



TEST CODE 002375

P1

FORM TP 23179

MAY/JUNE 2003

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

BIOLOGY

UNIT 2 – PAPER 02

*2 hours*

In addition to the 2 hours, candidates are allowed a reading time of 15 minutes. Candidates may write in their answer booklets during this 15-minute period.

**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.

SECTION A

You must attempt ALL THREE questions in this section. You should NOT spend more than 30 minutes on this section.

1. (a) Students were asked to set up the apparatus to show that an aquatic green plant, such as Canadian pond weed (*Elodea*), produces oxygen during photosynthesis. The apparatus was to be set up so that evolution of oxygen bubbles could be observed, and the rate of production of bubbles measured.

In the space below, draw the apparatus you would use for this purpose. No labels are required.

[ 3 marks]

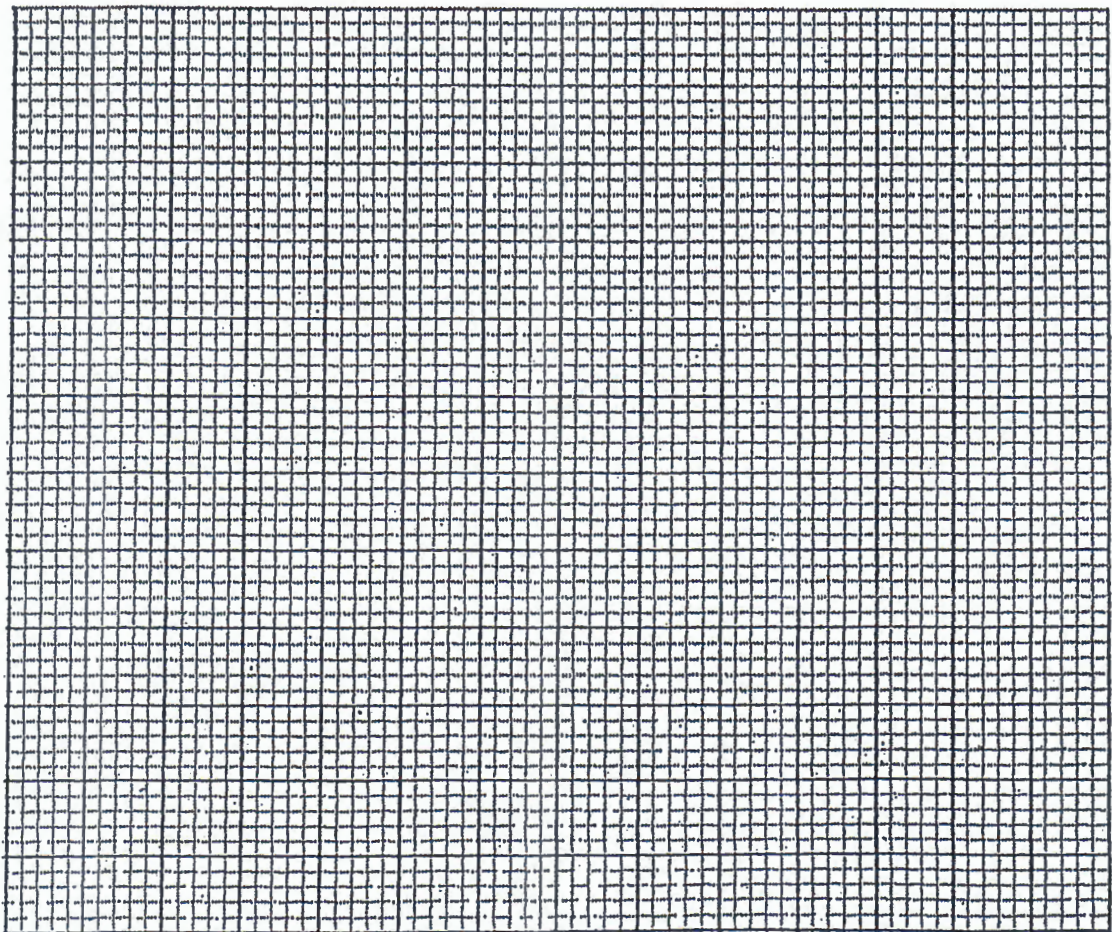
GO ON TO THE NEXT PAGE

- (b) The apparatus you have drawn in 1 (a) was used to determine the rate of photosynthesis under different wavelengths of light. Students were asked to find out how long it took for 25 bubbles of oxygen to be evolved. The results are shown in Table 1.

