General Education Foundations of Scientific Inquiry (FSI) Course Information Sheet

Please submit this sheet for each proposed course along with 1) a syllabus describing the key components of the course that will be taught regardless of the instructor and 2) assignment guidelines.

Department, Course Number, and Title Chemistry and Biochemistry, Chem 14AE, General Chemistry for Life Scientists I - Enhanced

Indicate when the department anticipates offering this course in 2020-21 and give anticipated enrollment:

Fall: Enrollment 270 Winter: Enrollment ____ Spring: Enrollment ____ Summer: Enrollment _____

As stated in the guidelines regarding courses in the Foundations of Scientific Inquiry (FSI), the aim of these course offerings is:

To ensure that students gain a fundamental understanding of how scientists formulate and answer questions about the operation of both the physical and biological world. These courses also deal with some of the most important issues, developments, and methodologies in contemporary science and technology, addressing such topics as the origin of the universe, environmental degradation, and the decoding of the human genome. Through lectures, experiential learning opportunities such as laboratories, writing, and intensive discussions students consider the important roles played by the laws of physics and chemistry in society, biology, earth and environmental sciences, and astrophysics and cosmology.

General Education FSI Student Goals: Courses fulfilling the GE FSI will provide a minimum of four units and should align with some (not necessarily all) of the following seven general goals:

1. Students will actively engage in the scientific process of inquiry, analysis, problem-solving, and quantitative reasoning.
2. Students will acquire an informed appreciation of scientists, scientific research, and technology.
3. Students will experience the interdisciplinary nature of science.
4. Students will develop information literacy.
5. Students will make evidence-based decisions in a wide array of science and non-science contexts.
6. Students will develop scientific literacy by addressing current, critical issues and topics in science that are personally meaningful in daily life and/or connected to the needs of society.
7. Students will recognize fundamental scientific principles and the connections between different domains of science.

General Education FSI Student Learning Outcomes: Each course should have student learning outcomes listed in the syllabus. These outcomes may be tied to a specific discipline but should be associated with the seven broad categories listed above (please see **Appendix I** for a sample list of possible learning outcomes supporting each goal).

General Guidelines for GE FSI Courses: GE Courses may be upper or lower division, but they should have no prerequisites. Any student should be able to take them and understand the material with the background expected from all UCLA students. While the course may include material related to the history of science and the social and cultural implications of scientific research, **at least half** of the course should be devoted to students actively engaging in the scientific process of inquiry, analysis, problem-solving, and quantitative reasoning (Goal #1).

Please indicate the area/s which you believe this course should satisfy.

Life Science: ☐ Physical Science: ☑ Life Science Lab*: ☐ Physical Science Lab*: ☐

**Please see the additional student learning outcomes and expectations for courses approved as GE FSI Labs.*

The GE FSI Assessment Project Resource Team would be delighted to meet with you to assist in filling out this form. Please contact us at RRamachandran@teaching.ucla.edu if you wish to arrange a meeting.

We are interested in understanding the alignment of your course learning outcomes with the GE FSI learning goals. First, identify measurable learning outcomes from your course and enter them in the first column of Table 1. You may add more rows as needed. If you need to state new learning outcomes, see Appendix I for a sample list of possible learning outcomes supporting each goal. Should you wish to choose any of these outcomes, you may simply indicate its number, e.g., 6a. Next, indicate how your learning outcomes relate to the GE FSI learning goals 1 through 7 (see previous page), by placing X's in the appropriate boxes. Note that all GE FSI courses must address Goal #1.

Table 1: Alignment of Course Learning Outcomes with GE FSI Learning Goals

	Your Course Learning Outcomes	Select GE FSI Goal #						
		1	2	3	4	5	6	7
1	Use measurements with correct scientific convention (units, significant figures, etc.)	✓	✓	✓	✓	✓	✓	✓
2	Balance chemical equations and perform stoichiometric calculations	✓	✓	✓	✓	✓	✓	✓
3	Describe atomic structure and utilize atomic structure to explain observed properties	✓	✓	✓	✓	✓	✓	✓
4	Distinguish between the different types of chemical bonds	✓	✓	✓	✓	✓	✓	✓
5	Use Valence Bond and Molecular Orbital theories to explain covalent bonding	✓	✓	✓	✓	✓	✓	✓
6	Determine the shape and geometry of molecules	✓	✓	✓	✓	✓	✓	✓

Please see attached Table 1 Continuation

Considering each of the GE FSI goals that you marked with X's in the table above, please provide information about related course activities and assignments.

Table 2: Course Activities and Assignments that Support the Learning Goals

Course Learning Outcome No. from Table 1	Course Activities How will progress towards meeting this outcome be facilitated? In other words, what types of course activities will be provided to assist students in achieving the learning goal?	Course Assignments How will students in the course demonstrate their ability to meet this goal? Please describe and provide a sample assignment, such as a term paper, exam, essay prompt, etc.
1	Please see attached Table 2	
2		
3		
4		
5		
6		

Please provide information on estimated weekly hours for the class.

A) STUDENT CONTACT PER WEEK (if not applicable write N/A)

Activity	Number of hours per week
Lecture	3 hours
Discussion Section	2 hours
Labs	0 hours - no lab component
Experiential (Community-engagement, internships, other	0 hours
Field Trips	0 hours
A) TOTAL student contact per week	5 hours

B) OUT-OF-CLASS HOURS PER WEEK (if not applicable write N/A)

Activity	Number of hours per week
General Review and Preparation	2 hours
Reading	1 hour
Group Projects	1 hour
Preparation for Quizzes & Exams	2 hours
Information Literacy Exercises	
Written Assignments	1 hour
Research Activity	
B) TOTAL Out-of-class time per week	7 hours

GRAND TOTAL (A) + (B) must equal 12 hours/week: 12 (hours)

Please note the following:

- If you're teaching a lab, your course should be 5 units and should entail 15 hours of work/week.
- If you're teaching a summer course, your aggregated total hours should be 120 (for non-lab courses) or 150 (for lab courses). For instance, if you're teaching a 5 week lab your total in-class and out-of-class time per week should equal 30 hours.

