AP Chemistry Unit 2

Content Area: **Science**
Course(s): **Chemistry AP**
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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

AP Chemistry 11,12

UNIT 2 - MOLECULAR AND IONIC COMPOUNDS

Belleville Board of Education

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Board Approved:

Unit Overview

Topics include:

Bohr Model

Quantum Model

Electron configuration including noble gas and orbital notation

Ionization Energy

Electron Affinity

Atomic and ionic size

Ionic Bonding

Coulomb's law and lattice energy

Covalent Bonding

Multiple Bonds

Polarity

Resonance structure and formal charge

VSEPR Theory

Molecular Geometry

Air composition and its effects on climate change

Enduring Understanding

Enduring 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. How come physical changes do not change the composition of matter?
2. How does quantum mechanics provide insight into nature?
3. How are physical and chemical properties explained by the structure of the atom?
4. How does the arrangement of electrons in an atom determine chemical activity?

Exit Skills

Skills Checklist:

- Calculate the wavelength of radiations emitted by electrons
- Determine electronic configuration
- Apply the Quantum Mechanical Model and how to use this model create an orbital diagram
- Relate the position of an element in the periodic table to its atomic number and atomic mass according to the periodic law
- Use the periodic table to identify families/groups as well as trends of electrons available for bonding.(Valence electrons)
- Relate the position of an element in the periodic table to its quantum electron configuration and to its reactivity with other ele ments in the table
- Atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds
- Salt crystals are repeating patterns of positive and negative ions held together by electrostatic attraction
- Calculate lattice energy
- Draw Lewis dot structures for covalent and ionic compounds
- Predict the shape of molecules and their polarity from Lewis dot structures using VSEPR Theory
- Understand the differences between chemical bonds and intermolecular forces of attraction and how they relate to states of matter and their properties
- Apply knowledge of resonance structures to explain the properties of some molecules

New Jersey Student Learning Standards (NJSLS-S)

NextGen Science Standards

SCI.HS.PS1.A	Structure and Properties of Matter
SCI.HS.PS2.B	Types of Interactions
SCI.HS.PS1.A	Structure and Properties of Matter
	Developing and Using Models
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.PS1.C	Nuclear Processes
SCI.HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and climate change have influenced human activity.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
SCI.HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
SCI.HS.ESS2.D	Weather and Climate
SCI.HS.ESS3.D	Global Climate Change
SCI.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.
SCI.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.
SCI.HS.ETS1.B	Developing Possible Solutions

Interdisciplinary Connections

Please list all and any additional **Interdisciplinary Connections/Cross-Curricular** New Jersey Student Learning Standards that link to this unit, and which are not included in the NJSLS section above.

LA.RH.11-12	Reading History
MA.N-RN.A	Extend the properties of exponents to rational exponents.
MA.N-RN.B	Use properties of rational and irrational numbers.
MA.N-Q.A	Reason quantitatively and use units to solve problems.
LA.RST.11-12	Reading Science and Technical Subjects
LA.WHST.11-12	Writing History, Science and Technical Subjects

