



TEST CODE **02107010**

FORM TP 2005170

MAY/JUNE 2005

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

ADVANCED PROFICIENCY EXAMINATION

BIOLOGY

UNIT 1 – PAPER 01

1 $\frac{3}{4}$ hours

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

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. Candidates must attempt ALL questions in this paper.
2. Answers are to be written in the spaces provided in this answer booklet.
3. EACH question is worth 10 marks.
4. The use of silent non-programmable calculators is allowed.

1. (a) Table 1 below is constructed to show the constituents and types of bonding in THREE saccharides. Complete Table 1 below.

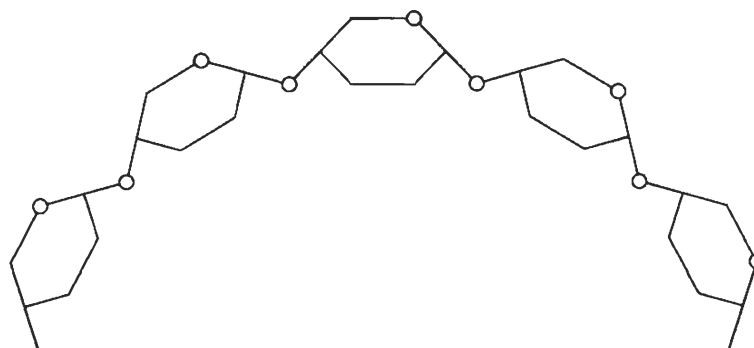
TABLE 1: BONDING IN THREE SACCHARIDES

Saccharide	Constituent monomers	Precise type of bonding
Sucrose		
Glycogen		
Cellulose		

[3 marks]

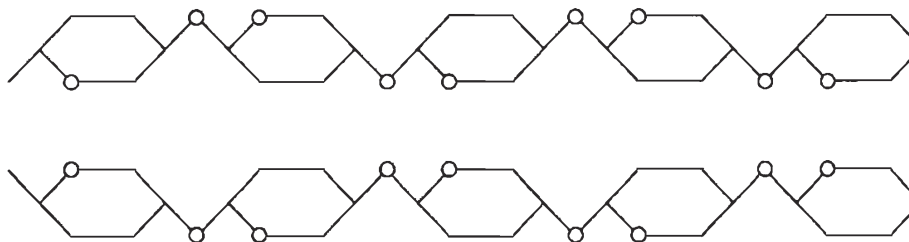
- (b) The diagrams in Figure 1 below show portions of two polysaccharides.
On EACH diagram, draw ALL the hydroxyl groups (– OH) on carbon number two of EVERY monomer.

- (i) Glycogen:



[1 mark]

- (ii) Cellulose:



[1 mark]

Figure 1. Two polysaccharides A and B

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(c) (i) Circle the groups involved in hydrogen bonding between the two adjacent polysaccharide chains in cellulose in Figure 1. [1 mark]

(ii) Suggest TWO ways in which the structure of glycogen supports its functions.

[2 marks]

(d) With reference to the structures shown in Figure 1, suggest why glycogen is soluble in water and cellulose is not.

[2 marks]

Total 10 marks

2. (a) Table 2 below is designed to show differences between prokaryotes and eukaryotes.

Complete Table 2 to detail the differences in size and structure between prokaryotes and eukaryotes.

TABLE 2

STRUCTURAL DIFFERENCES BETWEEN PROKARYOTES AND EUKARYOTES

Feature	Prokaryote cells	Eukaryote cells
Approximate size		
Nuclear Structure		
Structure of DNA		
Energy generating structures		
Ribosomes		

[5 marks]

(b) State THREE features possessed by

(i) animal cells but NOT plant cells.

Feature: _____

Feature: _____

Feature: _____

(ii) plant cells but NOT animal cells.

Feature: _____

Feature: _____

Feature: _____

[3 marks]

(c) The Benedict's test is used to confirm the presence of a reducing sugar in solution. If a solution contains ONLY a non-reducing sugar, what modifications must be made to the Benedict's test procedure to reveal the presence of the non-reducing sugar?

[2 marks]

Total 10 marks

3. (a) State why it is necessary for enzymes to be present in living organisms.