Additional Student Learning Outcomes for experiential learning courses approved as "GE FSI Labs"

GE FSI Lab Definition and Expectations: A hands-on laboratory, computer simulation, demonstration, or field experience that involves active participation in experimental observation, data generation and collection using the techniques, methodologies, and approaches of modern-day scientists. Any lab should be conducted under sufficient supervision by the instructor or a Teaching Assistant (TA). Furthermore, the instructor and TAs should meet regularly outside of class time (minimum weekly or biweekly) to practice performing the lab procedures and/or to review the experimental results.

Please <u>select one or more</u> of the following learning outcomes for your course (select all that apply):

☐ 1. Students will design, implement, and evaluate an experimental strategy for answering scientific questions, testing a hypothesis, or solving a problem.

☐ 2. When possible, students will replicate experiments to allow testing for and interpretation of statistical significance.

☐ 3. Students will apply commonly used mathematical concepts and statistical methods (e.g., basic addition, subtraction, multiplication, division, averages, standard deviation, t-test for significance) in their analysis of different types of scientific data they collect.

☐ 4. Students will be able to visually depict a quantitative dataset as a chart, graph, table, or mathematical equation.

☐ 5. Students will be able to concisely summarize trends and patterns deduced from quantitative and qualitative data to make informed conclusions about their experimental results.

☐ 6. When interpreting their results, students will distinguish between the most important and extraneous findings (i.e. identify those that are critical to addressing a question, solving a problem, or supporting/refuting a hypothesis).

☐ 7. When interpreting their results, students will infer relationships between controls and experimental variables as well as assess causality and correlation among variables.

☐ 8. Students will be able to troubleshoot experimental procedures or methods of analysis to develop a sound scientific rationale for deducing what went wrong and why.

Please present concise explanation of how your course satisfies these criteria.

How will students in this course actively experiment and engage in the hands-on process of gathering, analyzing, and interpreting data? How will progress towards meeting the student learning outcomes for "labs" be measured/assessed? In other words, what types of assignments will be given to determine whether students are achieving the learning outcomes?	

Appendix I. Student Learning Goals with Nested Learning Outcomes for All General Education (GE) Foundations in Scientific Inquiry Courses

Course Goals (1-7) and Student Learning Outcomes (a, b, c, etc.) for all "GE FSI" courses:

1. Students will actively engage in the scientific process of inquiry, analysis, problem-solving, and quantitative reasoning.
    a. Students will explain how scientists answer scientific questions, test a hypothesis, or solve a problem.
    b. Students will make reasonable predictions of experimental outcomes based on observation, measurements, and/or prior knowledge surmised from the scientific literature or other reliable, validated, accurate information sources.
    c. Students will break down, reason through, and solve complex quantitative problem sets.
    d. Students will be confident working with numerical data.
    e. Students will estimate and complete calculations to solve a quantitative problem.
    f. Students will recognize different objects and apply units of measurement at relevant scales (quantity, size, time) and orders of magnitude.
2. Students will acquire an informed appreciation of scientists, scientific research, and technology.
    a. Students will value their academic experiences in a science course that is outside their primary field of study.
    b. Students will recognize the benefits of science to society or their everyday life.
    c. Students will express interest in contributing to the sciences (e.g., engaging in research or scientific discourse with others).
    d. Non-science students will see scientists as role models, helping them to identify as scientists themselves.
3. Students will experience the interdisciplinary nature of science.
    a. Students will investigate topics from a variety of scientific fields.
    b. Students will explore the perspectives of multiple diverse scientists.
    c. Students will make logical connections between key concepts from multiple scientific disciplines.
4. Students will develop information literacy.
    a. Students will be mindful of information they encounter, recognizing contexts or situations when it is necessary to seek out other sources or data.
    b. Students will identify, locate, and critically evaluate information sources and datasets to ensure they are reliable, validated, accurate, and scholarly (i.e. associated with citations in peer-reviewed, public research studies).
    c. Students will explain the peer-review process in science and its role in critical evaluation and validation of published, scientific findings.
5. Students will make evidence-based decisions in a wide array of science and non-science contexts.
    a. Students will distinguish between opinion and fact (i.e. recognize data-supported conclusions).
    b. Students will use reliable, validated, accurate, and scholarly information sources and datasets before accepting or formulating a conclusion.
    c. Students will draw conclusions or make judgements about experimental results informed by critical thinking, that is, a comprehensive exploration of ideas and systematic engagement with the scientific process.
6. Students will develop scientific literacy by addressing current, critical issues and topics in science that are personally meaningful in daily life and/or connected to the needs of society (e.g., climate change, vaccination, GMOs, evolution).
    a. Students will clearly state the significance or relevance of a research question or problem (i.e. state why scientists are motivated to study the issue or topic).
    b. Students will discuss societal impacts by citing examples of the ways in which scientists and scientific research contribute to society.
    c. Students will describe the interactions between humans and their physical world and the positive and negative effects of this interaction.
    d. Students will explain why issues perceived as "controversial" in the public domain are not considered "controversial" in among scientists.
7. Students will recognize fundamental scientific principles and the connections between different domains of science.
    a. Students will describe the nature, organization, and evolution of living systems.
    b. Students will explain the origin and physical processes of the planet earth and the surrounding universe.
    c. Students will differentiate between a scientific theory, hypothesis, fact, or law.

