POCONO MOUNTAIN SCHOOL DISTRICT

COURSE: General Physical Science	**GRADE(S): 10-11**
Unit 1: Introduction to Physical Science	

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
- Distinguish among the isotopic forms of elements. Explain the probabilistic nature of radioactive decay based on subatomic rearrangement in the atomic nucleus. Explain how light is absorbed or emitted by electron orbital transitions.

3.2.12.A. 3.
- Explain how matter is transformed into energy in nuclear reactions according to the equation E=mc2.

3.2.12.A. 4.
- Apply oxidation/reduction principles to electrochemical reactions. Describe the interactions between acids and bases.

3.2.12.A. 5.
- MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.

3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

3.2.12.B. 2.
- Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.

3.2.12.B. 3.
- Describe the relationship between the average kinetic molecular energy, temperature, and phase changes.

3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:
- How is scientific knowledge created and communicated?
- How is the scientific method used to better understand the world around us?

FOCUS QUESTIONS:
- How does the process of science start and end?
- What is the relationship between science and technology?
- What are the branches of natural science?
- What is the goal of a scientific method?
- What are the characteristics of creditable and valid scientific calculations?
- How does scientific law differ from scientific theory?
- Why are scientific models useful?
- What is a safe laboratory?

- Why is scientific notation useful?
- What units do scientists use for their measurements?
- How does the precision of measurement affect the precision of scientific calculations?
- How do scientists organize data?
- How can scientists communicate experimental data?

UNIT OBJECTIVES/ESSENTIAL KNOWLEDGE

1. Describe the nature of science includes the fundamental concepts
    - The natural world is understandable;
    - Science is based on evidence - both observational and experimental;
    - Science is a blend of logic and innovation;
    - Scientific ideas are durable yet subject to change as new data are collected;
    - Science is a complex social endeavor; and
    - Scientists try to remain objective and engage in peer review to help avoid bias
2. Demonstrate an understanding of scientific reasoning, logic and the nature of science by planning and conducting
    - Chemicals and equipment are used safely;
    - Length, mass, volume, density, temperature, weight, and force are accurately measured;
    - Conversions are made among metric units, applying appropriate prefixes;
    - Triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, probeware, and spring scales are used to gather data;
    - Numbers are expressed in scientific notation where appropriate;
    - Independent and dependent variables, constants, controls, and repeated trials are identified;
    - Data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted;
    - Data tables for descriptive statistics showing specific measures of central tendency, the range of the data set, and the number of repeated
    - Trials are constructed and interpreted with frequency distributions, scatterplots, line plots, and histograms are constructed and interpreted;
    - Valid conclusions are made after analyzing data;
    - Research methods are used to investigate practical problems and questions;
    - Experimental results are presented in appropriate written form;
    - Models and simulations are constructed and used to illustrate and explain phenomena; and
    - Current applications of physical science concepts are used.
3. Explain how data scientists collect can be aggregated into measurements
    - Scientific notation makes very large or very small numbers easier to work with
    - Scientists use a set of measuring units called SI
    - The precision of a calculation is limited by the least precise measurement used in the calculation
4. Describe methods for presenting scientific data
    - Scientists can organize their data by using data tables and graphs
    - Scientists can communicate results by writing in journals or speaking at conferences

ACTIVITIES:

1. Propose and identify questions that can be answered through scientific investigations
2. Explain the relationship between science and technology
3. Make connections between the components of the nature of science and their investigations and the greater body of scientific knowledge and research
4. Select appropriate equipment (probeware, triple beam balances, thermometers, metric rulers, graduated cylinders, electronic balances, or spring scales) and utilize correct

VOCABULARY:

- Astronomy
- Biology
- Chemistry
- Conclusion
- Controlled experiment
- Conversion factor
- Data
- Density
- Direct proportion
- Forensic science
- Geology
- Graph

techniques to measure length, mass, density, weight, volume, temperature, and force
5. Design a data table that includes space to organize all components of an investigation in a meaningful way, including levels of the independent variable, measured responses of the dependent variable, number of trials, and mathematical means
6. Record measurements, using the following metric (SI) units: liter, milliliter (cubic centimeters), meter, centimeter, millimeter, grams, degrees Celsius, and newtons
7. Use a variety of graphical methods to display data; create an appropriate graph for a given set of data; and select the proper type of graph for a given set of data, identify and label the axes, and plot the data points
8. Gather, evaluate, and summarize information, using multiple and variable resources, and detect bias from a given source
9. Identify the key components of controlled experiments: hypotheses, independent and dependent variables, constants, controls, and repeated trials
10. Formulate conclusions that are supported by the gathered data
11. Apply the methodology of scientific inquiry: begin with a question, design an investigation, gather evidence, formulate an answer to the original question, communicate the investigative process and results, and realize this methodology does not always follow a prescribed sequence
12. Communicate in written form the following information about investigations: the purpose/problem of the investigation, procedures, materials, data and/or observations, graphs, and an interpretation of the results
13. Describe how creativity comes into play during various stages of scientific investigations
14. Use current technologies to model and simulate experimental conditions
15. Recognize examples of the use of nanotechnology and its applications

RESOURCES:
Textbook:
Physical Science Concepts in Action– Prentice Hall
Chapter 1, pages 1-31

- Hypothesis
- Inverse proportion
- Length
- Manipulated variable (independent variable)
- Model
- Observation
- Physics
- Procedure
- Responding variable (dependent variable)
- Science
- Scientific law
- Scientific method
- Scientific notation
- Scientific theory
- Slope
- Tables
- Technology
- Volume

ASSESSMENTS:
- ATBs/Closure Activities
- Daily Participation
- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
- Demonstrations
- Lab Participation
- Lab Reports
- Online Research
- Group Presentations
- Individual Presentations
- Quizzes
- Unit Tests
- Final Exams

REMEDIATION:
- Class Notes
- Graphic Organizers
- Chunking of Information
- Oral Questioning
- Group Discussion
- Small Lab Group Participation
- Reinforcement Videos and Animations
- Computer Simulation/Modeling Projects
- Web-based Reinforcement Activities
- Cooperative Learning Groups
- Peer Tutoring

	• Individualized Assistance • Small Group Assistance • Review Games • Content Review **ENRICHMENT:** • Class Presentations • Project-Based Assignments • Online Research • Group Discussions • Online Review Games • Independent Investigations • Individualized Teacher Support • Peer Tutoring

POCONO MOUNTAIN SCHOOL DISTRICT

COURSE: General Physical Science	**GRADE(S): 10-11**

UNIT 10: Magnetism and Power Generation

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
- Distinguish among the isotopic forms of elements. Explain the probabilistic nature of radioactive decay based on subatomic rearrangement in the atomic nucleus. Explain how light is absorbed or emitted by electron orbital transitions.

3.2.12.A. 3.
- Explain how matter is transformed into energy in nuclear reactions according to the equation E=mc2.

3.2.12.A. 4.
- Apply oxidation/reduction principles to electrochemical reactions. Describe the interactions between acids and bases.

3.2.12.A. 5.
- MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.

3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

3.2.12.B. 2.
- Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.

3.2.12.B. 3.
- Describe the relationship between the average kinetic molecular energy, temperature, and phase changes.

3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:

- What is the role of energy in our world?
- How is electrical energy produced, transmitted, and converted for use in the home?

FOCUS QUESTIONS:

- What is a magnetic field?
- How are magnetic fields produced?
- What are magnets and why do they behave the way they do?
- How are energy and magnetism related?
- How does a compass work?
- How is an electric current generated with the use of magnets?
- How does a generator operate?
- How does an electric motor operate?
- What is electromagnetism and why is it important?

- What forms of energy are used to generate power and electricity?
- How does electric current get to your home?
- Why is there a North and South Pole?

