



**RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES**

**Bachelor Science in Applied Sciences
First Year – Semester I Examination – July/ August 2023**

BIO 1201 – CELL BIOLOGY AND BIOCHEMISTRY

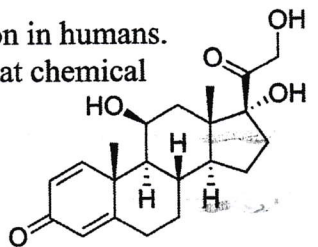
Time: Two (02) hours

This question paper consists of sections A, B and C. Answer ALL questions in section A and B and TWO (02) questions from section C.

Section A: Multiple choice questions (20 minutes)

Underline the most suitable option using a pen.

1.
 - a) Which of the following is the major role of molecular chaperones?
 - i. Renaturation of improperly folded proteins and unfolding them.
 - ii. Recognition of improperly folded proteins and unfolding them.
 - iii. Reactivation of denatured proteins.
 - iv. Folding the improperly folded proteins to their natural shape.
 - b) In oxidative phosphorylation, ATP is formed by
 - i. harvesting electrons through the electron transport chain.
 - ii. the ATP synthase enzyme using the proton gradient.
 - iii. transferring a phosphate group to ADP.
 - iv. transferring energy directly to ADP from a substrate.
 - c) Which of the following combinations include only active transport of molecules through membranes?
 - i. Sodium-Potassium pump, endocytosis, exocytosis
 - ii. osmosis, endocytosis, exocytosis
 - iii. exocytosis, diffusion, pinocytosis
 - iv. Sodium-Potassium pump, diffusion, phagocytosis,
 - d) The synaptonemal complex in meiosis enables the cell with the
 - i. alignment of chromosomes along the cell equator.
 - ii. random alignment of the sister chromatids along the cell equator.
 - iii. pairing of homologous chromosomes.
 - iv. arrangement of pairs of homologous chromosomes along the cell equator.

- e) Which of the following molecules could not serve as signal molecule for cells with intracellular receptors?
- Nitric Oxide (NO)
 - Steroid hormone
 - Sphingolipids
 - Glycine amino acid
- f) Which of the following is a reason for the ability of a single DNA polymerase enzyme to add nucleotides to both the leading and lagging strand at the same time?
- DNA polymerase acts very fast
 - The lagging strand loops allowing DNA polymerase to move in the same direction
 - DNA is synthesized in shorter fragments in the lagging strand
 - DNA Polymerase has three equally functional subunits
- g) People suffering from a certain disease showed elevated levels of dead organelles and toxic substances accumulated in the cell. Which cellular organelle would be faulty to cause the disease?
- mitochondrion
 - smooth endoplasmic reticulum
 - rough endoplasmic reticulum
 - lysosome
- h) Prednisolone is a drug that is commonly used to treat inflammation in humans. It is a non-polar molecule with a planar structure (see figure). What chemical class does it belong to?
- Lipid
 - Protein
 - Carbohydrate
 - Nucleic acid
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- i) Though hydrolysis of pyrophosphate and phosphoanhydride bonds in ATP yields the same amount of energy, ATP is considered to be better suited compared to pyrophosphate as the energy carrier molecule in the cell. This is because,
- ATP weakly binds to substrate molecules in biological reactions.
 - Pyrophosphate does not bind to substrate molecules in biological reactions.
 - Pyrophosphate cannot be hydrolysed easily in biological reactions.
 - Pyrophosphate binds reversibly to substrate molecules in biological reactions.
- j) The genome of mitochondria bears
- 95% of genes that code for proteins used in mitochondrial metabolism.
 - genes that code for proteins used in oxidative phosphorylation.
 - genes that code for proteins used in mitochondrial metabolism.
 - genes that code for proteins used in mitochondrial division.

(10 x 8 = 80 Marks)

Section B: Structured Essay Questions (40 minutes)

Answer all sections only in the space provided.

2.

- a) Write the empirical formula of carbohydrates.

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(03 marks)

- b) What is the generic name of the chemical subunit that makes polysaccharides?

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(03 marks)

- c) The above-mentioned (part b) chemical subunits can be oxidized by oxidizing agents (e.g.
- Fe^{+3}
- ,
- Cu^{+2}
-). Using the necessary reactions, describe how this happens.

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(08 marks)

- d) If the above-mentioned (part b) subunit has more than 4 carbon atoms, they are likely to make rings (cyclic form) in water. Describe how this could happen graphically using an example.

(12 marks)

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f) Explain briefly why polysaccharides are less soluble in water.

[illegible]

g) Describe why while animals transport carbohydrates in the form of glucose rather than as sucrose.

[illegible]

(Total: 60 marks)

3.

a) Describe briefly the role of enzymes in cells.

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(09 marks)

b) State how enzymes lower the activation energy of a reaction.

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(06 marks)

c) Explain the benefit of having a three-dimensional shape for enzymes in carrying out their role.

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(03 marks)

d) Describe how the pH affects the activity of enzymes.

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(09 marks)

[illegible]

a. $K_M = 4.7 \times 10^5 \text{ M}$
b. $K_M = 1.5 \times 10^8 \text{ M}$
c. $K_M = 1.5 \times 10^{-8} \text{ M}$
d. $K_M = 4.7 \times 10^{-5} \text{ M}$
e. $K_M = 4.7 \times 10^5 \text{ M}$

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(Total: 60 marks)

Section C: Essay questions (1 hour)

4. Explain how cells organize their functions through compartmentalization. **(100 marks)**
5. a) Describe the process of transcription in protein biosynthesis. **(75 marks)**
b) Explain the purpose of post-transcriptional modification in eukaryotic protein biosynthesis. **(25 marks)**
(100 marks)
6. Write short notes on the following.
a) Membrane proteins
b) Protein folding
c) Cell cycle
d) Mechanisms of cell signalling

(100 marks)**---END---**