

Syllabus

Advanced Placement Chemistry

Course Content

Advanced Placement Chemistry is an introductory college level chemistry course. Designed with the AP Chemistry Curriculum Framework, focused on the major concepts in chemistry and their connections, it allows students to develop deep conceptual understanding and integrate science practices through inquiry-based means. Structured around four Big ideas (Equilibria, Energy Relationships, Chemical Reactions, and Stoichiometry), encompassing the core scientific principles, theories, and processes governing chemical systems, at least one of the Big ideas will be incorporated in every lesson.

- **September: Summer Assignment: Chemical Fundamentals (5.1.12.A.1,2,3;B.1,3,4;C1,2,3;D.1,2;5.2.12.B.3;D.3), (8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1) Matter and Periodic Table (5.1.12.A.1,2;5.2.12.A.3,4;B.1,3), Stoichiometry (5.1.12.A.1,2,3;5.2.12.B.3); Solutions. (5.2.12.A.1,2,5,6;B.3)** - students will review topics of first chem class.

1. **Chemical Fundamentals (Unit 1):** reviews the Sci. Method, Matter and Energy, Units, Dimensional Analysis, and Prop. of Matter.
2. **Matter and Periodic Table (Unit 1):** reviews Elements, Compounds and Mixtures, Symbols, Formulas and Equations, Atomic Masses, Formation of Molecular/Ionic Cmpds., Ionic/Cov. Cmpds., Properties, Inorganic Nomenclature.
3. **Stoichiometry (Unit 1):** reviews the Mole Concept, Mol. Form., Bal. Chem. Equ., Lim. Reactant Calc., and Theoretical/% yield.
4. **Solutions (Unit 2):** reviews Rxns. in Soln., Molar Conc. Stoichiometry of Rxns. in Soln., Electrolytes and Non-electrolytes, Equ. for Ionic Rxns., Rxns. that Produce Ppt., Acids/Bases as electrolytes, Strong /Weak Acids/Bases, Acid Base Neut.

- **October: Properties of Solutions (5.1.12.A.1, 5; 5.2.12.A.2,5; C.2); Thermochemistry (5.1.12.A.1,2;C.1,2;5.2.12.C.2; D.1,2) (8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1); Chemical Thermodynamics (5.1.12.A.1,2; 5.2.12.D.2,5) (8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1)**- students will explore solutions by determining the properties that solutions have and how we calculate solution stoichiometry. Then they will find that energy affects all aspects of the world around us. They will explore the three laws of thermodynamics. Important concepts such as entropy, spontaneity, and enthalpies of reactions will be defined.

1. **Properties of Solutions (Unit 2):** Formation of Soln., Heats of Soln., Solubility and the Effect of Temperature, Pressure's effect on Sol. of Gases, Temperature-Independent Concentration Units, Effects of Vapor Pressure on Soln., Effects of Solutes on Freezing and Boiling Pts of Soln., Dialysis and Osmosis and Osmotic Pressure, Colligative Prop. of Soln. Electrolytes, Colloidal Dispersions;
2. **Thermochemistry (Unit 3):** Energy, Kinetic Theory of Matter, Energy Changes in Chem. Rxns., First Law of Thermodynamics: Heat and Work, Measuring Energy Changes: Calorimetry, Enthalpy Changes in Chemical Reactions, Hess's Law
3. **Chemical Thermodynamics (Unit 3):** Enthalpy changes and spontaneity, Entropy and spontaneous Change, The Second Law of Thermodynamics and the Gibbs Free Energy, The Third Law of thermodynamics, Standard Free energy Changes, Free Energy and Maximum Work, Free Energy and Equilibrium, Calculating Equilibrium Constants from Thermodynamic Data

- **November: Electronic Structure of Atoms (5.1.12.A.1,2;5.2.12.A.3;B.1) 8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1); Bonding (5.1.12.A.1,2;D.1,2,3;5.2.12.A.1,2,3;B.1;C.2) 8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1)**- students will reapply the ideas that they were exposed to in their first year of chemistry on the Modern model of the atom. They will then explore the idea of a chemical bond. Ionic and Covalent bonds will be explored, as well as the naming involved with such compounds. They will apply their understanding through visual representation utilizing Lewis Structures. They will apply electronegativity and VSEPR theory to covalent compounds to explore polarity, the cause of the intermolecular forces. They will also discover how Quantum Mechanics is used to define molecular bonding.

1. **Electronic Structure of Atoms (Unit 4):** EM Radiation, Atomic Spectra, Bohr Model, Wave Mechanics, Electron Spin, Pauli Exclusion Principle, Electronic Structures, Electron Configurations, Unexpected Electron Configurations, Shapes of Atomic Orbitals.
2. **Bonding (Unit 5, Unit 12):** Electron Transfer, Formation of Ionic Cmpd., Lewis symbols, Electron sharing, Formation of cov. Bonds, Electroneg. and Polarity of Bonds, Drawing Lewis Structures, Coordinate Cov. bonds, VSEPR Theory, Valence Bond Theory, Hybrid Orbitals, Double and Triple Bonds-pi bonding, Delocalized M.O.s, Bonding in solids

- **December: Gases (5.1.12.A.1,2;5.2.12.A.2;C.1) 8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1); Intermolecular Forces: (5.1.12.D.2, 5; 5.2.12.A.2, 5; C.2)** students will apply the kinetic molecular theory of matter of gases and discover the difference between

an ideal gas and a real gas. They will explore many relationships that gases have in regards to pres., temp., vol., and number of particles. They will also discover the kinetic energy of gases. This leads to the forces that hold all of matter together.

1. **Gases (Unit 6):** Pressure, P-V-T Relationships for $n=k$, Ideal Gas Law, Stoichiometry of Gases, Dalton's Law of Partial Pressures, Graham's Law of effusion, Kinetic theory and the Gas Laws, Real Gases: Dev. From Ideal Gas Law

2. **Intermolecular Forces (Unit 6):** Gases Differ from Liq/Sol., Intermolecular attractions, General Properties of Liq/Sol., Changes of State and Dynamic Equilibrium, Vapor Pressures of Liq/Sol., B.P. of Liq., Energy Changes during Changes of State, Dynamic

- **January: Chemical Kinetics (5.1.12.A.1,2,3;B.1,2,3;C1,2,3;D.2;5.2.12.A.5;B.2;C.2;D.2,4,5) (8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1)** - students will learn how to calculate and study the rates of reactions. They will write rate laws. They will also examine the collision theory and evaluate mechanisms of various reactions.

1. **Chemical Kinetics (Unit 7):** Speeds of Reactions, Factors that Affect Rxn. Rate, Measuring Rxn. Rates, Conc. and Rate, Conc. and Time, Theories about Rxn. Rates, Measuring the E_a , Collision Theory and Rxn. Mech., Catalysts

- **February: Chemical Equilibrium (5.1.12.A.1,2;D.2;5.2.12.D.5) (8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1)** - students will discover the uniqueness of equilibrium reactions and how to calculate concentrations, equilibrium constants and partial pressures. They will discover LeChatelier's Principle. They will calculate half-life, and discover radioactive decay using nuclear Equations. The problems and uses of nuclear reactions are explored as well as energy/mass relationships.

1. **Chemical Equilibrium (Unit 8):** Dynamic Eq. in Chemical Systems, Rxn. Reversibility, Eq. Law for a Rxn, Eq. Laws for Gaseous Rxn., Sig. of the Magnitude of K, Rel. between K_p and K, Heterogeneous Eq., LeChatelier's Principle and Chemical Eq., Eq. Calc.

- **March: Acid and Bases (5.2.12.A.3,5,6); Acid – Base Equilibria (5.1.12.A.1,2;5.2.12.A.5,6;D.2) 8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1); Additional Aspects of Aqueous Equilibria (5.1.12.A.1,2;5.2.12.A.5)** - students will continue to explore acid/bases in greater depth. The auto ionization of water and pH will be calculated. This leads on to the equilibria of weak/strong mixes. They will determine the pH of salts, discover polyprotic acids and titrate acids/bases.

1. **Acid and Bases (Unit 9):** Bronsted, Lewis Acids/Bases, Acid-Base Properties, Ionization of Water, pH, Strong Acids/Bases

2. **Acid – Base Equilibria (Unit 9):** Ionization Constants for Acids/Bases, Equilibrium calculations, Solutions of Salts, Buffers, Ionization of Polyprotic Acids, Acid-Base Titrations, Solubility Equilibria for Salts, Separating Metal Ions by Selective precipitation

- **April: Electrochemistry (5.1.12.A.1,2;5.2.12.B.2;D.2) 8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1)** - students will further their knowledge of reduction oxidation reactions by determining the importance of electrons in the reaction. They will discover practical uses of these reactions, and be shown how a battery produces an electric current.

1. **Electrochemistry (Unit 10):** Electrolysis, Industrial Applications of Electrolysis, Galvanic Cells, Cell Potentials.

- **May: Nuclear Chemistry, (5.1.12.A.1,2;5.2.12.D.3,5) 8.1.12.A;C;D;E;F, 8.2.12.F, 8.2F;2G, 9.1.12.A;B, 9.1F, 9.4O;4O(2), RST.11-12.1 thru 10, WHST.11-12.1 thru 10, N-R.1 thru 3, N-Q.1 thru 3, S-ID.1)** - students will calculate half-life, and discover radioactive decay. Energy/mass relationships will be explored..

1. **Nuclear Chemistry (Unit 11):** Nuclear Equations, Radioactive Decays and their particles, Half-Life, Fission and Fusion.

- **June: Chemistry Real Life Application Topic:** Interpreting NMR spectra of various organic compounds.

Course Expectations & Skills

1. Complete college level laboratory exercises, and identify essential findings & write College level lab reports.
2. Use dimensional analysis to solve stoichiometry problems.
3. Apply the appropriate rules in naming various types of compounds.
4. Recognize the affects that intermolecular forces have on the properties of matter.
5. Define and calculate the rates of reactions, concentration of reactants/products, and rate constants for various reactions.
6. Recognize how energy relationships control chemical and physical processes.
7. Demonstrate the importance of electrons in chemical reactions and chemical bonding.
8. Define the auto ionization of water and how it affects acid-base reactions.
9. Calculate various properties of acids and bases such as pH, concentration, pK_a ,.....

Resources

Primary text: Chemistry, the Central Science 12th Edition, Prentice Hall

Grading Scale

Grades are calculated according to the following proportions:

Tests/Quizzes: 60%

Labs/Homework/Classwork: 40%

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 1: Base Knowledge

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: AP Chemistry/ Base Knowledge	Unit Summary: This unit focuses on the material that should be mastered by the end of the first year of chemistry. It is of paramount importance that students are proficient in this material including the atom, matter, measurement, dimensional analysis, and stoichiometry before they can move on to AP topics.
Grade Level(s): 10-12	
Essential Question(s): <ol style="list-style-type: none"> 1. What are the fundamental building materials of matter and how can they be understood in terms of arrangement of atoms? 2. What happens to atoms during a chemical reaction? 3. How does the structure and arrangement of atoms, ions or molecules explain the chemical and physical properties of materials? 	Enduring Understanding(s): <ol style="list-style-type: none"> 1. Molecules are composed of specific combinations of atoms, different molecules are composed of combinations of different elements and of combinations of same elements in differing amounts. 2. Chemical analysis provides a method for determining the relative number of atoms in a substance, which can be used to identify the substance or determine its purity. 3. The mole is the fundamental unit for counting numbers of particles on the macroscopic level and allows quantitative connections to be drawn between laboratory experiments which occur on the macroscopic level and chemical processes, which occur on the atomic level. 4. The atom is composed of negatively charged electrons, which can leave the atom and a positively charged nucleus that is made of protons and neutrons. The attraction of the electrons to the nucleus is the basis of the structure of the atom. Coulomb's law is qualitatively useful for understanding the structure of the atom. 5. The electronic structure of the atom can be described using an electron configuration that reflects the concept of electrons in quantized energy levels or shells; the energetics of the electrons in the atoms can be understood by consideration of Coulomb's law. 6. Many properties of atoms exhibit periodic trends that are reflective of the periodicity of electronic structures. 7. The currently accepted best model of the atom is the quantum mechanical model. As is the case with all scientific models, any model of the atom is subject to refinement and change in response to new experimental results. In that sense, an atomic model is regarded as an exact description of the atom, but rather a theoretical construct that fits experimental data.

