

FORM TP 2015147



TEST CODE **0210702**

MAY/JUNE 2015

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

BIOLOGY

UNIT 1 – Paper 02

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions in TWO sections. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. You may use a silent, non-programmable calculator to answer questions.
5. You are advised to take some time to read through the paper and plan your answers.
6. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
7. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.



SECTION A

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

1. (a) Table 1 summarizes the results of an experiment comparing the effect of temperature on two protease enzymes, one from a mammal that lives in the tropics and the other from a prokaryote living in hot springs. The enzyme activity is expressed as a percentage of its maximum efficiency.

TABLE 1: EFFECT OF TEMPERATURE ON TWO PROTEASE ENZYMES

Temperature °C	% Maximum Efficiency	
	Prokaryote Protease	Mammalian Protease
0	0	0
5	0	10
10	0	25
20	8	35
30	15	48
40	30	95
50	45	35
60	65	0
70	100	0
90	40	0

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- (i) On the grid in Figure 1, plot the data in Table 1 for the mammalian protease as a line graph. [3 marks]

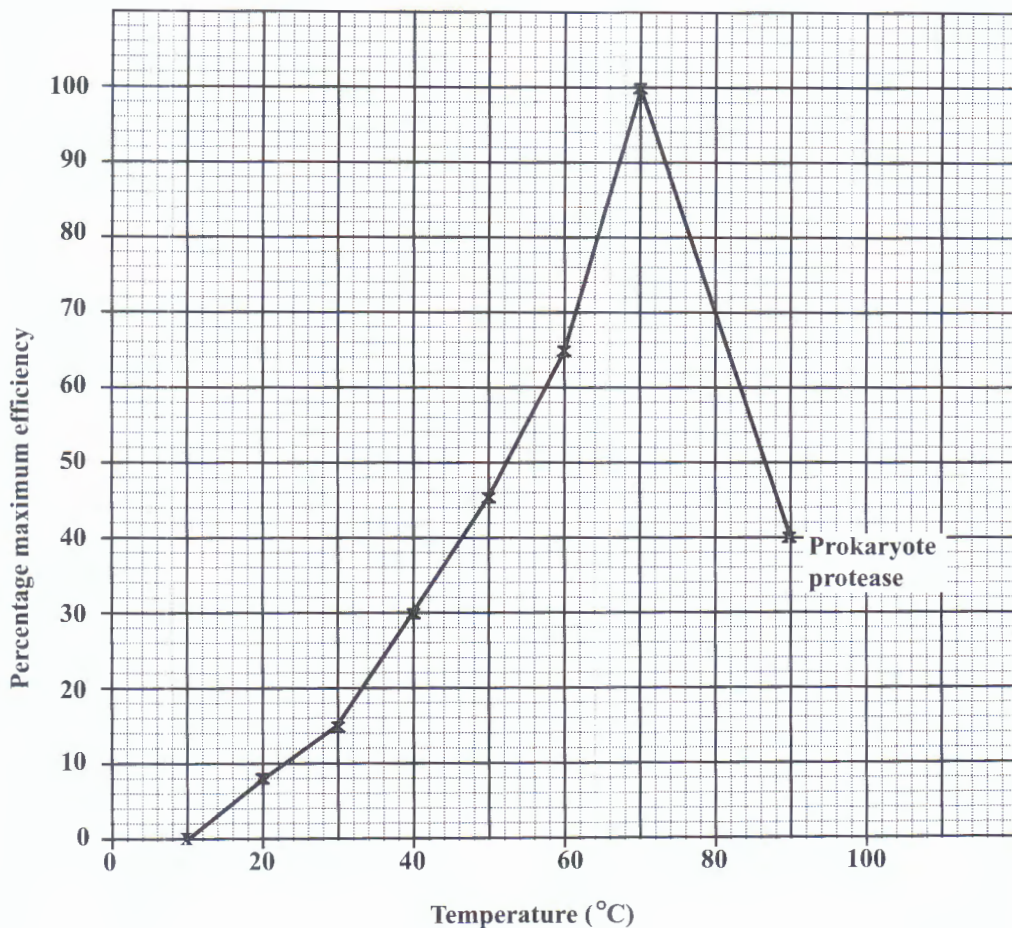


Figure 1. Effect of temperature on protease enzymes

- (ii) Using arrows labelled **P1** and **P2**, indicate, on the *x*-axis of Figure 1, the temperature at which EACH protease enzyme functions at its maximum efficiency. What accounts for any difference observed?

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[3 marks]

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- (iii) Enzymes are mainly globular proteins. With reference to the levels of protein organization, explain the effect of temperature on the prokaryote protease between 75 °C and 90 °C.

