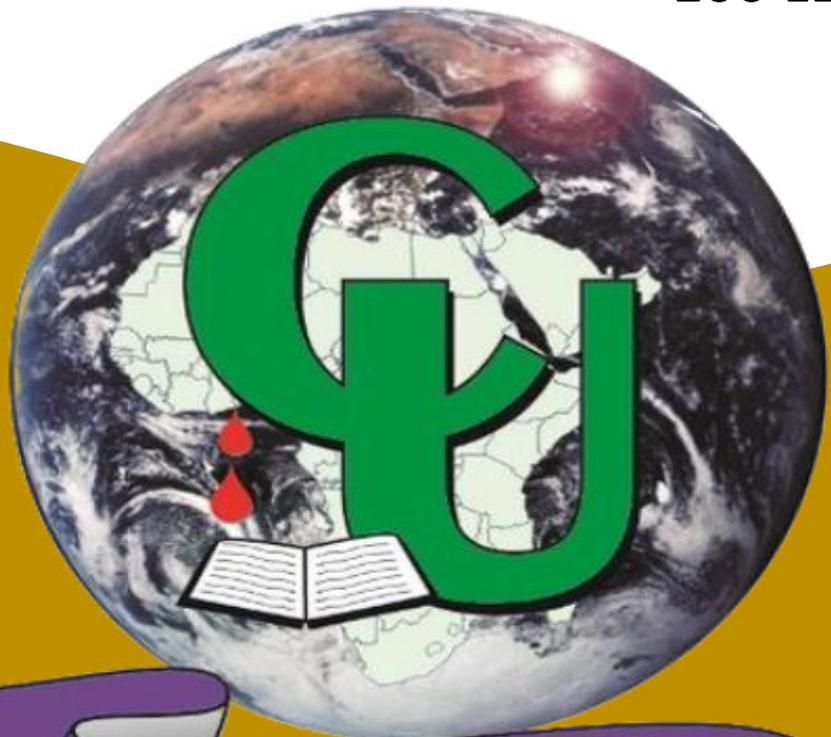


COVENANT UNIVERSITY

OMEGA SEMESTER TUTORIAL KIT
(VOL. 2)

PROGRAMME: BIOCHEMISTRY
100 LEVEL



Raising A New Generation Of Leaders

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LIST OF COURSES

BCH121: Introductory Biochemistry

***Not included**



COVENANT UNIVERSITY

CANAANLAND, KM 10, IDIROKO ROAD
P.M.B 1023, OTA, OGUN STATE, NIGERIA.

TITLE OF EXAMINATION: B.Sc EXAMINATION

COLLEGE: Science & Technology

SCHOOL: Natural and Applied Sciences

DEPARTMENT/PROGRAMME: Biological Sciences/Biochemistry

SESSION: 2015/2016

SEMESTER: OMEGA

COURSE CODE: BCH 121

CREDIT UNIT: 2

COURSE TITLE: Introductory Biochemistry

INSTRUCTION: Answer any **three** questions

TIME: 2 HOURS

1.(a) Define metabolism, and explain the differences between anabolism and catabolism (06 marks)

(b) Briefly highlight the concept of the cell theory (19 marks)

2. (a) Explain the following:-

i.) Effect of temperature on enzyme activity (8 marks)

ii.) Lock and key principle in an enzyme catalysed reactions (5 marks)

iii.) Broad specificity in an enzyme catalysed reaction (3 marks)

(b) Explain the systematic classification of enzymes as proposed by the International Enzyme Commission (9 marks)

3. (a) Briefly explain with examples the two main sources of protein to the body (3 marks)

(b) Discuss the two mechanisms proposed for the absorption of carbohydrates from the intestinal Lumen (22 marks)

4. Write short notes on the principles and application of **ANY THREE** named separation techniques in biochemistry and or molecular biology which you have studied (25 marks)

5. Give a comprehensive account of the topography of the living cell and the structures and functions of the major cell components (25 marks)



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COURSE TITLE: Introductory Biochemistry

INSTRUCTION: Answer any **three** questions

TIME: 2 HOURS

1.(a) Define metabolism, and explain the differences between anabolism and catabolism (06 marks)

Metabolism may be defined as the **chemical processes** that occur within a **living organism**, resulting in **energy production and growth** (2 marks)

1. The anabolism which consist of the **building up of simpler molecules to larger more complex molecules** (1 mark) with the taking up of energy (**endothermic processes**) (1 mark)
2. The catabolism which consist of **breakdown of large, more complex molecules into simpler molecules** (1 mark), releasing energy during the processes (**exothermic**) (1 mark)

b. (b) Briefly highlight the concept of the cell theory (19 marks)

- The cell is the **structural and functional unit** of all known living organisms (2 marks)
- It is the **smallest unit** of an organism that is classified as living, and is often called the **building blocks of life** (2 marks)
- Organisms can be either **unicellular** (consist of a single cell) like bacteria or **multicellular** as in humans (2 marks).

Humans have an estimated 100 trillion or 10^{14} cells (2 marks).

{The largest known cell is an unfertilized ostrich egg cell.}

- The cell theory, first developed in **1839** by **Matthias Jakob Schleiden and Theodor Schwann** (2 mark),
- states that **all organisms are composed of one or more cells** (2 marks).
- All cells come from **pre-existing cells** (2 mark).
- **Vital functions** of an organism **occur within cells**, and all cells contain the **hereditary information** necessary for **regulating cell functions** and for **transmitting information** to the next generation of cells (2¹/ marks).
- Each cell is at least somewhat **self-contained and self-maintaining**: it can take in nutrients, convert these nutrients into energy, carry out specialized functions, and reproduce as necessary (2¹/ marks).

2. (a) Explain the following terms:-

i.) **Effect of temperature on enzyme activity**

(8

marks) Amount of substrates consumed per time (2 marks)

Active site (1 mark)

Reaction rate of enzyme catalise reaction generally **increases with increase in temperature** (2 marks).

Reaction rates approximately **double for every 10°C rise in temperature** (1 mark).

Temperature coefficient (Q_{10}) ≈ 2 (2 marks)

ii.) Lock and key principle in an enzyme catalysed reactions (5

marks) Substrate (1 mark)

Enzyme activity (1 mark)

Pictorial diagram of enzyme catalysed reaction (2 marks)

Shape of substrate fitting into shape of active site (1 mark)

iii.) Broad specificity in an enzyme catalysed reaction (3 marks)

Enzymes ability to act on a number of **different structurally related substrate (1 mark)** It occurs at **widely different rates (1 mark)**.

Examples of such enzymes: **Alkaline phosphatase, Carboxyesterase, Carboxypeptidase (1 mark)**.

(b) Explain the systematic classification of enzymes as proposed by the International Enzyme Commission (9 marks)

Name is based on **the reaction they catalyze (1 mark)**.

Adding the suffix **–ase** to a major part of the name of the **substrate (1 mark)**. Any of the **examples below (1 mark)**

- **Urease: urea** to ammonia and carbondioxide.
- **Arginase: arginine** to ornithine and urea.
- **Phosphatase: phosphate** esters.
- Lactase: Lactose
- Protease: Protein

Scientist lost it in view of the fact that several enzymes have been discovered **(1 mark)**.

Trypsin and catalase are names {not related to their substrate} that are **uninformative (1 mark)**.

{A systematic classification recommended by an **International Enzyme Commission (IEC)**.} **six major classes** and set of sub-classes according to the type of reaction catalyses **(1 mark)**. Each enzyme is assigned

- A **recommended** name that is usually very short **(1 mark)**.
- A **systematic** name that identifies the reaction it catalyses **(1 mark)**.
- A **classification number** that is needed where it is accurate and unambiguous **(1 mark)**.

{ An example is the enzyme that catalyses this reaction:
ATP + Creatine → phosphocreatine + ADP

The recommended name : creatine kinase.

The systematic name :ATP: creatine phosphotransferase.
Its classification number is EC 2.7.3.2

EC stands for Enzyme Commission.

The first digit (2) stand for the subclass phosphotransferase with a N₂ group acceptor and 2 stand for creatine kinase. }

3. (a) Briefly explain with examples the two main sources of protein to the body (3 marks)

i. Exogenous proteins: these are proteins taken into the body through eating (1¹/₂ marks).

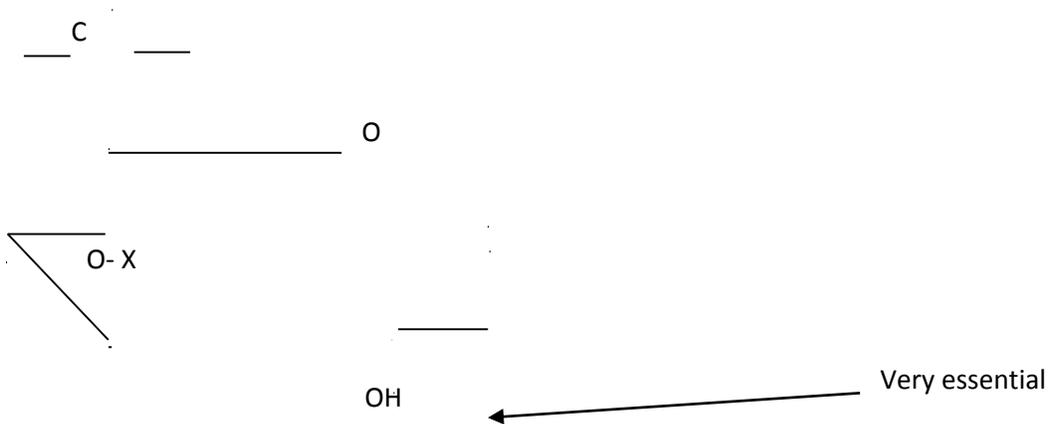
ii. Endogenous proteins: these are proteins generated within the body to sustain the need of the body (1¹/ marks).

(b) Discuss the two mechanisms proposed for the absorption of carbohydrates from the intestinal Lumen (22 marks)

All ingested carbohydrates consist of the **simple and the complex sugars** (1 mark). The complex sugars are **digested to the simple** sugars (1 mark).

The intestine will therefore contain a mixture of disaccharides, maltose, lactose and sucrose (1 mark) to be absorbed.

- The rate of absorption **depends on their concentration** in the intestinal lumen (1 mark).
- Two mechanisms have been proposed for absorption:-
- The macromolecules are linked with a **carrier** that has a very **high specificity** (1 mark).



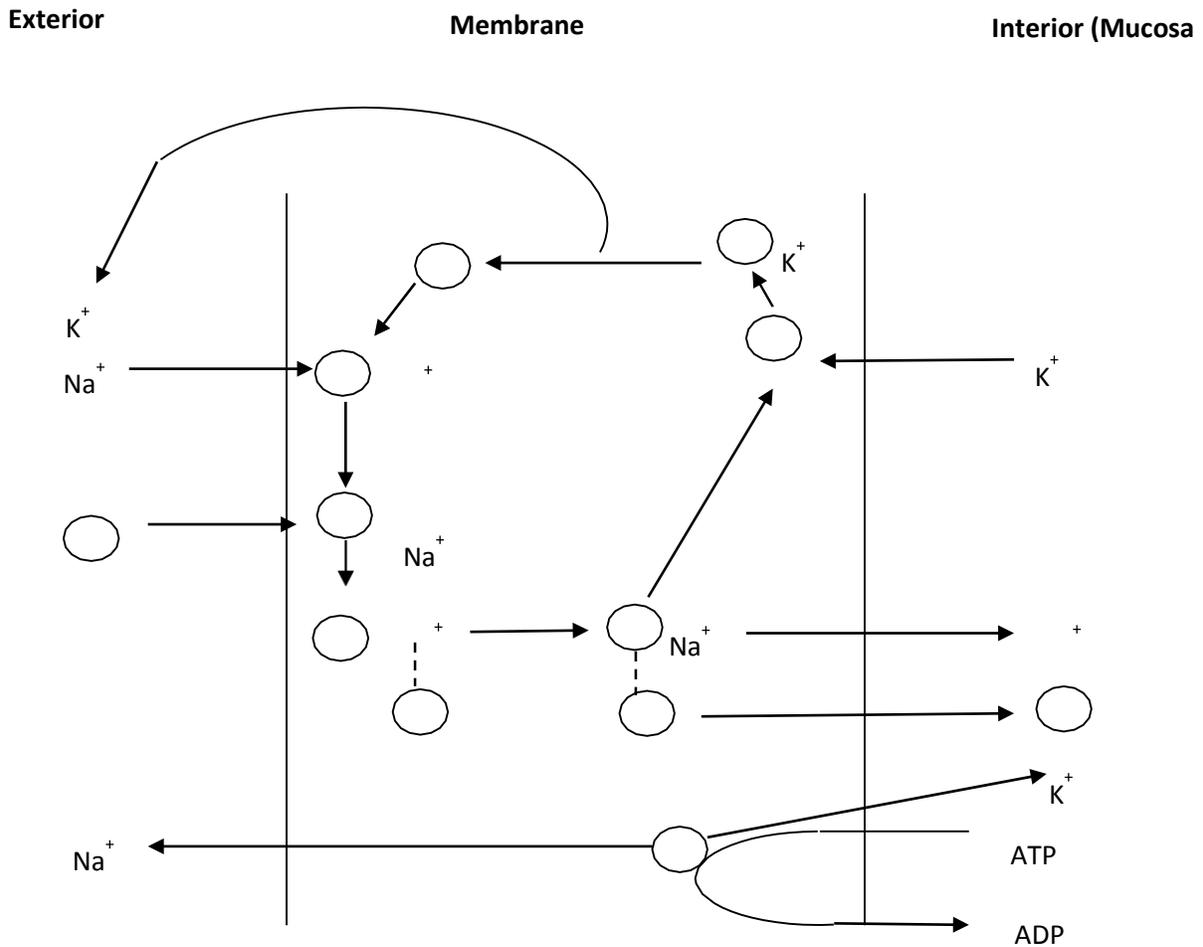
{DIAGRAM:- (2 marks)}

- The site of **X** has a lot of influence on the rate of transport e.g. 3-methyl glucose is

active while 3-ethyl and 3-propyl glucose are inactive (1 mark).

- The transport of glucose is linked to Na^+ , and K^+ transport (1 mark).
- Transport of a molecule of glucose from the lumen is accompanied by a **parallel transport of Na^+ and an anti-parallel transport of K^+** (1 mark).

- The following scheme was therefore constructed.



{DIAGRAM:- (5 marks) 1pt each for the lumen; membrane; mucosa sections; and also 2 pts for Na⁺-K⁺ pump below}

- {C is a carrier molecule }
- C has **low affinity** for the solute transported (glucose, etc.) until it is bound to Na⁺ when its **affinity increases** to a very large extent so that G can easily bind to C (2 marks).
- The **G-C-Na⁺** complex is then transferred to the membrane adjacent to the interior of the cell (1 mark).
- The carrier readily accept K⁺ from the interior of the cell transferring it to the exterior

(1 mark),

- The membrane **ATP phosphorylase (ATPase)** will transport K^+ back to the interior of the cell and Na^+ to the exterior (2 marks)
- the energy derived from hydrolyzing ATP is the **driving energy for the absorption** of substrate (**G**) (1 mark)

4. a) Write short notes on the principles and application of ANY THREE named separation techniques in biochemistry and or molecular biology which you have studied
(25 marks)

Topics covered: Biochemical Techniques

(b) **Answer hints:** Basic methods for analysis and assessment of biochemical parameters

(c) **Full answer:** (25 marks)

- i. Introduction: (2 marks)
- ii. List 3 methods/techniques (3 marks)
- iii. Explanation of principles for 3 techniques (10 marks)
- iv. Explanation of applications for the 3 techniques (10 marks)

5. Give a comprehensive account of the topography of the living cell and the structures and functions of the major cell components (25 marks)

Topics covered: Cell topography

(b) **Answer hints:** Organelles

(c) **Full answer:** (25 marks)

- i. General Layout & Introduction (5 marks)
- ii. Description/Listing of the various organelles (10 marks)
- iii. Function(s) of each identified organelle (10 marks)