P530/1
BIOLOGY
(Theory)
Paper 1
July-2025
2 hours

UGANDA ADVANCED CERTIFICATE OF EDUCATION
CONTINOUS ASSESMENT II-TERM II-2025
S.5
BIOLOGY
(Theory)
Paper 1
TIME: 2 hours

INSTRUCTIONS TO ITEM TAKERS

- Respond to all the items in this examination paper.
- You are advised to read the items carefully, prepare their responses, present them precisely and logically illustrating with well labeled diagrams where necessary.
- All the responses to the items must be written in the spaces provided.
- Use a pencil for drawings.

ITEM 1

A group of Biology students from a Ugandan A' level school participated in a hiking expedition to Mount Rwenzori. As they climbed above 3,000 meters, several students began experiencing increased breathing and heart rate, body weakness (fatigue), muscle cramps and many even fainted. They were rushed to the nearby regional hospital where several medical tests were conducted and the report revealed that the learners had no any medical condition and that the observed changes were a result of the level of the location toured.

The Doctors also decided to determine the saturation of Haemoglobin with oxygen in the lungs and muscle tissues (cardiac & skeletal) both at rest and during exercise. The results were recorded in the table below.

Location in Body	**Partial Pressure of O_2 (kPa)**	**% Hb Saturation during at rest**	**% Hb Saturation during exercise**
Lungs	13.3	97%	93%
Cardiac tissue	5.3	75%	30%
Skeletal tissue	2.7	35%	20%

Task:

(a) Account for the observed difference in the percentage saturation of haemoglobin during the exercise between the;

(i) Lungs and muscle tissues (**06 scores**)

(ii) Skeletal verses Cardiac muscle tissue (**06 scores**)

(b) Explain how the observed physiological changes in the learners' body came about? (**08 scores**)

(c) What can be done to minimize such effects next time they are to prepare for a similar expedition? (**04 scores**)

(d) Sketch a graph to show the saturation of haemoglobin in all the organs under high carbon dioxide levels and explain the significance of positions of the curves. (**04 scores**)

ITEM 2

A group of learners were studying specialized cells and how their organelles are modified to suit specific functions. Their biology teacher gave them two slide to observe under a microscope.

- Specimen **A**: A palisade mesophyll cell from a leaf.
- Specimen **B**: A cardiac muscle cell from heart.

After their observations, students noticed that while both cells contained basic organelles, they differed in the presence, quantity and specialization. The summary of their observations were recorded in the table below.

Organelle	**Specimen A**	**Specimen B**
Chloroplasts	Numerous	Absent
Mitochondria	fewer	Very many
Nucleus	Single	Very many
Endoplasmic reticulum	Less developed	Well developed

Task:

(a) Explain the structural differences between the two specimens that were observed under the microscope by the learners. (**08 scores**)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(b) Describe the structure of the organelle which is unique to only specimen **A**. (**06 scores**)

_____

_____

_____

_____

_____

(c) How does the structure of the cell organelle which is unique to specimen **A** relate to its functions? (**06 scores**)

ITEM 3

During a practical lesson on histology, learners were asked to examine three permanent slides, two of which were obtained from a plant stem while the other one was got from the leg of a goat.

- Slide **A**: Xylem tissue
- Slide **B**: Bone tissue obtained from the diaphysis of a long bone.
- Slide **C**: Phloem tissue.

Upon observation of the three slides, learners were puzzled by how the structures that looked different in the three tissues could perform vital roles in the organisms where they were obtained.

Task:

(a) Describe the structure of the tissue that was observed in slide **B**. (**08 scores**)

(b) Relate how the structures of tissue **A** and **C** relate to their functions? (**06 scores**)

(c) Give structural differences between tissue from slide **A** and **B**. (**04 scores**)

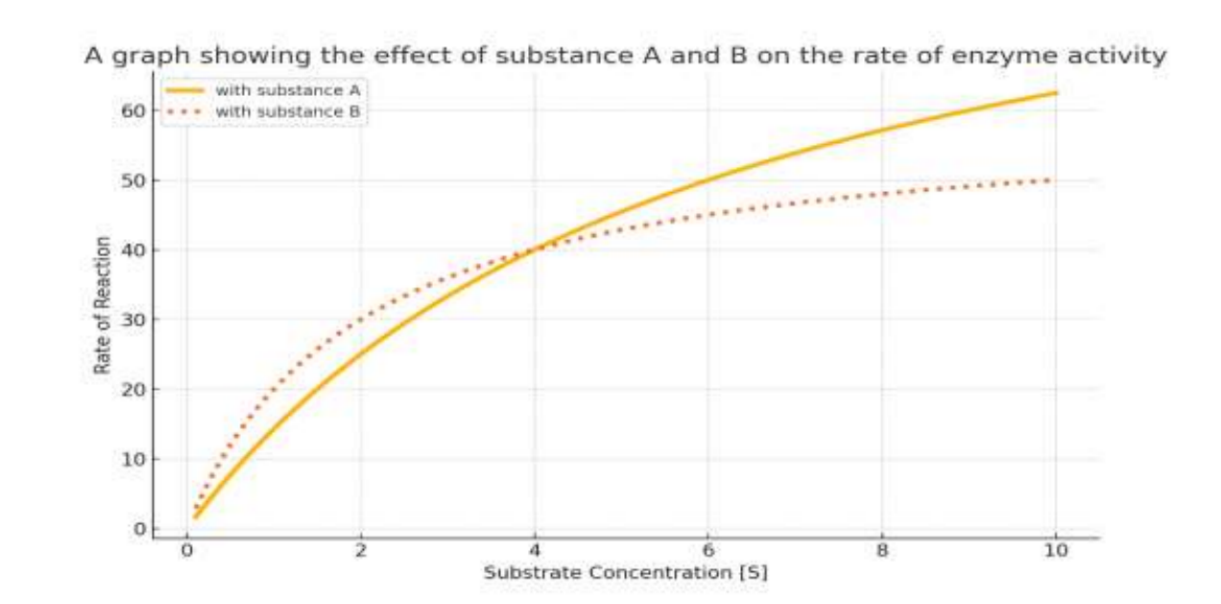
(d) Explain what would happen if;

(i) A mutation occurred which resulted the blockage of tissues from slide **A** and **C**? (**03 scores**)

(ii) The animal with tissue from slide **B** suffered from osteoporosis. (**03 scores**)

ITEM 4

A biotechnology company named **BioEnzyTech** limited is producing an important enzyme that breaks down a toxic compound found in industrial waste. However during the trials, it was observed that the presence of certain two substances **A** and **B** that came from a nearby chemical plant contaminated the industrial wastes and so affected the efficiency of the enzyme activity. The research team decided to do experimental investigations on how the two substances affected the enzyme activity. The results of their investigations were represented as shown on the graph below.



Task:

(a) Compare the effect of the two substances A and B on rate of enzyme activity. (**05 scores**)

(b) Explain any observed difference in the rate of enzyme activity caused by the presence of substance **A** and **B**. (**08 scores)**

(c) Predict with reason what would happen to the rate of enzyme activity if;

(i) Concentration of substance **A** was doubled while keeping the substrate concentration constant. (**04 scores**)

(ii) Concentration of substance **B** was doubled while keeping the substrate concentration constant. (**04 scores**)

(d) Of what commercial importance are substances **A** and **B**? (**03 scores**)

(e) Evaluate the advantages and disadvantages of using substances **A** and **B** in industrial enzyme applications where precise control of the reaction rate is required? (**04 scores)**

END