

**FORM TP 2010141**



TEST CODE **02107032**

MAY/JUNE 2010

**CARIBBEAN EXAMINATIONS COUNCIL**

**ADVANCED PROFICIENCY EXAMINATION**

**BIOLOGY**

**UNIT 1 – Paper 03/2**

**ALTERNATIVE TO INTERNAL ASSESSMENT EXAMINATION**

*2 hours*

**Candidates are advised to use the first 15 minutes for  
reading through this paper carefully.**

**READ THE FOLLOWING INSTRUCTIONS CAREFULLY.**

1. This paper consists of THREE questions. Answer ALL questions.
2. The use of silent non-programmable calculators is allowed.

1. You are provided with potato extract, which contains the enzyme catechol oxidase. This enzyme catalyses the removal of electrons and hydrogen from catechol. The product of the reaction is coloured.

You are required to carry out a simple investigation into the effect of substrate concentration on enzyme activity.

You are provided with the following concentrations of catechol solution: 0.001%, 0.01% and 0.5%.

Prepare the test tubes as outlined in Table 1.

**TABLE 1: TEST TUBE PREPARATION**

Test tube	Concentration of catechol solution (%)	Amount of catechol (cm <sup>3</sup> )	Amount of distilled water (cm <sup>3</sup> )	Amount of potato extract (catechol oxidase) (cm <sup>3</sup> )
1	0.001	1.0	–	1.0
2	0.01	1.0	–	1.0
3	0.5	1.0	–	1.0
4	–	–	1.0	1.0
5	0.5	1.0	1.0	–

**Please note that catechol is poisonous. Please use the gloves provided when handling the catechol solutions. If a spillage occurs wash your hands immediately and notify the invigilator.**

Begin the experimental procedure by first adding 1 cm<sup>3</sup> catechol to the test tube (where indicated). Next add the distilled water to test tubes 4 and 5.

**Do not add the potato extract to the first test tube until you have added the required volumes of catechol and distilled water to the tubes, 1 - 5 as outlined in Table 1. Start the reaction by adding the potato extract to the test tubes in sequence.**

For each test tube note the initial colour of the reaction mixture, then record the colour change after 10 minutes.

GO ON TO THE NEXT PAGE

- (a) Construct a table to show your results. The table should include the following:
- substrate concentration
  - initial colour of the solution
  - colour change after 10 minutes.

[ 4 marks]

- (b) Suggest a specific aim for your experiment.

---

---

[ 2 marks]

- (c) Based on your results deduce the relationship between substrate concentration and enzyme activity.

---

---

---

[ 2 marks]

- (d) Comment on the purpose of the test tubes, 4 and 5.

Test tube 4: \_\_\_\_\_

\_\_\_\_\_

Test tube 5: \_\_\_\_\_

\_\_\_\_\_

[ 3 marks]

- (e) Identify ONE limitation of the experiment.

\_\_\_\_\_

\_\_\_\_\_

[ 1 mark ]

- (f) Suggest a method which could be used to accurately determine the differences between the colour change in each tube.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[ 2 marks]

- (g) State TWO factors other than substrate concentration that can affect the rate of an enzyme-catalysed reaction.

\_\_\_\_\_

\_\_\_\_\_

[ 2 marks]

**Total 16 marks**

2. (a) In an experiment, red-flowered, short-stemmed plants were crossed with yellow-flowered, long-stemmed plants. All of the  $F_1$  phenotypes had red flowers and short stems. The  $F_1$  generation was then test-crossed. The results of this cross are shown in Table 2.

**TABLE 2: RESULTS OF TEST CROSS**

Colour of flower	Stem length	Number of progeny
Yellow	Long	102
Yellow	Short	110
Red	Long	99
Red	Short	106

- (i) State the ratio of the offspring in Table 2.

\_\_\_\_\_ [ 1 mark ]

- (ii) Explain, giving TWO reasons, why all of the  $F_1$  progeny were phenotypically alike.

Reason 1:

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

Reason 2:

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

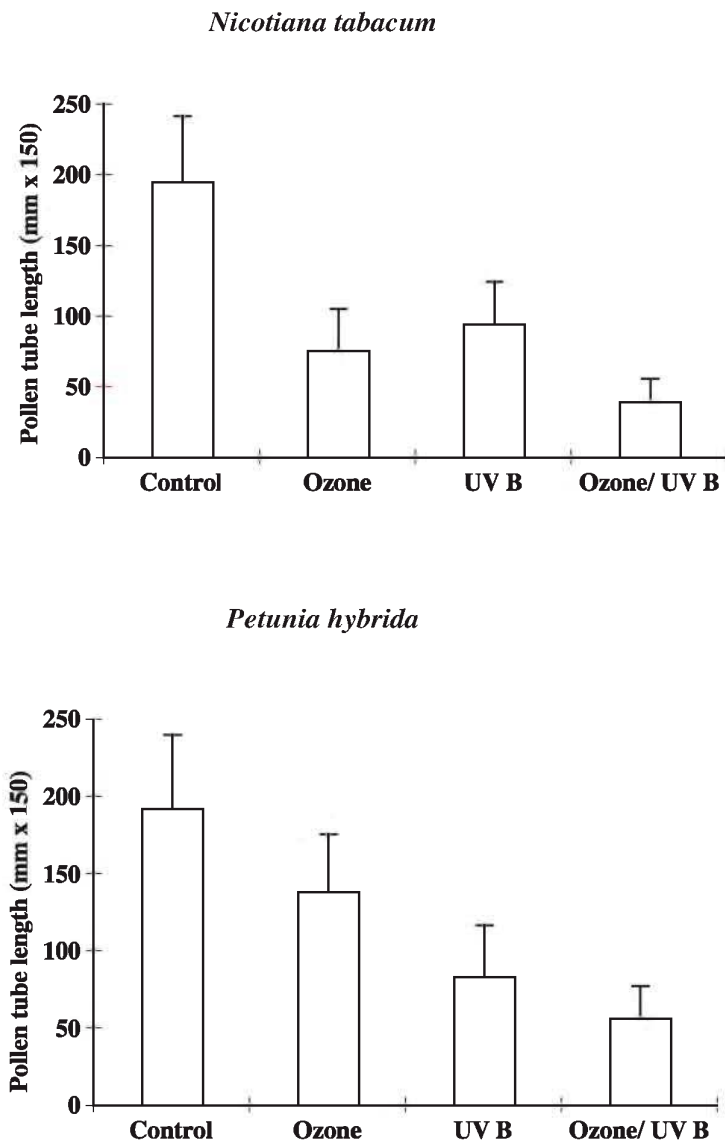
[ 2 marks ]

- (iii) Give an explanation for the ratio obtained from the test cross of the  $F_1$  generation plants.

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

[ 3 marks ]

- (b) Environmental extremes influence phenotypic expression. Figure 1 shows the effect of ozone, ultraviolet radiation and a combination of these two stresses on the growth of pollen tubes in *Nicotiana tabacum* and *Petunia hybrida*.



**Figure 1. Effect of ozone and ultraviolet radiation on the growth of pollen tubes**

Source: *Selection in Extreme Environments*; <http://www.sciencemag.org/cgi>

GO ON TO THE NEXT PAGE

7

1

[ 2 marks]

C  
*hybrida*

EACH

*Nicotiana tabacum*    *Petunia*

O

C

[ 3 marks]

T O

1

2

[ 4 marks]

negatively

[ 1 mark ]

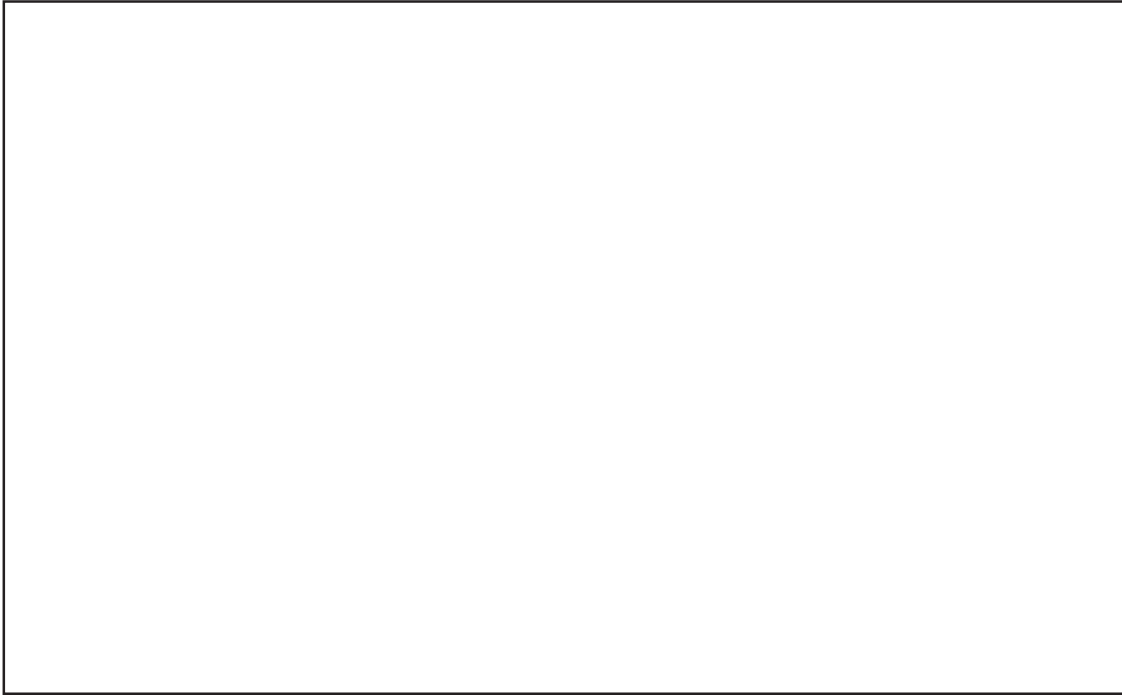
**Total 16 marks**

**GO ON TO THE NEXT PAGE**

3.

A

ONE



[ 6 marks]

(ii) Calculate the magnification of the drawing.

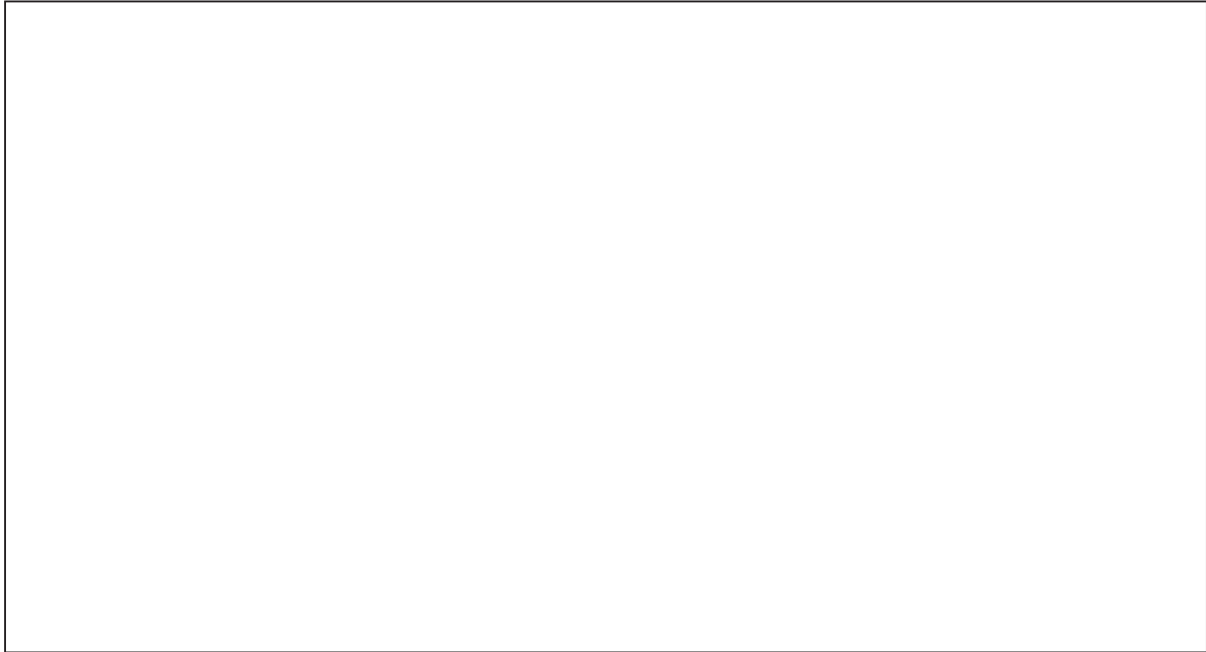
[ 1 mark ]

H

[ 1 mark ]



0  
stages in the development of the Graafian follicle up to the time of ovulation.



[ 5 marks]

(ii) Calculate the diameter of the mature Graafian follicle drawn in (b) (i) above.

[ 2 marks]

(iii) State ONE observable distinguishing feature of the mature Graafian follicle in

[ 1 mark ]

**Total 16 marks**

**END OF TEST**