Table 1: Alignment of Course Learning Outcomes with GE FSI Learning Outcomes (Continuation)

	Your Course Learning Outcomes	Select GE FSI Goal #						
		1	2	3	4	5	6	7
7	Connect the shape of molecules to macroscopic properties, such as boiling point	X	X	X	X	X	X	X
8	Determine the shape and structure of coordination compounds	X	X	X	X	X	X	X
9	Recognize biological functions of certain coordination compounds	X	X	X	X	X	X	X
10	Identify acids and bases, including relative strength	X	X	X	X	X	X	X
11	Calculate the pH of acidic and basic solution	X	X	X	X	X	X	X

Table 2: Course Activities and Assignments that Support the Learning Goals

Course Learning Outcome	Course Activities	Course assignments
1 – 11	All learning outcomes will be facilitated by the following activities: • Thrice-weekly lectures. About half the lecture time will devoted to presentation by the instructor. The remaining time will be spent in active and collaborative learning activities such as responding to and reflecting on polling questions and working with classmates to solve problems. • Weekly 2-hour discussion sections will use the "Process Oriented Guided Inquiry Learning (POGIL)" model in which students work together in assigned teams of three or four, where each student is assigned a specific team role. The teams work on scaffolded worksheets designed around an "explore, invent, apply" learning cycle. • Students complete pre-class reading and video watching assignments to help them acquire basic vocabulary prior to class and discussion. • Students engage in writing assignments with peer evaluation.	The class will contain a variety of formative and summative assessments. These include: • POGIL worksheets turned in weekly by discussion section teams. A sample POGIL worksheet is attached. • Pre-discussion and pre-lecture "quizzes" (students have three attempts) to prepare students so they come to lecture and discussion ready to engage in collaborative learning. • Weekly homework (10-20 questions) submitted through the textbook website to further hone problem solving skills. • Calibrated Peer Review, where students participate in peer review and self-review using instructor-designed rubrics. • One or two midterms that consists of individual and collaborative components. • Cumulative final exam.

Names of group members: _____ Section: _____

Chem 14AE Worksheet #1 – How much is too much?

Your team's *Recorder* is responsible for turning in the following completed worksheet within three days of your discussion section. The completed worksheet can be uploaded to Gradescope under "Week 1 Discussion Worksheet". Make sure that your team's *Recorder* includes all teammates' names when submitting the completed worksheet to Gradescope.

Learning Outcomes:

- Apply dimensional analysis when solving numerical problems
- Describe the relationship between wavelength, frequency, and energy
- Calculate the wavelength, frequency, and energy of a single photon as well as a mole of photons
- Use SI conversion factors to report answers with appropriate units
- Determine the appropriate number of significant figures to use in a final answer

READ ME!

Depending on the magnitude of a measurement, scientists may find it easier to work with a number if they express it in a different unit. For instance, using the unit of liters works well when thinking about the volume of Sprite®, but we wouldn't want to talk about the volume of the ocean in liters (for the record, the ocean is approximately 1.4×10^{21} liters of water!). In order to convert from one unit to another, we use the idea of *conversion factors* and *dimensional analysis*.

So what is a conversion factor? A conversion factor is simply when you turn an equality into a ratio. For instance, if we know that 1 liter is equal to 1000 milliliters (1 L = 1000 mL), then the conversion factor between liters and milliliters can be written as either $\frac{1000\ mL}{1\ L}$ or $\frac{1\ L}{1000\ mL}$.

Table 1**: Metric system equalities. **You must memorize these!

Prefix	Unit Abbreviation	Exponential Factor	Conversion Factor Example
Mega	M	10^6	*1 ML = 10^6 L*
kilo	k	10^3	*1 kL = 10^3 L*
		$10^0 = 1$	*liter (L)*
deci	d	10^{-1}	*1 dL = 10^{-1} L*
centi	c	10^{-2}	*1 cL = 10^{-2} L*
milli	m	10^{-3}	*1 mL = 10^{-3} m*
micro	μ (mu)	10^{-6}	*1 μL = 10^{-6} m*
nano	n	10^{-9}	*1 nL = 10^{-9} m*
pico	p	10^{-12}	*1 pL = 10^{-12} m*

Some common units:

Distance:
- Meter (m)
- Inches (in)
- Feet (ft)
- Miles (mi)

Volume:
- Liter (L)
- Gallon (gal)
- Cubic centimeter (cm^3)

Mass:
- Gram (g)
- Pound (lb)

Energy:
- Joule (J)
- Electron Volt (eV)
- Hartree (Eh)

Time:
- Second (s)
- Minute (min)
- Hour (hr)

Charge:
- Coulomb (C)

Table 2:** Other common conversion factors. **You must memorize these!

1 in = 2.54 cm	1 ft = 12 in	60 s = 1 min	1 cm^3 = 1 mL

Part 1: Modeling Dimensional Analysis

While there are many different ways to solve a dimensional analysis problem, one common and effective way is to setup a table (sometimes called "railroad tracks") that allows you to organize what information you know and the conversion factors that are available to you. Model 1 in Figure 1 demonstrates how to setup dimensional analysis in this way.

