Teaching Unit: ***C2: The Mole***

Sub Topic: ***Chemical Measurement,Mole***

Essential Understandings

The Mole
Chemical Measurement
Students here are introduced to the mole as the central unit in measuring the amount of a substance. Because the mole establishes the relationship between the number of particles involved in a reaction and the mass of the reactant or product, the mole is used to convert between moles and mass, between moles and particles, and between moles and volume. Students will also be introduced to Avogadro's number and how mole relationships are used to determine percentage composition, as well as empirical and molecular formulas.

Student Prerequisite Skills and Knowledge:

* using conversion factors to solve mathematical equations
* units of measurement
* calculating percentages

Outline

Section 10.1: Chemical Measurements

Section 10.2: Mole Conversions

Section 10.3: Empirical and Molecular Formulas

Knowledge and Skills

Teaching Unit: ***C2: Math of Chemical Equations***

Sub Topic: ***Stoichiometry,Limiting***

Essential Understandings

Knowledge and Skills

The Mathematics of Chemical Equations
Students are introduced to the quantitative relationships between reactants and products in chemical reactions. Students will apply the principles of stoichiometry to balanced chemical equations to predict the expected yield of reactions. The concept of limiting reactants is introduced and students will practice calculating the percent yield of reactions.

Student Prerequisite Skills and Knowledge:

* mole conversions
* balanced chemical equations

Outline

Section 11.1: Stoichiometry

Section 11.2: Solving Stoichiometry Problems

Section 11.3: Limiting Reactants and Percent Yield

Teaching Unit: ***C2: Thermochemistry***

Sub Topic: ***Enthalpy Changes,Hess's***

Essential Understandings

Knowledge and Skills

Heat in Chemical Equations

Thermochemistry is the study of heat effects in chemical reactions. In this chapter students will learn that heat is the transfer of kinetic energy from hotter to colder objects. The heat absorbed or released during a chemical reaction carried out at constant pressure is the change in enthalpy of the reaction (H). Students will learn to use Hess's law to calculate the heat of reaction. Finally, students will be introduced to calorimetry, a process used to measure the heats of chemical and physical changes.

Student Prerequisite Skills and Knowledge:

* solving stoichiometry problems

Outline

Section 12.1: Chemical Reactions That Involve Heat

Section 12.2: Heat and Enthalpy Changes

Section 12.3: Hess's Law

Section 12.4: Calorimetry

Section 12.5: What Is Heat?

Teaching Unit: ***C2: Gases***

Sub Topic: ***Models,Measurement,Laws,How***

Essential Understandings

Gases
We now investigate the kinetic-molecular theory of gases, which explains the submicroscopic behavior of gas particles, to describe the macroscopic behavior of gases. Gases can be measured and described by four properties: the number of particles, pressure, temperature, and volume. The laws of Boyle, Charles, and Avogadro relate the pairs of properties to one another. The ideal gas equation identifies the relationship among all the properties.

Student Prerequisite Skills and Knowledge:

* solving mathematical equations
* the kinetic-molecular theory of gases

Outline

Section 13.1: A Model to Explain Gas Behavior

Section 13.2: Measuring Gases

Section 13.3: The Gas Laws

Section 13.4: The Ideal Gas Law

Section 13.5: How Gases Work

Physical Properties of Gases

Gas Law Derivatives

Use Gas Laws to Explain Gas Behavior

Use Gas Laws to Predict Gas Behavor
Boyle's Law

Charles' Law, Gay-Lussac's Law, Avogadro's Law, Ideal Gas Law, Dalton's Law, Graham's Law

Kinetic-Molecular Theory

Real Gases.

Knowledge and Skills

Solve Gas problems using the Gas Laws and related concepts:
The kinetic molecular theory describes the motion of atoms and molecules and explains the properties of gases. As a basis for understanding this concept:

1. Students know the random motion of molecules and their collisions with a surface create the observable pressure on that surface.
2. Students know the random motion of molecules explains the diffusion of gases.
3. Students know how to apply the gas laws to relations between the pressure, temperature, and volume of any amount of an ideal gas or any mixture of ideal gases.
4. Students know the values and meanings of standard temperature and pressure (STP).
5. Students know how to convert between the Celsius and Kelvin temperature scales.
6. Students know there is no temperature lower than 0 Kelvin.
7. Students know the kinetic theory of gases relates the absolute temperature of a gas to the average kinetic energy of its molecules or atoms.
8. Students know how to solve problems by using the ideal gas law in the form PV = nRT.
9. Students know how to apply Dalton's law of partial pressures to describe the composition of gases and Graham's law to predict diffusion of gases.

