Science 1A – Introductory Chemical and Physical Science

Course Sections: 81154 and 81155 Term: Fall 2021
Lecture and Labs: Online
Instructor: Dr. Craig Van Degrift
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The first half of the semester covers physics - mechanics, fluid dynamics, thermodynamics, electricity & magnetism, and light & sound waves.

The second half covers chemistry - atomic structure, radioactivity, chemical compounds, chemical reactions, and organic molecules.

The official description of this course can be found on page 205 of the school catalog:
https://www.cloviscollege.edu/_uploaded-files/_documents/admissions-and-aid/catalogs/ccc-2021-2022-catalog.pdf

Student Learning Outcomes:

Upon completion of this course, students will be able to:

1. Correctly analyze natural phenomena using the concepts of physics and chemistry.
2. Investigate physical phenomena using appropriate equipment and methods, make valid comparisons with theoretical predictions, and communicate those results.
3. Gain an intuitive understanding of physics, chemistry, and the process of scientific investigation.
4. Become skilled at using simple formulas connected with natural phenomena and the metric units of measurement for related quantities.
5. Learn how to reliably measure these quantities, particularly ones that we cannot sense directly.
6. Gain experience with graphical analysis of data and the reality of random measurement errors.
7. Become able to understand technical specifications of equipment and components used in science and technology.

Official Objectives:

In the process of completing this course, students will:

1. Describe the states of matter and associate phase changes.
2. Classify matter as elements, compounds, mixtures and describe properties of each.
3. Describe basic atomic structure including the fundamental particles and electron energy levels.
4. Explain the history and structure of the periodic table.
5. Explain and describe different ways atoms combine to form compounds.
6. Describe the motion of objects as related through the concepts of position, displacement, speed, velocity and acceleration.
7. Use Newton's Laws to predict and explain the motion of an object.
8. Discuss the type of energy present in a system and use conservation of energy to solve problems.
9. Explain the requirements for a complete circuit in terms of a model of electric charge.
10. Describe color perception based on the wave nature of light and its interactions.

Laboratory Objectives:

11. Understand fundamentals of taking and recording measurements including measuring length, area, volume, mass, density, significant figures, converting between units and scientific notation.
12. Practical applications to both the chemistry and physics lecture objectives.
13. Drawing conclusions between data and results including constructing graphs and identifying relationships between variables.

Prerequisites:

Satisfaction of the CSU system General Education Quantitative Reasoning Requirement (CSU-GE Area B4).

Your success is my main concern and it can be achieved by following this syllabus, participating in the lab and class activities, asking questions, completing the reading assignments and preparing for the Quizzes and Tests. Learning is never easy, but I will do my best to make it as painless as possible. Your questions and class participation are important so that I can adjust my explanations to match your background and frame of mind.

Required Textbook

Physical Science, 12th Edition by Bill W. Tillery (McGraw-Hill), ISBN 978-1-260-41136-2.

Although this text is very expensive, you will be using it throughout this course and in your Earth Sciences course. It is also important to own a science textbook for reference after finishing college. Earlier editions are so similar, you should feel free to buy used earlier editions on-line if necessary.

The supplementary materials sold in association with this text may be helpful, but are NOT required.

Course Assignments

It is the responsibility of the students to follow the twice-weekly lecture notes and their links to other material. Lab activities will be described each week. Some lab activities will require using common items that might be found around a house, like marbles, balls, measuring sticks, timers (phone timers are great), kitchen scale, and maybe some food items. Both the lecture notes and lab activities will often involve watching YouTube videos or animated gifs. A major part of the chemistry part of the course has been centered around constructing various molecules using expensive MolyMod "atoms" and "bonds". COVID-19 has unfortunately forced us to forego that fun hands-on activity, and we will need to imagine it with rotating 3-D images used to show the molecular structure.

We will only use metric units. The "English" system used by in the United States, is not used in the rest of the world, nor is it used in our medical industry. Most engineering in the United States also uses the metric system. I hope you will have available a metric ruler, meter stick or tape measure, as well as a kitchen scale that can be switched to grams or kilograms.

The quiz and test questions will be derived from the example questions. Partial credit will be given for most questions with the available points listed for each question. **For questions that involve calculations, grading will be based primarily on writing the calculation "set up" properly with units and unit conversions shown. The final numeric answer is a relatively small part of a correct answer.** The solutions shown for the practice questions show how that must be done.

Many handouts provide supplementary information beyond that required for getting an "A" in the course. I hope that the pressure of school has not extinguished your basic curiosity and desire to learn more even when it is not going to be tested. That material is provided to make you a better parent, teacher, and citizen.

Science-1A students are often afraid of the mathematics used in calculations, especially in the physics part of the course. I am a big believer that learning is easiest when examples can be studied. **An "Algebra Refresher" handout with a set of companion video explanations is available on the school's Canvas web site in the "Modules" section to ease that concern in addition to the practice questions and their solutions.**

The purpose of the textbook is to provide a organizational framework for the course. You are expected to read its chapters, but specific assignments will not depend on its end-of-chapter questions. It is especially important to understand each example calculation, the definitions of special scientific words, and the metric units for physical quantities. At the end of each chapter is a “Summary of Equations” and “Key Terms” section, but the Science-1A handouts contain more in a 6-page Equation Sheet and a 5-page vocabulary list.

