AP Chemistry Syllabus (2017-2018)
Paulding County High School

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Course Description: Chemistry is a physical science that includes abstract concepts such as the structure of atoms, structure and properties of matter, and the conservation and interaction of energy and matter. AP Chemistry is designed to be the equivalent of the general chemistry course taken during the first year of college. The key concepts and related content that define the AP Chemistry course and exam are organized around a few underlying principles called big ideas, which encompass the core scientific principles, theories, and processes governing chemical systems.

Grading Policy: (Subject to change based on county policy)

A (90-100) B (80-89) C (70-79) F (below 70) 60% summative, 20% formative, 20% final exam

Flipped Classroom Model: This "flipped" course will utilize a variety of podcasts to introduce students to new concepts. Students are not expected to fully "understand" the concepts covered in podcasts. Podcasts are their first exposure to the rote background information and basic terminology. Students will then practice, apply, and explore these concepts in the classroom. The flipped classroom is a pedagogical model in which the typical lecture and homework elements of a course are reversed. Short video lectures, or podcasts, are viewed by students at home before the class session. This way, in-class time is devoted to laboratories, projects, discussions, and addressing student questions over the content. Little time is spent on lecture since it is my philosophy that learning is active not passive. Students are engaged in hands-on laboratory work, integrated throughout the course that accounts for more than 25% of the class time. Emphasis is placed on depth of understanding of a topic, rather than breadth of topics. If viewing this syllabus online (CLICK HERE) for a thorough explanation of the flipped classroom model.

Class/Lab Procedures and Rules: Students must return their signed Flinn Safety contracts before participating in lab-based activities. All school policies in the student handbook will be followed, as well as all lab safety rules and teacher policies. Tardy policy will be followed as listed in the student handbook.

Performance Assessments will include, but will not be limited to quizzes, unit tests, lab reports, projects, podcast composition book, and final exams.

Required Materials: Students must have a glued-stitched graph composition notebook for their labs, a glued-stitched college-ruled composition notebook for their notes, computer flash drive, and a scientific calculator

Textbook: Brown, LeMay, Bursten, et. al., Chemistry: The Central Science, 14th Edition. Pearson, 2017.

Big Ideas for AP Chemistry:

Big Idea 1: Atoms & Elements Big Idea 1 - The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.

Big Idea 2: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.

Big Idea 3: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.

Big Idea 4: Rates of chemical reactions are determined by details of the molecular collisions.

Big Idea 5: The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in matter

Big Idea 6: Any bond or intermolecular attraction that can be formed can be broken. These two processes are in a dynamic competition, sensitive to initial conditions and external perturbations.

The big ideas for AP Chemistry are correlated to the content of the course and to the lab and inquiry-based investigations done throughout the school year in the following table (BI = Big Idea; CLICK HERE for Big Idea descriptions)

Chapters in Textbook	**AP Chemistry Topic Covered**
1. Chemical Foundations	None
2. Atoms, Molecules, and Ions	Atomic Theory & Atomic Structure **(BI 1 & 2)**
3. Stoichiometry	Stoichiometry **(BI 3)**
4. Solution Stoichiometry & Chemical Analysis	Reaction Types & Stoichiometry **(BI 3)**
5. Gases	Gases **(BI 1 & 2)**
6. Thermochemistry	Thermodynamics **(BI 5)**
7. Atomic Structure and Periodicity	Atomic Theory & Atomic Structure **(BI 1 & 2)**
8. Bonding -- General Concepts	Chemical Bonding **(BI 1 & 2)**
9. Covalent Bonding: Orbitals	Chemical Bonding **(BI 1 & 2)**
10. Liquids and Solids	Liquids & Solids **(BI 1 & 2)**
11. Properties of Solutions	Solutions **(BI 2)**
12. Chemical Kinetics	Kinetics **(BI 4)**
13. Chemical Equilibrium	Equilibrium **(BI 6)**
14. Acids and Bases	Equilibrium **(BI 6)**
15. Applications of Aqueous Equilibria	Equilibrium **(BI 6)**
16. Spontaneity, Entropy, and Free Energy	Thermodynamics **(BI 5)**
17. Electrochemistry	Reaction Types **(BI 3)**
18. The Nucleus -- A Chemist's View	Nuclear Chemistry
19. The Representative Elements: Groups 1A Through 4A	Descriptive Chemistry **(BI 2)**
20. The Representative Elements: Groups 5A Through 8A	Descriptive Chemistry **(BI 2**)
22. Organic Chemistry	Descriptive Chemistry
AP Chemistry Exam Review	All

