CHEM105: CULINARY CHEMISTRY
Virtual instruction

Instructor:	Melissa A. Mullen Davis, Ph.D.
Pronouns:	she/her/hers
Office:	218 Caputo Hall
Office Phone:	717-871-7439
e-mail:	melissa.mullendavis@millersville.edu
Office Hours:	In person or Virtual Drop-In Zoom "Office Hours" – Link on D2L Tues 9:30 – 10:30, Wed 2 – 4, Thurs 9:30 – 11:30, and by appointment

Credit: 2 class hours per week lecture and 2 lab hours per week. No credit towards Chemistry major.

Meeting Times:

- Lecture: Asynchronous virtual instruction
- Lab: Synchronous instruction (1 hr) and Asynchronous activity (1 hr)
    - Section A: Tues 10:50 am – 11:40 am
    - Section B: Tues 1:40 pm – 2:30 pm

Required Materials:

- Textbook: *On Food and Cooking: The Science and Lore of the Kitchen* by Harold McGee. ISBN: 978-0684800011
- Scientific, non-graphing calculator which must be able to handle logarithms (log, ln) and exponents (10^x, e^x, y^x)
- Regular access to D2L (https://millersville.desire2learn.com), university email, and the internet.
- Recommended: Hard copy periodic table (a printed page would work!)
- Access to the following for at-home kitchen laboratory experiments. If you have any questions about items listed below, please ask me.
    - Stovetop or hot plate and frying pan
    - Oven or toaster oven, cooking sheet, and oven-safe container.
    - Analog or digital kitchen scale (available for <$10 from local or online retailers).
    - Bowl, mixing spoon, fork, knife, measuring cups (solid and liquid), measuring spoons.
    - There will be some required food ingredients which can be found in the "Food Ingredients" list on D2L. Please note for most laboratory sessions there will be choice of recipes and ingredients for you to choose within the laboratory framework. If you have questions or concerns about access or cost please let me know.

Course Overview:
Our goal is to learn foundational chemical principles using food as our inspiration. We will cover a variety of topics that will use chemistry to explain observations and phenomena associated with food. We will discuss ingredients and food preparation techniques from different cuisines and examine the global influence of flavors and cuisines.

Course Learning Outcomes:
The goals of this course are to enable you to:

- Classify diverse foods and ingredients by their chemical structures and physical properties and interpret their functions.
- Identify and interpret chemical terminology.
- Identify, describe, and distinguish between physical and chemical changes that occur during food preparation methods such as mixing, cooking, and baking.
- Apply and evaluate chemical principles in the context of food and food preparation from different cultures impacted by geography, economics, and history.
- Apply the scientific method to recipe development.

Course Organization
We will address the goals of the course by exploring a series of topics organized into modules. Within each module, topics will be organized to address an overarching topic or question. The modules are listed below along with the chemistry to be covered in each.

Module 1: Recipes and the Scientific Method
Scientific Method (Recipe), Accuracy and Precision, Measurements, Units, Unit Conversion

Module 2: Salt
Atoms, valence electrons, ions, ionic compounds, covalent compounds, intermolecular forces, polarity, water, solubility

Module 3: Ingredients on the Molecular Level
Chemical structure of food (fats, sugars, proteins, etc), organic molecules, functional groups, molecular properties, intermolecular interactions

Module 4: Chemical Transformations
States of matter, physical and chemical changes, mixtures, colloids, colligative properties, acid/base chemistry, chemical reactions, stoichiometry, moles, cultural and religious customs for food preparation

Module 5: Cooking Methods and Utensils
Metals and conductivity, polymer chemistry, heat vs temperature, gas phase chemistry, comparison of materials and methods (global, modern vs historical)

Module 6: Chemistry of Baking (leavening and gases)
Thermodynamics of heat and energy transfer, heat vs temperature, gas phase chemistry, bacteria, yeast, unleavened breads

Module 7: Herbs and Spices
Solubility, volatility, natural products, bioactive compounds, global culinary influence of silk route, colonization, and slave trade

Module 8: Coffee, Tea, Beer, and Wine
Fermentation, distillation, bacteria, yeast, enzymes, sustainability

What should I expect during each Module?
Each Monday I will send an email and post a course announcement with content for the week:

- Content videos with video participation questions
- Reading(s) and other external resources
- Handout(s) with practice questions
- D2L Homework
- Information for laboratory experiments and assignments

At the end of each module there will be a quiz administered on D2L to assess learning.