OBJECTIVES/ESSENTIAL KNOWLEDGE

1. Describe the behavior of magnets
    - A magnet has a north pole and a south pole
    - Like magnetic poles repel each other; unlike poles attract each other
    - A magnet is surrounded by a magnetic field that exerts forces on other magnets
    - Some materials are magnetic because their atoms behave like magnets
2. Relate the behavior of magnets to magnetic fields
    - Magnetic fields can produce electrical current in conductors
    - Electricity can produce a magnetic field and cause iron and steel objects to act like magnets
    - A magnetic force is exerted through a magnetic field
    - A moving electric charge such a moving electron creates a magnetic field
    - Magnetic fields surround all magnets
    - Magnetic field lines begin at the magnet's North Pole and end on the South Pole
    - Earth is surrounded by a magnetic field similar to the field around a bar magnet
    - Earth's magnetic poles move slowly, and sometimes change places
    - Earth's magnetic poles are now close to Earth's geographic poles
3. Explain why some materials are magnetic
    - Only certain materials such as iron can be made into magnets that are surrounded by a magnetic field
4. Describe how the magnetic field of an electromagnet depends on the current and number of coils
    - Electromagnets are temporary magnets that lose their magnetism when the electric current is removed
    - An electromagnet is made by wrapping a current-carrying wire around an iron core
    - To produce electric current, the wire is fashioned into a loop and a power source provides the kinetic energy to spin the wire loop
    - The magnetic field of an electromagnet is turned on or off when the electric current is turned on or off
5. Explain how motion can produce electricity
    - In an electric motor, a magnetic field turns electricity into motion
    - A generator uses a magnetic field to turn motion into electricity
6. Describe how motors, generators and transformers function
    - An electric motor transforms electrical energy into kinetic energy
    - An electric motor rotates when current flows through the wire loop that is surrounded by a magnetic field
    - A generator is a device that converts mechanical energy into electrical energy
    - Most of the electrical energy we use comes from generators
    - Electric motors convert electrical energy into mechanical energy that is used to do work
    - A transformer changes the voltage of an alternating current
    - Both a motor and a generator have magnets (or electromagnets) and a coil of wire that creates another magnetic field

ACTIVITIES:

- Describe the effects of magnetic forces and magnetic fields.
- Explain how magnetic poles determine the direction of magnetic forces.
- Explain how heat is used to generate electricity.
- Describe the Earth's magnetic field and its effect on a compass.
- Describe the advantages and disadvantages of using fossil and nuclear fuels to produce

VOCABULARY:

- Electric Motor
- Electromagnet
- Ferromagnetic Material
- Fuel cells
- Generator
- Magnetic Domain
- Magnetic Field
- Magnetic Force
- Magnetic Pole

electricity.
- Describe the advantages and disadvantages of using fuel cycles, wind and solar to produce electricity.
- Explain the behavior of ferromagnetic materials in terms of magnetic domains.
- Describe how matter is transformed into energy during nuclear fission.
- Describe how a moving electric charge can create a magnetic field.
- Explain how an electromagnet can be constructed.
- Explain how a generator works.
- Summarize how electrical energy is produced, transmitted, and converted for use in the home.

RESOURCES:

Textbook:
Physical Science Concepts in Action– Prentice Hall
Chapter 21, pages 628-653

- Nuclear fission
- Transformer
- Turbine

ASSESSMENTS:
- ATBs/Closure Activities
- Daily Participation
- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
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REMEDIATION:
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- Content Review

ENRICHMENT:
- Class Presentations
- Project-Based Assignments
- Online Research
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- Independent Investigations
- Individualized Teacher Support
- Peer Tutoring

COURSE: General Physical Science	GRADE(S): 10-11

UNIT 2: Properties of Matter

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
- Distinguish among the isotopic forms of elements. Explain the probabilistic nature of radioactive decay based on subatomic rearrangement in the atomic nucleus. Explain how light is absorbed or emitted by electron orbital transitions.

3.2.12.A. 3.
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3.2.12.A. 5.
- MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.

3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

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3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:
- How do the physical and chemical properties of a substance affect its possible uses?
- How does the structure of matter affect the properties and uses of materials?

FOCUS QUESTIONS:
- Why are elements and compounds classified as pure substances?
- How do mixtures differ from pure substances?
- What are some examples of physical properties?
- When does a physical change occur?
- What are some examples of chemical properties?
- When can chemical properties be observed?
- What observation might indicate that a chemical change has occurred?
- What is the difference between a physical and chemical change?

- How can shape and volume be used to classify materials?
- What are the states of matter?
- How can kinetic theory and forces of attraction be used to explain the behavior of solids, liquids and gases?
- What are six common phase changes?

UNIT OBJECTIVES/ESSENTIAL KNOWLEDGE

1. Describe how matter is classified
- Every sample of a given substance has the same properties because a substance has a fixed, uniform composition
- An element has a fixed composition because it contains only one type of atom
- A compound always contains two or more elements joined in a fixed proportion
- The properties of a mixture can vary because the composition of a mixture is not fixed
- Based on the size of its largest particles a mixture can be classified as a solution , a suspension, or a colloid

2. Provide examples of physical properties and identify substances based on their physical properties
- Viscosity, conductivity, malleability, hardness, melting point, boiling point, and density are examples of physical properties
- Physical properties are used to identify a material, to choose a material for a specific purpose, or to separate the substances in a mixture
- Filtration and distillation are common separation methods

3. Describe chemical properties of matter and clues that indicate a chemical change is taking place. Distinguish chemical changes from physical changes
- Chemical properties can be observed only when the substances in a sample of matter are changing into different substances
- Three common types of evidence for a chemical change are a change in color, the production of a gas, and the formation of a precipitate
- When matter undergoes a chemical change, the composition of the matter changes. When matter undergoes a physical change, the composition of the matter remains the same.

4. Describe 5 the states of matter and classify materials as solids, liquids, or gases
- Solids, liquids, gases, plasmas, and Bose-Einstein condensates (BEC) are all different states of matter.
- Each of these states is also known as a phase.
- Elements and compounds can move from one phase to another when specific physical conditions are present

5. Explain the behavior of gases, liquids, and solids, using kinetic theory
- The kinetic theory of matter states that all particles of matter are in constant motion
- There are forces of attraction among the particles in all matter
- The constant motion of particles in a gas allows a gas to fill a container of any shape or size
- A liquid takes the shape of its container because particles in a liquid can flow to new locations
- The volume of a liquid is constant because forces of attraction keep the particles close together
- Solids have a definite volume and shape because particles in a solid vibrate around fixed locations

6. Define gas pressure and identify factors that affect gas pressure
- Collisions between particles of a gas and the walls of the container cause the pressure in a closed container of gas
- Factors that affect the pressure of an enclosed gas are its temperature, its volume, and the number of its particles

7. Predict changes in gas pressure due to changes in temperature, volume and number of particles
- Raising the temperature of a gas will increase its pressure if the volume of the gas and number of particles is constant
- Reducing the volume of a gas increases its pressure if the temperature of the gas and

number of particles are constant
- Increasing the number of particles will increase the pressure of a gas if the temperature and the volume are constant

8. Describe phase changes and explain how temperature can be used to recognize a phase change
- Melting, freezing vaporization, condensation, sublimation, and deposition are six common phase changes
- The temperature of a substance does not change during a phase change
- Energy is either absorbed or released during a phase change

9. Explain what happens to the motion, arrangement, and average kinetic energy of water molecules during phase changes
- The arrangement of molecules in water becomes less orderly as water melts, and more orderly as water freezes

ACTIVITIES:
- Describe the particle theory of matter
- Describe how to determine whether a substance is an element, compound, or mixture
- Define compounds as inorganic or organic. (All organic compounds contain carbon)
- Describe what a salt is and explain how salts form
- Describe the properties of solids, liquids, gases, and plasma
- Distinguish between physical properties (i.e., shape, density, solubility, odor, melting point, boiling point, and color) and chemical properties (i.e., acidity, basicity, combustibility, and reactivity)
- Find the mass and volume of substances and calculate and compare their densities
- Analyze the pH of a solution and classify it as acidic, basic, or neutral
- Determine the identity of an unknown substance by comparing its properties to those of known substances
- Design an investigation from a testable question related to physical and chemical properties of matter. The investigation may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis. (Students should be able to use inquiry skills to compose a clear hypothesis, create an organized data table, and identify variables and constants, record data correctly construct appropriate graphs, analyze data, and draw reasonable conclusions)
- Classify pure substances as elements or compounds
- Describe the characteristics of an element and symbols used to identify elements
- Describe the characteristics of a compound
- Distinguish pure substances from mixtures
- Describe evidence that indicates a physical change is taking place
- Describe clues that indicate that a chemical change has taken place
- Classify materials as solid liquids or gases.

