

P530/1
Biology
(Theory)
Paper 1

UGANDA ADVANCED CERTIFICATE OF EDUCATION

S.5 END OF TERM ONE, 2025

BIOLOGY THEORY

TIME: $2\frac{1}{2}$ HOURS

INSTRUCTIONS:

- Attempt all the items in the spaces provided.
- Organize all your responses logically and precisely.

ITEM 1

Martin, a researcher is developing a new drug that must enter the human cell in order to effectively destroy the infectious bacteria inside. During the testing of the drug, he observed that some drugs molecules would pass easily through the cell membrane while others did so after being aided by some special molecules within the cell membrane. He also noted that the membrane remained flexible despite changes in the external temperature.

When he consulted a cytologist about the structure of the cell membrane and its behavior, he was surprised when the cytologist described it as "**fluid mosaic**" and also added that it behaves as "**selectively permeable barrier**".

Task:

- (a) Why did the cytologist describe the structure and behavior of that membrane as so? (06 scores)

(b) Provide a description of the structure of the cell membrane as described by the cytologist. (09 scores)

(c) Point out the key differences in the ultrastructure between the two cells Martin is dealing with in his investigations to develop the new drug. (05 scores)

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ITEM 2

A group of scientists discovered a rainforest ecosystem. They observed that large trees in the forest would transport water from their roots to the leaves. A nearby lake contained green plants, fish and some insects that would walk on water. They also noted that during a harsh winter, the fish and other aquatic organisms continued to survive beneath. However during summer, the nearby factory would release sewage and oil which floated thereby harming the ecosystem. However, when they got some water from the lake and added some powdered medicine, it was dissolved and never floated like oil did leaving them amazed.

Task:

- (a) Explain the properties of water that enabled it to perform such biological roles that were observed by the group of scientists? (08 scores)

- (b) Why did the medicine behave differently with the water unlike with the oil? (06 scores)

(c) Explain the likely impacts/consequences of having such a factory in that ecosystem? (07 scores)

(d) Explain the various strategies that can be done to conserve such an ecosystem? (04 scores)

ITEM 3

James, one of the member on a team of scientists prefers a diet rich in saturated fats and cholesterol. This team visited various ecosystems with different environmental temperatures so as to observe the nutrient compositions of animals that live in such places. It was observed that desert animals like camels stored a large amounts of fats in their humps as well as hibernating animals. They further noted that the poikilothermic animals that live in extreme cold climates had a higher proportion of unsaturated fatty acids compared to homoeothermic animals.

Task:

(a) Explain why such desert and hibernating animals prefer to store such food reserves than any other? **(05 scores)**

(b) Account for the observation made by the scientists between the poikilothermic and homoeothermic animals that live in cold climates. **(04 scores)**

(c) Explain to James the likely health risks associated with his diet and also advise him on how he can live a better life? **(08 scores)**

(d) In what ways would James' diet help to contribute to both structural and physiological functions in his body? **(08 scores)**

ITEM 4

A team of 5.6 students obtained pieces of tissues from a mammal and plant and examined them using an electron microscope. They observed a piece of tissue lining the small intestine and another one forming the outermost layer of the skin. They also observed a piece of tissue from plant leaf and noticed a layer of tightly packed cells on the surface. This left these students amazed by the enormous differences that were shown by these tissues of animals and plants.

Task:

- (a) Identify the plant and animal tissues that were observed and describe their functions. (06 scores)

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- (b) How does the structure of the observed plant and animal tissues relate to their functions? (08 scores)

- (c) Explain the advantages that are associated with that level of cellular organization to the respective organisms. (06 scores)

END