# AP Chemistry Unit 1 (Physical Science, Engineering Design)

Content Area: **Science**
Course(s): **Chemistry AP**
Time Period:
Length: **20 Days**
Status: **Published**

## Title Section

## Department of Curriculum and Instruction

**Belleville Public Schools**

**Curriculum Guide**

# AP Chemistry

# 11,12

# Big Idea #1 (The Chemical Elements)

**Belleville Board of Education**

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Board Approved: September 23, 2019

## 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

Intermolecular Forces

## 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 p eriodic 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 reactivit y with other elements in the table

Atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging el ectrons 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

Calculate the formal charge of atoms, and how to use it to predict the stability of a given structure

Assign the type of hybridization of atoms in a molecule and predict the bond angle

Predict and explain which species have the highest boiling / melting point

## New Jersey Student Learning Standards (NJSLS-S)

NextGen Science Standards

| | |
|---|---|
| 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-ETS1-1 | Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. |
| 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 |

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| | 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-PS1-3 | 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-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. |
| HS-PS2-6 | Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. |
| 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-PS1-4 | Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. |
| HS-PS1-5 | Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. |
| HS-PS1-6 | Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. |
| 9-12.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. |
| 9-12.HS-ETS1-1.1.1 | Analyze complex real-world problems by specifying criteria and constraints for successful solutions. |
| 9-12.HS-ETS1-4.4.1 | Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows— within and between systems at different scales. |
| 9-12.HS-ETS1-4.5.1 | Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. |
| 9-12.HS-ETS1-2.6.1 | Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. |
| 9-12.HS-ETS1-3.6.1 | Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. |
| 9-12.HS-ETS1-1.ETS1.A.1 | Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. |
| 9-12.HS-ETS1-4.ETS1.B.1 | Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. |
| 9-12.HS-ETS1-3.ETS1.B.1 | When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. |
| 9-12.HS-ETS1-2.ETS1.C.1 | Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. |
| 9-12.HS-PS1-3.1.1 | students observe patterns in systems at different scales and cite patterns as empirical |

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| | 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. |
| 9-12.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. |
| 9-12.HS-PS1-5.1.1 | 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. |
| 9-12.HS-PS1-1.1.1 | 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. |
| 9-12.HS-PS1-1.2.1 | Use a model to predict the relationships between systems or between components of a system. |
| 9-12.HS-PS1-8.2.1 | Develop a model based on evidence to illustrate the relationships between systems or between components of a system. |
| 9-12.HS-PS1-4.2.1 | Develop a model based on evidence to illustrate the relationships between systems or between components of a system. |
| 9-12.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. |
| 9-12.HS-PS1-4.5.1 | Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. |
| 9-12.HS-PS1-8.5.1 | In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. |
| 9-12.HS-PS1-2.6.1 | Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. |
| 9-12.HS-PS2-6.6.1 | students investigate systems by examining the properties of different materials, the structures of different components, and their interconnections to reveal the system's function and/or solve a problem. They infer the functions and properties of natural and designed objects and systems from their overall structure, the way their components are shaped and used, and the molecular substructures of their various materials. |
| 9-12.HS-PS1-5.6.1 | Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. |
| 9-12.HS-PS1-6.6.1 | Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. |
| 9-12.HS-PS1-6.7.1 | students understand much of science deals with constructing explanations of how things |

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| | change and how they remain stable. They quantify and model changes in systems over very short or very long periods of time. They see some changes are irreversible, and negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize systems can be designed for greater or lesser stability. |
| 9-12.HS-PS2-6.8.1 | Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). |
| 9-12.HS-PS1-6.PS1.A.1 | The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. |
| 9-12.HS-PS2-6.PS1.A.1 | The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. |
| 9-12.HS-PS1-1.PS1.A.1 | Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. |
| 9-12.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. |
| 9-12.HS-PS1-4.PS1.A.1 | A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. |
| 9-12.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. |
| 9-12.HS-PS1-1.PS1.A.2 | 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. |
| 9-12.HS-PS1-1.PS1.A.3 | 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. |
| 9-12.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. |
| 9-12.HS-PS1-6.PS1.B.1 | In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. |
| 9-12.HS-PS1-4.PS1.B.1 | Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. |
| 9-12.HS-PS1-5.PS1.B.1 | Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. |
| 9-12.HS-PS1-8.PS1.C.1 | Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. |
| 9-12.HS-PS2-6.PS2.B.1 | 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. |

## Interdisciplinary Connections

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

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.

