



# SUBJECT OUTLINE

Subject Name:

**Chemistry and Biochemistry**

Subject Code:

**BIOB1**

## SECTION 1 – GENERAL INFORMATION

Award/s:

Undergraduate Certificate in Human Biology

Total Course Credit Points:

14

Level:

1<sup>st</sup> Year

Duration:

1 Semester

Subject Coordinator: Dr Eric Owusu Sekyere (Sydney campus)

Subject is:

Core

Subject Credit Points:

4

### Student Workload:

No. timetabled hours per week:	No. personal study hours per week:	Total hours per week:
6	4	10

Delivery Mode:

e-Learning  
(Online)

Narrated PowerPoint presentations

Tutorials: Asynchronous tutor moderated discussion forum and activities

Student handouts, web-based resources

Full Time

Pre-requisites: Nil

Co-requisites: Nil

## SECTION 2 – ACADEMIC DETAILS

### Subject Rationale

The first part of this subject introduces the student to basic and organic chemistry and explores the nature and reactivity of matter. This provides the foundation for the second part – biochemistry — which examines the relationship between the structure and function of complex biomolecules. Students will study the role of enzymes, coenzymes and cofactors in energy metabolism, and metabolic pathways involving glucose, fatty acid and amino acid – providing knowledge of the metabolic processes that occur in the human body. This is a foundational subject for later study of nutrition, pharmacology, immunology, herbal medicine and clinical sciences.

### Learning Outcomes

1. Describe elements, atoms, ions, chemical bonding, chemical reactions, the significance of energy transfer and catalysts in biochemical systems.



2. Define the nature of matter and the different states of matter (solid, liquid, and gas) and describe how movement of atoms in the different states impacts their properties.
3. Describe solutions, mixtures and their equilibrium and relate it to how they impact physiological processes and metabolism.
4. Identify and apply nomenclature and common chemical reactions associated with organic functional groups.
5. Describe the components that make up the nucleic acids in cells, describe DNA and RNA structure and alterations in DNA (mutations).
6. Illustrate and analyse the chemical nature of major biochemical groups including carbohydrates, lipids and proteins.
7. Discuss the major biochemical pathways, including metabolism of carbohydrates, lipids and proteins.
8. Investigate the major biochemical pathways in the context of nutrition and health.

### Assessment Tasks

Type	Learning Outcomes Assessed	Session Content Delivered	Due	Weighting
<b>Online Quiz 1</b> multiple choice (40 minutes)	1-2	1-6	Week 4	20%
<b>Online Quiz 2</b> multiple choice (45 minutes)	3-4	7-15	Week 9	20%
<b>Written Assignment</b> (1200 words)	5-8	7-25	Week 12	20%
<b>Final Written Exam</b> multiple choice, short answers, definitions and extended responses (2.5 hours)	5-7	15-25	Final Examination Period	40%
All written assessments and online quizzes are due at 11:55 p.m. Sunday and submitted through the LMS				

### Prescribed Readings:

1. Stoker, H. S. (2016). *General, organic, and biological chemistry* (7th ed.). Boston, MA: Cengage Learning.
2. Summers, J., & Smith, B. (2014). *Communication skills handbook* (4th ed.). Milton, QLD: Wiley. [ebook available]



### Recommended Readings:

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2008). *Molecular biology of the cell* (5th ed.). New York, NY: Garland Science.
2. Berg, J. M., Tymoczko, J. L., & Stryer, L. (2015). *Biochemistry* (8th ed.). New York, NY: W. H. Freeman.
3. Bettelheim, F. A., Brown, W. H., Campbell, M. K., Farrell, S. O., & Torres, O. J. (2016). *Introduction to general, organic and biochemistry* (11th ed.). Boston, MA: Cengage Learning.
4. Dominiczak, M. H. (2007). *Flesh and bones of metabolism*. Edinburgh, Scotland: Elsevier Mosby.
5. Timberlake, K. C. (2015). *General, organic, and biological chemistry: Structures of life* (5th ed.). Boston, MA: Pearson
6. Tortora, G. J., Derrickson, B., Burkett, B., Peoples, G., Dye, D., Cooke, J., Mellifont, R. (2019). *Principles of anatomy and physiology* (2nd Asia-Pacific ed.). Milton, QLD: Wiley.