Assignments:

Chapter 1: **Chemical Foundations (10 days)**

Read: Pages 1-30

Problems: 16, 18, 20, 24, 26, 28, 30, 34, 36, 38, 40, 42, 46, 50, 52, 56, 59, 60, 64, 66, 70, and 75.

Labs: Safety/Lab Skills/Lab Preparation
Ion Chromatography (SP 6.1; LO 2.18) **[CR5b] & [CR6]**
Kool Aid Chromatography (SP 1.4, 6.4; LO 2.13) **[CR5b] & [CR6]**
Fractional Distillation (SP 4.2, 5.1, 6.4; LO 2.10) **[CR5b] & [CR6]**

Chapter 2: **Atoms, Molecules, and Ions (8 days)**

Read: Pages 39-69

Problems: 16, 18, 20, 24, 26, 30, 32, 34, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 60, 62, 64, 70, 72, 74, 77, and 82.

Labs: Determination of Avogadro's Number (SP 2.2, 6.1; LO 3.6) **[CR5b] & [CR6]**

Review: Shakashiri #1

Chapter 3: **Stoichiometry (9 days)**

Read: Pages 77-115

Problems: 24, 26, 28, 30, 36, 38, 40, 50, 52, 54, 58, 62, 65, 70, 72, 74, 76, 80, 82, 84, 90, 94, 98, 104, and 106.

Labs: *Guided Inquiry:* Determination of the Formula of a Compound (SP 4.2, 5.1, 6.4; LO 3.5) **[CR5b] & [CR6]**

Guided Inquiry: Finding the Ratio of Moles of Reactants in a Chemical Reaction (SP 2.1, 2.2, 4.2, 5.1, 6.4; LO 3.3, 3.5) **[CR5b] & [CR6]**

Chemical Reactions of Copper and Percent Yield (SP 1.4, 2.1, 2.2, 4.2, 5.1, 6.1, 6.4; LO 1.19, 3.2, 3.3, 3.4, 3.10)

Activity: **LO 3.6:** Use data from synthesis or decomposition of a compound to confirm the conservation of matter and the law of definite proportions.

The students present problems to the class in which they demonstrate how to find the empirical formula of a compound from data on the percent composition by mass. **[CR3c]**

Review: Shakashiri #1-4

Chapter 4: **Types of Chemical Reactions and Solution Stoichiometry (11 days)**

Read: Pages 127-170

Problems: 10, 12, 16, 18, 20, 22, 24, 26, 30, 32, 36, 38, 40, 44, 48, 52, 56, 58, 62, 64, 66, 68, 74, 76, 80, and 81.

Labs: Use of a Primary Standard -- $KHC_8H_4O_4$ **[CR5b] & [CR6]**

Reduction of Permanganate (SP 4.2, 5.1, 6.4; LO 1.20, 3.3) **[CR5b] & [CR6]**

Guided Inquiry: Progressive Precipitation (SP 1.5, 2.2, 4.2, 5.1, 6.4; LO 1.19, 2.10, 3.2, 3.3) **[CR5b] & [CR6]**

Review: Shakashiri #5, 6, & 28

technological components (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.