Succeeding in Virtual Chemistry Class!
I promise to provide you with the resources you need to help you succeed – class materials, examples, readings, practice problems, office hours, etc. but *you are ultimately responsible* for the knowledge you are gaining.

To do well in this class, it is important to:

1) Keep up with the material. I recommend keeping a schedule and working on Chemistry every day.
2) Engage in the material and be an active learner. Take handwritten notes during content videos and honestly attempt video content questions.
3) Complete practice problems from handouts and D2L homework. I recommend working without your notes first to test your understanding.
4) Seek help from available resources. Reach out to me, other chemistry students, peer tutoring, etc. Check the D2L Discussion Boards. Attend my virtual, drop-in office hours or schedule an appointment.

Evaluation of Learning:

Engagement	10%
Discussion	10%
Homework	20%
Quizzes	30%
Final Recipe Project	10%
Laboratory	20%
Total	100%

Final letter grades will be assigned on a standard plus/minus scale:

A: 90-100% (A: 93-100; A-: 90-93)
B: 80-90% (B+: 87-90; B: 83-87; B-: 80-83)
C: 70-80% (C+: 77-80; C: 73-77; C-: 70-73)
D: 60-70%
F: less than 60%

Students are expected to earn a passing grade (60%) in lecture, laboratory, and discussion components to earn a passing grade in the course.

Engagement, 10%
Engagement in course material is essential for learning chemistry! You are expected to take responsibility for learning course material and participating in the course. This can be challenging with online classes and virtual instruction. To facilitate engagement and participation you are expected to watch course content videos and engage with video discussion in comments. There will also be reflection assignments to provide you an opportunity to reflect and comment on what we are learning, the course, and the learning process.

Discussion Board Assignments, 10%
You will be expected to complete each discussion board assignment (no more than one per module). You will engage with some media related to course content, write an original discussion board post, and respond to classmates. Prompts will be included for each assignment with more specific details.

Homework, 20%
There will be two types of homework assignments.

(1) Learning activities. Each week I will provide practice questions to assist your learning of the content. You must complete and upload them to D2L by Sun 11:59 pm. Handouts will be graded on completion (5-10 points/handout) and it is up to you to check your answers against the provided key which will be visible after you upload your assignment.
(2) D2L Homework assignments. Homework assignments administered on D2L will be assigned to provide additional practice with course material. You may take them up to three times to gain mastery of the material and to improve your score. These will be graded for correctness (10 points/assignment) and must be completed by Sunday 11:59 pm. You will have the opportunity to earn additional attempts by attending office hours or asking appropriate questions about the assignment via email or question discussion board.

Quizzes, 30%
Seven quizzes will be administered on D2L at the end of each module. These will be opportunities for you to demonstrate your individual understanding and ability to apply, analyze, and synthesize the material discussed in the course and in assigned readings. Quizzes will be open-resource, will be open for at least 36 hours, and will have a time limit of 45 minutes.

Make-Up Quiz Policy
If you know ahead of time that you will miss a quiz you must tell me as soon as possible, ideally at least one full week before the due date. You will be expected to take the quiz before the scheduled period unless illness or a family emergency causes a late make-up to be necessary. The make-up will not necessarily be the same as the quiz administered to the rest of the class. Missing a quiz without prior permission will result in a score or zero and cannot be made up.