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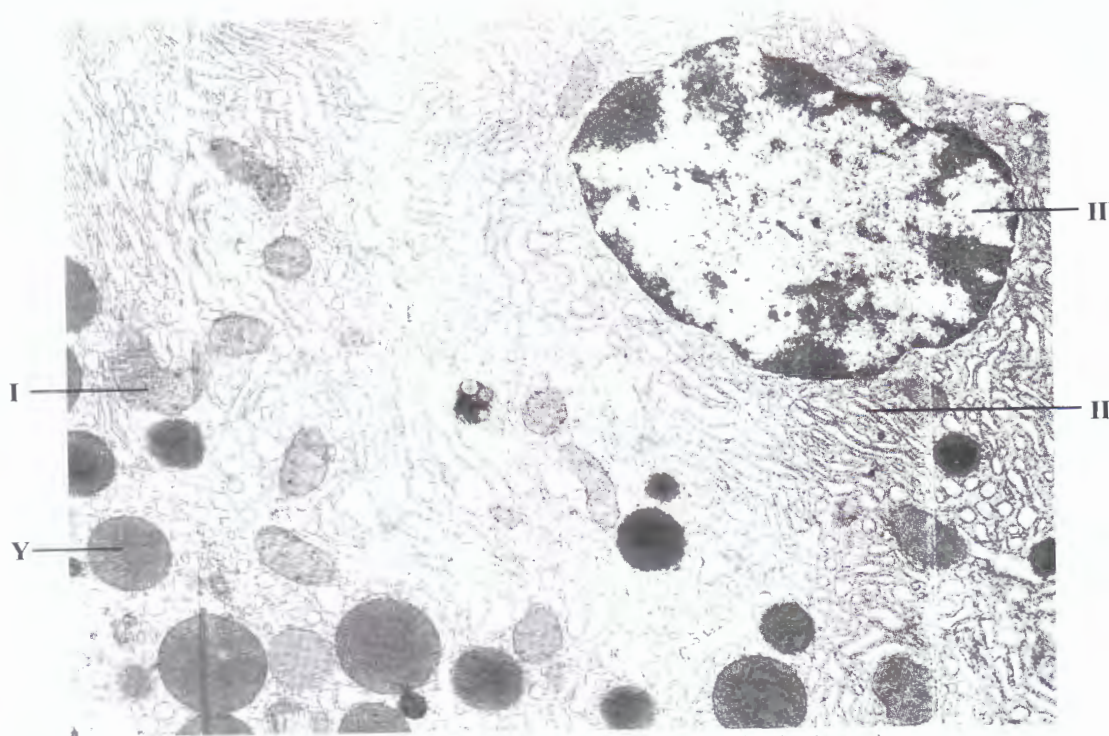
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[3 marks]

- (b) Figure 2 is an electron micrograph of a mammalian liver cell.



Courtesy of T. Howard. Cold Spring Harbor. Noncommercial, educational use only.

Figure 2. Transmission electron micrograph of a liver cell

Source: <http://www.dnalc.org/view/16649-Gallery-30-An-electron-micrograph-of-a-mouse-liver-cell.html>

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(i) Identify the organelles labelled I, II and III.

I:

II:

III:

[3 marks]

(ii) If the actual size of the structure labelled Y is 1.5 μm , calculate the magnification of the electron micrograph in Figure 2.

Magnification:

[1 mark]

(iii) Suggest a reason which may account for the extensive network of membranes seen in this type of animal cell.

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[2 marks]

Total 15 marks



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2. (a) Figure 3 is a diagram of a cell with four chromosomes (haploid number = 2) during the process of meiosis.

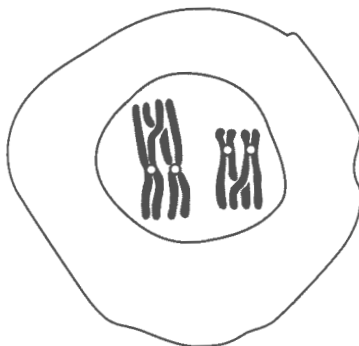


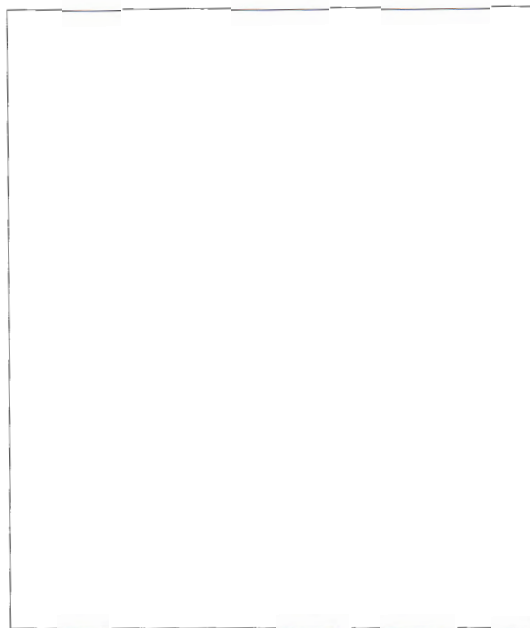
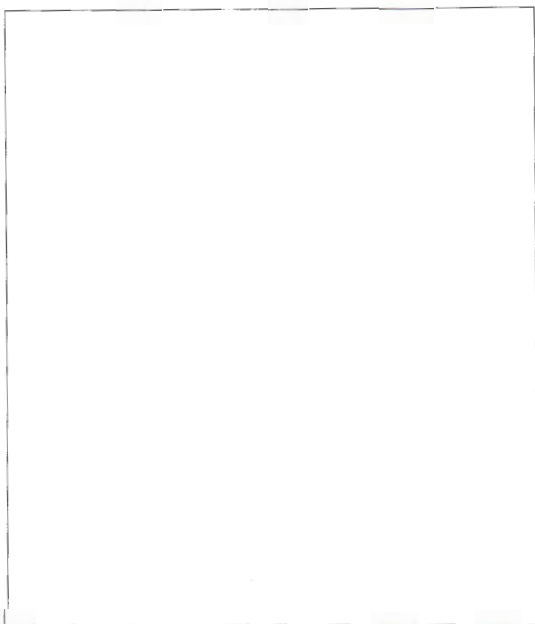
Figure 3. Diagram of a cell with four chromosomes

