

**RAFFLES INSTITUTION**

**2015 Year 6 Preliminary Examination**  
Higher 1

CANDIDATE  
NAME

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CIVICS  
GROUP

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INDEX  
NUMBER

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**BIOLOGY**

Paper 2

**8875/02**

**16<sup>th</sup> SEPTEMBER 2015**

**2 hours**

Additional materials:     Answer Sheet

**READ THESE INSTRUCTIONS FIRST**

Write your index number, CT group & name 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 **either ONE** question.

At the end of the examination, **hand in your essay SEPARATELY**.  
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
1	/ 9
2	/12
3	/9
4	/10
Section B	
5 or 6	/20
Total	/60

This document consists of **12** printed pages.



## Section A

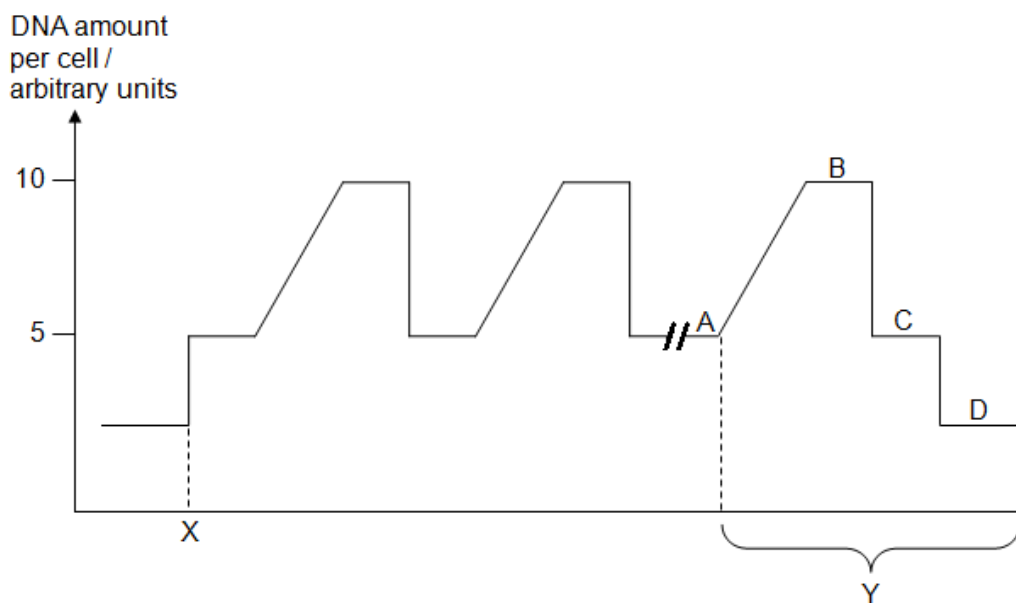
Answer **all** the questions in this section.

- 1 Meristematic root tissue from a barley seedling was prepared and its chromosomes were observed under a microscope. **Fig. 1.1** shows a cell from the root tissue at the metaphase stage of mitosis.



**Fig. 1.1**

**Fig. 1.2** shows the changes in amount of DNA at different stages of the barley life cycle.



**Fig. 1.2**

- (a) Mark out clearly with an arrow, ↓, on **Fig 1.2**, the part of the graph which corresponds to the stage shown in **Fig. 1.1**. [1]
- (b) With reference to **Fig. 1.2**, state which of the stages, from **A** to **D**,
- (i) has/have the **same** number of chromosomes as shown in **Fig. 1.1**; [1]

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- (ii) has/have a **different** number of chromosomes as shown in **Fig. 1.1**. [1]

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- (c) Explain how stages in **Y** lead to variation. [4]

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- (d) Explain the significance of the event occurring at **X**. [2]