Table 1. Time Taken (in Seconds) for 25 Bubbles of Oxygen to Accumulate when Pond Weed is Exposed to Different Wavelengths of Light

Colour of Incident light	Far Red	Red	Orange	Yellow	Green	Blue-Green	Blue	Violet	Ultra Violet
Time taken (Seconds)	200	20	40	140	150	70	40	60	200+

On the graph grid below, construct a histogram from the data in Table 1 above.



[ 4 marks]



(c) Figure 1 shows the absorption spectrum of Chlorophyll a.

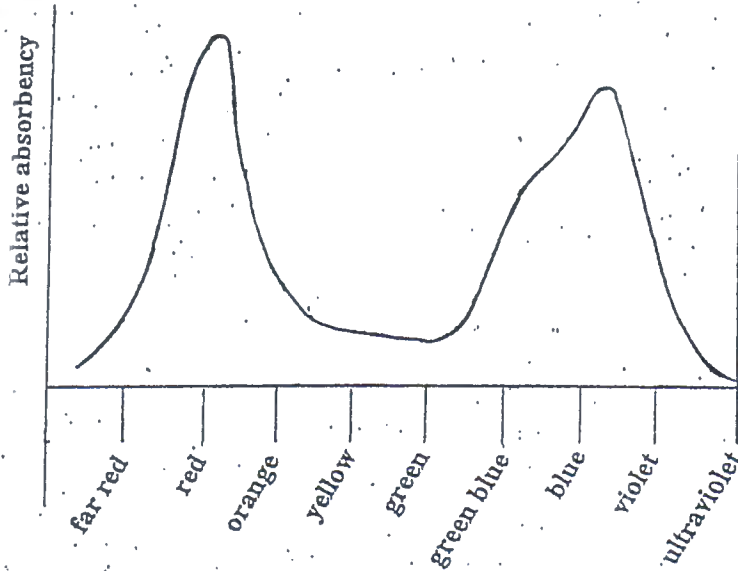


Figure 1

(i) Comment on the relationship between the histogram you have drawn and the graph in Figure 1.

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[ 2 marks ]

(ii) State ONE other limiting factor besides the wavelength of light, in the experiment.

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[ 1 mark ]

Total 10 marks



2. Figure 2, below is a microscopic slide of a transverse section of a leaf of Marram Grass. This sturdy grass grows on exposed sandy sea-shores, just above the high water mark. It is well adapted to coping with water stress.

