

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
 General Certificate of Education
 Advanced



CYD-BWYLLGOR ADDYSG CYMRU
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314/01

BIOLOGY

MODULE BI4

A.M. TUESDAY, 19 June 2007

(1 hour 40 minutes)

For Examiner's Use Only

Total Marks	
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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.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

1. (a) State **three** conditions necessary for growing bacteria in the laboratory. [1]

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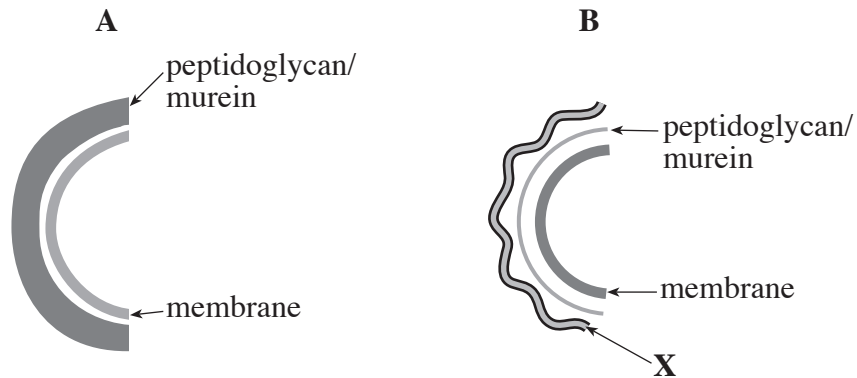
(b) Bacteria may be classified or grouped according to the shape of their cells. Complete the table below by drawing and naming **two** of the groups. [2]

<i>Shape of cells</i>	<i>Name of group</i>

(c) (i) Name the staining technique that may also be used to classify bacteria into two groups, positive and negative. [1]

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(ii) The diagrams show parts of two bacterial cells.



Complete the following table to show the colour each cell would be stained by the test and whether it is positive or negative. [2]

<i>Cell</i>	<i>Colour after staining</i>	<i>Positive or negative</i>
A		
B		

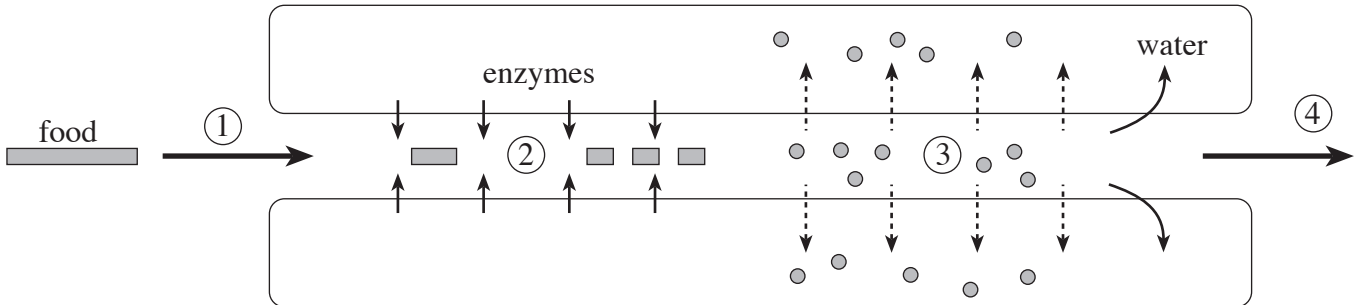
(iii) Name **two** chemical components of the structure labelled **X** in cell B. [2]

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(Total 8 marks)

2. The diagram shows the processes that would take place in a simple tube gut.



(a) (i) Name the processes numbered 1-4. [2]

1.
2.
3.
4.

(ii) Define the process numbered 2. [1]

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.....

