

BROOKDALE COMMUNITY COLLEGE

Chemistry 136 Syllabus

Introduction to Inorganic, Organic And Biological Chemistry

CODE: CHEM-136

TITLE: Introduction to Inorganic, Organic, and
Biological Chemistry

INSTITUTE: STEM **DEPARTMENT:** Chemistry

COURSE DESCRIPTION: The student will consider selected concepts from inorganic, organic and biological chemistry which will be applied to allied health and biological fields. Skills will be developed in a laboratory program which enhances topics under consideration. The program is designed for students who have had no previous chemistry course.

PREREQUISITE: MATH-012 or MATH-015 or satisfactory completion of the College's basic skills requirement in computation

COREQUISITES: None

CREDITS: 4

LECTURE HOURS: 3

LAB/STUDIO HOURS:3

REQUIRED MATERIALS:

All students

Text: *Chemistry: An Introduction to General, Organic, and Biological Chemistry*, 13th edition, by Timberlake, Pearson Publishing

Scientific calculator (At minimum)

Face-to-face students only

Lab Manual: *The Essential Laboratory Manual for General, Organic, and Biological Chemistry*, 2nd edition, by Timberlake, Pearson Publishing

Lab coat and lab goggles

Additional Time Requirements:

For information on Brookdale's policy on credit hour requirements and outside class student work refer to [Academic Credit Hour Policy](#).

COURSE LEARNING OUTCOMES:

- Utilize critical thinking skills to learn fundamental concepts from inorganic, organic, and biological chemistry (Critical Thinking, Mathematical Skill Competency, Problem Solving Competency)
- Perform chemistry-based problem solving. Reinforcement of chemical concepts will be made as hands-on skills are developed in the laboratory program (Critical Thinking, Mathematical Skill Competency, Problem Solving Competency)
- Demonstrate proper measurement techniques (Critical Thinking)
- Convert between metric and English units (Critical Thinking, Mathematical Skill Competency, Problem Solving Competency)
- Identify components of an IV bag and prove charge balance exists between electrolytes (Critical Thinking, Mathematical Skill Competency, Problem Solving Competency)
- Identify differences between organic functional groups like alcohols, aldehydes, ketones, carboxylic acids, and esters (Critical Thinking, Problem Solving Competency)
- Describe differences between carbohydrates, peptides, and proteins (Critical Thinking, Problem Solving Competency)

GRADING STANDARD:

Upon completion of the course, grades will be assigned as follows:

A = 92 - 100%	C+ = 76 - 78%
A- = 89 - 91%	C = 70 - 75%
B+ = 86 - 88%	D = 65 - 69%
B = 82 - 85%	F = <65%
B- = 79 - 81%	

Unit examination results will be reported as the grade assigned by the faculty calculated to the first decimal place. These grades will be weighed according to course grading policy.

In calculating the course grade, 0.5 will round up to the next numerical grade and 0.4 will round down to the next lower numerical grade.

COURSE CONTENT:

UNIT 1	Measurements and Energy and Matter
UNIT 1B	Atoms and Elements
UNIT 1C	Nuclear Radiation
UNIT 2A	Compounds and their Bonds
UNIT 2B	Chemical Quantities
UNIT 2C	Gases
UNIT 3A	Solutions
UNIT 3B	Acids and Bases
UNIT 4A	Introduction to Organic Chemistry
UNIT 4B	Alcohols, Phenols, Thiols, Ethers, Aldehydes, and Ketones
UNIT 4C	Carboxylic Acids, Esters, Amines, and Amides
UNIT 5A	Carbohydrates
UNIT 5B	Lipids
UNIT 5C	Amino Acids and Proteins
UNIT 5D	Enzymes and Digestion

DEPARTMENT POLICIES

1. Students are not allowed to attend any other lab section for any reason.
2. Students must pass both the lecture and the laboratory portion of the course.

