and the value of K_{eq}.

VOCABULARY
- Le Châtelier's principle

SECTION 3 Using Equilibrium Constants

MAIN IDEA Equilibrium constant expressions can be used to calculate concentrations and solubilities.

- Equilibrium concentrations and solubilities can be calculated using equilibrium constant expressions.
- K_{sp} describes the equilibrium between a sparingly soluble ionic compound and its ions in solution.
- If the ion product, Q_{sp}, exceeds the K_{sp} when two solutions are mixed, a precipitate will form.
- The presence of a common ion in a solution lowers the solubility of a dissolved substance.

VOCABULARY
- solubility product constant
- common ion
- common ion effect

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – __7__ Days
Instructor:

Chemistry - Ch. 17

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

-
-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

-
-

Essential Questions – meant to challenge study to ponder, question and query

-
-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

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Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – 8 Days
Instructor:

Chemistry - Ch. 18

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

-
-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

-
-

Essential Questions – meant to challenge study to ponder, question and query

-
-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

-
-
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CHAPTER 18 Acids and Bases

BIG IDEA **Acids and bases can be defined in terms of hydrogen ions and hydroxide ions or in terms of electron pairs.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 **Introduction to Acids and Bases** 1. What are the physical and chemical properties of acids and bases? 2. How are solutions classified as acidic, basic, or neutral? 3. How do the Arrhenius, Brønsted-Lowry, and Lewis models of acids and bases compare? 2 sessions 1 block	UCP.2, UCP.3, UCP.4; A.1; B.2, B.3, B.4	**Entry-Level Assessment** Focus Transparency 67 **Progress Monitoring** Formative Assessment, pp. 639, 641, 643 Reading Check, p. 638 Section Review, p. 643
SECTION 2 **Strengths of Acids and Bases** 1. How is the strength of an acid or base related to its degree of ionization? 2. How does the strength of a weak acid compare with the strength of its conjugate base? 3. What is the relationship between the strengths of acids and bases and the values of their ionization constants? 1 session 0.5 block	UCP.2, UCP.3, UCP.4; A.1; B.2, B.4	**Entry-Level Assessment** Focus Transparency 68 **Progress Monitoring** Formative Assessment, pp. 647, 648, 649 Reading Check, p. 646 Section Review, p. 649
SECTION 3 **Hydrogen Ions and pH** 1. What are pH and pOH? 2. How are pH and pOH related to the ion product constant for water? 3. How are the pH and pOH of aqueous solutions calculated? 1 session 0.5 block	UCP.2, UCP.3, UCP.4; A.1; B.2, B.4; E.3	**Entry-Level Assessment** Focus Transparency 69 **Progress Monitoring** Formative Assessment, pp. 654, 658 Reading Check, pp. 651, 656 Section Review, p. 658
SECTION 4 **Neutralization** 1. What do chemical equations of neutralization reactions look like? 2. How are neutralization reactions used in acid-base titrations? 3. How do the properties of buffered and unbuffered solutions compare? 2 sessions 1 block	UCP.2, UCP.3, UCP.4; A.1; B.2, B.3, B.4; E.2	**Entry-Level Assessment** Focus Transparency 70 **Progress Monitoring** Formative Assessment, pp. 660, 662, 667 Reading Check, p. 660 Graph Check, p. 661 Section Review, p. 668 **Summative Assessment** Chapter Assessment, p. 672 Exam*View*® *Assessment Suite* CD-ROM

CHAPTER 18 STUDY GUIDE

Vocabulary Practice

BIG IDEA Acids and bases can be defined in terms of hydrogen ions and hydroxide ions or in terms of electron pairs.

SECTION 1 Introduction to Acids and Bases

MAIN IDEA Different models help describe the behavior of acids and bases.

- The concentrations of hydrogen ions and hydroxide ions determine whether an aqueous solution is acidic, basic, or neutral.
- An Arrhenius acid must contain an ionizable hydrogen atom. An Arrhenius base must contain an ionizable hydroxide group.
- A Brønsted-Lowry acid is a hydrogen ion donor. A Brønsted-Lowry base is a hydrogen ion acceptor.
- A Lewis acid accepts an electron pair. A Lewis base donates an electron pair.

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

SECTION 2 Strengths of Acids and Bases

MAIN IDEA In solution, strong acids and bases ionize completely, but weak acids and bases ionize only partially.