(b) In mammals the gut is modified to form specialised organs with specific roles. Complete the following table to show some of the enzymes secreted by a mammalian gut, their action and the associated organs. [4]

<i>Enzyme</i>	<i>Substrate</i>	<i>Products</i>	<i>Site of secretion</i>
pepsin		peptides	
peptidases	peptides		
	lipids	fatty acids and glycerol	
		maltose	salivary gland

- (c) (i) In the spaces provided below, **draw** and **label** two cells, each of different types, from the epithelium of the small intestine, as they would be seen through a light microscope. [2]

Drawing of cell type 1	Drawing of cell type 2
Function of cell type 1	Function of cell type 2

- (ii) In the appropriate spaces above, give the functions of each of the cells you have drawn. [2]
- (iii) Describe an adaptation found in **one** of the cells you have drawn that enables it to carry out its function. [1]

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(Total 12 marks)

3. (a) (i) List **three** photosynthetic pigments found in the leaves of green plants. [1]

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- (ii) What is the advantage to plants of having more than one photosynthetic pigment? [1]

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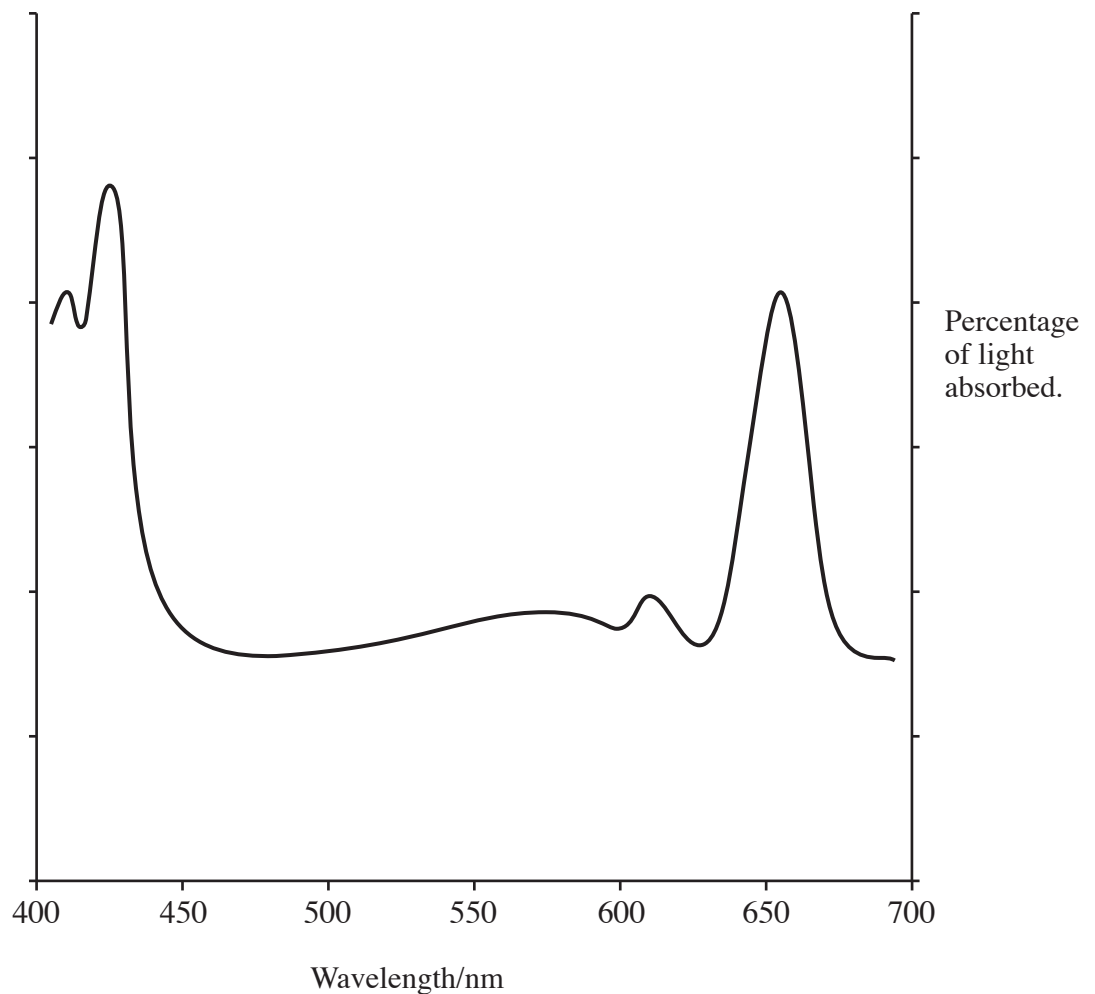
- (b) (i) Explain the term *action spectrum*. [2]