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| 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.11-12.4 | Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines faction in Federalist No. 10). |
| 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.WHST.11-12.2.A | Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. |
| LA.WHST.11-12.2.B | Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. |
| LA.WHST.11-12.2.E | Provide a concluding paragraph or section that supports the argument presented. |
| LA.WHST.11-12.6 | Use technology, including the Internet, to produce, share, and update writing products in response to ongoing feedback, including new arguments or information. |
| LA.WHST.11-12.8 | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |

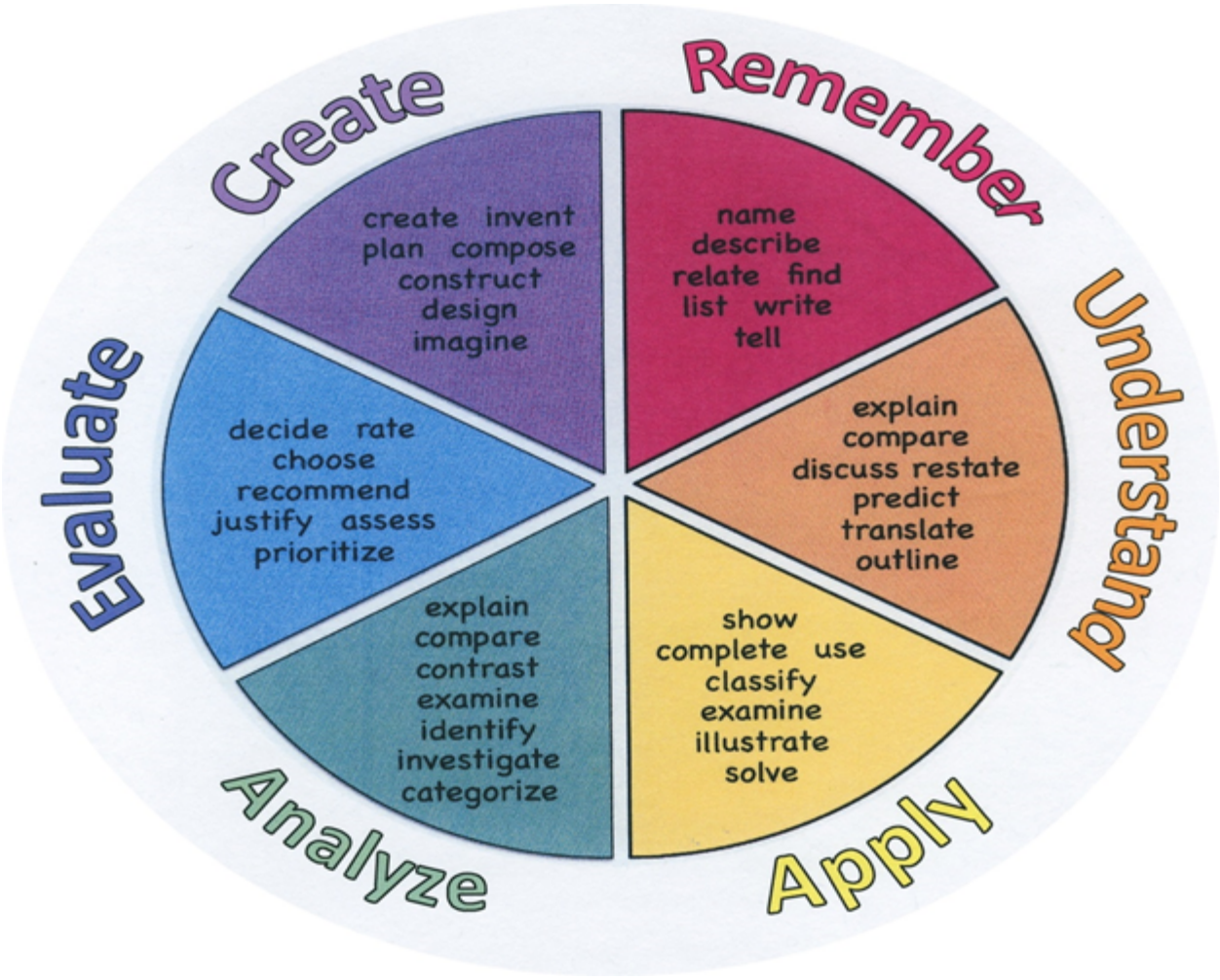
## Learning Objectives

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.
21. Identify, the type and classify the strength of different intermolecular forces

**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 | Modify | | | |
| | Estimate | Operate | | | |
| | Extrapolate | Subtract | | | |
| | Generalize | | | | |
| | Predict | | | | |




## 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.

## 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

## 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 spectrophotometer to find unknown concentration of solutions.

Use spectrophotometer to find wavelength  of maximum absorption of solutions.

