



Course Name: Elementary Biochemistry

Course Number: BB 350

Credits: 4

Instructor name: Dr. Kevin Ahern (<http://www.davincipress.com/professional.html>)

Instructor email: ahernk@oregonstate.edu or phone 541-908-4465

Course Description:

Service course for students desiring a short introduction to biochemistry. Four lectures weekly.

Official course description from [OSU course catalog](#), including co- and pre-requisites.

It will pay you to read this document. One question on the first exam may come straight from the syllabus.

Meeting Times

Academic year – all four terms

COURSE PREREQUISITE: - Organic chemistry

LEARNING RESOURCES:

1. Textbook: ***Biochemistry Free and Easy*** by Kevin Ahern and Indira Rajagopal – download at <http://biochem.science.oregonstate.edu/biochemistry-free-and-easy> (<http://biochem.science.oregonstate.edu/biochemistry-free-and-easy>) . Be sure to get the correct book. There are three books at the site.
2. Most of the materials for the course are found in an external Web site. This includes video lectures, a schedule, and exam info. These are all available through the Course Materials link in the Announcements section of Canvas
3. PowerPoint images are available in the Files section of Canvas.
4. Access the course Schedule page through Canvas

COURSE POLICIES - This is a two week course covering the same material as the course covered in 10 weeks during the academic year. Consequently it operates a bit differently from the 10 week course. The primary difference is that students can take exams anytime during the 2 weeks of the course and in any order, though I strongly urge you to take them in the order shown on the Schedule page. All exams must be completed no later than January 6 at 5:00 pm PST.

The instructor may, in the classroom class, give extra credit to students attending the lecture. This is not an option for Ecampus students and they will not lose points relative to

the classroom students. Reading and studying the assigned material before the lecture date is essential for success. Waiting to the last minute to study or prepare is a prescription for disaster. I expect students will meet all deadlines as appropriate for withdrawing from the class, should that be necessary. I do not routinely approve petitions to make changes after deadlines have passed, except in extraordinary circumstances. For questions, please consult with the **OSU Registrar** - [\(http://oregonstate.edu/registrar/\)](http://oregonstate.edu/registrar/)

TOPICS COVERED

Water/Buffers	Protein Synthesis
Amino Acids	Biotechnology
Peptides/Proteins	Viruses/Cancer/Oncogenes
Protein Structure	Immune System
Hemoglobin	Carbohydrate Structure
Protein Purification	Glycolysis
Enzymes	Carbohydrate Storage
Enzyme Controls	Citric Acid Cycle
Membranes	Electron Transport/Oxidative Phosphorylation
Nucleic Acids	Lipid Metabolism
DNA Synthesis	Photosynthesis
RNA Synthesis	Nitrogen Metabolism

GRADING- Course Points Distribution - Exam 1 (20%), Exam 2 (20%), Exam 3 (20%) Final Exam (40%). Students who ask questions that are answered in the syllabus will lose points. Students who ask for ways to earn extra credit will lost points. For the record, there is NO extra credit possible in this Ecampus course (even though it is mentioned in the videos). I do not (and in fact cannot) take into consideration improvement during the term in assigning grades. Ecampus students are NOT at a disadvantage for not having extra credit. This is taken into consideration in the calculation of your grades. No fixed grading scale will be used to assign letter grades and no fixed numbers of letter grades are set, so grading is, therefore, by definition, curved. Grades will be assigned on groupings as determined by the instructor at the conclusion of the course. These are also shown after each exam.

If your grade is low and you wonder how to improve it, the answer is to improve your performance against the average compared to what you did previously. Since the average varies with each exam, it means you need to do your best. Because grades are assigned

on a "curve," there is no way for me to tell you "how many points" you need to get a desired grade. **Please note this.** This is only possible for grading schemes that use fixed percentages – 90% = A, 80% = B, etc.

Final course grades will be posted to your OSU student account, NOT to Canvas. If you're not sure how to access your OSU student account, please consult with Ecampus.

HOW TO STUDY FOR THIS CLASS - This is a frequent question asked by students. The answer is that there are no secrets or "tricks". Everyone has their own way of studying and they tell me they have their own way of learning. Consequently, I have no "tips" for you. Everyone has their own approach and any approach I recommend may likely be different from what will work for you. This class isn't really any different from any other you may take. What works for you for other classes is what I recommend using here. That said, as it says in the lectures, exams are based on what I say in class. Focus your attention on what I talk about. Learn the principles of what I talk about as opposed to memorizing the "facts" of what I say. Good luck in your studies :-).