- Strong acids and strong bases are completely ionized in a dilute aqueous solution. Weak acids and weak bases are partially ionized in a dilute aqueous solution.
- For weak acids and weak bases, the value of the acid or base ionization constant is a measure of the strength of the acid or base.

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

SECTION 3 Hydrogen Ions and pH

MAIN IDEA pH and pOH are logarithmic scales that express the concentrations of hydrogen ions and hydroxide ions in aqueous solutions.

- The ion product constant for water, K_w, equals the product of the H^+ ion concentration and the OH^- ion concentration.

$K_w = [H^+][OH^-]$

- The pH of a solution is the negative log of the hydrogen ion concentration. The pOH is the negative log of the hydroxide ion concentration. pH plus pOH equals 14.

$pH = -\log [H^+]$ $\qquad$ $pOH = -\log [OH^-]$

$pH + pOH = 14.00$

- A neutral solution has a pH of 7.0 and a pOH of 7.0 because the concentrations of hydrogen ions and hydroxide ions are equal.

VOCABULARY
- ion product constant for water
- pH
- pOH

SECTION 4 Neutralization

MAIN IDEA In a neutralization reaction, an acid reacts with a base to produce a salt and water.

- In a neutralization reaction, an acid and a base react to form a salt and water.
- The net ionic equation for the neutralization of a strong acid by a strong base is $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$.
- Titration is the process in which an acid-base neutralization reaction is used to determine the concentration of a solution.
- Buffered solutions contain mixtures of molecules and ions that resist changes in pH.

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

CHAPTER 19 Redox Reactions

BIG IDEA **Oxidation-reduction reactions—among the most-common chemical processes in both nature and industry—involve the transfer of electrons.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 **Oxidation and Reduction** 1. What are oxidation and reduction? 2. How can oxidizing and reducing agents be identified? 3. How is the oxidation number of an element in a compound determined? 4. Does oxidation or reduction occur when the oxidation number increases? When it decreases? 2 sessions 1 block	UCP.2; B.3, B.6	**Entry-Level Assessment** Focus Transparency 71 **Progress Monitoring** Formative Assessment, pp. 681, 682, 686 Reading Check, p. 682 Section Review, p. 688
SECTION 2 **Balancing Redox Equations** 1. How are changes in oxidation number related to the transfer of electrons? 2. How can the changes in oxidation numbers be used to balance redox equations? 3. What are half-reactions and how can they be used to balance redox equations? 2 sessions 1 block	UCP.3; B.3, B.6, E.2	**Entry-Level Assessment** Focus Transparency 72 **Progress Monitoring** Formative Assessment, pp. 691, 693, 694 Section Review, p. 696 **Summative Assessment** Chapter Assessment, p. 700 Exam*View*® *Assessment Suite* CD-ROM

CHAPTER 19 STUDY GUIDE

Vocabulary Practice

BIG IDEA **Oxidation-reduction reactions—among the most-common chemical processes in both nature and industry—involve the transfer of electrons.**

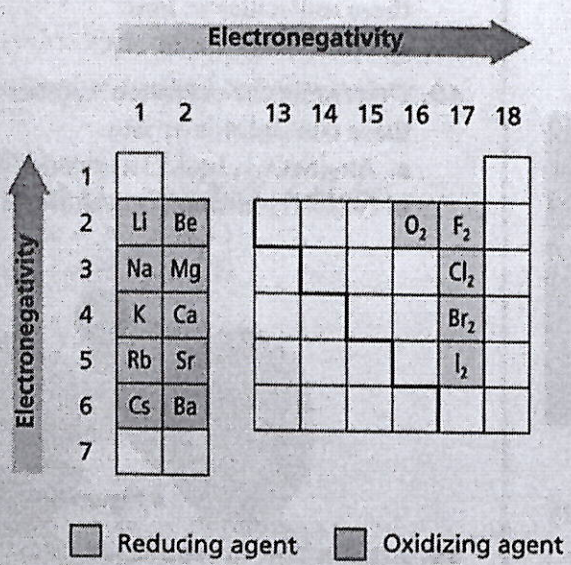
SECTION 1 Oxidation and Reduction

MAIN IDEA Oxidation and reduction are complementary—as a substance is oxidized, another substance is reduced.