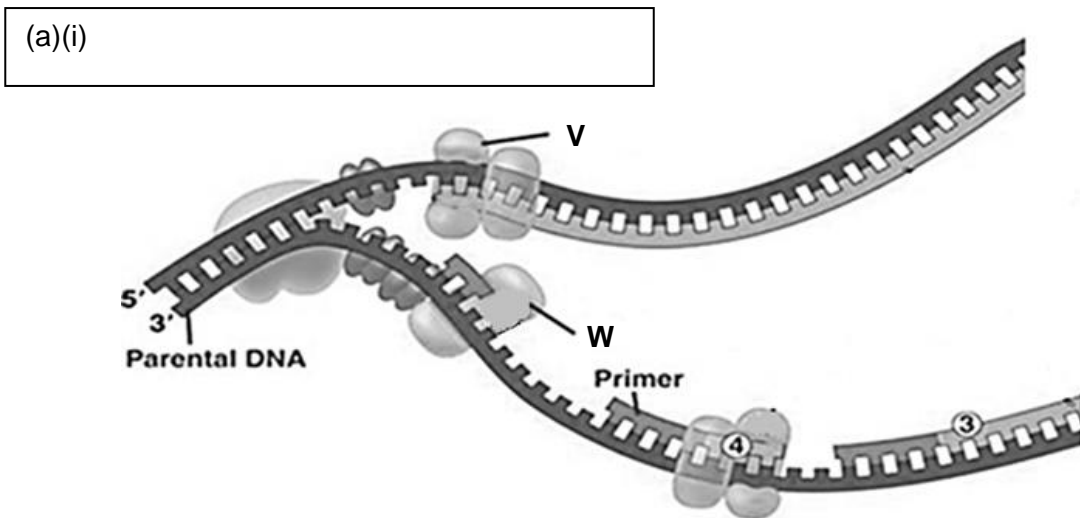
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[Total : 9]

2 **Fig. 2.1** shows DNA replication.



**Fig. 2.1**

(a) (i) Use an arrow to show the direction of replication of the leading strand in the box provided in **Fig. 2.1**. [1]

(ii) What do **5'** and **3'** on the DNA molecule represent? [2]

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(iii) Name the following molecules. [1]

**V:** .....

**W:** .....

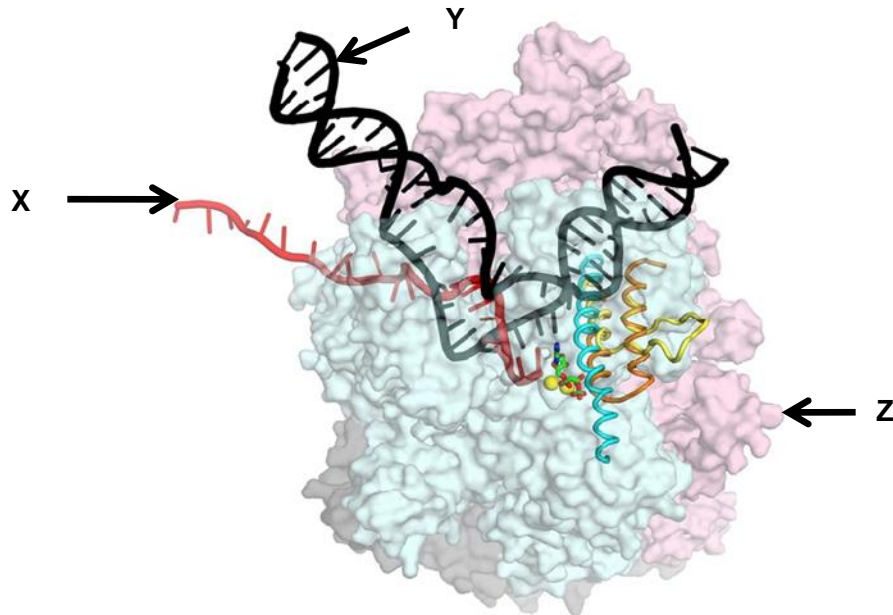
(iv) Describe the role of two named enzymes that are required for DNA replication. [2]

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**Fig. 2.2** shows transcription.



**Fig. 2.2**

**(b)** Name the following molecules [2]

**X** .....

**Y** .....

**(c)** Describe how the structure of molecule **Z** is adapted to its role in transcription. [2]

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**(d)** Describe how a silent mutation can result in no change in protein structure. [2]

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[Total :12]

3(a) Fig. 3.1 shows a series of aerobic and anaerobic reactions.

Each  $\bigcirc$  represents a carbon.