- (i) Name the stage of meiosis illustrated in Figure 3.

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[1 mark]

- (ii) In the boxes below, make labelled sketches to illustrate the next TWO key stages of meiosis in this cell. Write the name of the stages on the lines provided below the boxes.



Name of stage:

Name of stage:

[6 marks]

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(iii) Explain how the key stages identified in (a) (i) and (ii) contribute to genetic variation.

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[3 marks]

(b) Explain how 'substitution' and 'insertion' result in genetic variation. Discuss how gene mutation causes sickle-cell anaemia.

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[5 marks]

Total 15 marks

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2. (a) Table 2 is an incomplete comparison of some features of a human ovum with some features of a spermatozoon.

TABLE 2: COMPARISON OF FEATURES OF OVUM AND SPERMATOZOON

Feature	Ovum	Spermatozoon
Size	Can be seen with naked eye; about 0.1 mm to 0.2 mm in width.	
Shape		Elongated.
Overall structure	Not divided into distinct regions, surrounded by zona pellucida and follicle cells.	
Motility	Cannot move by itself.	
Food reserves		No food reserves.
Metabolic activity		Inactive, does not absorb or release substances.

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(i) Complete Table 2 by writing the missing information in the relevant spaces in the table. **[6 marks]**

(ii) With reference to a specific function of the human ovum, discuss how its structure is suited to the stated function.

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[3 marks]

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(b) Figure 4 is a diagram of a cross section of a fertilized ovule of a flowering plant.

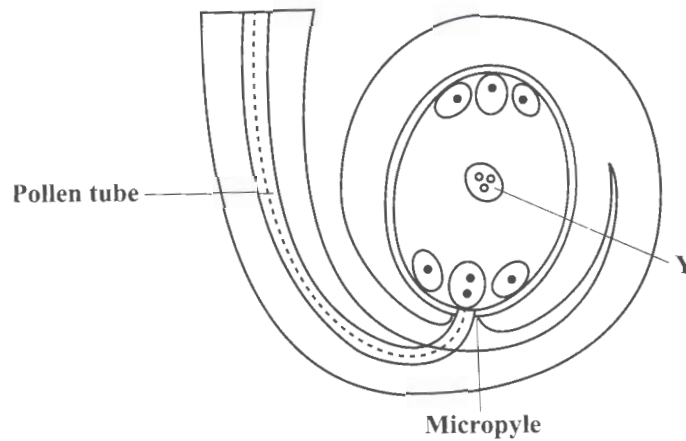


Figure 4. Cross section of a fertilized ovule

(i) On Figure 4, indicate, using an arrow labelled **X**, the structure which will develop a radicle and plumule. **[1 mark]**

(ii) Identify the structure labelled **Y** and explain its role in the developing embryo.

Identity of **Y**:

Role:

[2 marks]

(iii) An orange is described as a fleshy fruit. Name the part of a flowering plant which develops into a fleshy fruit after the ovule has been fertilized. Comment on the importance of the fruit, such as an orange, in the life cycle of a flowering plant.

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[3 marks]

Total 15 marks

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SECTION B

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

4. (a) (i) With the aid of an annotated diagram, describe the structure of phospholipids. **[4 marks]**

Space for annotated diagram of phospholipids

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- (b) Using a generalized structure for amino acids, outline the process of formation of a peptide bond between two amino acids. Explain, using an example, how amino acids differ from each other. **[6 marks]**

Space for formation of peptide bond between two amino acids

Total 15 marks

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(b) Gene therapy is the application of the principle of genetic engineering in the treatment of diseases.

(i) Give a brief description of one human disease for which the use of somatic gene therapy has been shown to be effective. **[2 marks]**

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- (b) Starting with contact of sperm cells with follicle cells of the oocyte, outline the process of fertilization in the human reproductive system. **[4 marks]**

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Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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