- Oxidation-reduction reactions involve the complete or partial transfer of electrons from one substance to another.
- When an atom or ion is reduced, its oxidation number is lowered. When an atom or ion is oxidized, its oxidation number is raised.
- In oxidation-reduction reactions involving molecular compounds (and polyatomic ions with covalent bonds), the more-electronegative atoms are treated as if they are reduced. The less-electronegative atoms are treated as if they are oxidized.

VOCABULARY

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



SECTION 2 Balancing Redox Equations

MAIN IDEA Redox equations are balanced when the total increase in oxidation numbers equals the total decrease in oxidation numbers of the atoms or ions involved in the reaction.

- Redox equations in which the same element appears in several reactants and products can be difficult to balance using the conventional method.
- The oxidation-number method is based on the number of electrons transferred from atoms or ions equaling the number of electrons accepted by other atoms or ions.
- To balance equations for reactions in an acidic solution, add hydrogen ions and water molecules.
- To balance equations for reactions in a basic solution, add hydroxide ions and water molecules.
- A half-reaction is one of the two parts of a redox reaction.

VOCABULARY

- oxidation-number method
- species
- half-reaction

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – __5__ Days
Instructor:

Chemistry - Ch. 19

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

-
-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

-
-

Essential Questions – meant to challenge study to ponder, question and query

-
-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

-
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Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – 7 Days
Instructor:

Chemistry - Ch. 20

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

-
-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

-
-

Essential Questions – meant to challenge study to ponder, question and query

-
-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

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CHAPTER 20 Electrochemistry

BIG IDEA **Chemical energy can be converted to electric energy and electric energy to chemical energy.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 Voltaic Cells 1. How is electrical energy obtained from a redox reaction? 2. What are the parts of a voltaic cell and how does each part operate? 3. How are cell potentials calculated and the spontaneity of redox reactions determined? 2 sessions 1 block	UCP.1, UCP.3; B.3, B.6; E.2; G.3	**Entry-Level Assessment** Focus Transparency 73 **Progress Monitoring** Formative Assessment, pp. 713, 714, 716 Reading Check, pp. 710, 716 Graph Check, p. 714 Section Review, p. 717
SECTION 2 Batteries 1. What are the structure, composition, and operation of the typical carbon-zinc dry-cell battery? 2. What is the difference between primary and secondary batteries and what are two examples of each type? 3. What is the structure of the hydrogen-oxygen fuel cell and how does it operate? 4. What is the process of corrosion of iron and what are methods to prevent corrosion? 2 sessions 1 block	UCP.1, UCP.3; A.1; B.3, B.6; E.1, E.2; F.6; G.1, G.3	**Entry-Level Assessment** Focus Transparency 74 **Progress Monitoring** Formative Assessment, pp. 719, 725, 726, 727 Reading Check, pp. 719, 721, 722, 723 Section Review, p. 727
SECTION 3 Electrolysis 1. How is it possible to reverse a spontaneous redox reaction in an electrochemical cell? 2. How does the molten sodium chloride electrolysis reaction compare with those in the electrolysis of brine? 3. What is the importance of electrolysis in the smelting and purification of metals? 1 session 0.5 block	UCP.1, UCP.3; A.1, A.2; B.3, B.6; E.2; F.3, F.4, F.6; G.1, G.3	**Entry-Level Assessment** Focus Transparency 75 **Progress Monitoring** Formative Assessment, p. 730 Reading Check, pp. 729, 730 Section Review, p. 732 **Summative Assessment** Chapter Assessment, p. 736 ExamView® *Assessment Suite* CD-ROM

CHAPTER 20 STUDY GUIDE

Vocabulary Practice

BIG IDEA Chemical energy can be converted to electric energy and electric energy to chemical energy.

SECTION 1 Voltaic Cells

MAIN IDEA In voltaic cells, oxidation takes place at the anode, yielding electrons that flow to the cathode, where reduction occurs.

- In a voltaic cell, oxidation and reduction take place at electrodes separated from each other.
- The standard potential of a half-cell reaction is its voltage when paired with a standard hydrogen electrode under standard conditions.
- The reduction potential of a half-cell is negative if it undergoes oxidation when connected to a standard hydrogen electrode. The reduction potential of a half-cell is positive if it undergoes reduction when connected to a standard hydrogen electrode.
- The standard potential of a voltaic cell is the difference between the standard reduction potentials of the half-cell reactions.

$$E^0_{cell} = E^0_{reduction} - E^0_{oxidation}$$

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

SECTION 2 Batteries

MAIN IDEA Batteries are voltaic cells that use spontaneous reactions to provide energy for a variety of purposes.

