

Candidate Name	Centre Number	Candidate Number
		2



**GCE A level**

314/01

**BIOLOGY – BI4**

P.M. FRIDAY, 13 June 2008

1 hour 40 minutes

<b>For Examiner's use only</b>		
Question	Maximum Mark	Mark Awarded
1	9	
2	5	
3	10	
4	9	
5	14	
6	8	
7	10	
8	10	
<b>TOTAL MARK</b>		

**INSTRUCTIONS TO CANDIDATES**

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

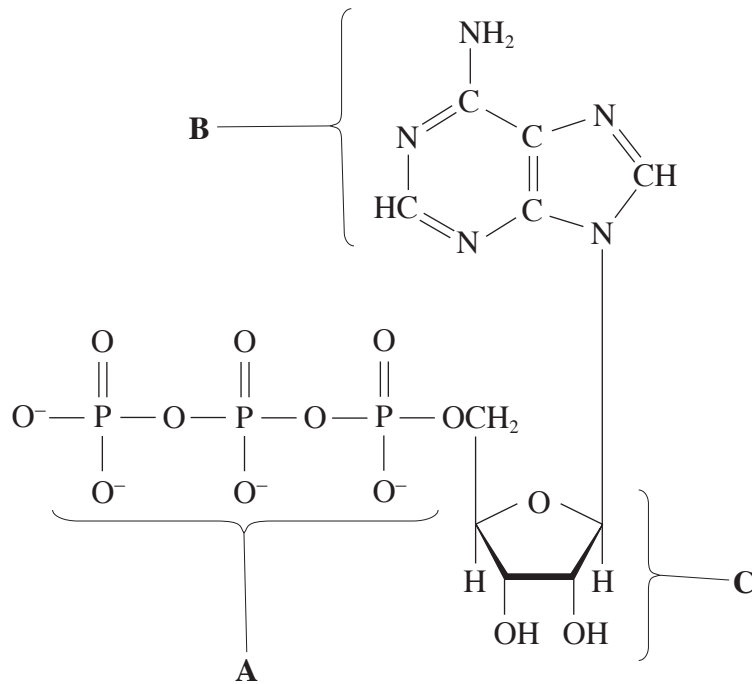
**INFORMATION FOR CANDIDATES**

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

You are reminded of the necessity for good English and orderly presentation in your answers.

The quality of written communication will affect the awarding of marks.

1. The diagram below shows a molecule of ATP.



(a) Identify parts **A**, **B** and **C**. [3]

**A** .....

**B** .....

**C** .....

(b) To what group of molecules does ATP belong? [1]

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(c) Explain why ATP is important in cells. [2]

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(d) State **three** sites of ATP synthesis within a cell. [3]

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**(Total 9 marks)**

2. Read the following passage.

The malarial parasite spends most of its life in the human within erythrocytes. One might think that tucked within erythrocytes, the parasite would be safe from the immune system.

However, the parasite synthesises a protein that appears on the surface of the erythrocyte. These proteins anchor the erythrocytes to the walls of the blood vessels so they are not swept into and destroyed by the host spleen. The surface protein also initiates an immune response.

To counter this problem, the parasite periodically alters the structure of the protein so that it is no longer recognised by the antibodies currently being synthesised.

When the stage that infects the mosquito is present, infected humans release an airborne attractant that attracts *Anopheles* mosquitoes to them.

(a) Give the correct biological name for the malarial parasite. [1]

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(b) What benefit does the parasite gain from being within erythrocytes? [1]

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(c) Why would the surface protein stimulate an immune response? [1]

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(d) What method of controlling malaria is affected by the constant changing of these surface proteins? [1]

