Course Syllabus

THE GOVERNOR'S SCHOOL for SCIENCE AND TECHNOLOGY

Advanced Chemical Analysis

(Dual Enrollment: CHM 111 & CHM 112 – Virginia Peninsula Community College)

Instructor Information

Instructor: Adem Guven, Ph.D. **Classroom and Office:** Room A-69
E-Mail: adem.guven@nhrec.org **Office Phone:** 766-1100 ext. 3320
Office Hours: Monday-Friday, 7:00 AM - 3:00 PM (except during class hours)
Communication: Students can contact the instructor via email, phone, or through the CANVAS Learning Management System (LMS). Use the InBox feature in CANVAS for direct communication.

Course Description

Advanced Chemical Analysis is a college-level course that explores the fundamental laws, theories, and mathematical concepts of chemistry, designed primarily for science and engineering majors. The course emphasizes understanding the science of matter, energy, and their interactions through lectures, discussions, laboratory experiments, and problem-solving activities. A strong background in mathematics is essential for success.

This course is dual-enrolled with *Virginia Peninsula Community* College *(VPCC)* and consists of **3 lecture credit hours and 1 lab credit hour per semester**.

Dual Enrollment Information

- **College Course Titles:** General Chemistry I & II *(CHM 111 & CHM 112)*
- **Credit Hours:** 3 lecture credit hours + 1 lab credit hour per semester
- **Affiliated Institution:** Virginia Peninsula Community College (VPCC)

Note: Successful completion of CHM 111 with a **grade of 70% or higher** is required to be eligible for CHM 112.

Course Learning Outcomes

By the end of this course, students will:

1. Apply fundamental chemistry concepts including atomic structure, bonding, stoichiometry, and thermodynamics**.**

2. Demonstrate proficiency in laboratory safety, experimental procedures, and data analysis**.**
3. Solve complex chemical problems using mathematical and analytical reasoning**.**
4. Communicate scientific findings effectively through written reports, oral presentations, and laboratory documentation**.**
5. Develop an understanding of chemical equilibrium, kinetics, and electrochemistry to prepare for advanced college-level chemistry coursework.
6. Collaborate effectively in teams to solve experimental challenges and present results.
7. Apply computational tools (spreadsheets, simulations, and statistical analysis) to chemical data.
8. Critically evaluate scientific literature and connect course concepts to real-world applications.

Textbooks & Materials

- **Primary Textbook:** *Chemistry* (AP Edition, 9th Edition) by Zumdahl & Zumdahl
- **Lab Materials:** Lab manuals and materials will be distributed in class or provided electronically via Canvas.
- **Scientific Calculator**: Provided for classroom use during problem-solving and calculations.

Additional Resources

- **Canvas LMS**: Assignments, lecture notes, grades, and announcements will be posted here.

Grading Policy

Component	% of Final Grade	Details
Exams/Tests (4 major + final)	25%	4 major exams (1 per quarter), each covering several chapters/units. Cumulative within the quarter. Includes multiple-choice + free-response.
Quizzes (frequent, cumulative)	25%	Shorter assessments given at the end of each unit/chapter. Cover targeted content and calculations.
Laboratory Reports & Notebook	25%	Includes pre-lab work, notebook checks, formal reports. Emphasis on data accuracy and analysis.
Homework/Assignments	25%	Problem sets, video notes, readings, and Canvas submissions. Late penalty: –10% per day. Not accepted after feedback release.

Grading Scale (VPCC Standard)

A = 90–100% | B = 80–89% | C = 70–79% | D = 60–69% | F = Below 60%

Course Meetings:

AM Governor's School: M, T, Th, F: 8:50 a.m. – 10:25 a.m.; W 8:40 a.m.– 9:40 a.m.

PM Governor's School: M, T, Th, F: 11:20 a.m. – 12:55 p.m.; W 11:20 a.m. – 12:20 p.m.