- Primary batteries can be used only once; secondary batteries can be recharged.
- When a battery is recharged, electric energy supplied to the battery reverses the direction of the battery's spontaneous reaction.
- Fuel cells are batteries in which the substance oxidized is a fuel from an external source.
- Methods of preventing corrosion are painting, coating with another metal, or using a sacrificial anode.

VOCABULARY
- battery
- dry cell
- primary battery
- secondary battery
- fuel cell
- corrosion
- galvanization

SECTION 3 Electrolysis

MAIN IDEA In electrolysis, a power source causes nonspontaneous reactions to occur in electrochemical cells.

- In an electrolytic cell, an outside source of power causes a nonspontaneous redox reaction to occur.
- The electrolysis of molten sodium chloride yields sodium metal and chlorine gas. The electrolysis of brine yields hydrogen gas, sodium hydroxide, and chlorine gas.
- Metals such as copper are purified in an electrolytic cell.
- Electrolysis is used to electroplate objects and to produce pure aluminum from its ore.

VOCABULARY
- electrolysis
- electrolytic cell

CHAPTER 21 Hydrocarbons

BIG IDEA Organic compounds called hydrocarbons differ by their types of bonds.

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 Introduction to Hydrocarbons 1. What do the terms *organic compound* and *organic chemistry* mean? 2. How are hydrocarbons and the models used to represent them identified? 3. How are saturated and unsaturated hydrocarbons distinguished? 4. Where are hydrocarbons obtained and how are they separated? 1 session 0.5 block	UCP.2, UCP.5; A.1, A.2; B.2, B.6; E.1, E.2; F.3, F.4, F.6; G.1, G.2, G.3	**Entry-Level Assessment** Focus Transparency 76 **Progress Monitoring** Formative Assessment, pp. 748, 749 Reading Check, pp. 745, 746, 748 Section Review, p. 749
SECTION 2 Alkanes 1. How are alkanes named when given their structures? 2. How are alkane structures drawn when given their names? 3. What are the properties of alkanes? 1 session 0.5 block	UCP.2, UCP.5; A.1, A.2; B.1, B.2; F.3, F.4; G.1, G.2	**Entry-Level Assessment** Focus Transparency 77 **Progress Monitoring** Formative Assessment, pp. 751, 753, 755, 756, 758 Reading Check, pp. 751, 752, 755 Section Review, p. 758
SECTION 3 Alkenes and Alkynes 1. How do the properties of alkenes and alkynes compare with those of alkanes? 2. How are the molecular structures of alkenes and alkynes described? 3. How are alkenes and alkynes named when given their structures? 4. How are alkenes and alkynes drawn when given their names? 2 sessions 1 block	UCP.2, UCP.5; A.1; B.2, B.3; G.2, G.3	**Entry-Level Assessment** Focus Transparency 78 **Progress Monitoring** Formative Assessment, pp. 760, 763 Reading Check, pp. 760, 762 Section Review, p. 764
SECTION 4 Hydrocarbon Isomers 1. How can the two main categories of isomers—structural isomers and stereoisomers—be distinguished? 2. How are *cis-* and *trans-* geometric isomers differentiated? 3. What is the structural variation in molecules that results in optical isomers? 1 session 0.5 block	UCP.2, UCP.5; B.2, B.4, B.6; E.2; F.1; G.2, G.3	**Entry-Level Assessment** Focus Transparency 79 **Progress Monitoring** Formative Assessment, pp. 766, 767, 768, 769 Reading Check, p. 766 Section Review, p. 769
SECTION 5 Aromatic Hydrocarbons 1. How do the properties of aromatic and aliphatic hydrocarbons compare and contrast? 2. What is a carcinogen and what are some examples? 1 session 0.5 block	UCP.2, UCP.5; A.1, A.2; B.2; E.2; F.1, F.3, F.4, F.5, F.6; G.2, G.3	**Entry-Level Assessment** Focus Transparency 80 **Progress Monitoring** Formative Assessment, pp. 771, 772 Reading Check, pp. 771, 773 Section Review, p. 774 **Summative Assessment** Chapter Assessment, p. 778 ExamView® Assessment Suite CD-ROM

CHAPTER 21 STUDY GUIDE

Vocabulary Practice

BIG IDEA Organic compounds called hydrocarbons differ by their types of bonds.