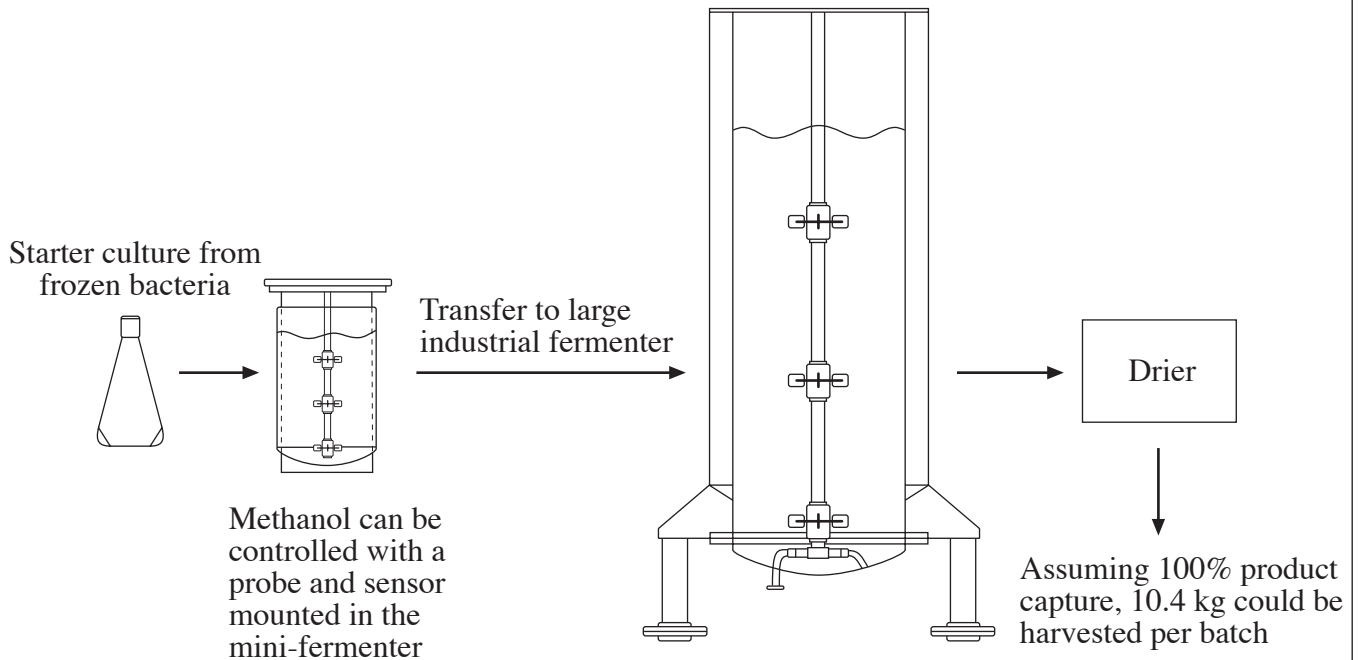
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(e) Suggest an advantage to the parasite of causing the production of attractant in infected individuals. [1]

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**(Total 5 marks)**

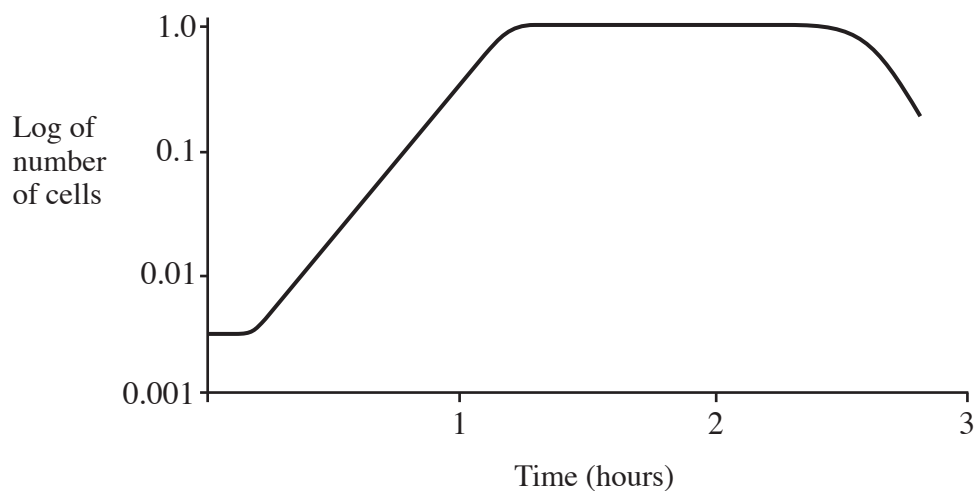
3. Below is a flow diagram showing batch fermentation for the production of animal feed supplement from methanol, using *Bacillus methanolicus*. A 300-litre fermenter is used for the final fermentation production stage. This runs for a number of hours, after which the bacteria are dried ready for addition to animal feed.



- (a) State **three** factors which would need to be controlled in the fermenter and state how they would be controlled. [3]

<i>Factor</i>	<i>Means of control</i>

The graph below shows the type of growth curve shown by the bacteria.



(b) Draw an arrow on the graph to show the point at which the bacteria should be harvested.

