



## CREDIT COURSE OUTLINE

### I. COVER PAGE

(1) CHEM 3B

(2) INTRODUCTORY ORGANIC AND BIOLOGICAL  
CHEMISTRY

(3) 3

Number

Title

Units

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2">(4) Lecture / Lab Hours:</td> </tr> <tr> <td colspan="2">Total Course Hours</td> </tr> <tr> <td style="width: 60%;">Total Lec hours:</td> <td style="text-align: right;">36.00</td> </tr> <tr> <td>Total Lab hours:</td> <td style="text-align: right;">54.00</td> </tr> <tr> <td>Total Contact hours:</td> <td style="text-align: right;">90.00</td> </tr> <tr> <td colspan="2">Lec will generate <u>0</u> hour(s) outside work.</td> </tr> <tr> <td colspan="2">Lab will generate <u>0</u> hour(s) outside work.</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>(5) Grading Basis:</td> <td>Grading Scale Only</td> <td></td> </tr> <tr> <td></td> <td>Pass/No Pass option</td> <td style="text-align: center;">X</td> </tr> <tr> <td></td> <td>Pass/No Pass only</td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2">(6) Advisories:</td> </tr> <tr> <td colspan="2">Eligibility for Math 101</td> </tr> <tr> <td colspan="2">Eligibility for English 125 or 126</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2">(7) Pre-requisites (requires C grade or better):</td> </tr> <tr> <td colspan="2">CHEM 1A or</td> </tr> <tr> <td colspan="2">CHEM 3A or equivalent</td> </tr> <tr> <td colspan="2">CHEM 3A</td> </tr> <tr> <td colspan="2">Corequisites:</td> </tr> </table>	(4) Lecture / Lab Hours:		Total Course Hours		Total Lec hours:	36.00	Total Lab hours:	54.00	Total Contact hours:	90.00	Lec will generate <u>0</u> hour(s) outside work.		Lab will generate <u>0</u> hour(s) outside work.		(5) Grading Basis:	Grading Scale Only			Pass/No Pass option	X		Pass/No Pass only		(6) Advisories:		Eligibility for Math 101		Eligibility for English 125 or 126		(7) Pre-requisites (requires C grade or better):		CHEM 1A or		CHEM 3A or equivalent		CHEM 3A		Corequisites:		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="4">(8) Classification:</td> </tr> <tr> <td style="width: 25%;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> </tr> <tr> <td></td> <td>Degree applicable:</td> <td></td> <td style="text-align: center;">X</td> </tr> <tr> <td></td> <td>Non-degree applicable:</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Basic skills:</td> <td></td> <td></td> </tr> <tr> <td>(9) RC</td> <td colspan="3">Fulfills AS/AA degree requirement: (area)</td> </tr> <tr> <td></td> <td colspan="3">General education category:</td> </tr> <tr> <td></td> <td colspan="3">Area A Natural Sciences</td> </tr> <tr> <td></td> <td>Major:</td> <td colspan="2"></td> </tr> <tr> <td></td> <td>Certificate of:</td> <td colspan="2"></td> </tr> <tr> <td></td> <td>Certificate in:</td> <td colspan="2"></td> </tr> <tr> <td>(10) CSU</td> <td>Baccalaureate:</td> <td></td> <td style="text-align: center;">X</td> </tr> <tr> <td>(11) Repeatable: (A course may be repeated three times)</td> <td></td> <td></td> <td style="text-align: center;">0</td> </tr> </table>	(8) Classification:									Degree applicable:		X		Non-degree applicable:				Basic skills:			(9) RC	Fulfills AS/AA degree requirement: (area)				General education category:				Area A Natural Sciences				Major:				Certificate of:				Certificate in:			(10) CSU	Baccalaureate:		X	(11) Repeatable: (A course may be repeated three times)			0
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(12) Catalog Description:

Introduction to the basic concepts of organic and biological chemistry. A study of the structure and behavior of organic and biochemical compounds, including metabolism, and regulation. Primarily for students in health oriented professions.

### II. COURSE OUTCOMES:

*(Specify the learning skills the student demonstrates through completing the course and link critical thinking skills to specific course content and objectives.)*

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

- I. Demonstrate structural formula--name conversions for less complex organic and biochemical compounds.
- II. Describe physical properties of organic compounds.
- III. Predict products of representative chemical reactions.
- IV. Understand basic concepts of biomolecules, such as carbohydrates, lipids, proteins, enzymes, and nucleic acids.
- V. Safely demonstrate laboratory experiments involving basic organic chemistry and biochemical themes.

