Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Education
Advanced

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314/01

BIOLOGY

MODULE BI4

A.M. TUESDAY, 24 January 2006

(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. Cholera is a disease caused by a bacterium. It is endemic to certain parts of the world but the population is at greater risk after disasters such as earthquakes and flooding.
On testing with the Gram stains, the bacterial cell wall stains red.

(a) State how cholera is normally spread from one person to another. [1]

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(b) Explain why there is an increased risk of cholera following an earthquake or flooding. [2]

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(c) What does the staining indicate about the structure of the bacterial cell wall? [2]

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(d) Suggest how a patient with cholera might be treated. [2]

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[Total 7 marks]

2. *(a)* Explain how vitamin C can help to provide resistance to disease. [1]

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(b) Owain is bitten by a dog when on holiday in France.

(i) Describe the localised defence response by the body following this injury. [1]

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(ii) Owain is given a 'rabies injection' as a treatment for his injury. Describe the type of immunity acquired in this way. [2]

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(c) Distinguish between *cell mediated* and *humoral* immune responses. [6]

Cell mediated

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Humoral

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(d) Why are viruses not affected by antibiotics? [1]

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(e) How is an allele for resistance passed from one bacterium to another? [1]

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(Total 12 marks)

3. Malaria is a disease that is endemic in many tropical and subtropical regions of the world. It is particularly widespread in Africa and Asia.

(a) Explain what is meant by the term *endemic*. [1]

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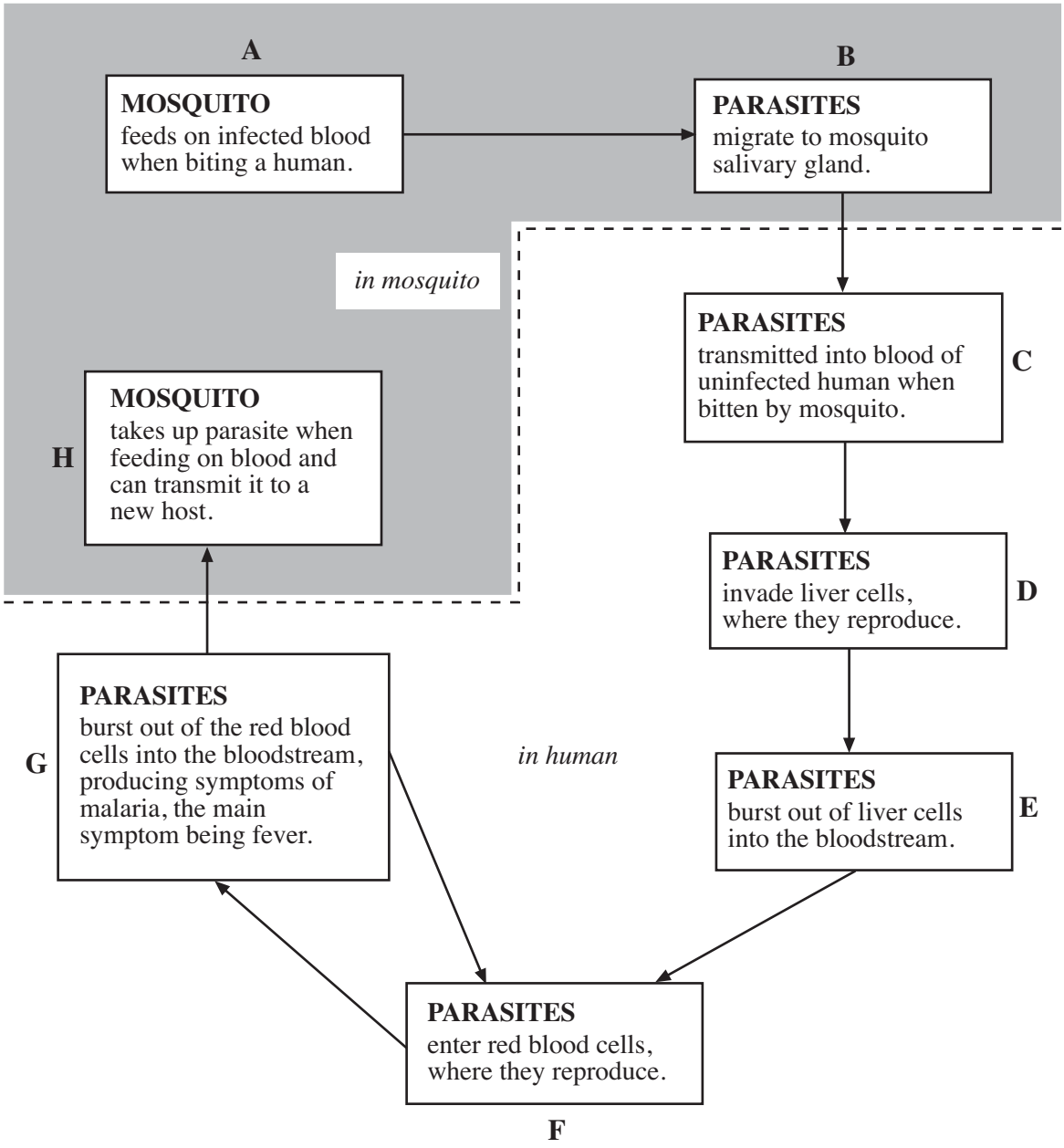
The diagram below outlines the life cycle of the malarial parasite.