[2 marks]

- (b) The anti-cancer drug methotrexate targets the enzyme dihydrofolate reductase. The activity of the enzyme dihydrofolate reductase is very high in some tumour cells.

Suggest whether methotrexate would be effective in curing tumours and give ONE reason for your answer.

[2 marks]

- (c) Diisopropylphosphorofluoridate (DIPF) reacts with the hydroxyl group of the amino acid serine at an enzyme's active site, preventing the use of this side chain in catalytic reactions. DIPF is classified as a nerve gas and can cause death.

Deduce the type of inhibition that is occurring.

[1 mark]

- (d) The enzyme succinate dehydrogenase is found in all mitochondria, and catalyses the conversion of succinate to fumarate. Oxaloacetate is similar to succinate but when this compound binds to the enzyme, no reaction occurs. In a mixture of succinate and oxaloacetate, when oxaloacetate moves out of the active site of succinate dehydrogenase, the enzyme is free, once again, to catalyse conversion of succinate to fumarate.

Deduce the type of inhibition occurring.

[1 mark]

- (e) In EACH graph in Figure 2 below, one line represents a catalysed reaction while the other represents an uncatalysed reaction.

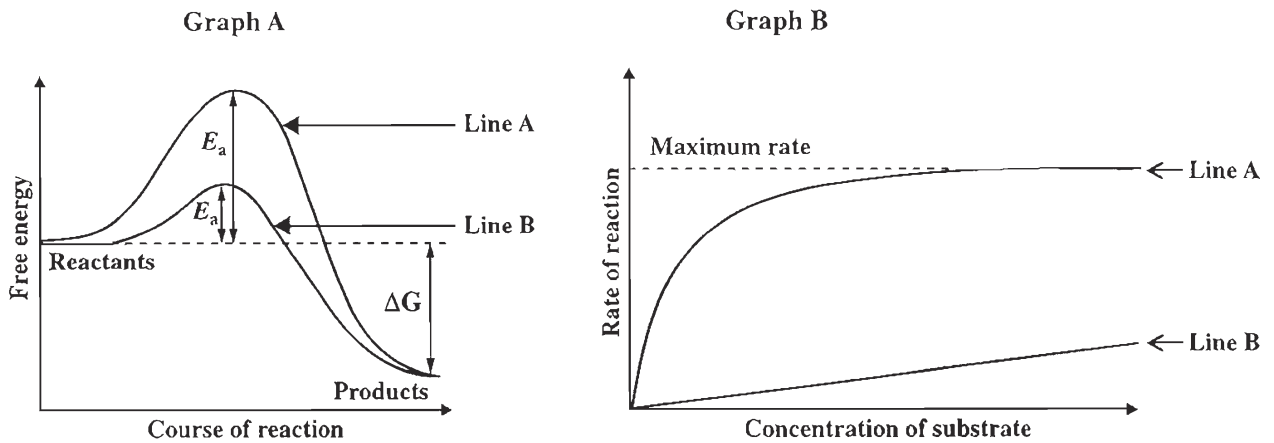


Figure 2. Catalysed and uncatalysed reactions

- (i) a) Examine Graph A in Figure 2. Which graph line represents the enzyme catalysed reaction?

Enzyme catalysed reaction: Line _____ [1 mark]

- b) Give ONE reason for your answer to (i) a) above.

_____ [1 mark]

- (ii) a) Examine Graph B in Figure 2. Which graph line represents the enzyme catalysed reaction?

Enzyme catalysed reaction: Line _____ [1 mark]

- b) Give ONE reason for your answer to (ii) a) above.

_____ [1 mark]

Total 10 marks

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4. (a) Briefly outline the process by which chromatids condense to one tenth of their original length.

[1 mark]

- (b) Name the FOUR nucleotide bases that are found in DNA.

[2 marks]

- (c) The drug dideoxycytidine is a nucleoside made with 2', 3' dideoxyribose sugar. This sugar does not have OH⁻ groups on the 2' and 3' positions. Consider the structure of a strand of DNA and explain why this drug would stop DNA replication.

[2 marks]

(d) Figure 3 shows two stages, A and B, of a biological process that occurs in living cells.