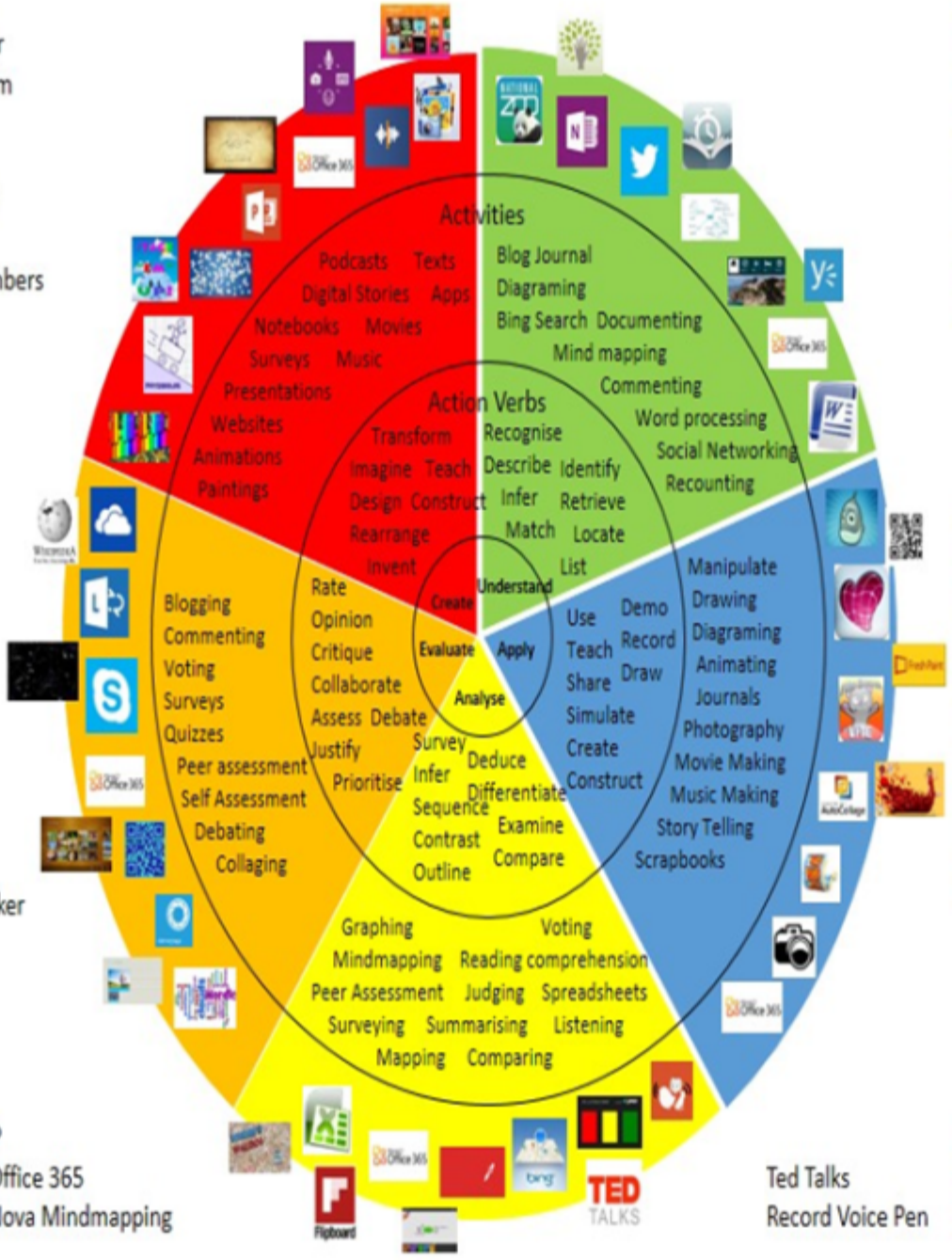
Use spectroscope to read line spectra.

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 Office 365
Flipboard 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

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

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.

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| 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.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. |
| CAEP.9.2.12.C.2 | Modify Personalized Student Learning Plans to support declared career goals. |
| CAEP.9.2.12.C.6 | Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business. |
| TECH.8.1.12.A.3 | Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue. |
| TECH.8.1.12.A.CS1 | Understand and use technology systems. |
| TECH.8.1.12.B | Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology. |
| TECH.8.1.12.B.CS1 | Apply existing knowledge to generate new ideas, products, or processes. |
| TECH.8.1.12.C | Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual |

learning and contribute to the learning of others.

## 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

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 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 instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

**Hi-Prep Differentiations:**

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments

- Tiered products
- Varying organizers for instructions

**Lo-Prep Differentiations**

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

## 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.

Students must be able to build atomic models. (Special Ed)

- 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
- Provide modifications as dictated in the student's IEP/504 plan
- 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

## 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 glossary in their native language.

Spanish speaking students may utilize Spanish Edition of a Textbook

- 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

## At Risk

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

Student provided access to virtual labs, presentations, videos, and practice questions.

- 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

## 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.

Students must be able to analyze Schroediger Equation.

- Above grade level placement option for qualified students

- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

## Sample Lesson

Unit Name:Structure of the Atom

NJSLS: HS PS1, HS PS2, RH 12.4, 12.7, 12.9, 12.10

Interdisciplinary Connection:Vocabulary and algebra contents

Statement of Objective:Students will demonstrate the ability to propose how to reproduce Rutherford's experiment in the discovery of the nucleus and its properties by debating questions with 90% accuracy.

Anticipatory Set/Do Now:What do you know about the electron cloud?

Learning Activity:Lecture - gold foil experiment and Rutherford's model.
Small groups activities: Reproduce Rutherford's model.
Final review: key steps of history of atomic structure

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

Materials: Cardboard box, marbles, tape, paper.

21st Century Themes and Skills: Critical thinking and Problem Solving

Differentiation/Modifications:

Students must be able to apply laws of probability. (Gifted and Talented)

Students must be able to build the model. (Special Ed)

Integration of Technology: PowerPoint Presentation