

CHEM450L | Biochemistry Lab

Course Text

Custom Lab Kit <https://esciencelabs.com/have/code> which is \$233 (plus shipping). Please search for search for Kit LP-5008-GB-01 to ensure that you purchase the correct Lab.

Course Description

This lab-only course is designed as a standalone addition to the Biochemistry course. Students will complete at-home laboratory experiments, track and record results, answer lab-based questions reflected in graded lab reports, and complete lab-based assessments to meet the lab requirement. The labs are provided by eScience Labs, a leading provider of at-home lab kits and online lab instructional materials and resources. Labs will cover the following topics: biological molecules, cell membrane transport, cellular respiration and, fermentation, extraction of DNA, RNA, and protein synthesis, casein extraction, metabolism of polysaccharides and anaerobic fermentation, and enzymes, temperature, pH and specificity.

Learning Outcomes

After completing this course, students will be able to:

1. Analyze experimental results to determine the presence of sugars, starch, lipids, protein, and DNA in a variety of samples.
2. Analyze experimental data to classify solutions as hypotonic, isotonic, or hypertonic.
3. Calculate aerobic respiration rates of germinated and dormant millet seeds.
4. Isolate DNA from split peas by physically breaking down plant tissues, lysing cell membranes with detergent, and precipitating isolated DNA in alcohol.
5. Illustrate the formation of a protein through transcription and translation.
6. Extract, determine the quantity of, and test casein proteins isolated from milk.
7. Analyze extracted solution from malted barley for the conversion of starch to dextrins using a starch-iodide test.
8. Analyze experimental data to calculate the optimal pH and temperature ranges for lactase activity.

Course Prerequisites

There are no prerequisites to take Biochemistry Lab though we highly recommend concurrent enrollment in Biochemistry (CHEM450).

Academic Integrity Statement

Academic integrity is the pursuit of scholarly activity in an honest, truthful and responsible manner. Violations of academic integrity include, but are not limited to, plagiarism, cheating, fabrication and academic misconduct. Failure to comply with the Academic Integrity Policy can result in a failure and/or zero on the attempted assignment/examination, a removal from the course, disqualification to enroll in future courses, and/or revocation of an academic transcript. Penalties for academic integrity violations can be retroactively applied upon discovery, and at our discretion.

Course Completion Policy

In order for a course to be considered complete, **all required coursework must be attempted, submitted, and graded.** Required coursework consists of graded assignments. Any Academic Integrity Policy violations may prevent a course from being considered complete.

Course Evaluation Criteria

Your score provides a percentage score and letter grade for each course. A passing percentage is 70% or higher.

There are a total of 1000 points in the course:

Topic	Assessment	Points	Learning Outcomes
Introduction	Upload: Lab Kit Photos	10	
1	Lab Exam 1	25	1
1	Lab 1 Worksheet: Biological Molecules	130	1
2	Lab Exam 2	25	2
2	Lab 2 Worksheet: Cell Membrane Transport	110	2
3	Lab Exam 3	25	3
3	Lab 3 Worksheet: Cellular Respiration and Fermentation	100	3
4	Lab Exam 4	25	4
4	Lab 4 Worksheet: Extraction of DNA	50	4
5	Lab Exam 5	25	5
5	Lab 5 Worksheet: DNA, RNA, & Protein	90	5
6	Lab Exam 6	25	6
6	Lab 6 Worksheet: Casein Extraction	100	6
7	Lab Exam 7	25	7
7	Lab 7 Worksheet: Metabolism of Polysaccharides and Anaerobic Fermentation	110	7
8	Lab Exam 8	25	8

Total

1000

Course Roadmap *Graded items in **bold*****Intro | Introduction and Getting Started****Objectives**

- Review the introductory information
- Complete the Statement of Academic Honesty and Integrity

Assignments

- How to Succeed in a Lab Course
- Academic Honesty and Integrity Lesson
- Statement of Academic Honesty and Integrity (required)
- Getting Started
- Lab Safety
- Lab Kit Inventory
- **Upload: Lab Kit Photos**

Topic 1 | Biological Molecules**Objectives**

- Define macromolecule, protein, carbohydrate, lipid, and nucleic acid.
- Explain the metabolism of simple and complex carbohydrates.
- Discuss the reagents used to identify biological macromolecules.
- Perform qualitative tests for lipids, sugars, proteins, and starch.
- Analyze experimental results to determine the presence of sugars, starch, lipids, protein, and DNA in a variety of samples.
- Identify an unknown through its composition of macromolecules.