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- (ii) The graph below shows the absorption spectrum for chlorophyll a. Draw a line to show how the action spectrum and the absorption spectrum are related and label the axis on the left. [2]

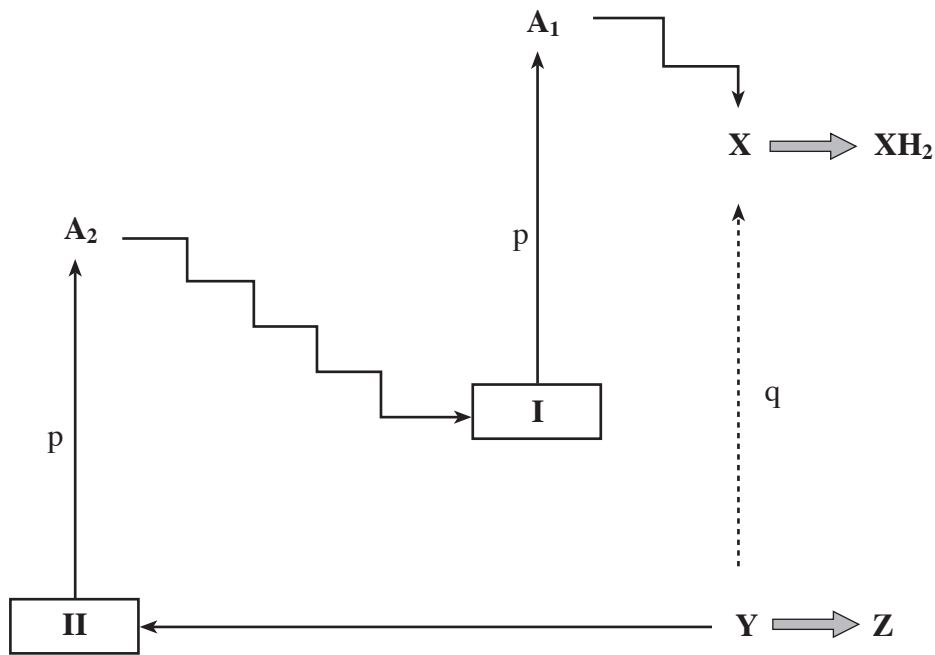


(iii) What does this relationship tell us about light and photosynthesis? [1]

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.....

(c) The diagram below shows part of the light dependent stage of photosynthesis:



(i) Name the light harvesting units **I** and **II**. [1]

(ii) Name the process by which **Y** is broken down. [1]

.....

(iii) Name **X**, **Y**, **Z**. [3]

(iv) Name particles **p** and **q** [2]

(v) What is the function of **A₁** and **A₂**? [1]

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(vi) Which of the compounds shown is used in the light independent stage? [1]

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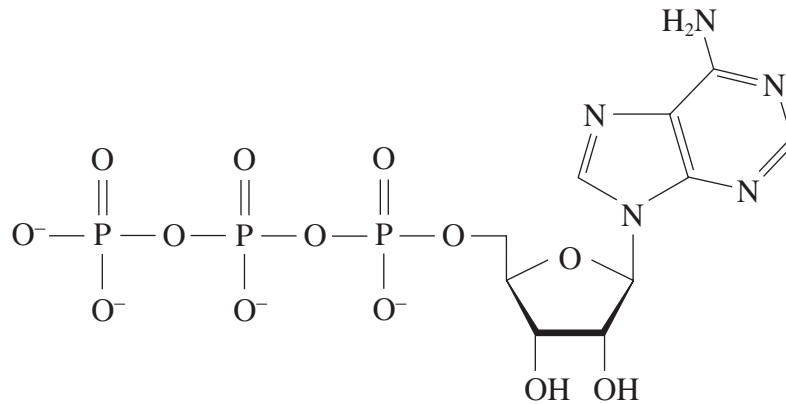
(vii) What is the function of this compound in the light independent stage? [1]

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(Total 17 marks)

Turn over.