CR5b—Students are provided the opportunity to engage in a minimum of 16 hands-on laboratory experiments integrated throughout the course while using basic laboratory equipment to support the learning objectives listed within the AP Chemistry Curriculum Framework.

CR6—The laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Chemistry Curriculum Framework. At minimum, six of the required 16 labs are conducted in a guided-inquiry format.

CR3c—The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 3: Chemical reactions.

Chapter 5:	**Gases (9 days)**
Read:	Pages 179-216
Problems:	20, 24, 28, 31, 32, 34, 42, 44, 46, 52, 58, 60, 62, 67, 70, 72, 74, 76, 80, 82, 86, 88, 97, and 99.
Labs:	Investigating Graham's Law (SP 2.2, 2.3; LO 2.6) **[CR5b] & [CR6]** Ideal Gas Law (SP 2.2, 2.3; LO 2.6) **[CR5b] & [CR6]** The Determination of the Molar Mass of a Volatile Liquid (SP 1.3, 1.4, 6.4, 7.2; LO 2.4, 2.5) **[CR5b] & [CR6]**
Review:	Shakashiri #9
Chapter 6:	**Thermochemistry (10 days)**
Read:	Pages 229-265
Problems:	10, 12, 19, 22, 26, 28, 32, 34, 36, 38, 42, 46, 50, 52, 56, 58, 62, 64, 68, 79, and 82.
Labs:	*Guided Inquiry:* Hess's Law (SP 4.2, 5.1, 6.4; LO 5.6, 5.7) **[CR5b] & [CR6]** Heat of Combustion of Magnesium (SP 4.2, 5.1, 6.4; LO 5.6, 5.7) **[CR5b] & [CR6]**
Activity:	**LO 5.2:** Students relate temperature to the motions of particles, either via particulate representations, such as drawings of particles with arrows indicating velocities, and/or via representations of average kinetic energy and distribution of kinetic energies of the particles, such as plots of the Maxwell-Boltzmann distribution. **[CR3e]** Students are accountable for answering homework questions about particle motions and kinetic energies of a sample at different temperatures while viewing a Podcast. The podcast begins with particulate animations and the narrator interprets the animations to show how kinetic energy distributions can explain the effect of temperature on the rate of a chemical reaction. The questions lead to the interpretation of activation energy on the distribution curve and eventually the refining of collision theory.
Review:	Shakashiri #8
Chapter 7:	**Atomic Structure and Periodicity (10 days)**
Read:	Pages 275-320
Problems:	18, 20, 22, 24, 26, 30, 32, 34, 38, 40, 42, 46, 55, 58, 62, 66, 68, 70, 74, 78, 81, 84, 86, 92, 104, and 112.
Labs:	*Guided Inquiry:* Relationship Between the Spectrum and Absorbance of Light (SP 4.1; LO 1.15) **[CR5b] & [CR6]** Poison in the Kool Aid-A Spectroscopic Inquiry (SP 4.1, 4.2, 5.1, 6.4; LO 1.15, 1.16) **[CR5b] & [CR6]** Beer's Law (SP 4.2, 5.1; LO 3.4) **[CR5b] & [CR6]**