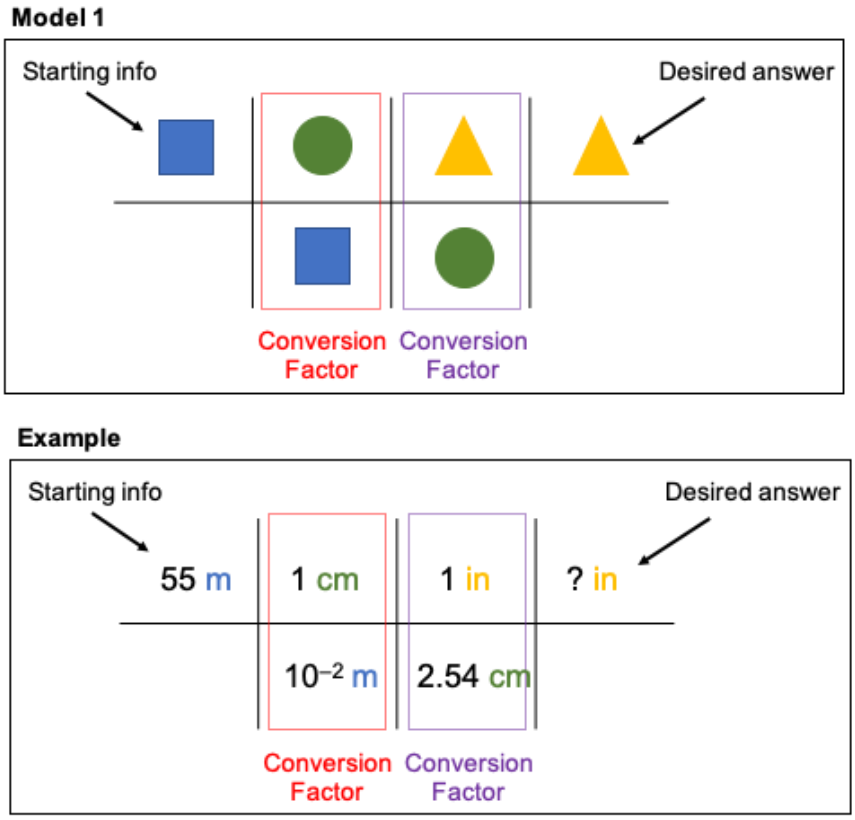


***Figure 1**: Model for solving dimensional analysis problems as well as an example of converting 55 meters to inches.*

Critical Thinking Questions

1. In no more than one or two complete sentences, describe the pattern you notice in Model 1.

2. Calculate the desired answer (including units) in the Example from Figure 1. _____

3. Consider 10^{-2} *m* in the Example in Figure 1. Limit your explanation to no more than two complete sentences.
   a. Why is the unit *m* placed in the denominator of the first conversion factor (boxed in red)?

   b. Why is the value of 10^{-2} used?

Steps Involved in Dimensional Analysis:

1. Note what information is given.
2. Determine what the question is asking for, including units.
3. What additional information is needed (conversion factors, relationships, etc.)? Is this information you should know or information you need to look up?
4. Calculate the answer, including correct significant figures and units.
5. Check your answer and make sure its magnitude seems reasonable.

Practice Exercises

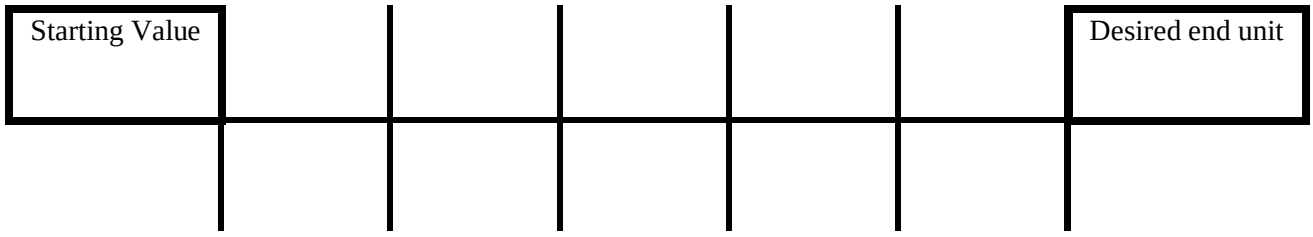
4. In this question, we want to know the number of hydrogen atoms that can be found in 1.0 L of water (H_2O). The molar mass of water is 18 g/mol and the density of water is 1.00 g/mL.

   a. Identify what value (including unit) we are starting with as well as what unit we ultimately want to end with.

   Starting value: _____ **Desired end unit: _____**

   b. In the outline provided in Question 4c, write in your starting value and desired end unit as indicated by the boxes. Using the pattern from Model 1, write in the appropriate units that will ultimately cancel so that you arrive at the correct desired end unit. ***Note:*** *Do NOT include the numbers associated with the conversion factors yet.*

   c. Using the conversion factors given in the prompt and/or conversion factors you look up, write in the appropriate numbers associated with the conversion factors in the outline provided below.



   d. Using your completed outline in Question 4c, calculate the number of hydrogen atoms in 1.0 L of water.

   e. Does the order of magnitude of your answer in Question 4d seem appropriate? Why or why not? Limit your explanation to no more than three complete sentences ***Hint:*** *Consider your response to Question 6 of this week's PDQ.*

Part 2: Dimensional Analysis in the Context of Electromagnetic Radiation

The figure below represents part of a wave. The entire wave can be thought of as extending infinitely in both directions. The wavelength (λ) is defined as the distance between two consecutive peaks (or troughs) in the wave. The frequency (ν) is defined as the number of wavelengths per second which travel past a given point.

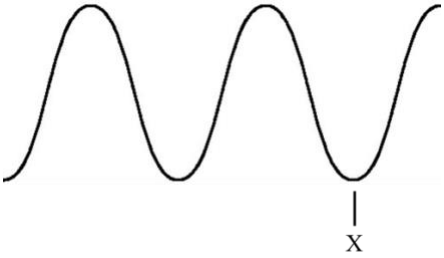


***Figure 2**: Portion of a wave*

Critical Thinking Questions

5. On the figure above, draw a line connecting two points whose separation is equal to the wavelength of the line. If there is more than one way to do this, then draw a second line.