	<ol style="list-style-type: none"> 8. The interaction of electromagnetic waves of light with matter is a powerful means to probe the structure of atoms and molecules and measure their concentrations. 9. Physical and Chemical processes can be depicted symbolically: when this is all done, the illustration must conserve all atoms of all types. 10. Conservation of atoms makes it possible to compute the masses of substances involved in physical and chemical processes. Chemical processes result in the formation of new substances, and the amount of these depends on the number and the types and masses of elements in the reactants as well as the efficiency of the transformation.
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PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

<u>Learning Target:</u> Students will be able to...	<u>NJCCCS or CCS</u>
<ol style="list-style-type: none"> 1. Select and apply mathematical routines to mass data to identify or infer the composition of pure substances and/or mixtures. 2. Connect the number of particles, moles, mass and volume of substance to one another both qualitatively and quantitatively. 3. Explain distribution of electrons in an atom or ion based upon data. 4. Analyze data relating to electron energies for patterns and relationships. 5. Calculate the Electromotive force generated by a voltaic cell 6. Describe the electronic structure of an atom using PFS data, ionization energy data, and /or Coulomb's law to construct explanations of how the energies of electrons within the shells in atoms vary. 7. Explain the distribution of electrons using Coulomb's law to analyze measured energies 8. Predict or justify trends in atomic properties based on location on the periodic table and/or shell model 9. Justify with evidence the arrangement of the periodic table and can apply periodic properties to chemical activity. 	<ol style="list-style-type: none"> 1. Science: 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1 World Lang: 7.1.IL.A.7 21st C. Life: 9.1.12.A.1 LAL: RI.11-12.8, L11-12.5 Technical subjects: RST.11-12.1, RST.11-12.4, RST.11-12.5 Writing: WHST.11-12.9 2. Science: 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1 World Lang: 7.1.IL.A.7 21st C. Life: 9.1.12.A.1 LAL: RI.11-12.8, L11-12.5 Technical subjects: RST.11-12.1, RST.11-12.4, RST.11-12.5 Writing: WHST.11-12.9 3. Science: 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1 World Lang: 7.1.IL.A.7 21st C. Life: 9.1.12.A.1 LAL: RI.11-12.8, L11-12.5 Technical subjects: RST.11-12.1, RST.11-12.4, RST.11-12.5 Writing: WHST.11-12.9

10. Analyze data, based on periodicity and the properties of binary compounds, to identify patterns and generate hypotheses related to the molecular design of compounds for which data are not supplied.
11. Explain why a given set of data suggests or does not suggest the need to refine the atomic model from a classical shell model with the quantum mechanical model.
12. Express law of conservation of mass quantitatively and qualitatively using symbolic representations and particulate drawings.
13. Apply conservation of atoms to the rearrangement of atoms in the various processes
14. Predict properties of substances based on their chemical formulas, and provide explanation of their properties based on particle views.
15. Explain a representation that connects properties of a molecular solid to its structural attributes and to its interactions present at the atomic level
16. Translate among macroscopic observations of change, chemical equations, and particle views.
17. Use stoichiometric calculations to predict the results of performing a reaction in the laboratory and/or to analyze deviations from the expected results.
18. Relate quantities measured to identify stoichiometric relationships for a reaction including limiting reactants and situations in which the reaction has not gone to completion.
19. Use data from the synthesis or decomposition of a compound to confirm the conservation of matter and the law of definite proportions

4. **Science:** 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1, 5.2.12.B.3
World Lang.: 7.1.IL.A.7
21st C Life: 9.1.12.A.1, 9.1.12.B.1, 9.1.12.E.1
LAL: L11-12.5
Math: N-R.3, N-CN.2
5. **Science:** 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1, 5.2.12.B.3
World Lang.: 7.1.IL.A.7
21st C Life: 9.1.12.A.1, 9.1.12.B.1, 9.1.12.E.1
LAL: L11-12.5
Math: N-R.3, N-CN.2
6. **Science:** 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1, 5.2.12.B.3, 5.2.12.B.2
World Lang.: 7.1.IL.A.7
21st C Life: 9.1.12.A.1
LAL: RI.11-12.2, RI.11-12.3, RI.11-12.7, L11-12.1, L11-12.3, L11-12.4, L11-12.5, L11-12.6
Technical Subjects: RST.11-12.2, RST.11-12.4, RST.11-12.5
Writing: WHST.11-12.9
7. **Science:** 5.1.12.A.1, 5.1.12.A.3, 5.1.12.B.1, 5.1.12.D.1, 5.2.12.B.3, 5.2.12.B.2, 5.1.12.A.3
World Lang: 7.1.IL.A.7
21st C. Life: 9.1.12.A.1
LAL: RI.11-12.8, L11-12.5
Technical subjects: RST.11-12.1, RST.11-12.4, RST.11-12.5
Writing: WHST.11-12.9

20. Evaluate the classification of a process as a physical change, chemical change or ambiguous change based on both macroscopic observations and the distinction between rearrangement of covalent interactions and noncovalent interactions

Inter-Disciplinary Connections:

Students will interact with text, and will be asked to read and draw inferences, cite specific evidence, follow procedures/tasks, translate word problems into mathematical problems, and assess text for use in forming arguments or comparing/contrasting arguments. Lab reports will involve technical writing. Students will be expected to write clearly and coherently, revising and editing, and use technology to produce and present their work. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impacts on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, Vernier probes, Microsoft Word or Excel) may be used to supplement lessons and investigations in this unit.

- examples of strategies and modified strategies are in the District Shared/Science/CURRICULUM WRITING 2013/AP Base Knowledge folder

Students will engage with the following text:

**The majority of this course is math-intensive but students will regularly use the text:
Chemistry the Central Science: Brown LeMay and Bursten**

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

Lab activities : ([sulfate lab](#) CURRICULUM WRITING 2013/AP Base Knowledge folder)

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs.

Students will write:

AP free response questions are 50% of the test therefore a huge part of preparation is practice in writing free response. Laboratory investigations will include a pre lab write-up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables) report results and their significance and source of error including ways to reduce or eliminate error. Students will formulate a connection to classroom material and relate the purpose of the experiments to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure. In addition to usual warm-ups, closing activities and lab reports, writing projects.

- examples of strategies and modified strategies are in the District Shared/Science/CURRICULUM WRITING 2013/AP Base Knowledge folder
Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

1. Hands-on labs/activities or group discussion of a particular topic ([sulfate lab](#))
2. Use of Webassign, [Gizmos](#), LabPro, Vernier or Pasco for collection ([summer assignment on webassign](#))
3. Real World Application: Utilizing measuring devices and incorporating problem-solving skills that can be implemented in other courses and outside of class.

Teacher Centered Strategies include

1. Power point/notes lecture ([notes](#))
2. You tube videos
 - examples of strategies and modified strategies are in the District Shared/Science/CURRICULUM WRITING 2013/AP Base Knowledge folder

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

- Weekly AP free response questions from past AP tests that include both conceptual questions and mathematical problems *understanding, applying, synthesizing* ([free response question](#))
- Completion of independent practice and problem sets([webassign](#)) *understanding, analyzing, evaluating*
- Writing samples used to relate material to a real world application through demonstrations *analyzing, evaluating, synthesizing, evaluating*
- Chapter and /or major topic tests *understanding, applying, analyzing, evaluating* ([Ch. 1-3 test](#))

- Laboratory investigations (ability to properly collect data and perform calculations pertaining to activity. Some examples might include:

- [Determining percent sulfate in an unknown sulfate compound](#): creating, evaluation
understanding, applying, analyzing
- [Vee Map](#) and [College Lab write up](#)

- examples of assessments and modified assessments are in the District Shared/Science/CURRICULUM WRITING 2013/AP Base Knowledge folder

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs, such as corrections on tests and quizzes at students' leisure.

Summative Assessments:

Students will be required to take a test to demonstrate proficiency on the material presented in this unit. Note: Unit Test which includes multiple choice, problem solving as well as free response ([Ch. 1-3 test](#) ex. CURRICULUM WRITING 2013/AP Base Knowledge folder) *understanding, applying, analyzing, evaluating*

1. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. *understanding, applying, analyzing* ([summer assignment](#))

- examples of assessments and modified assessments are in the District Shared/Science/CURRICULUM WRITING 2013/AP Base Knowledge folder

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs.

Performance Assessments:

1. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded *understanding, applying*
2. Ability to perform lab activities and perform calculations pertaining to activity *creating, applying, analyzing, evaluating*
3. Ability to predicting function of a compound based on structure
Ability to justify structure based on experimental data

- examples of assessments and modified assessments are in the District Shared/Science/CURRICULUM WRITING 2013/AP Chemistry Chemical reactions folder

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs.

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 2: Aqueous Reactions/Solutions

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: AP Chemistry /Aqueous Reactions/Solutions	Unit Summary: This unit focuses on solutions and reactions involving them. Solubility curves will be explored to determine if solutions are unsaturated, saturated or supersaturated. Some knowledge of solubility rules must be mastered to effectively represent precipitation reactions.
Grade Level(s): 11-12	
Essential Question(s): 1. How is the interaction of solute and solvent particles measured in solution? 2. What factors affect solubility? 3. How is a solubility curve of a substance constructed and interpreted?	Enduring Understanding(s): 1. Solutions are homogeneous mixtures in which the physical properties are dependent on the concentration of the solute and the strength of interaction among solute and solvent particles. Solutions can be saturated, unsaturated, or supersaturated 2. Factors such as temperature, surface area, concentration and agitation affect the solubility of a substance. 3. At specific temperatures certain amounts of solute can dissolve in a given mass of solvent. This data is used to construct a solubility curve. Unknown data then can be interpreted base on this curve, above the curve is supersaturated, on the curve is saturated and below is unsaturated.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

<u>Learning Target</u>	<u>NJCCCS or CCS</u>
1. Effectively represent the net ionic equations of the reaction of two aqueous solutions. 2. Construct and/or interpret solubility curves to determine the saturation of a solute in a solvent 3. Design and/or interpret the results of an experiment regarding the factors (i.e.	For Learning Targets 1-12 Science Standards apply: 5.1.12.D.1, 5.1.12.D.2, 5.1.12.D.3, 5.2.12.A.1, 5.2.12.A.2, 5.2.12.A.3, 5.2.12.A.4, 5.2.12.A.5, 5.2.12.A.6, 5.2.12.B.1, 5.2.12.B.2, 5.2.12.B.3, 5.2.12.C.1, 5.2.12.C.2, 5.2.12.D.2, 5.2.12.D.3, 5.2.12.D.4, 5.2.12.D.5 For Learning Targets 1-12 Interdisciplinary Standards

<p>temperature, concentration and surface area) that may influence the rate of a reaction.</p> <ol style="list-style-type: none"> 4. Explain how solutes can be separated by chromatography based on intermolecular interactions 5. Draw and /or interpret representations of solution that show interactions between the solute and the solvent 6. Create or interpret representations that link the concept of molarity with the particle views of solutions 7. Design or interpret results of a separation experiment (filtration, paper chromatography, column chromatography, or distillation) in terms of relative strength of interactions 8. Analyze concentration v. time data and relate to kinetics. 9. Design and/or interpret the results of an experiment regarding the absorption of light to determine the concentration of an absorbing species in a solution. 	<p>apply: (Learning targets in bold)</p> <ul style="list-style-type: none"> • 6,12. 8.1.12.A.1 Excel Graphs • 8.1.12.A2 Editing documents • 1-3.8.1.12.A4 Using the electronic portfolio • 1-3. 7.1.1L.A.7 word meaning • 3-12. 9.1.12.A.1 critical thinking • 7. 9.1.12.B1 Creativity and innovation • 3-12. 9.1.12.C4 Demonstrate collaborative skills • 6-12. S-ID.1 interpret data • 6-12. A-REI.2 solve problems • 6-12. A-REI.3 solve problems • 6, 8. A-REI.12 represent function graphically 3. A-CED.1 describing relationships • 2, 6, 12. RI-.11-12.1 read and draw inferences from • 2, 6, 12. text RI.11-12.3 Analyze how and why
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Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit.