4. The molecule shown in the diagram is a nucleotide known in biochemistry as intracellular energy currency.



- (a) The structure of this molecule consists of a purine base (adenine) and three phosphate groups attached to a pentose (ribose).

(i) Name the molecule. [1]

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(ii) Circle the purine base on the diagram. [1]

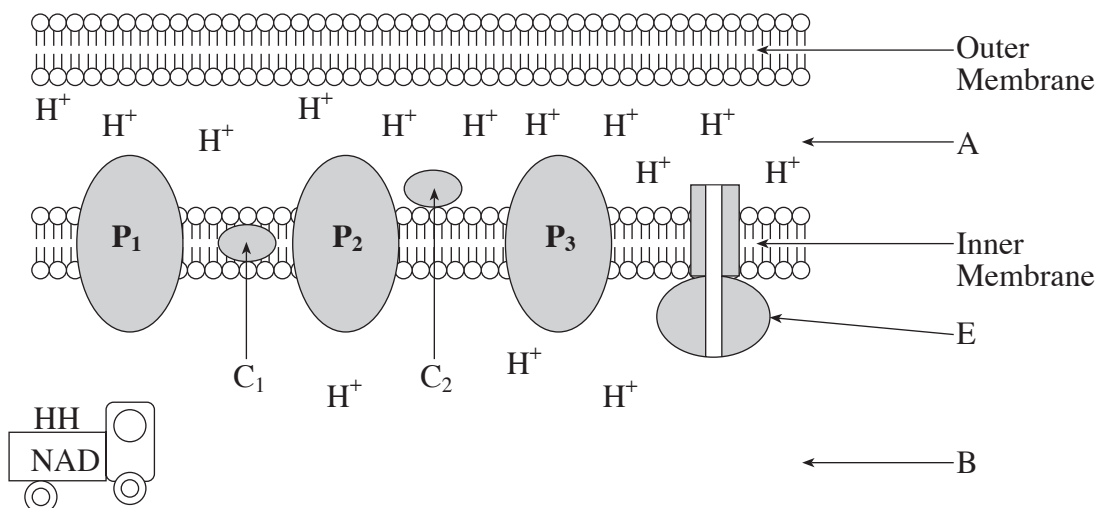
(iii) Name **two** products that are formed when the molecule in the diagram above has released energy in a cell. [1]

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(iv) Why might this energy currency molecule be described as **universal**? [1]

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- (b) The diagram shows components of a mitochondrion involved in generating the molecule shown in part (a).



(i) Name the areas labelled A and B. [2]

A

B

(ii) NAD is used to transport hydrogen atoms. Name **two** stages of cellular respiration from which NAD may pick up hydrogen atoms. [2]

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(iii) Hydrogen atoms consist of one proton and one electron. Explain how the components labelled P and C operate to generate an electrochemical gradient. [2]

P

.....

C

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(iv) What is the role of the electrons in this system? [1]

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(v) Name enzyme E. [1]

