#946 SCIENCE 10 SMALL GROUP

GRADE: 10

LEVEL: Small Group

CREDITS: 2.5

PREREQUISITES: An Individualized Educational Plan with this component

BASIC TEXT: Science Explorer, Chemical Building Blocks, Prentice Hall, 2002
Science Explorer, Chemical Interactions, Prentice Hall, 2002

SUPPLEMENTAL READINGS:

Chemistry: The Study of Matter Laboratory Manual	Prentice Hall
Chemistry: Laboratory Manual- Addison-Wesley	Prentice Hall
Merrill Chemistry Laboratory Manual	Glencoe

REQUIRED MATERIALS:

Three Ring Binder with dividers and notebook paper
Scientific Calculator
Pen / Pencil
Agenda

COURSE DESCRIPTION:

Students in Science 10 will receive small group instruction which addresses concepts and factual information in a manner consistent with their identified special needs. This introduction to chemistry class is aligned with the objectives outlined in the MCAS Frameworks. Using chemistry as a medium, a student will develop " habits of mind, such as curiosity, open mindedness, balanced with skepticism, a sense of stewardship and care, respect for evidence, and persistence." A student will learn laboratory safety rules, laboratory skills, problem solving techniques, and core chemistry concepts.

MISSION RELATED GOALS:

Foster communication
Foster problem solving
Academic excellence
Intellectual curiosity
Respect rights of others
Self-confidence

STUDENT EXPECTATIONS FOR LEARNING ADDRESSED:

Students will communicate effectively and work towards a common goal while developing appropriate problem solving skills. The students will respect the rights of others while promoting personal growth in accepting responsibility and working individually within a group setting.

GENERAL PERFORMANCE OBJECTIVES:

The students will be able to:

- Identify and explain some of the physical properties that are used to classify matter, e.g. density, melting point and boiling point.
- Explain the difference between mixtures and pure substances
- Describe the four states of matter (solid, liquid, gas, plasma) in terms of energy, particle motion and phase transitions
- Distinguish between physical and chemical changes
- Identify major components of the nuclear atom (protons, neutrons, and electrons) and how they interact
- Compare nuclear fission and nuclear fusion and mass defect
- Explain the relationship of an element's position on the periodic table to its atomic number and mass.
- Use the periodic table to identify metals, nonmetals, metalloids, families, periods, valence electrons, and reactivity with other elements in the table
- Relate the position of an element on the periodic table to its electron configuration
- Explain how atoms combine to form compounds through both ionic and covalent bonding
- Draw Lewis dot structures for simple molecules
- Predict chemical formulas based on the number of valence electrons
- Name and write chemical formulas for simple ionic and molecular compounds, including those that contain common poly-atomic ions.
- Balance chemical equations by applying the law of conservation of mass
- Recognize synthesis, decomposition, displacement and neutralization reactions
- Describe the process by which solutes dissolve in solvents
- Identify and explain the factors that affect the rate of dissolving, i.e., temperature, concentration, and mixing
- Define Arrhenius' theory of acids and bases in terms of the presence of Hydronium and hydroxide ions, and Bronsted theory of acids and bases in terms of proton donor and acceptor, and relate their concentrations to the pH scale

MASSACHUSETTS FRAMEWORKS STRANDS:

(1.1-1.4)

1. Identify and explain some of the physical properties that are used to classify matter, e.g., density, melting point.
2. Explain the difference between mixtures and pure substance.
3. Describe the four states of matter (solid, liquid, gas, plasma) in terms of energy, particle motion, and phase transitions.
4. Distinguish between chemical and physical changes.

(2.1-2.11)

5. Trace the development of atomic theory and the structure of the atom from the ancient Greeks to the present (Dalton, Thompson, Rutherford, and modern theroy).
6. Interpret Dalton's atomic theory in terms of the Laws of Conservation of Mass, Constant Composition, and Multiple Proportions.

7. Identify the major components of the nuclear atom (protons, neutrons, and electrons) and explain how they interact.
8. Describe the process of radioactive decay as the spontaneous breakdown of certain unstable elements (radioactive) into new elements (radioactive or not) through the spontaneous emission by the nucleus of alpha or beta particles. Explain the difference between stable and unstable isotopes.
9. Explain the concept of half-life of a radioactive element, e.g, explain why the half-life of C14 has made carbon dating a powerful tool in determining the age of very old objects.