Explain why you have chosen that point.

[2]

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(c) State **three** advantages of using industrial fermenters.

[3]

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(d) Suggest **one** reason why the bacteria are initially grown in a mini fermenter prior to adding the culture to the industrial fermenter.

[1]

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(e) Name **one other** product which is produced in an industrial fermenter.

[1]

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**(Total 10 marks)**

4. Antibiotics work in different ways. Below is a table showing some antibiotics and their effects on bacteria.

<i>Antibiotic</i>	<i>Method of action</i>
Penicillin	Inhibits formation of the bacterial cell wall by blocking cross-linking of the cell wall structure.
Vancomycin	Interferes with cell wall development by blocking the attachment of new cell wall subunits.
Tetracycline	Inhibits protein synthesis by binding to one of the subunits of the bacterial ribosome.

- (a) Explain why tetracycline cannot be used to treat viral infections. [1]

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- (b) Which antibiotic could be classed as broad spectrum? Explain your answer. [1]

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- (c) Which antibiotic would be least effective against Gram -ve infections? Explain your answer. [1]

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- (d) Which antibiotic is most likely to be bactericidal? Explain your answer. [1]

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- (e) Resistance to antibiotics is growing worldwide. Suggest how antibiotic resistance has arisen in bacterial populations. [3]

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- (f) How is resistance transferred between different species of bacteria? [1]

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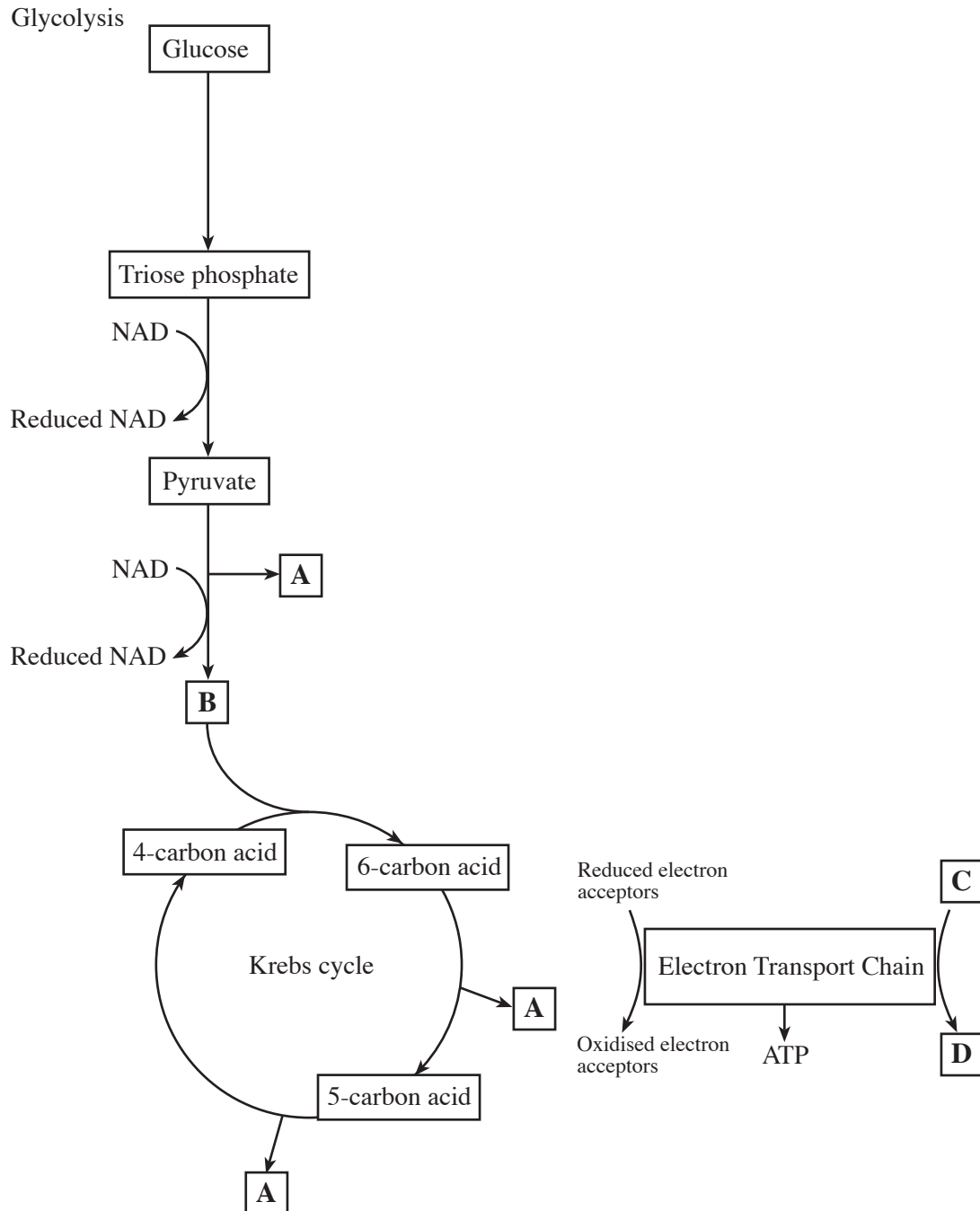
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- (g) Give an example of a pathogen which is now resistant to many antibiotics. [1]

