

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

CANDIDATE
NAME

CLASS

INDEX NUMBER

BIOLOGY

8875/02

Paper 2 Core Paper

15 September 2015

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.

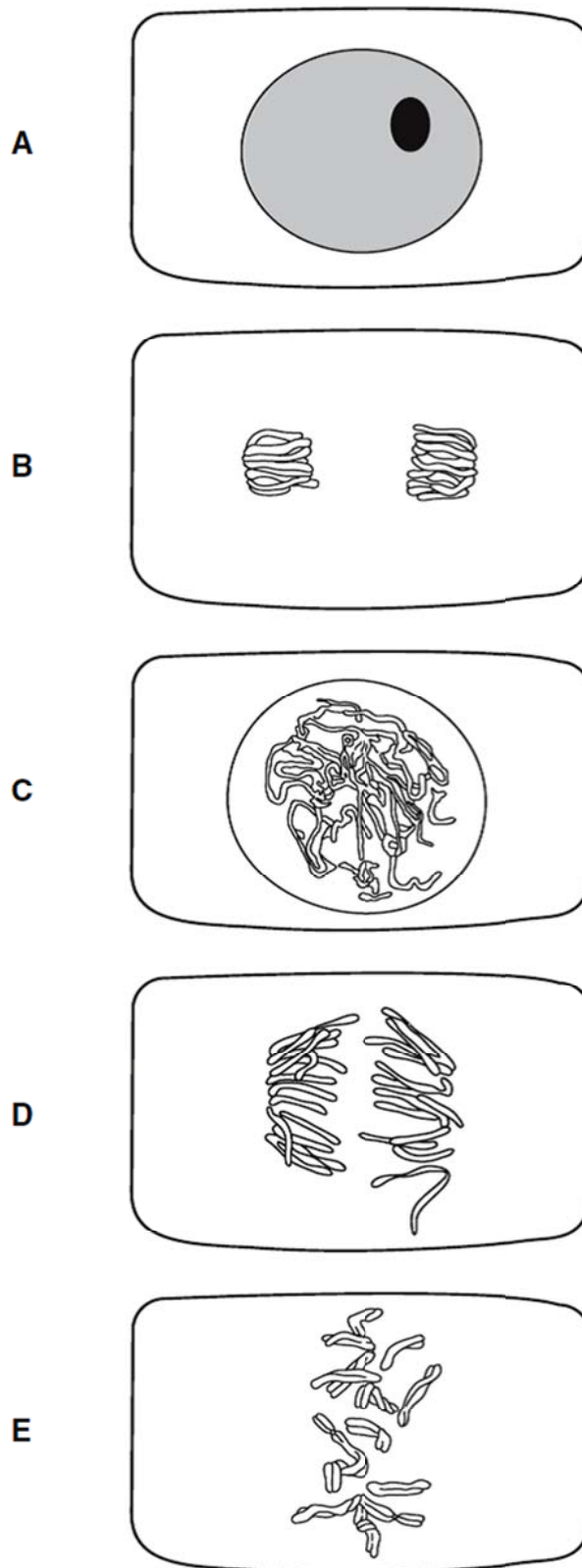
| For Examiner's Use | |
|--------------------|----|
| Section A | |
| 1 | 9 |
| 2 | 10 |
| 3 | 11 |
| 4 | 10 |
| Section B | |
| | 20 |
| Total | 60 |

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



Section AAnswer **all** questions.

- 1 Fig. 1.1 shows drawings of a stem cell at various stages in the mitotic cell cycle.

**Fig. 1.1**

- (a) (i) List the letters shown in Fig. 1.1 in the order in which these stages occur during a mitotic cell cycle. The first stage has been entered for you.

A

[1]

- (ii) Describe the events occurring in Stage D.

[2]

- (iii) Outline the fates of the daughter cells following cell division.

[2]

- (iv) Mitosis gives rise to two genetically identical daughter cells. Suggest a reason for the different fates of the daughter cells in part (iii).

[1]

Stem cells have the potential to treat many diseases such as diabetes and Parkinson's. These diseases are caused by the death or malnutrition of particular cells.

- (b) Explain why stem cells have the potential to treat diseases.

[3]

[Total: 9]

2 Protein synthesis in a prokaryote is illustrated in Fig. 2.1.

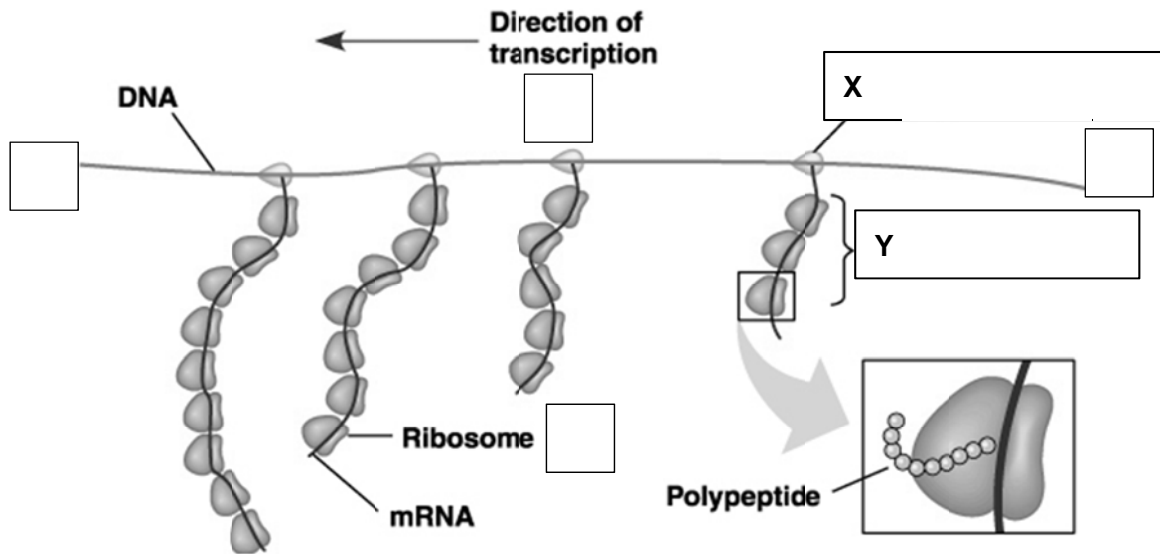


Fig. 2.1

(a) On Fig. 2.1, in the boxes provided,

(i) label the structures X and Y. [2]

(ii) label the 5' and 3' ends of the DNA template strand and the mRNA. [2]

(b) Explain the significance of structure Y.

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..... [2]

Chloramphenicol is an antibiotic that irreversibly binds to a receptor site on the large subunit of prokaryotic ribosomes, inhibiting the catalytic activity of the ribosome.

The mechanism of action of chloramphenicol is shown in Fig. 2.2.

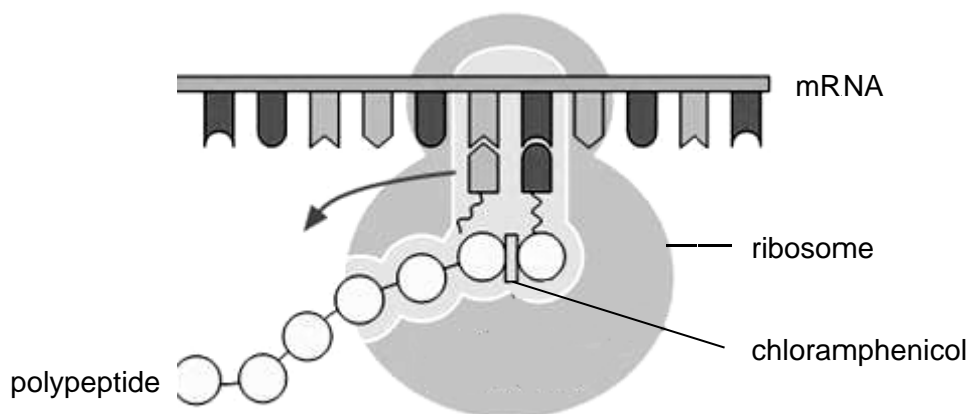


Fig. 2.2

- (c) (i) With reference to the information given and Fig. 2.2, explain how chloramphenicol kills bacteria.

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..... [2]

- (ii) Suggest why chloramphenicol can be taken by humans.

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..... [2]

[Total: 10]

- 3 A group of scientists measured the mean rate of respiration and mean rate of photosynthesis of a tree growing in sunlight, by measuring the concentration of carbon dioxide given out or taken in. Measurements were taken at different times of the day.

Fig. 3.1 shows the scientists' results.

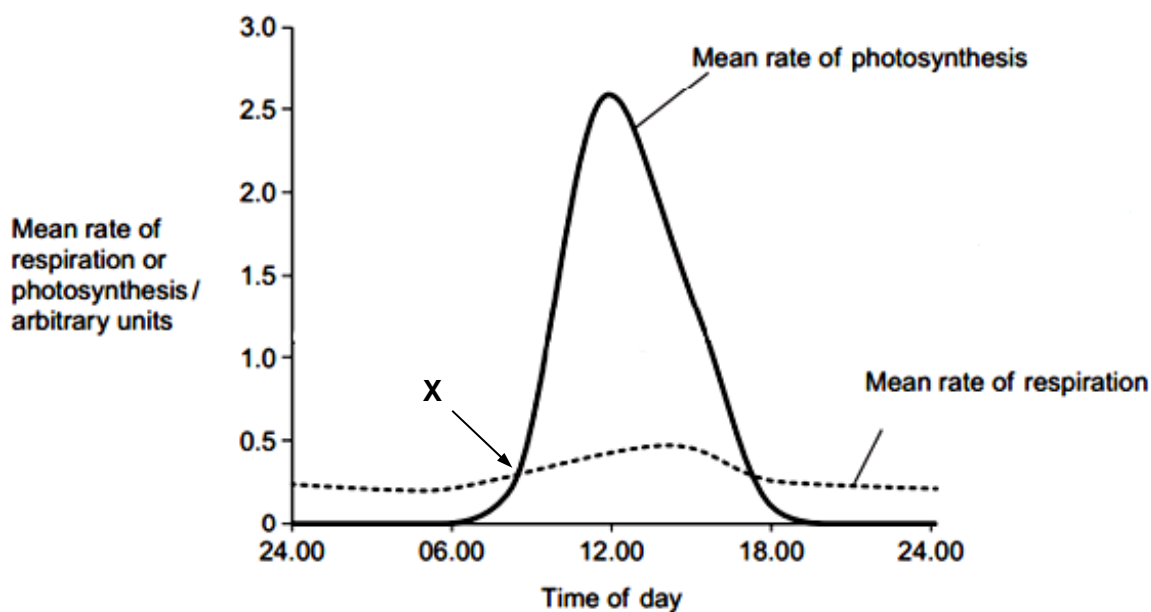


Fig. 3.1

(a) With reference to Fig. 3.1,

(i) Explain the peak in the mean rate of photosynthesis at 12.00.

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..... [3]

(ii) With reference to the biochemical processes occurring in photosynthesis and respiration, explain the significance of the point labelled X.

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..... [2]

(b) The scientists suggested that the rise in the mean rate of photosynthesis was the cause of the rise in the mean rate of respiration.

Suggest how the mean rate of photosynthesis could lead to the rise in the mean rate of respiration.

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..... [2]

Glyceraldehyde-3-phosphate produced during photosynthesis in plants may be converted to other forms of carbohydrates, such as starch and cellulose.

Fig. 3.2 shows the part of the structures of starch and cellulose.

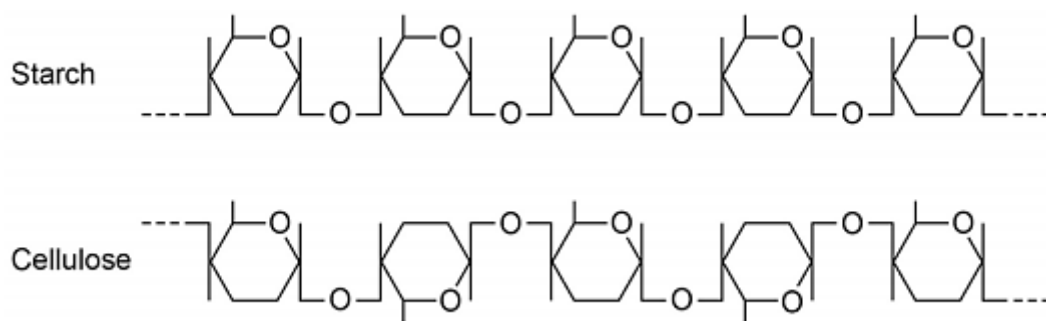


Fig. 3.2

- (c) Explain **two** differences in the structure of the starch molecule and the cellulose molecule as shown in Fig. 3.2.

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..... [2]

- (d) Starch molecules and cellulose molecules have different functions in plant cells. Each molecule is adapted for its function.

Explain **one** way in which starch molecules are adapted for their function in plant cells.

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..... [2]

[Total: 11]

- 4 To reduce damage caused by insect pests, some farmers spray their fields of crop with pesticide. Many of these pesticides have been shown to cause environmental damage.

Bt plants have been genetically modified to produce a toxin that kills insect pests. The use of Bt crop plants has led to a reduction in the use of pesticides.

To produce Bt plants, the bacterium *Agrobacterium tumefaciens* was used to introduce the recombinant plasmid containing the gene for Bt toxin to plant cells.

The plasmid used had the following sequences:

- an origin of replication
- ampicillin resistance gene, amp^R
- tetracycline resistance gene, tet^R , containing the *Bam*HI restriction site

- (a) Explain how a recombinant plasmid containing the gene coding for Bt toxin is produced.

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..... [2]

Replica plating was used to identify bacteria that successfully took up the recombinant plasmid, as shown in Fig. 4.1.

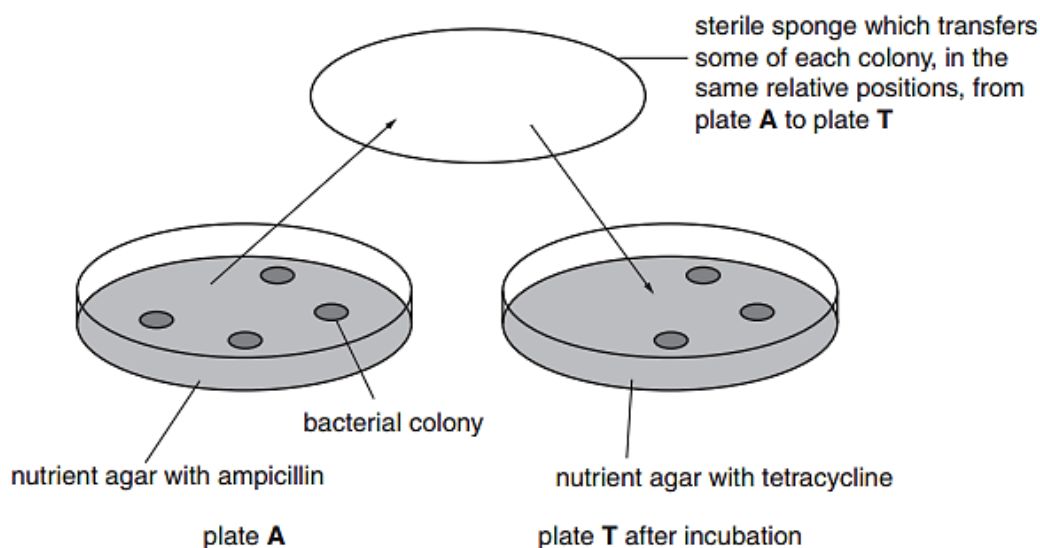


Fig. 4.1

- (b) On Fig. 4.1, use labelled arrow(s) to indicate the bacterial colony / colonies containing the recombinant plasmid. [1]

(c) Explain your answer in part (b).

[2]

Scientists have found that some species of insect pests have become resistant to the toxin produced by the Bt crop plants.

Fig. 4.2 shows information about the use of Bt crops and the number of species of insect pests resistant to the Bt toxin in one country.

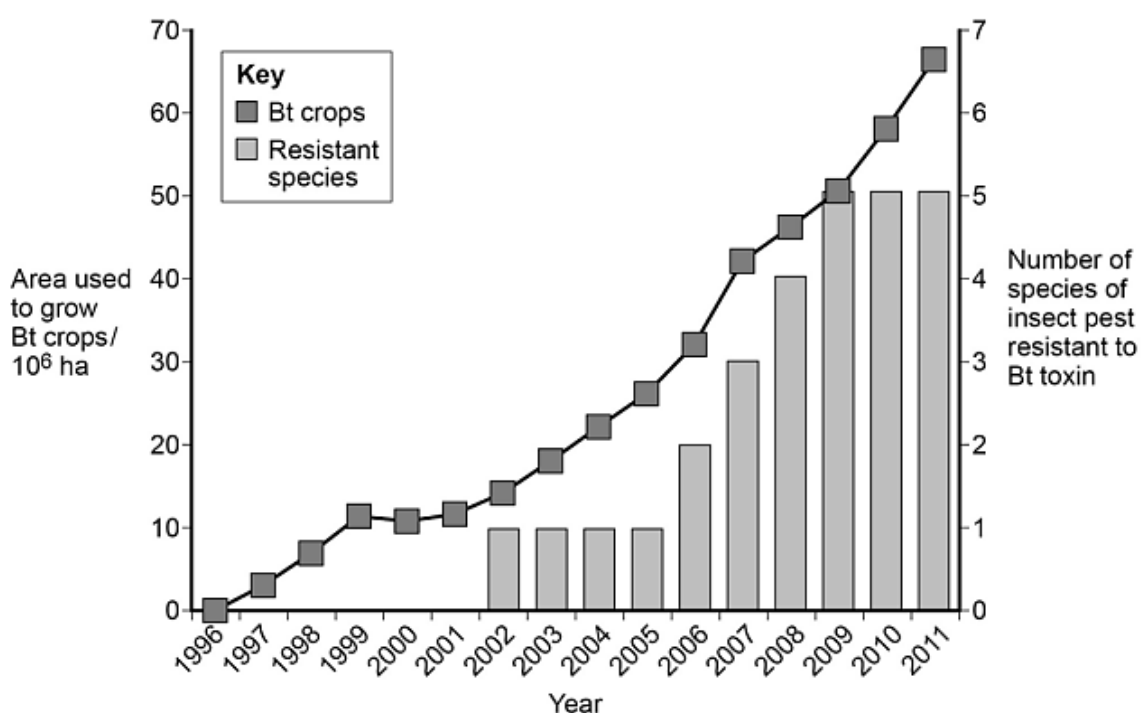


Fig. 4.2

(c) Discuss whether the increase in number of insect pest resistant to Bt toxin was due to the increase in the area used to grow Bt crops.

[3]

- (e) Apart from the possibility of pests developing resistance to Bt toxin, describe **two** other ethical and social implications of genetically modified organisms.

----- [2]

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

Either

- 5** **(a)** With reference to the levels of protein structure, explain how the specificity of an enzyme is determined by its structure. [6]
- (b)** Describe the effect of inhibitors on the rate of enzyme activity. [7]
- (c)** The enzyme catalase is found in potatoes. This enzyme catalyses the breakdown of hydrogen peroxide to water and oxygen.

Describe an experiment investigating the effect of temperature on the activity of catalase in potatoes, by measuring the release of oxygen. [7]

[Total: 20]

Or

- 6** **(a)** Describe and explain the fluid mosaic model of cell membranes. [6]
- (b)** Describe the structure of a phospholipid and its arrangement in cell membranes. [5]
- (c)** Discuss the role of membrane proteins in cell membranes. [9]

[Total: 20]