SECTION 1 Introduction to Hydrocarbons

MAIN IDEA Hydrocarbons are carbon-containing organic compounds that provide a source of energy and raw materials.

- Organic compounds contain the element carbon, which is able to form straight chains and branched chains.
- Hydrocarbons are organic substances composed of carbon and hydrogen.
- The major sources of hydrocarbons are petroleum and natural gas.
- Petroleum can be separated into components by the process of fractional distillation.

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

SECTION 2 Alkanes

MAIN IDEA Alkanes are hydrocarbons that contain only single bonds.

- Alkanes contain only single bonds between carbon atoms.
- Alkanes and other organic compounds are best represented by structural formulas and can be named using systematic rules determined by the International Union of Pure and Applied Chemistry (IUPAC).
- Alkanes that contain hydrocarbon rings are called cyclic alkanes.

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

SECTION 3 Alkenes and Alkynes

MAIN IDEA Alkenes are hydrocarbons that contain at least one double bond, and alkynes are hydrocarbons that contain at least one triple bond.

- Alkenes and alkynes are hydrocarbons that contain at least one double or triple bond, respectively.
- Alkenes and alkynes are nonpolar compounds with greater reactivity than alkanes but with other properties similar to those of alkanes.

VOCABULARY
- alkene
- alkyne

SECTION 4 Hydrocarbon Isomers

MAIN IDEA Some hydrocarbons have the same molecular formula but have different molecular structures.

- Isomers are two or more compounds with the same molecular formula but different molecular structures.
- Structural isomers differ in the order in which atoms are bonded to each other.
- Stereoisomers have all atoms bonded in the same order but arranged differently in space.

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

SECTION 5 Aromatic Hydrocarbons

MAIN IDEA Aromatic hydrocarbons are unusually stable compounds with ring structures in which electrons are shared by many atoms.

- Aromatic hydrocarbons contain benzene rings as part of their molecular structures.
- The electrons in aromatic hydrocarbons are shared evenly over the entire benzene ring.

VOCABULARY
- aromatic compound
- aliphatic compound

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – 8 Days
Instructor:

Chemistry . Ch. 21

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

-
-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

-
-

Essential Questions – meant to challenge study to ponder, question and query

-
-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

-
-
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Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – 9 Days
Instructor:

Chemistry. Ch. 22

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

-
-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

-
-

Essential Questions – meant to challenge study to ponder, question and query

-
-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

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-
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CHAPTER 22 Substituted Hydrocarbons and Their Reactions

BIG IDEA **The substitution of different functional groups for hydrogen atoms in hydrocarbons results in a diverse group of organic compounds.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 Alkyl Halides and Aryl Halides 1. What are functional groups, and what are some examples? 2. How do alkyl and aryl halide structures compare and contrast? 3. What factors affect the boiling points of organic halides? 1 session 0.5 block	UCP.1, UCP.2, UCP.5; A.1; B.2, B.3; E.2; F.4, F.6; G.3	**Entry-Level Assessment** Focus Transparency 81 **Progress Monitoring** Formative Assessment, pp. 788, 789, 790 Reading Check, pp. 788, 789, 790 Section Review, p. 791
SECTION 2 Alcohols, Ethers, and Amines 1. Which functional groups define alcohols, ethers, and amines? 2. How are the structures of alcohols, ethers, and amines drawn? 3. What are some properties and uses of alcohols, ethers, and amines? 1 session 0.5 block	UCP.1, UCP.2, UCP.5; B.2, B.3; E.2; G.3	**Entry-Level Assessment** Focus Transparency 82 **Progress Monitoring** Formative Assessment, pp. 793, 795 Reading Check, pp. 793, 794 Section Review, p. 795
SECTION 3 Carbonyl Compounds Which structures identify various carbonyl compounds? 2. What are the properties of compounds containing the carbonyl group? 2 sessions 1 block	UCP.1, UCP.2, UCP.5; A.1; B.2, B.3; E.2	**Entry-Level Assessment** Focus Transparency 83 **Progress Monitoring** Formative Assessment, pp. 798, 801 Reading Check, pp. 797, 798, 800 Section Review, p. 801
SECTION 4 Other Reactions of Organic Compounds 1. How are organic reactions classified? 2. Why is it useful to draw structural formulas when writing equations for reactions of organic compounds? 3. How can classifying a reaction help you predict the reaction's products? 2 sessions 1 block	UCP.1, UCP.2, UCP.5; A.2; B.2, B.3; E.1, E.2; G.1	**Entry-Level Assessment** Focus Transparency 84 **Progress Monitoring** Formative Assessment, pp. 804, 806, 807 Reading Check, pp. 802, 804, 806, 807 Section Review, p. 808
SECTION 5 Polymers 1. How does drawing a diagram help you understand the relationship between a polymer and the monomers from which it forms? 2. 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? 1 session 0.5 block	UCP.1, UCP.2, UCP.5; A.1; B.2, B.3, B.4; E.1, E.2; F.3, F.6; G.1, G.3	**Entry-Level Assessment** Focus Transparency 85 **Progress Monitoring** Formative Assessment, pp. 811, 813 Reading Check, pp. 810, 813 Section Review, p. 814 **Summative Assessment** Chapter Assessment, p. 818 ExamView® *Assessment Suite* CD-ROM

