

FORM TP 2019159



TEST CODE **02207020**

MAY/JUNE 2019

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

BIOLOGY

UNIT 2 – Paper 02

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of **THREE** questions. 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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02207020/MJ/CAPE 2019



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Module 1 — Bioenergetics

1. (a) The initial energy that enters ecosystems is from the sun.
- (i) Illustrate the flow of energy and nutrients through ecosystems by providing labels for A–F in the flow chart in Figure 1.

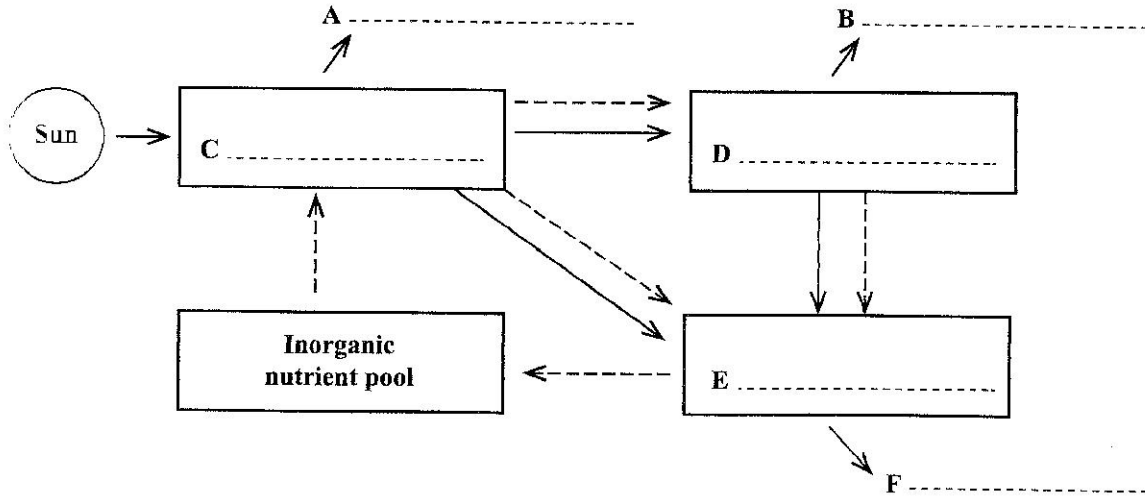


Figure 1. Flow of energy and nutrients through ecosystems

Source: <http://www.learner.org/courses/envsci/unit/text.phy?unit=4&secNum=3>

[5 marks]

- (ii) Explain the importance of energy flow in an ecosystem.

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[4 marks]

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- (iii) Explain why only a small percentage of the energy from sunlight that reaches terrestrial environments enters the ecosystem.

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(b) Mitochondria are important for making energy available within cells. Figure 2 is an incomplete diagram of the longitudinal section of a mitochondrion showing only the outer membrane.

(i) Complete the diagram in Figure 2 and include labels to illustrate the structure of a mitochondrion.

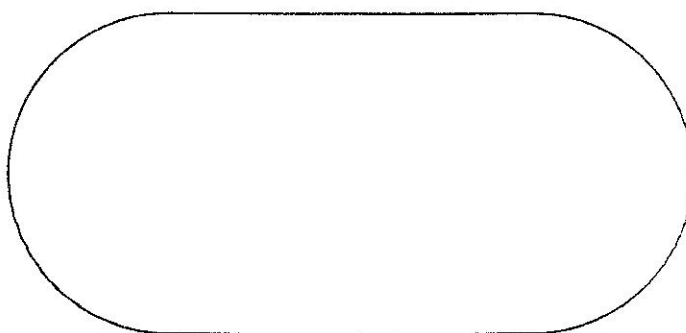


Figure 2. Longitudinal section of a mitochondrion

[5 marks]

(ii) Explain how the structure of the mitochondrion is important for its function in respiration.

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Module 2 — Biosystems Maintenance

2. (a) Impaired glucose tolerance is a risk factor for certain diseases. An oral glucose tolerance test was administered to persons with normal glucose tolerance (NGT) and impaired glucose tolerance (IGT1 and IGT2). Blood plasma glucose levels were monitored at 30-minute intervals for 2 hours. The data are given in Table 1.

TABLE 1: PLASMA GLUCOSE LEVELS FOLLOWING ORAL GLUCOSE INTAKE FOR GROUPS OF PERSONS WITH DIFFERENT GLUCOSE TOLERANCE LEVELS (NGT, IGT1 AND IGT2)

Time (min)	Plasma Glucose Levels (mmol/L)		
	NGT	IGT 1	IGT 2
0	5.4	5.7	6.4
30	8.8	9.8	11.2
60	7.8	10.7	12.6
90	6.6	10.0	11.0
120	5.7	8.8	9.0

*Adapted from Hanefeld et al., 2003. Diabetes Care 26 (3):868–874.
doi: 10.2337/diacare.26.3.868.*

- (i) On the grid provided on page 11, plot a line graph of the data provided in Table 1 with time on the x-axis. **[6 marks]**
- (ii) State TWO key observations that can be made based on the results of this study.

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[2 marks]



(iii) Explain the mechanisms by which glucagon and insulin function to maintain a normal concentration of glucose in the blood.

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[6 marks]

(iv) Comment on the clinical significance of the presence of glucose in the urine.

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[2 marks]



6. Control mechanisms involving regulators occur in plants. These control mechanisms have commercial applications. With reference to the properties of ethylene, analyse its actions to bring about desirable changes in fruits during commercial ripening.

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[6 marks]

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- (c) The control of the water content (water potential) of the body is called osmoregulation.

In the space below, construct an annotated flow chart to illustrate the mechanism by which the body responds to reduced blood water content (low water potential). Your flow chart should identify the effector, receptor, regulator and response.

[8 marks]

Total 30 marks

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Module 3 — Applications of Biology

3. (a) The *Aedes* mosquitoes are widespread throughout the Caribbean and are associated with the spread of viral diseases such as Zika, dengue and chikungunya. Figure 3 provides data for a Zika outbreak in Dominica in 2016.

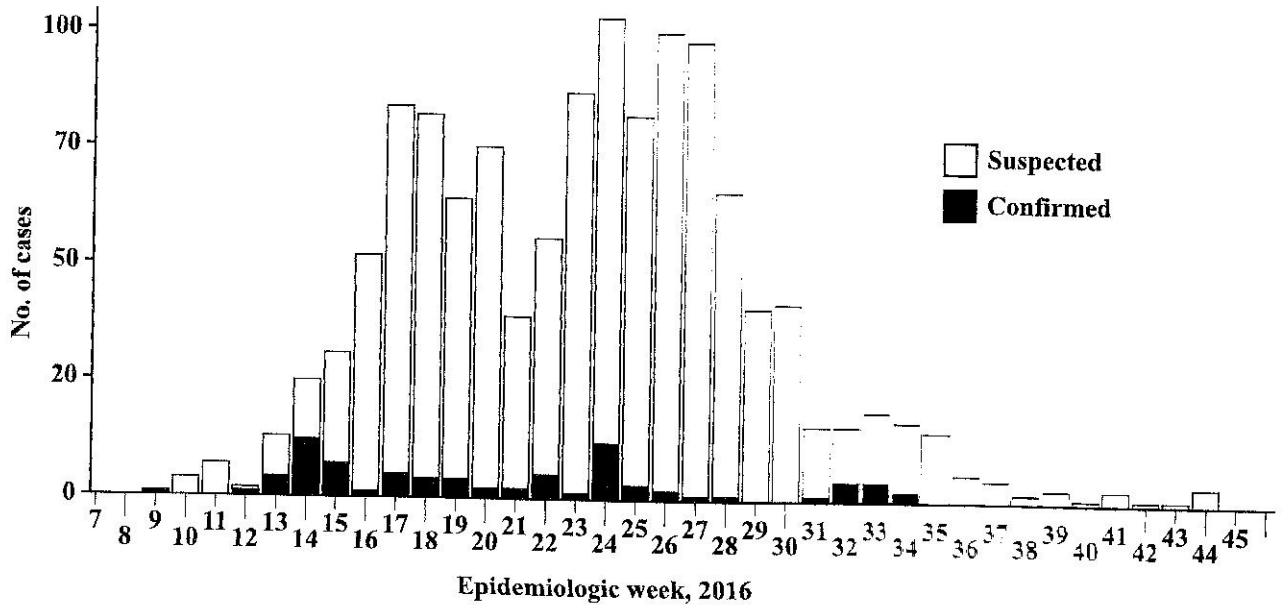


Figure 3. Number of suspected and confirmed cases of Zika virus infection during the 2016 outbreak in Dominica

Source: Ryan et al., 2017. *Emerging Infectious Diseases* 23(11): 1926–1927.

- (i) Assuming that epidemiologic week 1 (not shown on the graph) was the first week of January, in which month was the **first** confirmed case of a Zika virus infection recorded?

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[1 mark]

- (ii) List **FOUR other** observations from the data provided in Figure 3. Your statements can refer to the epidemiologic week (instead of month).

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[4 marks]

- (iii) Explain the mechanisms by which viruses can be transmitted from an infected to an uninfected person by mosquitoes.

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[6 marks]

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- (b) Vaccination can be used to control the spread of mosquito-borne diseases.
 - (i) With the aid of a labelled graph showing blood antibody concentration over time after vaccination, explain THREE ways in which vaccinations work to reduce the spread of diseases.

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[9 marks]

(ii) Distinguish between 'natural active immunity' and 'artificial active immunity'.

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[2 marks]

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