



TEST CODE **02107020**

**FORM TP 2006177**

MAY/JUNE 2006

**CARIBBEAN EXAMINATIONS COUNCIL**

**ADVANCED PROFICIENCY EXAMINATION**

**BIOLOGY**

**UNIT 1 – PAPER 02**

*2 $\frac{1}{4}$  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 **NINE** questions.
2. Section A consists of **THREE** questions. Candidates must attempt **ALL** questions in this section and should spend no more than 30 minutes on this section. Answers to this section **MUST** be written in this question paper.
3. Section B consists of **SIX** questions. Candidates must attempt **THREE** questions in this section, **ONE** question from **EACH** module. Answers to this section **MUST** be written in the separate answer booklet provided.
4. The use of silent non-programmable calculators is allowed.

### SECTION A

You must attempt ALL THREE questions in this section. You should NOT spend more than 30 minutes on this section.

1. The School Meals Department produces a popular dessert which the senior students take to the lab to analyse. They have access to distilled water, Bunsen burners, test tubes and the reagents listed in Table 1, Column 1. Table 1 is designed to show the tests, test results and deductions of the senior students.
- (a) Complete Table 1 by describing the testing procedures the students use; and state the type of food molecule found (if any).

**TABLE 1: ANALYSIS OF DESSERT**

Test Reagents	Testing Procedure	Test Results	Deduction
Benedict's solution		Clear blue solution	
Benedict's solution Dilute acid Sodium bicarbonate		Brick red precipitate	
Iodine in potassium iodide solution		Light yellow – brown colour	
Ethanol		White emulsion	
Biuret solution		Pale purple colour	

[ 5 marks ]

- (b) Suggest THREE food items you would purchase from the supermarket to make this dessert.

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[ 1 mark ]

GO ON TO THE NEXT PAGE

(c) Draw the following molecules accurately:

(i) A phospholipid molecule

[ 2 marks]

(ii) A portion of a cellulose molecule containing three glucose units.

[ 2 marks]

**Total 10 marks**

GO ON TO THE NEXT PAGE

2. (a) The structures shown in Figure 1 below are 5 cm lengths of plasticine. One piece is white, and the other ink-coloured (blue or black).



**Figure 1. Lengths of plasticine for chromosome models**

Using the white and ink-coloured lengths of plasticine, you are asked to conceptualize models of the following chromosomes during the process of meiosis and to draw the models in the spaces provided below:

- (i) ONE pair of homologous chromosomes aligning themselves.  
Illustrate ONE cross-over between two of the chromatids.

*To distinguish between the members of the pair of chromosomes, leave the white length of plasticine clear and the ink-coloured length of plasticine with hashed lines using your pen.*

[ 2 marks]

- (ii) Early anaphase of meiosis I, showing the exchanged chromatid material. (Shade appropriately).

[ 2 marks]

GO ON TO THE NEXT PAGE

(b) Figure 2 shows the sex chromosomes of a mammal.

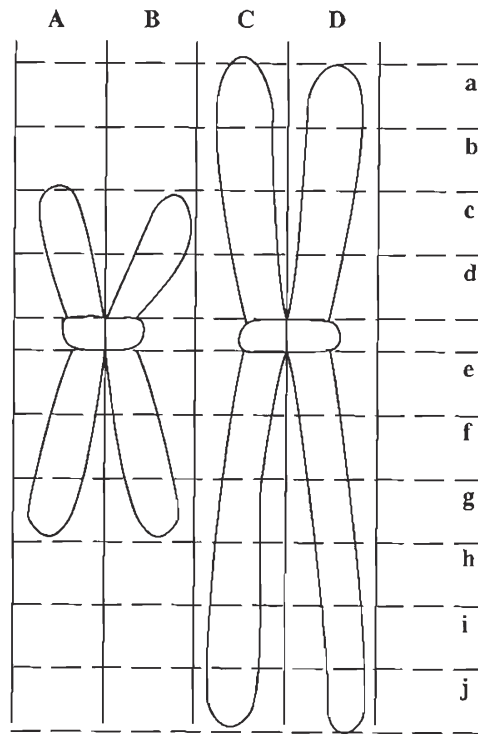


Figure 2. Sex chromosomes of a mammal

With reference to Figure 2 above, complete Table 2 to show which areas of the sex chromosomes can cross over to form chiasmata. (Place a tick (✓) in the appropriate column).

TABLE 2: CHIASMATA FORMATION BETWEEN SEX CHROMOSOMES

Chiasma co-ordinates	Chiasma possible	Chiasma not possible
(i) Ci and Di		
(ii) Af and Df		
(iii) Bc and Cb		
(iv) eD and Be		

[ 2 marks]

- (c) State TWO ways in which the process of meiosis contributes towards the variation of the gametes.

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[ 2 marks]

- (d) Table 3 is constructed to show the amount of DNA present in cells undergoing meiosis. The amount of DNA in a somatic cell is represented as 100 per cent.

Place a tick (✓) in the column which shows the amount of DNA present at the stage of meiosis listed.

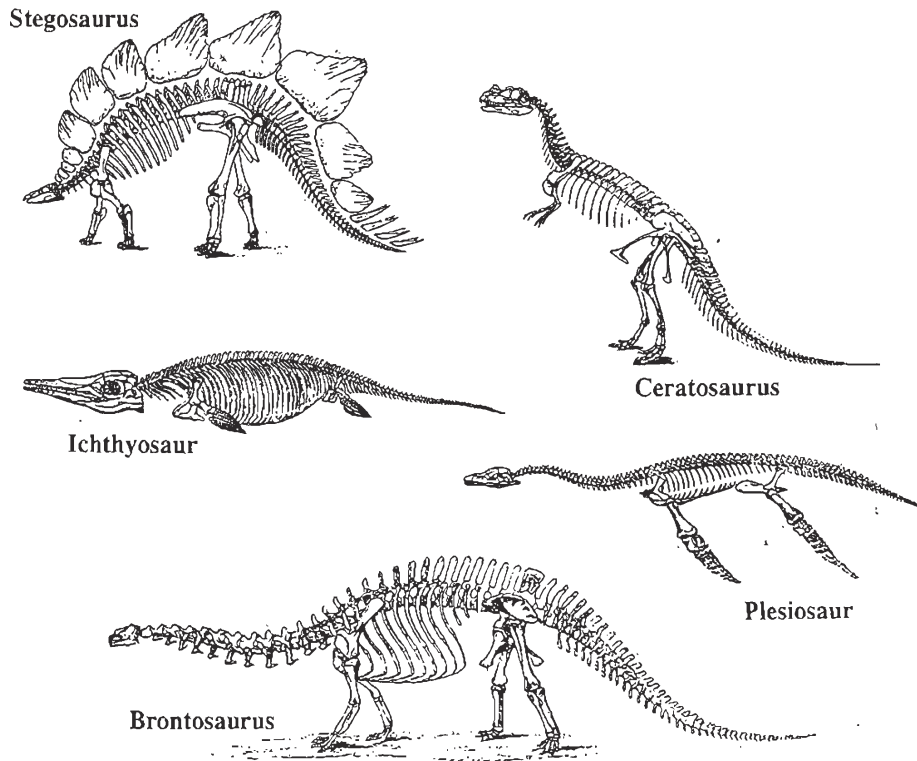
**TABLE 3: AMOUNT OF DNA IN CELLS DURING STAGES OF MEIOSIS**

Stage of meiosis	DNA present in the cells			
	50%	100%	150%	200%
Prophase I				
Anaphase I				
Cytokinesis I				
Metaphase II				
Telophase II				
Cytokinesis II				

[ 2 marks]

**Total 10 marks**

3. (a) Figure 3 shows the restored skeletons of fossil reptiles (not to scale).



Source: *General Zoology, 3rd Edition. T. Storer and R. Usinger. McGraw-Hill Book Company, Inc. 1957.*

**Figure 3. Skeletons of fossil reptiles**

Using distinguishing features of these reptiles, construct a set of dichotomous keys to assist in their identification.

[ 4 marks]

GO ON TO THE NEXT PAGE

- (b) Read the paragraph below, and then answer the questions that follow.

“Sixty million years ago, dinosaurs reigned over the world. These huge reptiles were well adapted to their environment and existed in harmony with the factors of the ecosystem. They changed little and prospered.

Various theories explain their demise. Evolving small mammals ate the eggs of the ground-based dinosaurs, and only the nesting types eluded them. Some scientists attribute their disappearance to a massive meteor, which threw up debris on impact. The atmosphere was darkened, preventing penetration of sunlight, obliterating photosynthesis, eradicating the primary producers, and eliminating the food chains.”

State THREE types of selection mentioned in the paragraph, and for EACH type, paraphrase a sentence from the passage to describe it.

Type of selection \_\_\_\_\_

Description: \_\_\_\_\_

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

[ 2 marks]

Type of selection \_\_\_\_\_

Description: \_\_\_\_\_

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

[ 2 marks]

Type of selection \_\_\_\_\_

Description: \_\_\_\_\_

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

[ 2 marks]

**Total 10 marks**



## SECTION B

You must answer **THREE** questions in this section. Answer **ONE** question **EACH** from Modules 1, 2 and 3. You **MUST** write your answers in the separate answer booklet provided.

### MODULE 1

Answer **EITHER** Question 4 **OR** Question 5.

4. (a) Describe the structural features of a typical plant cell **and** point out the features of contrast shown in animal cells. [10 marks]
- (b) "Prokaryotic cells differ from Eukaryotic cells."  
Elaborate on these differences. [ 6 marks]
- (c) Provide arguments in support of the endosymbiont theory. [ 4 marks]
- Total 20 marks**
5. (a) With reference to the structure of enzymes, distinguish between competitive and non-competitive enzyme inhibition. [ 4 marks]
- (b) Describe the steps involved in an enzyme-catalysed reaction. In your description, make reference to the active site of an enzyme-substrate complex, lowering of the activation energy and enzyme specificity. [ 6 marks]
- (c) (i) Alpha amylases catalyze the breakdown of starch in flour during the production of bread. The optimum temperature for alpha amylase activity is 38°C.  
  
Giving ONE reason, predict the effect that baking the bread over 110°C will have on enzyme activity. [ 2 marks]
- (ii) The enzyme pepsin digests protein in the stomach where hydrochloric acid maintains the contents at an optimum pH of between 1 and 3. The pancreas secretes alkaline bicarbonate ions into the duodenum.  
  
Giving ONE reason, predict the effect that the addition of these bicarbonate ions will have on pepsin action as the stomach contents pass into the duodenum. [ 2 marks]
- (iii) The enzyme xylanase digests xyloglucans in fresh apple juice. Twenty grams of purified xylanase clarifies 1000 litres of apple juice in 30 minutes. In a new clarification process, 30 g of xylanase will be used in the same volume of apple juice.  
  
Giving ONE reason, predict the effect that the new weight of xylanase will have on the clarification process. [ 2 marks]

GO ON TO THE NEXT PAGE

- (iv) During a shortage of xylanase, only 20 g of the purified enzyme is available to clarify 2000 litres of apple juice.

Giving ONE reason, predict the effect that this shortage will have on the clarification process. [ 2 marks]

- (v) Xyloglucans are the principal hemicelluloses in dicotyledons. The xyloglucan molecule consists of a backbone of beta-glucose units to which side chains of xylose are attached. Xylans are the principal hemicelluloses in monocotyledons. The xylan molecule consist of xylose units only.

Giving ONE reason, predict what would occur if xylanase were used to clarify fresh sugar cane juice. [ 2 marks]

**Total 20 marks**

## MODULE 2

Answer EITHER Question 6 OR Question 7.

6. (a) Explain how the sequence of nucleotides in the DNA molecule is related to:
- (i) the sequence of nucleotides in the RNA molecule [ 6 marks]
  - (ii) the order in which the t-RNA molecules align specific amino acids. [ 5 marks]
- (b) How are the following influenced by the organism's DNA?
- (i) The precise and accurate folding of globular proteins [ 5 marks]
  - (ii) The erroneous formation of haemoglobins in sickle-cell anaemia [ 4 marks]

**Total 20 marks**

GO ON TO THE NEXT PAGE

7. (a) Describe the structure of the anther **and** the way in which pollen grains are formed within it. **[10 marks]**
- (b) Name the type of fertilisation exhibited by EACH of the following plants and **briefly** explain the mechanism being used:
- In the flower *Chamaenerion angustifolia*, the stamens and carpels reach maturity at different times.
  - In the flower *Lilium longiflorum*, there is a wide separation of the anthers and the stigma.
  - In *Cajanus cajan*, the pollen grains from mother plants do not germinate if placed on its own stigma.
  - In *Mangifera indica*, honey bees visit the flowers bringing pollen from other flowers.
  - In *Carica papaya*, male and female flowers are found on separate plants and pollen passes from male to female plants. **[ 5 marks]**
- (c) Bananas and sweet potatoes reproduce by asexual methods. Tomatoes and peppers reproduce sexually.

Discuss the advantages and disadvantages of each type of reproduction in these plants. **[ 5 marks]**

**Total 20 marks**

### MODULE 3

Answer EITHER Question 8 OR Question 9.

8. (a) What is meant by the following terms?
- (i) Gene
  - (ii) Allele [ 2 marks]
- (b) Explain the operation of multiple alleles in the ABO Blood Grouping System in humans **and** use genetic diagrams to show how parents with A (mother) and B (father) blood types may produce a family with all four types of blood group represented in the children. [ 8 marks]
- (c) (i) What are sex chromosomes **and** how do they control the inheritance of sex? [ 4 marks]
- (ii) With the aid of a genetic diagram, explain sex linkage, showing how it is possible for a normal sighted woman and a normal sighted man to have colour-blind sons. [ 6 marks]

**Total 20 marks**

9. (a) Describe the five-kingdom classification system **and** discuss the principles and importance of modern classification systems. [10 marks]
- (b) A plant has been discovered that is unlike any in recorded literature. Suggest the procedure for classifying the new plant. [ 5 marks]
- (c) Discuss the importance of conserving biodiversity. [ 5 marks]

**Total 20 marks**

**END OF TEST**

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