

INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
in preparation for General Certificate of Education Advanced Level
Higher 1

CANDIDATE
NAME

CLASS

INDEX NUMBER

BIOLOGY

8875/02

Paper 2 Core Paper

23 August 2016

2 hours

Additional Materials: Answer Paper
Cover Page

READ THESE INSTRUCTIONS FIRST

Write your name and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions.

Section B

Answer **one** question.

At the end of the examination, fasten all your work securely together.

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

For Examiner's Use	
Section A	
1	14
2	11
3	8
4	7
Section B	
5 / 6	20
Total	60

This document consists of **11** printed pages and **1** blank page.



Section A
Answer **all** questions.

- 1 Fig. 1.1 shows an animal cell undergoing mitosis.



Fig. 1.1

- (a) (i) With reference to Fig. 1.1, identify a cell structure that is present only in an animal cell.

..... [1]

- (ii) Describe the structure and function of the structure identified in **a(i)**.

.....

 [3]

- (b) Explain the behaviour of the nuclear envelope in the early stage of mitosis.

.....

 [2]

(c) With reference to Fig. 1.1,

(i) state the number of chromosomes observed at metaphase stage.

..... [1]

(ii) state the number of chromosomes observed at anaphase stage.

..... [1]

(d) In an experiment, a protease was added to the mitotic stage immediately before the stage shown in Fig. 1.1.

Suggest the effect of addition of protease on the events shown in Fig. 1.1.

.....

.....

.....

..... [2]

Fig. 1.2 shows the same animal cell in a later stage of mitosis.

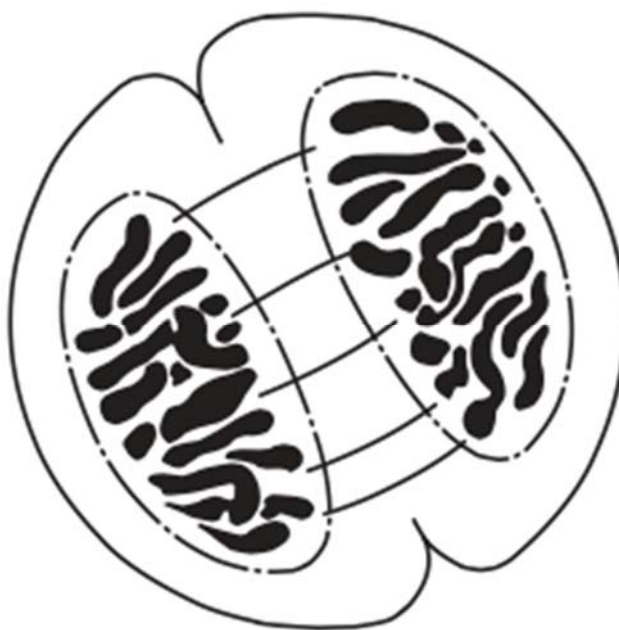


Fig. 1.2

- (e) Explain the property of the membrane that allows it to form the cleavage furrow.

.....

.....

..... [2]

- (f) State **two** changes in the composition of the membrane if the temperature surrounding the cell is increased.

.....

.....

..... [2]

[Total: 14]

- 2 Polymerase chain reaction (PCR) is a molecular technique used to amplify target DNA. It comprises of a three-stage process involving cycles of repeated heating and cooling.

Fig. 2.1 is a graph showing the process.

