



VICTORIA JUNIOR COLLEGE
BIOLOGY DEPARTMENT
JC2 PRELIMINARY EXAMINATIONS 2015
Higher 1

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CANDIDATE NAME

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EXAM NUMBER							
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BIOLOGY

8875/02

Paper 2 Core Paper

14 September 2015

Additional Materials: Answer Paper

2 hours

READ THESE INSTRUCTIONS FIRST

Write your CT GP/ INDEX no. and name on all the work you hand in.
Write in dark blue or blue pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use any staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions

Section B

Answer any **one** question.

Write your answers on separate answer paper provided.

At the end of the examinations,

1. hand in section A and the 1 question you have attempted from section B separately;
2. fasten all your work securely;
3. enter the number of the section B question you have answered in the grid opposite.

The intended number of marks is given in brackets [] at the end of each question.

For Examiner's Use	
Section A	
1	
2	
3	
4	
Section B	
5 or 6	
Total	

This paper consists of **11** printed pages

Section A

Answer **all** the questions in this section.

- 1 **Figure 1** shows ribosomes attached to the endoplasmic reticulum, in the process of synthesising lytic enzymes for the lysosomes in a eukaryotic cell.

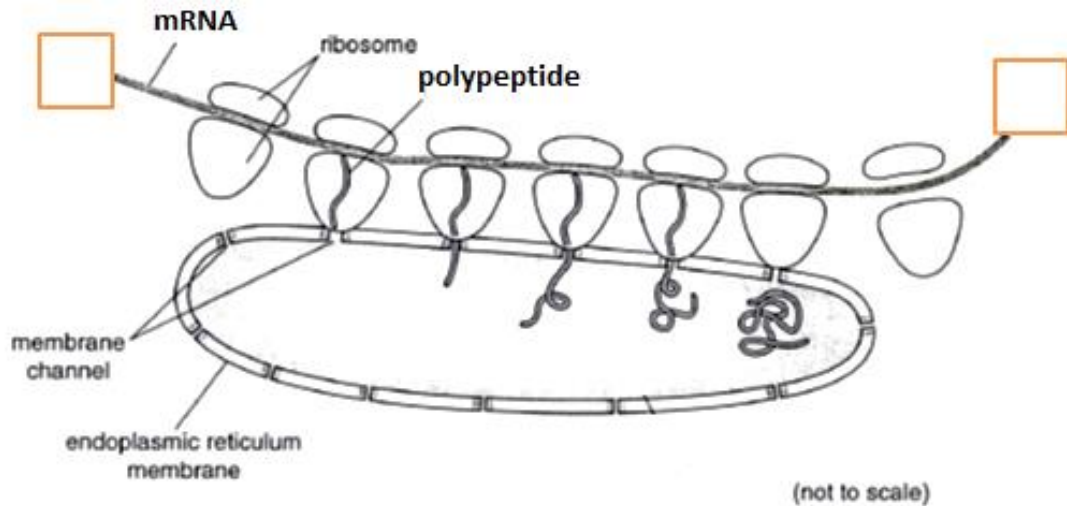


Figure 1

Source: GCE A Level N2009/P2

- (a) Label in the boxes provided above, the 5' and 3' end of the mRNA. [1]

- (b) Describe two structural differences between the ribosome and the endoplasmic reticulum. [2]

Ribosome	Endoplasmic reticulum

- (c) Suggest two possible functions of the protein that made up the membrane channel. [2]

- (d) Explain how the ribosomes above increase the efficiency of protein synthesis in the cell. [2]

An mRNA coding for the same polypeptide was isolated from the nucleus of the same cell. It is found to be longer in length compared to the mRNA shown in **Figure 1**.

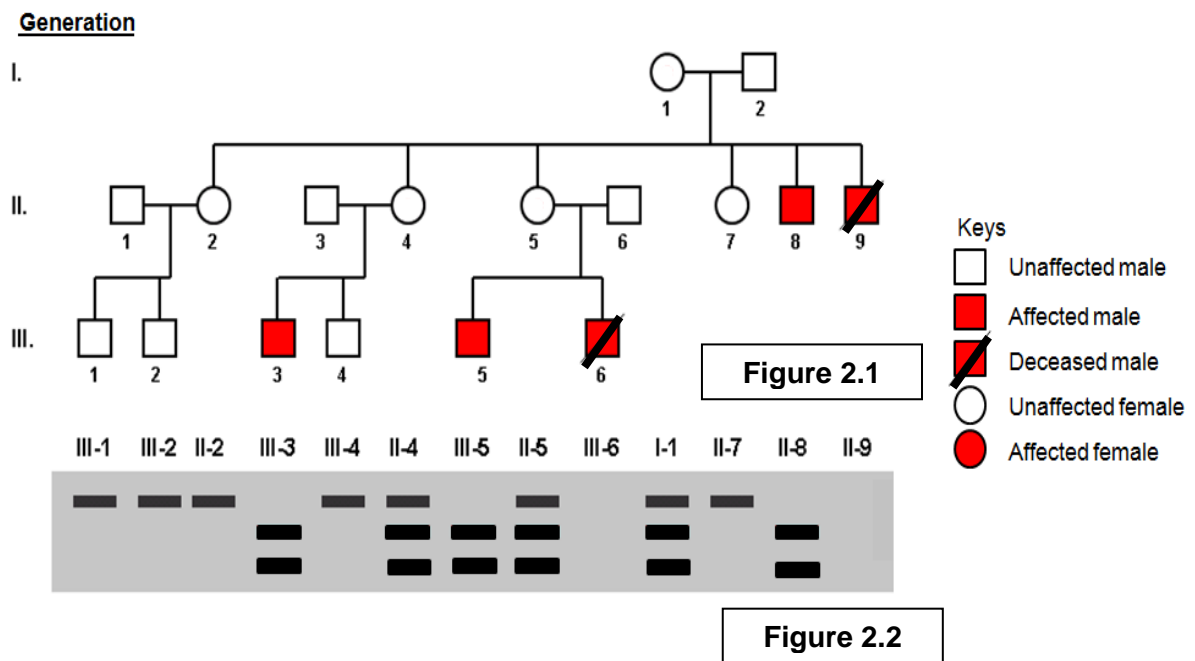
- (e) Explain the significance of this difference to the cell. [2]