Course Prerequisite: A solid foundation in mathematics is crucial for success in this course, as course involve extensive quantitative problem-solving. Additionally, completing an introductory high school chemistry course is highly recommended to ensure students are prepared with the necessary background knowledge.
Course Duration: 36 weeks (2 semesters)

Instructional Methods

This course is a **blended learning experience**, combining in-class instruction with online resources. We will meet daily for 90 minutes, five days a week, with approximately 25% of this time dedicated to hands-on laboratory activities related to class topics. In-class sessions will include lectures, discussions, text readings, videos, analysis of current events, experimental design, laboratory exercises, scientific research, and computer simulations and collaborative activities to foster an engaging learning environment. Outside of class, students will interact with instructional materials such as videos, reading assignments, and tutorials at home, submitting notes or other assignments for grading and instructor feedback. Safety in the laboratory is a priority, and strict safety rules will be enforced, including wearing **covered shoes**, tying back long hair, and using **splash goggles**. Laboratory coats, splash googles and nitrile gloves will be provided for experiments requiring personal protective equipment.

Students are expected to log in to **Canvas** regularly to access announcements, grades, lecture PowerPoint notes, links, and other course documents. During virtual learning periods (e.g., due to inclement weather or individual absences), the course will transition to a mix of **real-time interactive classes** (conducted through Zoom) and **self-paced independent or group work**. During real-time sessions, students should expect mini-lectures, large- and small-group discussions, and project presentations. **Cameras must be turned on during these sessions**, and active participation is required. If a student cannot meet this expectation, a parent-teacher conference will be necessary to determine appropriate accommodations.

Success in this course depends on **consistent attendance** and active engagement. Students are responsible for following up on missed assignments and labs within one week of an excused absence. Classroom behavior will be guided by **Respect, Responsibility, and Maturity**, and disruptive or immature behavior will not be tolerated, potentially resulting in removal from the class. This course demands a higher level of seriousness and commitment than a typical high school class, and students are expected to take ownership of their learning.

Types of Evaluation:

Exams/Tests (25%): Tests will typically follow the completion of a chapter or related chapters and will include both **multiple-choice** and **free-response questions**. These assessments will cover material from lectures, readings, labs, and previous units, ensuring a comprehensive understanding of the course content. Students are encouraged to correct missed questions to improve their understanding and may earn partial credit (up to 25% of the original point value) for corrected responses.

Quizzes (25%): Quizzes will be given frequently to assess students' understanding of readings, concepts, and calculations. These quizzes will include a mix of **multiple-choice** and **free-response questions**, covering content from assigned videos, text readings, class discussions, and lab experiments. This format ensures students stay engaged with the material throughout the course.

Laboratory (25%): The laboratory component is a core part of the course, with **3-4 hours per week** dedicated to hands-on experiments and activities that align with chapter and lecture topics. Labs may include **"wet labs"**(using chemicals), **microscale experiments**, or **virtual/dry labs** (without chemicals). Students will maintain a **lab notebook** to record procedures, observations, data, and conclusions. Lab notebooks will be checked and graded periodically, and colleges may request to see them when considering granting credit. **Prelab assignments** are required to ensure students are prepared for lab activities and must be submitted on lab day. Late prelab assignments will not be accepted unless the student is absent, in which case they must be submitted on the first day of their return. Lab concepts will also be assessed through quizzes and test questions.

Homework & Assignments (25%): Homework will include problem sets, reading assignments, pre-lab preparations, and note-taking from videos or readings. While some work may be completed in class with instructor and peer assistance, effective time management is essential to minimize out-of-class workload. Assignments must be submitted on time via **Canvas** or in person. Late submissions will incur a **10% penalty per day** and will not be accepted after feedback has been distributed. Students must show all calculations and steps for problem-solving assignments and be prepared to explain their approach in class. Organized, outline-style notes and a well-maintained notebook are strongly encouraged to support understanding and retention of course material.