### III. COURSE OBJECTIVES:

*(Specify major objectives in terms of the observable knowledge and/or skills to be attained.)*

In the process of completing this course, students will:

- I. assess the process, products, and coenzymes in metabolic pathways.
- II. describe different organic functional groups and major biological categories of compounds.
- III. use (with safe procedures) laboratory equipment for simple organic chemistry and biochemical experiments.
- IV. describe and discuss the procedures used in basic organic chemistry and biochemical experiments.

### IV. COURSE OUTLINE:

**Lecture Content:**

- A. Introduction to organic chemistry
  - 1. Sources of organic compounds
  - 2. Structure of organic compounds
  - 3. Hybrid orbitals
- B. Saturated hydrocarbons
  - 1. IUPAC nomenclature
  - 2. Cycloalkanes
  - 3. Physical and chemical properties
  - 4. Functional groups
- C. Unsaturated hydrocarbons
  - 1. Nomenclature
  - 2. Hybridization and geometry
  - 3. Physical and chemical properties
  - 4. Addition polymers
- D. Aromatic hydrocarbons
  - 1. Nomenclature
  - 2. Reactions of aromatic compounds
- E. Halogenated hydrocarbons
  - 1. Nomenclature
  - 2. Alkyl and aryl halides
- F. Alcohols, ethers, thiols
  - 1. Nomenclature
  - 2. Physical and chemical properties
  - 3. Important alcohols
- G. Aldehydes and ketones
  - 1. Nomenclature
  - 2. Physical and chemical properties
  - 3. Preparation by oxidation
  - 4. Important aldehydes and ketones
- H. Carboxylic acids and esters
  - 1. Nomenclature
  - 2. Physical and chemical properties
  - 3. Preparation and acidity of carboxylic acids
  - 4. Hydrolysis of carboxylic esters
- I. Amines and amides
  - 1. Nomenclature
  - 2. Physical and chemical properties
  - 3. Preparation, hydrolysis and basicity of amines and quaternary salts
- J. Stereoisomerism
- K. Carbohydrates
  - 1. Enantiomers and chirality
  - 2. Saccharides
- L. Lipids
  - 1. Structure and properties of fats
  - 2. Complex lipids and membranes
  - 3. Cholesterol and hormones
- M. Proteins
  - 1. Amino acids
  - 2. Zwitterions
  - 3. Peptides and proteins
  - 4. Primary, secondary and tertiary structure
  - 5. Denaturation
- N. Enzymes
  - 1. Nomenclature, common terms and classification of enzymes
  - 2. Factor affecting activity
  - 3. Mechanisms
  - 4. Enzyme regulation
- O. Vitamins, hormones
- P. Nucleic acids
  - 1. Components of nucleic acids
  - 2. Structure of DNA and RNA
  - 3. DNA replication
  - 4. RNA
  - 5. Transcription of information
  - 6. Genetic code
  - 7. Genes and mutations, genetic diseases
- Q. Carbohydrate metabolism
  - 1. Nutrition, calories, and digestion
- R. Lipid metabolism
  - 1. Nutrition, calories, and digestion

- S. Protein metabolism  
 1. Nutrition, calories, and digestion

Possible other topics: conversion of light energy to chemical energy, blood and blood components.

**Lab Content:**

- A. Properties of organic compounds
- B. Structure of alkanes
- C. Reactions of hydrocarbons
- D. Alcohols and phenols
- E. Aldehydes and esters
- F. Types of carbohydrates
- G. Carboxylic acids and esters
- H. Aspirin and other analgesics
- I. Lipids
- J. Saponification and soaps

**V. APPROPRIATE READINGS**

**Reading assignments may include but are not limited to the following:**

I. Sample Text Title:

1. Recommended - Karen C. Timberlake *Chemistry: An Introduction to General, Organic, and Biological Chemistry, Media Update*, ed. 10th Benjamin Cummings/Prentice Hall, 2009, ISBN: 0136079706
2. Recommended - Frederick Bettelheim *Introduction to General, Organic, and Biochemistry*, ed. 9 Brooks/Cole, 2010, ISBN: 0495391123
3. Recommended - Karen C. Timberlake *Laboratory Manual for Organic and Biological Chemistry*, ed. 2 Benjamin Cummings/Prentice Hall, 2011, ISBN: 0321695291

II. Other Readings

- Global or international materials or concepts are appropriately included in this course  
 Multicultural materials and concepts are appropriately included in this course

If either line is checked, write a paragraph indicating specifically how global/international and/or multicultural materials and concepts relate to content outline and/or readings.