Students will engage with the following text:

The majority of this course is math-intensive but students will regularly use the text:

Chemistry the Central Science: Brown LeMay and Bursten

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

[Precipitation Lab](#) (see district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Aqueous Reactions and Solutions

Additional Ancillary materials are available in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Aqueous Reactions and Solutions and may include but not excluded to current events,

Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure. In this class, students will constantly have to relate current material to previously covered units usually in the form of free response questions, where they must rationalize the material and make connections between new and old units.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

1. POGIL inquiry lessons (ex. [POGIL on solutions](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Aqueous reactions and solutions)
2. Hands-on labs/activities (ex. [Precipitation Lab](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Aqueous reactions and solutions)
3. [Demonstration Analysis](#) (ex. Demos in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases)
4. Use of Gizmos, LabPro, Vernier or Pasco for data collection in real or virtual settings
5. Real World Application: [Medicines](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases Constructing Graphs and interpreting data drawing conclusions about titration of acid and base.
6. Test Taking Strategies and additional practiced offered on WebAssign.net and [science geek](#)

Teacher Centered Strategies include

1. Power point/notes lecture (ex. [Solutions](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases Interactive Discussion including Socratic method)
2. You tube videos [For those about to dissolve we solute you](#)
3. Animations
4. Lab Discussions and performance

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying*
2. Lab Reports according to a rubric (ex. [College Write Up](#), Rubric in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases *applying, analyzing*)
3. Vee Maps (ex. [Sample Vee map](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases) – *analyzing, evaluating*
4. [Weekly free response](#) question that include both conceptual and mathematical problems – *understanding, applying, analyzing, evaluating*
5. [Completion of problems sets](#) – *remembering, understanding, applying*
6. AP sample test questions related to current material and prior using pollanywhere.com – *applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Summative Assessments:

1. [Unit Test](#) which includes multiple choice, problem solving as well as free response (ex. Acid Base Test in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Performance Assessments:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying, analyzing, evaluating*
2. Creating analogies to demonstrate full mastery of material learned through colloquialisms. – *remembering, understanding, applying, creating*
3. Ability to construct a procedure to neutralize an acid (Titration lab in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases) *remembering, understanding, applying, analyzing, evaluating, creating*
4. Ability to work collaboratively to complete inquiry based assignments acid (Acid/Base POGIL in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases) *remembering, understanding, applying, analyzing, evaluating, creating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 3 – Quantum Chemistry

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: AP Chemistry /03 Unit Quantum Chemistry and Periodic Trends	Unit Summary: This unit will build on students' prior knowledge of the early models of the atom. They will learn about electromagnetic radiation and how it affects the electron of the atom. They will find out about the theories underlying the modern atomic theory and also discover the practical aspects of those theories. Once they understand the orbitals of the atom, they will then see how the periodic table is composed of many trends that are useful in understanding the atom.
Grade Level(s): 11-12	
Essential Question(s): <ol style="list-style-type: none"> 1. What is electromagnetic radiation and how does it affect an atom? 2. Where are the electrons around the atom? 3. What are the quantum numbers? 4. What are the shapes of the orbitals? 5. What is enthalpy and entropy? 6. What does effective nuclear charge mean? 7. What trends are found in the periodic table? 	Enduring Understanding(s): <ol style="list-style-type: none"> 1. The atom is composed of negatively charged electrons, which can leave the atom, and a positively charged nucleus that is made of protons and neutrons. The attraction of the electrons to the nucleus is the basis of the structure of the atom. Coulomb's Law is qualitatively useful for understanding the structure of the atom. 2. The electronic structure of the atom can be described using an electron configuration that reflects the concept of electrons in quantized energy levels or shells; the energetics of the electrons in the atom can be understood by consideration of Coulomb's Law. 3. Many properties of atoms exhibit periodic trends that are reflective of the periodicity of electronic structure. 4. The currently accepted best model of the atom is based on the quantum mechanical model. 5. As is the case with all scientific models, any model of the atom is subject to refinement and change in response to new experimental results. In that sense, an atomic model is not regarded as an exact description of the atom, but rather a theoretical construct that fits a set of experimental data. 6. An early model of the atom stated that all atoms of an element are identical. Mass spectrometry data demonstrate evidence that contradicts this early model. 7. The interaction of electromagnetic waves or light with matter is a powerful means to probe the structure of atoms and molecules, and to measure their concentration.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

<u>Learning Target</u>	<u>NJCCCS or CCS</u>
<ol style="list-style-type: none">1. Describe the electromagnetic spectrum.2. Explain the significance of quantized energy levels.3. Explain the Bohr model of the atom, and why it fails as a model.4. Describe the quantum numbers n, l, m_l and m_s.5. Explain the Heisenberg Uncertainty Principle, the Pauli Exclusion Principle, Hund's Rule, and the Aufbau Principle.6. Describe how electrons fill in orbitals with electronic configuration, short hand electronic configuration and orbital notation.7. Explain the shapes and capacity of the electronic orbitals.8. Explain the concept of effective nuclear charge, and how it relates to orbital shape and size.9. Describe periodic trends.	<p>For Learning Targets 1-12 Science Standards apply: 5.1.12.A.1, , 5.2.12.A.2, 5.2.12.A.3, 5.2.12.B.1, 5.2.12.B.2, 5.2.12.B.3, 5.2.12.B.4, 5.2.12.C.1, 5.2.12.C.3, 5.1.12.D.1, 5.1.12.D.2, 5.1.12.D.3, 5.2.12.C.1, 5.2.12.C.2, 5.2.12.D.1, 5.2.12.D.2, 5.2.12.D.5</p> <p>For Learning Targets 1-12 Interdisciplinary Standards apply: (Learning targets in bold)</p> <ul style="list-style-type: none">• 6,12. 8.1.12.A.1 Excel Graphs• 8.1.12.A2 Editing documents• 1-3.8.1.12.A4 Using the electronic portfolio• 1-3. 7.1.1L.A.7 word meaning• 3-12. 9.1.12.A.1 critical thinking• 7. 9.1.12.B1 Creativity and innovation• 3-12. 9.1.12.C4 Demonstrate collaborative skills• 6-12. S-ID.1 interpret data• 6-12. A-REI.2 solve problems• 6-12. A-REI.3 solve problems• 6, 8. A-REI.12 represent function graphically 3. A-CED.1 describing relationships• 2, 6, 12. RI-.11-12.1 read and draw inferences from• 2, 6, 12. text RI.11-12.3 Analyze how and why

Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit. ex. Spectroscopy Lab in S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Labs

Students will engage with the following text:

**The majority of this course is math-intensive but students will regularly use the text:
Chemistry the Central Science: Brown LeMay and Bursten**

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

Additional Ancillary materials are available in district shared S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Notes, Diagrams and may include but not excluded to current events, online media and print materials

Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure . In this class, students will constantly have to relate current material to previously covered units usually in the form of free response questions, where they must rationalize the material and make connections between new and old units.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

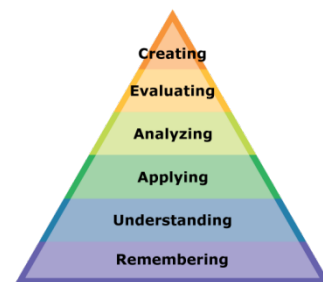
1. POGIL inquiry lessons (ex. Pogil_Electron_Configuration in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Activities)
2. Hands-on labs/activities (ex. Spectroscopy Lab in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Labs)
3. Demonstration Analysis (ex. Quantum Numbers in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Notes, Diagrams)
4. Use of Gizmos, LabPro, Vernier or Pasco for data collection in real or virtual settings
5. Real World Application: Quantum Numbers in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Notes, Diagrams)
6. Constructing Energy diagrams and interpreting data drawing conclusions about orbitals.
7. Test Taking Strategies and additional practiced offered on WebAssign.net

Teacher Centered Strategies include

1. Power point/notes lecture (ex. Quantum_Model[1] in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Labs)
2. Interactive Discussion including Socratic method
3. You tube videos
4. Animations
5. Lab Discussions and performance

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying*
2. Lab Reports according to a rubric (ex. Rubric in District Shared/Chemistry Curriculum/Thermochemistry) *applying, analyzing*
3. Vee Maps (ex. Sample Vee map in District Shared/Chemistry Curriculum/Thermochemistry) – *analyzing, evaluating*
4. Weekly free response question that include both conceptual and mathematical problems – *understanding, applying, analyzing, evaluating*
5. Completion of problems sets – *remembering, understanding, applying*
6. AP sample test questions related to current material and prior using pollanywhere.com – *applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Summative Assessments:

1. Unit Test which includes multiple choice, problem solving as well as free response (ex. AP Chem. Ch. 6 Test in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Tests) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Performance Assessments:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying, analyzing, evaluating*
2. Creating analogies to demonstrate full mastery of material learned through colloquialisms. – *remembering, understanding, applying, creating*
3. Ability to construct a procedure to explore molecular orbitals (Spectroscopy Lab in S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Labs) *remembering, understanding, applying, analyzing, evaluating, creating*
4. Ability to work collaboratively to complete inquiry based assignments acid (Pogil_Electron_Configuration S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\03 Unit Quantum Chemistry\Activities) *remembering, understanding, applying, analyzing, evaluating, creating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

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Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 4 – Thermochemistry

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<p>Course/Unit Title: AP Chemistry /04 Unit Thermochemistry</p> <p>Grade Level(s): 11-12</p>	<p>Unit Summary: This unit will build on students' prior knowledge of chemical reactions. They will begin by learning about calorimetry and utilize the information to calculate the enthalpies of formation and the enthalpy of reactions (Hess' Law). They will learn how to represent energy relationships in graphical form (E diagrams). Next they will learn what entropy is and how it affects chemical systems. This will lead into the idea of spontaneity and Gibbs Free Energy.</p>
<p>Essential Question(s):</p> <ol style="list-style-type: none"> 1. What is temperature and heat? 2. What is work, and how does it apply to chemical systems? 3. What is a closed vs. open system? 4. How can calorimetry data be used? 5. What is enthalpy and entropy? 6. What is spontaneity and how does Gibbs free energy predict it? 7. How is Gibbs free energy related to equilibrium? 	<p>Enduring Understanding(s):</p> <ol style="list-style-type: none"> 1. Temperature is a measure of the average kinetic energy of atoms and molecules. 2. The process of kinetic energy transfer at the particulate scale is referred to in this course as heat transfer, and the spontaneous direction of the transfer is always from a hot to a cold body. 3. Energy is transferred between systems either through heat transfer or through one system doing work on the other system. 4. When two systems are in contact with each other and are otherwise isolated, the energy that comes out of one system is equal to the energy that goes into the other system. The combined energy of the two systems remains fixed. Energy transfer can occur through either heat exchange or work. 5. Chemical systems undergo three main processes that change their energy: heating/cooling, phase transitions, and chemical reactions. 6. Calorimetry is an experimental technique that is used to measure the change in energy of a chemical system. 7. Net changes in energy for a chemical reaction can be endothermic or exothermic. 8. Entropy is a measure of the dispersal of matter and energy. 9. Some physical or chemical processes involve <i>both</i> a decrease in the internal energy of the components ($\Delta H^\circ < 0$) under consideration <i>and</i> an increase in the entropy of those components ($\Delta S^\circ > 0$). These processes are necessarily "thermodynamically favored" ($\Delta G^\circ < 0$). 10. If a chemical or physical process is not driven by <i>both</i> entropy and enthalpy changes, then the Gibbs free energy change can be used to determine whether the process is thermodynamically favored. 11. External sources of energy can be used to drive change in cases where the Gibbs free energy change is positive.

	12. A thermodynamically favored process may not occur due to kinetic constraints (kinetic vs. thermodynamic control).

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

<u>Learning Target</u>	<u>NJCCCS or CCS</u>
<ol style="list-style-type: none">1. Differentiate between kinetic and potential energy.2. Describe how kinetic energy varies with temperature.3. Explain the role of energy in making and breaking chemical bonds.4. Define system, surroundings, boundary, and insulated system.5. Recognize that water has a larger heat capacity than most substances.6. Explain the notion of a state function.7. Determine the overall enthalpy from an energy diagram.8. Apply Hess' Law to determine a reaction's enthalpy.9. Define and differentiate between the Three Laws of Thermodynamics.10. State the relationship between heat, work, and energy change.11. Define and differentiate between entropy and enthalpy.12. Predict the sign of ΔS at different temperature, volumes and H values.13. Define spontaneity.14. Explain Gibbs Free Energy and its relationship to enthalpy and entropy.15. Calculate the ΔG° of selected reactions.16. Explain the relationship between Free Energy and equilibrium systems.17. Use ΔG to determine the conditions of spontaneity of a reaction.	<p>For Learning Targets 1-12 Science Standards apply: 5.1.12.A.1, , 5.2.12.A.2, 5.2.12.A.3, 5.2.12.B.1, 5.2.12.B.2, 5.2.12.B.3, 5.2.12.B.4, 5.2.12.C.1, 5.2.12.C.3, 5.1.12.D.1, 5.1.12.D.2, 5.1.12.D.3, 5.2.12.C.1, 5.2.12.C.2, 5.2.12.D.1, 5.2.12.D.2, 5.2.12.D.5</p> <p>For Learning Targets 1-12 Interdisciplinary Standards apply: (Learning targets in bold)</p> <ul style="list-style-type: none">• 6,12. 8.1.12.A.1 Excel Graphs• 8.1.12.A2 Editing documents• 1-3.8.1.12.A4 Using the electronic portfolio• 1-3. 7.1.1L.A.7 word meaning• 3-12. 9.1.12.A.1 critical thinking• 7. 9.1.12.B1 Creativity and innovation• 3-12. 9.1.12.C4 Demonstrate collaborative skills• 6-12. S-ID.1 interpret data• 6-12. A-REI.2 solve problems• 6-12. A-REI.3 solve problems• 6, 8. A-REI.12 represent function graphically 3. A-CED.1 describing relationships• 2, 6, 12. RI-.11-12.1 read and draw inferences from• 2, 6, 12. text RI.11-12.3 Analyze how and why

Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit. ex. Specific Heat in S:\Staff....CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\04 Unit Thermochemistry\Labs.