CHAPTER 22 STUDY GUIDE

Vocabulary Practice

BIG IDEA The substitution of different functional groups for hydrogen atoms in hydrocarbons results in a diverse group of organic compounds.

SECTION 1 Alkyl Halides and Aryl Halides

MAIN IDEA A halogen atom can replace a hydrogen atom in some hydrocarbons.

- The substitution of functional groups for hydrogen in hydrocarbons creates a wide variety of organic compounds.
- An alkyl halide is an organic compound that has one or more halogen atoms bonded to a carbon atom in an aliphatic compound.

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

SECTION 2 Alcohols, Ethers, and Amines

MAIN IDEA Oxygen and nitrogen are two of the most-common atoms found in organic functional groups.

- Alcohols, ethers, and amines are formed when specific functional groups substitute for hydrogen in hydrocarbons.
- Because they readily form hydrogen bonds, alcohols have higher boiling points and higher water solubilities than other organic compounds.

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

SECTION 3 Carbonyl Compounds

MAIN IDEA Carbonyl compounds contain a double-bonded oxygen in the functional group.

- Carbonyl compounds are organic compounds that contain the C=O group.
- Five important classes of organic compounds containing carbonyl compounds are aldehydes, ketones, carboxylic acids, esters, and amides.

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

SECTION 4 Other Reactions of Organic Compounds

MAIN IDEA Classifying the chemical reactions of organic compounds makes predicting products of reactions much easier.

- Most reactions of organic compounds can be classified into one of five categories: substitution, elimination, addition, oxidation-reduction, and condensation.
- Knowing the types of organic compounds reacting can enable you to predict the reaction products.

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

SECTION 5 Polymers

MAIN IDEA Synthetic polymers are large organic molecules made up of repeating units linked together by addition or condensation reactions.

- Polymers are large molecules formed by combining smaller molecules called monomers.
- Polymers are synthesized through addition or condensation reactions.
- The functional groups present in polymers can be used to predict polymer properties.

