AP Chemistry Unit 1-Safety and Scientific Method

Content Area: **Science**
Course(s): **Sample Course**
Time Period: **SeptOct**
Length: **4 Weeks**
Status: **Published**

Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

AP Chemistry

11,12

Belleville Board of Education

102 Passaic Avenue

Belleville, NJ 07109

Prepared by: Joy Elaine Alfano, Ph.D

Dr. Richard Tomko, Superintendent of Schools

Mr. Thomas D'Elia, Director of Curriculum and Instruction

Ms. Diana Kelleher, District Supervisor of ELA/Social Studies

Mr. George Droste, District Supervisor of Math/Science

Board Approved: OCTOBER 17, 2016

Unit Overview

1. Safety in the Laboratory - Proper laboratory techniques and safety protocols are esential in the high school science laboratory
2. Introduction to Chemistry and Chemistry as a Physical Science - Chemical reactions, including rates of reactions and energy changes, can be understood by students at this level in terms of the collisions of molecules and the rearrangements of atoms.
3. Introduction to Chemistry and Chemistry as a Physical Science - Students are expected to communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
4. Data Collection and Analysis - The crosscutting concepts of *structure and function*, *patterns*, *energy and matter*, and *stability and change* are called out as the framework for understanding the disciplinary core ideas. Students use *developing and using models*,*planning and conducting investigations*, *using mathematical thinking*, and *constructing explanations and designing solutions*.
5. Data Collection and Analysis -Students are also expected to use the science and engineering practices to demonstrate proficiency with the core ideas.
6. Data Collection and Analysis -Students analyze major global problems. They begin by breaking these problems into smaller problems that can be tackled with engineering methods. To evaluate potential solutions, students are expected not only to consider a wide range of criteria, but also to recognize that criteria need to be prioritized.

This unit is based on HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS2-6, HS-ETS1-3, and HS-ETS1-4.

NJSLS

HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Exit Skills

Skills Checklist:

1. know, understand, and practice safety protocols and meaures

- read and understand SDS sheets
- understand the selection process of safety equipment
- follow safety procedures and respond during an emergency

2. Identify basic laboratory materials

- select which measurement tools should be used balances, rulers, thermometers, and graduated cylinders

3. Use units and measure in the metric system

- demonstrate the ability to measure using electronic balances, rulers, thermometers, and graduated cylinder
- show proficiency in units of measurement
- identify the differences between acurracy and precision as they pertain to measurement
- use the rules of significant figures in order to perform mathmatical operations using significant figure
- use signific notation to express numerical equations
- use dimensional analysis to complete calculations
- preform simple density equation

4. use the scientific method

- collect, organize, and analyze data
    - **identify the independent and dependent variables when given a set of data**
    - **identify the independent and dependent variables in an experiment when given a research question**
    - **dentify two or more variables that must be controlled in an experiment.**
    - **write a research question for an experiment stating the independent and dependent variables.**

- transfer learning of scientific method in use of the scientific method to address a specific practice or problem
- organize the data in coordination of the specific problem
- analyze the data and note errors and possible sources of error
- anaylze data noting errors
- idenitification of errors within experimental design and experimental process

Enduring Understanding

Ednuring Understandings:

1. In these lessons students learn what the science of chemistry means and how will we approach learning chemistry through a combination of didactic and practical exercises. A learning schedule and procedures are imperative to create a safe, structured, and enthusiastic learning environment. In this first unit students will receive necessary information from instructor regarding applicable classroom and lab policies of the school.
2. All our surroundings and every object solid, liquid, and gas is matter. Matter can be classified and identified by their properties whether extensive properties or intensive properties. Extensive properties are dependent upon how much matter is present while intensive are dependent on type of material. We can classify matter by their physical properties and can then explore physical changes where matter changes phase although the chemical composition remains the same.