Late Assignments: Assignments must be submitted on time via **Canvas** or in person, depending on the specific requirements of the assignment. If a student is absent on the day an assignment is due on paper, they may submit their work electronically by the due date or on paper on the first day of their return. Assignments submitted after the due date will incur a **10% penalty per day** and will receive no credit if submitted after instructor feedback has been distributed to the class. It is the student's responsibility to ensure timely submission and to communicate with the instructor if there are any issues.

Absences: Regular attendance is critical for success in this course, as a significant amount of material is covered each day. Missing class not only impacts the absent student

but also their laboratory partners and the class, as the contributions of each student are valuable to discussions and group activities.

- **Unexpected Absences (e.g., illness, family emergency):** If a student is unexpectedly absent, a parent or guardian must communicate with the instructor within **one day** of the absence to explain the reason. Acceptable forms of communication include handwritten notes, emails, or phone messages. The student and instructor will then agree on a plan for completing missed work or labs within a reasonable timeframe.
- **Long-Term Absences:** In the event of a long-term absence, the instructor will provide alternate assignments or modified deadlines to accommodate the student's needs. The instructor will determine a reasonable timeframe for submitting make-up work to ensure the student can still earn credit.
- **Lab Make-Up Work:** Due to the nature of laboratory materials (e.g., material constraints, time-sensitive chemicals), make-up labs may not always be possible. If a lab cannot be repeated, the instructor will provide the student with data to complete a formal lab report or assign an alternate activity to make up for the missed experience.

Classroom Expectations

Active Participation and Engagement: Students are expected to actively participate in class discussions, take detailed notes during lectures, and complete all assignments on time. Chemistry is a challenging but fascinating subject, and students are encouraged to approach lessons and assignments with curiosity, making connections between new material and previously learned concepts. The instructor will provide feedback on assignments, and students are expected to review and apply this feedback to improve their understanding and performance.

Success in this course depends on consistent attendance and active engagement. Students are responsible for following up on missed assignments and labs within **one week of an excused absence**. Classroom behavior will be guided by **Respect, Responsibility, and Maturity**, and disruptive or immature behavior will not be tolerated, potentially resulting in **removal from the class**. This course demands a **higher level of seriousness and commitment** than a typical high school class, and students are expected to take ownership of their learning.

Distance Learning Etiquette: At various points during the school year, distance learning strategies may be employed, such as during **inclement weather, early release days, or mandated closures**. During virtual sessions, students are required to **log in to Canvas regularly** to access announcements, grades, lecture PowerPoint notes, links, and other course documents. The course will transition to a mix of **real-time interactive classes (conducted through Zoom)** and **self-paced independent or group work**.

During real-time sessions, students should expect **mini-lectures, large- and small-group discussions, and project presentations**. Cameras **must be turned on** during these sessions, and active participation is required. If a student cannot meet this expectation, a **parent-teacher conference** will be necessary to determine appropriate accommodations. Microphones should be **muted when not speaking** to prevent feedback, and respectful dialogue—whether spoken or written in the chat—is expected.

Academic Integrity: Plagiarism, cheating, or copying will not be tolerated. All work, including homework, lab reports, and assignments, must be the student's own. Violations of academic integrity will result in a **zero on the assignment** and may lead to disciplinary action. Proper citation of sources is required for all research-based work.

Assignment Submission and Communication: Assignments will be submitted electronically via **Canvas** or in person, depending on the specific requirements. Due dates are strictly enforced, and late submissions will incur a **10% penalty per day**. If a student has accommodations for extra time, they must notify the instructor and provide documentation from a **guidance counselor**. Students are encouraged to communicate with the instructor if they need help or accommodations, as the instructor can only support students who actively seek assistance.

Respectful and Mature Behavior: Disruptive or inappropriate behavior will not be permitted. Students are expected to demonstrate **respect, responsibility, and maturity** at all times. Verbal warnings will be given for minor infractions, but repeated issues will result in **parent/guardian notification** and potential involvement of the GSST administration.