Students will engage with the following text:

The majority of this course is math-intensive but students will regularly use the text:

Chemistry the Central Science: Brown LeMay and Bursten

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

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Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure . In this class, students will constantly have to relate current material to previously covered units usually in the form of free response questions, where they must rationalize the material and make connections between new and old units.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

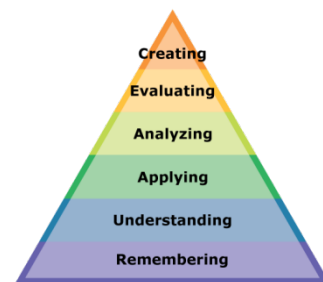
1. POGIL inquiry lessons (ex. POGIL 06 - Thermochemistry 2-1 - Supplemental Notes - Heat Capacities of Common Substances in S:\Staff....CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\04 Unit Thermochemistry\Activities)
2. Hands-on labs/activities (ex. activity - Calorimetry Exercises 2 - Mixture Problems in S:\Staff....CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\04 Unit Thermochemistry\Labs.
3. Demonstration Analysis (ex. Second Law in S:\Staff....CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\04 Unit Thermochemistry\Notes, Diagrams.)
4. Use of Gizmos, LabPro, Vernier or Pasco for data collection in real or virtual settings
5. Real World Application: Second Law in S:\Staff....CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\04 Unit Thermochemistry\Notes, Diagrams.)
6. Constructing Energy diagrams and interpreting data drawing conclusions about the enthalpy of reactions.
7. Test Taking Strategies and additional practiced offered on WebAssign.net

Teacher Centered Strategies include

1. Power point/notes lecture (ex. Notes06 in S:\Staff....CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\04 Unit Thermochemistry\Notes, Diagrams.)
2. Interactive Discussion including Socratic method
3. You tube videos
4. Animations
5. Lab Discussions and performance

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying*
2. Lab Reports according to a rubric (ex. Rubric in District Shared/Chemistry Curriculum/Thermochemistry) *applying, analyzing*
3. Vee Maps (ex. Sample Vee map in District Shared/Chemistry Curriculum/Thermochemistry) – *analyzing, evaluating*
4. Weekly free response question that include both conceptual and mathematical problems – *understanding, applying, analyzing, evaluating*
5. Completion of problems sets – *remembering, understanding, applying*
6. AP sample test questions related to current material and prior using pollanywhere.com – *applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Summative Assessments:

1. Unit Test which includes multiple choice, problem solving as well as free response (ex. AP Chem. Ch. 5,19 Test (06) in S:\Staff....CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\04 Unit Thermochemistry\Tests) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Performance Assessments:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying, analyzing, evaluating*
2. Creating analogies to demonstrate full mastery of material learned through colloquialisms. – *remembering, understanding, applying, creating*
3. Ability to construct a procedure to explore molecular orbitals (Specific Heat in S:\Staff....CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\04 Unit Thermochemistry\Labs.) *remembering, understanding, applying, analyzing, evaluating, creating*
4. Ability to work collaboratively to complete inquiry based assignments acid (POGIL 06 - Thermochemistry 2-1 - Supplemental Notes - Heat Capacities of Common Substances in District S:\Staff....CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\04 Unit Thermochemistry\Activities.) *remembering, understanding, applying, analyzing, evaluating, creating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 5 – Bonding

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: AP Chemistry /05 Unit Bonding	Unit Summary: This unit will build on students' prior knowledge of the atom and quantum chemistry. They will explore how these things predict reactivity and how the atoms combine to form molecules. They will then take the periodic trend of electronegativity and use it to describe the polarity of molecules. Finally they will recognize the various shapes that molecules have and learn about the different molecular orbitals that form bonds.
Grade Level(s): 11-12	Enduring Understanding(s): <ol style="list-style-type: none"> 1. Molecules are composed of specific combinations of atoms; different molecules are composed of combinations of different elements and of combinations of the same elements in differing amounts and proportions. 2. The strong electrostatic forces of attraction holding atoms together in a unit are called chemical bonds. 3. Ionic bonding results from the net attraction between oppositely charged ions, closely packed together in a crystal lattice. 4. Ionic solids have high melting points, are brittle, and conduct electricity only when molten or in solution. 5. Electrostatic forces exist between molecules as well as between atoms or ions, and breaking the resultant intermolecular interactions requires energy. 6. In covalent bonding, electrons are shared between the nuclei of two atoms to form a molecule or polyatomic ion. Electronegativity differences between the two atoms account for the distribution of the shared electrons and the polarity of the bond. 7. Many properties of atoms exhibit periodic trends that are reflective of the periodicity of electronic structure, substance and the forces of attraction among them. 8. The localized electron bonding model describes and predicts molecular geometry using Lewis diagrams and the VSEPR model. 9. Dipole forces result from the attraction among the positive ends and negative ends of polar molecules. 10. Molecular solids with low molecular weight usually have low melting points and are not expected to conduct electricity as solids, in solution, or when molten. 11. Covalent network solids generally have extremely high melting points, are hard, and are thermal insulators. Some conduct electricity. 12. Metallic bonding describes an array of positively charged metal cores surrounded by a sea of mobile valence electrons.
Essential Question(s): <ol style="list-style-type: none"> 1. How does an atom form ions, and what is an ionic bond? 2. What are the properties of ionic compounds? 3. What is a covalent bond and what are its properties? 4. What is electronegativity and how does it affect polarity in a molecule? 5. What shapes do molecules have? 6. What is a metallic bond and what are its properties? 7. What different types of molecular orbitals form bonds? 	

	13. Metallic solids are good conductors of heat and electricity, have a wide range of melting points, and are shiny, malleable, ductile, and readily alloyed.
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PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit. ex. Molecular Orbital Diagrams of Diatomic Molecules Lab Report in S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\05 Unit Bonding\Labs

Students will engage with the following text:

The majority of this course is math-intensive but students will regularly use the text:

Chemistry the Central Science: Brown LeMay and Bursten

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

Additional Ancillary materials are available in district shared S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\05 Unit Bonding\Notes, Diagrams and may include but not excluded to current events, online media and print materials

Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure . In this class, students will constantly have to relate current material to previously covered units usually in the form of free response questions, where they must rationalize the material and make connections between new and old units.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

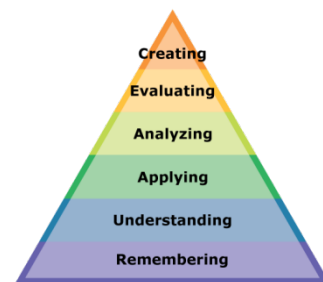
How will students uncover content and build skills.

Student-Center Strategies may include:

1. POGIL inquiry lessons (ex. ionic vs. covalent POGIL in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\05 Unit Bonding\Activities)
 2. Hands-on labs/activities (ex. Molecular Orbital Diagrams of Diatomic Molecules Lab Report in S:\Staff...\AP Chemistry\Unit 5 Bonding
 3. Demonstration Analysis (ex. Bond Energy Graph in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\05 Unit Bonding\Notes, Diagrams)
 4. Use of Gizmos, LabPro, Vernier or Pasco for data collection in real or virtual settings
 5. Real World Application: Bond Energy Graph in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\05 Unit Bonding\Notes, Diagrams)
 6. Constructing Energy diagrams and interpreting data drawing conclusions about molecular orbitals.
 7. Test Taking Strategies and additional practiced offered on WebAssign.net
- Teacher Centered Strategies include
1. Power point/notes lecture (ex. AP Chem Unit 9 in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\05 Unit Bonding\Notes, Diagrams)
 2. Interactive Discussion including Socratic method
 3. You tube videos
 4. Animations
 5. Lab Discussions and performance

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying*
2. Lab Reports according to a rubric (ex. Rubric in District Shared/Chemistry Curriculum/Thermochemistry) *applying, analyzing*
3. Vee Maps (ex. Sample Vee map in District Shared/Chemistry Curriculum/Thermochemistry) – *analyzing, evaluating*
4. Weekly free response question that include both conceptual and mathematical problems – *understanding, applying, analyzing, evaluating*
5. Completion of problems sets – *remembering, understanding, applying*
6. AP sample test questions related to current material and prior using pollanywhere.com – *applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Summative Assessments:

1. Unit Test which includes multiple choice, problem solving as well as free response (ex. AP-Chapter-7-9-Test in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\05 Unit Bonding\Tests) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Performance Assessments:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying, analyzing, evaluating*
2. Creating analogies to demonstrate full mastery of material learned through colloquialisms. – *remembering, understanding, applying, creating*
3. Ability to construct a procedure to explore molecular orbitals (Molecular Orbital Diagrams of Diatomic Molecules Lab Report in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\05 Unit Bonding\Labs) *remembering, understanding, applying, analyzing, evaluating, creating*
4. Ability to work collaboratively to complete inquiry based assignments acid (ionic vs. covalent POGIL in District S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\05 Unit Bonding\Activities) *remembering, understanding, applying, analyzing, evaluating, creating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 6 – States of Matter

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: AP Chemistry /06 Unit States of Matter	Unit Summary: This unit will explore the forces that determine the properties of matter. First the student's understanding of gases and the gas laws will be developed, along with the concept of a real gas vs. an ideal gas.
Grade Level(s): 11-12	Intermolecular forces will be defined, and will be shown to affect numerous properties of matter.
Essential Question(s): <ol style="list-style-type: none"> 1. What are the properties of matter? 2. How do pressure, volume, temperature and amount of substance define a gas? 3. How do the attractive forces between molecules affect the properties of matter? 4. Why do phase changes require energy? 5. What causes surface tension, viscosity and vapor pressure? 6. How do we change a substance's phase? 	Enduring Understanding(s): <ol style="list-style-type: none"> 1. Matter can be described by its physical properties. The physical properties of a substance generally depend on the spacing between the particles (atoms, molecules, ions) that make up the substance and the forces of attraction among them. 2. Forces of attraction between particles (including the noble gases and also different parts of some large molecules) are important in determining many macroscopic properties of a substance, including how the observable physical state changes with temperature. 3. Electrostatic forces exist between molecules as well as between atoms or ions, and breaking the resultant intermolecular interactions requires energy. 4. The different properties of solids and liquids can be explained by differences in their structures, both at the particulate level and in their supramolecular structures. 5. The gaseous state can be effectively modeled with a mathematical equation relating various macroscopic properties. A gas has neither a definite volume nor a definite shape; because the effects of attractive forces are minimal, we usually assume that the particles move independently. 6. Solutions are homogenous mixtures in which the physical properties are dependent on the concentration of the solute and the strengths of all interactions among the particles of the solutes and solvent. 7. Forces of attraction between particles (including the noble gases and also different parts of some large molecules) are important in determining many macroscopic properties of a substance, including how the observable physical state changes with temperature. 8. London dispersion forces are attractive forces present between all atoms and molecules. London dispersion forces are often the strongest net intermolecular force between large molecules. 9. Dipole forces result from the attraction among the positive ends and negative ends of polar molecules. Hydrogen bonding is a strong type of dipole-dipole force.

10. Intermolecular forces play a key role in determining the properties of substances, including biological structures and interactions.

11. Potential energy is associated with the interaction of molecules; as molecules draw near each other, they experience an attractive force.

12. At the particulate scale, chemical processes can be distinguished from physical processes because chemical bonds can be distinguished from intermolecular interactions.

13. Noncovalent and intermolecular interactions play important roles in many biological and polymer systems.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

Learning Target

1. Describe the characteristics common to all Gases.
2. Explain pressure as a force over a specific area.
3. Define atmospheric pressure and use this concept to explain the function of a barometer.
4. Apply dimensional analysis to solve problems converting pressure units.
5. Identify conditions of STP.
6. Use Boyle's, Charles', Gay-Lussac's, Avogadro's and the Combined gas laws to solve problems involving gases.
7. Describe an Ideal Gas.
8. Describe and calculate the value of the Ideal Gas Law Constant, R.
9. Apply the Ideal Gas Law to solve problems involving gases.
10. Recognize how density and molar mass relate to the Ideal Gas Law.
11. Describe and apply Dalton's law of partial pressures to solve gas problems.
12. Solve problems using mole fractions and mole percent of gases in mixtures.
13. Describe the Kinetic Molecular Theory of Gases.
14. Describe and calculate the root mean squared speed of gases.
15. Describe and apply Graham's law of effusion to solve gas problems.
16. Describe the properties of gases and conditions that cause a deviation in Ideal Behavior.
17. Apply the van der Waals equation to account for the deviations in Ideal Behavior.
18. Describe and compare/contrast the characteristics of gases to solids and liquids.
19. Differentiate between intermolecular forces and intramolecular forces.
20. Conceptualize an instantaneous dipole.
21. Describe the factors that increase London dispersion forces and recognize the physical characteristics affected by them.
22. Recognize electronegativity trends in the elements and identify polar covalent molecules.
23. Explain the physical characteristics affected by dipole-dipole interactions.
24. Describe a Hydrogen bond and explain its importance in aqueous and biological systems.
25. Identify an ion-dipole interaction.
26. Compare the relative strengths of the intermolecular

NJCCCS or CCS

For Learning Targets 1-31 Science Standards apply:

5.1.12.A.1, 5.1.12.A.2, 5.1.12.A.3, 5.1.12.B.1, 5.1.12.B.2, 5.1.12.B.3, 5.1.12.B.4, 5.1.12.C.2, 5.1.12.D.1, 5.1.12.D.2, 5.1.12.D.3, 5.2.12.A.1, 5.2.12.A.2, 5.2.12.B.1, 5.2.12.C.1, 5.2.12.C.2, 5.2.12.D.2,

For Learning Targets 1-31

Interdisciplinary Standards apply: (Learning targets in bold)

- **6,12.** 8.1.12.A.1 Excel Graphs
- 8.1.12.A2 Editing documents
- **1-3.**8.1.12.A4 Using the electronic portfolio
- **1-3.** 7.1.1L.A.7 word meaning
- **3-12.** 9.1.12.A.1 critical thinking
- **7.** 9.1.12.B1 Creativity and innovation
- **3-12.** 9.1.12.C4 Demonstrate collaborative skills
- **6-12.** S-ID.1 interpret data
- **6-12.** A-REI.2 solve problems
- **6-12.** A-REI.3 solve problems
- **6, 8.** A-REI.12 represent function graphically **3.** A-CED.1 describing relationships
- **2, 6, 12.** RI-.11-12.1 read and draw inferences from
- **2, 6, 12.** text RI.11-12.3 Analyze how and why

Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit. i.e. freezing_point_depression; S:\Staff....CURRICULUM WRITING\AP Chemistry\06 Unit States of Matter\Unit Materials\Labs.