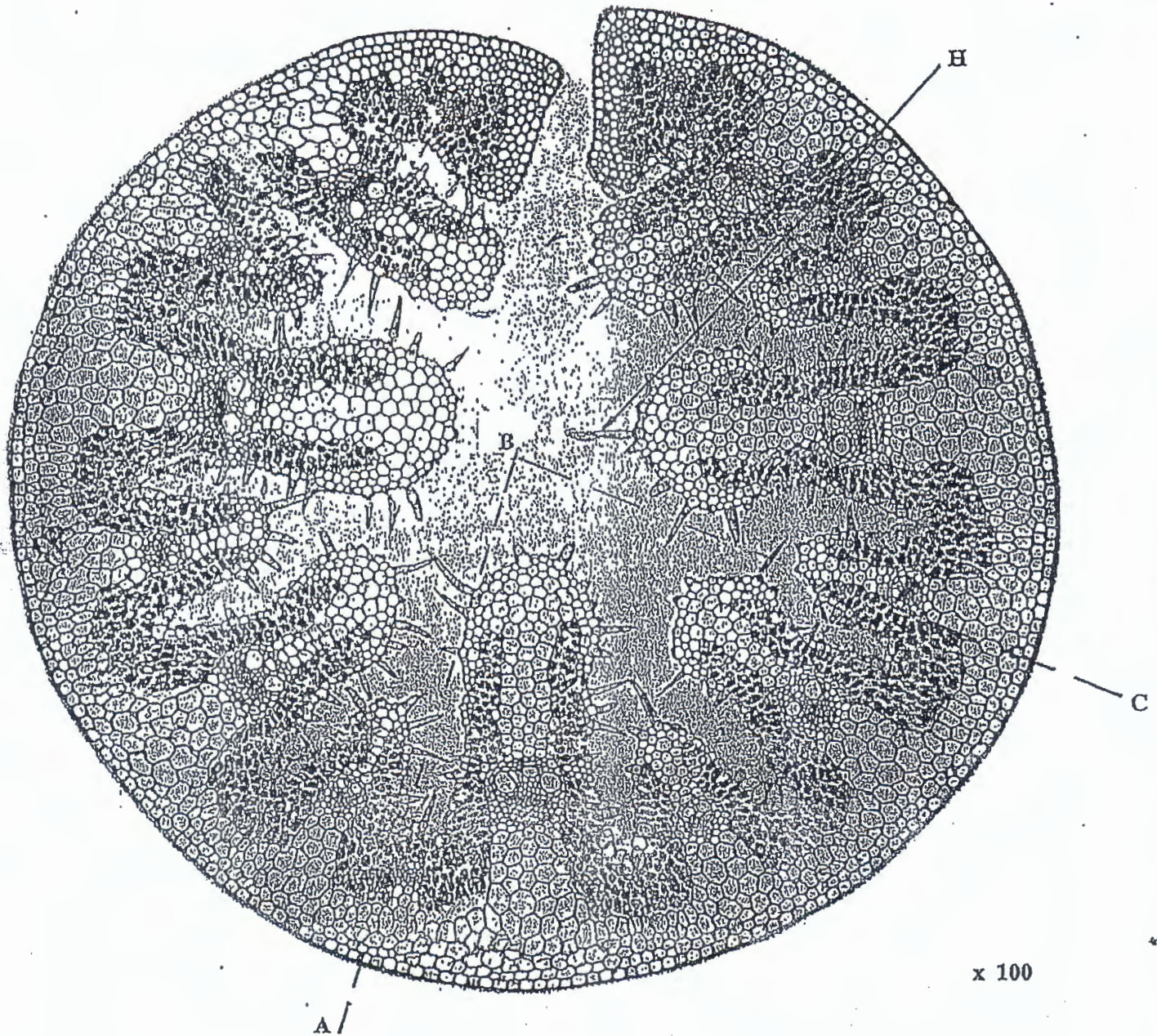


Figure 2

*From Skills in Advanced Biology Volume 2,  
Observing, Reading and Interpreting. J.W. Garvin and J.D. Boyd.  
Stanley Thornes (Publishers) Ltd. Cheltenham. 1990.*

- (a) In the space provided on the opposite page, draw the ENTIRE outline of the leaf, the same size and proportion as in Figure 2. Copy the labels 'ABC' on to your drawing, then carefully and accurately draw the distribution of tissues in this segment only. (No cells are to be drawn).



Drawing of the outline and a pie segment of a section through the leaf of Marram Grass with the tissue distribution shown in the segment.

[ 4 marks]

(b) Label the following structures on your drawing of segment ABC:

- Parenchyma tissue
- Photosynthetic tissue
- Phloem tissue
- Hinge cells (large upper epidermal cells, which act as 'hinges' and are found at the base of the grooves on the upper epidermis)

[ 2 marks]

(c) State TWO features of the habitat of Marram Grass which cause water stress.

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[ 1 mark ]

(d) State the actual length of the structure labelled 'H'?

Answer \_\_\_\_\_

[ 1 mark ]

(e) State ONE feature of the lower epidermis, which enables it to conserve water.

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[ 1 mark ]

(f) Suggest ONE mechanism by which the hinge cells control the degree of rolling of the leaf.

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[ 1 mark ]

Total 10 marks

3. (a) Define the term 'restriction enzyme'.

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[ 2 marks]

(b) Plasmid X, shown in Figure 3 A below, has three sites that can be cut with the restriction enzymes Hind III, E COR 1 and Bam HI.

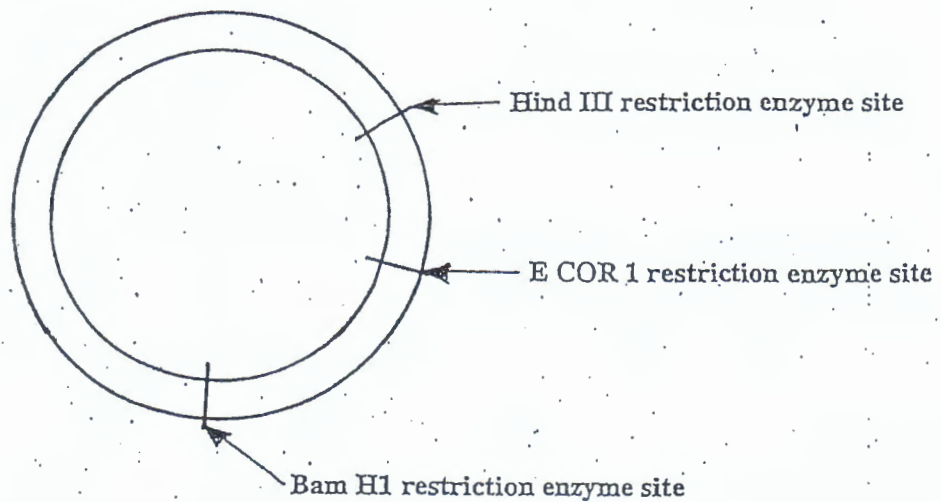


Figure 3 A. Plasmid X.