6. Indicate whether the following statement is true or false and explain your reasoning using no more than two complete sentences (a picture may be helpful in setting up your explanation). At this point, avoid using equations to explain the relationship and instead use Figure 2 above as a starting place for your explanation.
   For waves traveling at the same speed, the longer the wavelength the greater the frequency.

7. Based upon what we have discussed in lecture, what is the mathematical relationship between frequency and wavelength? Does this mathematical relationship fit with your response to Question 6?

   Mathematical Relationship:

   Is the mathematical relationship above in agreement with Q6? *(Circle One)* **YES** **NO**

READ ME!

Light can be thought of as an electromagnetic wave (or electromagnetic radiation) having a particular wavelength and frequency. Additionally, electromagnetic radiation can be thought of as a stream of particles known as photons (thanks to Albert Einstein and the photoelectric effect – we will talk more about this in lecture!).

The relationship between the energy of a *single* photon and the frequency of light is: $E_{photon} = h\nu$ where h (Planck's constant) is equal to 6.626×10^{-34} Js. Remember that light travels at a speed of 2.998×10^{8} m/s.

Practice Exercises

8. When listening to the radio, you select a certain station (such as KISS, KROQ, KPCC, KPWR, etc.) – these channels are related to radiowaves of a certain frequency and wavelength. When "tuning in" to that station, the radio receives the radiowaves of the specified frequency and decodes the wave into the sounds you hear.

    a. According to the Los Angeles Almanac, the most popular radio station in the Los Angeles area corresponds to radiowaves with a wavelength of 2.96 m. Determine the frequency (in MHz) of these radiowaves.

    b. What Los Angeles radio station does this frequency correspond to? ***Hint****: You can look up the frequency you calculate online to figure out what radio station this relates to.*

    c. Let's determine the energy (in Joules) of **one** photon of radiowave radiation with a wavelength of 2.96 m.

        i. What equation(s) may be appropriate to use to determine the energy of **one** photon? ***Hint:*** *You may want to review the* **READ ME!** *on page 4.*

        ii. Do you have values for all of the variables you need in order to use the equation(s)? If not, explain in one or two sentences what can you do to find values for the variables you are missing.

        iii. Using your answers to parts (i) and (ii), calculate the energy (in J) of **one** photon of this radiowave radiation. Report your answer to the correct number of significant figures and with the correct final unit.

9. Radiowaves are being broadcast all the time – we use these frequencies not just for the radio, but for our cell phones and TV's as well. This means our bodies are constantly being bombarded by radiowaves in our everyday lives. Cellphones generally emit radiowaves with a frequency of 800 MHz. Let's assume that the emitted power from the cell phone is 1 W (1 Watt = 1 J/s) – this is the maximum allowed by the US FCC (Federal Communications Commission).
   a. Calculate the energy (in kJ) associated with using your cell phone for 1 full day (24 hours). *Hint: Refer to the process used in Model 1 as a guide on how to setup this question.*

   b. What is the energy (in J) of each photon being emitted?

Real World Connection

10. There have been concerns about cell phones potentially causing cancer. Question 9 of this week's PDQ assigned you a specific article to read. Each of your team members were assigned a different article, so spend some time discussing the following statement in the context of your assigned article:

    We should limit our cell phone use since cell phone usage has been linked to increased risk of cancer.

    Things to consider when reviewing a source:
    - Who is the source of the information? Are they an authority on the subject? Could they have potential bias?
    - Is the main purpose of the information to inform, persuade, entertain, or to sell something?
    - Is the information provided complete, relevant, and unbiased?
    - Is there a logical presentation of the facts and are appropriate references cited?

11. Based on your team's discussion related to Question 10, construct an argument related to cell phone usage and increased cancer risk using the ideas of evidence, claims, and conclusions. Have your Presenter write your team's argument in the shared Google document "Is Cell Phone Usage Linked to Cancer?". ***Note:*** *You do NOT need to rewrite your argument here.*

CHEMISTRY 14AE: General Chemistry for Life Scientist I - Enhanced

SYLLABUS & COURSE ORGANIZATION

COURSE INFORMATION

This course provides a strong chemistry foundation. We begin with a review of physical and chemical principles. Then we move on to atomic structure based on quantum mechanics, specifically studying atomic properties, trends in the periodic table, and the chemical bonding in molecules and coordination compounds with an emphasis on structure and shape. The course concludes with the structure and properties of inorganic, organic, and biological acids, bases, and salts. Throughout the course, biological and environmental examples are used to illustrate the central role chemistry plays in the world around us. Emphasis is placed on developing problem-solving skills and collaborative interaction and learning.

GE Credit Acknowledgment: Upon successful completion of this course, students will satisfy one General Education course requirement in the Foundations of Scientific Inquiry area, physical sciences subgroup.

Lecture: Monday, Wednesday, Friday 1:00-1:50PM via Zoom*

Discussion Sections: **1A:** Thursday 8:00-9:50AM via Zoom*
1B: Thursday 1:00-2:50PM via Zoom*
1C: Thursday 3:00-4:50PM via Zoom*

***All Zoom meeting links can be found on CCLE, under the tab "Zoom Conferencing"

Preparation: High school chemistry or equivalent background and 3.5 years of high school mathematics

Enforced Co-Requisites: Life Sciences 30A or Mathematics 3A or 31A or score of 35 or better on Mathematics Diagnostic Test.