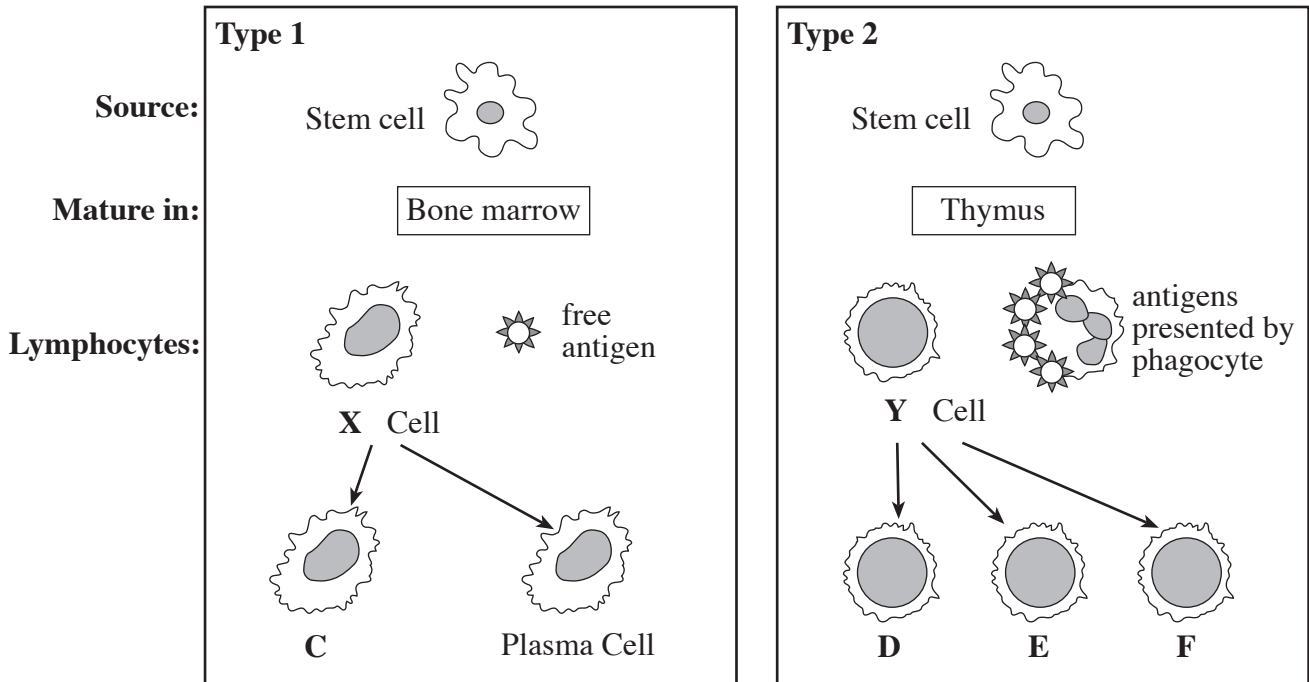
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(vi) Explain how the enzyme generates ATP. [2]

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(Total 14 marks)

5. (a) There are two main types of immune response. These are labelled **Type 1** and **Type 2** in the diagram below:



- (i) Name response **types 1** and **2**. [2]

Type 1

Type 2

- (ii) Name the cells **X** and **Y**. [2]

X **Y**

- (iii) Where in the body are the stem cells shown in the diagram produced? [1]

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- (iv) Plasma cells in the **type 1** response secrete antibodies. Name the other type of cell (**C**) in this system and describe its function. [2]