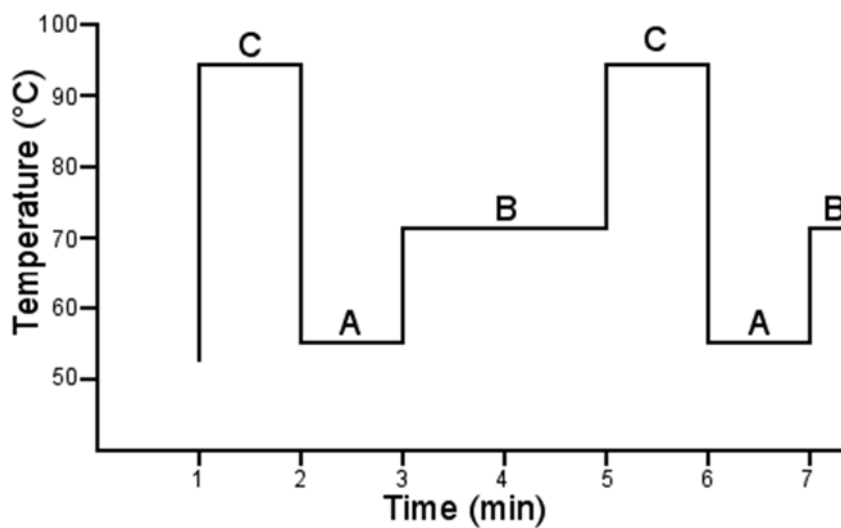


Fig. 2.1

(a) With reference to Fig. 2.1,

(i) describe the process occurring in stage **B**.

.....

.....

.....

.....

.....

..... [3]

(ii) describe the process occurring in stage **C**.

.....

.....

.....

..... [2]

(b) Stage **A** is the annealing phase of PCR.

Describe **two** differences between this phase for DNA replication in eukaryotes and in stage **A** of PCR.

.....

.....

.....

..... [2]

In PCR, the design of the primer is important in the successful amplification of the target sequence.

Fig. 2.2 shows the efficacy of different primers (**D**, **E** and **F**) binding to the same target sequence against its melting temperature. The same concentration of primers was used in the experiment. A higher amount of fluorescence observed indicates the presence of higher amounts of bound primer.

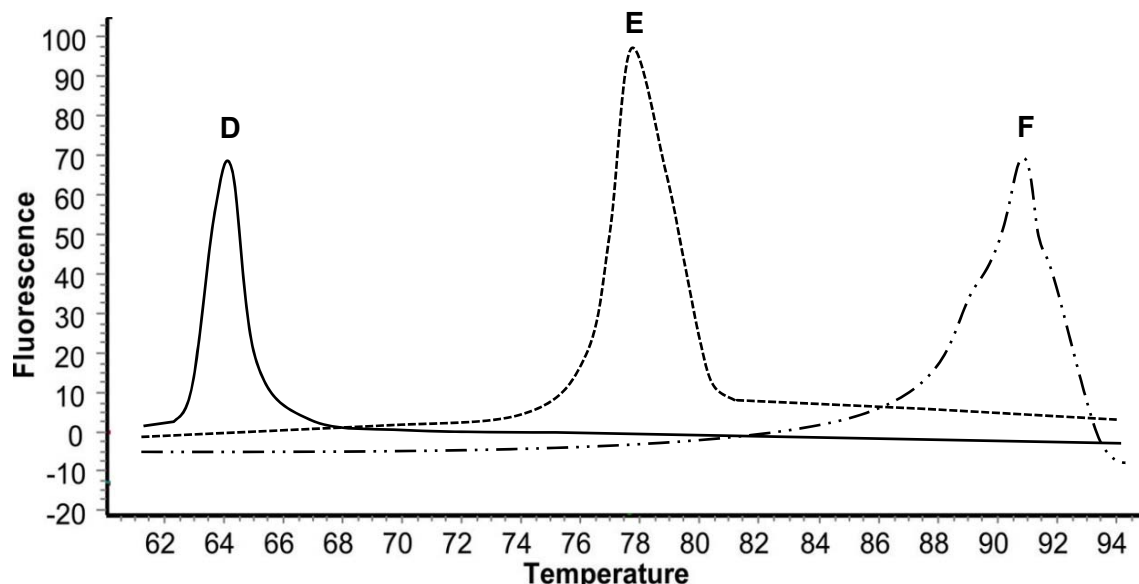


Fig. 2.2

(c) With reference to Fig. 2.1 and Fig. 2.2,

(i) explain why primers **D** and **E** have different melting temperatures;

.....

.....

.....

..... [2]

(ii) suggest and explain which is the optimal primer to be used for this PCR.

.....

.....

.....