VOCABULARY:
- Atom
- Boiling point
- Bose - Einstein condensate
- Chemical change
- Chemical property
- Colloid
- Compound
- Condensation
- Conductivity
- Distillation
- Element
- Endothermic
- Evaporation
- Exothermic
- Filtration
- Flammability
- Gas
- Heat of fusion
- Heat of vaporization
- Heterogeneous mixture
- Homogenous mixture
- Kinetic energy
- Liquid
- Malleability
- Melting point
- Phase change
- Physical change
- Physical property
- Plasma
- Precipitate
- Pure substance
- Reactivity
- Solid
- Solution
- Suspension
- Temperature
- Vapor pressure
- Vaporization
- Viscosity

ASSESSMENTS:
- ATBs/Closure Activities
- Daily Participation

- Explain the behavior of solids liquids and gasses using kinetic theory

RESOURCES:
Textbook:
Physical Science Concepts in Action– Prentice Hall
Chapter 2, pages 36-65
Chapter 3, pages 66-97

Discovery Streaming:
"Matter and Energy"
"Matter and Energy: How Is It Put Together"
"Discovering the Elements"
"Science Investigations: Physical Science: Investigating Chemical Properties"

- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
- Demonstrations
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- Lab Reports
- Online Research
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ENRICHMENT:
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POCONO MOUNTAIN SCHOOL DISTRICT

COURSE: General Physical Science	**GRADE(S): 10-11**
UNIT 3: Atomic Structure	

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
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3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

3.2.12.B. 2.
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3.2.12.B. 3.
- Describe the relationship between the average kinetic molecular energy, temperature, and phase changes.

3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:
- How does the structure of matter affect the properties and uses of materials?
- What is Atomic Theory and how has it changed over time?

FOCUS QUESTIONS:
- What was Dalton's theory of the structure of matter?
- What contributions did Thomson and Rutherford make to the development of Modern Atomic Theory?
- What are three subatomic particles?
- What properties can be used to compare protons, neutrons, and electrons?
- How are atoms of one element different from atoms of other elements?
- What is the difference between isotopes of the same element?
- What can happen to electrons when atoms gain or lose energy?

- What type of model does a scientist use to describe how electrons behave in atoms?
- What is the most stable configuration of electrons in an atom?

UNIT OBJECTIVES/ESSENTIAL KNOWLEDGE

1. List the main points of Dalton's atomic theory
- Dalton proposed the theory that:
  - All matter is composed of atoms
  - Atoms cannot be made or destroyed
  - All atoms of the same element are identical
  - Different elements have different types of atoms
  - Chemical reactions occur when atoms are rearranged
  - Compounds are formed from atoms of the constituent elements

2. Explain how Thomson and Rutherford used data from experiments to produce their atomic models
- The structure of atom was first given by the plum pudding model of J.J. Thomson before the experiment of Ernest Rutherford
- The plum pudding model explained an atom as a positive charge body which contains small negatively charged particles which are called electrons
- Thomson also described that the negative charge in atom is balanced with the equal amount of positive charge to maintain the neutrality of atom
- Thomson's experiences provided the first evidence that atoms are made of even smaller particles
- Earnest Rutherford set up an apparatus and did an experiment that could confirm JJ Thomson's model of an atom. But he ended up with some new facts in the structure of the atom
- Rutherford's experiments concluded that a high central charge was concentrated into a very small volume in comparison to the rest of the atom and this central volume also contained most of the atomic mass of the atom
- This region was named the "nucleus" of the atom in later years

3. **I**dentify three subatomic particles and compare their properties
- Protons, electrons, and neutrons are subatomic particles
- Protons, electrons, and neutrons can be distinguished by mass, charge, and location in the atom

4. Distinguish the atomic number of an element from the mass number of an isotope, and use these numbers to describe the structure of atoms
- Atoms of different elements have different numbers of protons
- Isotopes of an element have the same atomic number but different mass number because they have different numbers of neutrons

5. Describe Bohr's model of the atom and evidence for energy levels
- In Bohr's model, electrons move with constant speed in fixed orbits around the nucleus
- Each electron in an atom has a specific amount of energy
- The possible energies that electrons in an atom can have are called energy levels
- An electron in an atom can move from one energy level to another when the atom gains or loses energy

6. Explain how the electron cloud model represents the behavior and locations of electrons in atoms
- Scientists use the electron cloud model to describe the possible locations of electrons around the nucleus
- An electron cloud is a good approximation of how electrons behave in their orbitals

7. Distinguish the ground state from excited states of an atom based on electron configurations
- When all the electrons in an atom have the lowest possible energies, the atom is said to be in its ground state
- An excited state is less stable than the ground state

ACTIVITIES:	**VOCABULARY:**
• Describe the historical development of the concept of the atom and the contributions of	• Atomic number • Atomic theory

Dalton, Thomson, Rutherford, Bohr and other scientists (Schrödinger).

- Differentiate among the three basic particles in the atom (proton, neutron, and electron) and their charges, relative masses, and locations
- Compare the Bohr atomic model to the electron cloud model with respect to its ability to represent accurately the three-dimensional structure of the atom
- Explain how Thomson and Rutherford used data from experiments to produce their atomic models
- Distinguish the atomic number of an element from the mass number of an isotope and use these numbers to describe the structure
- Describe Bohr's model of the atom and evidence for energy levels
- Explain how the electron cloud model represents behavior and locations of electrons in atoms
- Distinguish the ground state from excited states of an atom based on electron configurations

RESOURCES:

Textbook:

Physical Science Concepts in Action– Prentice Hall
Chapter 4, pages 98-123

- Atoms
- Electron
- Electron cloud
- Electron configuration
- Energy levels
- Ground state
- Isotopes
- Mass number
- Neutron
- Nucleus
- Orbital
- Proton
- Subatomic particles

ASSESSMENTS:

- ATBs/Closure Activities
- Daily Participation
- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
- Demonstrations
- Lab Participation
- Lab Reports
- Online Research
- Group Presentations
- Individual Presentations
- Quizzes
- Unit Tests
- Final Exams

REMEDIATION:

- Class Notes
- Graphic Organizers
- Chunking of Information
- Oral Questioning
- Group Discussion
- Small Lab Group Participation
- Reinforcement Videos and Animations
- Computer Simulation/Modeling Projects
- Web-based Reinforcement Activities
- Cooperative Learning Groups
- Peer Tutoring
- Individualized Assistance
- Small Group Assistance
- Review Games
- Content Review

ENRICHMENT:

- Class Presentations
- Project-Based Assignments

	• Online Research • Group Discussions • Online Review Games • Independent Investigations • Individualized Teacher Support • Peer Tutoring

COURSE: General Physical Science	GRADE(S): 10-11
UNIT 4: Periodic Table	

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
- Distinguish among the isotopic forms of elements. Explain the probabilistic nature of radioactive decay based on subatomic rearrangement in the atomic nucleus. Explain how light is absorbed or emitted by electron orbital transitions.