COLLEGE POLICIES:

As an academic institution, Brookdale facilitates the free exchange of ideas, upholds the virtues of civil discourse, and honors diverse perspectives informed by credible sources. Our College values all students and strives for inclusion and safety regardless of a student's disability, age, sex, gender identity, sexual orientation, race, ethnicity, country of origin, immigration status, religious affiliation, political orientation, socioeconomic standing, and veteran status. For additional information, support services, and engagement opportunities, please visit www.brookdalecc.edu/support.

For information regarding:

- ◆ Brookdale's Academic Integrity Code
- ◆ Student Conduct Code
- ◆ Student Grade Appeal Process

Please refer to the [BCC STUDENT HANDBOOK AND BCC CATALOG](#).

NOTIFICATION FOR STUDENTS WITH DISABILITIES:

Brookdale Community College offers reasonable accommodations and/or services to persons with disabilities. Students with disabilities who wish to self-identify must contact the Disabilities Services Office at 732-224-2730 (voice) or 732-842-4211 (TTY) to provide appropriate documentation of the disability, and request specific accommodations or services. If a student

qualifies, reasonable accommodations and/or services, which are appropriate for the college level and are recommended in the documentation, can be approved.

ADDITIONAL SUPPORT/LABS:

See the Tutoring Center for information <https://www.brookdalecc.edu/academic-tutoring/tutoring-center/>.

MENTAL HEALTH:

- Mental Health Crisis Support: From a campus phone, dial 5555 or 732-224-2329 from an external line; off-hours calls will be forwarded to BCC police (2222 from a campus phone)
- Psychological Counseling Services: 732-224-2986 (to schedule an appointment during regular hours)

UNIT 1A

- Chapters:** 1, 2 (omit 2.2 and 2.3) 3.3, 3.4, 3.5, 3.7
- Name of Unit:** Measurements and Energy and Matter
- Unit Objective:** Apply some of the basic concepts of the metric system, density, specific gravity, and energy. Also distinguish between solids, liquids, and gases.
- Lab Experiments:** Experiments 1, 2 – Measurement, and Experiment 3 – Density and Specific Gravity

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 1 and 2

- | | |
|---|--|
| 1. Create a study plan for learning chemistry | READ: 1.3
DO: all on page 9 |
| 2. Convert numbers to scientific notation and vice versa | READ: 1.5
DO: 1.47-8 |
| 3. Perform conversions within the metric system and between the metric and U.S. | READ: 2.1, 2.4-2.6
MEMORIZE: Table 2.5
DO: 2.1-8, 31-46, 47-52 (no sig figs), 53-65, 97-102, 109-14 |
| 4. Solve problems involving density and specific gravity | READ: 2.7
DO: 66-70, 89-94 |

Chapter 3

- | | |
|---|--|
| 5. Solve energy problems
a.) Potential and kinetic energy
b.) Energy Units
c.) Calories in carbohydrates, lipids, and proteins | READ: 3.4-3.5
CHEM. LINK TO HEALTH (CLTH):
p. 76
DO: 3.21-36, 57-8, 69-70, 93--4 |
| 6. Perform conversions between the temperature scales (°F, °C, and K) | READ: 3.3
CLTH: page 71
DO: 15-20, 65-6, 81-4 |

UNIT 1B

- Chapter:** 3.1,3.2, 3.7 Chapter 4 (Omit 4.7)
- Name of Unit:** Matter, Atoms and Elements
- Unit Objective:** Determine the fundamental structure of an atom
- Lab Experiments:** Experiment 4 – Atomic Structure, Experiment 5 – Electronic Arrangement and Periodic Properties

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 3 and 4

1. Be able to classify matter according to its components: elements, compounds, mixtures. Discuss states of matter
READ: 3.1, 3.2, 3.7 (No calculations)
DO: 3.1-14, 43-4, 46-8, 59-62, 71-6
2. Give the names and symbols for elements.
READ: 4.1
DO: 4.1-6
3. Discover how the periodic table is organized
READ: 4.2
CLTH: p. 104
DO: 7-16
4. Solve problems involving subatomic particles, isotopes atomic number, and mass number
READ: 4.3-4.5
DO: 4.17-8, 33-44, 79-85, 93-106, 5.57-8
5. Give the electron level arrangement for the first 18 elements
READ: 4.6, Table 4.9
DO: 49-52, 107-8