..... [2]

[Total: 11]

- 3 Sickle cell anaemia is caused by a mutation in the gene coding for haemoglobin. This mutation results in a loss of the restriction site *DdeI*, as shown in Fig. 3.1.

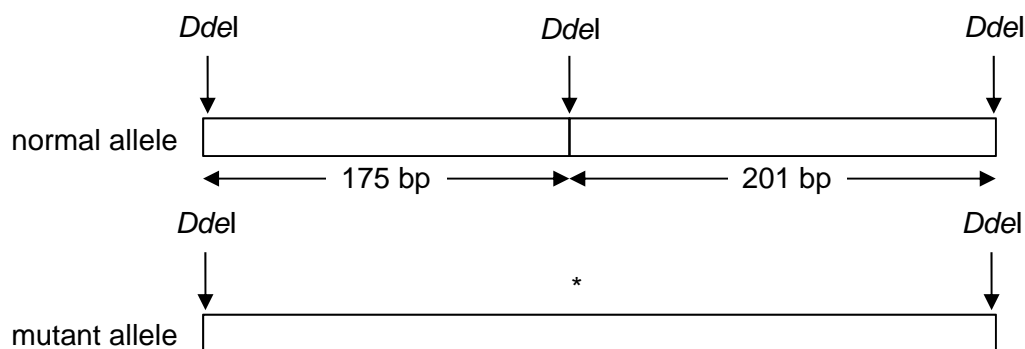


Fig. 3.1

DNA samples were obtained from children of a family. After subjecting the samples to restriction digestion using the enzyme *DdeI*, the resultant fragments were analysed using gel electrophoresis.

Fig. 3.2 shows the inheritance of sickle cell anaemia in the family and the results obtained from the gel electrophoresis.

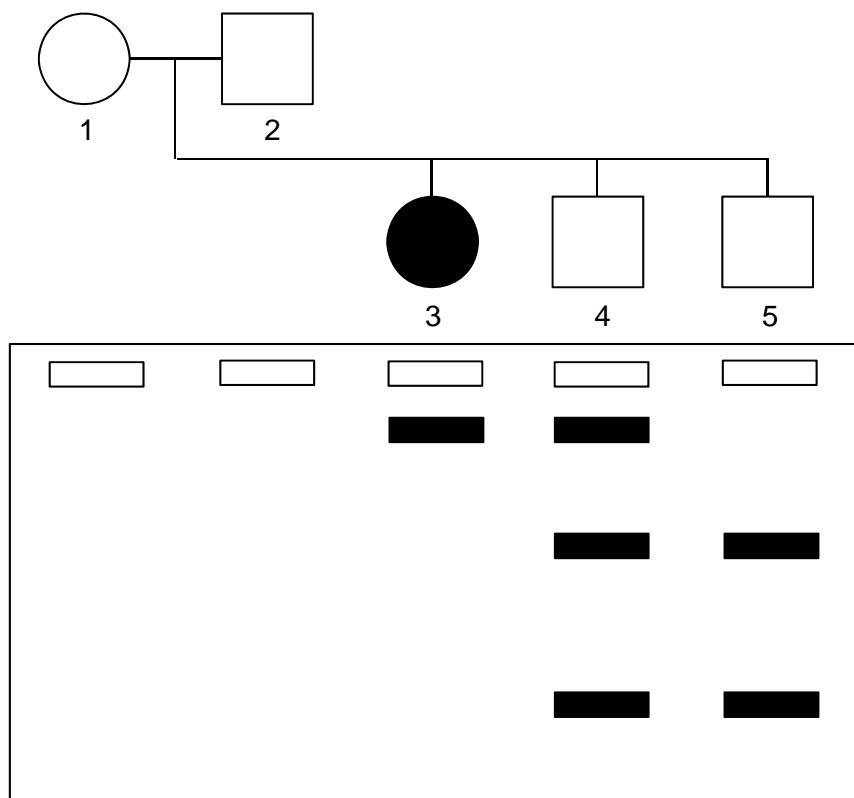


Fig. 3.2

- (a) State the mode of inheritance of sickle cell anaemia.

[1]

- (b) Using the symbols **A** and **a**, determine the genotypes of individuals **3**, **4** and **5**.

