AP Chemistry Unit 2: Solutions and Stoichiometry

Content Area: **Science**
Course(s): **Sample Course**
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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

AP Chemistry

11, 12

Belleville Board of Education

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Unit Overview

Topics include:

1. Matter and Energy
2. The mole concept
3. Names of compounds
4. Chemical formulas
5. Limiting reactant
6. Percent yield

NJSLS

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-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-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-PS1-2	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. The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.
HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-PS1-2.PS1.B.1	The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.
HS-PS1-2.1.1	students observe patterns in systems at different scales and cite patterns as empirical evidence for causality in supporting their explanations of phenomena. They recognize classifications or explanations used at one scale may not be useful or need revision using a different scale; thus requiring improved investigations and experiments. They use mathematical representations to identify certain patterns and analyze patterns of performance in order to reengineer and improve a designed system.
HS-PS1-3.3	Planning and Carrying Out Investigations
HS-PS1-3.3.1	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
HS-PS1-3.PS1.A.1	The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.
HS-PS1-3.PS1.A.2	Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.
HS-PS1-7.5	Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
HS-PS2-4.5.1	Use mathematical representations of phenomena to describe explanations.

Exit Skills

1. name binary compounds
2. name compounds containing polyatomic ions
3. write the formula of a compound given its name
4. predict the products of reactions based upon the reactants
5. mathematical prove the relationship between reactants and products
6. identify the reagent that is in excess and limited
7. identify the theoretical yield of a chemical process
8. calculate the percent yield

Enduring Understanding

1. representations and models can be used to communicate scientific phenomena and solve scientific problems.
2. mathematics, appropriately applied, can be used to explain phenomena.
3. scientific questioning can be used to extend thinking or to guide investigations within the context of the AP course. planning and implementation of data collection strategies in relation to a particular scientific question, leads to supported conclusions and problem solutions
4. proper data analysis and evaluation of evidence is imperative in scientific studies.
5. scientific explanations and theories must be used as guiding principles for scientific investigations
6. connections of knowledge across various scales, concepts, and representations in and across domains leads to comprehensive responses to problems in science.

Essential Questions

1. Why is it necessary to determine the composition of mixtures?
2. Why do chemical engineers ensure that expensive reactants are completely used in a manufacturing process?

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
7. Using data from synthesis or decomposition of a compound to confirm the conservation of matter and the law of definite proportions.

8. Selecting and applying mathematical routines to mass data to identify or infer the composition of pure substances and/or mixtures.
9. Justifying the observation that the ratio of the masses of the constituent elements in any pure sample of that compound is always identical on the basis of the atomic molecular theory.
10. Selecting and applying mathematical relationships to mass data in order to justify a claim regarding the identity and/or estimated purity of a substance.
11. 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.

Interdisciplinary Connections

Please list all and any cross-curricular content standards that link to this Unit.

MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
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.
MA.S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
MA.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
MA.S-ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
MA.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
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.
	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

Mastery of key subjects and 21st century themes is essential for all students in the 21stcentury.

Key subjects include:

- English, reading or language arts
- World languages
- Arts
- Mathematics
- Economics
- Science
- Geography
- History
- Government and Civics

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

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. Do now activities; section and chapter review questions, reinforcement worksheets, homework, proble m solving, and Q&A
2. Lab activities and lab reports
3. Video on Lab Safety
4. Video on the Metric System
5. PowerPoint Presentation
6. www.masteringchemistry.com
7. textbook
8. Internet Resources
9. Science Department Video Library
10. United Streaming
11. Demonstration (Demo a Day, Shakazeera Demo Books, Textbook Demonstrations)
12. The Princeton Review, cracking the AP chemistry exam
13. Laboratory manual: Hostage David, Fossett Martin, AP Chemistry

Sample Lesson