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

CHAPTER 23 The Chemistry of Life

BIG IDEA **Biological molecules—proteins, carbohydrates, lipids, and nucleic acids—interact to carry out activities necessary to living cells.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 Proteins 1. How can the structures of amino acids and proteins be described? 2. What are the roles of proteins in cells? 1 session 0.5 block	UCP.2; A.1; B.2, B.3; C.5; F.1; G.2	**Entry-Level Assessment** Focus Transparency 86 **Progress Monitoring** Formative Assessment, pp. 827, 831 Reading Check, pp. 827, 828, 830 Section Review, p. 831
SECTION 2 Carbohydrates 1. How can the structures of monosaccharides, disaccharides, and polysaccharides be described? 2. What are the functions of carbohydrates in living things? 1 session 0.5 block	UCP.2; B.2; C.5; F.1; G.2	**Entry-Level Assessment** Focus Transparency 87 **Progress Monitoring** Formative Assessment, pp. 832, 833 Reading Check, p. 833 Section Review, p. 834
SECTION 3 Lipids 1. How can the structures of fatty acids, triglycerides, phospholipids, and steroids be described? 2. What are the functions of lipids in living organisms? 3. What are some reactions that fatty acids undergo? 4. How are the structure and function of cell membranes related? 2 sessions 1 block	UCP.2; A.1; B.2, B.3; C.5; F.1; G.2	**Entry-Level Assessment** Focus Transparency 88 **Progress Monitoring** Formative Assessment, p. 837 Reading Check, pp. 835, 836 Section Review, p. 839
SECTION 4 Nucleic Acids 1. What are the structural components of nucleic acids? 2. How is the function of DNA related to its structure? 3. What are the structure and function of RNA? 1 session 0.5 block	UCP.2; A.1, A.2; B.2, B.3; C.5; G.2, G.3	**Entry-Level Assessment** Focus Transparency 89 **Progress Monitoring** Formative Assessment, pp. 840, 841, 842 Reading Check, p. 841 Section Review, p. 843
SECTION 5 Metabolism 1. How do anabolism and catabolism compare? 2. What is the role of ATP in metabolism? 3. How can the processes of photosynthesis, cellular respiration, and fermentation be compared and contrasted? 1 session 0.5 block	UCP.2; A.2; B.2, B.3, B.6; C.5; F.1; G.2	**Entry-Level Assessment** Focus Transparency 90 **Progress Monitoring** Formative Assessment, pp. 846, 847, 848 Reading Check, p. 845 Section Review, p. 848 **Summative Assessment** Chapter Assessment, p. 852 ExamView® *Assessment Suite* CD-ROM

CHAPTER 23 STUDY GUIDE

Vocabulary Practice

BIG IDEA **Biological molecules—proteins, carbohydrates, lipids, and nucleic acids—interact to carry out activities necessary to living cells.**

SECTION 1 Proteins

MAIN IDEA Proteins perform essential functions, including regulation of chemical reactions, structural support, transport of materials, and muscle contractions.

- Proteins are biological polymers made of amino acids that are linked by peptide bonds.
- Protein chains fold into intricate three-dimensional structures.
- Proteins have many functions in the human body, including functions within cells, functions between cells, and functions of structural support.

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

SECTION 2 Carbohydrates

MAIN IDEA Carbohydrates provide energy and structural material for living things.

- Carbohydrates are compounds that contain multiple hydroxyl groups (–OH) and a carbonyl functional group (C=O).
- Carbohydrates range in size from single monomers to polymers composed of hundreds or thousands of monomers.
- Monosaccharides in aqueous solution exist in both open-chain and cyclic structures.

VOCABULARY
- carbohydrate
- monosaccharide
- disaccharide
- polysaccharide

SECTION 3 Lipids

MAIN IDEA Lipids make cell membranes, store energy, and regulate cellular processes.

- Fatty acids are long-chain carboxylic acids that usually have between 12 and 24 carbon atoms.
- Saturated fatty acids have no double bonds; unsaturated fatty acids have one or more double bonds.
- Fatty acids can be linked to glycerol backbones to form triglycerides.
- Steroids are lipids that have multiple-ring structures.

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

SECTION 4 Nucleic Acids

MAIN IDEA Nucleic acids store and transmit genetic information.

- Nucleic acids are polymers of nucleotides, which consist of a nitrogen base, a phosphate group, and a sugar.
- DNA and RNA are the information-storage molecules of a cell.
- DNA is double stranded, and RNA is single stranded.

VOCABULARY
- nucleic acid
- nucleotide

SECTION 5 Metabolism

MAIN IDEA Metabolism involves many thousands of reactions in living cells.

- Living organisms undergo catabolism and anabolism.
- Photosynthesis directly or indirectly provides almost all living things with energy.
- The net equation for cellular respiration is the reverse of the net equation for photosynthesis.

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

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – __8__ Days
Instructor:

Chemistry - Ch. 23

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

-
-

Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

-
-

Essential Questions – meant to challenge study to ponder, question and query

-
-

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

-
-
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Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – 8 Days
Instructor:

Chemistry - Ch. 24

Unit title and short description

-

Major Academic Standards Addressed

Concepts – Content ——**What students should know**

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Essential Questions – meant to challenge study to ponder, question and query

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BIG IDEA **Nuclear chemistry has a vast range of applications, from the production of electricity to the diagnosis and treatment of diseases.**