Course Textbook: Chemical Principles (7^{th} edition) by Atkins**

**The e-book and Sapling-Pro are generously being provided free of cost to our class

Required Materials:

- Microphone (most laptops and mobile devices come with a built-in microphone but for desktop setups, you may need to purchase one; some good, inexpensive options include ZekPro USB Computer Microphone, XIAOKOA USB Computer Microphone)
- Scientific Calculator (must be able to display scientific notation and compute log, ln, and exponentials)

Recommended Materials:

- Webcam (most laptops and mobile devices come with a built-in camera but for desktop setups, you may need to purchase one; some good, inexpensive choices include Logitech HD Webcam C310, Allinko 610 Webcam, Spedal Full HD Webcam)
- Drawing tablet (when drawing on the virtual whiteboard, you may find it easier to use a drawing tablet rather than your mouse; some good, inexpensive options include XP-Pen StarG640, XP-Pen G430S, VEIKK S640)

Course Website: The course website can be found at http://www.ccle.ucla.edu/. You should check the course website often (at least a few times a week) for any new announcements, assignments, etc.

INSTRUCTOR INFORMATION

Course Instructor: Dr. Jennifer R. Casey
E-mail: jrcasey@chem.ucla.edu
Office Hours (via Zoom): Mon 10:00-11:00AM, Fri 2:00-4:00PM

CORRESPONDENCE

This course will use https://piazza.com/ for any course-related questions/discussions. Piazza is a discussion forum that will allow you to quickly get your questions answered as well as answer or comment on other students' questions. Rather than email a general course-related or content-related question to your instructor or TA, you are encouraged to post your question to Piazza instead. Piazza is FERPA (Family Education Rights and Privacy Act) compliant and you can post anonymously.

If you have any personal matters you wish to discuss that should be handled privately, please email the instructor directly. Be sure to start the subject line of all correspondence sent to your instructor or TA with **14AES20**. If you are unsure if your question/concern should be posted publicly to Piazza, please email the instructor first.

LEARNING OUTCOMES

By the end of this course, you should be able to

- Use measurements with correct scientific convention (units, sig figs, etc.)
- Balance chemical equations and perform stoichiometric calculations
- Describe atomic structure and utilize atomic structure to explain trends in atomic properties
- Distinguish between the different types of chemical bonds
- Use valence bond and Molecular Orbital (MO) theories to explain covalent bonding
- Draw the structure of molecules using Lewis structures
- Determine the shape and geometry of molecules
- Connect the shape of molecules to macroscopic properties, such as boiling point
- Determine the shape and structure of coordination compounds
- Recognize biological functions of certain coordination compounds
- Identify acids and bases, including relative strength
- Calculate the pH of acid and base solutions

LECTURE

Each week before select lectures, you will be required to complete a short, online survey (Learn Before Lecture, LBL) related to the content of the upcoming lecture. The LBL will open two days before the lecture in which the LBL is due. Each LBL will be worth 5 points and you will be given three attempts to complete the LBL; your highest scoring attempt will be counted. Everyone will be allowed to drop their lowest LBL.

Class polling will be utilized during lecture in order to facilitate discussion and monitor student understanding of the material. Each question response will be worth one point (graded strictly on participation, not on correctness). The maximum points a student can receive through polling responses is 40 points.

DISCUSSION SECTION

Before each discussion section, you will be required to complete a short, online survey (Pre-Discussion Quizlet, PDQ) related to the content of the upcoming discussion section. The PDQ will open on Tuesday mornings and be due before your discussion section meets on Thursday. Each PDQ will be worth 5 points and you will be given three attempts to complete the PDQ; your highest scoring attempt will be counted. Everyone will be allowed to drop their lowest PDQ.

During discussion section, students will work in teams on weekly worksheets that explore more in-depth coverage of certain topics. Each week, one of your teammates (the recorder) will upload the team's worksheet onto Gradescope. The completed worksheet is worth up to 8 points. Additionally, one of your teammates (the reflector) will complete a short survey on CCLE each week. This completed survey is worth 2 points. The maximum points a student can receive is 90 points.

READINGS & HOMEWORK

Each week you will be assigned reading and homework from the textbook. Each weekly homework assignment is worth 5 points and will be due at the end of the week.

QUIZZES

There will be four 15-minute quizzes administered online, during our scheduled lecture time (see schedule for dates). These quizzes will take place via CCLE. There are no make-up quizzes. One quiz will be dropped at the end of the quarter. These quizzes help ensure you are prepared for class, as well as provide some incentive for working through homework problems.

ABSENCES

Please contact the instructor and/or TA immediately if you must miss a lecture or a discussion section. Given the current environment, we understand that extenuating circumstances may arise. For this reason, you do not need to answer all lecture polls, attend all discussion sections, or take all quizzes in order to receive full credit on those grade categories.

CALIBRATED PEER REVIEW

CPR (Calibrated Peer Review) is a web-based, instructional tool that allows students to practice their scientific writing. Students are given a specific prompt and asked to write a thoughtful response. Students' responses are then anonymously evaluated by their peers and finally re-evaluated by themselves. Final grade assignments are based on peer and self-evaluation. One CPR assignment will be given during the quarter, at which time more information will be provided.

EXAMS

There will be one midterm and one final exam (see schedule below for dates). All exams will be open-note and open-book. During the first part of the scheduled exam time, you are expected to work alone, but during the second part of the scheduled exam time, you may consult your team mates and update your answers accordingly. All exam material will be directly related to assigned readings, class notes, homework assignments, and material covered in discussion sections. The best preparation is to attend class and discussion, work through all readings and homework, and to come to office hours regularly.

This course will use Gradescope (http://www.gradescope.com/) to grade your exams as Gradescope allows for more consistent and transparent grading. Using Gradescope will also allow the TA's to easily access your responses and grade your exams online. More information about Gradescope (such as how to set up your account, how to upload documents, etc.) can be found on our course website.

The tentative exam schedule is below (dates and material are subject to change):

Exams	**Date**	**Time**	**Material covered**
Midterm	Wednesday, May 6th	6:00 – 8:00PM	Fundamentals: A, B, C, D, E Topics: 1A, 1B, 1C, 1D, 1E, 1F, 2A, 2B, 2C
Final Exam	Sunday, June 7th	11:30 – 2:30PM	Cumulative

Students who commit any forms of academic dishonesty will receive a 0 on the exam and further action will be taken. No make-up exams will be given.