Activity:	**LO 1.10:** Justify with evidence the arrangement of the periodic table and apply periodic properties to chemical reactivity. Students are given several elements pairing them by families or by period and are asked to rationalize the change in electronegativity of each group based on the electronic structure of the atom **[CR3a]**
Review:	Shakashiri #10-11
Chapter 8:	**Bonding: General Concepts (9 days)**
Read:	Pages 329-381
Problems:	14, 16, 18, 20, 22, 28, 32, 36, 38, 42, 46, 48, 52, 54, 56, 64, 66, 68, 70, 74, 75, 77, 80, 86, 90, 92, 96, and 103.
Lab:	Molecular Geometry (SP 1.4; LO 2.21) **[CR5b] & [CR6]** *Guided Inquiry:* Conductivity of Solids & Metals (SP 4.2, 6.4; LO 2.22) **[CR5b] & [CR6]**
Activity:	**LO 2.21:** Use Lewis diagrams and VSEPR to predict the geometry of molecules, identify hybridization, and make predictions about polarity. Students construct balloon models of the arrangement of pairs of electrons around a central atom. They then draw 2D pictures of these arrangements and apply these to predicting the shapes of molecules. **[CR3b]**
Review:	Shakashiri #12-14
Chapter 9:	**Covalent Bonding: Orbitals (9 days)**
Read:	Pages 391-417
Problems:	8, 10, 14, 16, 24, 26, 30, 34, 36, 38, 42, 44, 50, 52, and 56.
Lab:	Determination of the Formula of a Hydrate (SP 2.1, 4.2, 6.4; LO 3.5) **[CR5b] & [CR6]**
Review:	Shakashiri #14-15
Chapter 10:	**Liquids and Solids (8 days)**
Read:	Pages 425-474
Problems:	16, 20, 28, 32, 34, 36, 38, 39, 42, 44, 48, 50, 52, 54, 60, 62, 64, 72, 80, 82, 84, 86, 88, 89, 90, and 92.
Labs:	The Structure of Crystals (SP 1.1, 1.4, 7.1; LO 2.19, 2.23, 2.24) **[CR5b] & [CR6]** Enthalpy of Vaporization of Water (SP 6.4, 7.1; LO 2.3) **[CR5b] & [CR6]**

CR3a—The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 1: Structure of matter.

CR3b—The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 2: Properties of matter-characteristics, states, and forces of attraction.

CR5b—Students are provided the opportunity to engage in a minimum of 16 hands-on laboratory experiments integrated throughout the course while using basic laboratory equipment to support the learning objectives listed within the AP Chemistry Curriculum Framework.

CR6—The laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Chemistry Curriculum Framework. At minimum, six of the required 16 labs are conducted in a guided-inquiry format.

Chapter 11:	**Properties of Solutions (8 days)**
Read:	Pages 485-518
Problems:	12, 14, 16, 22, 24, 26, 28, 30, 32, 36, 40, 44, 46, 48, 52, 54, 60, 64, 70, 74, 76, 78, 80, 84, 85, and Chapter 11 PowerPoint problem.
Lab:	Freezing Point Depression (SP 1.1, 1.2, 6.4; LO 2.8) **[CR5b] & [CR6]** Winter of Tomis (SP 1.1, 1.2, 6.4; LO 2.8) **[CR5b] & [CR6]** http://chem.lapeer.org/Chem2Docs/APChem2Manual.htm#tomis
Review:	Shakashiri #6, 7, & 16
Chapter 12:	**Chemical Kinetics (12 days)**
Read:	Pages 527-566
Problems:	10, 12, 16, 20, 24, 26, 28, 29, 31, 33, 35, 37, 41, 43, 47, 49, 51, 53, 55, 59, 63, 65, and 67.
Labs:	Reaction Rates (SP 4.2, 6.4; LO 4.1, 4.2) **[CR5b] & [CR6]** Rate Law Determination: Crystal Violet Reaction (SP 5.1, 6.4; LO 4.1, 4.2, 4.4) **[CR5b] & [CR6]** *Guided Inquiry:* Factors that affect reaction rates and determining reaction rates and reaction mechanisms (SP 6.2, 7.2; LO 4.5, 4.9) **[CR5b] & [CR6]**
Activity:	**LO 4.8:** Translate among reaction energy profile representations, particulate representations, and symbolic representations (chemical equations) of a chemical reaction occurring in the presence and absence of a catalyst. Students create energy diagrams to explain why catalysts and raising the temperature can increase the rate of a chemical reaction. **[CR3d]**
Review:	Shakashiri #23 & 24
Chapter 13:	**Chemical Equilibrium (11 days)**
Read:	Pages 578-612
Problems:	13, 17, 18, 20, 22, 26, 28, 30, 32, 36, 38, 40, 44, 46, 48, 54, 58, 64, 67, and 74.
Lab:	*Guided Inquiry:* Equilibrium Position (SP 4.2; LO 6.9) **[CR5b] & [CR6]** Equilibrium Constant Determination (SP 4.2; LO 6.9) **[CR5b] & [CR6]** Equilibrium of Ethyl Acetate (SP 4.2; LO 6.9) **[CR5b] & [CR6]**
Activity:	**LO 6.1:** Given a set of experimental observations regarding physical, chemical, biological, or environmental processes that are reversible, student is able to construct an explanation that connects the observations to the reversibility of the underlying chemical reactions or processes.