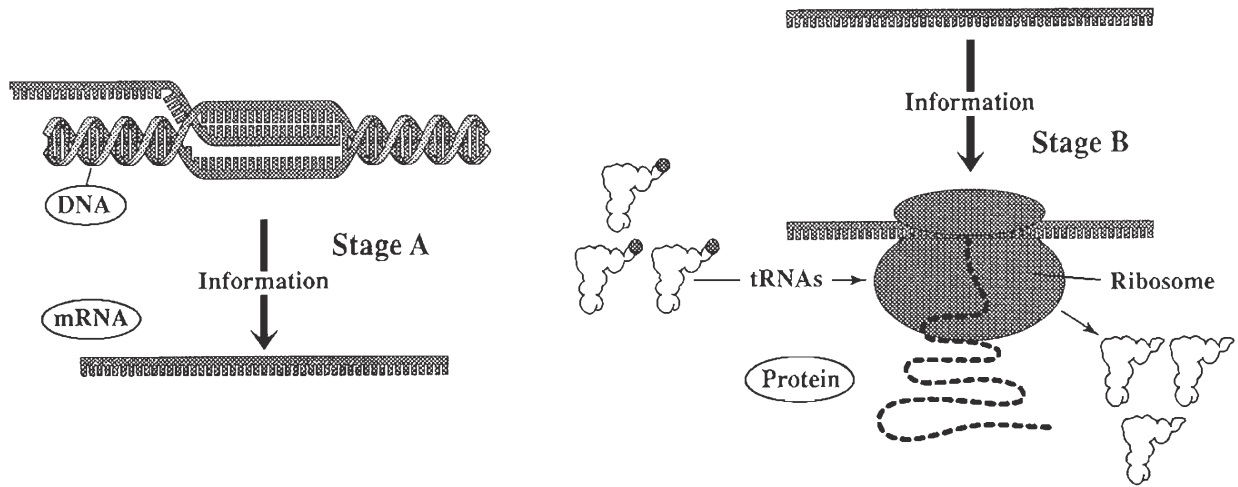


Figure 3. A biological process occurring in living cells

(i) Name the stages A and B of the process occurring in Figure 3.

Stage A _____

Stage B _____

[2 marks]

(ii) Outline the process occurring at Stage A in Figure 3.

[3 marks]

Total 10 marks

5. Study Figure 4 showing a post-fertilization carpel.

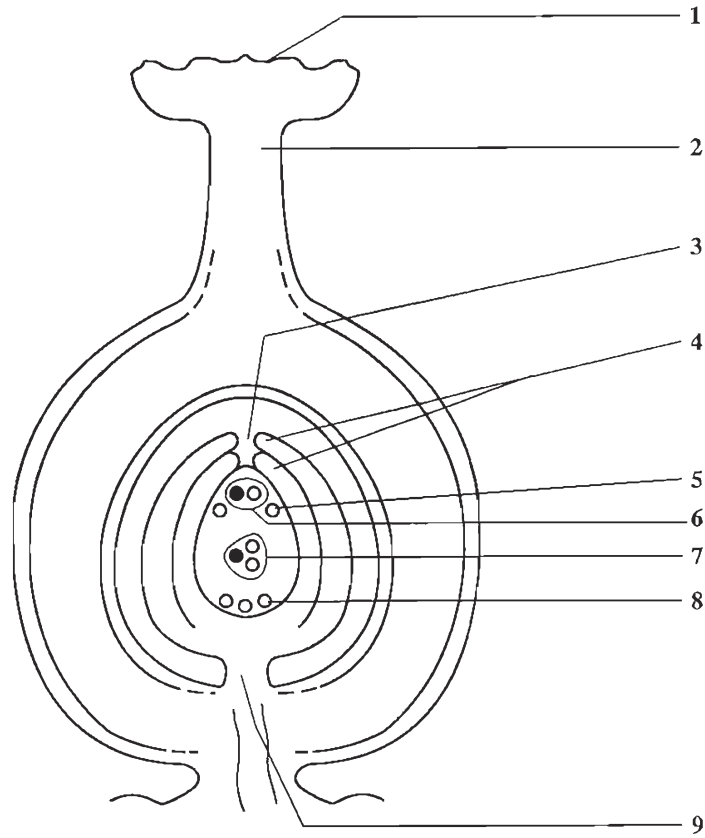


Figure 4. A post-fertilization carpel

(a) Identify the structures labelled 1 to 9 in Figure 4 above.

- | | | | |
|---|-------|---|-------|
| 1 | _____ | 5 | _____ |
| 2 | _____ | 6 | _____ |
| 3 | _____ | 7 | _____ |
| 4 | _____ | 8 | _____ |
| | | 9 | _____ |

[3 marks]

(b) State the contributions of the structures labelled 3 and 4 in Figure 4 to the establishment of the next generation.

(i) Label No. 3 _____

_____ [2 marks]

(ii) Label No. 4 _____

_____ [1 mark]

(c) In the plant structure shown in Figure 4, a 'double fertilization' occurs. State the names of the FOUR nuclei which contribute to the double fertilization.

_____ [2 marks]

(d) Compare the development of the zygote with that of the fertilized endosperm cell, in relation to:

(i) The future differentiation of tissue

_____ [1 mark]

(ii) The location of food storage

_____ [1 mark]

Total 10 marks

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6. Figure 5 shows a foetus in its eighth week of pregnancy.

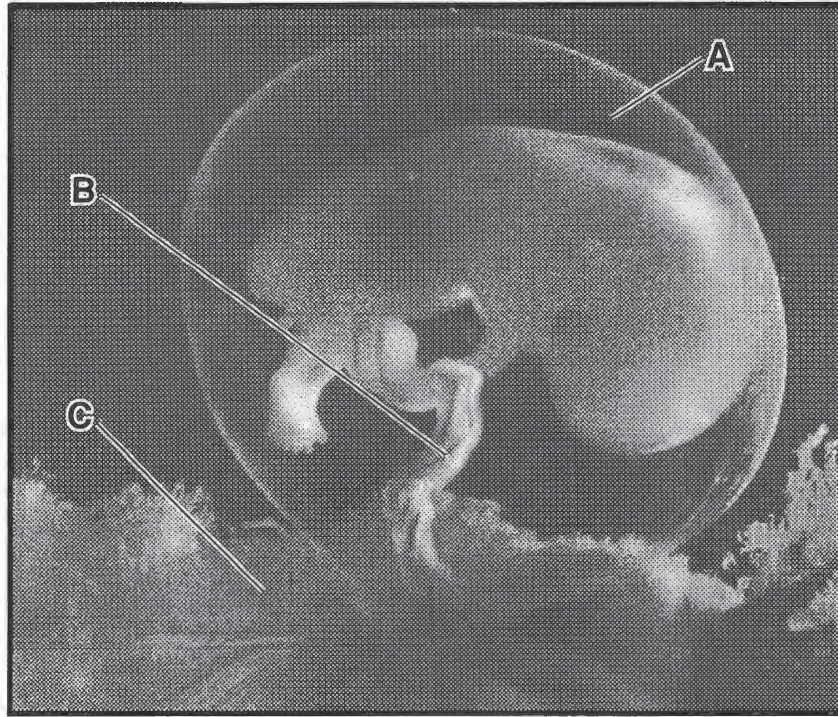


Figure 5. Foetus in the eighth week of pregnancy

Biology of Life on Earth.
J. Audesirk, G. Audesirk, Prentice Hall

- (a) (i) Name the cavity, labelled A in Figure 5, in which the foetus is developing **and** state its function.

[3 marks]

- (ii) Name the structure labelled B in Figure 5 **and** describe its function.

[3 marks]

GO ON TO THE NEXT PAGE

(iii) Identify the structure in Figure 5 which acts as an endocrine organ.

[1 mark]

(b) Describe the effect on her unborn child when a woman drinks excessive quantities of alcohol.

[2 marks]

(c) Explain why the placenta is not an effective barrier against substances that can harm the foetus.

[1 mark]

Total 10 marks

7. (a) State TWO ways in which the process of meiosis increases rearrangement of the chromosomal material before it reaches the poles of the cell.

[2 marks]

- (b) Down's Syndrome is an example of a mutation.

(i) What type of mutation is involved in Down's Syndrome?

[1 mark]

(ii) State how this mutation is caused.