## Subject Content

Week	Lectures	Tutorials / Practicals
1.	<p>Session 1</p> <p><b>Introduction</b> (Subject Outline / Subject Aims / Assessment / Teaching Resources)</p> <p><b>Introduction to Chemistry</b></p> <ul style="list-style-type: none"> <li>➤ Matter and the structure of the atom</li> <li>➤ Periodic table of elements</li> <li>➤ Use of the periodic table to predict physical and chemical properties of elements</li> <li>➤ Electronic configuration and the octet rule</li> <li>➤ Formation of ions</li> <li>➤ Significance of isotopes</li> </ul>	<p>Activities are developed to allow the students to explore relevant concepts, expand on ideas and have peer and lecturer interaction. Activities also allow for formative assessment and feedback.</p> <ul style="list-style-type: none"> <li>➤ Review of atom/subatomic particles, periodic table, and electronic configuration</li> <li>➤ Animations on electron configuration</li> </ul>
	<p>Session 2</p> <p><b>Chemical Bonding</b></p> <ul style="list-style-type: none"> <li>➤ Ionic and covalent bonding</li> <li>➤ Polyatomic ions</li> <li>➤ Electro negativity and polarity of bonds</li> <li>➤ Naming ionic and molecular compounds</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of writing and naming compounds</li> </ul> <p><b>Formative quiz 1</b></p>
2.	<p>Session 3</p> <p><b>Chemical Reactions</b></p> <ul style="list-style-type: none"> <li>➤ Chemical change</li> <li>➤ Chemical equations</li> <li>➤ Mole</li> <li>➤ Formula weight</li> <li>➤ Balancing equations</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of balancing equations</li> </ul>



	<ul style="list-style-type: none"> <li>➤ Classification of chemical reactions</li> <li>➤ Heat of reaction</li> </ul>	
	<p>Session 4</p> <p><b>Reaction Rates</b></p> <ul style="list-style-type: none"> <li>➤ Le Châtelier's principle and equilibrium</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of factors affecting chemical equilibrium</li> </ul> <p><b>Formative quiz 2</b></p>
3.	<p>Session 5</p> <p><b>Physical States of Matter</b></p> <ul style="list-style-type: none"> <li>➤ Solids, liquids and gases</li> <li>➤ Boyle's law</li> <li>➤ Dalton's law</li> <li>➤ Transition between states of matter and intermolecular forces</li> <li>➤ Solubility</li> <li>➤ Kinetic molecular theory</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of different states of matter, gas laws, types of solutions, solubility, osmosis and dialysis</li> <li>➤ Animations on different states of matter</li> </ul>
	<p>Session 6</p> <p><b>Acids and Bases</b></p> <ul style="list-style-type: none"> <li>➤ Reactions of acids and bases, pH and buffers</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of acids and bases, pH and buffer</li> <li>➤ Virtual labs on the use of indicators in distinguishing acids and bases</li> </ul> <p><b>Formative quiz 3</b></p>
4.	<p>Session 7</p> <p><b>Introduction to Organic Chemistry</b></p> <ul style="list-style-type: none"> <li>➤ Organic compounds</li> <li>➤ Hydrocarbons</li> <li>➤ Functional groups</li> <li>➤ Stereo isomers</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of hydrocarbon compounds</li> </ul>
	<p>Session 8</p> <p><b>Properties of the Functional Groups</b></p> <ul style="list-style-type: none"> <li>➤ Alkanes</li> <li>➤ Alkenes</li> <li>➤ Alkynes</li> <li>➤ Aromatics</li> <li>➤ Alcohols</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of alkanes, alkenes, alkynes, aromatics and alcohols</li> </ul> <p><b>Formative quiz 4</b></p>
5.	<p>Session 9</p> <p><b>Properties of the Functional Groups (Continued)</b></p> <ul style="list-style-type: none"> <li>➤ Phenols</li> <li>➤ Ketones</li> <li>➤ Aldehydes</li> <li>➤ Carboxylic acids</li> <li>➤ Esters</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of phenols, ketones, aldehydes, carboxylic acids and esters</li> </ul>