Assignments

- Lab 1: Biological Molecules Lecture & Instructions
- **Lab Exam 1**
- **Lab 1 Worksheet: Biological Molecules**

Topic 2 | Cell Membrane Transport**Objectives**

- Describe the structure and function of the cellular plasma membrane.

Assignments

- Lab 2: Cell Membrane Transport Lecture & Instructions

- Define simple diffusion, osmosis, and active transport.
- Explain water movement across a membrane in hypertonic, hypotonic, and isotonic solutions.
- Observe osmosis in living cells using potato tissue and sucrose solutions.
- Analyze experimental data to determine if solutions are hypotonic, isotonic, or hypertonic.
- Examine the selective permeability of a membrane to molecules of different sizes.

- **Lab Exam 2**
- **Lab 2 Worksheet: Cell Membrane Transport**

Topic 3 | Cellular Respiration and Fermentation

Objectives

- Define cellular respiration, ATP, and ADP.
- Discuss the steps of aerobic respiration and the energy that is produced.
- Explain fermentation and the energy that is produced.
- Measure aerobic respiration rates of germinated and dormant millet seeds.
- Graphically analyze experimental data.
- Examine yeast fermentation under experimental conditions.

Assignments

- Lab 3: Cellular Respiration & Fermentation Lecture & Instructions
- **Lab Exam 3**
- **Lab 3 Worksheet: Cellular Respiration**

Topic 4 | Extraction of DNA

Objectives

- Define deoxyribonucleic acid (DNA) and describe its role in living organisms.
- Summarize the structure of a double-stranded DNA molecule.
- Define the three main components of a nucleotide and describe the structure of a nucleotide.
- List the four nitrogenous bases of DNA and describe base-pairing.
- Isolate DNA from split peas by physically breaking down plant tissues, lysing cell membranes with detergent, and precipitating isolated DNA in alcohol.
- Record observations of the appearance and volume of DNA extracted from peas.

Assignments

- Lab 4: Extraction of DNA Lecture & Instructions
- **Lab Exam 4**
- **Lab 4 Worksheet: Extraction of DNA**

Topic 5 | DNA, RNA, and Protein Synthesis

Objectives

- Define DNA, codon, and amino acid.
- Describe the processes of transcription and translation.
- Discuss point and frameshift mutations.
- Illustrate the formation of a protein through transcription and translation.
- Model the effects of a mutation during translation.

Assignments

- Lab 5: DNA, RNA, and Protein Synthesis Lecture & Instructions
- **Lab Exam 5**
- **Lab 5 Worksheet: DNA, RNA, & Protein**

Topic 6 | Casein Extraction

Objectives

- Isolate, determine the quantity of, and test casein proteins extracted from milk.
- Explain why proteins interact with metal ions in solution.
- Describe how protein folding patterns are determined by different amino acid residues.

Assignments

- Lab 6: Casein Extraction Lecture & Instructions
- **Lab Exam 6**
- **Lab 6 Worksheet: Casein Extraction**

Topic 7 | Metabolism of Polysaccharides and Anaerobic Fermentation

Objectives

- Define metabolism, anabolism, and catabolism.
- Describe the stages of catabolism.
- Explain the difference between anaerobic and aerobic conditions.
- Discuss the significance of fermentation to the beer and wine industries.
- Extract starch from malted barley.
- Analyze the extracted solution for the conversion of starch to dextrans using a starch-iodide test.
- Measure the specific gravity of a solution before and after fermentation.
- Calculate alcohol by volume.
- Ferment wort using yeast in a controlled environment.

Assignments

- Lab 7: Metabolism of Polysaccharides & Anaerobic Fermentation Lecture & Instructions
- **Lab Exam 7**
- **Lab 7 Worksheet: Metabolism**

Topic 8 | Enzymes, Temperature, pH and Specificity

Objectives

- Define enzyme, active site, substrate, and activation energy.
- Describe the relationships between concentration, pH, temperature, and enzymatic activity.
- Discuss the enzymatic reaction between lactase and lactose.
- Demonstrate the specificity of lactase in reactions with milk and sucrose.
- Analyze experimental data to determine the optimal pH and temperature ranges for lactase activity.
- Relate experimental results to conditions within the human body.

Assignments

- Lab 8: Enzymes, Temperature, pH & Specificity Lecture & Instructions
- **Lab Exam 8**
- **Lab 8 Worksheet: Enzymes & Temperature**

Review | Review

Objectives

- Review the course materials
- Complete the End of Course Survey

Assignments

- End of Course Survey

Related Courses

CHEM450:
Biochemistry

PHY250: General
Physics I

PHY250L: General
Physics I Lab