Learning Accommodations
Any student who meets the eligibility requirements to receive academic accommodations through learning services should speak with the Office of Learning Services in Lyle Hall as early in the semester as possible. For more information: http://www.millersville.edu/learningservices.

Laboratory Assignments, 20%
The virtual laboratory component of CHEM 105 is designed to give you hands-on experience with the concepts we discuss in the lecture portion of the course. Within the kitchen laboratory framework you will have some choice of materials, ingredients, and recipes to use.

There will be four parts to the CHEM 105 virtual laboratory:

(1) A **synchronous meeting** with your lab and laboratory instructor at your scheduled laboratory time using Zoom (or an alternative teleconferencing software). During this time we will introduce laboratory experiments, discuss results of experiments or recipes, and/or listen to student presentations. You are expected to attend synchronous sessions (5 pts/session) and there will be additional points for some synchronous lab-related activities.
(2) A **kitchen laboratory experiment or recipe** will be assigned related to the content discussed in the lecture portion of the course. Depending on the topic and week, the experiments/recipes may have specific protocols to follow or you may have choice of protocol/recipe.
(3) A **laboratory assignment** will be due each Sunday at 11:59 pm related to the kitchen experiment or recipe assigned. This assignment format may vary by week and topic but could include open-ended questions about laboratory protocol, recipes and ingredients used, data analysis, calculations, preparation of graphs, etc. The assignment may also include practice

questions about chemistry topics. Details will be posted in the Monday announcement and can be seen in the laboratory folder on D2L.

(4) During the last several weeks of lab, we will have a special **Global Food Project** assignment which will help you consider the function of ingredients and illustrate the global nature of science and food. In laboratory groups you will: (1) Identify a unique dish that originated in a country other than the United States, (2) Find a recipe and determine what ingredients are critical for the recipe, (3) Determine the major chemical structure present in the ingredients, (4) Determine the physical properties of the ingredients, and (5) Determine the purpose of the ingredient, and (6) Identify at least one influence of that dish or culture in another region or cuisine. In your groups you will complete written questions and present your information to the laboratory the following week. More details will be provided in lab and on D2L.

Final Recipe Project, 10%

Throughout the course of the semester and our chemistry investigations each of you will prepare several different recipes. For your final project, you must choose a recipe as your focus and prepare the original recipe and a variation, changing one ingredient, measurement, or cooking condition/technique. You will choose the "best" recipe from your experiment to report in the form of a Food Blog (at least 500 words) or Recipe Highlight Video or Video Series (at least 3.5 minutes) which will be included in our Culinary Chemistry Recipe Book. The Food Blog should contain (1) Final detailed recipe and instructions for preparation, (2) a description of the chemistry of ingredients, (3) a discussion about the alteration made including the chemistry behind the change, and (4) the results of your change and which variation was preferred. More details will be provided in the Recipe Project prompt posted on D2L.

Course Policies:

Class Attendance and Participation

You are expected to complete all online course content which will be presented and distributed on D2L and access materials at *least* once a week. You are also expected to log in to lab synchronously each week at your scheduled laboratory time. Please contact me as soon as possible if you are unable to attend any synchronous sessions. Any graded work conducted outside the scheduled time may differ significantly in form and exact content from the other version.

Computer Resources

You are expected to use **D2L** for CHEM 105 and set up alerts for any announcements posted to the D2L site. This provides mechanisms for contact, distribution of information and data, submission of written work, completion of peer reviews, etc. You are also responsible for all course information sent to your campus email address.

Submitting Late Work

As your instructor, I have designed the course to help you learn chemistry in the context of food and cooking; all of the course components and assignments are included because I truly believe they will help you meet learning objectives. Because of this, I encourage you to submit work even if it is late as there is a benefit to completing all assignments. However, it is important that you progress steadily through the material and complete the work by the deadlines. Work submitted after a deadline may receive a penalty of up to 5% a day.