UNIT 1C

Chapter: 5 (Omit 5.6)

Name of Unit: Nuclear Radiation

Unit Objective: Explain why some atoms decay radioactively, identify some of the particles emitted, and recognize some of the harmful and beneficial uses of radiation

Lab Experiment: Experiment 6 – Nuclear Radiation

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 5

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|--|--|
| 1. Identify common radioactive particles | READ: 5.1
DO: 5.1-12 |
| 2. Be able to write equations for alpha and beta decay. Complete nuclear equations | READ: 5.2
DO: 5.13-22, 51-4, 59-62 |
| 3. Recognize units of radiation (no calculations) | READ: 5.3
CLTH: p. 148
DO: 23-4 |
| 4. Complete half-life problems | READ: 5.4
DO: 55-6, 67-8 |
| 5. Describe some medical uses for radioactivity | READ: 9.5
CLTH: p. 154 and 157
DO: 5.35 |

UNIT 2A

- Chapters:** 6 (Omit 6.8)
- Name of Unit:** Compounds and their Bonds
- Unit Objective:** Describe the types of chemical bonds by showing their formation using valences and Lewis electron dot structures
- Lab Experiment:** Experiment 7 – Compounds and their Formulas

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 6

1. For atoms:
 - a.) define and be able to recognize ions (cations and anions)
 - b.) Know the charges associated with groups 1A through 8A when those elements form ions

READ: 6.1
MEMORIZE: Table 6.2 and 6.3
DO: 6.5-10
2. List some important ions in the body and state their function
CLTH: page 173
3. Name and write formulas for ionic and molecular compounds
READ: 6.2-6.5
MEMORIZE: Tables 6.8 on p. 182
DO: 11-56, 99-100, 109-10, 115-25
4. Determine valence electrons and draw basic Lewis Electron dot structures
READ: 6.6
DO: 6.40
5. Determine if covalent bonds are polar or nonpolar by using the table of electronegativities. Sketch the bond dipole
READ: 6.7
DO: 62-3, 105-6, 129-36

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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6. Explore the different attractive forces and their impact on physical properties

READ: 6.9

DO: 79, 83

UNIT 2B

- Chapters:** 7 (7.1-7.4 only)
- Name of Unit:** Chemical Quantities
- Unit Objective:** Understand how we count atoms and molecules, and be able to solve problems using molar mass

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 7

1. Explain the significance of the mole
calculate moles for a certain number
of molecules
READ: 7.1
DO: 7.1-8
2. Calculate the molar mass of a compound
Convert between moles and grams
for atoms and compounds.
READ: 7.2-7.3
DO: 11-34, 93-6
3. Use the Law of Conservation of Mass
to balance chemical equations
READ: 7.4
DO: 7.35-40, 83-4, 85-90 (a and b only)

UNIT 2C

Chapter: 8 (Omit 8.5)
(omit all math in Boyle's, Charles', and Gay-Lussac's Laws, but do the math of Dalton's Law)

Name of Unit: Gases

Unit Objective: Explain the gas laws and apply them

Lab Experiment: Experiment 14 – Partial Pressures

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 8

1. Know the key points to Kinetic molecular Theory of Gases
READ: 8.1
DO: 8.1-2
2. Understand the 4 properties that describe a gas. Convert between mmHg, Torr, and atmospheres.
READ: 8.1
CLTH: p. 260
DO: 3-8
3. State and recognize applications of Boyle's, Charles', Gay-Lussac's, and Avogadro's Law
READ: 6.3 – 6.5 (omit math), 6.8
CLTH: p. 266
DO: 8.9-10, 8.11a, 8.12-4, 24-6, 47-8, 68-9
4. Explain the relationship between Dalton's Law and partial pressure. Be able to calculate using Dalton's Law
READ: 8.7
DO: 53-60, 70