Learning Objectives

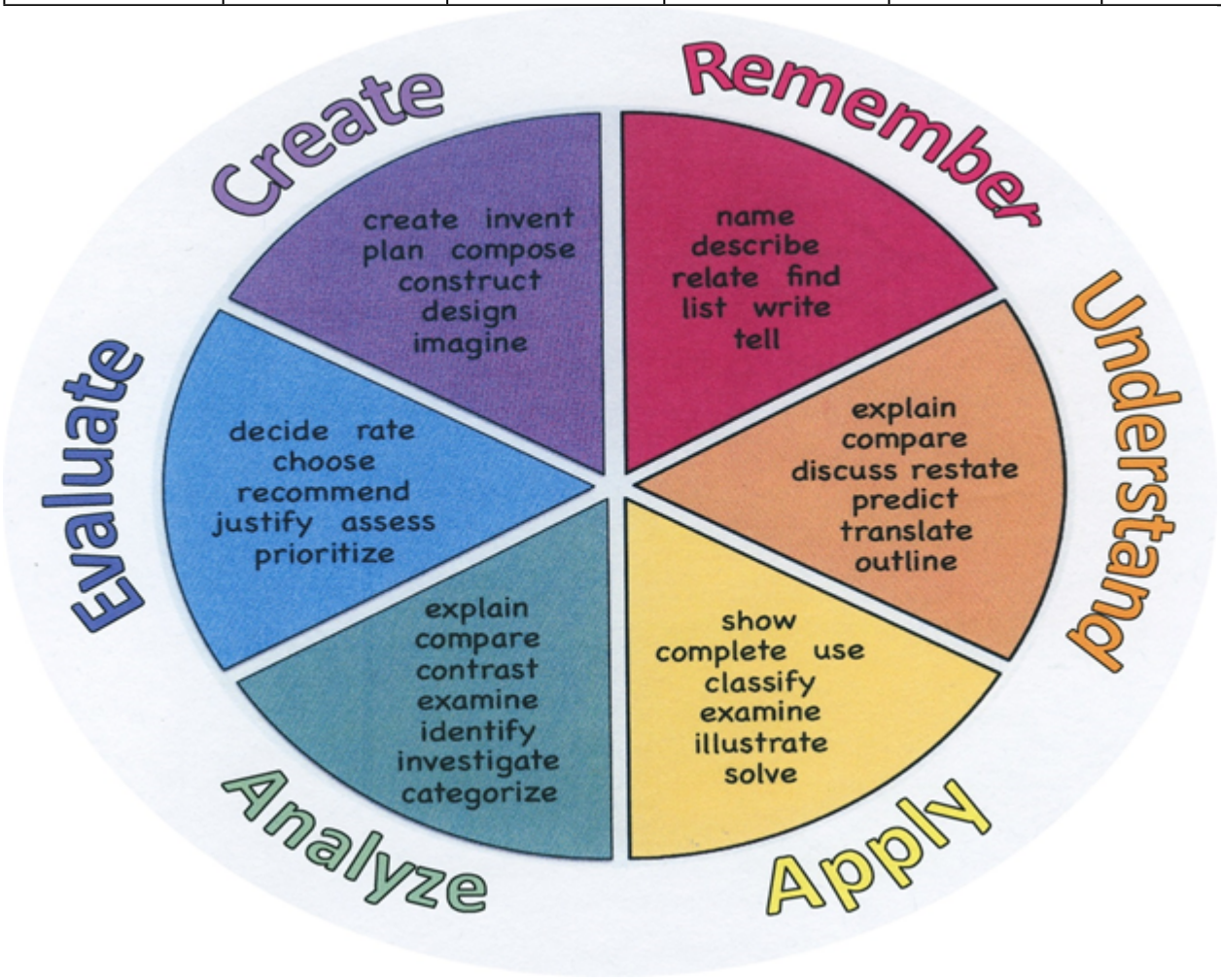
1. Differentiate Electromagnetic Radiation their applications, and the effect on the human body
2. Differentiate the Bohr Model of the Atom and the Quantum Mechanical Model
3. Relate the Quantum Mechanical Model to Electron Configuration

4. Integrated Electron Configuration into the Modem Theory of the atom
5. Compare and contrast electron configuration to quantum numbers
6. Deduce the electron configuration of an element from the periodic table
7. Formulate the relationship between periodic properties and the periodic table
8. Differentiate between atomic properties and ionic properties
9. Justify that a bond is a force of attraction between charged particles
10. Identify the relationship between cation and anions in a compound
11. Calculate the lattice energy of an ionic compound
12. Integrate Coulomb's law into chemical bonds properties
13. Describe and draw Lewis Dot Diagrams and Lewis Structures.
14. Compare and contrast Ionic Bonds to Covalent Bonds.
15. Predict plausible Lewis Structures for Complex Covalent Bonding (Multiple Bonds).
16. Explain why a molecule forms multiple bonds.
17. Evaluate the molecular geometry of challenging molecules using the VSEPR Theory.
18. Molecules resonance structures are needed.
19. How formal charge can help to predict the stability of a structure.
20. Predict the hybridization of the orbitals and the bond angle.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			

	Discuss Estimate Extrapolate Generalize Predict	Modify Operate Subtract			



Suggested Activities & Best Practices

- What situations in ordinary life could help to master this unit?

Analyze a line spectrum and calculate frequency and energy of several radiations.

- Debate the differences between a line spectrum and a continuous spectrum.

- Build tridimensional tablets to visualize atomic trends.

- Atmospheric concentration of Carbon Dioxide (ppm) and consequences on climate change.

How LGBTQ Scientists made a difference in our society.

Assessment Evidence - Checking for Understanding (CFU)

Student must be able to graph fundamental atomic trends: atomic radius, ionization energy, electron affinity. (Formative)

Students must be able to read wavelength from a spectroscope. (Formative)

Students must be able to convert different types of electron configuration notations. (Formative)

Unit Test/Quiz (Summative)

"Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics

- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Chemistry - The Central Science: AP Edition; 12th Edition.

Pearson: Brown, Lemay, Bursten, Murphy, and Woodward 2012

Albert.io

AP Collegeboard

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

Technology Infusion

Use a spectrophotometer to find unknown concentrations of solutions.

Use a spectrophotometer to find the wavelength of maximum absorption of solutions.

Use spectroscope to read line spectra.