CR5b—Students are provided the opportunity to engage in a minimum of 16 hands-on laboratory experiments integrated throughout the course while using basic laboratory equipment to support the learning objectives listed within the AP Chemistry Curriculum Framework.

CR6—The laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Chemistry Curriculum Framework. At minimum, six of the required 16 labs are conducted in a guided-inquiry format.

CR3d—The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 4: Rates of chemical reactions.

Students view the NO_2/N_2O_4 Equilibrium simulation available on the General Equilibria Animations Index page at Iowa State University and verbally report and discuss their answers to teacher supplied questions regarding the number of reactant and product molecules present at a particular point in the equilibrium process, the breaking and forming of bonds during the process, and how the reactant and product molecules are changing in order to illustrate the dynamic nature of equilibrium. **[CR3f]**

CR3f—The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 6: Equilibrium.

Review: Shakashiri #17

Chapter 14: Acids and Bases (11 days)

Read: Pages 623-672

Problems: 17, 25, 28, 30, 32, 34, 38, 40, 42, 44, 52, 60, 64, 66, 70, 72, 76, 78, 84, 88, 98, 102, 104, 114, 116, 118, 122, and 124.

Labs: K_a Prelab

Determination of Dissociation Constant of Weak Acids (SP 1.1, 1.4, 2.3; LO 6.11) **[CR5b] & [CR6]**

Guided Inquiry: Hydrolysis of Salts (SP 6.4; LO 6.20) **[CR5b] & [CR6]**

Determination of Vitamin C and Aspirin Content (SP 4.2, 5.1, 6.4; LO 1.20) **[CR5b] & [CR6]**

CR5b—Students are provided the opportunity to engage in a minimum of 16 hands-on laboratory experiments integrated throughout the course while using basic laboratory equipment to support the learning objectives listed within the AP Chemistry Curriculum Framework.

Review: Shakashiri #18-20

CR6—The laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Chemistry Curriculum Framework. At minimum, six of the required 16 labs are conducted in a guided-inquiry format.

Chapter 15: Applications of Aqueous Equilibria (16 days)

Read: Pages 681-739

Problems: 22, 24, 26, 32, 40, 44, 46, 48, 52, 56, 57, 62, 66, 70, 76, 80, 86, 92, 94, 98, 100, 104, 108, and 112.

Labs: Acid-Base Titration (SP 4.2, 5.1, 6.4; LO 1.20) **[CR5b] & [CR6]**

Titration of a Diprotic Acid (SP 5.1, 6.4; LO 3.2, 6.13) **[CR5b] & [CR6]**

Titration Curves of Strong and Weak Acids and Bases (SP 1.4, 6.2, 6.4; LO 1.18, 6.12) **[CR5b] & [CR6]**

Determination of a Solubility Product Constant (SP 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.1, 5.1; LO 1.4, 3.3, 6.12, 6.20) **[CR5b] & [CR6]**

Buffered Solutions (SP 2.3, 4.2, 6.4; LO 1.4, 6.18, 6.20) **[CR5b] & [CR6]**

Review: Shakashiri #21-22

Chapter 16: Spontaneity, Entropy, and Free Energy (10 days)

Read: Pages 749-782

Problems: 18, 20, 21, 24, 26, 28, 30, 32, 34, 36, 38, 44, 46, 48, 49, 54, 58, 60, 62, and 70.