(3.1 – 3.4)

10. Explain the relationship of an element's position on the periodic table to its atomic number and mass.
11. Use the periodic table to identify metals, nonmetals, metalloids, families (groups), periods, valence electrons, and reactivity with other elements in the table.
12. Relate the position of an element on the periodic table to its electron configuration.

(4.1 – 4.7)

13. Explain how atoms combine to form compounds through both ionic and covalent bonding.
14. Draw Lewis dot structure for simple molecules.
15. Predict chemical formulas based on the number of valance electrons.
16. Name and write formulas for simple ionic and molecular compounds, including those that contain common polyatomic ions.

(5.1-5.6)

17. Balance chemical equations by applying the law of conservation of mass.
18. Recognize synthesis, decomposition, single displacement, double displacement, and neutralization reactions.
19. Calculate percent yield in a chemical reaction.

CURRICULUM FRAMEWORK LEARNING STANDARDS (# and description)

1. (1.1) Identify and explain some of the physical properties that are used to classify matter, e.g. density, melting point and boiling point.
2. (1.2) Explain the difference between mixtures and pure substances
3. (1.3) Describe the four states of matter (solid, liquid, gas, plasma) in terms of energy, particle motion and phase transitions
4. (1.4) Distinguish between physical and chemical changes
5. (2.3) Identify major components of the nuclear atom (protons, neutrons, and electrons) and how they interact
6. (2.9) Compare nuclear fission and nuclear fusion and mass defect
7. (3.1) Explain the relationship of an element's position on the periodic table to its atomic number and mass.
8. (3.2) use the periodic table to identify metals, nonmetals, metalloids, families, periods, valence electrons, and reactivity with other elements in the table
9. (3.3) Relate the position of an element on the periodic table to its electron configuration
10. (4.1) Explain how atoms combine to form compounds through both ionic and covalent bonding
11. (4.2) Draw Lewis dot structures for simple molecules

12. (4.6) Predict chemical formulas based on the number of valence electrons
13. (4.7) Name and write chemical formulas for simple ionic and molecular compounds, including those that contain common polyatomic ions.
14. (5.1) Balance chemical equations by applying the law of conservation of mass
15. (5.2) Recognize synthesis, decompositon, displacement and neutralization reactions
16. (7.1) Describe the process by which solutes dissolve in solvents
17. (7.2) Identify and explain the factors that affect the rate of dissolving, i.e., temperature, concentration, and mixing.
18. (8.1) Define Arrhenius' theory of acids and bases in terms of the presence of hydronium and hydroxide ions, and Bronstead's theory of acids and bases in terms of proton donor and acceptor, and relate their concentrations to the pH scale

UNTS AND THEMES COURSE OUTLINE:

I. **Introduction** (1.1)
   1. Lab safety and skills
   2. Math concepts, metric system, graphing, and problem solving
   3. Scientific Method

II. **Introduction to Matter** (1.1,1.2,1.3,1.4,2.1)
   1. Describing Matter
      a. Distinguish between Chemical and Physical Changes
      b. Identify characteristic properties of matter and explain their uses
      c. Compare mixtures and a pure substance and describe elements and compounds Measuring Matter
      d. Explain the difference between weight and mass
      e. Calculate the density of substances using SI units for mass and volume
   2. Particles of Matter
      a. Identify atoms as the smallest particles of an element
      b. Describe Dalton's theory of atoms Explain that chemical bonds are what hold atoms together in molecules

III. **Changes in Matter** (1.3, 1.4, 6.1)
   1. Solids, Liquids, and Gases
      a. Define and differentiate solids, liquids and gases in terms of shape and volume
      b. Compare the particle motion in solids, liquids and gases
   2. Behavior of Gases
      a. Define the relationship between volume and pressure of a gas and state Boyle's Law
      b. Define the relationship between pressure and temperature of a gas
      c. Define the relationship between volume and temperature of a gas and state Charles' Law
      d. Construct and interpret graphs for Charles' and Boyle's Law
   3. Physical and Chemical Changes
      a. Describe the differences between physical and chemical changes
      b. Explain how energy is involved in changes of matter
      c. Describe changes of states
      d. Define chemical reactions and explain ways that energy can change in chemical reactions