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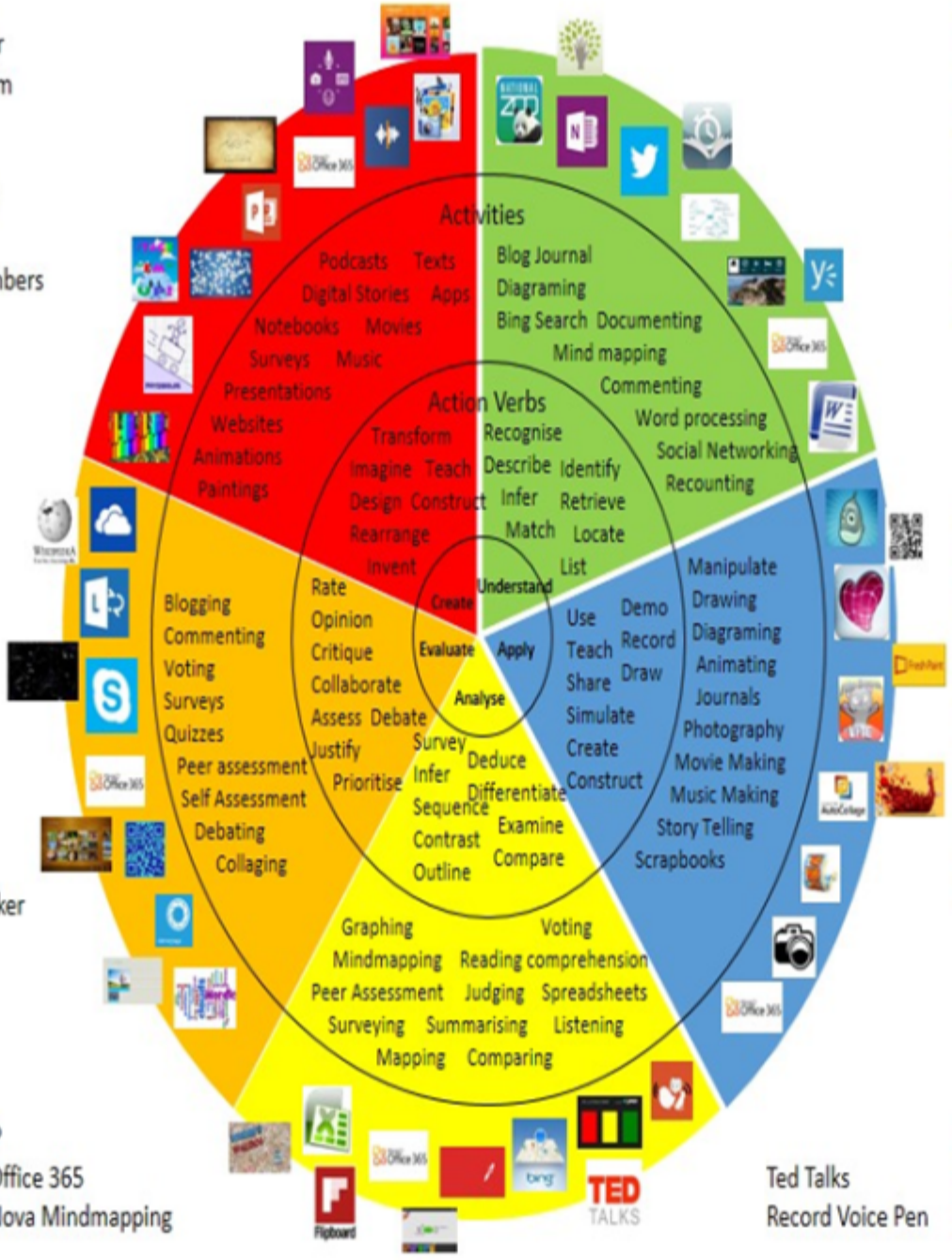
AP Collegeboard

What **Technology Infusion** and/or strategies are integrated into this unit to enhance learning? Please list all hardware, software and strategies. Please find a technology pedagogy wheel for assistance while completing this section.

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel
Flipboard
Office 365
Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

CS.9-12.8.1.12.NI.1	Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing.
CS.9-12.8.1.12.NI.2	Evaluate security measures to address various common security threats.
CS.9-12.8.2.12.ED.5	Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
CS.9-12.8.2.12.ED.6	Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
WRK.9.2.12.CAP.10	Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans).
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.DC.2	Compare and contrast international differences in copyright laws and ethics.

21st Century Skills/Interdisciplinary Themes

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century/Interdisciplinary Themes** that will be incorporated into this unit.

- 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

21st Century Skills

Please list only the **21st Century Skills** that will be incorporated into this unit.