The three restriction enzymes Bam HI, E COR 1 and Hind III are added to the plasmid and an enzymatic reaction is allowed to occur. The plasmid DNA fragments are analysed by gel electrophoresis in order to determine the lengths of the fragments.

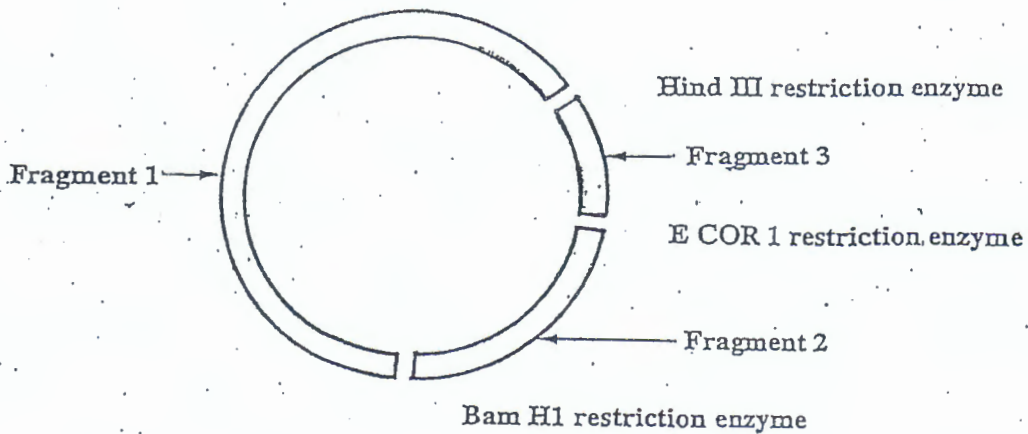


Figure 3 B. Plasmid X, cut into three fragments



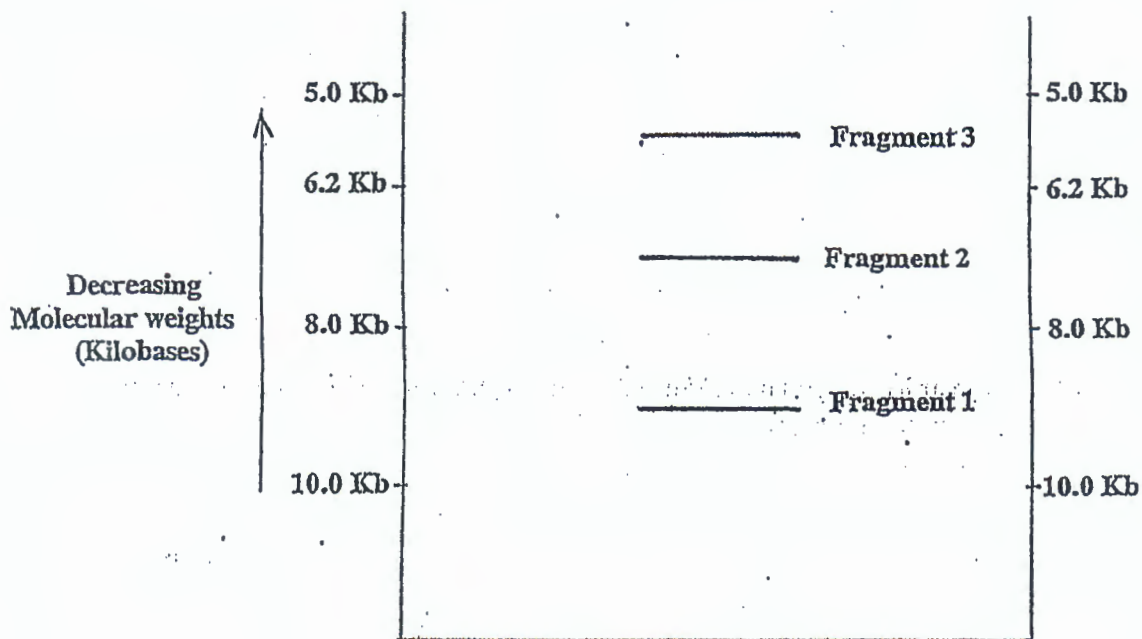


Figure 3 C. Gel Electrophoresis

Determine the lengths of Fragments 1, 2 and 3. Show your working.