Teaching Unit: ***C2: Liquids & Solids***

Sub Topic: ***Condensed States,State Changes***

Essential Understandings

Knowledge and Skills

Liquids and Solids
Students will expand their understanding of the kinetic-molecular theory as they study liquids and solids. They will relate intermolecular forces in liquids to viscosity and surface tension. Four categories of solids will be described and related to the structure and bonding in each. Students will also learn about changes of state and how to interpret phase diagrams.

Student Prerequisite Skills and Knowledge:

* kinetic-molecular theory
* covalent bonding

Outline

Section 14.1: Condensed States of Matter

Section 14.2: Properties of Liquids

Section 14.3: The Nature of Solids

Section 14.4: Changes of State

Teaching Unit: ***C2: Solutions***

Sub Topic: ***Concentration,Formation,Colligative***

Essential Understandings

Solutions
In this study, students will be introduced to the characteristics of solutions. They will calculate the concentration of solutes in molarity, molality, and mole fraction. Students will also explore the effects of concentration on colligative properties. The concept of solubility is introduced and students will learn the factors that affect the rate of dissolving.

Student Prerequisite Skills and Knowledge:

* homogeneous and heterogeneous mixtures
* mole conversions
* solving mathematical equations

Knowledge and Skills

Teaching Unit: ***C2: Chemical Equilibrium***

Sub Topic: ***Concept & Law,LeChatlier's***

Essential Understandings

Equilibrium
We explore the concept of equilibrium. Equilibrium is reached when the concentration of products and reactants remains constant. The concentrations of reactants and products at equilibrium are related by an equilibrium expression. The equilibrium constant, Keq, is a measure of whether the reaction favors the reactants or the products. Le Chatelier's principle can be used to predict changes in the equilibrium positions of reversible reactions.

Prerequisite Skills and Knowledge:

* solutions chemistry
* stoichiometry
* exponents

Knowledge and Skills

Teaching Unit: ***C2: Acids,Bases,Salts I & II***

Sub Topic: ***Calculations,Lab ID of Strength***

Essential Understandings

Knowledge and Skills

Acids and Bases I
This exploration examines the physical and chemical differences between acids and bases. Scientists classify acids and bases according to the way in which they react. Brønsted-Lowry acids are compounds that donate H+ ions (protons) in a reaction, while bases are the compounds that accept these protons. The dissociation constants of acids and bases, Ka and Kb, are a measure of the relative strengths of acids and bases. The study concludes with a description of the various rules for naming acids and bases.

Student Prerequisite Skills and Knowledge:
* ionic compounds
* double-replacement reactions
* understanding of aqueous solutions

Outline
Section 18.1: Defining Acids and Bases
Section 18.2: Determining the Strengths of Acids and Bases
Section 18.3: Naming and Identifying Acids and Bases

Acids and Bases II
This study begins by discussing the self-ionization of water. The equilibrium constant of water is used to describe the relationship between [H30+] and [OH-]. Students will learn how pH is used to describe the concentration of acidic and basic solutions. The study explains how buffers are used to maintain the pH of solutions. It also presents titration as a procedure that can be used to find the concentration of an acid or base.

Student Prerequisite Skills and Knowledge:
* solving mathematical equations
* using logarithms
* fundamentals of acids and bases

Outline
Section 19.1: The Self-Ionization of Water and pH
Section 19.2: Buffers
Section 19.3: Acid-Base Titration

Teaching Unit: ***C2: Reactions of Acids/Bases***

Sub Topic: ***Water & pH,Buffers,Acid/Base***

Essential Understandings

Knowledge and Skills

Acids and Bases
This study begins by discussing the self-ionization of water. The equilibrium constant of water is used to describe the relationship between [H30+] and [OH-]. Students will learn how pH is used to describe the concentration of acidic and basic solutions. The chapter explains how buffers are used to maintain the pH of solutions. It also presents titration as a procedure that can be used to find the concentration of an acid or base.

Student Prerequisite Skills and Knowledge:

* solving mathematical equations
* using logarithms
* fundamentals of acids and bases

Outline

Section 19.1: The Self-Ionization of Water and pH

Section 19.2: Buffers

Section 19.3: Acid-Base Titration

Teaching Unit: ***C2: Oxidation & Reduction***

Sub Topic: ***Electron Transfer in Oxidation and***

Essential Understandings

Knowledge and Skills

Oxidation and Reduction
Students will investigate electron transfer in oxidation and reduction reactions, and the assignment and use of oxidation numbers. The different types of oxidation and reduction reactions will be explained using common chemical reactions as examples. Finally, students will practice balancing redox equations using oxidation numbers.

Student Prerequisite Skills and Knowledge:

* kinds of chemical reactions
* electronegativity
* balancing chemical equations

Outline

Section 20.1: Oxidation-Reduction Reactions

Section 20.2: Types of Redox Reactions

Section 20.3: Applications of Redox Reactions

Section 20.4: Balancing Redox Equations