

TEST CODE 02107020

MAY/JUNE 2017

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.

FORM TP 2017152

- 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.

Copyright © 2015 Caribbean Examinations Council All rights reserved.

02107020/CAPE 2017



- 4 -

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

1. (a) Figure 1 is a stained animal cell as seen under a light microscope.



Figure 1. Animal cell

Source: http://imgarcade.com/

(i) In the box below, make a detailed drawing of the cell in Figure 1 and label FOUR structures seen in the cell.



[6 marks]

(b)

An experiment is conducted to determine the amount of reducing sugar and starch in bananas at different degrees of ripeness. Extracts of equal quantities of tissue samples of bananas, at three different stages of ripeness, are prepared by mashing and grinding the

- 6 -

DO NOT WRITE IN THIS AREA



ŝ



- 5 -

micrometer. Show your working.

(ii)

Using the magnification provided, calculate the actual size of the cell, highlighted

by the bar line at the left of the image. State the calculated value to the nearest

Size:

GO ON TO THE NEXT PAGE

l

[2 marks]

An experiment is conducted to determine the amount of reducing sugar and starch in bananas at different degrees of ripeness. Extracts of equal quantities of tissue samples of bananas, at three different stages of ripeness, are prepared by mashing and grinding the samples in water. For each stage, sample extracts are placed in two sets of test tubes. A fourth test tube is set up with only water and no banana extract. Tests for reducing sugar and starch are conducted on all four test samples. The findings of the experiment are summarized in Table 1.

Note: For the Fehling's test the amount of the precipitate is measured as the height of precipitate (cm) at the bottom of the test tube.

TABLE 1: OBSERVATIONS OF SAMPLE EXTRACTS AFTER TESTING

Food Test		Green Raw Banana	Half-ripe Banana	Ripe Banana	Water with no Banana Extract
Fehling's	Observation after heating	Greenish solution with red precipitate	Greenish solution with red precipitate	Greenish solution with red precipitate	Blue solution
Solution	Height of precipitate (cm)	0.2	0.4	1.0	0.0
Iodine	Intensity of colour	Intense blue- black colour	Medium blue-black colour	Pale blue- black colour	Brown colour

(i) Suggest a hypothesis for this experiment.

.....

0210702006

[1 mark]



02107020/CAPE 2017

(b)

	- 7 -
(ii) C b	Compare the results obtained for the amount of reducing sugar and starch in the anana samples. Include in your comparison reference to the observations recorded.
	[3 marks]
(iii) C u	Comment on the significance of the findings of this experiment in relation to the se of bananas as a food item.
	[2 marks]
(iv) S	tate the purpose of testing a sample with no banana extract
·. · ·	tate the purpose of testing a sample with no banana extract.
	[1 mark]
	Total 15 marks

GO ON TO THE NEXT PAGE



02107020/CAPE 2017

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

ġ

A CONTRACT AND A CONTRACT OF A

DO NOT WRITE IN THIS AREA

KINSTHIT NI TTINHEDUT OD

ţ,

FAR ATHING THING OF

- (a) Haemophilia is a recessive sex-linked condition in humans in which the blood does not clot properly, leading to excessive bleeding. Use the symbols X^H for the normal allele and X^h for the haemophilia allele in your responses.

 - (ii) Using the genotypes stated in (i) as parental genotypes, construct a Punnett square diagram to show how haemophilia-affected offspring can result from normal clotting parents. State the phenotype of all offspring.

[3 marks]

DO NOT WRITE IN THIS ARE4

DO NOT WRITE IN THIS AREA

DO NOT HRITE IN THIS AREA DO NOT WRITE IN THIS AREA

(iii) Give an explanation as to why a man with haemophilia cannot pass on the condition to his son.

[1 mark]

02107020/CAPE 2017

2.

-9-

(b) A geneticist crossed two types of pea and obtained 5474 plants with round seeds and 1850 plants with wrinkled seeds in the F_2 generation. You are required to use the Chisquare test to show that these results are consistent with the 3:1 ratio normally expected from a monohybrid cross.

(i) State the null hypothesis for this test.

[1 mark]

(ii) Calculate Chi-square using the formula, Chi-square = $\sum (O - E)^2/E$, where O is the observed and E the expected number of plants. Show your working in tabular form as follows.

Plant Type	Observed	Expected	O - E	(O - E) ²	$(O - E)^2 / E$
Round seeds					
Wrinkled seeds					
				Chi-square =	

[2 marks]

(iii) Use the data in Table 2 on page 10 to make an inference based on your calculated Chi-square value.

[2 marks]

GO ON TO THE NEXT PAGE

02107020/CAPE 2017

٩

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Ą

DO NOT WRITE IN THIS AREA

Degrees of Freedom	Number of Classes			χ² Values			-
1	2	0.46	1.64	2.71	3.84	6.64	10.83
2	3	1.39	3.22	4.61	5.99	9.21	13.82
3	4	2.37	4.64	6.25	7.82	11.34	16.27
4	5	3.36	5.99	7.78	9.49	13.28	18.47
Probability [p] that chance alone could produce the deviation		0.50 (50%)	0.20 (20%)	0.10 (10%)	0.05 (5%)	0.01 (1%)	0.001 (0.1%)

TABLE 2: STATISTICAL TABLE – CRITICAL VALUES OF CHI-SQUARE DISTRIBUTION

(c) The variation in size of an organism in a population is depicted in Figure 2.



Figure 2. Size distribution of an organism in a population

 Using the axes provided in Figure 3, illustrate the effect of disruptive selection or the population distribution in Figure 2. [1 mark]



Figure 3. Effect of disruptive selection

GO ON TO THE NEXT PAGE

02107020/CAPE 2017

ŝ,

(ii)	Using Darwin's theory of natural selection, explain how disruptive selection can lead to the formation of new species.
	[3 marks]

Total 15 marks

GO ON TO THE NEXT PAGE

l



02107020/CAPE 2017

考

DONOD WATE IN THIS AREA

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

.

.

DO NOT WRITE IN THIS AREA

- 11 -

3.

Ą

(a) An experiment is conducted to investigate the effects of type of culture medi sucrose concentration on the pollen germination rate of a species of palm. Polle are collected from newly opened flowers of the same bunch on the same day. Th are inoculated into two types of medium: a liquid culture medium and a solid medium. The solid culture medium consists of different concentrations of sucrose The liquid medium is similar to the solid medium with respect to the sucrose concer but does not contain agar. The results of the investigation are given in Table 3.

TABLE 3: EFFECTS OF CULTURE MEDIUM AND SUCROSE CONCENTRATIO ON POLLEN GERMINATION RATE IN A SPECIES OF PALM

	% Pollen G	ermination
Sucrose Concentration (gl ⁻¹)	Liquid Culture Medium	Solid Culture Med
0	51	27
20	52	39
40	73	87
60	50	57
80	41	66
100	0	41

0210702012

Source: American Journal of Plant Sciences, 2013, 4, 1669

GO ON TO THE NEXT P.

02107020/CAPE 2017



A CONTRACTOR AND A CONTRACTOR OF A

DO NOT WRITE IN THIS AREA

DO NOT HREEN THAN AREA

ł

- Based on the results shown in Table 3, what can be deduced about the effect of (iii) the type of culture medium on the maximum rate of pollen germination? _____ _____ [2 marks]
- (b) Figure 5 is a drawing of a section through a human placenta in situ.



- 14 -

Figure 5. Section through a human placenta

Identify and describe the main function of EACH of the structures labelled I, II (i) and III.

I:	
II:	
III:	
	[3 marks]

GO ON TO THE NEXT PAGE

I

02107020/CAPE 2017

5



1		
	(ii)	Comment on TWO roles of the structure labelled \mathbf{Y} in the development of the foetus.
		[2 marks]
((iii)	Outline TWO ways in which the placenta acts as a protective barrier for the developing foetus.
ž		
		[2 marks]
		Total 15 marks

0040700041

GO ON TO THE NEXT PAGE

02107020/CAPE 2017

DU NUT KRITE IN THIS AKA

.

SECTION B

- 16 -

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

4.	(a)	(i)	Compare the cell size and THREE structural features of prokaryotic and eukaryotic cells.
Ą			
			[4 marks]

GO ON TO THE NEXT PAGE

,



02107020/CAPE 2017



GO ON TO THE NEXT PAGE

02107020/CAPE 2017

I

DO NOT WRITE IN THES AREA DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

ţ

(b)	Discuss the importance of protein structure for determining enzyme specificity and mode of action.
ą	
	[6 marks]
	Total 15 marks
02107020/CA	GO ON TO THE NEXT PAGE
1	

5. (a	Describe the roles of DNA and RNA in protein synthesis.
ţ	
	[5 ma
001000	GO ON TO THE NEXT PA
021070	20/こみアビ 2017

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

.

:

.

,

. 1

**

(i)	Outline the principle of genetic engineering, including a brief description of the basic steps of this technique.
	·····
	[5 marks]

02107020/CAPE 2017

(b)

ķ

l

|--|

02107020/CAPE 2017

(ii)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

3

GO ON TO THE NEXT PAGE

I

Despite its promising potential, one of the arguments sometimes raised against the use of gene therapy is that it is technically too dangerous. With reference to cystic fibrosis, discuss reasons for this viewpoint.
[5 marks] Total 15 marks

6. (a) Giving examples, discuss TWO advantages of vegetative propagation of plants.			
	2		
		[5 marks]	
0210)7020/C	GO ON TO THE NEXT PAGE	

- 22 -

۰,

02107020/CAPE 2017

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

Ŗ

GO ON TO THE NEXT PAGE

I

•	
•	
•	
•	
•	· · · · · · · · · · · · · · · · · · ·
•	
•	
•••	
•••	
•••	
•••	
•••	
••	
•••	

(c)	Describe the development of fruit and seed structures from floral structures after fertilization		
	· · · · · · · · · · · · · · · · · · ·		
	· · · · · · · · · · · · · · · · · · ·		
	[6 marks]		

ţ

Total 15 marks

END OF TEST

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

02107020/CAPE 2017