**VI. METHODS TO MEASURE STUDENT ACHIEVEMENT AND DETERMINE GRADES:**

Students in this course will be graded in at least one of the following four categories. Please check those appropriate. A degree applicable course must have a minimum of one response in category A, B, or C.

<b>A. Writing</b>			
Check either 1 or 2 below			
X	1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.		
	2. Substantial writing assignments are NOT required. If this box is checked leave this section blank. For degree applicable courses you must complete category B and/or C.		
X	a) essay exam(s)	X	d) written homework
	b) term or other paper(s)		e) reading reports
X	c) laboratory report(s)		f) other (specify)

**Required assignments may include but are not limited to the following:**

Question: Suggest a reason that free cholesterol forms gallstones but various esters of cholesterol do not.

Answer: The various esters of cholesterol have different fatty acids (saturated, unsaturated, ect.). This prevents them from packing into a crystal lattice. Cholesterol, being uniform, does form a crystal lattice.

Question: Acetone is an important laboratory solvent. For similar compounds, solvation ability increases as molecular weight decreases. Can you give a reason why formaldehyde and acetaldehyde are not important laboratory solvents?

Answer: They are unstable and can be easily oxidized. They can react with oxygen in the air to form their corresponding carboxylic acid.

<b>B. Problem Solving</b>			
Computational or non-computational problem-solving demonstrations, including:			
X	a) exam(s)	X	d) laboratory reports
X	b) quizzes		e) field work

<input checked="" type="checkbox"/>	c) homework problems	<input type="checkbox"/>	f) other (specify):
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**Required assignments may include but are not limited to the following:**

Question: Draw the structural formula for isopropyl methyl ketone

Answer:

Question: What does the D in NAD and FAD stand for? What feature in the structure prompted this name?

Answer: D stands for dinucleotide. Two nucleotides, which are composed of a sugar, a base and a phosphate.

<b>C. Skill demonstrations, including:</b>			
<input type="checkbox"/>	a) class performance(s)	<input type="checkbox"/>	c) performance exams(s)
<input type="checkbox"/>	b) field work	<input checked="" type="checkbox"/>	d) other (specify)

**Required assignments may include but are not limited to the following:**

The students should be able to safely and effectively perform a re-crystallization of a crude material using proper solvents and equipment. Then use experimentally determined melting points to prove the purity and identification of the substance.

<b>D. Objective examinations including:</b>			
<input checked="" type="checkbox"/>	a) multiple choice	<input type="checkbox"/>	d) completion
<input checked="" type="checkbox"/>	b) true/false	<input type="checkbox"/>	e) other (specify):
<input checked="" type="checkbox"/>	c) matching items		

**COURSE GRADE DETERMINATION:**

Description/Explanation: Based on the categories checked in A-D, it is the recommendation of the department that the instructor's grading methods fall within the following departmental guidelines; however, the final method of grading is still at the discretion of the individual instructor. The instructor's syllabus must reflect the criteria by which the student's grade has been determined. (A minimum of five (5) grades must be recorded on the final roster.)

If several methods to measure student achievement are used, indicate here the approximate weight or percentage each has in determining student final grades.

Attached Files:

<b><u>BASIC SKILLS ADVISORIES PAGE</u></b> The skills listed are those needed for eligibility for English 125, 126, and Math 101. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least <u>three</u> major basic skills needed at the beginning of the target course and check off the corresponding basic skills listed at the left.	
(eligibility for Math 101) (as outcomes for Math 250)  <input checked="" type="checkbox"/> Performing the four arithmetic operations on whole numbers, arithmetic fractions, and decimal fractions. <input checked="" type="checkbox"/> Making the conversions from arithmetic fractions to decimal fractions, from decimal fractions to percents, and then reversing the process. <input type="checkbox"/> Applying the concepts listed above to proportions, percents, simple interest, markup and discount. <input checked="" type="checkbox"/> Applying the operations of integers in solving simple equations. <input checked="" type="checkbox"/> Converting between the metric and English measurement systems	Students will be required to convert between the metric system and English measurement system.  Students will be required to perform arithmetic operations.  Students will be required to make conversions from arithmetic fractions to decimal fractions.
(eligibility for English 125) (as outcomes for English 252)  <input checked="" type="checkbox"/> Writing complete English sentences and avoiding errors most of the time. <input checked="" type="checkbox"/> Using the conventions of English writing: capitalization, punctuation, spelling, etc. <input type="checkbox"/> Using verbs correctly in present, past, future, and present perfect tenses, and using the correct forms of common irregular verbs.	Writing complete English sentences and avoiding errors most of the time.  Expressing the writer's ideas in lab reports.  Using the conventions of English Writing.