3.2.12.A. 3.
- Explain how matter is transformed into energy in nuclear reactions according to the equation E=mc2.

3.2.12.A. 4.
- Apply oxidation/reduction principles to electrochemical reactions. Describe the interactions between acids and bases.

3.2.12.A. 5.
- MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.

3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

3.2.12.B. 2.
- Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.

3.2.12.B. 3.
- Describe the relationship between the average kinetic molecular energy, temperature, and phase changes.

3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:
- How does the structure of matter affect the properties and uses of materials?
- How is the periodic table organized and used to better understand the world around us?

FOCUS QUESTIONS:
- How is the modern Periodic Table organized?
- What does the atomic mass of an element depend upon?
- What categories are used to classify elements on the periodic table?
- How do the properties vary across a period in the Periodic Table?
- Why do the elements in a group have similar properties?
- What are some properties of Alkali Metals?
- What are some properties of Alkaline Metals?
- What are some properties of the Boron Family?

- What are some properties of the Carbon Family?
- What are some properties of the Nitrogen Family?
- What are some properties of the Halogens?
- What are some properties of the Noble Gases?
- How are the properties of the first 20 elements related to their Atomic Structure?

UNIT OBJECTIVES/ESSENTIAL KNOWLEDGE

1. Describe how Mendeleev arranged the elements in his table
- Mendeleev arranged the elements into rows in order of increasing mass so that elements with similar properties were in the same column

2. Explain how the predictions Mendeleev made and the discovery of new elements demonstrated the usefulness of his periodic table
- The close match between Mendeleev's predictions and actual properties of new elements showed how useful his periodic table could be

3. Describe the arrangement of elements in the modern periodic table
- There are more than 110 known elements
- No element with an atomic number greater than 92 is found naturally in measurable quantities on Earth
- The remaining elements are artificially produced in a laboratory setting
- Elements combine in many ways to produce compounds that make up all other substances on Earth
- In the modern periodic table, elements are arranged by increasing atomic number
- Each row on the table is a period and each column is a group or family
- Properties of elements repeat in a predictable way when atomic numbers are used to arrange elements into groups
- Elements in the same column of the periodic table contain the same number of electrons in their outer energy levels. This gives rise to their similar properties and is the basis of periodicity — the repetitive pattern of properties such as boiling point across periods on the table

4. Explain how the atomic mass of an element is determined and how atomic mass units are defined
- Atomic mass is a value that depends on the distribution of an element's isotopes in nature and masses of those isotopes

5. Identify general properties of metals, nonmetals, and metalloids
- Elements are classified as metals, nonmetals, and metalloids. Metals are elements that are good conductors of electric current and heat. Nonmetals are poor conductors of electric current and heat. Metalloids are elements with properties that fall between those of metals and nonmetals.

6. Describe how properties of elements change across a period in the periodic table
- Across a period from left to right, the elements become less metallic and more nonmetallic in their properties

7. Relate the number of valence electrons to groups in the periodic table and to properties of elements in those groups
- Elements in a group have similar properties because they have the same number of valence electrons
- The alkali earth metals in Group 1A are extremely reactive. The reactivity of these metals increases from the top of the group to the bottom
- Differences in reactivity among the alkaline earth metals in Group 2A are shown by the ways they react with water
- Group 3A contains the most abundant metal in Earth's Crust-aluminum.
- Group 4A contains the nonmetal carbon. Most compounds in the body contain carbon. Carbon compound control reactions that occur in cells
- Fertilizers usually contain the Group 5A elements nitrogen and phosphorus
- Oxygen, in Group 6A, is the most abundant element in Earth's crust
- Despite their physical differences, the halogens in Group 7A are all highly reactive nonmetals
- The noble gases, in Group 8A, are colorless and odorless and extremely unreactive

ACTIVITIES:

- Describe the arrangement of elements in the modern periodic table.
- Explain how the atomic mass of an element is determined and how atomic mass units are defined.
- Identify general properties of metals, nonmetal and metalloids.
- Describe how the properties of elements change across a period in the periodic table.
- Explain why elements in a group have similar properties.
- Relate the number of valence electrons to groups in the Periodic Table and to the properties of elements in the group.
- Predict the reactivity of some elements based on the locations within a group.
- Use the periodic table to obtain the following information about the atom of an element:
  - symbol
  - atomic number
  - atomic mass
  - state of matter at room temperature
  - number of outer energy level (valence) electrons.
- Describe the organization of the periodic table in terms of
  - atomic number
  - metals, metalloids, and nonmetals
  - groups/families vs. periods
- Recognize that an atom's identity is related to the number of protons in its nucleus
- Categorize a given element as metal, nonmetal, or metalloid
- Given a chemical formula of a compound, identify the elements and the number of atoms of each that comprise the compound
- Recognize that the number of electrons in the outermost energy level determines an element's chemical properties or chemical reactivity

RESOURCES:

Textbook:

Physical Science Concepts in Action– Prentice Hall
Chapter 5, pages 124-155

VOCABULARY:

- Alkali metals
- Alkaline earth metals
- Atomic mass unit (AMU)
- Group
- Halogens
- Metalloids
- Metals
- Noble Gases
- Nonmetals
- Period
- Periodic Law
- Periodic Table
- Reactivity
- Transition metals
- Valence electrons

ASSESSMENTS:

- ATBs/Closure Activities
- Daily Participation
- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
- Demonstrations
- Lab Participation
- Lab Reports
- Online Research
- Group Presentations
- Individual Presentations
- Quizzes
- Unit Tests
- Final Exams

REMEDIATION:

- Class Notes
- Graphic Organizers
- Chunking of Information
- Oral Questioning
- Group Discussion
- Small Lab Group Participation
- Reinforcement Videos and Animations
- Computer Simulation/Modeling Projects
- Web-based Reinforcement Activities
- Cooperative Learning Groups
- Peer Tutoring
- Individualized Assistance
- Small Group Assistance
- Review Games
- Content Review

	ENRICHMENT: • Class Presentations • Project-Based Assignments • Online Research • Group Discussions • Online Review Games • Independent Investigations • Individualized Teacher Support • Peer Tutoring

COURSE: General Physical Science	**GRADE(S): 10-11**
UNIT 5: Chemical Bonds	

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
- Distinguish among the isotopic forms of elements. Explain the probabilistic nature of radioactive decay based on subatomic rearrangement in the atomic nucleus. Explain how light is absorbed or emitted by electron orbital transitions.

3.2.12.A. 3.
- Explain how matter is transformed into energy in nuclear reactions according to the equation E=mc2.

3.2.12.A. 4.
- Apply oxidation/reduction principles to electrochemical reactions. Describe the interactions between acids and bases.

3.2.12.A. 5.
- MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.

3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

3.2.12.B. 2.
- Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.

3.2.12.B. 3.
- Describe the relationship between the average kinetic molecular energy, temperature, and phase changes.

3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:

- How do atoms manage to stay together to form new substances?

FOCUS QUESTIONS:

- When is an atom unlikely to react?
- What is one way in which elements can achieve stable electron configuration?
- How does the structure of an ionic compound affect its properties?
- What is an ionic bond?
- What is a covalent bond?
- How are atoms held together in a covalent bond?
- What are diatomic molecules?
- What factors determine whether a molecule is polar?
- How does the attraction between polar molecules compare to the attractions between non-

polar molecules?
- What are the forces that give a metal its structure as a solid?
- How do metallic bonds produce some of the properties of metals?
- What are alloys?

UNIT OBJECTIVES/ESSENTIAL KNOWLEDGE

1. Recognize stable electron configurations
    - When the highest occupied energy level of atom is filled with electrons, the atom is stable and not likely to react
2. Predict an element's chemical properties using number of valence electrons and electron dot diagrams
    - The chemical properties of an element depend on the number of valence electrons
    - An electron dot diagram is a model of an atom in which each dot represents a valence electron
3. Describe how an ionic bond forms and how ionization energy affects the process
    - Some elements achieve stable electron configurations through the transfer of electrons between atoms. An ionic bond forms when electrons are transferred from one atom to another
    - The properties of an ionic compound can be explained by the strong attractions among ions within a crystal lattice
4. Predict the composition of an ionic compound from its chemical formula
    - Compounds that contain ionic bonds are ionic compounds which can be represented by chemical formulas.
    - A chemical formula is a notation that shows what elements a compound contains and the ratio of the atoms or ions of these elements in a compound
5. Describe how covalent bonds form and the attractions that keep atoms together in molecules
    - The attractions between the shared electrons and the protons in each nucleus hold the atoms together in a covalent bond
6. Compare polar and nonpolar bonds, and demonstrate how polar bonds affect the polarity of a molecule
    - When atoms form a polar covalent bond, the atom with greater attraction for electrons has a partial negative charge. The other atom has a partial positive charge
    - The type of atoms in a molecule and its shape are factors that determine whether a molecule is polar or nonpolar
7. Compare the attractions between polar and nonpolar molecules
    - Attractions between polar molecules are stronger than attractions between nonpolar molecules
8. Name and determine chemical formulas for ionic and molecular compounds
    - The name of an ionic compound must distinguish the compound from other ionic compounds containing the same elements
    - The formula of an ionic compound describes the ratio of the ions in the compound
9. Describe the structure and strength of bonds in metals
    - Cations are positively charged ions that are formed when an atom loses one or more electrons during a chemical reaction
    - The cations in a metal form a lattice that is held in place by strong metallic bonds between the cations and the surrounding valence electrons
10. Define an alloy and demonstrate how the composition of an alloy affect its properties
    - Scientists can design alloy with specific properties by varying the types and amounts of elements in an alloy

ACTIVITIES:	**VOCABULARY:**
• Recognize stable electron configuration • Predict an element's chemical properties using number of valence electrons and electron dot diagrams • Describe ionic bonding • Describe how an ion forms and how	• Anion • Cation • Chemical bond • Chemical formula • Covalent bond • Polar covalent bond

ionization energy affects the process.
- Predict the composition of an ionic compound from its chemical formula
- Describe covalent bonding
- Describe how covalent bonds form and the attraction that keeps them together
- Compare polar and non-polar bonds, and demonstrate how polar bonds affect the polarity of a molecule
- Describe metallic bonding
- Describe the structure and strength of bonds in metals
- Relate the properties of metals to their structure
- Define an alloy and demonstrate how the composition of an alloy affects its properties
- Describe the difference between ionic and covalent bonding
- Predict what kind of bond (ionic or covalent) will likely form when metals and nonmetals are chemically combined

RESOURCES:

Textbook:
Physical Science Concepts in Action– Prentice Hall
Chapter 6, pages 156-189

United Streaming:
"Elements of Chemistry: Compounds and Reactions"
"Simply Science: Reaction Equations"
"Simply Science: Reaction Equations"
"Simply Science: Water: Highway of Life"

- Subscript
- Crystal lattice
- Crystals
- Diatomic
- Electron dot diagram
- Ion
- Valence electron
- Ionic bond
- Ionization energy
- Metallic bond
- Molecule
- Orbitals

ASSESSMENTS:
- ATBs/Closure Activities
- Daily Participation
- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
- Demonstrations
- Lab Participation
- Lab Reports
- Online Research
- Group Presentations
- Individual Presentations
- Quizzes
- Unit Tests
- Final Exams

REMEDIATION:
- Class Notes
- Graphic Organizers
- Chunking of Information
- Oral Questioning
- Group Discussion
- Small Lab Group Participation
- Reinforcement Videos and Animations
- Computer Simulation/Modeling Projects
- Web-based Reinforcement Activities
- Cooperative Learning Groups
- Peer Tutoring
- Individualized Assistance
- Small Group Assistance
- Review Games
- Content Review

ENRICHMENT:
- Class Presentations
- Project-Based Assignments
- Online Research

	• Group Discussions • Online Review Games • Independent Investigations • Individualized Teacher Support • Peer Tutoring

COURSE: General Physical Science	**GRADE(S): 10-11**

UNIT 6: Acids and Bases

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
- Distinguish among the isotopic forms of elements. Explain the probabilistic nature of radioactive decay based on subatomic rearrangement in the atomic nucleus. Explain how light is absorbed or emitted by electron orbital transitions.

3.2.12.A. 3.
- Explain how matter is transformed into energy in nuclear reactions according to the equation E=mc2.

3.2.12.A. 4.
- Apply oxidation/reduction principles to electrochemical reactions. Describe the interactions between acids and bases.

3.2.12.A. 5.
- MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.

3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

3.2.12.B. 2.
- Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.

3.2.12.B. 3.
- Describe the relationship between the average kinetic molecular energy, temperature, and phase changes.

3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:
- How does the structure of matter affect the properties and uses of materials?
- How do the physical and chemical properties of acids and bases make them so important?

FOCUS QUESTIONS:
- What are some of the general properties of an acid?
- How is acid rain different from pure water?
- What are some of the general properties of a base?
- How do strong acids and bases differ from weak acids and bases?
- What is a neutralization reaction?
- What is the pH scale?
- How is pH used to describe the concentration of acids and bases?
- What type of building materials are resistant to the effects of acid rain?

UNIT OBJECTIVES/ESSENTIAL KNOWLEDGE

1. Describe how a substance can dissolve in water by dissociation, dispersion, or ionization
    - Substances can dissolve in water in three ways- through dissociation, dispersion, and ionization
    - Dissociation is a process where ionized compounds separated into ions and dissolve in the chemical compound
    - Dispersion is the process by which the ionic compound breads into small pieces that spread throughout the matter
    - Ionization is the process by which neutral molecules gain or lose ions in a chemical change
2. Describe how the physical properties of a solution can differ from those of its solute and solvent
    - Three physical properties of a solution that can differ from those of its solute and solvent are conductivity, freezing point, and boiling point
3. Identify energy changes that occur during the formation of a solution
    - During the formation of a solution, energy is either released or absorbed
4. Describe factors affecting the rate at which a solute dissolves in a solvent
    - Factors that affect the rate of dissolving include surface area, temperature, and stirring
5. Define solubility and describe factors affecting solubility
    - Solubility is defined as the maximum amount of solute that dissolves in a given amount of solvent at a given temperature
    - Solutions are described as unsaturated, saturated, or supersaturated, depending on the amount of solute in solution
6. Classify solutions as unsaturated, saturated, or supersaturated
    - A saturated solution is one that contains as much solute as the solvent can hold a given temperature
    - An unsaturated solution has less than the maximum amount of solute that can be dissolved
    - A supersaturated is one that contains more solute than it can normally hold.
    - Concentration can be expressed as percent by volume, percent by mass, and molarity
7. Define acid and describe some of the general properties of an acid
    - Acids make up an important group of compounds that contain hydrogen ions
    - When acids dissolve in water, hydrogen ions (H+) are released into the resulting solution
    - pH is a measure of the hydrogen ion concentration in a solution
    - Solutions with a pH lower than 7 are acidic
    - Acid is a corrosive substance: a sour-tasting compound that releases hydrogen ions to form a solution with a pH of less than 7, reacts with a base to form a salt, and turns blue litmus red
8. Define base and describe some of the general properties of a base
    - A base is a substance that releases hydroxide ions (OH–) into solution
    - Solutions with a pH greater than 7 are basic
    - Taste bitter
    - Feel slippery or soapy
    - Bases don't change the color of litmus; they can turn red litmus back to blue
    - Their aqueous (water) solutions conduct electric current (are electrolytes)
    - React with acids to form salts and water
9. Identify a neutralization reaction, and describe the reactants and products of neutralization
    - The neutralization reaction between an acid and a base produces a salt and water
    - A pH of 7 is neutral
    - When an acid reacts with a base, a salt is formed, along with water.
    - A salt is any compound which can be derived from the neutralization of an acid and a base.
    - The word "neutralization" is used because the acid and base properties of H^+ and OH^- are destroyed or neutralized.
10. Explain how acids and bases can be defined as proton donors and proton acceptors
    - Acids lose or donate protons and bases accept protons
    - Acids can be defined as proton donors and Bases can be defined as proton acceptors