Essential Questions

Essential Questions:

1. What is the science of chemistry and what are the methods that will be utilized in order to gain the knowledge of chemistry?
2. What are classroom expectations and rules? What is safety first?
3. How is data collected and analyzed?
4. How does properties of matter determine how we use or create products that we use every day?
5. How come physical changes do not change the composition of matter?
6. How does quantum mechanics provide insight into nature?
7. How are physical and chemical properties explained by the structure of the atom?
8. How does the arrangement of electrons in an atom determine chemical activity?

Learning Objectives

1. Translating among macroscopic observations of change, chemical equations, and particle views.
2. Translating an observed chemical change into a balanced chemical equation, and justify the choice of equation type (molecular, ionic, or net ionic) in terms of utility for the given circumstances.
3. Using stoichiometric calculations to predict the results of performing a reaction in the laboratory and/or to analyze deviations from the expected results.
4. Relating quantities (measured mass of substances, volumes of solutions, or volumes and pressures of gases) to identify stoichiometric relationships for a reaction, including situations involving limiting reactants and situations in which the reaction has not gone to completion.
5. Designing, and/or interpreting data from, an experiment that uses gravimetric analysis to determine the concentration of an analyte in a solution.
6. Designing a plan in order to collect data on the synthesis or decomposition of a compound to confirm the conservation of matter and the law of definite proportions.

Interdisciplinary Connections

MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
LA.RH.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of primary and secondary sources, connecting insights gained from specific details to develop an understanding of the text as a whole.

LA.RH.11-12.2	Determine the theme, central ideas, information and/or perspective(s) presented in a primary or secondary source; provide an accurate summary of how key events, ideas and/or author's perspective(s) develop over the course of the text.
LA.RH.11-12.3	Evaluate various perspectives for actions or events; determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.
LA.RH.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, qualitatively, as well as in words) in order to address a question or solve a problem.
LA.RH.11-12.8	Evaluate an author's claims, reasoning, and evidence by corroborating or challenging them with other sources.
LA.RH.11-12.9	Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
	Data are gathered, displayed, summarized, examined, and interpreted to discover patterns and deviations from patterns. Quantitative data can be described in terms of key characteristics: measures of shape, center, and spread. The shape of a data distribution might be described as symmetric, skewed, flat, or bell shaped, and it might be summarized by a statistic measuring center (such as mean or median) and a statistic measuring spread (such as standard deviation or interquartile range). Different distributions can be compared numerically using these statistics or compared visually using plots. Knowledge of center and spread are not enough to describe a distribution. Which statistics to compare, which plots to use, and what the results of a comparison might mean, depend on the question to be investigated and the real-life actions to be taken.
	Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability. Statistics provides tools for describing variability in data and for making informed decisions that take it into account.
	Functions may be used to describe data; if the data suggest a linear relationship, the relationship can be modeled with a regression line, and its strength and direction can be expressed through a correlation coefficient.

Alignment to 21st Century Skills & Technology

Key SUBJECTS AND 21st CENTURY THEMES

- English, reading and language arts
- Mathematics
- Science
- Computer Science
- Economics and Government