<input type="checkbox"/> Expanding and developing basic sentence structure with appropriate modification. <input type="checkbox"/> Combining sentences using coordination, subordination, and phrases. <input checked="" type="checkbox"/> Expressing the writer's ideas in short personal papers utilizing the writing process in their development.	
(eligibility for English 126) (as outcomes for English 262)  <input checked="" type="checkbox"/> Using phonetic, structural, contextual, and dictionary skills to attack and understand words. <input checked="" type="checkbox"/> Applying word analysis skills to reading in context. <input checked="" type="checkbox"/> Using adequate basic functional vocabulary skills. <input checked="" type="checkbox"/> Using textbook study skills and outlining skills. <input checked="" type="checkbox"/> Using a full range of literal comprehension skills and basic analytical skills such as predicting, inferring, concluding, and evaluating.	Applying word analysis skills to reading in context.  Using textbook study skills and outlining skills.  Using a full range of literal comprehension skills and basic analytical skills.
<u>Check the appropriate spaces.</u> <input checked="" type="checkbox"/> Eligibility for Math 101 is advisory for the target course. <input type="checkbox"/> Eligibility for English 126 is advisory for the target course. <input type="checkbox"/> Eligibility for English 125 is advisory for the target course. <i>If the reviewers determine that an advisory or advisories in Basic Skills are all that are necessary for success in the target course, stop here, provide the required signatures, and forward this form to the department chair, the appropriate associate dean, and the curriculum committee.</i>	

#### CONTENT REVIEW

#### CHEM 3A INTRODUCTORY GENERAL CHEMISTRY

#### CHEM 1A GENERAL CHEMISTRY

predict ionic and covalent bonding between species;

calculate molecular weights, formula weights, gas volumes, temperature, pressure concentration of solutions, molarity, empirical and molecular formulas, and percentage composition;

describe covalently bonded structures using Lewis theory, valence bond theory (including hybrid orbitals), and molecular orbital theory of diatomic molecules;

#### CHEM 3A INTRODUCTORY GENERAL CHEMISTRY

#### REQUISITES

#### Subject Prerequisite -- CHEM 3A INTRODUCTORY GENERAL CHEMISTRY

- Use dimensional analysis to solve for an unknown parameter of density, volume, mass, pressure, temperature, molar mass, concentration, or an empirical formula.
- Construct and balance a chemical reaction and use the reaction to predict stoichiometric quantities.
- Competent knowledge and understanding of the periodic table and the ability use the periodic table to solve chemical problems.
- Understand acid-base reactions and how to calculate pH.
- Safely conduct laboratory experiments implementing concepts and principles learned in lecture.
- Name and draw Lewis diagrams of inorganic and molecular compounds from the formula and vice versa.

- assess the process, products, and coenzymes in metabolic pathways.
- describe different organic functional groups and major biological categories of compounds.
- use (with safe procedures) laboratory equipment for simple organic chemistry and biochemical experiments.
- describe and discuss the procedures used in basic organic chemistry and biochemical experiments.

#### ESTABLISHING PREREQUISITES OR COREQUISITES

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

1. \_\_\_\_ The prerequisite/corequisite is required by law or government regulations.  
Explain or cite regulation numbers:
2.  The health or safety of the students in this course requires the prerequisite.  
Justification: Indicate how this is so.  
Lab technique is first learned in Chemistry 3A.
3.  The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.  
Justification: Indicate how this is so.  
Lab technique is first learned in Chemistry 3A.
4. \_\_\_\_ The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.  
Justification: Indicate how this is so.
5.  Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.  
Justification: Cite the statistical evidence from the research.  
Chemistry 3A is the introductory material to Chemistry 3B.
6.  The prerequisite course is part of a sequence of courses within or across a discipline.  
Chemistry 3A is the introductory material to Chemistry 3B.
7. \_\_\_\_ Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course: