FORM TP 2018153

TEST CODE 02107020

MAY/JUNE 2018

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.

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SECTION A

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

1. (a) In the space below, draw AND label the chemical structure of a typical phospholipid molecule, clearly indicating its THREE major components. Label the hydrophilic and hydrophobic parts of the molecule.

[4 marks]

(b) Describe how phospholipids are oriented to form the lipid bilayer of cellular membranes.

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[3 marks]

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(c) State the name of the lipid responsible for maintaining the fluidity of cellular membranes.

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[1 mark]

(d) Describe how intrinsic proteins allow the movement of substances across cellular membranes.

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[4 marks]

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(a) Figure 1 shows the molecular structure of a cellular lipid.

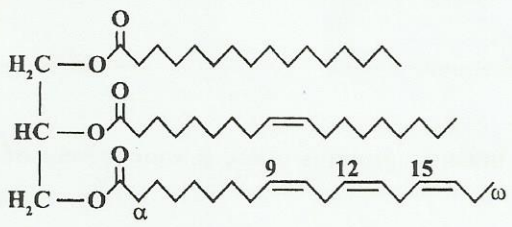

Figure 1. Molecular structure of a cellular lipid

(i) Identify the class of lipids to which the biomolecule in Figure 1 belongs.

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[1 mark]

(ii) Explain how TWO features of the biomolecule in Figure 1 are related to its function in animal tissues.

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[2 marks]

Total 15 marks

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2. (a) Seed type in pea plants is determined by a single gene with round seed, R, dominant to wrinkled seed, r. Three pairs of homologous chromosomes are depicted in Figure 2, with the gene locus for seed type indicated by X.

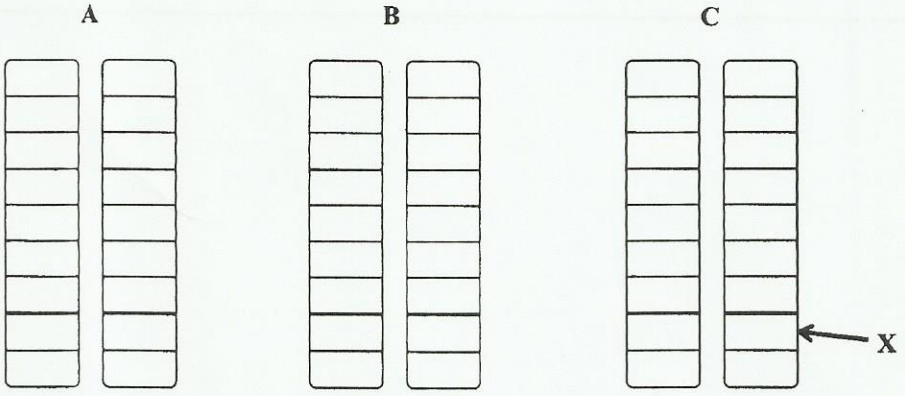

Figure 2. Diagram depicting three pairs of homologous chromosomes

(i) In Figure 2, insert the appropriate alleles which correspond to the phenotypes of A, B and C given the following characteristics:

A – homozygous round-seeded variety
B – homozygous wrinkle-seeded variety
C – heterozygous variety.

[3 marks]

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(ii) **Draw a Punnett square** in the following box to illustrate a test cross involving a pea variety which is heterozygous for seed type. State the ratio of the phenotypes for the offspring.

Ratio of phenotypes: .....

[3 marks]

(iii) Distinguish between 'a gene' and 'an allele'.

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[2 marks]

(b) A micrograph of pressed onion root meristem cells is reproduced in Figure 3, with a scale bar of 10 µm given in the lower left corner.

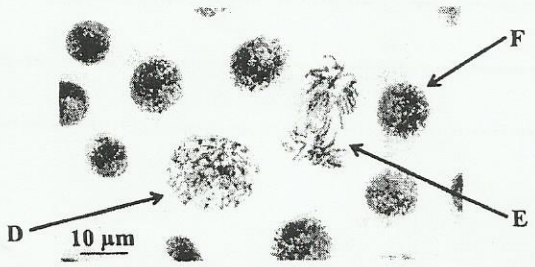

Figure 3. Micrograph of pressed onion root meristem cells

Source: Doc. RNDr. Josef Reischig, CSc. (Author's archive) [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

(i) Make a scaled drawing of the cells labelled D, E and F in Figure 3. Show the magnification of the drawing.

Magnification .....

[4 marks]

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(ii) Identify the cell cycle stages displayed in cells D, E and F in Figure 3.

D.....

E.....

F.....

[3 marks]

Total 15 marks

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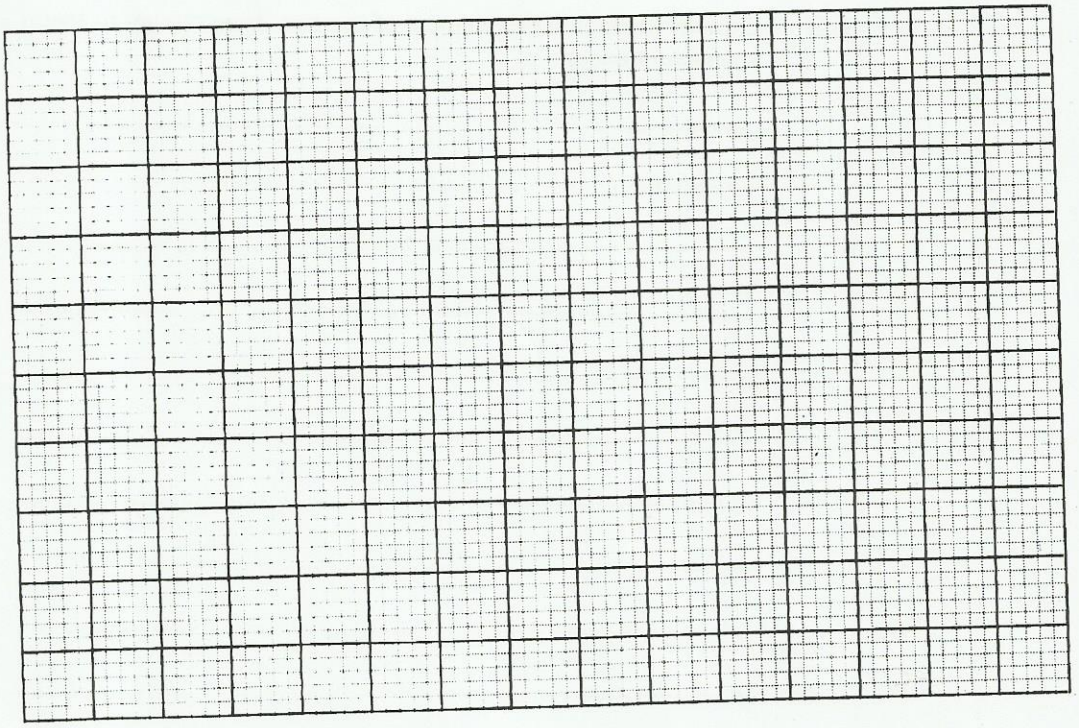
3. (a) Dental amalgam fillings are composed of approximately 50% metallic mercury. Mercury is a toxin and has been linked to neurodevelopmental disorders in babies. Table 1 shows the relationship between mercury fillings and the concentration of mercury in the blood.

TABLE 1: NUMBER OF MATERNAL AMALGAM FILLINGS AND CONCENTRATION OF MERCURY IN MATERNAL AND FOETAL BLOOD

	Mercury Concentration (ug/L)	
Number of Maternal Amalgam Fillings	**Maternal Blood**	**Foetal Blood**
2	9	15
4	20	26
9	63	76

(i) On the grid provided below, draw a bar chart to compare the concentration of mercury in maternal and foetal blood with the number of maternal amalgam fillings. **[3 marks]**



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(ii) State TWO conclusions based on the comparisons shown on the graph.

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[2 marks]

(iii) Explain whether the movement of mercury from mother to foetus is an active or a passive process.

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[3 marks]

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(b) Figure 4 is a cross-section of a mature pollen grain. Write the correct labels for A, B, C and D.

[2 marks]

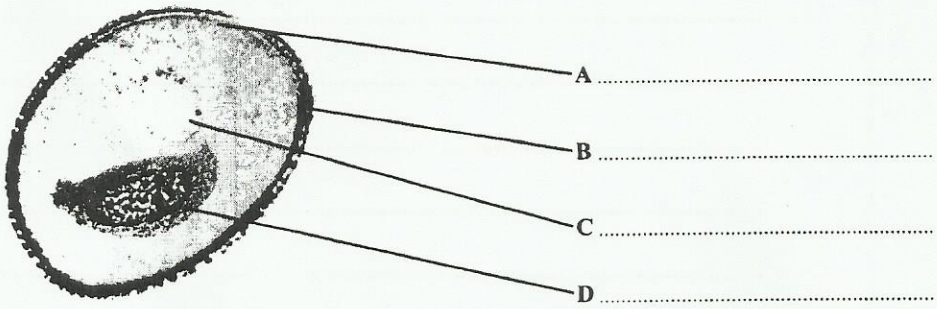

Figure 4. Mature pollen grain from *Lilium*

Source: gopher://wiscinfo.wisc.edu:2070/I9/.image/.bot/.130/Angiosperm/Lilium/Adroecium/Anther_pollen_tetrads

(c) (i) Describe the events following pollination which lead to double fertilization.

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[3 marks]

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(e) (ii) State the significance of double fertilization to the human diet.

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[2 marks]

Total 15 marks

SECTION B

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

4. (a) With reference to the structure of enzymes, distinguish between 'competitive inhibition' and 'non-competitive inhibition' with respect to enzyme activity.

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[7 marks]

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(b) Discuss the role of FOUR tissues found in the roots of a plant that support the major functions of the root.

[8 marks]

Total 15 marks

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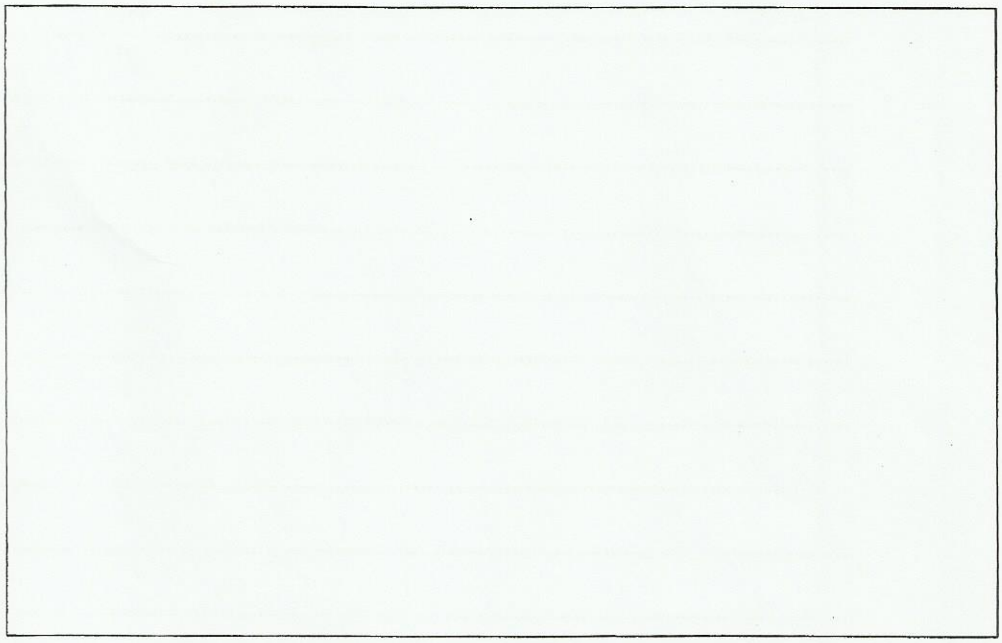
5. (a) With the aid of a diagram, explain how the information stored in a gene is used to synthesize RNA.



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(b) Using an example, briefly explain how proteins are responsible for the phenotype of organisms.

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[5 marks]

Total 15 marks]

6. (a) Outline the steps involved in plant tissue culture AND explain the key scientific principle underlying this technique.

[7 marks]

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(b) **Complete Table 2 by comparing the structure and function of the following FOUR features** in a human sperm cell with those of a secondary oocyte.

TABLE 2: COMPARISON OF HUMAN SPERM CELL AND SECONDARY OOCYTE

Feature	Structure and Function of Human Sperm Cell	Structure and Function of Human Secondary Oocyte
Overall structure and size		
Nucleus		

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Cell membrane		
Mitochondria		

[8 marks]

Total 15 marks

END OF TEST

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

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