

Candidate Name	Centre Number	Candidate Number
		2



**General Certificate of Education
Advanced**

314/01

**BIOLOGY
MODULE BI4**

A.M. WEDNESDAY, 23 January 2008
(1 hour 40 minutes)

For Examiner's Use Only

Total Marks	
------------------------	--

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. The table below shows statements relating to disease and four diseases to which these statements may apply.

Complete the table by indicating with a tick (✓) to which disease(s) each statement applies. [9]

<i>Statement</i>	<i>Disease</i>			
	<i>Salmonellosis</i>	<i>Cholera</i>	<i>Influenza</i>	<i>Malaria</i>
caused by a virus				
caused by a bacterium				
organism has a secondary host in its life cycle				
spread by droplet infection				
spread related to poor personal hygiene				
spread by eating infected eggs				
pathogen enters body's blood cells				
vaccine available				
toxins affect the gut lining				

[Total 9 marks]

2. Respiration is carried out as a number of stages.

Complete the table by stating the main products of each of the stages in respiration and where, precisely in the cell, each process takes place. [10]

<i>Stage of respiration</i>	<i>Main products</i>	<i>Where it takes place</i>
Glycolysis		
Krebs cycle		
Electron transport chain		

[Total 10 marks]

3. Read the following passage and answer the questions that follow.

Tuberculosis (TB) is an infectious disease that is endemic in many countries. The pathogen is a bacterium, *Mycobacterium tuberculosis*.

5 One way of contracting the disease is by drinking milk from infected cows, which form a reservoir of infection. Dairy herds are regularly tested for the disease. This, together with the fact that most people are vaccinated against the disease, has restricted its spread.

10 Before vaccination, a test is carried out to determine whether the individual already has immunity to TB. The most common test is the Heaf test in which small needles are pressed onto the skin of the forearm. The needles carry tiny amounts of tuberculin protein, which is derived from the bacteria. If the test is positive (a raised red reaction on the skin) then the individual has previously been in contact with the bacterium and has already developed immunity. If no reaction is seen, immunisation is given as the BCG vaccination, the vaccine containing a live but weakened form of the pathogen.

People with the disease are treated with antibiotics. If, however, these drugs are mismanaged or misused then multi-drug resistant strains of the bacterium develop.

(a) State what is meant by each of the following:

(i) infectious disease (line 1); [1]

.....
.....

(ii) endemic (line 1); [1]

.....
.....

(iii) pathogen (line 1); [1]

.....
.....

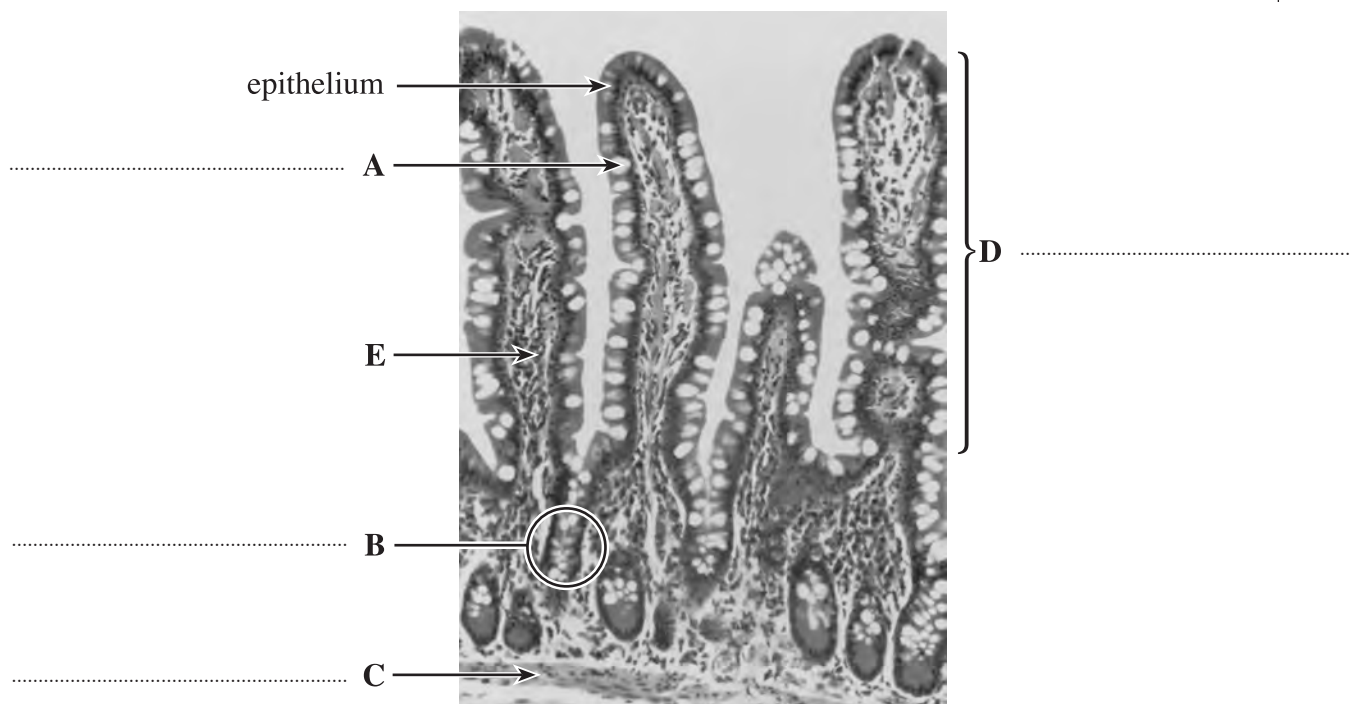
(iv) reservoir (line 4); [1]

.....
.....

(v) antibiotic (line 13). [2]

.....
.....

4. (a) The light micrograph shows a section through the wall of the intestine.



Biophoto Associates/Science Photo Library

(i) Identify **A** to **D** on the micrograph. [4]

(ii) State **two** types of vessel found in the region labelled **E**. [2]

(b) Describe how **two** features of the cells of the epithelium aid in the absorption of the products of digestion. [4]

Feature 1

Description 1

Feature 2

Description 2

(c) The use of antibiotics, to treat infections, reduce the population of ‘good bacteria’ in the intestine that aid digestion and help to fight disease, by keeping the numbers of ‘bad bacteria’ under control. Those ‘bad bacteria’, such as *Clostridium difficile*, that can withstand the antibiotic will therefore increase in number and cause illness. *C. difficile* is found in the intestines of 3% of healthy adults and as many as 70% of healthy babies. Older people and those in hospital who are being treated with antibiotics are most likely to become ill with *C. difficile*.

Suggest why older people in hospital are most likely to become ill with *C. difficile*. [1]

.....

.....

- (d) The public impression is that MRSA is a significant problem in our hospitals, despite the efforts made to eliminate it and prevent its spread. Less is publicised or known about *C. difficile* and so it is considered to be less of a problem.

The table below shows the numbers of reported cases of MRSA and *C. difficile* in Wales between 2002 and 2006.

<i>Year</i>	<i>Number of reported cases of MRSA</i>	<i>Number of reported cases of C. difficile</i>
2002	486	1724
2003	477	1668
2004	462	2346
2005	407	2323
2006	336	2473

Figures from National Public Health Service (Wales)

- (i) The percentage decrease in the number of reported cases of MRSA between 2003 and 2006 is 29.6%.

Calculate the percentage change in the number of reported cases of *C. difficile* in the same time period. [2]

Answer

- (ii) Does the data support the public impression of the relative problems of these two diseases? Explain your reasoning. [2]

.....

.....

.....

.....

.....

.....

- (e) Many advertisements promote the use of probiotic foods, usually yoghurts. They claim to contain cultures of bacteria that can help to restore the natural balance of bacterial populations in the intestine. A bottle of a typical yoghurt drink needs to contain 10 million of the correct species of bacteria to be effective.

Suggest **one** feature that a bacterium should possess for it to be effective in restoring the natural balance of bacteria in the intestine. [1]

.....

.....

[Total 16 marks]

5. (a) Organisms use the Calvin cycle to fix carbon dioxide.

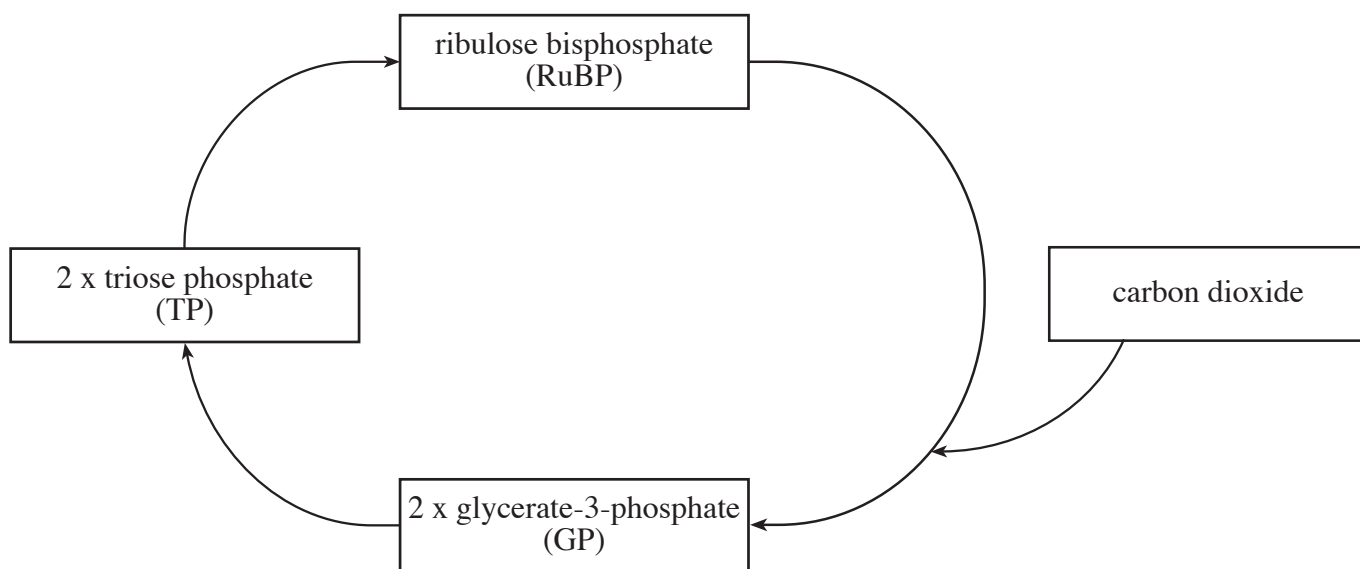
(i) Name a **cell** in which the Calvin cycle occurs. [1]

.....

(ii) State precisely where in this cell the Calvin cycle occurs. [1]

.....

- (b) The main stages of the Calvin cycle are outlined below.



(i) Name a 3C compound in this cycle. [1]

.....

(ii) Name a 5C compound in this cycle. [1]

.....

(iii) State which compound in this cycle leads to the formation of amino acids. [1]

.....

(c) The reactions in the Calvin cycle are controlled by enzymes.

In an investigation, the rate of photosynthesis was calculated for a species of plant at a number of different temperatures. The results are as follows.

<i>Temperature / °C</i>	<i>Rate of photosynthesis / arbitrary units</i>
5	1.8
10	3.4
15	4.0
20	3.8
25	2.1
30	0.0

A general statement made for reactions is that

‘for every rise in temperature of 10°C, the rate of reaction will double’.

To what extent do these results confirm the statement?

Explain any differences observed.

[3]

.....

.....

.....

.....

.....

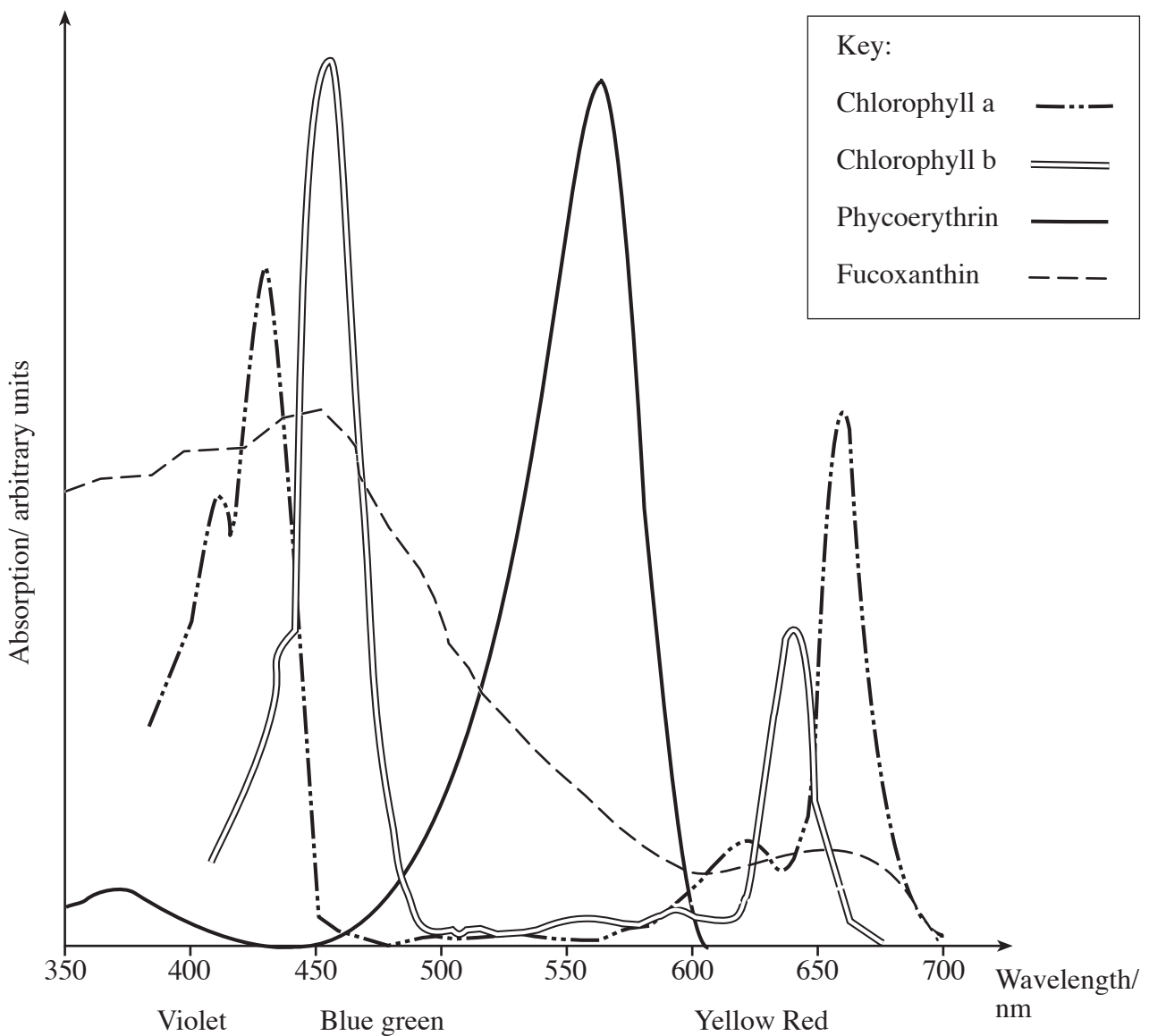
.....

(d) Different types of seaweed possess different pigments.

The table below gives information about the pigments present in green, red and brown seaweeds.

<i>Seaweed</i>	<i>Main pigments</i>	
Green	chlorophyll a	chlorophyll b
Brown	chlorophyll a	fucoxanthin
Red	chlorophyll a	phycoerythrin

The graph shows the absorption spectrum for each of these pigments.



Green seaweeds are generally found at the surface of the water, while the brown and red are found in deeper water. The production of fucoxanthin and phycoerythrin increase as light intensity decreases.

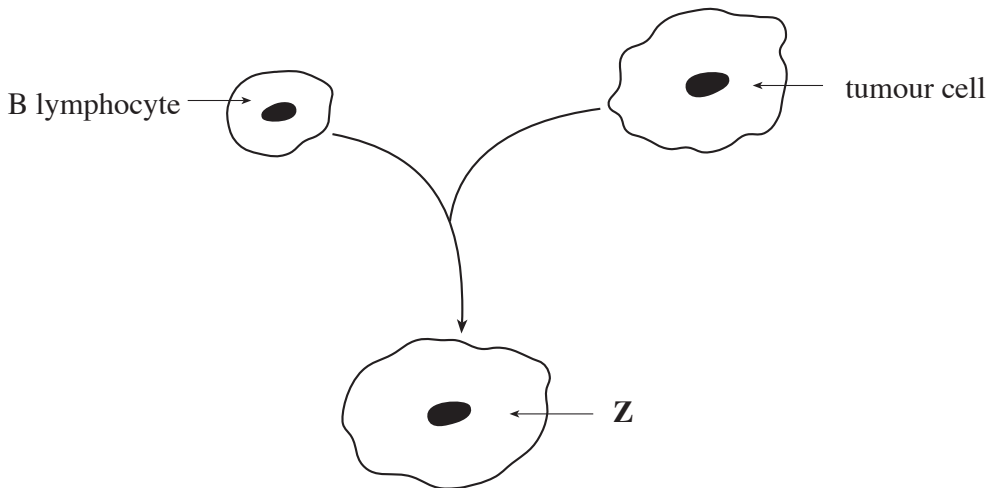
What is the advantage to the brown and red seaweeds of having the pigments fucoxanthin and phycoerythrin? [2]

.....
.....
.....
.....
.....

[Total 10 marks]

6. Cloned cell cultures are used to produce monoclonal antibodies.

(a) The diagram shows how the cloned cells are produced.



(i) Name cell Z. [1]

.....

(ii) What property of the tumour cell is important in producing these cell cultures? [1]

.....

(b) (i) What feature of monoclonal antibodies makes them suitable for use in diagnosis and treatment? [1]

.....

(ii) Give **one** example where monoclonal antibodies are used for diagnosis. [1]

.....

(iii) Give **one** example where monoclonal antibodies are used for treatment. [1]

.....

[Total 5 marks]

Turn over.

