AP Chemistry Unit 6: Bonding, VSEPR, and Inter-molecular Forces

Content Area: **Science**
Course(s): **Sample Course**
Time Period: **January**
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 adapted from Pietro Doldi 2010

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

- Topics:

    1. Covalent Bonding
    2. Multiple Bonds
    3. Polarity
    4. Resonance structure and formal charge
    5. VSEPR Theory
    6. Molecular Geometry
    7. Intermolecular Forces

NJSLS

SCI.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.
SCI.HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

SCI.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.
SCI.HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
SCI.HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
SCI.HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
SCI.HS-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
SCI.HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
SCI.HS-PS2-5	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

Exit Skills

Skills;

1. draw Lewis dot structures for covalent and ionic compounds
2. predict the shape of molecules and their polarity fi:om Lewis dot structures using VSEPR Theory
3. understand the differences between chemical bonds and intermolecular forces of attraction and how they relate to states of matter and their properties
4. Apply knowledge of resonance structures to explain the properties of some molecules
5. Calculate the formal charge of atoms, and how to use it to predict the stability of a given structure
6. assign de type of hybridization of atoms in a molecule e predict the bond angle
7. predict and explain which species have the highest boiling / melting point
8. predict and explain the solubility of different elements / compounds

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.
4. planning and implementation of data collection strategies in relation to a particular scientific question, leads to supported conclusions and problem solutions
5. proper data analysis and evaluation of evidence is imperative in scientific studies.
6. scientific explanations and theories must be used as guiding principles for scientific investigations
7. connections of knowledge across various scales, concepts, and representations in and across domains leads to comprehensive responses to problems in science.

Essential Questions

1. How does the particular sequence and type of chemical bond between atoms affect chemical and physical properties of multi-atomic materials?
2. How can there be so many different kinds of materials in the universe if there are only 90 naturally occurring elements?
3. Why is life on Earth Carbon-based?

Learning Objectives

1. describe and draw Lewis Dot Diagrams and Lewis Structures?
2. compare and contrast Ionic Bonds to Covalent Bonds?
3. predict plausible Lewis Structures for Complex Covalent Bonding (Multiple Bonds)?
4. explain why a molecule forms multiple bonds?
5. evaluate the molecular geometry of challenging molecules using the VSEPR Theory?
6. molecules resonance structures are needed?
7. How formal charge can help to predict the stability of a structure?
8. predict the hybridization of the orbitals and the bond angle?
9. identify, the type and classify the strength of different intermolecular forces
10. predict and explain which species have the highest boiling / melting point?
11. predict and explain the solubility of different elements / compounds?

Interdisciplinary Connections

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

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.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
	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

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

Please list ALL other resources available to strengthen your lesson.

Sample Lesson