	<p>Session 10</p> <p><b>Properties of the Functional Groups (Continued)</b></p> <ul style="list-style-type: none"> <li>➤ Ethers</li> <li>➤ Thiols</li> <li>➤ Amines and amides</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of ethers, thiols, amines and amides</li> </ul>
6.	<p>Session 11</p> <p><b>Carbohydrates</b></p> <ul style="list-style-type: none"> <li>➤ An introduction to classification, structure and function of carbohydrates</li> </ul>	<ul style="list-style-type: none"> <li>➤ Concept maps on carbohydrate types</li> </ul>
	<p>Session 12</p> <p><b>Lipids</b></p> <ul style="list-style-type: none"> <li>➤ An introduction to classification, structure and function of lipids</li> </ul>	<ul style="list-style-type: none"> <li>➤ Concept maps on lipid types</li> </ul>
7.	<p>Session 13</p> <p><b>Molecular Biology: Nucleic Acids, Nucleotides, DNA, RNA</b></p> <ul style="list-style-type: none"> <li>➤ Classification, structure, nucleosides and nucleotides</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of types of nucleic acids, DNA replication, review</li> <li>➤ DVD on DNA structure</li> </ul>
	<p>Session 14</p> <p><b>Amino Acids and Proteins</b></p> <ul style="list-style-type: none"> <li>➤ Introduction to classification, structure and function of amino acids</li> <li>➤ Introduction to protein classification, structure and function</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of amino acids and proteins</li> <li>➤ Animations on the structure and formation of different levels of protein organisation</li> </ul>
<p><b>NON-TEACHING WEEK</b> (note that make-up classes may be scheduled in this week)</p> <p><b>Online students</b> – The non-teaching week falls between Weeks 7 and 8</p>		
8.	<p>Session 15</p> <p><b>Enzymes and Co-enzymes</b></p> <ul style="list-style-type: none"> <li>➤ The different classes of enzymes are studied and the types of reactions they catalyse</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of enzymes</li> <li>➤ Virtual lab on the effect of various factors on enzyme activity</li> </ul>
	<p>Session 16</p> <p><b>In Class Study Revision</b></p>	
9.	<p>Session 17</p> <p><b>Bioenergy Production</b></p> <ul style="list-style-type: none"> <li>➤ An overview of the role</li> <li>➤ Integration of the common catabolic pathways</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of cell structure, role of ATP and co-enzymes, significance of ATP</li> </ul>
	<p>Session 18</p> <p><b>Metabolism</b></p>	<ul style="list-style-type: none"> <li>➤ Review of carbohydrate metabolism</li> </ul>



	<ul style="list-style-type: none"> <li>➤ Digestion of carbohydrates</li> <li>➤ Glycolysis, pyruvate pathways</li> <li>➤ Glycogen metabolism</li> </ul>	
10.	<p>Session 19</p> <p><b>Metabolism (Continued)</b></p> <ul style="list-style-type: none"> <li>➤ The citric acid cycle</li> <li>➤ The Cori cycle</li> </ul>	<ul style="list-style-type: none"> <li>➤ Concept map on carbohydrate metabolism</li> </ul>
	<p>Session 20</p> <p><b>Metabolism (Continued)</b></p> <ul style="list-style-type: none"> <li>➤ Electron transport chain</li> <li>➤ Oxidative phosphorylation</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of electron transport chain/oxidative phosphorylation</li> <li>➤ Animations of ATP synthesis</li> </ul>
11.	<p>Session 21</p> <p><b>Metabolism (Continued)</b></p> <ul style="list-style-type: none"> <li>➤ Gluconeogenesis</li> <li>➤ Hormonal control of carbohydrate metabolism</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of carbohydrate metabolism</li> </ul>
	<p>Session 22</p> <p><b>Lipid Metabolism</b></p> <ul style="list-style-type: none"> <li>➤ <math>\beta</math>-oxidation, ketogenesis</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of metabolism of lipids</li> </ul>
12.	<p>Session 23</p> <p><b>Lipid Metabolism (Continued)</b></p> <ul style="list-style-type: none"> <li>➤ Fatty acid synthesis</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of metabolism of lipids</li> </ul>
	<p>Session 24</p> <p><b>Protein Metabolism</b></p> <ul style="list-style-type: none"> <li>➤ Urea cycle and synthesis of amino acids</li> </ul>	<ul style="list-style-type: none"> <li>➤ Review of metabolism</li> <li>➤ Concept map on protein metabolism</li> </ul>
13.	<p>Session 25</p> <p><b>Metabolism (Continued)</b></p> <ul style="list-style-type: none"> <li>➤ Integrating the metabolic pathways</li> </ul>	<ul style="list-style-type: none"> <li>➤ Concept map on integration of carbohydrates, protein and fat metabolism</li> </ul>
	<p>Session 26</p> <p><b>In Class Study Revision</b></p>	
14-15.	<p><b>Non-Teaching Week/Practical Examination Weeks 1 &amp; 2</b></p> <p>Note that make-up classes may be scheduled in these weeks</p>	
16-17.	<p><b>Final Examination Weeks 1 &amp; 2</b></p> <p>Students are required to sit examinations using the Respondus Lockdown Browser software per the <a href="#">Examination Policy - Higher Education</a>. Refer to your local campus calendar for exam opening and closing times.</p>	