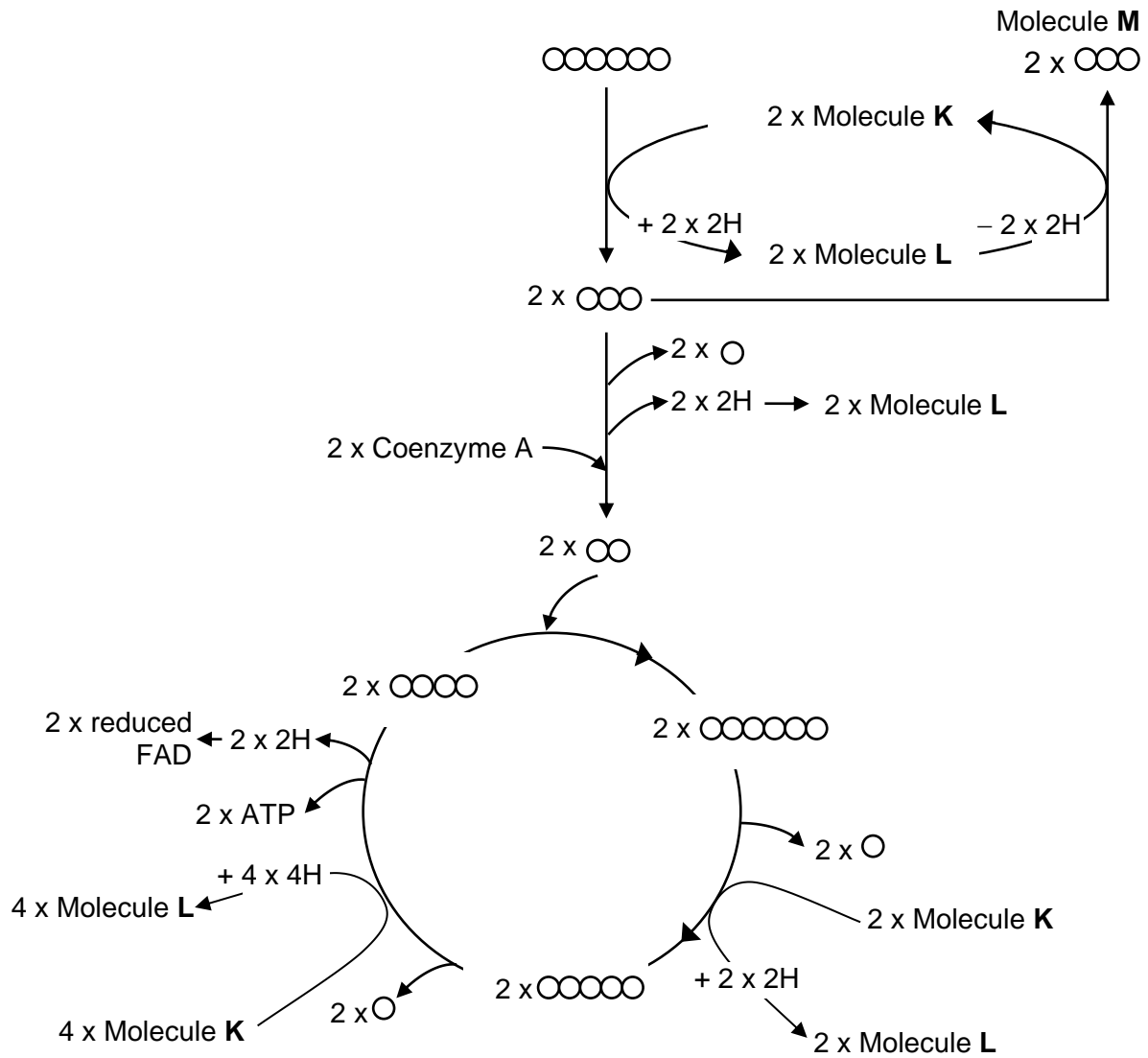
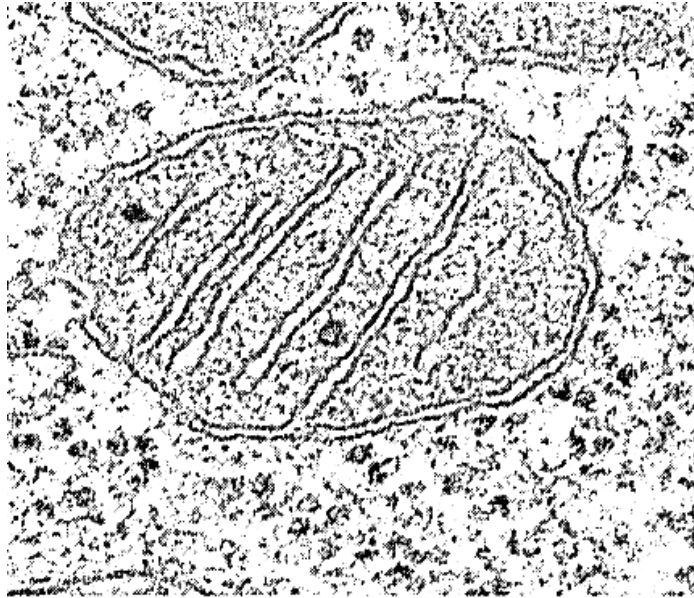