GENERAL EXAMINATION INFO – Exams have been taken by students from all over the world in this course, including war zones. They simply require a proctor approved by OSU's Ecampus at the beginning of the term.

Contact them [HERE](#)

(http://ecampus.oregonstate.edu/services/proctoring/finding_proctor.htm) or phone 800-667-1465 or 541-737-9204. It is required that exams be started and completed within the time windows defined on the Schedule page. No exceptions will be made for any reason, including getting the time wrong or overlooking the correct times or misunderstanding the correct times. Ecampus students are required to take exams under the guidance of an OSU Ecampus-approved proctor. The exams are multiple choice and are a different format from the classroom exams. Ecampus students are graded on a curve unique to their class – the grades of the classroom class do not affect grades for the Ecampus class. See the Schedule page (link in Announcements) for more information on grades.

EXAM PROCTORING

Proctoring of exams for this class is REQUIRED. Please click [HERE](#) (http://ecampus.oregonstate.edu/services/proctoring/finding_proctor.htm) or phone 800-667-1465 or 541-737-9204 for additional information. The proctor gives exams to you under the conditions I set. Please be aware that you need to have this set up well in advance of the exam and the proctor MUST be approved by Ecampus. The exam MUST be taken in the time window described on the Schedule page. There are no exceptions to this window due to incorrect scheduling or student oversight. Students should be aware that proctors' "windows" for taking exams close before the window I give. Please be sure you have taken this into consideration in scheduling. Please note also that I have no

knowledge of how to get a proctor or how to get one approved.

Ecampus has all of the answers to that. The only way I can get involved about proctoring is if there is some problem with the Ecampus. You are responsible for having ALL proctor issues settled well in advance of taking exams.

EXAM POLICIES

There will be three midterm exams and one final exam given in this course. The final will be comprehensive. Preparing makeup exams requires a significant effort. Excused absences will not be given for missing exams due to airline reservations, routine illness (colds, flu, stomach aches), or other common ailments. Excused absences will almost never be given after the absence has occurred. Students therefore must notify the instructor if they encounter difficulties BEFORE the exam occurs. If I decide your reason for missing an exam is valid, I might allow you to take a makeup exam. The following situations are NOT grounds for missing an exam:

1. You misread the date of the exam on the syllabus.
2. You went to the wrong place.

It is the responsibility of each student to check that their exam has been properly graded. If errors are made, or if the student feels that more points should have been awarded for a particular question, students must write a CLEAR explanation stating their case. Requests for regrading must be made in writing within 3 school days after the examination is made available to the class. Failure to follow these instructions will result in automatic denial of the request. Frivolous requests involving "fishing for points" will result in loss of points.

Students are also responsible for taking no longer than the allotted time for exams - 50 minutes for midterms and 110 minutes for finals (unless otherwise noted). Running over the allotted time for exams will result in lost of one point for every minute that the allotted time is exceeded.

No notes, books, cell phones, or other devices other than a simple calculator are allowed on the midterm exams. You are allowed to use one blank sheet of paper provided by your proctor. If you are using Proctor U, they require that you use an erasable small whiteboard in place of a blank piece of paper. On the final exam ONLY, students are allowed to use one 5x8 inch note card with HANDWRITTEN notes on it (both sides). Note cards with material from a printer are not allowed. Students in this course do not have to get the card from me.

One of the most common problems students have with deadlines for exams/problems arise from waiting to the last possible hour to take the exam within the exam window and then having a problem, such as a flat tire, catching a cold, or having a technical problem. I am generally not sympathetic to last minute problems. The best way to avoid such problems is to schedule exams earlier in the time window so that if something

unexpected happens, you have plenty of time to request a fix. Further, telling me about a problem AFTER the window closes means I will be unable to do anything about it.

OLD EXAMS

I get a lot of requests for practice or old exams. In my experience, students use these exams for all the wrong reasons and in all the wrong ways. A practice/old exam is useful for illustrating the format of an exam and for that purpose only. In the lecture version of this course, the exam format is a little unusual, so I provide a practice exam to show the format. You can hear me saying that in the videos. In this Ecampus course, the exam format is simple multiple choice, so there is no good reason to give practice exams to "study from". The problems students run into with practice exams is that they use them as study tools. This is a very bad mistake because it leads students to study narrowly and study patterns of information instead of the content of the material itself. Questions change, but the content does not. Thus, when exam wording changes from one exam to another and students have been learning patterns, they answer according to the pattern they learned on an old exam, not according to the information they are being asked about. Usually, when they answer according to patterns, they find they are wrong. It is one of the most common reasons students feel like professors are trying to "trick" them. While I won't say some professors don't have a bit of that in mind, I can say definitively that I do not. As noted on the class Schedule page, the format of exams in this Ecampus course is multiple choice. This is a simple format and there is no need to illustrate it with a practice exam. Consequently, I do not provide practice exams for this Ecampus course and by doing this, I (hope) I am doing you a favor by getting you to focus on the actual information and not on the pattern of information. I hope this is helpful to you and I wish you the best on your exams.