[1 mark]

- (c) Sickle cell anaemia is caused by a mutation in the haemoglobin gene. The normal alleles are AA, the lethal sickle cell alleles are SS, and the heterozygote, which shows mild sickling, is AS. The sickle cell allele has been established in the African population for thousands of years, alongside the disease malaria.

The maps of Africa in Figure 6 show the distribution of sickle cell disease and malaria, prior to the 1950s, when mosquito eradication programs began.

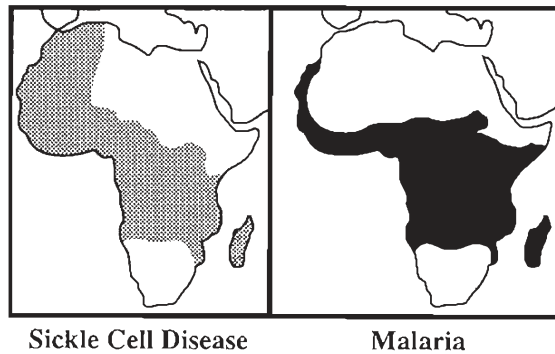


Figure 6. Distribution of two diseases

Following the mosquito eradication programs in Africa, the incidence and distribution of malaria were reduced.

What effect would this reduction in the cases of malaria have on the incidence and distribution of sickle cell disease, and why?

[4 marks]

- (d) Between 1650 and 1850, African populations were established in the Caribbean. Some of the territories had endemic malaria and some did not. The present-day frequencies of sickle cell (SS, AS) and the normal gene (AA) have been calculated, and the results are expressed in Table 3.

TABLE 3: FREQUENCIES OF TWO DISEASES

Malaria present in territory			Malaria absent in territory		
Territory	Alleles		Territory	Alleles	
	SS or AS	AA		SS or AS	AA
Honduras	164	541	St. Vincent	65	683
Suriname	35	137	Barbados	64	848

Use the figures in Table 3 to determine the ratio of sicklers (SS and AS) to normal (AA) in the malaria-present territories in comparison with the malaria-absent territories. How do they compare?

[2 marks]

Total 10 marks

8. (a) Give TWO reasons why classification systems are important.

[2 marks]

- (b) Figure 7 below shows eight carefully preserved prehistoric specimens discovered by a student. These specimens must be classified.

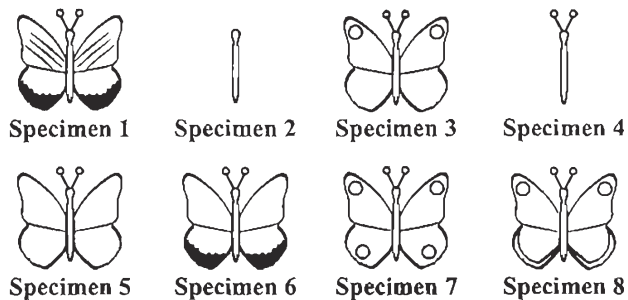


Figure 7. Butterfly specimens

- (i) Select TWO features that could be used to classify the prehistoric specimens in Figure 7.

[2 marks]

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- (ii) Using your knowledge of hierarchy in classification systems, arrange the specimens in evolutionary order from original ancestor to descendants. Use specimen numbers to illustrate your answer. DO NOT draw the specimens.

ORIGINAL ANCESTOR

DESCENDENTS

[4 marks]

- (c) Name the five kingdoms of the 'Five-Kingdom Classification System'.

[1 mark]

- (d) Explain what is meant by the term 'dichotomous key'.

[1 mark]

Total 10 marks

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9. (a) By means of named examples, distinguish between:

(i) Biome and Biomass

[2 marks]

(ii) In situ and ex situ conservation methods

[2 marks]

(b) Give TWO reasons why it is more difficult to store frozen embryos than frozen sperm.

[2 marks]

(c) There are fewer than 250 white (albino) tigers on earth and they all live in zoos or reserves. Captive breeding programs are used between the network of tiger sanctuaries.

(i) Give TWO reasons why white tiger populations in the wild have become so low.

[2 marks]

(ii) Describe TWO objectives of the 'captive breeding programs' used between the network of tiger sanctuaries.

[2 marks]

Total 10 marks

END OF TEST

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