11. Distinguish between strong and weak acids and between strong and weak bases
- The strength of an acid or base depends on the degree to which it dissociates or ionizes in water

12. Explain how electrolytes can be classified
- An electrolyte is a substance that ionizes or dissociates when it dissolves in water. The resulting solution can conduct electric current

13. Define acid rain and provide examples of damage caused by acid rain
- Acid rain is a broad term referring to a mixture of wet and dries deposition (deposited material) from the atmosphere containing higher than normal amounts of nitric and sulfuric acids.
- Acid rain has caused damage to stone structures and also damages metal and concrete

ACTIVITIES:
- Describe how the physical properties of a solution can differ from those of its solute and solvent
- Identify energy changes that occur during the formation of a solution
- Describe the factors that affect the rate at which a solute dissolves in a solvent
- Define solubility and describe the factors affecting solubility
- Define acid and describe some of the general properties of an acid
- Define base and describe some of the general properties of a base
- Identify a neutralization reaction and identify the reactants and products of neutralization
- Define pH and explain how the pH scale is used.
- Differentiate between strong acids and weak acids, strong bases and weak bases
- Explain what causes acid rain and describe some of the problems associated with the effects of acid rain
- Identify building materials that are resistant to the effects of acid rain

RESOURCES:

Textbook:

Chapter 8
Section 8.3, page 240 - 245
Section 8.4, page 246 - 255
Chapter 9
Section 9.1, page 269 (Acid Rain)

VOCABULARY:
- Acid
- Base
- Buffer
- Electrolyte
- Indicator
- Neutralization
- pH scale
- Salt
- Saturated solution
- Solubility
- Solute
- Solution
- Solvent
- Unsaturated solution

ASSESSMENTS:
- ATBs/Closure Activities
- Daily Participation
- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
- Demonstrations
- Lab Participation
- Lab Reports
- Online Research
- Group Presentations
- Individual Presentations
- Quizzes
- Unit Tests
- Final Exams

REMEDIATION:
- Class Notes
- Graphic Organizers
- Chunking of Information
- Oral Questioning
- Group Discussion

	• Small Lab Group Participation • Reinforcement Videos and Animations • Computer Simulation/Modeling Projects • Web-based Reinforcement Activities • Cooperative Learning Groups • Peer Tutoring • Individualized Assistance • Small Group Assistance • Review Games • Content Review **ENRICHMENT:** • Class Presentations • Project-Based Assignments • Online Research • Group Discussions • Online Review Games • Independent Investigations • Individualized Teacher Support • Peer Tutoring

POCONO MOUNTAIN SCHOOL DISTRICT

COURSE: General Physical Science	**GRADE(S): 10-11**

UNIT 7: Carbon Chemistry

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
- Distinguish among the isotopic forms of elements. Explain the probabilistic nature of radioactive decay based on subatomic rearrangement in the atomic nucleus. Explain how light is absorbed or emitted by electron orbital transitions.

3.2.12.A. 3.
- Explain how matter is transformed into energy in nuclear reactions according to the equation E=mc2.

3.2.12.A. 4.
- Apply oxidation/reduction principles to electrochemical reactions. Describe the interactions between acids and bases.

3.2.12.A. 5.
- MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.

3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

3.2.12.B. 2.
- Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.

3.2.12.B. 3.
- Describe the relationship between the average kinetic molecular energy, temperature, and phase changes.

3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:
- How does the structure of matter affect the properties and uses of materials?
- How does science and technology affect the quality of our lives?
- How do the physical and chemical properties of carbon make it so important?

FOCUS QUESTIONS:
- How does the structure of a carbon atom make it a unique element?
- How does the structure of a carbon atom affect the type of bonds it forms?
- What is an organic compound?
- What are hydrocarbons?
- What are the products and by products of the combustion of hydrocarbons?
- What are some of the important uses of carbon based compounds?
- What is the structure of carbon based polymers?
- How are synthetic polymers produced?
- How are carbon based polymers classified and formed?

- How do monomers combine to create polymers?
- How does the structure of polymers affect their physical properties?
- What materials can be produced from the cracking of petroleum?
- What are plastics?
- What are fossil fuels?
- What are some important petroleum products?
- How are saturated hydrocarbons different from unsaturated hydrocarbons?

UNIT OBJECTIVES/ ESSENTIAL KNOWLEDGE

1. Relate the structures of three forms of carbon to their properties
   - Diamond, graphite and fullerenes are forms of carbon. Each has a different arrangement of bonded carbon atoms
   - Graphite forms layers that slide past on another
   - Fullerenes are large hollow spheres or cages of carbon
2. Relate the number and arrangement of carbon atoms in hydrocarbons to their properties
   - A hydrocarbon is an organic compound that contains only the elements hydrogen and carbon
   - Factors that determine the properties of a hydrocarbon are the number of carbon atoms and how the atoms are arranged
   - Hydrocarbons can form a straight chain, a branched chain, or a ring
3. Distinguish unsaturated from saturated hydrocarbons
   - Saturated hydrocarbons all have single bonds
   - Unsaturated hydrocarbons contain one or more double or triple bonds
4. Describe the formation, composition, and uses of three types of fossil fuels
   - Fossil fuels are mixtures of hydrocarbons that formed from the remains of plants or animals
   - The type of fossil fuel produced depends on the origin of the organic material and the conditions under which it decays
   - Three types of fossil fuels are coal, natural gas, and petroleum
   - Coal has a high ratio of carbon to hydrogen, and when burned produces more soot than other fossil fuels
   - Natural Gas formed from the remains of marine organisms and is used for heating and cooking
   - Petroleum is also formed from the remains of marine organisms. It is a complex liquid mixture of hydrocarbons
   - For petroleum to be useful it must be separated into simpler mixtures or fractions such as gasoline and heating oil
5. Distinguish complete combustion from incomplete combustion of fossil fuels
   - Incomplete combustion of fossil fuels can produce carbon monoxide
   - The primary products of complete combustion of fossil fuels are carbon dioxide and water
6. Distinguish a monomer from a polymer
   - A polymer is a large molecule that forms when many smaller molecules are linked together by covalent bonds
   - The smaller molecules that join together to form polymers are called monomers
   - Poly means many and Mono means one
7. Compare examples of polymers
   - The properties of a polymer depend on the type and number of monomers in the polymer
   - Polymers can be classified as natural or synthetic polymers
8. Describe the structures and functions of synthetic and natural polymers
   - Synthetic polymers are derived from petroleum oil, and made by scientists and engineers
   - Examples of synthetic polymers include nylon, polyethylene, polyester, Teflon, and epoxy
   - Natural polymers occur in nature and can be extracted, they are often water based
   - Examples of naturally occurring polymers are silk, wool, DNA, cellulose and proteins

ACTIVITIES:	**VOCABULARY:**
• Relate the structures of the three forms of carbon to their properties • Explain how carbon atoms bond in various ways • Explain why there are many different types of	• Complete combustion Saturated Hydrocarbon • Cracking • Synthetic Polymer

organic compounds
- Describe the combustion of hydrocarbons
- List some of the uses of carbon based compounds
- Differentiate unsaturated from saturated hydrocarbons
- Identify the important materials that result from the cracking of petroleum
- Explain the short and long impacts of landfills and incineration of waste materials on the quality of the environment
- Describe the formation, composition, and uses of three types of fossil fuels
- Differentiate complete combustion of fossil fuels from incomplete combustion
- Describe the effects of some products of the combustion of fossil fuels
- Explain the greenhouse effect and the impact that it has upon our environment
- Explain how a monomer is different from a polymer
- Explain the general formation and structure of carbon based polymers
- Explain how monomers and polymers can be combined
- Describe three types of synthetic polymers
- Describe the structures and functions of four types of natural polymers