LETTERS OF REFERENCE

I am frequently asked to write letters of reference for students from the class. Since I must know a student personally to write a letter of reference, it is almost never possible for me to do this in the Ecampus, unless I know you through some other means.

POLICY ON INCOMPLETES

A grade of I is appropriate when 1) a course requirement has not been completed due to circumstances beyond the control of the student and 2) at least half of the work for the course has been completed at a level of C- or better. For medical problems that prohibited the student from fulfilling a requirement of the course, a note from a doctor is required. The request may be supplied without the note, and the request (if acceptable) will typically be granted, conditional on the note being provided later. For other circumstances, supporting evidence, such as a note from an advisor, will be helpful to the petitioner's case.

The following is a list of reasons that are **not** acceptable:

- The course proved to be more time-consuming or difficult than expected.
- Work in other courses ended up taking too much time.
- Work or travel associated with a job ended up interfering with course work.
- Time conflicts prohibited contact with the instructor or TAs during office hours.
- The student misunderstood the requirements or grading schemes of the course.
- The student wishes to avoid a low grade.
- The student wishes to retake the course at a later date

LEARNER EXPECTATIONS -

1. Advance preparations, including reading notes before lectures are given.
2. Avoid last minute studying
3. Questions to answer concepts/processes that the student does not understand BEFORE it is too late.
4. Recognition that an understanding of a complex topic like biochemistry requires considerable background prior to the class, a considerable amount of information to be acquired in the class, and sufficient time and effort to put these together to master the material.

LEARNER OUTCOMES - The intention of the course is for students to:

1. Acquire the technical language used to communicate biochemistry information
2. Gain familiarity with basic biochemistry principles, including metabolic pathways, molecule names, molecular structures (where noted), enzymes, control mechanisms, and terms used to describe categories of molecules
3. Perform analyses and basic calculations relating to solutions, energy, and catalysis and gain understanding of how they relate nutritional and physically to the human body
4. Communicate (through writing) key concepts of biochemistry
5. Understand and apply elementary concepts of biochemistry to relevant, specific problems.

GENERAL OSU AND DEPARTMENTAL POLICIES- Please note: "Students with documented disabilities who may need accommodations, who have any emergency medical information the instructor should know, or who need special arrangements in the event of evacuation, should make an appointment with the instructor as early as possible, no later than the first week of the term.

Students whose observance of religious holidays that conflict with class responsibilities must inform the instructor at the beginning of the term. Students with disabilities seeking accommodations in the course should be registered with the Office of Services for Students with Disabilities.

Statement Regarding Students with Disabilities

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval, please contact DAS immediately at 541-737-4098 or at ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

The Department of Biochemistry/Biophysics follows the university policies on student conduct. These can be found at [Student Code of Conduct](#)

Academic Misconduct

Cheating or plagiarism by students is subject to the disciplinary process outlined in the Student Conduct Regulations. Students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

- cheating- use or attempted use of unauthorized materials, information or study aids
- fabrication- falsification or invention of any information
- assisting- helping another commit an act of academic dishonesty
- tampering- altering or interfering with evaluation instruments and documents
- plagiarism- representing the words or ideas of another person as one's own.

Behaviors disruptive to the learning environment will not be tolerated and will be referred to the Office of Student Conduct for disciplinary action.

The goal of Oregon State University is to provide students with the knowledge, skill and wisdom they need to contribute to society. Our rules are formulated to guarantee each student's freedom to learn and to protect the fundamental rights of others. People must treat each other with dignity and respect in order for scholarship to thrive. Behaviors that are disruptive to teaching and learning will not be tolerated, and will be referred to the Student Conduct Program for disciplinary action. Behaviors that create a hostile, offensive or intimidating environment based on gender, race, ethnicity, color, religion, age, disability, marital status or sexual orientation will be referred to the Affirmative Action Office.