UNIT 3A

Chapter:	9 (Omit 9.5)
Name of Unit:	Solutions and their properties
Unit Objective:	Describe solutions and express solution concentrations as a ratio in mass/volume percent and in molarity. Describe electrolytes, non-electrolytes, colloids, and suspensions. Explain processes of osmosis and dialysis, and understand the purpose of the “mEq/L” concentration system
Lab Experiment:	Experiment 15A – Solutions Experiment 18 – Solutions, Colloids, and Suspensions, Experiment 17 – Electrolytes and Insoluble Salts

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 7

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|--|--|
| 1. Describe how a solution is formed
Describe the meaning behind “like dissolves like” | READ: 9.1
DO: 9.1-6, 77-8, 85 |
| 2. Know and be able to identify
the three types of electrolytes. Express
the relationship between moles and
equivalents | READ: 9.2
DO: 7-16, 79 |
| 3. Describe saturated vs unsaturated
and discuss what effects solubility
of solids and gases | READ: 9.3
CLTH: |
| 4. Perform solution concentration
calculations for mass & volume ratios,
mass/volume %, molarity, and dilution. | READ: 9.4 - 9.5
DO: 33-59, 80-3, 93-112 |
| 5. List ways in which the body gains
and loses water to maintain fluid
balance | CLTH: p. 292 |

6. For osmosis and dialysis:

- a.) describe the processes in terms of diffusion & membranes
- b.) recognize solutions as iso-, hypo-, or hypertonic, and determine which way water will flow across an osmotic membrane
 1. define osmotic pressure
 2. determine relative osmotic pressures

READ: 9.6

DO: 63-72, 84

7. For fluid motion explain:

- a.) renal (kidney) function
- b.) hemodialysis

READ: 9.6

CLTH: p. 312 & 313

UNIT 3B

Chapter: 10 (Omit calculations) (Omit 10.4 and 10.5)

Name of Unit: Acids and Bases

Unit Objective: Recognize acids, bases, and salts, and determine the pH range for a substance in aqueous solution. Describe systems in the body which guard against drastic pH change.

Lab Experiment: Experiment 19 – Acids, Bases, pH, and Buffers

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 10

1. Describe characteristics of and name **READ:** 10.1–10.3 acids and bases, and write dissociation **DO:** 10.1-14, 81-2 reactions. Know the difference between strong and weak acids and bases. Use equations to show how acids donate protons and bases accept them
2. Understand the ionization of Water and the pH Scale **READ:** 10.6
(NO CALCULATIONS) **CLTH:** p. 345
DO: 35-6
3. Know the basic reactions of acids and bases. **READ:** 10.7
(OMIT TITRATIONS) **CLTH:** p 349
DO: 45-50
4. Identify and describe what Buffers are and how they work **READ:** 10.8
List some key buffers in the human **CLTH:** p. 352
body **DO:** 55-62

UNIT 4A

- Chapter:** 11 (Omit 11.8)
- Name of Unit:** Introduction to Organic Chemistry
- Unit Objective:** Compare some specific physical properties of inorganic and organic compounds. Name, draw, and predict reaction products for cyclic and acyclic hydrocarbons and haloalkanes.
- Lab Experiments:** Experiment 21 – Properties of Organic Compounds, Experiment 22 – Structures of Alkanes, Experiment 23 – Reactions of Hydrocarbons (omit part D)