- (f) Outline how a lysosome is formed after the enzymes have been synthesised in the endoplasmic reticulum.[2]

[Total: 11]

- 2 Haemophilia A is a blood clotting disorder caused by a mutation in the gene that codes for an essential blood-clotting protein, anti-haemophilic factor (AHF). The disorder is characterized by episodes of internal and external bleeding in affected individual.

Figure 2.1 shows a pedigree of a family with history of haemophilia A. The AHF gene was first isolated from each individual using Polymerase Chain Reaction (PCR). The PCR products were then digested using restriction enzymes and the resulting fragments separated by gel electrophoresis. **Figure 2.2** shows the results of the gel electrophoresis for some of the individuals.



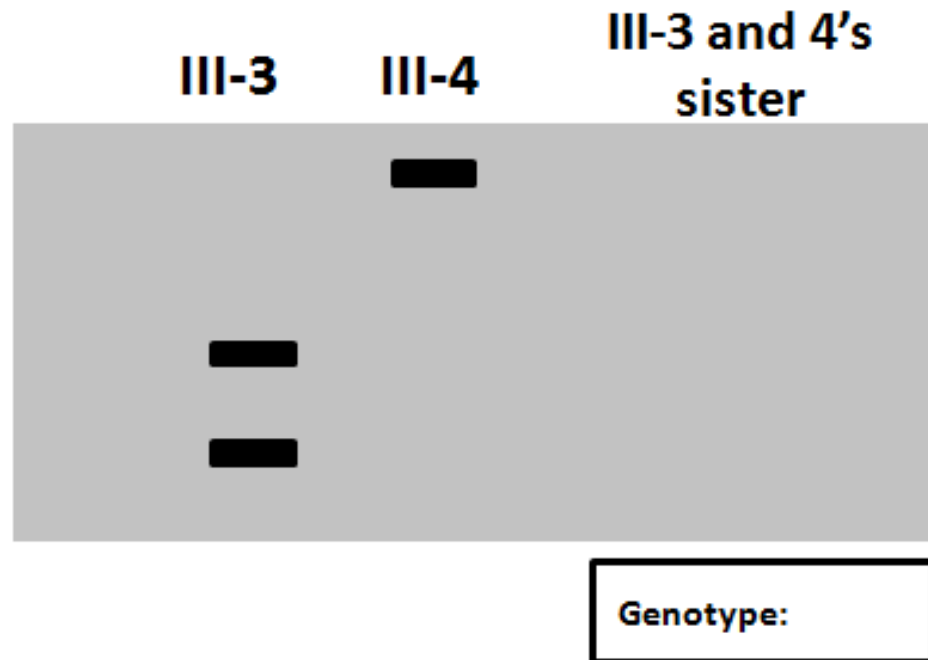
- (a) Using evidence from the **Figure 2.1**, state two pieces of evidence to show that the inheritance of haemophilia A is sex-linked, recessive. [2]

- (b) Explain, using a genetic diagram, how a cross between two phenotypically normal individuals, II-3 and II-4, can result in an affected child, III-3. [3]

Symbols:

- (c) With reference to **Figure 2.2**, suggest what could have happened to the AHF gene to cause the difference in the gel pattern between individuals III-1 and III-3. [4]

- (d) If couple II-3 and II-4 has a daughter, what will be a possible gel electrophoresis pattern for her? Draw the band(s) in the box provided below and state her corresponding genotype. [2]



[Total: 11]

- 3 **Figure 3** below shows the molecular structure of the protein ATP synthase that has been extracted from the mitochondria of yeast. The structure of this protein can be divided into two main parts based on their structure as well as function.