Course Summary:

Details	Due
Exam 1	due by 5pm
Exam 2	due by 5pm
Exam 3	due by 5pm
Final Exam	due by 5pm

BB 350 Schedule, Ecampus Two Week Holiday Term

This is the page for the accelerated 2-week **ECAMPUS** version of Kevin Ahern's BB 350 biochemistry course at Oregon State University. Web pages for the BB 350 classroom class are NOT the same and are not appropriate for the Ecampus class. Figures for the lectures are available on the Canvas site (<https://oregonstate.instructure.com>). The page is required reading for this course and it is also available on the Canvas site. Please note -this two week course compresses all of the material of a 10 week course into two weeks. As a result, this course will operate differently from the 10 week course. The most obvious difference is that you will be able to do the course completely at your own pace. You may take exams as you see fit anytime during the two weeks of the term. For example, you could take all of the exams on the same day if you chose, though I would not recommend that. As a consequence, I will only be able to give you an estimate of your standing in the class at any given time, since grades are determined by performance of the class as a whole and that won't be known until the very end of the two week period. Please be in touch with Ecampus about rules for when you can withdraw from this class if you need to. I am happy to give you an estimate of your performance at any time. Just send me an email at ahernk@oregonstate.edu

I strongly recommend you go through the material sequentially as I have laid it out, as I think you will find that the easiest approach. This class uses the 100% free electronic textbook called "*Biochemistry Free and Easy*" written by Kevin Ahern and Indira Rajagopal. **Please be sure you are using the 3rd Edition.** You can download it [HERE](#). If you prefer a traditional textbook, you can get a copy of Campbell and Farrell from the OSU Bookstore for a lot of \$\$\$\$. That textbook is NOT required.

This course features my **Wildly Popular Metabolic Melodies**. You can see all of them and download them for free [HERE](#). I also enjoy writing limericks and some of them are linked below. I hope you enjoy them. You are not responsible for knowing songs or limericks - they are just for fun. I offer other fun and useful freebies at the Web page [HERE](#).

Links	Pages	Problems
<p>Lecture #1 - Introduction</p> <p>Highlights Streaming video HERE</p> <p>Note - the video had focus problems until I got the computer started. Here are highlights from what I said before the computer started.</p> <ol style="list-style-type: none"> 1. You need to read the syllabus on Canvas. One question from the first exam will come directly off of the syllabus. 2. I will use Canvas primarily to send messages and give exams. Course content will largely come through this page. 3. Highlights of what you are responsible for this lecture will be listed in the Highlights link above. 4. Please call me "Kevin" and not Dr. Ahern :-) <p>Song /Limerick</p>	10-22	
<p>Lecture #2 - Water/Biochemistry</p> <p>Highlights Streaming video HERE</p> <p>Song HERE /Limerick</p>	10-22	Please note – the problems in this column are here for students who asked for practice. Some are above the level required for this class. If you want to practice them, fine, but please do not obsess with them. They are ONLY FOR PRACTICE
<p>Lecture #3 - Buffers</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	10-22	Number problems / Solutions More practice problems Solutions
<p>Lecture #4 - Amino Acids/Peptides</p> <p>Highlights Streaming video HERE</p>	42-51	Problem Solving Videos for buffers/proteins HERE and HERE

<p>Song HERE / Limerick</p>		<p>Transparency Scans</p>
<p>Lecture #5 - Proteins (3D)</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	<p>42-51</p>	
<p>Lecture #6 - Hemoglobin and Myoglobin</p> <p>Highlights Streaming video HERE</p> <p>Song HERE/ Limerick</p>	<p>51-56</p>	
<p>Lecture #7 - Protein Purification</p> <p>Highlights</p> <p>Streaming video HERE Song HERE / Limerick</p>	<p>213-224</p>	<p>Additional problems</p>
<p>I do not approve petitions for dropping, withdrawal, or pass/no pass grading after any of the relevant deadlines have passed, unless there are extraordinarily unusual circumstances. To drop a class completely (no grade), you must do so in accordance with the timelines in OSU's regulations shown HERE</p> <p>It is your responsibility to understand the drop policy in the link above. I do not approve retroactive withdrawals from the course due to not reading the policy above.</p>		<p>NEW A.A./Protein Charge Problem Solving Video HERE</p> <p>Transparencies</p>