You have **one week** from the day your exam was returned to notify the instructor of any grading mistakes. If an exam is submitted, the instructor reserves the right to re-grade the entire exam, potentially resulting in less points being awarded.

GRADING

Your mastery of the course will be measured through your performance on the following grade categories:

Surveys	5 points (1%)
Homework	50 points (10%)
Clicker Questions	40 points (8%)
Pre-Discussion Quizlet	45 points (9%)
Learn Before Lecture	45 points (9%)
Discussion Worksheets	90 points (18%)
Calibrated Peer Review	30 points (6%)
Quizzes	45 points (9%)
Midterm	50 points (10%)
Final Exam	100 points (20%)
Total	500 points

Plus and minus grades are frequently assigned, but final decisions to award these grades are not made until the end of the quarter when all the student data has been evaluated. The following are the minimum scores necessary for each grade level. These grades are the minimum needed to ensure the indicated letter grades. This scale may be lowered at the instructor's discretion at the end of the quarter. **90 - 100% = A**; **80 - 89% = B**; **70 - 79% = C**; **60 - 69% = D**; **0 - 59% = F**

EXPECTATIONS OF STUDENTS

The following is expected of all students:

- **Communication:** Important communication to the class and individual students will be done using campus email and the course website, so it is essential that you check regularly and read emails and announcements thoroughly.
- **Time commitment**: In order for you to be successful in this class, it is *essential* that you plan your schedule to include **16–20 hours per week** of work for this course. While the times of day and specific days of the week in which you do this work are flexible (meaning you can do your work in the middle of the night if this is best for you!), in order to fulfill your responsibilities as a member of our class community, you *must* be prepared for each lecture and discussion section. This means setting aside specific time in your schedule every few days, each week.
- **Netiquette:** An online classroom is still a classroom, and therefore certain behaviors are expected when you communicate with your instructor, TA, and peers. Always treat everyone with respect; do not make personal or insulting remarks. If you disagree with someone, express your differing opinion in a non-critical way. Please be cautious when using humor or sarcasm; it can be difficult to interpret intention online. Finally, be open-minded and receptive to learning from others. If you do not follow these policies, you will be removed from the meeting.
- **Technology Skills:** Participating in an online course requires basic technology skills. It is your responsibility to make sure that you can navigate the technology used in this course. For support, visit http://uit.ucla.edu/ or call 310-206-4525.

ACADEMIC INTEGRITY

Academic dishonesty will be treated as an extremely serious matter with severe consequences that can range from receiving no credit for assignments/tests, failing the class, and/or expulsion. It is never permissible to turn in any work that has not been authored by the student, such as work that has been copied from another student or copied from a source (including Internet) without properly acknowledging the source. It is your responsibility to make sure that your work meets the standards set forth in the "Academic Honesty Policy" (see https://www.deanofstudents.ucla.edu/Academic-Integrity). Any and all instances of cheating will result in a referral to the Dean of Students.

CAMPUS POLICY ON DISABILITY ACCESS FOR STUDENTS

If you require academic adjustments based on disability, you must register with the Center for Accessible Education (CAE). You can call CAE at 310-825-1501 or you can go in person to their office at A255 Murphy Hall. When possible, students with disabilities requiring academic adjustments should contact the CAE within the first two weeks of each term as reasonable notice is needed to coordinate accommodations. For more information visit www.cae.ucla.edu.

As the professionals delegated authority by the campus to determine reasonable academic adjustments, CAE will access your needs and communicate appropriately with your respective professors and/or Teaching Assistant to inform us of your approved accommodations. In the event that CAE approves you for proctoring arrangements during exams, please inform your respective professors and/or Teaching Assistant before the date of exam.

MENTAL HEALTH AND WELLNESS

Many students experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, depression, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. UCLA offers services to address these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, please contact **CAPS** which provides confidential mental health services on campus. Visit www.counseling.ucla.edu or call 310-825-0768 (available 24/7).

TENTATIVE NATURE OF SYLLABUS

If necessary, this syllabus and its contents are subject to revision; students are responsible for any changes or modifications announced or distributed in class or posted on our course website.

STUDYING TIPS

Below are some suggested study tips to help you succeed in this course.

1. **If you aren't sure what to do, ask for help.**
   Chemistry can be a challenging subject when you try to tackle it alone. If you ever feel lost, make sure to reach out to someone. This can be done by asking a question to clarify what you don't quite understand, posting on the class discussion board, or coming to office hours and seeking advice there. Remember that you aren't alone in this.
2. **Read the textbook, preferably before we cover the material in class.**
   It is always good to be ahead of lecture in the reading since then when we cover new material during lecture, you are able to integrate the new information more easily and ask pointed questions about potential difficulties. Even if you don't have time to read beforehand, you should read the chapter at some point. There are guided questions and answers throughout the chapters that can help you organize the information.
3. **Review the notes from the last lecture before the next lecture.**
   It is a good idea to review what we previously discussed before going to lecture. That way you can identify any parts of the last lecture that didn't make sense and ask about them at the beginning of class before we move on to more advanced material.
4. **Rewrite notes in your own words and go through example problems again.**
   Review your notes before attempting problems on your own. Write down questions you have about the notes and make sure to clarify these issues as soon as possible (either through the class discussion board or during office hours).
5. **Make lists of topics and formulas used in the chapter.**
   This is a good way to review and to make sure that you are familiar and comfortable with everything in the chapter. It will also help you organize the information so you can recall and use it more easily.
6. **Work through problems strategically.**
   Homework problems should be done as we learn the material, not after all of the material in the chapter has been covered. Make sure you are completely comfortable with all of the homework problems and if you aren't, ask for help! It is important that you can work though problems independently since that is what is expected on quizzes and exams.
7. **Don't avoid certain topics – be comfortable with all of the material.**
   You should not come into an exam hoping that a certain question won't be on it. You should be prepared for any question and if there is a question you don't feel comfortable with, you should get help with it before the exam.
8. **Be thoughtful about how you approach questions.**
   One of most difficult parts of this course is figuring out how to answer all of the various types of question. It is a good idea to look over homework, quizzes, discussion worksheets, and clicker questions and think about how you solved the problem and why you took that approach. Consider even going in with a differently colored pen and highlighting the key points to the problem. This will help you see the patterns in the questions so you can more easily identify how to approach new problems on exams.