Diversity and Inclusion Policy

This course is a judgement free and inclusive learning environment. Our class includes students from a wide variety of social identities and life circumstances. Everyone will treat one another with respect and consideration at all times or be asked to leave the virtual classroom.

As your instructor I will:

- Learn and correctly pronounce everyone's names.
- Use correct pronouns for those who wish to indicate this to me/the class
- Work to accommodate/prevent English language related challenges

In this course we will discuss foods from different cultures with different flavor profiles and highlight food preparation methods of different cultures and religions. I frequently tell my daughters: "Everyone has different tastes!" and "Don't yuck someone else's yum!" We will discuss all cuisines will respect and acknowledge the differences in each others' palates and food preferences. These differences may arise from a persons' medical restrictions, religious or cultural norms, or personal preferences. Anyone not respecting personal decisions, preferences, or tastes will be asked to leave the virtual classroom.

Children and pets are welcome to attend live sessions as long as you are considerate of other learners. In general, I suggest keeping your microphone muted when not speaking to avoid outside noise for the rest of the class.

If you tell me that you are having trouble I will not judge you or think less of you. You do not owe me an explanation of your health (physical or mental) or the health of your loved ones; but you are welcome to tell me and I will listen. If I can not help you, I will find someone who can. If you need help or more information, please ask and I will work with you.

<u>Academic Honesty</u>

Students are expected to abide by the policy outlined by Millersville University shown below. During some laboratory sessions or group projects students will collaborate on collecting, interpreting, reporting data and information. Students are expected to contribute equally to collaborative work. Fabrication of data or plagiarism in preparing assignments, reports, or projects will not be tolerated in this course. Anyone caught cheating in these ways will be assigned a score of zero on the work.

Your instructor knows how to use Google, Chegg, and other study sites. Please do not post questions from in-class assessments on sites such as Chegg. It is also against our academic honesty policy to use AI technology (such as ChatGPT) for any assessments. All answers submitted should be in your own words (even when assessments are open-resource).

According to Millersville University's Academic Honesty Policy: *"Students of the University are expected to be honest and forthright in their academic endeavors."* If you break the academic honesty policy, there are severe penalties. A failing grade will be assigned and you may be prosecuted by an Academic Review board. Actions that violate the Academic Honesty Policy are:

1. Plagarism: inclusion of someone else's words, ideas, or data as one's own work.
2. Fabrication: falsification of research or other findings.
3. Cheating: the act or attempted act of deception by which an individual tries to misrepresent that the individual has mastered subject matter in an academic project or the attempt to gain an advantage by the use of illegal or illegitimate means. Submitting in-class participation cards for another student is considered cheating.
4. Academic Misconduct: violation of University policies by tampering with grades or participating in the distribution of any part of a test before its administration.

Official Attendance Policy

1. Students are expected to attend all classes. It is the student's responsibility to complete all course requirements even if a class is missed. If a student misses class for an officially excused reason, then the student is entitled to make up the missed work but only at the convenience of the faculty member. Responsibility for materials presented in, assignments made for, and tests/quizzes given in regularly scheduled classes lies solely with the student.
2. The Millersville University policy states that faculty will excuse absence for the following reasons:
    a. personal illness
    b. death or critical illness in the family
    c. participation in a university-sponsored activity
    d. jury duty
    e. military duties
    f. religious holidays
3. Faculty judge the validity of student absences from class within the University's approved guidelines and may require documentation for excuse absences. Faculty will evaluate any reason, other than those listed above, for a student missing class and determine whether the absence is justified. In these circumstances, a student may make up missed work at the discretion of the instructor.
4. In the case of foreseeable absences, students are encouraged to notify the faculty member in advance. A student who will miss class due to participation in an official University activity must notify the instructor well in advance of the activity to assure that the absence is excused.
5. For more information: http://www.millersville.edu/registrar/faculty/attendance_policy.php

Title IX Statement

Millersville University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment, comply with Title IX of the Education Amendments of 1972, 20 U.S.C. §1681, et seq., and act in accordance with guidance from the Office for Civil Rights, the University requires faculty members to report to the University's Title IX Coordinator incidents of sexual violence shared by students. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report to the person designated in the University Protection of Minors policy incidents of sexual violence or any abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is available at www.millersville.edu/titleix.