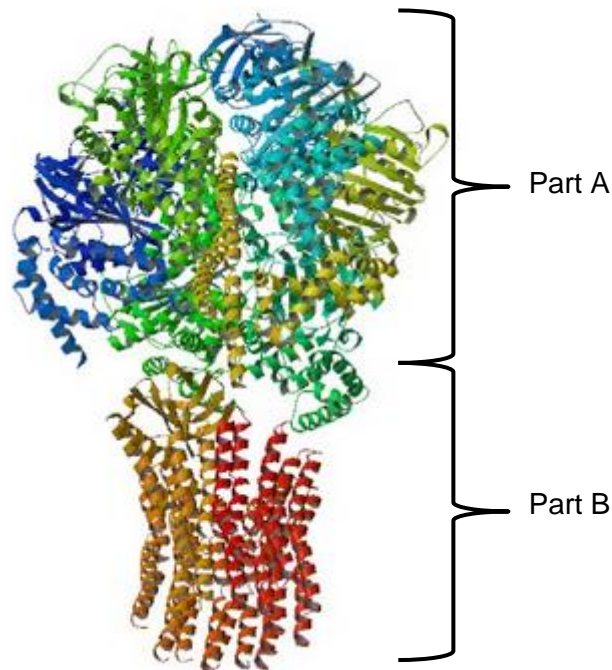


Figure 3 ATP synthase

Source: www.rcsb.org

(a) With reference to the figure, relate the structure of A and B to their specific functions [4]

(i) Part A [2]

(ii) Part B [2]

(b) Describe the importance of ATP synthase in ATP production. [2]

(c) Brown adipose tissue or brown fat is one of two types of fat found in mammals. It is especially abundant in newborns and in hibernating mammals. The mitochondria present in these tissues have a higher than normal concentration of a protein known as thermogenin present on the inner membrane. This protein uncouples electron transport from oxidative phosphorylation.

Based on the information above, suggest the function of brown fats in newborns and hibernating animals. Explain your answer. [2]

[Total: 8]

- 4 **Figure 4.1** illustrates two major classes of stem cells as well as somatic cells that can be found within a living multicellular organism.

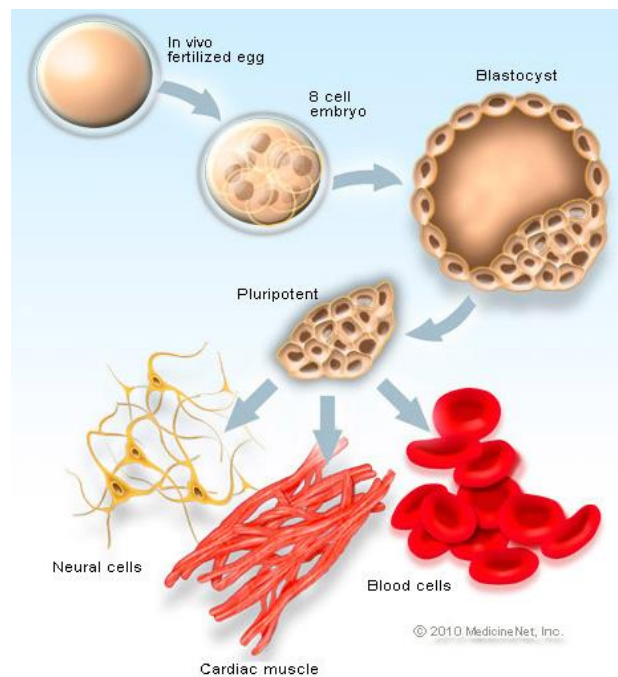


Figure 4.1

[<http://www.medicinenet.com/script/main/art.asp?articlekey=14526>]

(a) With reference to **Figure 4.1**,

(i) distinguish between stem cells and somatic cells. [2]

(ii) identify the two classes of stem cells and account for their separate classification. [2]

- (b)** Adult stem cells in the mature organism occur in small numbers throughout the body. Explain their biological significance despite occurring in small numbers. [3]

- (c)** Cordlife is a commercial enterprise that charges its customers to cord blood banking. It is touted as the “unique opportunity for parents to help safeguard the health of their child by storing the newborn’s cord blood stem cells at birth.”

Explain the basis of the claim that cord blood can safeguard the health of a child when cord blood stem cells are stored from birth. Suggest if the claim is valid. [3]

[Total: 10]

Section B

Answer EITHER 5 or 6.

Write your answers on the separate answer paper provided.

Your answers should be illustrated by large, clearly labelled diagrams, where appropriate.

Your answers must be in continuous prose, where appropriate.

Your answers must be set out in sections **(a)**, **(b)** etc., as indicated in the question.

Either

- 5** (a) Describe the process of Polymerase Chain Reaction (PCR). [6]
- (b) How does PCR differ from DNA replication? [6]
- (c) Using named examples, explain the significance of genetic engineering in improving the quality and yield of crop plants and animals and also in solving the demand for food in the world. [8]

[Total: 20]

- 6** (a) Compare the molecular structure of a triglyceride and a phospholipid, relating these structures to their functions in living organisms. [8]
- (b) Explain how anatomical, embryological and molecular homology supports Darwin's theory of natural selection. [7]
- (c) Discuss the ethical and social implications of genetically modified salmon. [5]

[Total: 20]

-End of paper-