(b) Explain why one of the symptoms of malaria is fever. [1]

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(c) Giving a different reason each time, outline how each of the following methods prevents the transmission of malaria.

(i) Use of insect repellent spray. [1]

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(ii) Draining swamps. [1]

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(iii) Introduction of sterile male mosquitoes. [1]

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(iv) Stocking ponds with fish. [1]

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(v) Spraying oil on the surface of ponds. [1]

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(d) DDT reduces the risk of mosquitoes biting people. DDT acts in a number of ways when sprayed onto the walls and other surfaces of houses.

	Estimate of mosquito population affected/%
Repels entry,	90
of those that do not enter, are discouraged from biting,	50
of those that are discouraged from biting, prolonged contact kills the mosquito.	50

Assuming that the DDT was sprayed correctly and used over a period of time, calculate its effectiveness in preventing a sleeping child from being bitten by a mosquito.

Show your working. [2]

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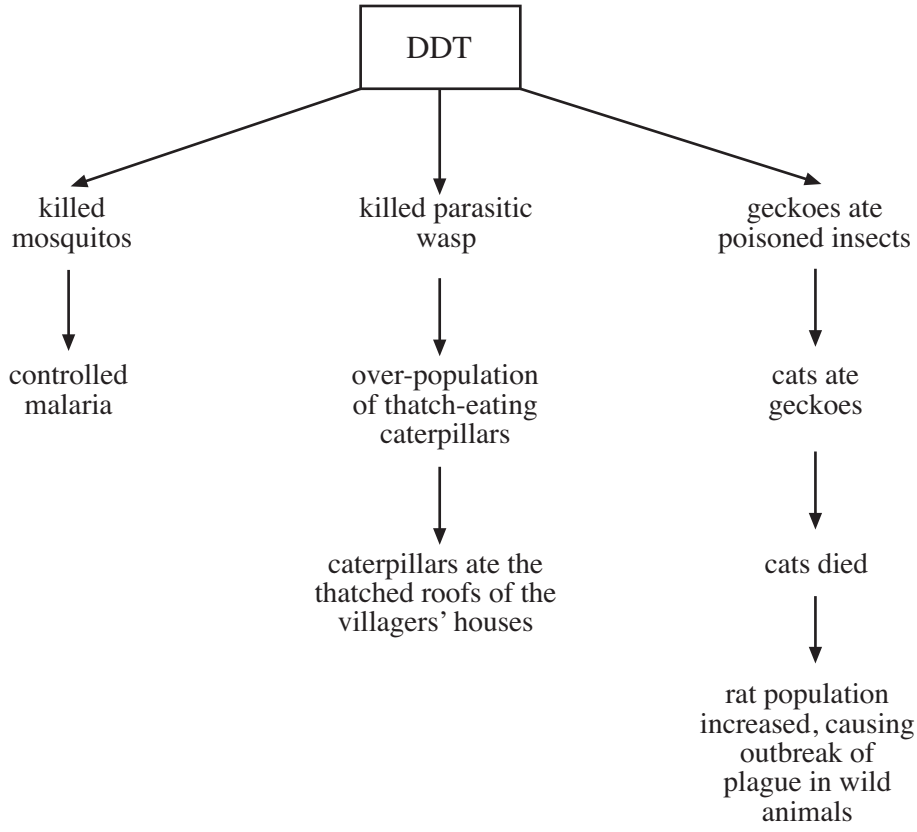
(e) In certain countries, DDT is no longer widely used. The diagram below outlines some of the consequences when DDT was used to control malaria in Borneo in the 1950s.