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
1. Compare inorganic and organic compounds with respect to bonding and physical properties.	READ: 11.1 DO: 11.1-6, 41-2
2. Name and draw any cyclic or acyclic alkane, haloalkane, alkene, alkyne, or aromatic compound. This includes drawing and differentiating between expanded, condensed, and molecular formulae.	READ: 11.2-11.3, 11.5 DO: 7-10, 13-18, 46-50, 55-8
3. Define: Structural isomers. Analyze structures to determine if they are isomers. Recognize Alkenes that exhibit cis- and trans-isomerism	READ: 11.3 CLTH: p. 383 DO: 11-12, 29-30, 43-4, 52-3
4. Describe the physical properties of hydrocarbons	READ: 11.4 DO: 19-20
4. Write equations for: a.) combustion of alkanes b.) hydrogenation of alkenes c.) hydrogenation of alkynes (addition) d.) hydration of alkenes (addition)	READ: 11.4 DO: 21-2, 33-4, 61-6 .

UNIT 4B

- Chapter:** 12 (No aromatics or phenols)
- Name of Unit:** Alcohols, Thiols, Ethers, Aldehydes, and Ketones
- Unit Objective:** Name, draw, and predict reaction products for alcohols, phenols, thiols, ethers, aldehydes, and ketones
- Lab Experiments:** Experiment 26 – Alcohols and Phenols, Experiment 27 – Aldehydes and Ketones

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 12

- Name and draw alcohols, thiols, ethers, aldehydes, and ketones.
Describe their physical properties
READ: 12.1-12.3
CLTH: p. 407
DO: 12.1-8, 15-22, 45-8, 56-8
(No aromatics or phenols)
- For alcohols:
 - classify as 1°, 2°, or 3°
 - explain their water solubility and high boiling point based upon hydrogen bonding
 - explain why 1° and 2° alcohols oxidize and 3° alcohols do not**READ:** 12.2, 12.4
DO: 9-14, 43-4, 49-50
(No aromatics or phenols)
- Write equations for:
 - dehydration of alcohols to form alkenes
 - oxidation of 1° alcohols, 2°
 - alcohols, thiols, and aldehydes**READ:** 12.4
DO: 27-34, 51-2, 54, 61-2

UNIT 4C

Chapter:	14
Name of Unit:	Carboxylic Acids, Esters, Amines, and Amides
Unit Objective:	Name, draw, and predict reaction products carboxylic acids, esters, amines, and amides
Lab Experiment:	Experiment 30 – Carboxylic Acids and Esters

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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Chapter 14

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| 1. Name and draw carboxylic acids, esters, amines, and amides. | READ: 14.1, 14.3, and 14.5
DO: 14.1-6, 19-22, 29-32, 41-4, 57-60, 67-8, 71-2 (No aromatics) |
| 2. Explain how hydrogen bonding impacts the water solubility and high boiling point of carboxylic acids and amines. Describe the acidic nature of CAs and basic nature of amines | READ: 14.2, 14.5
DO: 7-10, 35-6 |
| 3. For amines:
a.) classify as 1°, 2°, or 3°
b.) define alkaloid | READ: 14.4
CLTH: p. 490
DO: 33-4, 65-6 |
| 4. Write equations for:
Carboxylic acids:
a.) ionization
b.) neutralization
c.) esterfication, acidic ester hydrolysis, and saponification
d.) amidation and acidic amide hydrolysis
Amines:
a.) neutralization | READ: 14.2-14.5
CLTH: p 494
DO: 11-2, 15-8, 25-8, 37-40, 45-6, 61-4, 69-70, 73-4 |

UNIT 5A

Chapter: 13 , 18.2

Name of Unit: Carbohydrates

Unit Objective: Classify carbohydrates according to their structures and predict whether a given carbohydrate will give a positive reducing sugar, fermentation, or iodine test. Describe the digestion (hydrolysis), absorption, and storage of carbohydrates.