Students will engage with the following text:

**The majority of this course is math-intensive but students will regularly use the text:
Chemistry the Central Science: Brown LeMay and Bursten**

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

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Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure . In this class, students will constantly have to relate current material to previously covered units usually in the form of free response questions, where they must rationalize the material and make connections between new and old units.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

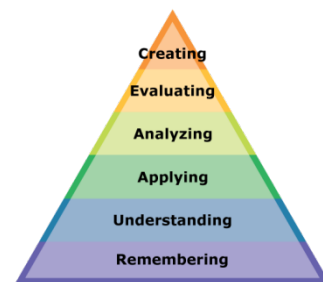
1. POGIL inquiry lessons (ex. Chem116_POGIL_Week01_000; S:\Staff....CURRICULUM WRITING\AP Chemistry\06 Unit States of Matter\Unit Materials\Activities.)
2. Hands-on labs/activities (ex. freezing_point_depression; S:\Staff....CURRICULUM WRITING\AP Chemistry\06 Unit States of Matter\Unit Materials\Labs.)
3. Demonstration Analysis (ex. diver problem S:\Staff....CURRICULUM WRITING\AP Chemistry\06 Unit States of Matter\Unit Materials\Activities)
4. Use of Gizmos, LabPro, Vernier or Pasco for data collection in real or virtual settings
5. Real World Application: (ex. crushed tank car; S:\Staff....CURRICULUM WRITING\AP Chemistry\06 Unit States of Matter\Unit Materials\Notes, Diagrams)
6. Constructing Graphs and interpreting data drawing conclusions about phase changes
7. Test Taking Strategies and additional practiced offered on WebAssign.net

Teacher Centered Strategies include

1. Power point/notes lecture (ex. AP Chem Unit 10 in S:\Staff....CURRICULUM WRITING\AP Chemistry\06 Unit States of Matter\Unit Materials\Notes, Diagrams.)
2. Interactive Discussion including Socratic method
3. You tube videos
4. Animations
5. Lab Discussions and performance
6. Teacher demonstrations

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying*
2. Lab Reports according to a rubric (ex. Rubric in District Shared/Chemistry Curriculum/Thermochemistry) *applying, analyzing*
3. Vee Maps (ex. Sample Vee map in District Shared/Chemistry Curriculum/Thermochemistry) – *analyzing, evaluating*
4. Weekly free response question that include both conceptual and mathematical problems – *understanding, applying, analyzing, evaluating*
5. Completion of problems sets – *remembering, understanding, applying*
6. AP sample test questions related to current material and prior using pollanywhere.com – *applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Summative Assessments:

1. Unit Test which includes multiple choice, problem solving as well as free response (ex. AP Chem. Ch. 11,13 Test (07) in S:\Staff....CURRICULUM WRITING\AP Chemistry\06 Unit States of Matter\Unit Materials\Tests.) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Performance Assessments:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying, analyzing, evaluating*
2. Creating analogies to demonstrate full mastery of material learned through colloquialisms. – *remembering, understanding, applying, creating*
3. Ability to construct a procedure to determine the MW of an unknown gas (Freon in S:\Staff....CURRICULUM WRITING\AP Chemistry\06 Unit States of Matter\Unit Materials\Labs) *remembering, understanding, applying, analyzing, evaluating, creating*
4. Ability to work collaboratively to complete inquiry based assignments (Chem116_POGIL_Week01_000; S:\Staff....CURRICULUM WRITING\AP Chemistry\06 Unit States of Matter\Unit Materials\Activities.) *remembering, understanding, applying, analyzing, evaluating, creating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

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AP Chemistry Curriculum

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Unit 7 – Kinetics

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: AP Chemistry /07 Unit Kinetics	Unit Summary: This unit will build on students' prior knowledge of concentration and stoichiometry and show how these things affect the rate of a reaction.
Grade Level(s): 11-12	They will learn the other factors that affect the rate and how these factors are explained through the collision theory, a part of the kinetic molecular theory. They will learn about reaction mechanisms, activation energy, activated complexes, intermediates and will be able to identify these in an energy diagram. Finally they will learn about the rate law of a reaction and how it is affected by the rate determining step of the mechanism of the reaction. They will be able to determine the rate law through experimental initial rates and concentrations, as well as the rate law constant, k.
Essential Question(s): <ol style="list-style-type: none"> 1. What is the rate of a reaction and what affects it? 2. What is the rate law and what is a rate law's order and constant? 3. What is the collision theory? 4. What is a mechanism and how can it help us determine the type and rate of a chemical reaction? 5. How can we graph a reaction mechanism in an energy diagram? 6. What does the slow step of a reaction mechanism mean, and how does it affect the rate? 7. What is a catalyst and how does it affect the 	Enduring Understanding(s): <ol style="list-style-type: none"> 1. The rate of a reaction is influenced by the concentration or pressure of reactants, the phase of the reactants and products, and environmental factors such as temperature and solvent. 2. The rate law shows how the rate depends on reactant concentrations. 3. The magnitude and temperature dependence of the rate of reaction is contained quantitatively in the rate constant. 4. Elementary reactions can be unimolecular or involve collisions between two or more molecules. 5. Not all collisions are successful. To get over the activation energy barrier, the colliding species need sufficient energy. Also, the orientations of the reactant molecules during the collision must allow for the rearrangement of reactant bonds to form product bonds. 6. A successful collision can be viewed as following a reaction path with an associated energy profile. 7. The mechanism of a multistep reaction consists of a series of elementary reactions that add up to the overall reaction. 8. In many reactions, the rate is set by the slowest elementary reaction, or rate limiting step. 9. Reaction intermediates, which are formed during the reaction but not present in the overall reaction, play an important role in a multistep mechanism. 10. Catalysts function by lowering the activation energy of an elementary step in a reaction mechanism, and by providing a new and faster reaction mechanism. 11. Important classes in catalysis include acid-base catalysis, surface catalysis,

rate of a reaction?

and enzyme catalyst.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

<u>Learning Target</u>	<u>NJCCCS or CCS</u>
<ol style="list-style-type: none">1. Define the term kinetics.2. Describe what factors affect reaction rate.3. Define the term catalyst.4. Describe rate of a reaction as a function of concentrations per unit of time.5. Calculate the average rate of a reaction.6. Recognize the change in rate over time of a chemical reaction.6. Calculate the instantaneous rate of a reaction.7. Determine a rate from the stoichiometry of a reaction.8. Use initial rates and initial concentrations to determine the rate law equation for a chemical reaction.9. Define the rate law and the rate law constant, k.10. Identify the reaction order of constituents of a reaction and of the overall reaction.11. Determine the units and magnitude of the rate law constant.12. Use the Integrated Rate Equation to solve problems graphically and mathematically for 1st, 2nd and 0th order reactions.13. Define and calculate the half life of a reaction.14. Describe the main idea behind collision theory and effective collisions.15. Use potential energy diagrams of identify activation energy and activated complexes.16. Explain and use the Arrhenius Equation to determine the activation energy of a reaction.17. Recognize a reaction mechanism.18. Define and identify the terms unimolecular, bimolecular, trimolecular and intermediate.19. Use potential energy diagrams to recognize an intermediate.20. Determine the overall reaction from a reaction mechanism.21. Define rate determining step.22. Determine the rate law of a reaction from the mechanism of the reaction.23. Describe the function and affect of various catalysts.	<p>For Learning Targets 1-12 Science Standards apply: 5.1.12.A.1, , 5.2.12.A.2, 5.2.12.A.3, 5.2.12.B.1, 5.2.12.B.2, 5.2.12.B.3, 5.2.12.C.1, 5.2.12.C.2, 5.2.12.C.3, 5.1.12.D.1, 5.1.12.D.2, 5.1.12.D.3, 5.2.12.A.4, 5.2.12.A.5, 5.2.12.B.3, 5.2.12.C.1, 5.2.12.C.2, 5.2.12.D.2, 5.2.12.D.4, 5.2.12.D.5, 5.3.12.A.2</p> <p>For Learning Targets 1-12 Interdisciplinary Standards apply: (Learning targets in bold)</p> <ul style="list-style-type: none">• 6,12. 8.1.12.A.1 Excel Graphs• 8.1.12.A2 Editing documents• 1-3.8.1.12.A4 Using the electronic portfolio• 1-3. 7.1.1L.A.7 word meaning• 3-12. 9.1.12.A.1 critical thinking• 7. 9.1.12.B1 Creativity and innovation• 3-12. 9.1.12.C4 Demonstrate collaborative skills• 6-12. S-ID.1 interpret data• 6-12. A-REI.2 solve problems• 6-12. A-REI.3 solve problems• 6, 8. A-REI.12 represent function graphically 3. A-CED.1 describing relationships• 2, 6, 12. RI-.11-12.1 read and draw inferences from• 2, 6, 12. text RI.11-12.3 Analyze how and why

Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit. ex. Iodine Clock in S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Labs

Students will engage with the following text:

**The majority of this course is math-intensive but students will regularly use the text:
Chemistry the Central Science: Brown LeMay and Bursten**

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

Additional Ancillary materials are available in district shared S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Notes, Diagrams and may include but not excluded to current events, online media and print materials

Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure. In this class, students will constantly have to relate current material to previously covered units usually in the form of free response questions, where they must rationalize the material and make connections between new and old units.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

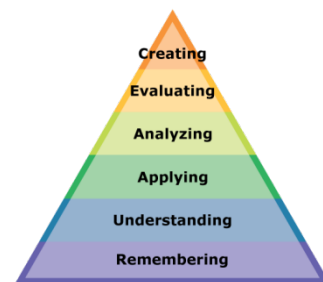
1. POGIL inquiry lessons (ex. Chem116_POGIL_Week06 in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Activities)
2. Hands-on labs/activities (ex. alka_rx in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Labs)
3. Demonstration Analysis (ex. ArrheniusPlota in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Notes, Diagrams)
4. Use of Gizmos, LabPro, Vernier or Pasco for data collection in real or virtual settings (ex. Iodine clock computer lab in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Labs)
5. Real World Application: 1stOrderQ in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Notes, Diagrams)
6. Constructing Graphs and interpreting data drawing conclusions about first and second order reactions.
7. Test Taking Strategies and additional practiced offered on WebAssign.net

Teacher Centered Strategies include

1. Power point/notes lecture (ex. kinetics I in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Notes, Diagrams)
2. Interactive Discussion including Socratic method
3. You tube videos
4. Animations
5. Lab Discussions and performance

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying*
2. Lab Reports according to a rubric (ex. Rubric in District Shared/Chemistry Curriculum/Thermochemistry) *applying, analyzing*
3. Vee Maps (ex. Sample Vee map in District Shared/Chemistry Curriculum/Thermochemistry) – *analyzing, evaluating*
4. Weekly free response question that include both conceptual and mathematical problems – *understanding, applying, analyzing, evaluating*
5. Completion of problems sets – *remembering, understanding, applying*
6. AP sample test questions related to current material and prior using pollanywhere.com – *applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Summative Assessments:

1. Unit Test which includes multiple choice, problem solving as well as free response (ex. AP Chem. Ch. 14 Test (10) in S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Tests) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Performance Assessments:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying, analyzing, evaluating*
2. Creating analogies to demonstrate full mastery of material learned through colloquialisms. – *remembering, understanding, applying, creating*
3. Ability to construct a procedure to determine the rate of a reaction (alka_rx in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Labs) *remembering, understanding, applying, analyzing, evaluating, creating*
4. Ability to work collaboratively to complete inquiry based assignments acid (Chem116_POGIL_Week06 in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\07 Unit Kinetics\Activities) *remembering, understanding, applying, analyzing, evaluating, creating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 8 – Equilibrium

