# PHY 123 – Food, Fire, and Physics

Spring 2022

## Instructor Information

**Professor**: Kevin Aptowicz, Ph.D. (Dr. Aptowicz)
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**Office**: SECC 365
**Office Hours**:

Monday: 1 to 3 pm
Tuesday: 11:30 to 12:00 pm
Wednesday: 1 to 3 pm (virtual)
Thursday: 11:30 to 12:00 pm

## Materials

**Required Textbook**:

- McGee, H. (2004). *On Food and Cooking: The Science and Lore of the Kitchen.* Scribner
  ISBN: 0684800012
  (PDFs of chapter available on D2L)

**Required Materials**:

- A computer to use D2L, OneNote, YouTube, and other web-based applications. Not needed for class time.
- Smartphone or laptop computer needed during class for PollEverywhere URL or APP.

## Time Commitment – Semester

The life of a student isn't easy. You have many demands on your time beyond this course. I need to be reasonable by not assigning more work than a student should be doing in a three-credit science general education course. This calculation is an attempt to do just that. In order to determine how much time a student can commit to PHY 123, I've made the following assumptions.

- The student (that's you!) spends a total of **40 hours a week** on his or her college studies.
- The student course load is 15 credits.

Therefore, the total time a student commits to this course per week is:

$$\frac{40 \text{ hours}}{15 \text{ credits}} \times 3 \text{ credits} = 8 \text{ hours}$$

However, realizing that this is a Gen Ed course and thus should not be as intensive as a course in one's major, I'm designing the course assuming you will dedicate 6 hours a week to this course.

*A student will need to spend, on average, **6 hours a week** on this course.*

If you are unable to commit this time to the course, you will likely struggle to complete the weekly assigned work. Of those six hours, 2.5 hours will be lecture and 3.5 hours will be work assigned outside of lecture.

# Course Descriptions

## Summary

An exploration of food and cooking from a physical science perspective. Principles of soft matter physics (e.g. phase diagram, intermolecular forces, viscosity, diffusion, self-assembly, polymer physics) are discussed and used to gain insight into food and cooking.

## Professor's unofficial goals

Before we get into the nuts-and-bolts of the course, I want to take a moment to thank you for enrolling in this course and state clearly my hopes for you:

- I hope students thoroughly enjoy the course and find it to be a thought-provoking experience.
- I hope students end the course inspired to go into their own kitchen and experiment with different cooking techniques.
- I hope students continue to think about food and cooking from a scientific perspective for the rest of their lives. (You will never see scrambled eggs without thinking of the protein unraveling and bonding!)

## General Education Student Learning Outcomes

PHY 123 is an approved science-distributive course in the WCU General Education program. It is designed to help students meet the first three general education goals. Further details can be found in the subsections below.

### Goal #1 - Communicate Effectively

*Student Learning Outcome: Demonstrate comprehension of and ability to explain information and ideas accessed through reading*

This course will involve lots of reading. Every lecture will have assigned reading which will serve to further explore the ideas introduced in lecture. Your ability to comprehend the information and ideas covered in the reading will be assessed throughout the course. In particular, reading questions will be part of a weekly packet students submit on D2L. The packet will serve as a formative assessment tool to test a student's ability to explain information and ideas accessed through the reading. In addition, exams will include questions focused explicitly on the assigned reading. These reading quizzes and exam questions will serve as the primary form of summative assessment of reading comprehension.

### Goal #2 - Think Critically and Analytically

*Student Learning Outcome: Reach sound conclusions based on a logical analysis of evidence*

Critical and analytically thinking will serve as a foundation for this course. During the semester, we will think about food and cooking on different length scales while we attempt to connect macroscopic phenomena to microscopic and molecular interactions. As we make these connections, we will develop simple models of food to understand their properties as well as develop mathematical expressions that will serve as predictive models. For example, what can we learn about diffusion by measuring the change in opacity of a piece of fish soaked in an acid solution? Is there a mathematical relationship that captures the relationship between the average distance diffused by the acid and the time passed? What general properties are involved in a diffusive process? How can we test if other processes are diffusive? This critical and analytical thinking will occur throughout the course including reading questions, in-class concept questions, problem set questions, and exam questions. Exam questions will serve as a primary form of assessment.