Fragment 1 \_\_\_\_\_

\_\_\_\_\_

Fragment 2 \_\_\_\_\_

\_\_\_\_\_

Fragment 3 \_\_\_\_\_

\_\_\_\_\_

[ 6 marks ]

(c) What is 'gene therapy'.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[ 1 mark ]

(d) Suggest ONE benefit of gene therapy.

\_\_\_\_\_  
\_\_\_\_\_

[ 1 mark ]

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) Describe glycolysis and the Krebs' Cycle and explain how these metabolic pathways are linked. [10 marks]
- (b) 2, 4 dinitrophenol is a chemical that freely transports  $H^+$  ion through the inner membrane of mitochondria. Cyanide inhibits the protein complex that transfers electrons in the electron transport chain to  $O_2$ . With specific reference to the electron transport chain in mitochondria, deduce how 2, 4 dinitrophenol and cyanide would prevent the formation of ATP. [ 5 marks]
- (c) The AVERAGE speed of a 5000 metre run in the Olympics, is slower than the 100 metre dash. Runners breathe deeply and pant, after completing the 100 metre race. Discuss the reasons for these phenomena. [ 5 marks]

Total 20 marks

5. (a) With reference to ONE example in EACH case, distinguish between the terms:
- (i) Ecosystem [ 4 marks]
- (ii) Habitat [ 3 marks]
- (iii) Niche [ 3 marks]
- (b) Trophic levels within an ecosystem can be analysed by using the concept of THREE different ecological pyramids. Comment on the SHAPE and ACCURACY of each of these pyramids in interpreting the interrelations of the levels. [10 marks]

Total 20 marks



MODULE 2

Answer EITHER Question 6 OR Question 7.

6. (a) A student has a tomato plant which has many large mature leaves, two small developing leaves and one large tomato. Describe the pressure-flow theory of sugar transport in the phloem in relation to this tomato plant. [10 marks]
- (b) When a normal aphid pierces a sieve tube, the pressure in the tube forces fluid out of the plant and into the aphid's digestive tract. A mutant form of aphid inserts its stylet into the vessel elements of the xylem instead of the phloem. Deduce if xylem fluid would flow into the aphid and if the aphid could live on xylem fluid. [6 marks]
- (c) In an experiment, Tomato Plant A was kept in soil that was continuously flooded with water. Tomato Plant B was kept in soil and was regularly given water containing a high concentration of salt. Suggest the effects these conditions would have on the uptake of ions and water by the plant roots. [4 marks]

Total 20 marks

7. (a) Describe the way in which each of the following, present in the hepatic portal vein, is eventually excreted in the urine
- (i) excess protein
  - (ii) excess water
- [10 marks]
- (b) While atmospheric air contains 21 % of oxygen, alveolar air only contains 13 % of oxygen. Despite this the haemoglobin in the pulmonary vein is 95 % saturated. Account for this. [4 marks]
- (c) Comment on the benefits of homeostasis. [6 marks]

Total 20 marks

MODULE 3

Answer EITHER Question 8 OR Question 9.

8. (a) Explain how the maintenance of a physically fit body and adherence to a balanced diet can reduce the incidence of hypertension, obesity and cardiovascular diseases. [10 marks]
- (b) People with anorexia nervosa experience an intense fear of gaining weight. They achieve weight loss by eating little food, self-induced vomiting, laxative intake and excessive exercise. In bulimia nervosa persons consume extraordinarily large amounts of food, followed by self-induced vomiting and laxative consumption. Girls and young women are most at risk for these diseases. Suggest how many categories of disease, EACH of the following fall under. Give reasons for your answer.
- (i) Anorexia nervosa
- (ii) Bulimia nervosa [5 marks]
- (c) With reference to the causes, progression and eventual outcome of AIDS, suggest why current AIDS treatments do not cure. [5 marks]

Total 20 marks

9. (a) Give an account of the development, maturation and functions of the two groups of lymphocytes. [10 marks]
- (b) Tumour cells differ from normal cells. Suggest how such differences could be exploited in cancer treatment. [4 marks]
- (c) The common cold is a common occurrence because no vaccine is effective. Discuss this statement. [6 marks]

Total 20 marks

END OF TEST