P530/2

BIOLOGY

PAPER 2

2½ hours

March 2023

Uganda Advanced Certificate of Education

BIOLOGY DEPARTMENT – 2023

SET TWO

PAPER 2

THEORY

2 hours 30 minutes.

INSTRUCTIONS TO CANDIDATES:

- ✓ Answer question one in section **A** plus three others from section **B**.
- ✓ Candidates are advised to read the questions carefully, organize their answers and present them precisely and logically, illustrating with well labeled diagrams where ever necessary.
- ✓ Write on the answer sheet, your name, index number and the questions attempted in their order as shown in the table.

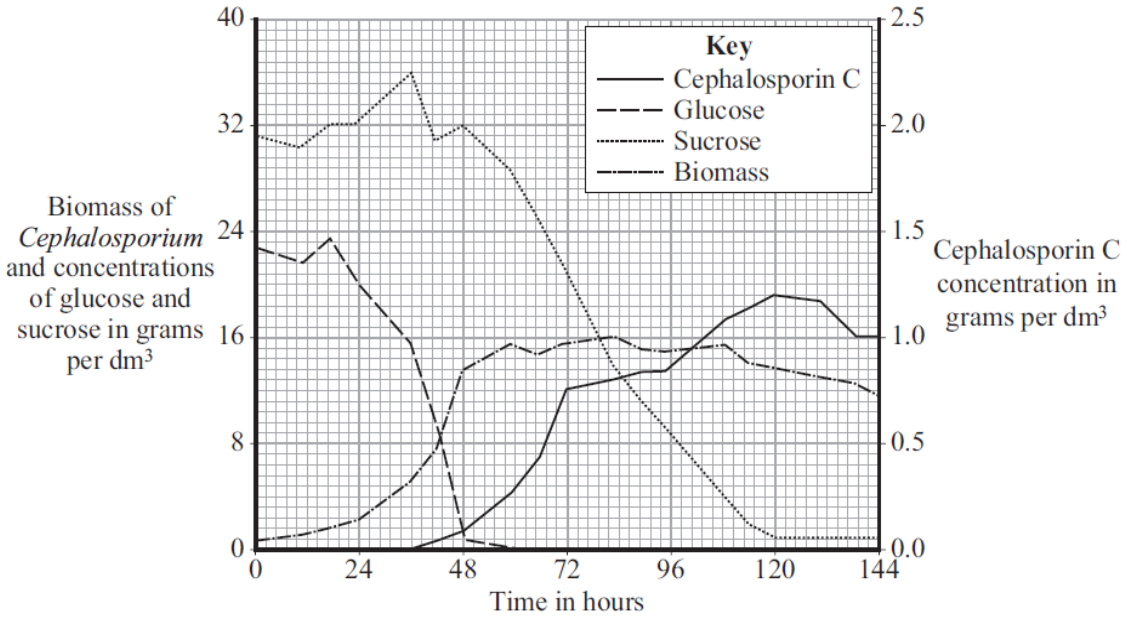
QUESTION	MARKS
TOTAL	

SECTION A: (40 Marks)

Compulsory.

1. In an investigation to determine the rate of substrate consumption during antibiotic production, a fermenter was used to grow the fungus ***Cephalosporium*** which makes the antibiotic **Cephalosporin C**. The reaction medium contained a mixture of the sugars glucose and sucrose, and other mineral ions. The fermentation chamber was flashed with nitrogen under sterile air.

   The graph below shows changes in the concentrations of **glucose, sucrose, Cephalosporin C** and the **biomass of *Cephalosporium*** measured in the fermenter over 6 days.



a) Describe the changes in concentrations of glucose and cephalosporin C through the 6-days period.

   i. Glucose concentration. **(04marks)**

   ii. Cephalosporin C **(04marks)**

b) State and explain the relationship between glucose concentration, the biomass of *Cephalosporium* and the concentration of Cephalosporin C. **(06 marks)**

c) What evidence is there that *Cephalosporium* is able to use glucose more easily than sucrose? **(03marks)**

d) Ethanol is one of the primary metabolites formed in the fermentation chamber.

   i. Sketch a graph to show how the concentration of ethanol and biomass of Cephalosporium would vary with time. **(03marks)**

   ii. Explain the relationship between ethanol and biomass of Cephalosporin as sketched in (i) above. **(04marks)**

e) Explain the following observations. Why

i. Other mineral ions were added to the reaction medium? **(02marks)**

ii. Nitrogen was flashed in the reaction vessels? **(02marks)**

iii. Sterile air was used to introduce nitrogen? **(02marks)**

f) Apart from antibiotic production, name any other three industrial processes that rely on fermentation. **(03 marks)**

g) Distinguish fermentation with the Cephalosporium from that of mammalian cells. **(05marks)**

SECTION B: (60 Marks)

Attempt only 3 questions from this section.

2. (a) Describe the role played by the different microorganisms in the following stages of the nitrogen cycle.

i. Nitrogen fixation. **(03marks)**

ii. Nitrification. **(05marks)**

iii. Denitrification. **(03marks)**

(b) Account for the significance of nitrogen incorporated into the different body components in living organisms. **(09marks)**

3. (a) How is support achieved in vegetable plants? **(06marks)**

(b) Describe how mass flow hypothesis accounts for the movement of organic substances in plants. **(08marks)**

(c) Outline the evidences for and against mass flow hypothesis. **(06marks)**

4. (a) How significant is the proximal convoluted tubules in the functioning of the kidneys? **(12marks)**

(b) What are the adaptations of the proximal convoluted to performing it functions? **(08marks)**

5. (a) Explain what is meant by the term mutation? **(05marks)**

(b) How are mutations a basis for variations in a population? **(10marks)**

(c) State the main features of mutations. **(05marks)**

6. (a) Which structures in;

(i) Hydra, **(05marks)**

(ii) Paramecium, **(05marks)**

are functionally equivalent to the following structures in the human: skin, mouth, anus, kidney and limbs?

(b) Outline the advantages and disadvantages of multicellularity over unicellularity. **(10marks)**

END