Capital City High School AP® Chemistry Syllabus, 2021-2022

Welcome to AP® Chemistry!

Instructor: Abbie Ritter

Contact: abbie.ritter@jcschools.us

Tutoring Hours: before school daily or after school by appointment

Course Description:
The AP® Chemistry course is designed to be the equivalent of the general chemistry course usually taken during the first year of college. Students will obtain an understanding of chemistry foundations to support additional learning in chemistry. This course will develop critical thinking skills and the ability for students to clearly express their ideas and understandings. It will be necessary for students to complete work outside of class. Details regarding course objectives and units, please refer to the AP® Chemistry Course Description.

Course Prerequisites:
Students should have completed Algebra II and a general chemistry course.

Required Materials:

TI80 or higher graphing calculator (see AP® Central for an approved list of calculators)
Composition Notebook (for lab notebook)
Spiral-bound notebook
2" Binder
Student Chromebook

Text: Zumdahl Steven S., Susan A. Zumdahl and Donald J. DeCoste. *Chemistry (AP Edition)*, 10th edition. National Geographic Learning/Cengage Learning. 2018.

Absences:

- If you are absent **due to a school function** (extracurricular activities, field trips, etc.), you are expected to get your assignments **PRIOR** to your leave and complete them by the **due date**. It will be your responsibility to come in for any additional help as needed before/after school to get the work done on time.

- If you have an **excused** absence, (not due to a school function), you are expected to see me **before or after school on the day you return** to pick up all make-up work. Do not expect assignments to be given to you during valuable class time. Students must have make-up work completed by the time they take their unit test on those objectives. No make-up work will be accepted after that.

- Credit for make-up work will be allowed for up to four (4) absences during a nine (9)-week term for **Not Documented Excused** and **Unexcused absences**. However, if a student is **truant** they will not receive any credit for make-up work regardless of the number of days they have been absent. The fifth and above absence will result in a zero for any homework, labs, or tests given that day. The only one who can excuse your absence is your **assigned** principal.

Google Classroom:
All class materials can be found on Google Classroom, in which students will be given the code to the first week of school. This will include assignments, notes, practice problems, and other resources. Students may find additional assignments or practices on AP® Classroom.

Course Procedures:

- Students should be in their seats when the bell rings.
- AP® Chemistry will be used for the study of chemistry. You will not be allowed to work on homework from any other class unless your chemistry work is complete. Any homework from other classes that is out when you should be working on chemistry will be confiscated.
- Daily participation in chemistry is expected. Nonparticipation will not reflect well on your grade, as we complete a lot of work and work through concepts together as a class.
- Labs need to be cleaned up appropriately before the end-of-class bell rings. There should be no used paper towels or lab materials left on the floor, workspaces,or sinks. Lab equipment should be returned to its proper place.

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- Students should be in their seats at the end of class in order to be dismissed. The instructor will dismiss the students, not the bell. **You will not be permitted to line up at the door before the end of class.**

Personal Electronic Device Policy

Electronic devices will be used for academic purposes only. **If students do bring cell phones and/or other electronic devices to school, they will need to be turned off during class periods and stored in their backpacks or assigned lockers.** Cell phone usage is only permitted during passing times and the lunch periods. These privileges may be revoked by administration when deemed necessary**. Headphones or earbuds will need to be stored securely and should not be worn during class time unless the teacher has approved an activity that requires listening on chrome books or school provided media.** A student using these items without permission is subject to discipline consequences. Refer to the Prohibited Conduct; Technology Misconduct; 'a' in Section VI of the student handbook for consequence detail.

Course Topics:

Time	Topics/Subtopics	Curriculum Framework (Scientific Practices in parenthesis)
2 weeks	Unit 1: Atomic Structure & Properties ● Moles & molar mass ● Spectroscopy ● Elemental & mixture composition ● Atomic structure & electron configuration ● Periodic trends	**Big Ideas**: SPQ; SAP **Learning Objectives**: SPQ-1.A (SP 5.B); SPQ-1.B (SP 5.D); SPQ-2.A (SP 2.A); SPQ-2.B (SP 5.A); SAP-1.A (SP 1.A); SAP-1.B (SP 4.B); SAP-2.A (SP 4.A)
3 weeks	Unit 2: Molecular & Ionic Compound Structure & Properties ● Chemical bonds ● Intramolecular forces ● Structure of ionic solids, metals, & alloys ● Lewis diagrams, resonance, formal charge ● VSEPR & bond hybridization	**Big Ideas**: SAP **Learning Objectives**: SAP-3.A (SP 6.A); SAP-3.B (SP 3.A); SAP-3.C (SP 4.C); SAP-3.D (SP 4.C); SAP-4.A (SP 3.B); SAP-4.B (SP 6.C); SAP-4.C (SP 6.C)
4 weeks	Unit 3: Intermolecular Forces & Properties ● Intermolecular forces ● Solids, liquids, & gases ● Gas laws & kinetic theory ● Solutions & mixtures ● Chromatography ● Photoelectric effect ● Beer-Lambert law	**Big Ideas**: SPQ; SAP **Learning Objectives**: SAP-5.A (SP 4.D); SAP-5.B (SP 4.C); SAP-6.A (SP 3.C); SAP-7.A (SP 5.C); SAP-7.B (SP 4.A); SAP-7.C (6.E); SPQ-3.A (SP 5.F); SPQ-3.B (SP 3.C); SPQ-3.C (SP 2.C, 4.D); SAP-8.A (SP 4.A); SAP-8.B (SP 5.F); SAP-8.C (SP 2.E)
4 weeks	Unit 4: Chemical Reactions ● Physical & chemical changes ● Net ionic equations ● Stoichiometry ● Titration ● Reaction types including acid-base and redox	**Big Ideas**: SPQ; TRA **Learning Objectives**: TRA-1.A (SP 2.B); TRA-1.B (SP 5.E); TRA-1.C (SP 3.B); TRA-1.D (SP 6.B); SPQ-4.A (SP 5.C); SPQ-4.B (SP 3.A); TRA-2.A (SP 1.B); TRA-2.B (SP 1.B); TRA-2.C (SP 5.E)
3 weeks	Unit 5: Kinetics ● Reaction rates & rate law ● Elementary reactions ● Collision model ● Energy profile ● Reaction mechanism & rate law ● Catalysis ● Multistep reactions	**Big Ideas**: TRA; ENE **Learning Objectives**: TRA-3.A (SP 6.E); TRA-3.B (SP 5.C); TRA-3.C (SP 5.B); TRA-4.A (SP 5.E); TRA-4.B (SP 6.E); TRA-4.C (SP 3.B); TRA-5.A (SP 1.B); TRA-5.B (SP 5.B); TRA-5.C (SP 5.B); TRA-5.D (SP 3.B); ENE-1.A (SP 6.E)
2 weeks	Unit 6: Thermodynamics ● Endothermic & exothermic processes ● Energy diagrams ● Heat transfer	**Big Ideas**: ENE **Learning Objectives**: ENE-2.A (SP 6.D); ENE-2.B (SP 3.A); ENE-2.C (SP 6.E); ENE-2.D