Labs: Determination of Soluble Chloride (SP 1.4, 2.2, 2.3, 5.1, 6.4, 7.1; LO 6.22, 6.23, 6.24) **[CR5b] & [CR6]**

	Percentage Calcium in Calcium Supplements (SP 4.2, 5.1, 6.4; LO 1.19) **[CR5b] & [CR6]**
Review:	Shakashiri #8
Chapter 17:	**Electrochemistry (11 days)**
Read:	Pages 791-829
Problems:	17, 21, 26, 28, 30, 32, 36, 39, 50, 56, 58, 59, 64, 72, 76, 80, 84, 86, 88, 92, and 95.
Labs:	A Chemical Activity Series (SP 3.1, 3.2, 3.3, 4.2, 4.3, 4.4, 5.1; LO 3.3) **[CR5b] & [CR6]** Corrosion (SP 3.1, 3.2, 3.3, 4.2, 4.3, 4.4, 5.1; LO 3.3) **[CR5b] & [CR6]** Electroplating (SP 3.1, 3.2, 3.3, 4.2, 4.3, 4.4, 5.1; LO 3.3) **[CR5b] & [CR6]** *Guided Inquiry*: Electrochemical Cells (SP 2.2, 2.3, 5.1, 6.4; LO 3.12, 3.13) **[CR5b] & [CR6]**
Review:	Shakashiri #28-30
Chapter 18:	**The Representative Elements: Groups 1A Through 4A (Chapter 18 & 19 are tested together-8 days)**
Read:	Pages 875-895
Problems:	2, 8, 10, 16, 18, 19, 22, 24, 26, 28, 30, 32, 34, 36, 39, 42, 44, 46, 48, 51, 53, 56, 57, and 62.
Lab:	Using Conductivity to Find an Equivalence Point (SP 1.1, 6.2, 7.1; LO 2.24, 2.32) **[CR5b] & [CR6]**
Review:	Shakashiri #25-27
Chapter 19:	**The Representative Elements: Groups 5A through 8A**
Read:	Pages 901-935
Problems:	2, 6, 8, 10, 12, 14, 16, 18, 20, 22, 23, 25, 28, 29, 32, 33, 38, and 46.
Labs:	Percent Sulfate in a Mixture (SP 6.4, 7.1; LO 2.1) **[CR5b] & [CR6]**
Review:	Shakashiri #25-27

CR5b—Students are provided the opportunity to engage in a minimum of 16 hands-on laboratory experiments integrated throughout the course while using basic laboratory equipment to support the learning objectives listed within the AP Chemistry Curriculum Framework.

CR6—The laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Chemistry Curriculum Framework. At minimum, six of the required 16 labs are conducted in a guided-inquiry format.

Labs & Classwork: Labs are all "hands-on" and placed throughout the instructional year. All of the laboratory experiments in this course are hands-on. Students work individually or in a group of two depending upon the lab. They collect, process, manipulate, and graph data from both qualitative and quantitative observations. Inquiry is emphasized in many of the experiments that students complete. The laboratory work requires students to design, carry out, and analyze data using guided inquiry principles. For all labs, students are required to report the purpose, procedure, all data, data analysis, error analysis, results, and conclusions in a graph composition lab report that is submitted for grading. All laboratory experiments are intended to be completed in one double period (90 minutes) except the following guided-inquiry labs that require two days of work or two double lab periods:

1. Determination of the Formula of a Compound
2. Finding the Ratio of Moles of Reactants in a Chemical Reaction
3. Progressive Precipitation
4. Hess's Law
5. Relationship Between the Spectrum and Absorbance of Light
6. Conductivity of Solids & Metals
7. Factors that affect reaction rates and determining reaction rates and reaction mechanisms
8. Equilibrium Position
9. Hydrolysis of Salts 10. Electrochemical Cells