Suggest two **general** biological problems with using DDT, which results in damage to houses and an increased population of rats. [2]

1. .....

2. .....

(f) Certain human populations show a greater level of resistance to malaria.

Population I	In Africa and Papua New Guinea, some populations do not have a particular protein (antigen) on their red blood cells.

Population II	*Plasmodium falciparum* produces serious symptoms of malaria. However, in Vanuatu (a group of islands in the south-west Pacific), it has been noted that people who have been first infected with the less severe *Plasmodium vivax* do not seem to produce many of the more serious symptoms when subsequently infected by *Plasmodium falciparum*.

Suggest how the greater resistance is achieved in **each** of the above populations. [3]

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II .....

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(g) When Cerys travelled to Kenya on holiday, she was advised to take antimalarial drugs.

(i) When is the parasite vulnerable to these drugs? [1]

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(ii) State **one** disadvantage of using these drugs. [1]

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(iii) Suggest why it is important for Cerys to continue taking these drugs for a period after returning home. [1]

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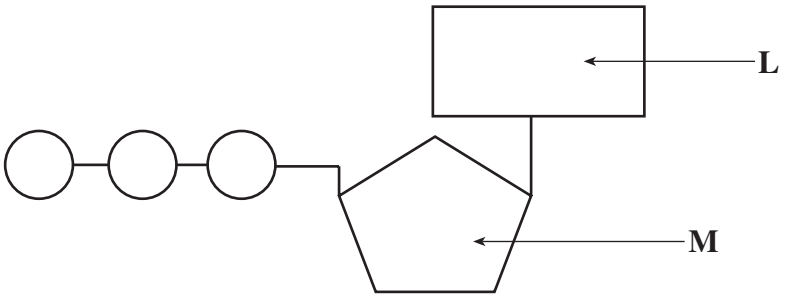
(Total 17 marks)

4. A diagram of a molecule of adenosine triphosphate (ATP) is shown below.



(a) (i) Name the parts of the molecule labelled **L** and **M**. [2]

L .....

M .....

(ii) Describe the use of ATP in the process of respiration. [2]

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(iii) Describe the production of ATP by chemiosmosis. [4]

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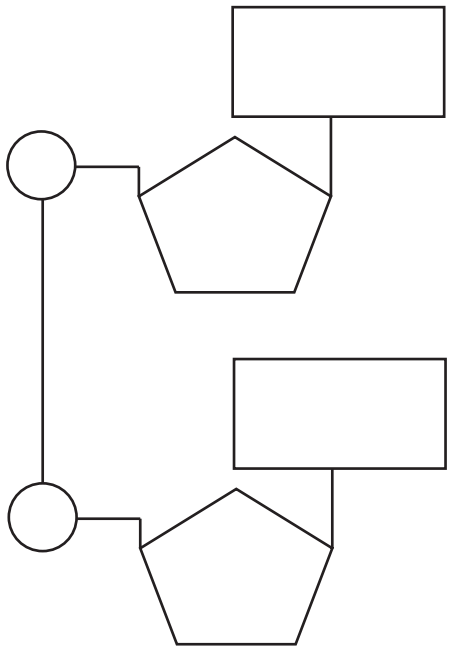
(b) NAD is a compound that is similar to ATP in structure.

A diagram of a molecule of NAD is shown below.