RESOURCES:

Textbook:

Physical Science Concepts in Action– Prentice Hall
Chapter 9, pages 260-289

- Cross liked polymers
- Fossil Fuels
- Hydrocarbon
- Incomplete combustion
- Landfill
- Monomer
- Unsaturated Hydrocarbon
- Natural polymer
- Organic compound
- Petroleum
- Plastic
- Polymer

ASSESSMENTS:

- ATBs/Closure Activities
- Daily Participation
- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
- Demonstrations
- Lab Participation
- Lab Reports
- Online Research
- Group Presentations
- Individual Presentations
- Quizzes
- Unit Tests
- Final Exams

REMEDIATION:

- Class Notes
- Graphic Organizers
- Chunking of Information
- Oral Questioning
- Group Discussion
- Small Lab Group Participation
- Reinforcement Videos and Animations
- Computer Simulation/Modeling Projects
- Web-based Reinforcement Activities
- Cooperative Learning Groups
- Peer Tutoring
- Individualized Assistance
- Small Group Assistance
- Review Games
- Content Review

ENRICHMENT:

- Class Presentations
- Project-Based Assignments
- Online Research

	• Group Discussions • Online Review Games • Independent Investigations • Individualized Teacher Support • Peer Tutoring

COURSE: General Physical Science	**GRADE(S): 10-11**

UNIT 8: Energy Forms and Changes

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
- Distinguish among the isotopic forms of elements. Explain the probabilistic nature of radioactive decay based on subatomic rearrangement in the atomic nucleus. Explain how light is absorbed or emitted by electron orbital transitions.

3.2.12.A. 3.
- Explain how matter is transformed into energy in nuclear reactions according to the equation E=mc2.

3.2.12.A. 4.
- Apply oxidation/reduction principles to electrochemical reactions. Describe the interactions between acids and bases.

3.2.12.A. 5.
- MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.

3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

3.2.12.B. 2.
- Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.

3.2.12.B. 3.
- Describe the relationship between the average kinetic molecular energy, temperature, and phase changes.

3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:
- What is the role of energy in our world?
- How is the utilization of energy dependent upon its ability to adopt different states and forms?

FOCUS QUESTIONS:
- What is energy?
- How is energy conserved?
- What are the major forms of energy?
- How can energy be converted from one form to another?
- How is matter affected by heat energy?
- How is heat energy transferred?
- How is energy related to phase change?
- How do we heat our homes?
- What forms of energy are available to harness for power?

OBJECTIVES / ESSENTIAL KNOWLEDGE

1. Differentiate among the various forms of energy and recognize that they can be transformed from one form to others
    - Energy can be converted from one form to another. The process of changing energy from one form to another is energy conversion
    - The law of conservation of energy states that energy cannot be created or destroyed
    - The major forms of energy are mechanical, thermal, chemical, electrical, electromagnetic, and nuclear energy
        - Mechanical energy is the energy associated with the motion and position of everyday objects
        - Thermal energy is the total potential and kinetic energy of all the microscopic particles in an object. When an object's atoms move faster, its thermal energy increases and the object becomes warmer
        - Chemical energy is the energy stored in chemical bonds. When the bonds are broken, the released energy can do work
        - Electrical energy is the energy associated with electric charges. Electric charges can exert forces that do work
        - Electromagnetic energy is a form of energy that travels through space in the form of waves.
        - Nuclear energy is the energy stored in atomic nuclei
2. Describe how changes in the nucleus of an atom during a nuclear reaction
    - Nuclear fission is a process that releases energy by splitting nuclei apart
    - Nuclear fusion releases energy when less massive nuclei combine to form a more massive nucleus
3. Distinguish between examples of kinetic and potential energy (i.e., gravitational) within a system
    - The gravitational potential energy of an object is converted to the kinetic energy of motion as the object falls
    - Conversion between kinetic and potential energy can happen in both directions, from kinetic to potential or from potential to kinetic
4. Describe the relationship between energy and mass
    - Einstein's equation shows that energy and mass are equivalent and can be converted into each other- In other words- Energy is released as matter is destroyed and matter can be created from energy
5. List the major nonrenewable and renewal sources of energy and describe how energy resources can be conserved
    - Nonrenewable energy resources include oil, natural gas, coal, and uranium
    - Renewable energy resources include hydroelectric, solar, geothermal, wind, biomass, and possibly in the future nuclear fusion
    - Energy resources can be conserved by reducing energy needs and increasing the efficiency of energy use
6. Differentiate between thermal energy, heat and temperature
    - The thermal energy of an object is the sum of the kinetic and potential energy of all the molecules in an object
    - Thermal energy depends on the mass, temperature, and phase (solid, gas, liquid) of an object
    - Thermal expansion occurs because particles of matter tend to move further apart as temperature increases
    - Heat is the transfer of thermal energy due to a temperature difference
    - Heat flows spontaneously from hot objects to cold objects
    - Temperature is a measure of the average value of the kinetic energy of the molecules in random motion
7. Interpret examples of heat transfer (e.g., home heating, solar panels) as convection, conduction, or radiation
    - Conduction is the transfer of thermal energy when substances are in direct contact
    - Conduction in gases is slower than in liquids and solids because the particles in a gas collide less often

- Radiation is the transfer of thermal energy by electromagnetic waves
- All objects radiate energy. As an object's temperature increases, the rate at which it radiates energy increases
- Convection is the transfer of thermal energy by the movement of matter
- Convention currents are important in many natural cycles, such as ocean currents, weather systems, and movements of hot rock in Earth's interior

8. Differentiate between the properties of thermal conductors and insulators
    - A thermal conductor is a material that conducts thermal energy well. Metal conducts thermal energy quickly
    - Thermal energy does not flow easily in an insulator easily. For example, wood and air are good insulators
9. Provide details for each of the three laws of thermodynamics
    - The first law of thermodynamics states that energy is conserved
    - The second law of thermodynamics states that thermal energy can flow form colder objects to hotter objects only if work is done on the system
    - The third law of thermodynamics states that absolute zero cannot be reached

ACTIVITIES:

- Give examples of the major forms of energy and explain how each is produced
- Describe conversions of energy from one form to another
- Illustrate that energy can be transformed from one form to another, using examples from everyday life and technology
- Calculate efficiency by identifying the useful energy in a process.
- Qualitatively identify the various energy transformations in simple demonstrations
- State and apply the Law of Conservation of Energy
- Classify energy resources as renewable and nonrenewable
- Relate thermal energy to the motion of particles that make up a material
- Describe conduction, convection, and radiation.
- Describe how different types of heating systems work
- Identify solar energy as the primary source of energy on earth
- Explain how solar energy is converted to other forms of energy on earth
- Provide and explain examples of how energy can be converted from potential energy to kinetic energy and the reverse
- Provide and explain examples showing linear momentum is the product of mass and velocity, and is conserved in a closed system distinguish between heat and temperature.
- Compare and contrast Celsius and Kelvin temperature scales and describe absolute zero.
- Illustrate and explain the effect of the addition or subtraction of thermal energy on the motion of molecules.
- Analyze a time/temperature graph of a phase change experiment to determine the temperature at which the phase change occurs

VOCABULARY:

- Chemical energy
- Conduction
- Convection
- Electrical energy
- Electromagnetic energy
- Energy
- Energy Conversion
- Heat
- Kinetic energy
- Mechanical energy
- Nuclear energy
- Potential energy
- Radiation
- Solar energy
- Temperature
- Thermal energy

ASSESSMENTS:

- ATBs/Closure Activities
- Daily Participation
- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
- Demonstrations
- Lab Participation
- Lab Reports
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(freezing point, melting point, or boiling point).
- Compare and contrast methods of thermal energy transfer (conduction, convection, and radiation) and provide and explain common examples.
- Explain, in simple terms, how the principle of thermal energy transfer applies to heat engines, thermostats, refrigerators, heat pumps, and geothermal systems.
- Design an investigation from a testable question related to thermal energy transfer. The investigation may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis.