	● Heat capacity & calorimetry ● Enthalpy of reactions/formation ● Bond enthalpies ● Hess's law	(SP 2.D); ENE-2.E (SP 1.B); ENE-2.F (SP 5.F); ENE-3.A (SP 5.F); ENE-3.B (SP5.F); ENE-3C (SP 5.A); ENE-3D (SP 5.A)
4 weeks	Unit 7: Equilibrium ● Reversible reactions ● Reactions quotient & equilibrium constant ● Equilibrium concentrations ● Le Chatelier's principle ● Common-ion effect ● pH & solubility ● Free energy of dissolution	**Big Ideas**: TRA **Learning Objectives**: TRA-6.A (SP 6.D); TRA-6.B (SP 4.D); TRA-7.A (SP 3.A); TRA-7.B (SP 5.C); TRA-7.C (SP 6.D); TRA-7.D (SP 5.A); TRA-7.E (SP 3.A); TRA-7.F (SP 3.C); TRA-8.A (SP 6.F); TRA-8.B (SP 5.F); SPQ-5.A (SP 5.B); SPQ-5.B (SP 2.F); SPQ-5.C (SP 2.D); SPQ-5.D (SP 4.D)
4 weeks	Unit 8: Acids & Bases ● pH & pOH ● Strong/weak acids & bases ● Acid-base reactions & buffers ● Acid-base titration ● pH & pK_a ● Henderson-Hasselbalch ● Buffer capacity	**Big Ideas**: SAP **Learning Objectives**: SAP-9.A (SP 5.B); SAP-9.B (SP 5.B); SAP-9.C (SP 5.C); SAP-9.D (SP 5.F); SAP-9.E (SP 5.D); SAP-9.F (SP 6.C); SAP-10.A (SP 2.D); SAP-10.B (SP 6.D); SAP-10.C (5.F); SAP-10.D (SP 6.G)
3 weeks	Unit 9: Applications of Thermodynamics ● Entropy ● Gibbs Free Energy & thermodynamic favorability ● Thermodynamic & kinetic control ● Coupled reactions ● Galvantic & electrolytic cells ● Cell potential & free energy ● Faraday's law	**Big Ideas**: SPQ; SAP; ENE **Learning Objectives**: ENE-4.A (SP 6.C); ENE-4.B (SP 5.F); ENE-4.C (SP 6.E); ENE-4.D (SP 6.E); ENE-5.A (SP 6.D); ENE-5.B (SP 4.D); ENE-6.A (SP 2.F); ENE-6.B (SP 5.F); ENE-6.C (SP 6.D); ENE-6.D (SP 5.B)

Student Evaluation:
The final grade will be a composite of an evaluation of the student's performance in such exercises as tests, homework assignments, quizzes, writing lab reports, and reaction papers.

Weighting Scale:

Exams and Quizzes	60%
Homework, Labs, Classwork	30%
Final Exam	10%

Grading Scale (total points):

A 90-100%
B 80-89%
C 70-79%
D 60-69%
F 59% and below

Exams:
In this course there will be nine total exams; one for each unit of study. In order to simulate the AP® Chemistry exam format, unit tests will include two formats: multiple choice and free response questions. Unit tests may include content from previous units, but the emphasis will be content learned since the last unit assessment. As this is a college level course, test retakes are not offered. Students may complete test corrections before the next unit test. Students must arrange a time with the instructor to complete corrections, and will earn 1/3 credit back on their missed points.

Quizzes:
Quizzes will be administered at the discretion of the instructor. Make up quizzes and exams will be arranged at the discretion of the instructor. Granted that homework for the unit has been turned in, students may retake their quizzes before the end of the unit. The second score for the quiz will be recorded.

Test and Quiz Make-Up Policy: Due to changes in JCHS building policies, tests missed due to an absence on test day must be made up within three days of the student's return to school. Science Department policy is that students must make up their test the day they return to school in either the student's Jaytime, or the following day during their science class. Any school work missed during the class period is due the following day. Students may request a before school or after school test makeup time, but the test must be completed by the end of their science class on the third day after their absence.

Assignments:
Homework will be assigned on a regular basis, and students will be required to show the completed homework to their teachers by the assigned due date. Most assignments will take more than one evening to complete, and students are responsible for coming in to get help before or after school. No late work will be accepted.

Labs:
During the course of the year, 25% of classroom time will be spent in the laboratory. We will complete 16 labs, and 6 of them will be inquiry-based. The labs will be hands-on, and will build upon students' prior knowledge. They are of the utmost importance in AP® Chemistry; they are to be taken very seriously. Labs that are turned in late will receive a 10% deduction for every day that they are late. For example, if a student is two days late in turning in a lab, they will automatically lose 20% of their score. Labs will not be accepted after the day of the unit test.

Lab Portfolio:
Students will be required to keep a lab journal throughout the span of the course. Many colleges will not grant college credit for AP® Chemistry without a written record of a laboratory notebook, and a laboratory notebook may serve as a record of laboratory work. All laboratory investigations and observations will be recorded in a lab oratory journal, and will serve as a resource to complete lab reports.

The first page of all lab notebooks will include a table of contents to be filled out through the course of the year. Reports are to be written by hand, not typed, and must be written in blue or black ink. Mistakes cannot be erased and the use of whiteout is not permitted; students will strike through mistakes with a single line and continue. Pages cannot be removed from the notebook as they are to serve as a written record of laboratory work. Students will be assessed over an understanding and mastery of the following: procedures, data collection, and calculations; students will not be permitted to retake a laboratory quiz.