Fig. 3.1

**Fig. 3.2** shows an electron micrograph of a mitochondrion.



**Fig. 3.2**

With reference to **Fig. 3.1**,

- (i) Using an 'X', mark a point on **Fig. 3.2** clearly, showing where Molecule **M** is produced. [1]

- (ii) Name Molecule **L**. [1]

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- (iii) In aerobic conditions, explain how Molecule **L** is converted to Molecule **K**. [2]

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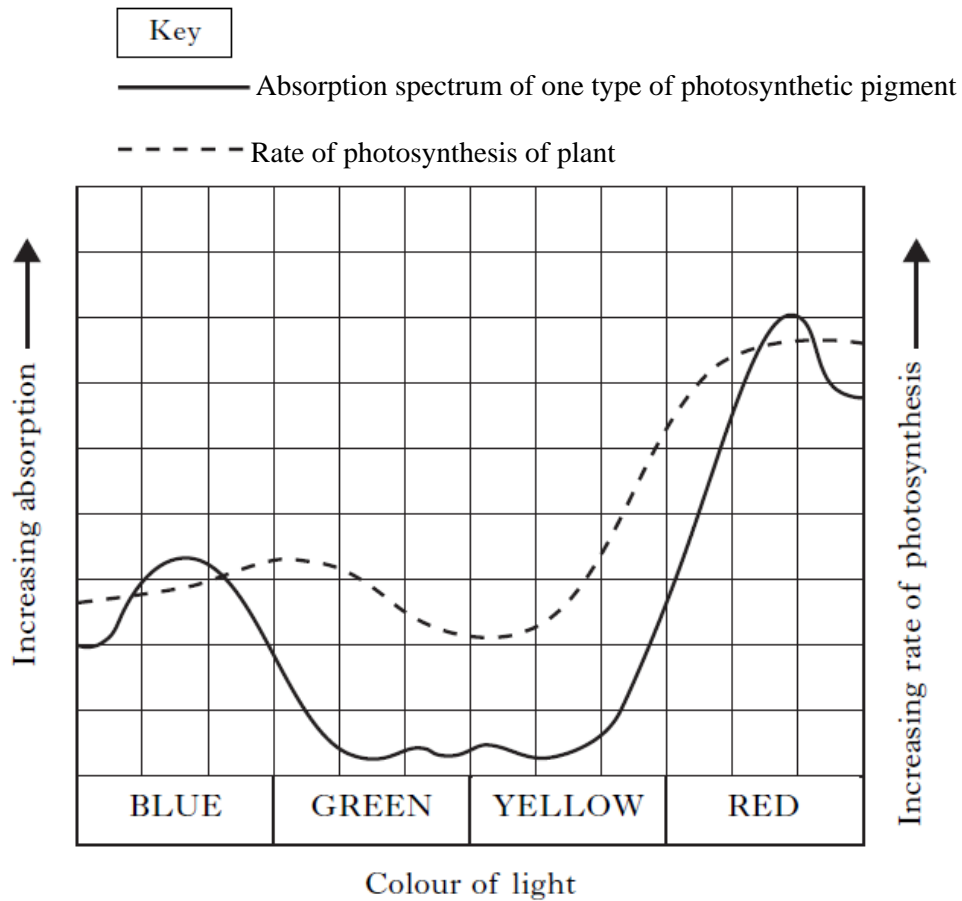
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- (iv) The mitochondrion has two major compartments. Suggest the significance of compartmentalisation within the mitochondrion. [1]

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- (b) **Fig. 3.3** shows the absorption spectrum of one type of photosynthetic pigment from a plant and the rate of photosynthesis of the plant in different colours of light.