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**(Total 9 marks)**

5. The diagram below shows an outline of the stages involved in aerobic respiration.





(a) Name **A**, **B**, **C** and **D**. [4]

**A** .....

**B** .....

**C** .....

**D** .....

(b) Identify all the steps involved in glycolysis by drawing a box around them on the diagram. [1]

(c) Precisely where do the Krebs cycle and the electron transport chain occur in a mammalian cell? [2]

Krebs cycle .....

Electron transport chain .....

(d) (i) Indicate, by writing a letter **E** on the diagram, where ATP is **used** in respiration. [1]

(ii) Indicate, by writing ATP on the diagram, the **two** stages, not including the electron transport chain, where ATP is **produced** during respiration. [1]

(e) State the type of enzyme involved in the formation of reduced NAD. [1]

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(f) Describe what happens to pyruvate in anaerobic conditions in mammalian cells. [2]

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(g) Indicate on the diagram, using the correct names, where other respiratory substrates from the breakdown products of lipids enter the aerobic respiration pathway. [2]

**(Total 14 marks)**

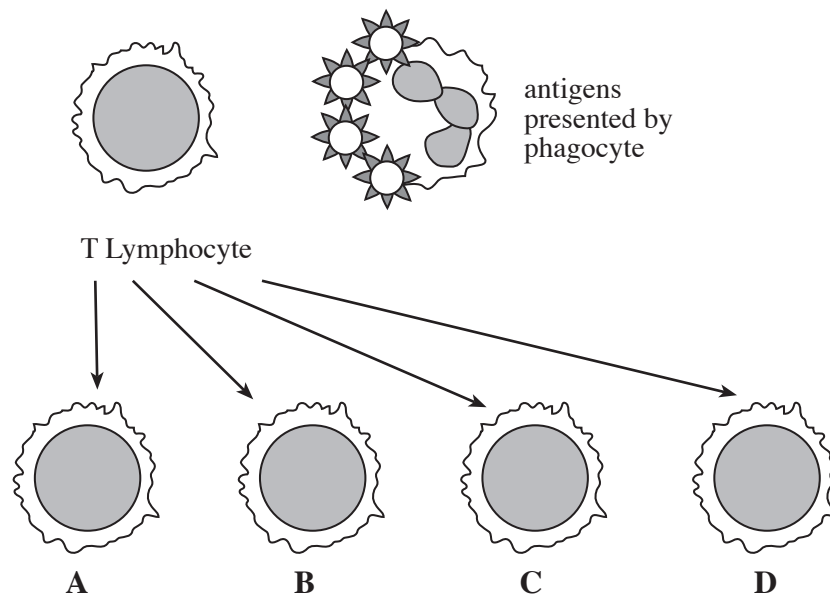
6. The nude mouse is used in laboratory research and gets its name because it has no hair. Nude mice cannot generate mature T lymphocytes, therefore they are unable to carry out many types of immune responses. Their ability to maintain human tissue grafts have made them useful tools for investigating, for example, human cancers.