21st Century/Interdisciplinary Themes

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

21st Century Skills

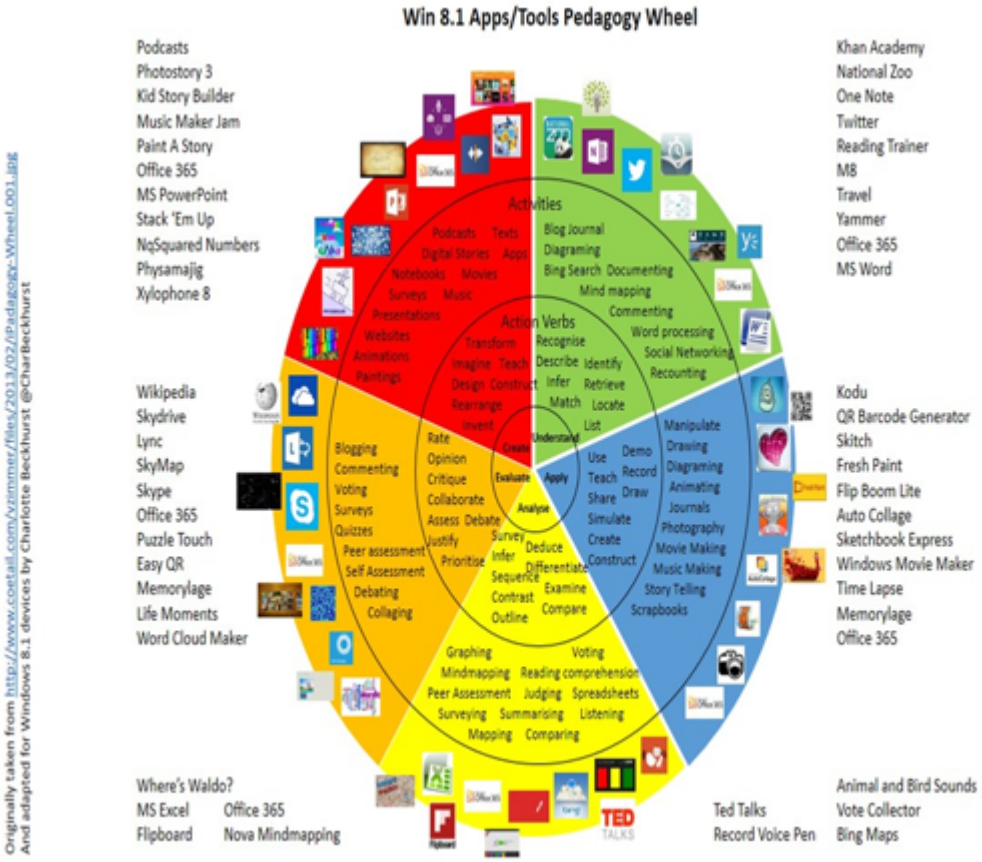
- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to

	search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Technology Infusion

What technology can be used in this unit to enhance learning?



Differentiation

As a Reminder:

The basis of good differentiation in a lesson lies in differentiating by content, process, and/or product.

Resources:

- NJDOE: Instructional Supports and Scaffolds for Success in Implementing the Common Core State Standards http://www.state.nj.us/education/modelcurriculum/success/math/k2/

Special Education

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

ELL

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

Intervention Strategies

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests

- using videos, illustrations, pictures, and drawings to explain or clarify

Evidence of Student Learning-CFU's

Please list ways educators may effectively check for understanding in this secion.

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit tests

Primary Resources

Please list all resources available to you that are located either within the district or that can be obtained by district resources.

Ancillary Resources

1. Teacher and Publisher supplied powerpoints, notes, laboratory guides, and worksheets
2. Textbooks
3. Resource Manuals
4. Internet Resources
5. Computer and smartboard Activities

Sample Lesson

Enduring Understandings: Scientific Measurement is used during experimentation to collect data. Students must learn to express and evaluate measurements in a scientific way. The metric system is the system in which scientist's measure length, mass, and volume. Students will become familiar with the system of unites used for scientific measurement and apply dimensional analysis to solve conversion problems.

Lesson Rational: Scientists use research techniques to explore, examine, and extrapolate knowledge. Students must experience conduction experiments, collect data, examine data, and analyze data along with expressing their finding in writing in a clear and well developed report.

Essential Questions: How do scientists use, express, and evaluate measurements in experiments?

Objectives: Students will be able to

1. Convert measurements to scientific notation
2. Distinguish among accuracy, precision, and give examples
3. Define the error of measurement
4. Determine the number of significant figures in a measurement and summarize rules
5. Determine the number of significant figures in a calculation and summarize the rules fro addition and subtraction

Anticipatory Set: What is the difference between accuracy and precisio

Student Centered Inquiry-based Learning Procedure/Method:

1.) Anticipatory Set

2.) Didactic Presentation - Power Point

3.) Sample Problems

4.) Concept Check

Meaningful Closure: Socratic Questioning

Differentiation: Use of didactic and practical exercises are used in this lesson

Accommodations: Accommodations will be made as specified by IEP.

Pre, Formative and/or Summative Assessment Strategies Evaluations: Students will complete learning and concept checks with an accuracy of 100%.