**Fig. 3.3**

- (i) Leaves of this plant contain more than one type of photosynthetic pigment. Use evidence from the graph to justify this statement. [1]

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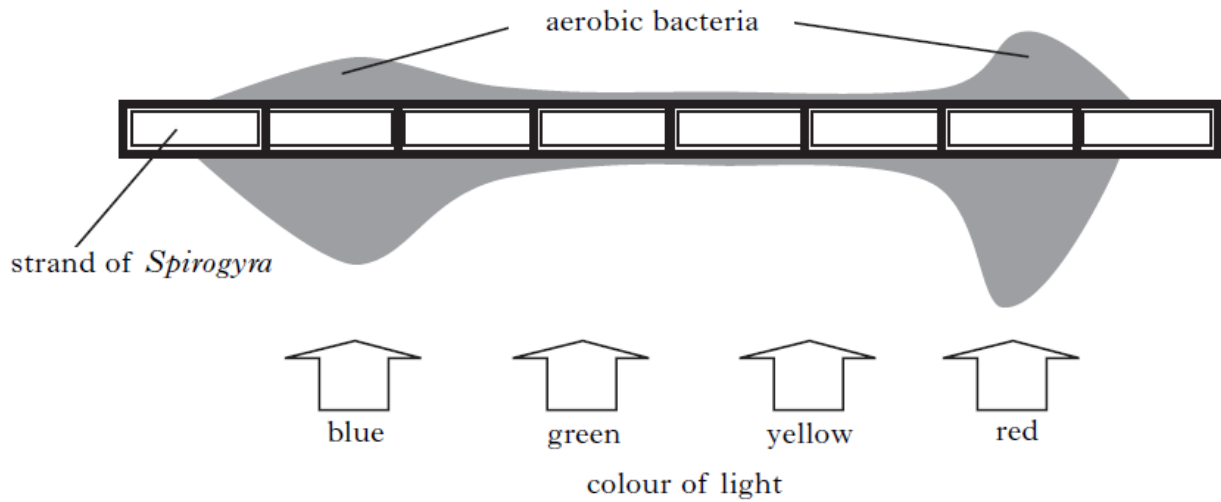
- (ii) Plants typically have several photosynthetic pigments. Describe the role of accessory pigments in photophosphorylation. [1]

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*Spirogyra* is a photosynthetic green alga which grows as a long strand of cells. A strand of *Spirogyra* was placed into water containing aerobic bacteria. Different parts of the strand were exposed to different colours of light. After a period of time, the bacteria had moved into the positions shown in **Fig. 3.4**.



**Fig. 3.4**

- (c) Explain the distribution of aerobic bacteria shown in the diagram. [2]

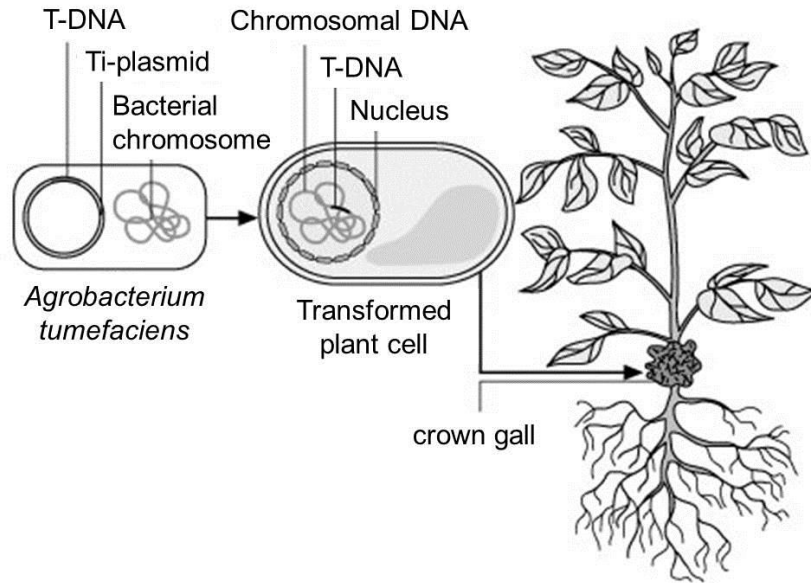
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- 4 (a) **Fig. 4.1** shows the bacterium, *Agrobacterium tumefaciens*, and its ability to cause crown gall disease in certain plants. T-DNA, which is a part of the Ti plasmid, is integrated into the plant host chromosome upon infection by the bacteria. Scientists have manipulated the natural ability of the bacterium, and used it to transfer desirable genes into the cells of crop plants.