Lab Experiment: Experiment 29 – Test for Carbohydrates

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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|---|--|
| 1. For carbohydrates:
a.) write the photosynthesis equation
b.) write the metabolism equation
c.) identify them given a formula
d.) be familiar with medical conditions associated with them
e.) classify them as aldoses or ketoses and as hexoses and pentoses, etc. | READ: 13.1
CLTH: p 443
DO: 13.1-13.10 |
| 2. Classify carbohydrates as mono-, di- or polysaccharides; indicate components and hydrolysis (digestion) products | READ: 13.1, 13.6-13.7, 18.2
CLTH: p. 456 (Blood types)
DO: 41-8 |
| 3. Identify open and ring forms of monosaccharides | READ: 13.4 |
| 4. Predict whether a given carbohydrate will give a positive Benedict's, | READ: 13..5
CLTH: p. 452
DO: 37-40 |

UNIT 5B

Chapter: 15, 18.2

Name of Unit: Lipids

Unit Objective: Identify the structure and classes of lipids and describe the digestion of triglycerides.

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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1. For lipids:

READ: 15.1-15.3,

a.) List/identify the different classes (e.g. waxes, triglycerides, steroids, etc.)

DO: 15.1-16, 19-28

b.) Give components for each class

c.) Give examples of compounds from each class

d.) Define saturated, mono-unsaturated, and polyunsaturated fatty acids and understand how this affects melting point

2. For triglycerides:

READ: 15.3-15.4, 18.2

a.) Differentiate between fats & oils **CLTH:** p. 522

b.) Write the structure given fatty acid components **DO:** 29-30, 37-8

c.) Recognize cis- and trans- fats

d.) Explain what is meant by the terms “partially” and “fully hydrogenated” oils

e.) Write hydrogenation equations

f.) Show how soaps are made

3. For phospholipids:

READ: 15.7 and 15.7

a.) Describe the similarities and differences between triacylglycerides and phospholipids

CLTH: p. 529

DO: 39-40, 59-60

b.) Their importance in creating phospholipid bilayer

4. Describe the general structure and function of steroids

READ: 15.6-15.7

DO: 47, 49-54, 57-8, 61

UNIT 5C

Chapter:	16 (16.1 – 16.4)
Name of Unit:	Amino Acids and Proteins
Unit Objective:	Understand how proteins are synthesized and hydrolyzed (digested) and state structural features of amino acids and proteins.
Lab Experiments:	Experiment 37 – Peptides and Proteins; Experiment 41 – Analysis of Urine

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
1. Describe the classes of proteins and Their functions	READ: 16.1 DO: 16.1-2
2. For amino acids: a.) Recognize the general formula b.) Write an equation joining two amino acids (you won't need to memorize amino acid structures) c.) classify amino acids	READ: 16.1 DO: 16.3-8, 13-4, 63-4
3. Define and illustrate for amino acids and proteins: a.) Zwitterion b.) Amphoteric nature (capable of reacting as both an acid and base) c.) Essential Amino Acids- complete vs. incomplete	READ: 16.1 CLTH: p. 555 & 557
4. For proteins, describe: a.) Their functions in the body b.) Denaturation	READ: 16.2-16.3 CLTH: page 560 & 565 DO: 17-22, 25-28, 65,6

- c.) 1°, 2°, 3° & 4° structures
- d.) and linkages holding them together

UNIT 5D

Chapter: 16 (16.4 – 16.8) and 18.2

Name of Unit: Enzymes and Digestion

Unit Objective: Describe how the body digests, absorbs, and distributes carbohydrates, triglycerides, and proteins.

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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1. For enzymes:

- a) Describe their nomenclature and name the different classes
- b) Describe effect on activity of:
 - Substrate concentration
 - Enzyme concentration
 - Temperature
 - pH
- c.) Understand cofactors

READ: 16.5-16.6

DO: 29-48, 56, 58

2. For digestion of carbohydrates, triglycerides, and proteins state:

- a.) Enzyme involved
- b.) What hydrolysis occurs mouth, stomach, and small intestine
- c.) What end products are formed,

READ: 16.5, 16.6, 18.2

DO: 7-12

absorbed, and stored (if at all)

The syllabus is intended to give student guidance in what may be covered during the semester and will be followed as closely as possible. However, the faculty member reserves the right to modify, supplement, and make changes as the need arises.