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: AP Chemistry /08 Unit Equilibrium	Unit Summary: This unit will build on students' prior knowledge of kinetic rate laws, showing how the forward and reverse rate laws combine to make a constant at equilibrium. They will learn how to calculate the equilibrium constant and determine the equilibrium expression. Utilizing these concepts, they will solve a multitude of problems. They will learn of LeChatelier's principle and determine the changes that occur when conditions are altered in equilibrium.
Grade Level(s): 11-12	
Essential Question(s): <ol style="list-style-type: none"> 1. What is equilibrium and how is it mathematically represented? 2. When are K and Q equivalent? 3. What changes K, and what does its magnitude tell us? 4. How does K vary between concentration and partial pressures? 5. How can you calculate K, or the concentrations of the components of equilibrium? 6. What is LeChatelier's principle? 7. How does equilibrium change when the conditions of a reaction change? 	Enduring Understanding(s): <ol style="list-style-type: none"> 1. In many classes of reactions, it is important to consider both the forward and reverse reaction. 2. The current state of a system undergoing a reversible reaction can be characterized by the extent to which reactants have been converted to products. The relative quantities of reaction components are quantitatively described by the reaction quotient, Q. 3. When a system is at equilibrium, all macroscopic variables, such as concentrations, partial pressures, and temperature, do not change over time. Equilibrium results from an equality between the rates of the forward and reverse reactions, at which point $Q = K$. 4. The magnitude of the equilibrium constant, K, can be used to determine whether the equilibrium lies toward the reactant side or product side. 5. Systems at equilibrium respond to disturbances by partially countering the effect of the disturbance (LeChatelier's principle). 6. A disturbance to a system at equilibrium causes Q to differ from K, thereby taking the system out of the original equilibrium state. The system responds by bringing Q back into agreement with K, thereby establishing a new equilibrium state.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

<u>Learning Target</u>	<u>NJCCCS or CCS</u>
<ol style="list-style-type: none">1. Define equilibrium and represent it according to the law of mass action.2. Describe the relationship between Q and K.3. Determine the equilibrium constant expression for various reactions.4. Calculate the equilibrium constant, K_c.5. Convert K_c to K_p or vice versa.6. Determine whether reactants or products are favored through the magnitude of the equilibrium constant.7. Determine the equilibrium constant when the reaction stoichiometry is altered, the reaction is reversed, or when reactions are summed together.8. Determine the equilibrium expression for heterogeneous equilibrium.9. Establish concentration tables to calculate an unknown concentration of a reactant or product at equilibrium.10. Use LeChatelier's Principle to determine shifts in equilibria.11. Predict the effects when there is a change to a dynamic equilibrium. (5.6.B.1.2.3)12. Identify the effects to equilibrium by the addition of a catalyst.	<p>For Learning Targets 1-12 Science Standards apply: 5.1.12.A.1, , 5.2.12.A.2, 5.2.12.A.3, 5.2.12.B.1, 5.2.12.B.2, 5.2.12.B.3, 5.2.12.C.1, 5.2.12.C.2, 5.2.12.C.3, 5.1.12.D.1, 5.1.12.D.2, 5.1.12.D.3, 5.2.12.A.5, 5.2.12.B.3, 5.2.12.D.2, 5.2.12.D.4, 5.2.12.D.5</p> <p>For Learning Targets 1-12 Interdisciplinary Standards apply: (Learning targets in bold)</p> <ul style="list-style-type: none">• 6,12. 8.1.12.A.1 Excel Graphs• 8.1.12.A2 Editing documents• 1-3.8.1.12.A4 Using the electronic portfolio• 1-3. 7.1.1L.A.7 word meaning• 3-12. 9.1.12.A.1 critical thinking• 7. 9.1.12.B1 Creativity and innovation• 3-12. 9.1.12.C4 Demonstrate collaborative skills• 6-12. S-ID.1 interpret data• 6-12. A-REI.2 solve problems• 6-12. A-REI.3 solve problems• 6, 8. A-REI.12 represent functions graphically 3. A-CED.1 describing relationships• 2, 6, 12. RI-.11-12.1 read and draw inferences from• 2, 6, 12. text RI.11-12.3 Analyze how and why

Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit. ex. LeChat's princ in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Labs

Students will engage with the following text:

The majority of this course is math-intensive but students will regularly use the text:

Chemistry the Central Science: Brown LeMay and Bursten

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

Additional Ancillary materials are available in district shared S:\Staff....\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Notes, Diagrams and may include but not excluded to current events, online media and print materials

Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure. In this class, students will constantly have to relate current material to previously covered units usually in the form of free response questions, where they must rationalize the material and make connections between new and old units.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

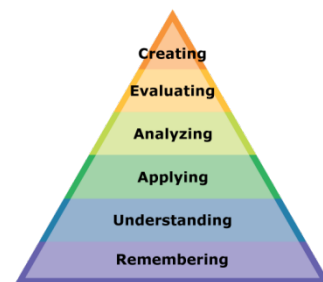
1. POGIL inquiry lessons (ex. Equilibrium ICE POGIL in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Activities)
2. Hands-on labs/activities (ex. Det eq cons in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Labs)
3. Demonstration Analysis (ex. LeChat's princ in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Labs)
4. Use of Gizmos, LabPro, Vernier or Pasco for data collection in real or virtual settings
5. Real World Application: LeChat's princ in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Labs)
6. Constructing Graphs and interpreting data drawing conclusions about first and second order reactions.
7. Test Taking Strategies and additional practiced offered on WebAssign.net

Teacher Centered Strategies include

1. Power point/notes lecture (ex. Equilibrium I in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Notes, Diagrams)
2. Interactive Discussion including Socratic method
3. You tube videos
4. Animations
5. Lab Discussions and performance

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying*
2. Lab Reports according to a rubric (ex. Rubric in District Shared/Chemistry Curriculum/Thermochemistry) *applying, analyzing*
3. Vee Maps (ex. Sample Vee map in District Shared/Chemistry Curriculum/Thermochemistry) – *analyzing, evaluating*
4. Weekly free response question that include both conceptual and mathematical problems – *understanding, applying, analyzing, evaluating*
5. Completion of problems sets – *remembering, understanding, applying*
6. AP sample test questions related to current material and prior using pollanywhere.com – *applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Summative Assessments:

1. Unit Test which includes multiple choice, problem solving as well as free response (ex. BLB Ch. 15 test in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Tests) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Performance Assessments:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying, analyzing, evaluating*
2. Creating analogies to demonstrate full mastery of material learned through colloquialisms. – *remembering, understanding, applying, creating*
3. Ability to construct a procedure to neutralize an acid (Det eq cons in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Labs) *remembering, understanding, applying, analyzing, evaluating, creating*
4. Ability to work collaboratively to complete inquiry based assignments acid (Equilibrium ICE POGIL in S:\Staff...\CURRICULUM WRITING 2013\AP Chemistry\Unit Materials\08 Unit Equilibrium\Activities) *remembering, understanding, applying, analyzing, evaluating, creating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 9: Acids and Bases

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: AP Chemistry /Acid and Bases	Unit Summary: This unit will build on students' prior knowledge of acids and bases exploring further the properties of acids and bases, how the acidity and alkalinity is measured and what effects does that have on the environment. Factors affecting solubility of these solutions will also be explored in detail.
Grade Level(s): 11-12	
Essential Question(s): <ol style="list-style-type: none"> 1. What are the properties of both acids and bases? 2. How alkalinity and acidity measured? 3. What is the purpose of a titration? 4. How and why is a solution buffered? 5. What factors affect solubility? 	Enduring Understanding(s): <ol style="list-style-type: none"> 1. Acidity depends on Hydrogen ion concentration in a solution. Acids are sour to taste for example lemons. Alkalinity depends on hydroxide ion concentration. Bases are slippery to touch, soap for example. 2. Acidity and Alkalinity are measured using pH and pOH respectively. 3. A titration is used to measure the amount of base needed to neutralize an acid or vice versa. In a neutralization reaction, protons are transferred from an acid to a base. 4. The pH is an important characteristic of aqueous solutions that can be controlled with buffers. Comparing pH and pKa allows one to determine the protonation state of a molecule with a labile proton. This is important to stabilize a pH for example in human blood. 5. Solubility of a substance can be understood in terms of chemical equilibrium, which is affected by temperature and the presence of other solutes (common-ion, pH, complex ions, and amphotericism)

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

<u>Learning Target</u>	<u>NJCCCS or CCS</u>
<ol style="list-style-type: none">1. Identify the formulas and names of common acids and bases2. Identify the properties of both acids and bases3. Compare Bronsted-Lowry, and Arrhenius identifying conjugate acid/base pairs4. Calculate the pH and pOH, Hydrogen ion concentration and Hydroxide ion concentration in a solution.5. Calculate the amount of base needed to neutralize and acid and vice versa6. Titrate a solution to the end point effectively and interpret graphic data for a strong acid/strong base solution, strong acid/weak base solution and strong base/weak acid solution as well as polyprotic acids.7. Determine what indicators are appropriate for use with different titrations.8. Construct equation that shows neutralization of an acid or base given salt and water9. Applying the relationship between K_a and K_b. calculate the K_a of a weak acid/K_b of a weak base.10. Use the common-ion effect to calculate the pH of buffered solutions determining the buffer's pH range11. Use data to calculate solubility equilibria K_{sp}12. Determine and experimentally apply the factors that affect solubility including common-ion effect, pH, formation of complex ions, amphoterism.	<p>For Learning Targets 1-12 Science Standards apply: 5.1.12.D.1, 5.1.12.D.2, 5.1.12.D.3, 5.2.12.A.1, 5.2.12.A.2, 5.2.12.A.3, 5.2.12.A.4, 5.2.12.A.5, 5.2.12.A.6, 5.2.12.B.1, 5.2.12.B.2, 5.2.12.B.3, 5.2.12.C.1, 5.2.12.C.2, 5.2.12.D.2, 5.2.12.D.3, 5.2.12.D.4, 5.2.12.D.5</p> <p>For Learning Targets 1-12 Interdisciplinary Standards apply: (Learning targets in bold)</p> <ul style="list-style-type: none">• 6,12. 8.1.12.A.1 Excel Graphs• 8.1.12.A2 Editing documents• 1-3.8.1.12.A4 Using the electronic portfolio• 1-3. 7.1.1L.A.7 word meaning• 3-12. 9.1.12.A.1 critical thinking• 7. 9.1.12.B1 Creativity and innovation• 3-12. 9.1.12.C4 Demonstrate collaborative skills• 6-12. S-ID.1 interpret data• 6-12. A-REI.2 solve problems• 6-12. A-REI.3 solve problems• 6, 8. A-REI.12 represent function graphically 3. A-CED.1 describing relationships• 2, 6, 12. RI-.11-12.1 read and draw inferences from• 2, 6, 12. text RI.11-12.3 Analyze how and why

Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit.

Students will engage with the following text:

The majority of this course is math-intensive but students will regularly use the text:
Chemistry the Central Science: Brown LeMay and Bursten

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

[Determination of \$K_a\$ of a Weak acid](#) (see district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases)

Additional Ancillary materials are available in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases and may include but not excluded to current events, online media and print materials

Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure. In this class, students will constantly have to relate current material to previously covered units usually in the form of free response questions, where they must rationalize the material and make connections between new and old units.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

1. POGIL inquiry lessons (ex. [POGIL on buffers](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases)
2. Hands-on labs/activities (ex. [Determination of \$K_a\$ of a Weak acid Lab](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases)
3. [Demonstration Analysis](#) (ex. Demos in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases)
4. Use of Gizmos, LabPro, Vernier or Pasco for data collection in real or virtual settings
5. Real World Application: [Buffers in Lemonade](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases Constructing Graphs and interpreting data drawing conclusions about titration of acid and base.