Cell name

Function

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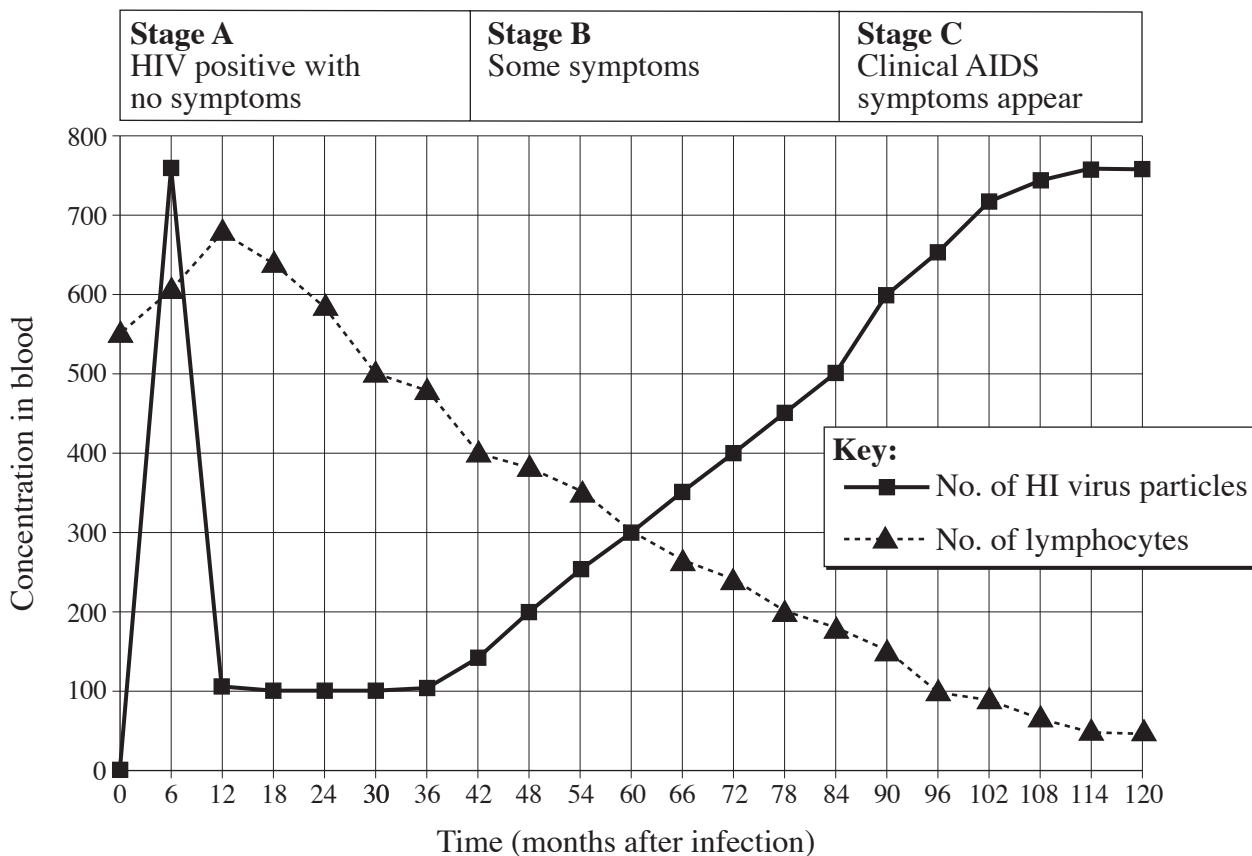
- (v) Name the **three** types of differentiated cell (**D**, **E** and **F**) in the **type 2** response. [2]

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- (vi) Describe the function of **one** of the cell types you named in part (v). [1]

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- (b) AIDS (acquired immune deficiency syndrome) is due to an infection with HIV (Human Immunodeficiency Virus). The progress of infection has three clinical stages as shown on the graph below:



Using information from the graph and your knowledge of the immune systems, suggest explanations for the following:

- (i) The rise in lymphocytes over the first 6 months. [1]

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- (ii) The rapid fall in virus particles in the blood plasma between 6 and 12 months. [1]

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- (iii) Individuals with clinical AIDS (Stage C) suffer from infections. [1]

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(c) The following is an extract from the web-site, www.wellcome.ac.uk

One of the key problems with HIV vaccine research is that the immune responses generated do not work against all HIV strains The virus is known to have a handful of vulnerable sites at which antibody binding would block infection. A team at Duke University Medical Centre, North Carolina, has found that the immune system does generate antibodies against one of these sites, but these antibodies also recognise cardiolipin, a phospholipid found in human cell membranes.

Explain why the discovery described in the last sentence makes it impossible to use the 'vulnerable site' in vaccines. [1]

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(Total 14 marks)

6. Answer **one** of the following questions.

Any diagrams included in your answer must be fully annotated.

Either, (a) Describe how the principles of a batch culture fermenter are applied in the industrial production of penicillin. [10]

Or (b) Briefly describe the main stages of the life cycle of *Plasmodium*. Explain how a knowledge of the habits and life cycle of the vector may be used to control malaria. [10]

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(Total 10 marks)