Preparation and Organization: Students are expected to come to class **prepared**, having completed assigned readings, watched instructional videos, and reviewed notes. Effective time management and organization are essential for success in this course. While some assignments may not carry a grade, they are **critical for understanding the material** and preparing for graded assessments.

Laboratory Investigations, Skills, and Lab Notebook

1. **Lab Component:** Throughout the academic year, approximately **25% of classroom time** will be dedicated to laboratory investigations. Students will complete **16 laboratory experiments**, with **6 of them being inquiry-based**, requiring students to design their own procedures and analyze data critically. Laboratory work is an **essential component** of this course, and students are expected to approach each experiment with diligence and professionalism. Labs will be **hands-on** and will build upon prior knowledge, reinforcing theoretical concepts through experimental application.

2. **Lab Safety and Conduct**

    - Students must perform a **minimum of 8 "wet" supervised hands-on labs per semester**.
    - **Lab safety is a priority**—students must wear **splash-resistant goggles**, **proper lab clothing**, and **closed-toed shoes** at all times.
    - Proper handling and **safe disposal of chemicals** is required.
    - Students must **read and analyze** a **Safety Data Sheet (SDS)** before working with any chemicals.
    - **Hazardous waste** must be collected and disposed of following laboratory safety protocols.
    - Students should be able to **recognize and properly use basic laboratory equipment**.

3. **Lab Reports and Late Submissions:** Students must submit their completed **lab reports** by the assigned due date. Late submissions will incur a **10% penalty per day**, up to the day of the **unit test**, after which no late lab reports will be accepted.

4. **Laboratory Skills**

Students will develop and demonstrate proficiency in key laboratory skills, including but not limited to:

- Making **accurate measurements** using the correct number of **significant figures**.
- **Utilizing laboratory notebooks** effectively, especially for **data acquisition, handling, and analysis**.
- Performing a **minimum of six wet labs** documented in a **lab notebook**, including an **introduction, procedure, data table, and conclusion**.
- Using **spreadsheets to graph (plot) and analyze data** and conducting **basic error analysis**.
- Writing **formal lab reports** using **proper scientific analytical writing**, incorporating **good data analysis** and discussion of results.
- Properly using **volumetric glassware**, including **burets** for precise measurements.
- Performing **accurate titrations** and **stoichiometric calculations**.
- Using basic laboratory equipment such as **balances, hot plates, and thermometers**.
- Operating **spectrometers or colorimeters** for spectroscopic analysis.
- Connecting laboratory experiments to **lecture topics** and **real-world applications**.

5. **Lab Notebook and Portfolio Requirements**

Each student will maintain a **lab notebook** as an organized and thorough record of their laboratory work. This notebook is a **critical requirement** and serves as a **comprehensive record** of laboratory investigations.

Lab Notebook Guidelines:

- The **first page** of the notebook must include a **table of contents**, which will be updated throughout the year.
- **All entries must be handwritten** in **blue or black ink**—typed reports will not be accepted.
- **Corrections** must be made by drawing a **single line** through mistakes; the use of whiteout or erasing is strictly prohibited.
- **Pages must remain intact**—removing or tearing pages from the lab notebook is not allowed.
- The notebook will be used for documenting observations, data collection, and analysis, and will serve as a reference for lab quizzes and reports.

Assessment and Lab Quizzes

Students will be evaluated on their **understanding and mastery** of laboratory procedures, data collection, and calculations. Additionally, lab quizzes may be administered to assess comprehension, and **retakes will not be permitted**.

Lab Write-Up Structure

Each lab report must be structured as follows:

1. **Title, Name, Date*** *(Clearly identify the experiment, your name, and the date of completion.)*
2. **Learning Objectives*** *(Describe the scientific concepts and skills the lab aims to address.)*
3. **Materials List*** *(Include all chemicals, glassware, and equipment used in the experiment.)*
4. **Procedure*** *(Detailed step-by-step directions written in your own words; must be clear enough to replicate without the original instructions.)*
5. **Data Tables and Observations** *(Organized data collection, including measurements, qualitative observations, and graphical representations when applicable.)*
6. **Calculations** *(Show all relevant calculations with units and explanations where necessary.)*
7. **Error Analysis** *(Identify possible sources of error and explain how they may have affected the results.)*
8. **Discussion and Conclusion** *(Explain the results, compare findings to theoretical values, and demonstrate how evidence supports the conclusion.)*

Must be completed prior to the start of the lab.