3

4

5 [1]

- (c) The same procedure was performed on the DNA samples obtained from the parents.

In the outline of the gel shown in Fig. 3.2, sketch the DNA banding pattern obtained for individuals **1** and **2**. [2]

- (d) With reference to the information given, outline how the following procedures are used in detection of sickle cell anaemia:

- (i) restriction digestion;

.....

 [2]

- (ii) gel electrophoresis.

.....

 [2]

[Total: 8]

- 4 Iron deficiency is the most common nutritional deficiency in the world. Use of genetic engineering to increase the iron content of the crops can be achieved by the introduction of genes coding for iron-binding proteins.

FvC5sdp is an iron-binding protein expressed in fungus. Five plants (**D-1**, **D-2**, **D-3**, **D-4** and **D-5**) expressing the gene coding for FvC5sdp were created. The total iron content of the fruits from wild type control (**WT**) and the transgenic lines were measured. The results are shown in Fig. 4.1.

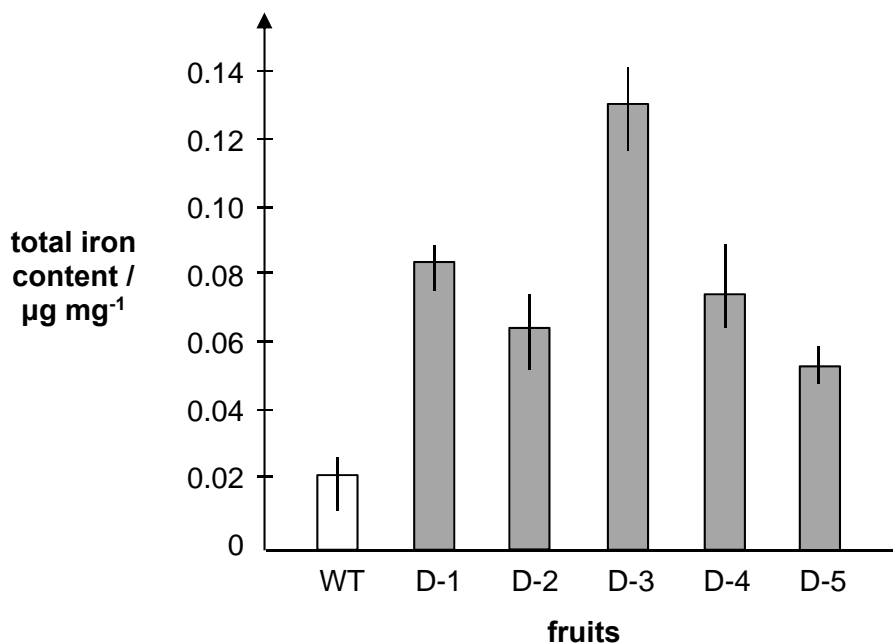


Fig. 4.1

- (a) With reference to Fig. 4.1, account for the effect of introducing the gene coding for FvC5sdp into the plants.

.....

.....

.....

..... [2]

- (b) Genetically modifying plants to increase iron content improves the quality of such crop plants.

Describe another example of a genetically modified crop plant with improved quality.

.....

.....

.....

..... [2]

- (c) Discuss the ethical and social implications of genetically modifying crop plants.

----- [3]

[Total: 7]

Section B

Answer **one** question.

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 section **(a)**, **(b)** etc., as indicated in the question.

Either

- 5** **(a)** Describe the structure of an amino acid and how a peptide bond is formed with another amino acid. [6]
- (b)** Explain how the structure of haemoglobin is adapted to its function. [6]
- (c)** Catalase is an enzyme found in potatoes. It catalyses the breakdown of hydrogen peroxide to oxygen and water.
- Describe how you would investigate the effect of substrate concentration on the rate of reaction. [8]

[Total: 20]

Or

- 6** **(a)** Outline the main features of photophosphorylation. [6]
- (b)** Explain how the structure of chloroplasts is adapted to its function. [6]
- (c)** Describe how Calvin cycle differs from the Krebs cycle. [8]

[Total: 20]