<p>Lecture #8 - Protein Purification II/ Enzymes</p> <p>Highlights HERE Streaming video HERE</p> <p>Song HERE / Limerick</p>	81-95	<p>Protein Charge Video</p> <p>A.A./Protein Charge Problem Solving Video HERE</p> <p>Transparencies</p>
<p>Lecture #9 - Enzymes</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p> <p>Exam 1 material will cover through the place noted in the Highlights of this lecture</p>	81-95	
<p>Lecture #10 - Enzyme Controls</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	96-99	
<p>Lecture #11 - Enzyme Controls</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p> <p>Exam 1 Review Session HERE</p>	96-99	
<p>Exam 1</p> <p>The format of all exams in the course is simple multiple choice.</p> <p>For this reason, I do not provide practice exams.</p> <p>The exam must be started and completed under the</p>	Exam 1	Exam 1

<p>supervision of an Ecampus-approved proctor.</p> <p>You MUST be sure to get your proctored exam started and finished within the window specified by the proctor. This is your responsibility and failure to get this taken care of may result in a score of zero.</p> <p>You may not use notes on this exam. If you are using ProctorU please note that you will ONLY be allowed to use a whiteboard or chalkboard for scratch paper. No other type of scratch paper is allowed. If you are not using Proctor U, you may use a blank piece of scratch paper provided by your proctor.</p> <p>You will get access to your answers and the correct answers for this exam after you complete it</p>		
<p>Lecture #12 - Membranes</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	70 -79	
<p>Lecture #13 - Membranes</p> <p>Highlights Streaming video HERE</p> <p>Limerick</p>	70 -79	
<p>Lecture #14 - Nucleic Acids</p> <p>Highlights Streaming video HERE</p> <p>Song #1 HERE / Song #2 HERE</p> <p>Limerick</p>	58 -64	

<p>Lecture #15 - DNA Synthesis</p> <p>Highlights Streaming video HERE Song HERE / Limerick</p>	102-116	
<p>Lecture #16 DNA Synthesis II</p> <p>Highlights Streaming video HERE Song HERE / Limerick</p>	102 -116	
<p>Lecture #17 RNA SYNTHESIS</p> <p>Highlights Streaming video HERE Song HERE / Limerick</p>	117-132	
<p>Lecture #18 RNA SYNTHESIS</p> <p>Highlights Streaming video HERE Song HERE / Limerick</p>	117-132	
<p>Lecture #19 Protein Synthesis</p> <p>Highlights Streaming video HERE See Highlights for boundary of material covered on exam 3 Songs HERE and HERE / Limerick</p>	132-139	
<p>Lecture #20 Protein Synthesis</p> <p>Highlights Streaming video HERE</p>	132-139	<p>Animations Inner Life of a Cell</p> <p>YouTube video DNA Structure</p>

<p>Review Session Video HERE</p> <p>Limerick</p>		<p>DNA Replication Transcription and Translation Central Dogma</p>
<p>Exam 2</p> <p>The exam must be started and completed under the supervision of an Ecampus-approved proctor. This exam will only be over material covered since the material for the first exam</p> <p>You MUST be sure to get your proctored exam started and finished within the window specified by the proctor. This is your responsibility and failure to get this taken care of may result in a score of zero.</p> <p>You may not use notes on this exam. If you are using ProctorU please note that you will ONLY be allowed to use a whiteboard or chalkboard for scratch paper. No other type of scratch paper is allowed. If you are not using Proctor U, you may use a blank piece of scratch paper provided by your proctor.</p> <p>You will get access to your answers and the correct answers for this exam after you complete it</p>	<p>Exam 2</p>	<p>Exam 2</p>
<p>Lecture #21 Protein Synthesis /Biotechnology</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	<p>224-227</p>	
<p>Lecture #22 - Biotechnology</p> <p>Highlights Streaming video HERE</p> <p>Limerick</p>	<p>224-227</p>	

<p>Lecture #23 - Viruses, Cancer, and Oncogenes / Immune System & Energy</p> <p>Highlights Streaming video HERE Songs HERE and HERE / Limerick</p>	<p>24-32 141-143</p>	<p>Practice Gibbs problems</p> <p>Gibbs Free Energy Video HERE</p> <p>Transparencies</p>
<p>Lecture #24 - Carbohydrates</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	<p>64-71</p>	<p>Structure of fructose</p> <p>Structure of ribose</p> <p>Structure of sucrose</p>
<p>Lecture #25 - Carbohydrates & Energy</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	<p>143 - 150</p>	<p>Glycolysis Animations</p> <p>HERE, HERE, and</p>
<p>Lecture #26 - Glycolysis</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	<p>143 -150</p>	
<p>Lecture #27 - Glycolysis & Gluconeogenesis</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p> <p>See Highlights for boundary of material covered on exam 3</p> <p>Review Session HERE</p>	<p>150-153</p> <p>173-181</p>	