By maintaining a **well-organized** and **detailed** lab notebook, students will develop essential **scientific documentation skills** that will benefit them in future coursework and professional research environments.

Lab Report Rubric Highlights:

- Clarity & Organization – 10%
- Data Accuracy & Tables – 25%
- Calculations (steps + units) – 20%
- Error Analysis – 20%
- Discussion & Conclusion – 25%

Tentative Course Schedule – Advanced Chemical Analysis

Week	Chapter/ Topic(s) Covered	Lab Experiments / Demonstrations	Learning Objectives
1	Orientation & Safety Week	Orientation, Syllabus, Icebreaker, Pre-assessment, Lab Safety Training, Safety Contract, Lab Tour, Scientific Method Intro	-Understand course structure and expectations -Navigate course resources -Recognize the importance of laboratory safety - Complete a pre-assessment to reflect on prior chemistry knowledge. -Demonstrate basic safety practices -Commit to responsible laboratory behavior
2	1.Chemical Foundations	Density of Liquids and Solids lab, Activity: Measurement & Significant Figures Demonstration: Observation and Uncertainty in Measurement	-Outline the steps of the scientific method and experimental design. -Understand the scientific method and measurement uncertainty. - Use SI units and common laboratory units - Use significant figures and unit conversions. - Calculate density - Differentiate matter classifications
3	2.Atoms, Molecules, and Ions	Flame Test Lab, Atomic Structure Models	- Identify atomic structure components and isotopes. - Understand periodic table organization. - Name and write chemical formulas.
4-5	3.Stoichiometry	Percent Composition & Empirical Formula Lab, Limiting Reactants Lab	- Perform mole-mass-particle conversions. - Solve stoichiometric problems, including limiting reactants.
6	4.Types of Chemical Reactions & Solution Stoichiometry	Precipitation Reactions, Conductivity of Solutions	- Classify and predict products of chemical reactions. - Write balanced chemical, ionic, and net ionic equations.
7-8	5.Gases	Gas Laws Lab, Molar Mass of a Gas	- Apply gas laws (Boyle's, Charles's, Ideal Gas Law). - Understand kinetic molecular theory.
9	6.Thermochemistry	Heat of Reaction (Calorimetry), Hess's Law Experiment	- Apply the laws of thermodynamics. - Calculate enthalpy changes using calorimetry.
10-11	7.Atomic Structure and Periodicity	Photoelectron Spectroscopy (PES), Periodic Trends Demo	- Describe electronic structure using quantum theory. - Analyze periodic trends (electronegativity, ionization energy, etc.).
12-13	8.Bonding: General Concepts	Lewis Structures & Molecular Models, VSEPR Theory	- Predict molecular geometry using VSEPR. - Determine bond polarity and intermolecular forces.

Week	Chapter/ Topic(s) Covered	Lab Experiments / Demonstrations	Learning Objectives
14	9.Covalent Bonding: Orbitals	Hybridization and Molecular Orbital Theory Models	- Describe sigma and pi bonding. - Explain hybridization and molecular orbital theory.
15	10.Liquids and Solids	Intermolecular Forces Lab, Phase Diagram Analysis	- Differentiate between intermolecular forces and their effects on properties.
16	11.Properties of Solutions	Solubility and Colligative Properties Lab	- Analyze factors affecting solubility. - Perform calculations with molarity and molality.
17-18	12.Chemical Kinetics	Rate Laws and Reaction Mechanisms Lab	- Determine reaction rates and rate laws. - Understand factors affecting reaction speed.
19-20	13.Chemical Equilibrium	Le Chatelier's Principle Lab	- Write equilibrium expressions (Kc, Kp). - Apply Le Chatelier's Principle.
21-22	14.Acids and Bases	Acid-Base Titration & pH Indicators	- Identify properties of acids/bases. - Perform pH and titration calculations.
23-24	15.Acid-Base Equilibria	Buffer Solutions Lab	- Determine buffer capacity. - Calculate pH of weak acids/bases and buffers.
25-26	16.Solubility & Complex Ion Equilibria	Solubility Product Constant Lab	- Apply Ksp calculations. - Predict precipitation reactions.
27-28	17.Thermodynamics	Entropy & Free Energy Lab	- Apply the laws of thermodynamics. - Use Gibbs free energy to determine spontaneity.
29-30	18.Electrochemistry	Electrochemical Cells & Redox Titrations	- Construct and analyze galvanic and electrolytic cells. - Calculate cell potential using standard reduction potentials.
31-32	19.The Nucleus: A Chemist's View	Radioactive Decay Simulation	- Understand nuclear reactions and decay processes.
33-34	20.Organic and Biological Molecules	Simple Organic Synthesis & Functional Group Identification	- Recognize and name organic molecules. - Predict chemical behavior of functional groups.
35-36	Final Exam & Course Reflection	Lab Cleanup & Notebook Submission	- Demonstrate cumulative knowledge and practical lab skills.

Note about Dual Enrollment with VPCC:

While the Governor's School for Science and Technology (GSST) will do all in its power to secure dual enrollment (DE) status for its courses, dual enrolled course credits are not guaranteed. Since the Virginia Community College System (VCCS) and Virginia Peninsula Community (VPCC) set the criteria for DE and must approve each course and instructor, unavoidable circumstances that are not within the control of GSST may change the DE eligibility of any given GSST course. Alternative pathways for meeting specialty program requirements (E.g. concurrent associate's degree) should be discussed in advance with the home high school counselor.

The decision to dual-enroll in a course requires careful consideration. You have options, as you can see from the DE module on Faculty Advising Canvas course. You may wish to contact your top choice colleges to ask what the impact of taking a dual-enrollment course might be for your goals. Please be aware that you are generating a permanent college transcript with all the courses for which you are dual-enrolled. You can also use the dual-enrollment student guide from Transfer Virginia

Links to an external site.

to help you determine the potential impact.

If you choose to dual-enroll, you must monitor your course grade. If you find you are not earning grades you want to have on your permanent college transcript, you may consider dropping the dual-enrollment portion prior to the Add/Drop date for the term of the course, or to withdraw from the dual-enrollment portion prior to the Withdrawal date. If you choose to withdraw from dual enrollment for the class, you will still earn high school credit and can plan to be well-prepared for the class in college. Dropping will have no record on your transcript, while withdrawal will leave a note on your college transcript indicating you withdrew, but no grade will be recorded on your college transcript. You can request a decline or withdrawal form from me.

Note: Based on Virginia Community College System rules you must achieve at least 70% or above on the lecture part of the course for the credit to be transferable. This also means that CHM 112 credit will not be counted as DE credit since CHM 111 is a prerequisite.

No matter what you choose to do, I will respect your wishes. I want to work with you to support your learning, but I cannot learn the information for you; you will have to invest effort in the course to succeed. This may require you to learn new learning strategies that you haven't used in the past. I will do my utmost to support your personal learning in the class and encourage you to pursue your goals.

Acknowledgement Form

Please return this page to the instructor by Thursday, August 28, 2025.

I have read the syllabus for Advanced Chemical Analysis at GSST. I will contact Dr. Guven by phone at 766-1100 ext. 3320, via CANVAS In-Box, or by email at adem.guven@nhrec.org if I have any questions.

Date: _____
Student's Printed Name: _____
Student's Signature: _____
Parent/Guardian's Signature: _____