UCLA Course Inventory Management System

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New Course Proposal

	Chemistry & Biochemistry 14AE General Chemistry for Life Scientists I--Enhanced
Course Number	Chemistry & Biochemistry 14AE
Title	General Chemistry for Life Scientists I--Enhanced
Short Title	GEN CHEM LSI-ENHNCD
Units	Fixed: 4
Grading Basis	Letter grade or Passed/Not Passed
Instructional Format	Lecture - 3 hours per week Discussion - 2 hours per week
TIE Code	LECS - Lecture (Plus Supplementary Activity) [T]
GE Requirement	No
Major or Minor Requirement	Yes
Requisites	Preparation: high school chemistry or equivalent background and three and one half years of high school mathematics. Enforced corequisite: Life Sciences 30A or Mathematics 3A or 31A or score of 48 or better on Mathematics Diagnostic Test.
Course Description	Lecture, three hours; discussion, two hours. Preparation: high school chemistry or equivalent background and three and one half years of high school mathematics. Enforced corequisite: Life Sciences 30A or Mathematics 3A or 31A or score of 48 or better on Mathematics Diagnostic Test. Not open to students with credit for course 14A or 20A. Study of foundations of chemistry. Discussion of foundations of quantum mechanics and how these principles can be used to understand atomic and molecular structure and properties; how molecules interact; and properties of inorganic, organic, and biological acids, bases, and salts. Biological, environmental, and socially-relevant examples are used to illustrate central role that chemistry plays in our world. Emphasis on developing problem-solving skills and collaborative interaction and learning.
Justification	Chem 14AE and 14BE would introduce general chemistry to students who did not have chemistry in high school or whose exposure to the subject prior to college has been only moderate, whereas the existing courses (14A and 14B) would cover the same content but for students whose exposure to the subject prior to college has been substantial.

Syllabus	File *New Chem 14AE Syllabus.docx* was previously uploaded. You may view the file by clicking on the file name.
Supplemental Information	Approved on behalf of Catherine Clarke, Chair, Chemistry & Biochemistry
Grading Structure	Total Grade: Graded Assignment/Exam Points Possible I-Clicker In class participation 16 pts Discussion Section Worksheets 50 pts In Class Quizzes 30 pts Midterm 1 30 pts Midterm 2 30 pts Final Exam 60 Pts Total 216 pts
Effective Date	Fall 2019
Instructor	Name: Daniel Neuhauser — Title: Professor Name: Al Courey — Title: Professor
Quarters Taught	☑ Fall ☑ Winter ☑ Spring ☐ Summer
Department	Chemistry
Contact Routing Help	Name: DENISE MANTONYA — E-mail: dmm@chem.ucla.edu

ROUTING STATUS	
Role:	Registrar's Office
Status:	Processing Completed

Role:	Registrar's Publications Office - Livesay, Blake Cary (blivesay@registrar.ucla.edu) - 61590
Status:	Added to SRS on 4/5/2019 9:27:52 AM
Changes:	Description
Comments:	Equivalent to 14A and not open for credit to students with credit for 14A or 20A per Denise. Course description edited into official version.

Role:	Registrar's Scheduling Office - Lin, Jessica (jlin@registrar.ucla.edu) - 58253
Status:	Added to SRS on 3/27/2019 4:48:39 PM
Changes:	Short Title
Comments:	No Comments

Role:	FEC School Coordinator - Ries, Mary Elizabeth (mries@college.ucla.edu) - 61225
Status:	Returned for Additional Info on 3/19/2019 8:48:36 AM
Changes:	No Changes Made
Comments:	no changes

Role:	FEC Chair or Designee - Tornell, Aaron (tornell@econ.ucla.edu) - 41686
Status:	Approved on 3/17/2019 6:08:57 PM
Changes:	No Changes Made
Comments:	No Comments

Role:	UgC Coordinator - Ries, Mary Elizabeth (mries@college.ucla.edu) - 61225
Status:	Returned for Additional Info on 3/11/2019 10:59:10 AM
Changes:	No Changes Made
Comments:	No changes. Routing to Aaron Tornell for FEC review and approval.

Role:	Dean College/School or Designee - Garcia-Garibay, Miguel A (mgarciagaribay@college.ucla.edu) - 53159, 53958
Status:	Approved on 3/11/2019 10:54:40 AM
Changes:	No Changes Made
Comments:	No Comments

Role:	L&S FEC Coordinator - Ries, Mary Elizabeth (mries@college.ucla.edu) - 61225
Status:	Returned for Additional Info on 3/5/2019 2:43:43 PM
Changes:	No Changes Made
Comments:	no changes. Routing to Dean Garcia-Garibay for review and approval.

Role:	Initiator/Submitter - Mantonya, Denise M (dmm@chem.ucla.edu) - 54660
Status:	Submitted on 3/5/2019 1:44:38 PM
Comments:	Initiated a New Course Proposal

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