**Fig. 4.1**

- (i) Explain how the Ti plasmid can be used to introduce a desirable gene into the cells of a crop plant. [3]

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- (ii) With named examples, describe **two** potential benefits of transferring new genes into crop plants. [2]

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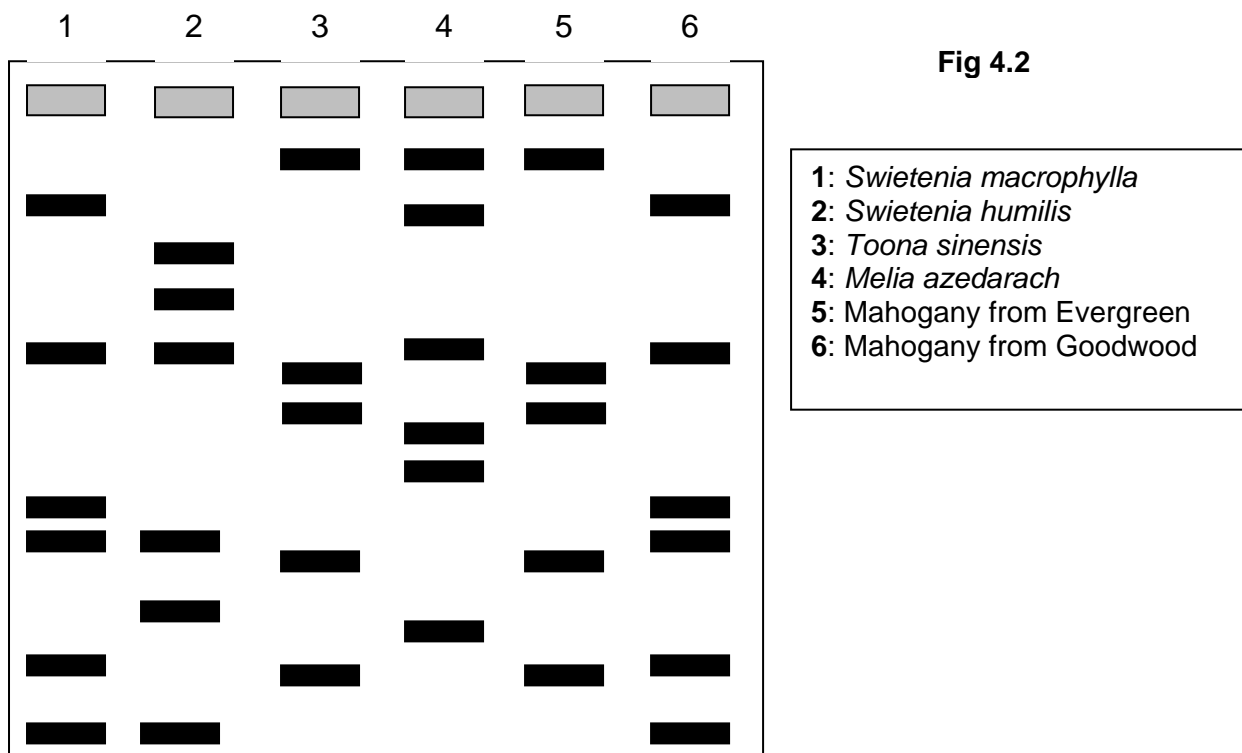
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- (b) Wood from “big leaf mahogany”, *Swietenia macrophylla*, is prized for its beauty, durability and colour. Thus, it is highly valued in the furniture industry. Regulations with regards to the logging of *Swietenia macrophylla* have been put in place to curb excessive logging, greatly limiting the supply of big leaf mahogany in the furniture industry.

Some furniture suppliers claimed to produce furniture using mahogany from *Swietenia macrophylla* and fetch high prices for their products, when they used other variants of mahogany, e.g. *Toona sinensis*, *Melia azedarach*.

Molecular methods can be used to determine the type of mahogany used. Big leaf mahogany from two furniture companies, Evergreen and Goodwood were tested. *Cytochrome c* gene from the wood were amplified using PCR, subjected to restriction enzyme digest and resulting fragments were separated using gel electrophoresis. Samples of various known mahogany were also tested. **Fig. 4.2** shows the results of gel electrophoresis.



- (i) Explain how gel electrophoresis is used to produce the different positions of the bands shown in **Fig 4.2** [3]

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- (ii) Which of the two companies are selling furniture made from big leaf mahogany? Explain. [2]

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[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 labeled 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.

- 5 (a)** Explain the importance of mitosis in growth, repair and asexual reproduction. [6]
- (b)** Describe the structure and role of tRNA. [6]
- (c)** Explain the ways in which islands favour the formation of new species. [8]
- 6 (a)** Compare glycosidic bonds in carbohydrates with peptide bonds in protein. [5]
- (b)** Using a named example, relate the structure of a fibrous protein to its functions. [7]
- (c)** Explain how primary, secondary and tertiary structures of a protein affect the functions of a proteinaceous enzyme [8]

**-- END OF PAPER --**