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

Differentiation

Please remember: Effective educational **Differentiation** in a lesson lies within content, process, and/or product.

Please identify the ones that will be employed in this unit.

Differentiations:

- Small group assignments (to prepare a unit 1review of key concepts)
- Extra time to complete assignments (completed at home)
- Pairing oral instruction with visuals (College Board videos of Unit 1Review)
- Repeat directions (Rephrase the problem on mixtures giving real-life examples)
- Use manipulatives (building atoms)
- Multisensory approaches (youtube videos on Unit 1)

- Preview content & concepts (percent composition of students in AP chem class)
- Student(s) work with an assigned partner (Complete a lab on flame test)
- Visual presentation (flame test lab video)

Hi-Prep Differentiations:

- Alternative formative and summative assessments (debating atomic trends exceptions)
- Leveled rubrics (writing rubric with siblings that took a science class in college)
- Project-based learning (propose a new project for low prep students)
- Problem-based learning (design solution for climate change)

Lo-Prep Differentiations

- Choice of books or activities (choose an article on Newsela on global warming)
- Cubing activities (apply the cubic method to atomic trends)
- Reading buddies (pair Lo-prep and Hi-prep students)
- Varied supplemental materials (Youtube videos on electron configuration)

Special Education Learning (IEP's & 504's)

Please identify the **Special Education Learning** adaptations that will be employed in the unit, using the ones identified below.

- visualize Sodium Chloride Structure.

- behavior management plan (Cubing activities (apply the cubic method to the periodic table)
- computer or electronic device utilizes (Varied supplemental materials (Youtube videos on climate change)
- modified assignment format (Reading buddies (pair Lo-prep and Hi-prep students)
- student working with an assigned partner (Students must be able to build atomic models)
- Use open book, study guides, test prototypes (choose an article on Newsela on global warming)

English Language Learning (ELL)

Please identify the **English Language Learning** adaptations that will be employed in the unit, using the ones identified below.

Students are provided with a glossary in their native language of climate change.

Spanish-speaking students may utilize the Spanish Edition of a Textbook to solve Unit 2 problems.

- visualize Sodium Chloride Structure.

- using videos, illustrations, pictures, and drawings to explain or clarify (Students are provided with videos in their native language on climate change.)
- allowing the use of note cards or open-book during testing (Students are provided with glossary in their native language)
- providing study guides (Students are provided with a glossary in their native language on climate change)

At Risk

Please identify Intervention Strategies that will be employed in the unit, using the ones identified below.

- visualize Sodium Chloride Structure.

- teaching key aspects of a topic. Eliminate nonessential information ((electron configuration exceptions are omitted))
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required (electron configuration exceptions are omitted)
- having peers take notes or providing a copy of the teacher's notes (videos from College Board provided)
- tutoring by peers (climate change discussed by peers)
- using videos, illustrations, pictures, and drawings to explain or clarify (Students provided access to virtual labs)

Talented and Gifted Learning (T&G)

Please identify the **Talented and Gifted** adaptations that will be employed in the unit, using the ones identified below.

- visualize Ammonium Nitrate Structure.

- Advanced problem-solving (Students must be able to analyze Schrodinger Equation)
- Allow students to work at a faster pace (Princeton Review problems are solved)
- Cluster grouping (to propose original solutions of climate change)
- Complete activities aligned with above grade level text using Benchmark results (Students must be able to analyze Schrodinger Equation)
- Higher order, critical & creative thinking skills, and discovery (exceptions of electron configuration are underlined and discussed)

- Using atomic models to identify the shape, the bond angle and the hybridization of molecules.

Sample Lesson

Unit Name: Ionic and molecular compounds.

NJSLS: SCI.HS-PS1 &2 &3 & 4; SCI.HS.ESS3.D

Interdisciplinary Connection: Vocabulary and algebra contents

Statement of Objective: Students will demonstrate the ability to build the molecular structure phosphoric acid, propose, molecular shape, bond angles, and hybridization of the atoms with 90% accuracy.

Anticipatory Set/Do Now: What do you know about valence electrons?

Learning Activity: Lecture - molecular shape, bond angles, and hybridization, and How LGBTQ Scientists made a difference in our society.
Small groups activities: to build the molecular structure phosphoric acid, propose, molecular shape, bond angles, and hybridization of the atoms
Final review: ionic and covalent bonds.

Student Assessment/CFU's: Survey, written report, Exit ticket

Materials: Chromebook, balls and sticks
21st Century Themes and Skills: Critical thinking and Problem Solving

Differentiation/Modifications:

Students must be able to build the structure of citric acid. (Gifted and Talented)

Students must be able to build the structure of nitrous acid. (Special Ed)

Integration of Technology: Chromebook PowerPoint Presentation