6. Test Taking Strategies and additional practiced offered on WebAssign.net and [science geek](#)

Teacher Centered Strategies include

1. Power point/notes lecture (ex. [Acid Base Notes](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases Interactive Discussion including Socratic method)
2. You tube videos
3. Animations
4. Lab Discussions and performance

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying*
2. Lab Reports according to a rubric (ex. [College Write Up](#), Rubric in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases *applying, analyzing*)
3. Vee Maps (ex. [Sample vee map](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases) – *analyzing, evaluating*
4. [Weekly free response](#) question that include both conceptual and mathematical problems – *understanding, applying, analyzing, evaluating*
5. [Completion of problems sets](#) – *remembering, understanding, applying*
6. AP sample test questions related to current material and prior using pollanywhere.com – *applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Summative Assessments:

1. [Unit Test](#) which includes multiple choice, problem solving as well as free response (ex. Acid Base Test in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Performance Assessments:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying, analyzing, evaluating*
2. Creating analogies to demonstrate full mastery of material learned through colloquialisms. – *remembering, understanding, applying, creating*
3. Ability to construct a procedure to neutralize an acid (Titration lab in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases) *remembering, understanding, applying, analyzing, evaluating, creating*
4. Ability to work collaboratively to complete inquiry based assignments acid (Acid/Base POGIL in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases) *remembering, understanding, applying, analyzing, evaluating, creating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 10: Electrochemistry

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<p>Course/Unit Title: AP Chemistry/ Electrochemistry</p>	<p>Unit Summary: In this unit, finding oxidation numbers of elements will be reviewed. The activity series for metals and the halogens will be described and utilized to predict products of oxidation-reduction reactions and write/balance chemical equations describing those reactions. Students will also relate electrochemistry to equilibrium and thermodynamics quantitatively and qualitatively</p>
<p>Grade Level(s): 10-12</p>	
<p>Essential Question(s):</p> <ol style="list-style-type: none"> What happens during a redox reaction? How is energy transformed in electrochemical reactions? 	<p>Enduring Understanding(s):</p> <ol style="list-style-type: none"> In oxidation-reduction (redox) reactions, there is a net transfer of electrons. The species that loses electrons is oxidized and the species that gains electrons is reduced. Electrochemistry shows the interconversion between chemical and electrical energy in galvanic and electrolytic cells.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

<p>Learning Target: Students will be able to...</p> <ol style="list-style-type: none"> Identify oxidizing agent and reducing agent in an oxidation reduction reaction Balance simple oxidation-reduction reactions by the oxidation number method as well as the half cell method. Diagram voltaic and electrolytic cells labeling the anode, cathode, direction of ion and electron movement, and signs of electrodes. Calculate the Electromotive force generated by a voltaic cell 	<p>NJCCCS or CCS</p> <ol style="list-style-type: none"> <p>Science: 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1</p> <p>World Lang: 7.1.IL.A.7</p> <p>21st C. Life: 9.1.12.A.1</p> <p>LAL: RI.11-12.8, L11-12.5</p> <p>Technical subjects: RST.11-12.1, RST.11-12.4, RST.11-12.5</p> <p>Writing: WHST.11-12.9</p> <p>Science: 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1</p> <p>World Lang: 7.1.IL.A.7</p> <p>21st C. Life: 9.1.12.A.1</p>
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5. Predict whether a reaction is spontaneous or nonspontaneous using electromotive force.
6. Interconvert electromotive force, free energy and equilibrium.
7. Use the Nernst Equation to calculate the concentration of an ion, and emf under nonstandard conditions
8. Interrelate time, current and the amount of substance produced or consumed in an electrolysis reaction.
9. Calculate maximum electrical work performed by a voltaic cell and the minimum electrical work required for an electrolytic process.

LAL: RI.11-12.8, L11-12.5

Technical subjects: RST.11-12.1, RST.11-12.4, RST.11-12.5

Writing: WHST.11-12.9

3. Science: 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1

World Lang: 7.1.IL.A.7

21st C. Life: 9.1.12.A.1

LAL: RI.11-12.8, L11-12.5

Technical subjects: RST.11-12.1, RST.11-12.4, RST.11-12.5

Writing: WHST.11-12.9

4. Science: 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1, 5.2.12.B.3

World Lang.: 7.1.IL.A.7

21st C Life: 9.1.12.A.1, 9.1.12.B.1, 9.1.12.E.1

LAL: L.9-10.5 or L11-12.5

Math: N-R.3, N-CN.2

5. Science: 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1, 5.2.12.B.3

World Lang.: 7.1.IL.A.7

21st C Life: 9.1.12.A.1, 9.1.12.B.1, 9.1.12.E.1

LAL: L.9-10.5 or L11-12.5

Math: N-R.3, N-CN.2

6. Science: 5.1.12.A.1, 5.1.12.B.1, 5.1.12.D.1, 5.2.12.B.3, 5.2.12.B.2

World Lang.: 7.1.IL.A.7

21st C Life: 9.1.12.A.1

LAL: RI.11-12.2, RI.9-10.3 or RI.11-12.3, RI.11-12.7, L11-12.1, L11-12.3, L11-12.4, L11-12.5, L11-12.6

Technical Subjects: RST.11-12.2, RST.11-12.4, RST.11-12.5

Writing: WHST.11-12.9

	<p>7. Science: 5.1.12.A.1, 5.1.12.A.3, 5.1.12.B.1, 5.1.12.D.1, 5.2.12.B.3, 5.2.12.B.2, 5.1.12.A.3</p> <p>World Lang: 7.1.IL.A.7</p> <p>21st C. Life: 9.1.12.A.1</p> <p>LAL: RI.11-12.8, L11-12.5</p> <p>Technical subjects: RST.11-12.1, RST.11-12.4, RST.11-12.5</p> <p>Writing: WHST.11-12.9</p>
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Inter-Disciplinary Connections:

Students will interact with text, and will be asked to read and draw inferences, cite specific evidence, follow procedures/tasks, translate word problems into mathematical problems, and assess text for use in forming arguments or comparing/contrasting arguments. Lab reports will involve technical writing. Students will be expected to write clearly and coherently, revising and editing, and use technology to produce and present their work. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impacts on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, Vernier probes, Microsoft Word or Excel) may be used to supplement lessons and investigations in this unit.

- examples of strategies and modified strategies are in the District Shared/APPS/Science Chem Lab Pro electrochem <P:\ChemLab Pro\Echem.dll>

Students will engage with the following text:

The majority of this course is math-intensive but students will regularly use the text:
Chemistry the Central Science: Brown LeMay and Bursten

Enrichment/Enhancement
Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

Lab activities : [electrochem lab 1](#)(CURRICULUM WRITING 2013/AP Electrochemistry folder) |

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs.

Students will write:

AP free response questions are 50% of the test therefore a huge part of preparation is practice in writing free response. Laboratory investigations will include a pre lab write-up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify

constants and variables) report results and their significance and source of error including ways to reduce or eliminate error. Students will formulate a connection to classroom material and relate the purpose of the experiments to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure. In addition to usual warm-ups, closing activities and lab reports, writing projects.

- examples of strategies and modified strategies are in the District Shared/Science/CURRICULUM WRITING 2013/AP electrochemistry folder

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

1. Hands-on labs/activities or group discussion of a particular topic lab: [electrochem 1](#)
2. Use of Webassign, [Gizmos](#), LabPro, Vernier or Pasco for collection
3. Real World Application: Utilizing measuring devices and incorporating problem-solving skills that can be implemented in other courses and outside of class. [Real life](#)

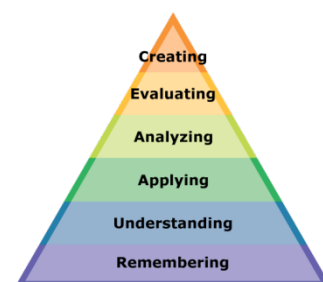
Teacher Centered Strategies include

1. Power point/[notes](#) lecture
2. You tube videos
 - examples of strategies and modified strategies [you start at the anode](#) in the District Shared/Science/CURRICULUM WRITING 2013/AP Electrochemistry folder

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

- Weekly AP free response questions from past AP tests that include both conceptual questions and mathematical problems *understanding, applying, synthesizing*

- Completion of independent practice and problem sets(webassign) *understanding, analyzing, evaluating*
- Writing samples used to relate material to a real world application through demonstrations *analyzing, evaluating, synthesizing, evaluating*
- Chapter and /or major topic tests *understanding, applying, analyzing, evaluating*
- Laboratory investigations (ability to properly collect data and perform calculations pertaining to activity.

Some examples might include:

- [Electrochem Lab 1](#) *understanding, applying, analyzing*
- [Electrochem Lab 2](#) *applying, analyzing, evaluating*
- [Electrochem Lab 3](#) *applying, analyzing, evaluating*

- examples of assessments and modified assessments are in the District Shared/Science/CURRICULUM WRITING 2013/AP Electrochemistry folder

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs, such as corrections on tests and quizzes at students' leisure.

Summative Assessments:

Students will be required to take a test to demonstrate proficiency on the material presented in this unit. Note: Unit Test which includes multiple choice, problem solving as well as free response [Test](#)(ex. CURRICULUM WRITING 2013/AP Electrochemistry folder) *understanding, applying, analyzing, evaluating*

1. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. *understanding, applying, analyzing*

- examples of assessments and modified assessments are in the District Shared/Science/CURRICULUM WRITING 2013/AP Electrochemistry folder

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs.

Performance Assessments:

1. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded *understanding, applying*
2. Ability to perform lab activities and perform calculations pertaining to activity *applying, analyzing, evaluating*
3. Ability to differentiate between [galvanic and electrolytic](#) . *analyzing, evaluating*
4. Ability to predict products of electrochemical reactions as well as a quantitative amount of electricity either consumed or produced. *applying, analyzing, evaluating, creating*

- examples of assessments and modified assessments are in the District Shared/Science/CURRICULUM WRITING 2012/Chemistry Chemical reactions folder

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs.

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 11: Nuclear Chemistry

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: AP Chemistry /Nuclear	Unit Summary: This unit will discuss the properties of radioactivity, the different particles emitted, the pathway in which they are emitted, how they are measured and what effects does that have on the environment.
Grade Level(s): 10-12	
Essential Question(s): <ol style="list-style-type: none"> How does fusion on our sun work? How is energy generated in our nuclear power plants and what are the risks? What is carbon dating and how is it used? 	Enduring Understanding(s): <ol style="list-style-type: none"> Fusion is a process that combines two smaller nuclei into a larger one. It requires incredibly hot temperatures to start which makes the fact that it is used on the sun and stars logical. Fission splits a nucleus apart into two smaller nuclei. This is used by our power plants creating nuclear waste. If controls are not met, it can be disastrous (Chernobyl, Three Mile Island) The energy released during nuclear decay can be in different forms such as alpha particles, beta particles, gamma rays. The half live of a substance is how long it takes half the atoms in a given sample to decay. This is used in Carbon dating Quantitative information can be derived from stoichiometric calculations that utilize the mole ratios from the balanced chemical equations. The role of stoichiometry in real-world applications is important to note, so that it does not seem to be simply am exercise done only by chemists.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

Learning Target <ol style="list-style-type: none"> Identify the types of nuclear radiation and write them symbolically. Describe nuclear fission macroscopically and 	NJCCCS or CCS For Learning Targets 1-12 Science Standards apply: 5.1.12.D.1, 5.1.12.D.2, 5.1.12.D.3, 5.2.12.A.1, 5.2.12.A.2, 5.2.12.A.3, 5.2.12.A.4, 5.2.12.A.5, 5.2.12.A.6,
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<p>symbolically and how it is used in the world</p> <p>3. Describe nuclear fusion macroscopically and symbolically and how it is used in the world</p> <p>4. Calculate the half life of substance graphically and using the Arrhenius equation</p>	<p>5.2.12.B.1, 5.2.12.B.2, 5.2.12.B.3, 5.2.12.C.1, 5.2.12.C.2, 5.2.12.D.2, 5.2.12.D.3, 5.2.12.D.4, 5.2.12.D.5</p> <p>For Learning Targets 1-12 Interdisciplinary Standards apply:(Learning targets in bold) CCS</p> <ul style="list-style-type: none"> • 4. 8.1.12.A.1 Excel Graphs • 4. 8.1.12.A4 Using the electronic portfolio • 1-3 7.1.1L.A.7 word meaning • 2-3. 9.1.12.A.1 critical thinking • 2-3. 9.1.12.B1 Creativity and innovation • 2-4. 9.1.12.C4 Demonstrate collaborative skills • 4.S-ID.1 interpret data • 4. A-REI.2 solve problems • 4. A-REI.3 solve problems • 4. A-REI.12 represent linear function graphically • 1-4 A-CED.1 describing relationships • 1-3. RI-.11-12.1 read and draw inferences from text
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Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit.

- **Fat Man and Little Boy**

- examples of strategies and modified strategies are in the District Shared/Science/CURRICULUM WRITING 2013/Chemistry/AP Nuclear folder

Students will engage with the following text:

**The majority of this course is math-intensive but students will regularly use the text:
Chemistry the Central Science: Brown LeMay and Bursten**

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

[Radioactive Decay Activity](#)

Additional Ancillary materials are available in district shared District Shared/Science/CURRICULUM WRITING 2013/Chemistry/AP Nuclear folder and may include but not excluded to current events, online media and print materials |

- examples of strategies and modified strategies are in the District Shared/Science/CURRICULUM WRITING

2013/Chemistry/AP Nuclear folder

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. They may include but not be limited to :

Reading: Decrease reading as necessary, read text chapter aloud for auditory learners, use of pictures and captions to aide in understanding.

Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure **In addition to the usual warm ups, closing activities, lab reports, writing assignments may be given**

- examples of strategies and modified strategies are in the District Shared/Science/CURRICULUM WRITING 2013/Chemistry/AP Nuclear folder

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. They may include but not be limited to :

Writing: Decrease writing as needed, less emphasis on writing mechanics and spelling, graphic organizers to brainstorm ideas.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

1. POGIL inquiry lessons (ex. [POGIL on Nuclear fission and fusion](#) District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder)
2. Hands-on labs/activities (ex. [Half-life of pennies lab](#) District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder)
3. Demonstration Analysis (ex. [Nuked Salt](#) District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder Use of [Gizmos](#), LabPro, Vernier or Pasco for data collection in real or virtual settings)
4. Real World Application: [History of Manhattan Project](#) District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder
5. [Constructing Graphs and interpreting data drawing conclusions about half lives of substances.](#) District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder

Teacher Centered Strategies include

1. Power point/notes lecture (ex. [112 Unit Vi Nuclear chemistry](#) District

Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder

2. Interactive Discussion including Socratic method
3. You tube videos
4. Animations

- examples of strategies and modified strategies are in the District Shared/Science/CURRICULUM WRITING 2012/Chemistry/Nuclear folder

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. **Ability to perform lab activities and perform calculations pertaining to activity** –(ex. [Half-life of pennies](#) District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder) *remembering, understanding, applying*
2. **Lab Reports according to a rubric** (ex. [Rubric](#) District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder) *applying, analyzing*
3. **Vee Maps** (ex. [Sample Vee map](#) District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder)– *analyzing, evaluating*
4. **Weekly quizzes that include both conceptual and mathematical problems** – *understanding, applying, analyzing, evaluating*
5. **Completion of independent and collaborative worksheets and problems sets** – *remembering, understanding, applying*
6. **Writing samples relate material to a real world application through demonstrations** –*applying, analyzing, evaluating*

- examples of assessments and modified assessments are in the District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs.

Examples of ways to accommodate the special needs of students and to modify assessments to provide means of accurately assessing these students may include but not be limited to:

Extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment), modifying directions for clarity, chunking test items, modify free response to include specific information in

order of complexity as well as a need to decrease writing , reading math equations aloud to aid in understanding of reactants and products, use of formulas to help the student solve for the mathematical equation, using concept maps to organize notes and lab reports, modifying lab reports, and homework assignments as needed. Extra help from the Special Education teacher should be available after school to reinforce key concepts.

The Special Education teacher will be available for additional support in reading test items and questions for understanding, modify labs based upon a student's learning style, read and help student self-edit lab reports for understanding of meaning, modify tests/quizzes by rewording directions, using colored pencils to aid in comprehension of chemical formulas and equations/distinguishing reactants from products, chunk lab reports where writing is minimized, assess students on main topics covered in class as opposed to ancillary material. The Special Education teacher will work with students after school if multiple step lab is too long to complete in lab period, The Special Education teacher will assist students with providing formulas and lab review guides in order for students to perform the lab successfully, provide mock lab presentations to model how the lab should be performed in class. Research supports collaborative inclusion settings with two teachers in the classroom to help classified students and students with 504 plans have a positive outlook to learning therefore they feel better about themselves. (Tindal and Fuchs, 2000), (Lance, 2004).

Summative Assessments:

1. **Unit Test** which includes multiple choice, problem solving as well as free response (ex. District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*
3. Students will complete Free Response Questions from AP Collegeboard as practice for the exam

- District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs.

Examples of ways to accommodate the special needs of students and to modify assessments to provide means of accurately assessing these students may include but not be limited to:

Extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment), modifying directions for clarity, chunking test items, modify free response to include specific information in order of complexity as well as a need to decrease writing, reading math equations aloud to aid in understanding of reactants and products, use of formulas to help the student solve for the mathematical equation, modifying lab reports, and homework assignments as needed. Extra help from the Special Education teacher should be available after school to reinforce key concepts.

The Special Education teacher will be available for additional support in reading test items and questions for understanding, using concept maps to organize notes and lab reports, modify labs based upon a student's

learning style, read and help student self-edit lab reports for understanding of meaning, using different font to distinguish chemical reactions, using colored pencils to highlight various chemical reactions, use of manipulatives to build models of chemical reactions, modify tests/quizzes by rewording directions, using colored pencils to aid in comprehension of chemical formulas and equations/distinguishing reactants from products, chunk lab reports where writing is minimized, assess students on main topics covered in class as opposed to ancillary material.

The Special Education teacher will work with students after school if multiple step lab is too long to complete in lab period, The Special Education teacher will assist students with providing formulas and lab review guides in order for students to perform the lab successfully, provide mock lab presentations to model how the lab should be performed in class. Research supports collaborative inclusion settings with two teachers in the classroom to help classified students and students with 504 plans have a positive outlook to learning therefore they feel better about themselves. (Tindal and Fuchs, 2000), (Lance, 2004).

Performance Assessments:

1. **Ability to perform lab activities and perform calculations pertaining to activity** – *remembering, understanding, applying, analyzing, evaluating*
2. **Creating analogies to demonstrate full mastery of material learned through colloquialisms.** – *remembering, understanding, applying, creating*
3. **Ability to construct a procedure** (lab District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder)*remembering, understanding, applying, analyzing, evaluating, creating*

- examples of assessments and modified assessments are in the District Shared/Science/CURRICULUM WRITING 2013/AP Nuclear folder

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student's needs.

Black Horse Pike Regional School District Curriculum Template

AP Chemistry Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 12: Organic, Biochemistry and Complex ions

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<p>Course/Unit Title: <i>AP Chemistry</i></p> <p>Unit 10: Organic Biochemistry and Complex ions</p>	<p>Unit Summary: This unit will focus on the rules for naming of the organic compounds, functional groups and how the compounds interact.</p> <p>Organic compounds are involved extensively in biochemical reactions. Some of these will be examined on the macroscopic and symbolic level. Again students will see how structure relates to function and how it directly affects them.</p> <p>Lastly, complex ions will be examined. First they will be synthesized and then analyzed .</p>
<p>Grade Level(s): 11-12</p>	<p>Enduring Understanding(s):</p> <ol style="list-style-type: none"> Carbon is the common element in organic compounds. Nomenclature depends on the number of carbons, the types of bonds and the functional groups attached. Compounds of the same formula may present different properties based on isomerism. Biological processes such as combustion, esterification, substitution involve organic compounds Complex ions are used in biochemistry. (For example hemoglobin to transport oxygen to blood)
<p>Essential Question(s):</p> <ol style="list-style-type: none"> What characteristics make a compound organic? How do you name and write formulas for organic compounds? How are biological processes and chemical reactions related? What is a complex ion and how do they react? 	

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

<p>Learning Target</p> <ol style="list-style-type: none"> Using the octet rule, write the symbols for both atoms and the single ions for the organic compounds. Write names and formulas for organic 	<p>NJCCCS</p> <p>Science:</p> <ol style="list-style-type: none"> 5.1A1 5.1A3, 5.1A2 5.2A2, 5.2A3 5.2A1, 5.2A3
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<p>compounds and different functional groups using IUPAC nomenclature.</p> <ol style="list-style-type: none"> 3. Draw Lewis structures and write formulas for various compounds containing complex ions. 4. Symbolically represent how a complex ion is synthesized. 5. Describe the characteristics of a coordinate covalent bond, which makes up a complex ion. 6. Interpret characteristics of compounds based upon bonding 7. Analyze an unknown solution to determine if complex ions are present. 	<ol style="list-style-type: none"> 3. 5.2A1, 5.2A3 4. 5.2A1, 5.2A3 5. 5.2A1, 5.2A3 6. 5.2A1, 5.2A2, 5.2A3 7. 5.2A1, 5.2A2, 5.2A3 <p>CCS</p> <p>For 5.1A1</p> <p>3.1G, 3.1H, 3.2A, 3.2B, 3.2C, 3.2D, 3.5A, 3.5B, 4.1A, 8.1A, 8.1E, 8.1F, 8.2B, 8.2G, 9.1A, 9.1B, 9.1D, 9.1F, 9.4A, 9.4O, 9.4O(1), 9.4O(2)</p> <p>For 5.1A2</p> <p>3.1G, 3.2A, 3.2B, 3.2C, 3.2D, 3.5A, 3.5B, 8.1A, 8.1F, 8.2B, 9.1A, 9.1B, 9.1F, 9.4A, 9.4O, 9.4O (1), 9.4O (2)</p> <p>For 5.1A3</p> <p>3.1G, 3.1H, 3.2A, 3.2B, 3.2C, 3.2D, 3.5A, 3.5B, 4.1A, 8.1A, 8.1C, 8.1F, 8.2B, 8.2F, 9.1A, 9.1B, 9.1C, 9.1D, 9.1F, 9.4A, 9.4O, 9.4O (1), 9.4O (2)</p> <p>5.2A1-</p> <p>3.1G, 3.2A, 3.2B, 3.2C, 3.2D, 3.5A, 3.5B, 4.1A, 8.1A, 8.1F, 9.1A, 9.1B, 9.1C, 9.1D, 9.1E, 9.4A, 9.4O, 9.4O(1), 9.4O(2)</p> <p>5.1A2</p> <p>3.1G, 3.2A, 3.2B, 3.2C, 3.2D, 3.5A, 3.5B, 8.1A, 8.1F, 8.2B, 9.1A, 9.1B, 9.1F, 9.4A, 9.4O, 9.4O (1), 9.4O (2)</p> <p>5.2A3- 3.1G, 3.2A, 3.2B, 3.2C, 3.2D, 3.5A, 3.5B, 4.1A, 8.1A, 8.1F, 9.1A, 9.1B, 9.1C, 9.1D, 9.1E, 9.4A, 9.4O, 9.4O(1), 9.4O(2)</p>
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Inter-Disciplinary Connections:

Lab reports will involve reading comprehension, as well as technical writing. Most concepts presented in this unit will incorporate algebra and problem solving skills. Technological advancements (and their impact on society) utilizing concepts will also be incorporated in this unit. Additionally, the uses of computer technology (Pasco, LoggerPro, or Excel) may be used to supplement lessons and investigations in this unit.

Students will engage with the following text:

The majority of this course is math-intensive but students will regularly use the text:
Chemistry the Central Science: Brown LeMay and Bursten

Enrichment/Enhancement

Due to the high rigor of the course students will often need additional resources. Additional reading and enrichment activities are provided on an as needed basis. There are also after school study sessions available for students who benefit from the extra individual attention. In addition students are directed to the AP Central website for additional practice essays and sample AP test questions.

[Esterification Lab](#) (see district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions

Additional Ancillary materials are available in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions and may include but not excluded to current events, online media and print materials

Students will write:

Laboratory investigations will involve a pre-lab write up including purposes and procedures. Lab reports will include conclusions in which students will restate the purpose, summarize the procedure (identify constants and variables), report results and their significance/meaning, and sources of error and ways to reduce and or eliminate it. Students will formulate a connection to classroom material and relate the purpose of the experiment to the conclusion, where necessary changing a hypothesis and sometimes synthesizing a new procedure . In this class, students will constantly have to relate current material to previously covered units usually in the form of free response questions, where they must rationalize the material and make connections between new and old units.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Student-Center Strategies may include:

1. POGIL inquiry lessons (ex. [POGIL on Alkanes](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions)
2. Hands-on labs/activities (ex. [Esterification Lab](#) and [analysis of silver group ions](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions)
3. [Demonstration Analysis](#) (ex. Demos in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions)
4. Use of Gizmos, LabPro, Vernier or Pasco for data collection in real or virtual settings
5. Real World Application: [Hemoglobin](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions
6. Test Taking Strategies and additional practiced offered on WebAssign.net and [science geek](#)

Teacher Centered Strategies include

1. Power point/notes lecture (ex. [Nomenclature](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions)
2. Interactive Discussion including Socratic method
3. You tube videos [It's a Family thing](#) and [Organic Reactions](#)
4. Lab Discussions and performance

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Examples of assessments may include but are not limited to:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying*
2. Lab Reports according to a rubric (ex. [College Write Up](#), Rubric in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases *applying, analyzing*)
3. Vee Maps (ex. [Sample Vee map](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Acid and Bases) – *analyzing, evaluating*
4. [Weekly free response](#) question that include both conceptual and mathematical problems – *understanding, applying, analyzing, evaluating*
5. [Completion of problems sets](#) – *remembering, understanding, applying*
6. AP sample test questions related to current material and prior using pollanywhere.com – *applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Summative Assessments:

1. [Organic Test](#) which includes multiple choice, problem solving as well as free response (ex. Acid Base Test in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions) *remembering, understanding, applying, analyzing, evaluating*
2. Students will be required to turn in homework and lab reports based on the material in this unit. These

assignments will be graded. Although most homework is formative in nature, select homeworks may also function summatively. *remembering, understanding, applying, analyzing, evaluating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed

Performance Assessments:

1. Ability to perform lab activities and perform calculations pertaining to activity – *remembering, understanding, applying, analyzing, evaluating*
2. Creating analogies to demonstrate full mastery of material learned through colloquialisms. – *remembering, understanding, applying, creating*
3. Ability to construct a procedure to identify what cations are in a solution ([analysis of silver group ions](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions) *remembering, understanding, applying, analyzing, evaluating, creating*
4. Ability to work collaboratively to complete inquiry based assignments acid ([Organic POGIL](#) in district shared Science/CURRICULUM WRITING 2013/ AP Chemistry/AP Organic Biochemistry Complex Ions) *remembering, understanding, applying, analyzing, evaluating, creating*

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student IEP's including: extended time, step-by-step problem set-up, and alternative evaluation (such as project based assessment)

Modifications could include modifying directions for clarity, chunking test items, modifying lab reports, and modify homework assignments as needed