### Goal #3 - Employ Quantitative Concepts and Mathematical Methods

*Student Learning Outcome: Employ quantitative methods to examine a problem in the natural or physical world*

Over the course of the semester, we will have 10 different themes: 'Unit Conversion,' 'Building Blocks of Food,' 'Temperature, Heat, and Energy,' 'Phase Transitions,' 'Elasticity,' 'Dispersions and Diffusion,' 'Heat Transfer', 'Viscosity', 'Emulsions and Foams', and 'Fermentation & Enzymatic Reactions.' During the discussion of each theme, we will explore an equation that provides insight into that theme. These mathematical expressions will serve as a bridge between macroscopic phenomena we observe in the kitchen and the microscopic or molecular interactions at play. Students will utilize the mathematical expressions discussed in class to solve quantitative problems on problem sets and exams. Exam questions will serve as a primary form of assessment. Student Learning Outcome: Apply the basic methods and thought processes of the scientific method for natural/physical science in a particular discipline. The scientific method serves as the primary tool for knowledge creation in the physical sciences. In this course, we will explore the scientific method using various cooking demonstrations and experiments. Using cooking as a back-drop, we will discuss the process of generating a hypothesis, testing it, and then re-evaluating. A student's understanding of the scientific method will be tested during lecture with concept questions as well as on problem sets and exams. Exam questions will serve as a primary form of assessment.

### Meeting & Assessing Student Learning Outcomes

Summative assessment of student learning outcomes will occur via written exams.

## Attendance Policy

You are expected to attend all class sessions in person.

## Evaluation & Grading

20% - *OneNote* Kitchen Observations
20% - *PollEverywhere* participation
20% - Module packets
5% - Engagement
20% - Exams (4 Exams in total)
15% - Semester-long Cookbook Project
**Total: 100%**

A letter grade will be assigned based on performance in the course according to the following scale:

| Grade | Quality Points | Percentage Equivalents | Interpretation |
|---|---|---|---|
| A | 4.00 | 93-100 | Excellent |
| A- | 3.67 | 90-92 | |
| B+ | 3.33 | 87-89 | Superior |
| B | 3.00 | 83-86 | |
| B- | 2.67 | 80-82 | |
| C+ | 2.33 | 77-79 | Average |
| C | 2.00 | 73-76 | |
| C- | 1.67 | 70-72 | |
| D+ | 1.33 | 67-69 | Below Average |
| D | 1.00 | 63-66 | |

| | | | |
|---|---|---|---|
| D- | 0.67 | 60-62 | |
| F | 0 | < 60% | Failure |

Refer to the Undergraduate Catalog for description of NG (No Grade), W, Z, and other grades.

Student MUST reach out to instructor 24-hours (if possible) prior to missing an exam to discuss alternate plan.

## Tentative Course Outline

The course is composed of 28 modules. Modules are composed of one lecture as well as activities outside of lecture. Modules are designed take approximately 3 hours to complete including time spent in lecture.

| Modules | TOPICS |
|---|---|
| **1-2** | Introduction and Orientation |
| **3** | **SCIENCE**: Unit Conversion and Ratios |
| **4** | **SCIENCE**: Atoms, Molecules, and Moles |
| **5** | **SCIENCE**: Water and Fats |
| **6** | **SCIENCE**: Proteins and Carbohydrates |
| **7** | **SCIENCE**: Temperature, Heat, and Energy |
| **8** | **SCIENCE**: Heat Transfer and Diffusion |
| **9** | **Review and Group Exam #1** |
| **10** | THE SCIENCE OF **COOKING**: Eggs |
| **11** | **SCIENCE**: Phase Transitions |
| **12** | THE SCIENCE OF **TEMPERING**: Chocolate |
| **13** | **SCIENCE**: Time, Temperature, and Pressure |
| **14** | THE SCIENCE OF **COOKING**: Brisket and Pulled Pork |
| **15** | **SCIENCE**: Chemical Reactions and Diffusion |
| **16** | **Review and Group Exam #2** |
| **17** | **SCIENCE**: Plastic and Elastic Deformation |
| **18** | THE SCIENCE OF **GRILLING**: Steak & Tofu |
| **19** | THE SCIENCE OF **BAKING**: Pizza |
| **20** | **SCIENCE**: Viscosity |
| **21** | THE SCIENCE OF **SAUCES**: Bechamel and Balsamic Vinegar Reduction |
| **22** | THE SCIENCE OF **EMULSIONS** & **FOAMS**: Mayonnaise and Meringue |
| **23** | **Review and Group Exam #3** |
| **24** | Exploring the Science of your Recipe |
| **25** | Drafting a Cookbook Entry |
| **26** | Course Content Review |
| **27** | **Cumulative Group Exam** |
| **28** | Revising Cookbook Entry |
| | |
| | FINAL: The final draft of your cookbook entry is your final exam. |

## Statements Common to All WCU Undergraduate Syllabi

**ACADEMIC & PERSONAL INTEGRITY**
It is the responsibility of each student to adhere to the university's standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another's work and/or using ideas of another and presenting them as one's own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Undergraduate Handbook, the Undergraduate Catalog, the Ram's Eye View, and the University website at www.wcupa.edu.

**STUDENTS WITH DISABILITIES**
If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities (OSSD), please visit them at 223 Lawrence Center. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is ossd@wcupa.edu, and their website is at https://www.wcupa.edu/universityCollege/ossd/. In an effort to assist students who either receive or may believe they are entitled to receive accommodations under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, the University has appointed a student advocate to be a contact for students who have questions regarding the provision of their accommodations or their right to accommodations. The advocate will assist any student who may have questions regarding these rights. The Director for Equity and Compliance/Title IX Coordinator has been designated in this role. Students who need assistance with their rights to accommodations should contact them at 610-436-2433.

**EXCUSED ABSENCES POLICY**
Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Undergraduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

**REPORTING INCIDENTS OF SEXUAL VIOLENCE**
West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the University's commitment to offering supportive measures in accordance with the new regulations issued under Title IX, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. 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 sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University Protection of Minors Policy.** Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: https://www.wcupa.edu/_admin/diversityEquityInclusion/sexualMisconduct/default.aspx

**INCLUSIVE LEARNING ENVIRONMENT AND ANTI-RACIST STATEMENT**
Diversity, equity, and inclusion are central to West Chester University's mission as reflected in our Mission Statement, Values Statement, Vision Statement and Strategic Plan: Pathways to Student Success. We disavow racism and all actions that silence, threaten, or degrade historically marginalized groups in the U.S. We acknowledge that all members of this learning community may experience harm stemming from forms of oppression including but not limited to classism, ableism, heterosexism, sexism, Islamophobia, anti-Semitism, and xenophobia, and recognize that these forms of oppression are compounded by racism.

Our core commitment as an institution of higher education shapes our expectation for behavior within this learning community, which represents diverse individual beliefs, backgrounds, and experiences. Courteous and respectful behavior, interactions, and responses are expected from all members of the University. We must work together to make this a safe and productive learning environment for everyone. Part of this work is recognizing how race and other aspects of who we are shape our beliefs and our experiences as individuals. It is not enough to condemn acts of racism. For real, sustainable change, we must stand together as a diverse coalition against racism and oppression of any form, anywhere, at any time.
Resources for education and action are available through WCU's Office for Diversity, Equity, and Inclusion (ODEI), DEI committees within departments or colleges, the student ombudsperson, and centers on campus committed to doing this work (e.g., Dowdy Multicultural Center, Center for Women and Gender Equity, and the Center for Trans and Queer Advocacy).
Guidance on how to report incidents of discrimination and harassment is available at the University's Office of Diversity, Equity and Inclusion.

**EMERGENCY PREPAREDNESS**
All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit www.wcupa.edu/wcualert. To report an emergency, call the Department of Public Safety at 610-436-3311.

**ELECTRONIC MAIL POLICY**
It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.