(a) Where do T lymphocytes mature? [1]

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(b) What type of diseases are nude mice most likely to suffer from? [1]

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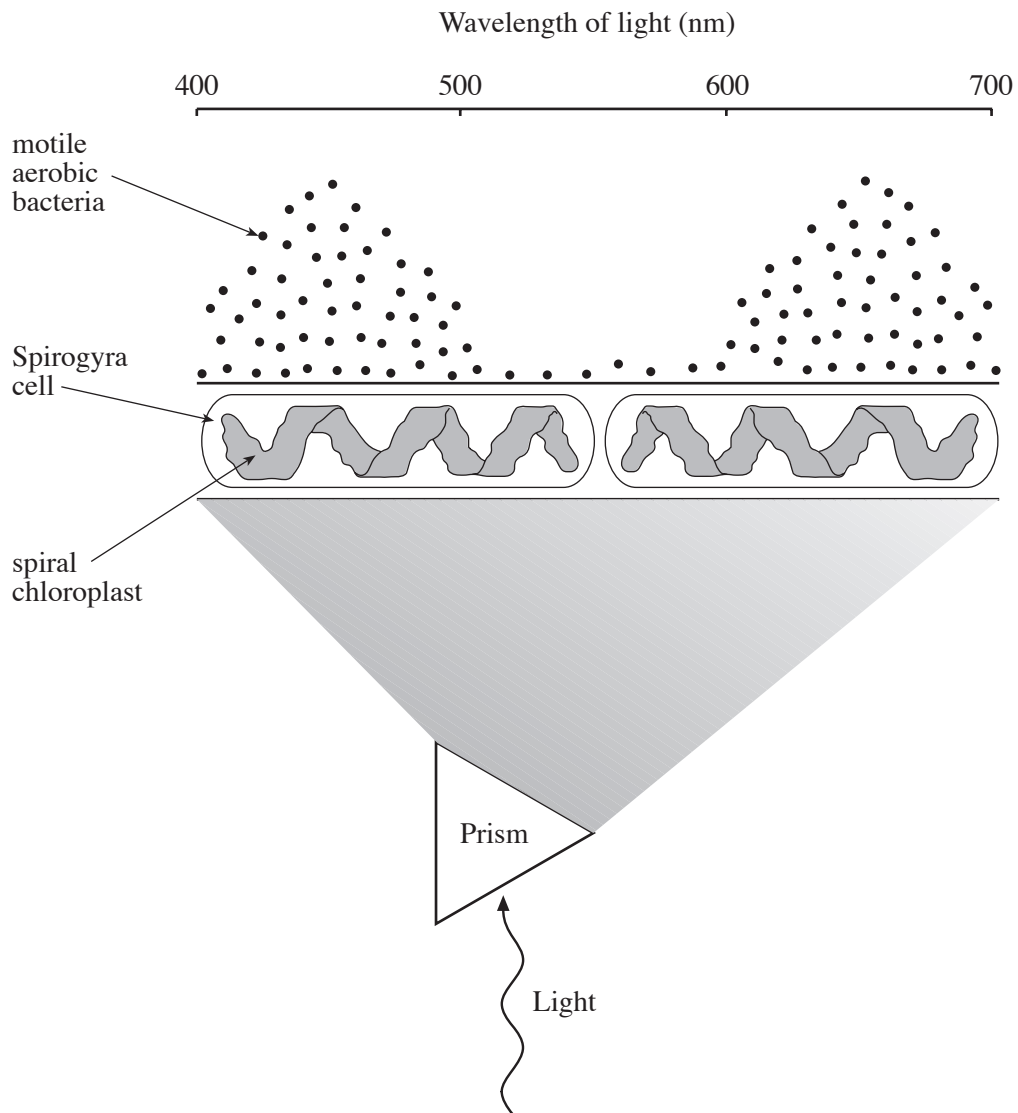


- (c) In the diagram opposite, there are four different cell types produced as a result of the T lymphocyte binding to antigen.  
Name **three** of the cell types produced as a result of the mitosis and differentiation of the lymphocytes and give a function for each. [6]

<i>Name of cell type</i>	<i>Function</i>

**(Total 8 marks)**

7. In 1883, Thomas Englemann devised an experiment to determine which wavelengths of light were the most effective in carrying out photosynthesis in a green alga such as *Spirogyra*. He placed the algae in a suspension of motile, aerobic bacteria, which were evenly distributed, and exposed the *Spirogyra* cells to a range of wavelengths. After a short time he obtained the results shown in the diagram below.



(a) Fully explain the results of this experiment. [3]

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(b) Modern experiments allow the rate of photosynthesis at each wavelength to be determined more accurately. The results can then be plotted onto a graph.

What is the name given to this graph? [1]

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(c) Describe the process of non-cyclic photophosphorylation. [4]

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(d) Describe what happens to the products of non-cyclic photophosphorylation. [2]

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**(Total 10 marks)**