ESSENTIAL QUESTIONS	NATIONAL STANDARDS	RESOURCES TO ASSESS MASTERY
SECTION 1 **Nuclear Radiation** **1.** How was radioactivity discovered and studied? **2.** What are the key properties of alpha, beta, and gamma radiations? 1 session · 0.5 block	UCP.1, UCP.3; A.1, A.2; B.1, B.3, B.6; F.5; G.1; G.2, G.3	**Entry-Level Assessment** Focus Transparency 91 **Progress Monitoring** Formative Assessment, pp. 862, 863 Reading Check, pp. 861, 862, 864 Section Review, p. 864
SECTION 2 **Radioactive Decay** **1.** Why are certain nuclei radioactive? **2.** How are nuclear equations balanced? **3.** How can you use radioactive decay rates to analyze samples of radioisotopes? 2 sessions · 1 block	UCP.1, UCP.3; B.1, B.4, B.6	**Entry-Level Assessment** Focus Transparency 92 **Progress Monitoring** Formative Assessment, pp. 866, 867, 868, 870, 871 Reading Check, pp. 866, 867, 868, 870 Graph Check, pp. 866, 870 Section Review, p. 874
SECTION 3 **Nuclear Reactions** **1.** How are mass and energy related? **2.** How do nuclear fission and nuclear fusion compare and contrast? **3.** What is the process by which nuclear reactors generate electricity? 2 sessions · 1 block	UCP.1, UCP.3; B.1, B.4, B.6; E.2; F.1, F.4, F.5, F.6; G.1	**Entry-Level Assessment** Focus Transparency 93 **Progress Monitoring** Formative Assessment, p. 881 Reading Check, pp. 880, 882 Section Review, p. 884
SECTION 4 **Applications and Effects of Nuclear Reactions** **1.** What are several methods used to detect and measure radiation? **2.** How is radiation used in the treatment of disease? **3.** What are some of the damaging effects of radiation on biological systems? 1 session · 0.5 block	UCP.1, UCP.3; A.1, A.2; B.1, B.6; E.1, E.2; F.1, F.5; G.1	**Entry-Level Assessment** Focus Transparency 94 **Progress Monitoring** Formative Assessment, pp. 886, 888, 889 Reading Check, pp. 886, 887 Section Review, p. 890 **Summative Assessment** Chapter Assessment, p. 894 ExamView® *Assessment Suite* CD-ROM

CHAPTER 24 STUDY GUIDE

Vocabulary Practice

BIG IDEA Nuclear chemistry has a vast range of applications, from the production of electricity to the diagnosis and treatment of diseases.

SECTION 1 Nuclear Radiation

MAIN IDEA Under certain conditions, some nuclei can emit alpha, beta, or gamma radiation.

- Wilhelm Roentgen discovered X-rays in 1895.
- Henri Becquerel, Marie Curie, and Pierre Curie pioneered the fields of radioactivity and nuclear chemistry.
- Radioisotopes emit radiation to attain more-stable atomic configurations.

VOCABULARY
- radioisotope
- X-ray
- penetrating power

SECTION 2 Radioactive Decay

MAIN IDEA Unstable nuclei can break apart spontaneously, changing the identity of atoms.

- The conversion of an atom of one element to an atom of another by radioactive decay processes is called transmutation.
- Atomic number and mass number are conserved in nuclear reactions.
- A half-life is the time required for half of the atoms in a radioactive sample to decay.

$$N = N_0\left(\frac{1}{2}\right)^n \text{ or } N = N_0\left(\frac{1}{2}\right)^{t/T}$$

- Radiochemical dating is a technique for determining the age of an object by measuring the amount of certain radioisotopes remaining in the object.

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

SECTION 3 Nuclear Reactions

MAIN IDEA Fission, the splitting of nuclei, and fusion, the combining of nuclei, release tremendous amounts of energy.

- Induced transmutation is the bombardment of nuclei with particles in order to create new elements.
- In a chain reaction, one reaction induces others to occur. A sufficient mass of fissionable material is necessary to initiate the chain reaction.
- Fission and fusion reactions release large amounts of energy.

$$E = mc^2$$

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

SECTION 4 Applications and Effects of Nuclear Reactions

MAIN IDEA Nuclear reactions have many useful applications, but they also have harmful biological effects.

- Different types of counters are used to detect and measure radiation.
- Radiotracers are used to diagnose disease and to analyze chemical reactions.
- Short-term and long-term radiation exposure can cause damage to living cells.

$$I_1 d_1^2 = I_2 d_2^2$$

VOCABULARY
- ionizing radiation
- radiotracer