Quizzes and tests will require you to obey an honor system. Two 6-page Equation Sheets are needed, one to be marked up, and one to be left clean for use during the quizzes and tests. For the chemistry part of the course, two Periodic Table of Elements sheets will be needed, one to be marked up, and the other for use during quizzes and tests. The Equation Sheet does **not** give you a table of unit prefixes (kilo-, centi-, milli, micro-, etc.). **You must memorize the powers of 10 associated with those 10 prefixes!**

College differs from High School in that you are largely on your own to learn – you sink or swim without being coddled. Instructors and textbooks provide the material and answer questions. Tests allow the instructor to certify whether or not the student has learned the material. **The student, however, must exhibit the necessary discipline and study habits to take advantage of these resources without "homework" being specifically assigned and graded.**

In this course, simple inexpensive experiments will be stressed since the first step to learning science is by observing how nature works. The second step, applying the more powerful tools of mathematics, comes later and will not be stressed in this course. You will, however, be expected to know how to use and rearrange the simplest equations of physics and chemistry. Most experiments will involve inexpensive materials obtainable from hardware stores and supermarkets. To be an effective K-6 teacher, you must have a large repertoire of inexpensive hands-on science experiments to maintain student interest and nurture scientific reasoning.

Evaluation Methods

Two midterm tests, eight 10-minute quizzes, and one final exam will be given. Also, an informal record of your lab activities must be reported via e-mail. Explanations of laboratory demonstrations will also be part of the material to be tested in the quizzes, mid-term tests and final. You will be expected to understand most of the experiments and demonstrations well enough to perform and explain them to others. Tests and quizzes are graded with partial credit being awarded. Points are accumulated through the course as follows:

Calculations Test	100	8 Quizzes	160 points
Midterm - Chapters 1-7	200 points	Lab Record	200 points
Midterm - Chapters 8-13	200 points	Final Exam	400 points

The content of the final exam will be variations on the more advanced questions given in the midterm tests.

Course letter grades will be given according to the following scale:

1260–1100: A 1099–920: B 919–750: C 749–580: D 579–0: F

Academic dishonesty is not tolerable. When you are interviewed by a prospective employer, they will quickly figure out if you mastered your course material.

Calculations

Quantitative results are crucial to physics and chemistry so you will need to be able to do calculations using scientific notation, logarithm, and powers of 10. You will need to demonstrate your proficiency at these calculations in a separate Calculation Test. When doing in-class labs, an entire lab session was devoted to making sure that each student knew how to do the Calculations Test questions on their particular calculator. Such calculations are usually done on separately purchased scientific calculators, but if your computer or phone has an application for doing these calculations, it will also be allowed **for the Calculation Test only**. Do-overs on the calculation test will be provided until it is mastered. The numeric answers for the quiz and test questions must be obtained using a scientific calculator.

No cell phones or computer assistance will be allowed during all other testing. For those tests and quizzes, you will be required to write the setup for the calculation, but the actual numerical value for the answer will be a smaller part of the partial credit. You must, however, **always show the units for values in the setup equation and for any numeric answer that has units.**

Week-1	**August 9-15**	Lecture – Chapter 1: What is Science, Syllabus and Course Outline Lab – 1: Measurement using metric units, density, gravity and free fall Lecture – Appendix A: Working With Equations, Algebra Refresher
Week-2	**August 16-22**	Lecture – Chapter 2: Quiz 1 Preparation Lab – 2: **Calculations Test** (Redone until mastered) Lecture – Pressure & Fluid Flow
Week-3	**August 23-29**	**Quiz 1 (Chapter 1 & Appendix A)** due September 5 Lecture – Chapter 3: Energy Lab – 3: Kinetic Energy, electrolysis, H_2-O_2 explosion, Pendulums Lecture – Chapter 3: Energy
Week-4	**Aug. 30-Sept. 5**	Lecture – Chapter 4: Quiz 2 Preparation Lab – 4: Levers, Balance, H_2O warming, Pressure & Fluid Flow Lecture – Chapter 4: Heat & Temperature
	September 6	Labor Day Holiday, campus closed
Week-5	**September 7-12**	**Quiz 2 (Chapters 2 & 3 + Pressure & Fluid Flow)** due September 19 Lecture – Chapter 5: Wave Motions & Sound Lab – 5: Buoyancy, Bernoulli Effect; rope, slinky and sound waves Lecture – Chapter 6: Electricity
Week-6	**September 13-19**	Lecture – Chapter 6: Quiz 3 Preparation Lab – 6: Electrostatics and Multimeter use, and DC Circuits Lecture – Electricity – Static Electricity