RESOURCES:
Textbook:
Physical Science Concepts in Action– Prentice Hall
Chapter 15 and 16, pages 445-497

REMEDIATION:
- Class Notes
- Graphic Organizers
- Chunking of Information
- Oral Questioning
- Group Discussion
- Small Lab Group Participation
- Reinforcement Videos and Animations
- Computer Simulation/Modeling Projects
- Web-based Reinforcement Activities
- Cooperative Learning Groups
- Peer Tutoring
- Individualized Assistance
- Small Group Assistance
- Review Games
- Content Review

ENRICHMENT:
- Class Presentations
- Project-Based Assignments
- Online Research
- Group Discussions
- Online Review Games
- Independent Investigations
- Individualized Teacher Support
- Peer Tutoring

COURSE: General Physical Science	**GRADE(S): 10-11**
UNIT 9: Electricity	

PA ACADEMIC STANDARDS

3.2.12.A - **Physical Sciences: Chemistry and Physics ~ Chemistry**

3.2.12.A.1.
- Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.

3.2.12.A. 2.
- Distinguish among the isotopic forms of elements. Explain the probabilistic nature of radioactive decay based on subatomic rearrangement in the atomic nucleus. Explain how light is absorbed or emitted by electron orbital transitions.

3.2.12.A. 3.
- Explain how matter is transformed into energy in nuclear reactions according to the equation E=mc2.

3.2.12.A. 4.
- Apply oxidation/reduction principles to electrochemical reactions. Describe the interactions between acids and bases.

3.2.12.A. 5.
- MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.

3.2.12.B - **Physical Sciences: Chemistry and Physics ~ Physics**

3.2.12.B. 1.
- Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

3.2.12.B. 2.
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3.2.12.B. 4.
- Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

3.2.12.B. 5.
- Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission.

3.2.12.B. 6.
- CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

ESSENTIAL QUESTIONS:
- What is the role of energy in our world?
- How is the utilization of energy dependent upon its ability to be transformed and transferred?

FOCUS QUESTIONS:
- What is static charge and how can it be created and transferred?
- What is an electric current?
- What is an electrical conductor?
- What is an electrical insulator?
- Using Ohm's Law, how is voltage calculated?
- Using Ohm's Law, how is current calculated?
- Using Ohm's Law, how is resistance calculated?
- What is an electric circuit?
- What is the difference between series and parallel circuits?

- How can Ohm's Law be used to develop electric circuits?
- What causes lightning?
- What is an electrical force?
- How does a battery enable a flashlight to light?

OBJECTIVES/ESSENTIAL KNOWLEDGE

1. Explain how an electric charge is produced
    - Electric charge is a property that causes protons and electrons to attract or repel each other
    - An excess or shortage of electrons produces a net electric charge
2. Describe an electric force
    - The force of attraction or repulsion between electrically charged objects is electric force
    - Electric force depends on the charge and distance
    - Opposite charges attract each other
    - Like charges repel each other
3. Design an investigation to illustrate the effects of static electricity
    - Friction can cause electrons to be transferred from one object to another
    - These static electrical charges can build up on an object and be discharged slowly or rapidly
    - Charge can be transferred by friction, by contact and by induction
4. Construct and compare series and parallel circuits
    - An electric circuit is a complete path through which charge can flow
    - In a series circuit, charge has only one path through which it can flow, If one element stops functioning in a series circuit none of the elements can operate
    - A parallel circuit is an electric circuit with two or more path through which charges can flow, If one element stops functioning in a parallel circuit the rest of the element still can operate
5. Construct simple circuits to determine the relationship between voltage, resistance, and current.
    - Current:
        - In an electric circuit, voltage, resistance and current are related. According to Ohm's Law, this relationship can be written V=IR
        - The continuous flow of electric charge is electric current
        - There are two types of current- direct current and alternating current
        - Charge flows in one direction in direct current (DC) (battery operated devices normally use direct current
        - Alternating current (AC) is flow of electric charge that regularly reverses its direction (electric current in home and school is normally AC
            - Resistance
            - Resistance is opposition to the flow of charges in a material. A material's thickness, length, and temperature affect its resistance
            - Electric resistance is due to collisions between flowing electrons and the atoms in a material
            - Electric resistance in a circuit converts electrical energy into thermal energy and light
    - Voltage
        - Voltage is a measure of the amount of electrical potential energy an electron flowing in a circuit can gain
        - As voltage increases more potential energy is available to be transformed into other forms of energy
        - Voltage is measured in volts (V)
6. Determine the electric power used in a circuit.
    - The electric power used by an appliance is the rate at which the appliance converts electrical energy to other forms of energy
    - The electric power used by an appliance can be calculated using the equation P= IV (Power equals current x voltage)

- The electrical energy used by an appliance depends on the power of the appliance and the length of time it is used. Electrical energy usually is measured in kWh.

7. Describe electronic devices used to control electron flow
   - A generator is a device that converts mechanical energy into electrical energy.
   - Most of the electrical energy we use comes from generators. Electric motors convert electrical energy into mechanical energy that is used to do work. Examples of motors include those in many household appliances, such as blenders and washing machines.
   - A conductor is a material that transfers an electric current well. An insulator is material that does not transfer an electric current. A semiconductor is in-between a conductor and an insulator.
   - The diode is a semiconductor device that acts like a one way valve to control the flow of electricity in electrical circuits. Solar cells are made of semiconductor diodes that produce direct current (DC) when visible

ACTIVITIES:

- Design an investigation to illustrate the effects of static electricity.
- Construct and compare series and parallel circuits.
- Create an electromagnet and explain how it works.
- Explain the relationship between a magnetic field and an electric current.
- Construct simple circuits to determine the relationship between voltage, resistance, and current.
- Compare and contrast generators and motors and how they function.
- Identify situations in everyday life in which motors and generators are used.
- Provide examples of materials that are good conductors, semiconductors, and insulators.
- Identify current applications of semiconductors and their uses (e.g., diodes and transistors).

RESOURCES:

Textbook:
Physical Science Concepts in Action– Prentice Hall
Chapter 15, page 445-472

VOCABULARY:

- Alternating Current
- Battery
- Conductor
- Direct Current
- Electric Charge
- Electric Circuit
- Electric Current
- Electric Field
- Electric Force
- Electronics
- Fuse
- Insulator
- Ohm's Law
- Parallel Circuit
- Resistance
- Series Circuit
- Static Electricity
- Voltage

ASSESSMENTS:

- ATBs/Closure Activities
- Daily Participation
- Daily Classwork
- Homework
- Group Discussions
- Group Projects
- Individual Projects
- Cooperative Learning Activities
- Model Creations
- Writing Prompts
- Reading Guides
- Demonstrations
- Lab Participation
- Lab Reports
- Online Research
- Group Presentations
- Individual Presentations
- Quizzes
- Unit Tests
- Final Exams

REMEDIATION:

- Class Notes

	• Graphic Organizers • Chunking of Information • Oral Questioning • Group Discussion • Small Lab Group Participation • Reinforcement Videos and Animations • Computer Simulation/Modeling Projects • Web-based Reinforcement Activities • Cooperative Learning Groups • Peer Tutoring • Individualized Assistance • Small Group Assistance • Review Games • Content Review **ENRICHMENT:** • Class Presentations • Project-Based Assignments • Online Research • Group Discussions • Online Review Games • Independent Investigations • Individualized Teacher Support • Peer Tutoring