IV. **Elements and the Periodic Table** (3.1, 3.2, 3.3) 2 weeks
   1. Organizing the elements
      a. State key events in the historical development of the periodic table
      b. List the information in the periodic table and describe how it is organized
      c. Describe uses of the periodic table
      d. Define valence electrons and tell how they are related to the periodic table
   2. Metals
      a. Describe chemical and physical properties of metals
      b. Identify and describe different groups of metals and describe how the reactivity of metals changes across the periodic table

3. Nonmetals and Metalloids
    a. Locate nonmetals and metalloids in the periodic table
    b. Compare the physical and chemical properties of nonmetals with those of metals and describe the properties of metalloids

V. **Atoms and Bonding** (2.3, 4.1, 4.2,4.6, 4.7)
1. Inside an atom
    a. Describe the structure of an atom and define protons, neutrons and electrons
    b. Explain the role of valence electrons in forming chemical bonds
2. Atoms in the Periodic Table
    a. Describe the organization of the periodic table
    b. Identify the groups within the periodic table and state what properties elements in a group have in common
3. Ionic Bonds
    a. Explain the differences between an atom and an ion
    b. Describe how an ionic bond forms
    c. Identify the properties of ionic compounds
    d. Nomenclature of basic ionic compounds, compounds with polyatomic ions
4. Covalent Bonds
    a. Describe how covalent bonds form
    b. Identify properties of molecular compounds
    c. Nomenclature of basic molecular
    d. Distinguish between polar and nonpolar bonds, and between polar and nonpolar compounds
5. Crystal Chemistry
    a. Explain how the chemical bonds of a crystal determines the substances properties
    b. Describe and give examples of mineral crystals

VI. **Chemical Reaction** (2.3, 5.1, 5.2)
1. Matter and Changes in Matter
    a. Define and compare elements, compounds, mixtures, atoms, and molecules
    b. Compare chemical changes to physical changes
    c. Explain how chemical bonds are changed during chemical reactions
2. Describing Chemical Reactions
    a. Describe the information conveyed in a chemical equation
    b. Apply the principle of conservation of mass to chemical reactions
    c. Identify and describe the three categories of chemical reactions
3. Controlling Chemical Reactions
    a. Explain that every chemical reaction requires activation energy to get started
    b. List factors that control the rate of chemical reactions
    c.

VII**.** **Acids, Bases, and Solutions** (7.1,7.2,8.1)
1. Working with solutions
    a. Define and compare solutions and suspensions
    b. Explain what happens to particles of a solute when a solution forms
    c. Identify the factors that affect solubility of a substance
    d. Describe how solutes affect the freezing and boiling points of solvents

2. Describing Acids and Bases
    a. Identify and describe the properties of acids and give examples
    b. Identify and describe the properties of bases and give examples
3. Acids and Bases in Solution
    a. Describe the ions formed when acids and bases are dissolved in water
    b. Describe the pH scale and tell how it is used
    c. Explain what happens in neutralization reaction

VIII. **Exploring Materials** (2.9, 2.10, 2.11, 4.1)
1. Polymers and Composites
    a. Explain the composition of polymers and give several examples of polymers
    b. Describe a composite material and state why composites are useful
2. Radioactive Elements
    a. Describe radioactive decay and the emissions produced during decay
    b. Explain why half-life is a useful property of radioactive elements
    c. Identify uses and dangers of radioactive isotopes
    d. Explain Isotopes in terms of mass numbers

SUGGESTED INSTRUCTIONAL STRATEGIES:
- Problem Solving / Critical thinking skills
- Reasoning
- Inquiry
- Experimental investigation
- Measurement skills
- Graphing Skills
- Research skills
- As specified by Individual Education Plan

SUGGESTED INTEGRATED ACTIVITIES: (Tie-ins with other disciplines and student activities)

USE OF TOOLS / TECHNOLOGY:
- Use of classroom computers and software packages
- Use of overhead projector with transparencies
- View Video selections
- Use of a basic calculator
- Use of laser disc technology
- Use of computer laboratory for simulations and research
- Web quests in computer laboratory

ASSESSMENT TECHNIQUES:
- Students will take free-response and multiple choice tests
- Students will participate in classroom discussions and demonstrate problem solving on the chalkboard and/ or overhead projector
- Students will work in cooperative situations and report out their results
- Students will prepare integration projects