Week-7	**September 20-26**	**Quiz 3 (Chapters 4 & 5)** due October 3 Lecture – Chapter 6: Electricity – Magnetism and Electromagnetism Lab – 7: Electromagnetism, Levitation, and Transformers Lecture – Chapter 7: Light
Week-8	**Sept. 27-Oct. 3**	Lecture – Quiz 4 Preparation Lab – 8: Refraction, Diffraction, Polarization, Optical instruments Lecture – Resonances and Quantum Phenomena
Week-9	**October 4-10**	**Quiz 4 (Chapters 6 & 7.1-7.3)** due October 17 Lecture – Chapter 7.4-7.6 – Photons, Relativity, Chapter 8 – Periodic Table Lab – 9: Molecular models: building fats, sugars, cellulose, and starch Lecture – Chapter 8: Atoms & Periodic Properties
Week-10	**October 11-17**	**Physics Midterm (Chapters 1-7.3)** due October 24 Lecture – Chapter 9: Chemical Bonds Lecture – Chapter 10: Chemical Reactions
Week-11	**October 18-24**	Lecture – Chapter 10: Quiz 5 Preparation Lab – 10: Build models of amino acids, oxytocin, proteins Lecture – Chapter 11: Water and Solutions
Week-12	**October 25-31**	**Quiz 5 (Remainder of Chapter 7, Chapters 8 & 9)** due November 7 Lecture - Balancing Chemical Reactions Lab – 11: Molecular Handedness, Sugars, Starch, Cellulose and Chitin Lecture – Chapter 11: Moles, Acids & Bases, pH and Flint, MI, Tragedy
Week-13	**November 1-7**	Lecture – Chapter 11: Quiz 6 Preparation Lab – 12 and Friday Lecture : Amino Acids, Polypeptides, Proteins and DNA
Week-14	**November 8-14**	**Quiz 6 (Chapters 10 & 11)** due November 21 Lecture – Chapter 13: Quiz 7 Preparation Lab – 13: Cabbage pH indicator, pH, Solubility and Electrochemistry Lecture – Chapter 13: Nuclear Reactions
	November 11	Veteran's Day (campus closed)
Week-15	**November 15-21**	**Quiz 7 (Chapter 12)** due November 28 Lecture – Chapter 13: Quiz 8 Preparation Lab – 14: Radioactivity, Making Liquid Nitrogen Ice Cream Lecture – Nuclear Reactions
Week-16	**November 22-28**	**Quiz 8 (Chapter 13)** due December 5 Lecture – Review of Chapters 7.4-7.6 and 8-13 Lab – 15: Hiroshima, Fukushima, 3-Mile Island, and Chernobyl Lecture – More Review of Chapters 7.4-7.6 and 8-13
	November 25-26	Thanksgiving holiday (campus closed)
Week-17	**Nov. 29-Dec. 5**	**Chemistry Midterm (Chapters 7.4-7.6 and 8-13)** due December 5 Lecture – Review of Physics for Final Lecture – Review of Physics for Final
Week-18	**December 6-10**	**Final Exam on entire course** due December 10 (but earlier would be nice)

Handouts and Notices will be available from *http://yosemitefoothills.com/Science-1A*

All handouts will be on my web site at *http://yosemitefoothills.com/Science-1A*. Links to them will be in the Lecture and Lab Notes. The weekly Lecture and Lab notes will also be on the School Canvas web site for the course in the "Modules" section.

E-mail Address for Instructor Craig Van Degrift

My e-mail address is: ***science1a@yosemitefoothills.com***
but always also CC to: *craig.vandegrift@scccd.edu*
(Be sure to spell Yosemite correctly and don't forget the 's' at the end of foothills.
That e-mail address is direct to me, but it is important to also CC to the scccd address.)

I am a night owl, so my quickest response is likely to be in the afternoon or between midnight and 5 AM. I look at my yosemitefoothills.com e-mails often, but do not let them interrupt me upon arrival.

Important Dates

August 9	M	Start of Fall 2021 semester
August 20	F	Last day to drop a Fall 2021 full-term class for a full refund
August 27	F	Last day to register for a Fall 2021 full-term class in person
August 27	F	Last day to drop a Fall 2021 full-term class to avoid a “W” in person
August 29	Su	Last day to drop a Fall 2021 full-term class to avoid a “W” on WebAdvisor
August 29	Su	Last day to add a Fall 2021 full-term class with an authorization code on WebAdvisor
September 6	M	Labor Day Holiday (no classes held, campus closed)
September 10	F	Last day to change a Fall 2021 class to/from a Pass/No-Pass grading basis
October 8	F	Last day to drop a full-term class (letter grades assigned after this date)
November 11	Th	Veterans Day observance (no classes held; campus is closed)
November 25-26	Th-F	Thanksgiving holiday (no classes held; campus is closed)
December 6-10	M-F	Fall 2021 Final Exams Week
December 10	F	End of Fall 2021 semester
December 13-31	M-F	Winter Recess (Campus open Dec. 13-24; campus closed Dec. 25-Jan.2)

Disable Students Notice

If you have a verified need for an academic accommodation or materials in alternate media (i.e. Braille, large print, electronic test, etc.) per the American With Disabilities Act or Section 504 of the Rehabilitation Act please contact your me as soon as possible.