All lab write-ups should include the following:

1. Title, Name, Date*****
2. Learning Objectives*****
3. Materials List*****
4. Procedure (directions should be clear enough as to not need to the original instructions)*****
5. Data tables (complete with observations)
6. Calculations (as necessary)
7. Error Analysis
8. Discussion and Conclusion (explanation should show how evidence supports the conclusion)

***Must be completed prior to the start of the lab.**

Laboratory Experiments & Classroom Activities:

Unit	Name	Sample Activities
Unit 1: Atomic Structure & Properties	Determination of the Empirical Formula of Silver Oxide	
Unit 1: Atomic Structure & Properties	Investigation 3: What Makes Water Hard? **(GI)**	
Unit 2: Molecular & Ionic Compound Structure & Properties	Investigation 5: How Do You Separate Molecules That Are Attracted to One Another? **(GI)**	Students will use a PhET simulation to construct 3D models of the molecular and electronic geometries of different substances. **(SP 3)**
Unit 3: Intermolecular Forces & Properties	Liquid Chromatography	

Unit 3: Intermolecular Forces & Properties	Investigation 1: What Is the Relationship Between the Concentration of a Solution and the Amount of Transmitted Light Through the Solution? **(GI)**	Students will use manipulatives to create particle representations of various substances as solid, liquid, and gase. Students will use these representations to describe the particle-level properties of the substances in each state. **(SP 1)**
Unit 4: Chemical Reactions	Investigation 2: How Can Color Be Used to Determine the Mass Percent of Copper in Brass? **(GI)**	
Unit 4: Chemical Reactions	Investigation 8: How Can We Determine the Actual Percentage of H_2O_2 in a Drugstore Bottle of Hydrogen Peroxide? **(GI)**	
Unit 5: Kinetics	Investigation 10: How Long Will That Marble Statue Last? **(GI)**	Students graph values for concentration over times for substances under different temperature conditions, and determine the order of the reaction in each scenario. In a response, students will predict the order of reaction and explain why using the relationship between concentration and temperature. **(SP 4)**
Unit 5: Kinetics	Investigation 11: What Is the Rate Law of the Fading of Crystal Violet Using Beer's Law? **(GI)**	
Unit 6: Thermodynamics	Thermodynamics-Enthalpy of Reaction and Hess's Law	Students will calculate changes in Gibbs Free Energy, entropy, and enthalpy to make a claim about whether or not these conditions are thermodynamically favorable. Calculations will serve as support for student claims. **(SP 6)**
Unit 6: Thermodynamics	Investigation 12: The Hand Warmer Design Challenge: Where Does the Heat Come From? **(GI)**	
Unit 7: Equilibrium	Investigation 13: Can We Make the Colors of the Rainbow? An Application of Le Chatelier's Principle. **(GI)**	**Real World Application:** After completing the colors of the rainbow lab, students will write an analysis of how Le Chatelier's Principle applies in cases where patients are treated with high pressure oxygen to combat carbon monoxide poisoning.
Unit 7: Equilibrium		Students will use data sets in a POGIL to determine how the solubility of a solid is affected by another ion in solution. **(SP 5)**
Unit 8: Acids & Bases	Preparation and Properties of Buffer Solutions	
Unit 8: Acids & Bases	Investigation 15: To What Extent Do Common Household Products Have Buffering Activity? **(GI)**	Students observe a demonstration in which the color of water is changed from clear, to purple, and back to clear just by pouring it into different beakers. Students develop a question to generate data to explain this. **(SP 2)**
Unit 9: Applications of Thermodynamics	Electrochemical Cells	
Unit 9: Applications of Thermodynamics	Electrolytic Synthesis of Iodoform	

Laboratory Experiment Sources:

Vonderbrink, Sally Ann. *Laboratory Experiments for Advanced Placement Chemistry*, 2nd Edition. Flinn Scientific, 2006.

College Board. *AP Chemistry Guided Inquiry Experiments: Applying the Science Practices*, 2019.

Hostage, David, and Fossett, Martin. *Laboratory Investigations: AP* Chemistry*. Peoples Education, Incorporated. 2006.