Candidates are advised to use the first 15 minutes for reading through this paper carefully.

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of NINE questions.

2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section and should spend no more than 30 minutes on this section. Answers to this section MUST be written in this answer booklet.

3. Section B consists of SIX questions. Candidates must attempt THREE questions in this section, ONE question from EACH module. Answers to this section MUST be written in the answer booklet provided.

4. The use of silent non-programmable calculators is allowed.
1. Figure 1 is an illustration of the apparatus used to measure the rate of photosynthesis of a water plant, *Elodea*, over a known period of time.

(a) Explain how the apparatus can be used to measure the rate of photosynthesis.
The graph in Figure 2 shows the results of an experiment in which a plant was exposed to light at varying intensities and at different concentrations of carbon dioxide. The rate of photosynthesis was measured as the volume of oxygen per unit time.

Figure 2.

(i) Explain the shape of Curve A.

(ii) Compare Curves A and B and account for the observed differences.

(iii) Suggest a possible hypothesis for this experiment.

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Total 10 marks
2. (a) Figure 3 (a) is a longitudinal section of part of the wall of the heart, as seen on a microscope slide. Figure 3 (b) is a diagram of the structure of the heart.

(i) By means of a plan drawing (without drawing actual cells), draw in outline the structures shown in Figure 3 (a). Use the space below and a magnification of x1.


Figure 3 (a)

Figure 3 (b)
(ii) By means of a ruled square or rectangle, indicate on Figure 3 (b), the location of the drawing you provided in (a) (i). [1 mark]

(b) On the drawing of Figure 3 (a), use labels to identify EACH of the following:

(i) The identity of the structures marked A, B, C, D

A ____________________________

B ____________________________

C ____________________________

D ____________________________

(ii) The areas labelled E and F

E ____________________________

F ____________________________ [3 marks]

(c) State the width of the wall at G as a proportion of the wall width at H.

__________________________________________ [1 mark]

(d) Give a reason for the differences in width you gave in your answer to (c).

__________________________________________ [2 marks]

Total 10 marks
3. Figure 4 shows the outcome of a study among men whose cumulative increase in risk for developing lung cancer (as a %) was determined in association with the age at which they stopped smoking.


**Figure 4**

(a) Use the data from the graph to answer the following questions:

(i) At age 75 which group has

   a) the HIGHEST cumulative risk?

   b) the LOWEST cumulative risk?

(ii) In this study, at what age have all men been considered to have a cumulative risk of zero?

   [ 1 mark ]

   [ 2 marks]
(iii) At age 65, what is the difference in risk between those who stopped smoking at 30, compared with those who stopped smoking at age 50?

[1 mark]

(iv) Suggest how the failure of 50-year-old men in 2007 to quit smoking will affect their risk of developing lung cancer in 2027 in comparison with those who never smoked.

[2 marks]

(b) Ten 35-year-old women comprise 5 smokers (Group A) and 5 non-smokers (Group B). How could you precisely design an experiment, and what measurements would you take in order to determine which group is the fittest in relation to their pulse rate (P), their blood pressure elevation (BP) and their breathing rate, (BR), following exercise. The equipment you are provided with is

1. a set of stairs
2. equipment to measure blood pressure
3. a stopwatch.

[4 marks]

Total 10 marks
SECTION B

You must answer THREE questions in this section. Answer ONE question EACH from Modules 1, 2 and 3. You MUST write your answers in the answer booklet provided.

MODULE 1

Answer EITHER Question 4 OR Question 5.

4. (a) For living organisms state TWO specific cellular processes that require energy, giving brief explanations as to why energy is required. [2 marks]

(b) (i) What is meant by the term 'glycolysis'?

(ii) Describe, in their correct sequence, SIX major steps in glycolysis. [8 marks]

(c) (i) 'Anaerobic respiration' is considered to be inefficient, in terms of energy, when compared to aerobic respiration.

Discuss this statement referring to SIX points in your discussion.

(ii) Discuss, using FOUR points, the importance of the production of lactate when a person does sustained vigorous exercise. [10 marks]

Total 20 marks

5. (a) In an ecosystem, energy and nutrients flow through three nutritional groups, namely producers, consumers and decomposers. State the sources and the differences between energy flow and nutrient flow through these nutritional levels. [6 marks]

(b) When nutrients cycle through an ecosystem, point out the advantages of a food web over a food chain. [4 marks]

(c) In tropical rainforests, leaves, fruits and branches fall to the ground and are subject to the action of micro-organisms and chemical actions which regenerate minerals essential for further plant growth. Apply your knowledge of the nitrogen cycle to explain, in detail, how deforestation/slash-and-burn interferes with EACH stage of the cycle. [10 marks]

Total 20 marks
MODULE 2

Answer EITHER Question 6 OR Question 7.

6. (a) (i) Draw a large, labelled diagram to illustrate the detailed structure of a nephron of a mammalian kidney.
(ii) Outline the role of the 'Loop of Henle' in water conservation. [10 marks]
(b) Discuss the effect that pregnancy has on the functioning of the kidney. [2 marks]
(c) High glucose and protein levels were detected in a urine sample from a 60-year-old patient.
Discuss the clinical significance of this result. [8 marks]
Total 20 marks

7. (a) (i) Give a large, clear drawing of a section through a synapse, and label the pre- and post-synaptic membranes.
(ii) Label FOUR additional structures you have clearly drawn.
(iii) Describe briefly the sequential steps which occur in the transmission of an impulse across a synapse, and its reception at the post-synaptic membrane. [10 marks]
(b) Clarify the role and mode of action of synapses in the following events.
(i) The waking cries of the baby in the bedroom gradually penetrate our awareness. [6 marks]
(ii) A dish of food given to you is painfully hot and your reflex action urges you to drop it. However, it is your mother's favourite china and you immediately hold on even though your fingers are burning. [6 marks]
(c) Discuss FOUR points of difference between the operation of the nervous and endocrine systems in response to stimuli. [4 marks]
Total 20 marks
MODULE 3

Answer EITHER Question 8 OR Question 9.

8. (a) (i) Explain how HIV causes AIDS. [12 marks]
(ii) Outline FIVE symptoms of AIDS.
(iii) Discuss the impact of AIDS in the Caribbean.

(b) (i) Briefly explain how malaria is transmitted to humans.
(ii) Discuss the role of biological factors in the prevention and control of malaria. [ 8 marks]

Total 20 marks

9. (a) (i) Explain what is meant by the term ‘restriction enzymes’ and state their normal function in life.
(ii) Describe how restriction enzymes are used in genetic engineering using plasmids, bacteria and gene probes to produce recombinant DNA, which includes a specific transplanted gene. [10 marks]

(b) (i) Comment on the therapeutic procedures used to treat a genetic disorder.
(ii) Gene therapy can be applied to both germ cells and somatic cells. Most countries prohibit the application of germ cell therapy in humans. Give reasons for their decision. [10 marks]

Total 20 marks

END OF TEST

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