<p>Lecture #28 - Carbohydrate Storage II</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	<p>150-153</p> <p>173-181</p>	
<p>Exam 3</p> <p>The exam must be started and completed under the supervision of an Ecampus-approved proctor. This exam will only be over material covered since the material for the second exam</p> <p>You MUST be sure to get your proctored exam started and finished within the window specified by the proctor. This is your responsibility and failure to get this taken care of may result in a score of zero.</p> <p>You may not use notes on this exam. If you are using ProctorU please note that you will ONLY be allowed to use a whiteboard or chalkboard for scratch paper. No other type of scratch paper is allowed. If you are not using Proctor U, you may use a blank piece of scratch paper provided by your proctor.</p> <p>You will get access to your answers and the correct answers for this exam after you complete the exam</p>	<p>Exam 3</p>	<p>Exam 3</p>
<p>Lecture #29 - Citric Acid Cycle</p> <p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>	<p>153-157</p>	
<p>Lecture #29 - Citric Acid Cycle</p> <p>Highlights Streaming video HERE</p>	<p>153-157</p>	

Song HERE / Limerick		
Lecture #30 - Electron Transport/ Oxidative Phosphorylation Highlights Streaming video HERE Music Video HERE / Song lyrics HERE / Limerick	32-35	Beautiful animation of ATP synthesis HERE
Lecture #31 - Lipid Metabolism Highlights Streaming video HERE Limerick	157-171	
Lecture #32 - Lipid Metabolism II Highlights Streaming video HERE Songs HERE , HERE , and HERE / Limerick	157-171	
Lecture #33 - Lipid Metabolism III Highlights HERE Streaming video HERE Song HERE / Limerick HERE	157-171	
Lecture #34 - Photosynthesis Highlights Streaming video HERE Song HERE / Limerick	35-38 181-184	
Lecture #35 - Nitrogen Metabolism	184-194	

<p>Highlights Streaming video HERE</p> <p>Song HERE / Limerick</p>		
<p>Lecture #36 - Nitrogen Metabolism II</p> <p>184-194</p> <p>Highlights Streaming video HERE</p> <p>Review Sessions HERE and HERE</p> <p>Songs HERE and HERE</p> <p>All of the Metabolic Melodies HERE</p> <p>Limerick HERE</p> <p>Bonus Limericks HERE HERE HERE</p> <p>Review Session HERE</p> <p>Please friend me on Facebook :-)</p>		
<p>All exams in this course must be completed no later than 5:00 PM PST on January 6. Students are responsible for getting all exams scheduled AND completed by this time. Proctor U will have their own deadlines for scheduling the exams that may be different from this. Students are responsible for all aspects of scheduling. Plan ahead. Please note that on the final exam and ONLY on the final exam may students use a notecard, as described below. The notecard may not be used on other exams.</p> <p>Comprehensive Final Exam</p> <p>This exam will cover all material covered in the course. You MUST be sure to get your proctored exam started and finished within the window specified by the proctor. This is your responsibility and failure to get this taken care of may result in a score of zero.</p> <p>If you are using ProctorU please note that you will ONLY be allowed to use a whiteboard or chalkboard for scratch paper. No other type of scratch paper is allowed. If you are not using Proctor U, you may use a blank piece of scratch paper provided by your proctor.</p> <p>You will get access to your answers and the correct</p>	<p>Comprehensive Final Exam</p>	<p>Comprehensive Final Exam</p> <p>All the Metabolic Melodies HERE</p>

answers for this exam AFTER the window for taking it has completely closed.

On this exam ONLY, you are allowed to bring and use one 5x8 inch notecard with hand-filled notes (both sides). This includes students using Proctor U. No print-outs of any sort allowed.

You do not have to get the notecard from me, but you need to turn it in to the proctor when you are through. If you are using ProctorU please note that you will ONLY be allowed to use a whiteboard or chalkboard for scratch paper. No other type of scratch paper is allowed. If you are not using Proctor U, you may use a blank piece of scratch paper provided by your proctor.

This exam will have 40-50 questions (about 25% on material since the last exam) and you will have 110 minutes to take the exam.

Good luck to you.

I hope you have enjoyed and learned a lot in my class

Metabolic Melodies Book [HERE](#) –

Free Version [HERE](#)

Limerick Book

[HERE](#)