Counseling Reminder

Students sometimes face mental health or drug/alcohol challenges in their academic careers that interfere with their academic performance and goals. Millersville University is a caring community and resources are available to assist students who are dealing with problems. The Counseling Center (717-871-7821) is an important resource for both mental health and substance abuse issues. Additional resources include: Health Services (717-871-5250), Center for Health Education and Promotion (717-871-4141), Campus Ministries, and Learning Services (717-871-5554).

Americans with Disabilities Act

Millersville University is committed to equality of opportunity and freedom from discrimination for all students, employees, applicants for admission or employment, and all participants in public University-sponsored activities. In keeping with this commitment, and in accordance with the Americans with Disabilities Act (ADA) the University will make every effort to provide equality of opportunity and freedom from discrimination for all members of the University community and visitors to the University,

regardless of any disability an individual may have. Accordingly, the University has taken positive steps to make University facilities accessible to individuals with disabilities and has established procedures to provide reasonable accommodations to allow individuals with disabilities to participate in University programs. The University administration and management are obligated to report any allegation of discrimination to the appropriate office as defined in this policy.

Please let me know how I may make accommodations in the classroom setting that will enhance and support your learning.

CHEM 105 Tentative Schedule*

Date	Readings	Topics	Lab Activity	Synch Session
Week 1 8/25-31		Introduction to Chemistry Module 1: Recipes and the Scientific Method	Pre-Assessment	Welcome/Safety
Week 2 9/1-9/7 LABOR DAY	Appendix Chemistry Primer	Module 2: Salt **Quiz 1**	Measuring and Density	Tastes and Describing Food
Week 3 9/8-14	Appendix Chemistry Primer	Module 2: Salt	Sautéing with Salt	Concentration and Electrolytes
Week 4 9/15-21	Ch 15	Module 3: There are Molecules in My Food **Quiz 2**	Solutions and Solubility	Salt Discussion, Dilutions
Week 5 9/22-28	Ch 3	Module 4: Chemical Transformations	Concentrations	Polarity and Solubility
Week 6 9/29-10/5	Ch 3	Module 4: Chemical Transformations **Quiz 3**	Emulsions	Intermolecular Forces
Week 7 10/6-12	Ch 14	Module 5: Cooking Methods and Utensils	**NO LAB FALL BREAK**	Heat Transfer in Cooking Methods
Week 8 10/13-19	Ch 14	Module 5: Cooking Methods and Utensils **Quiz 4**	Cooking Methods	**NO LAB FALL BREAK**
Week 9 10/20-26	Ch 10	Module 6: Chemistry of Baking	Neutralization Reactions	pH of Household Acids and Bases
Week 10 10/27-11/2	Ch 10	Module 6: Chemistry of Baking **Quiz 5**	Gluten and Baking	Balancing Chemical Reactions
Week 11 11/3-9	Ch 8	Module 7: Herbs and Spices	Seasonings	Herbs and Spices
Week 12 11/10-16	Posted readings	Module 7: Herbs and Spices **Quiz 6**	Global Food Project	
Week 13 11/17-23	Ch 8 and 13	Module 8: Coffee, Tea, Beer, and Wine	Global Food Project	
Week 14 11/24-30	Ch 13	Module 8: Coffee, Tea, Beer, and Wine **Thanksgiving Break (11/27-12/1)**	**NO LAB**	Global Food Project Presentations
Week 15 12/1-7		Module 8: Coffee, Tea, Beer, and Wine	Final Project Proposals	
Week 16 12/8-12		**Quiz 7; Final Projects Due**	**NO LAB**	**NO LAB**