(i) State **two** ways in which the structure of this molecule differs from a molecule of ATP. [2]

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(ii) Describe the role of NAD in aerobic respiration. [3]

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(Total 13 marks)

5. *(a)* Name the mineral ion that is required for chlorophyll synthesis. [1]

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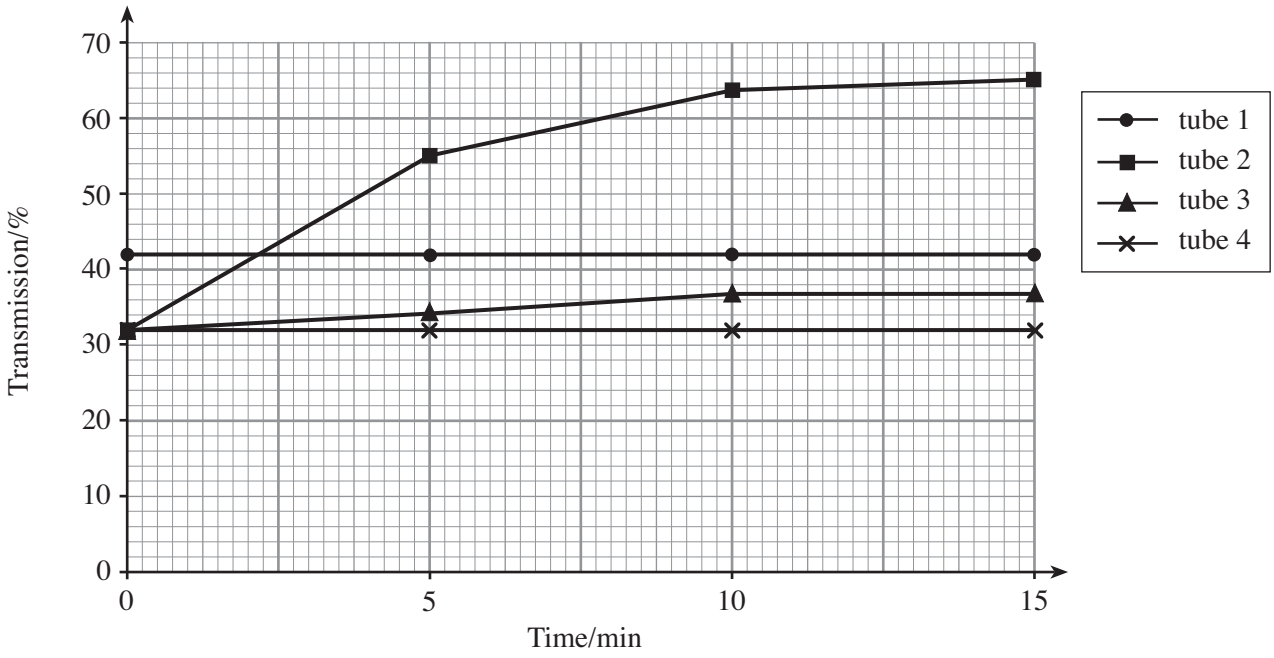
(b) An experiment was carried out to investigate the photosynthetic activity of isolated chloroplasts.
The photosynthetic activity was indicated by the reduction of a dye, DCPIP. When oxidised, DCPIP is blue but when reduced, by gaining electrons, it is colourless.

Four test tubes were prepared as follows:

Tube	*Contents*	*Treatment*	*DCPIP decolourised?*
1	$2cm^3$ buffer solution $5cm^3$ DCPIP	Placed in bright light	
2	$2cm^3$ chloroplast suspension $5cm^3$ DCPIP	Placed in bright light	
3	$2cm^3$ boiled chloroplast suspension $5cm^3$ DCPIP	Placed in bright light	
4	$2cm^3$ chloroplast suspension $5cm^3$ DCPIP	Placed in darkness	

At intervals during the experiment, the percentage of light transmitted (passing through) each tube was measured. This was recorded and plotted on a graph.



(i) Complete the table above, using a tick (✓) or a cross (×), to show whether the DCPIP is decolourised in each tube. [2]

(ii) Explain the difference in transmission observed in the contents of tubes 2 and 4 during the experiment. [5]

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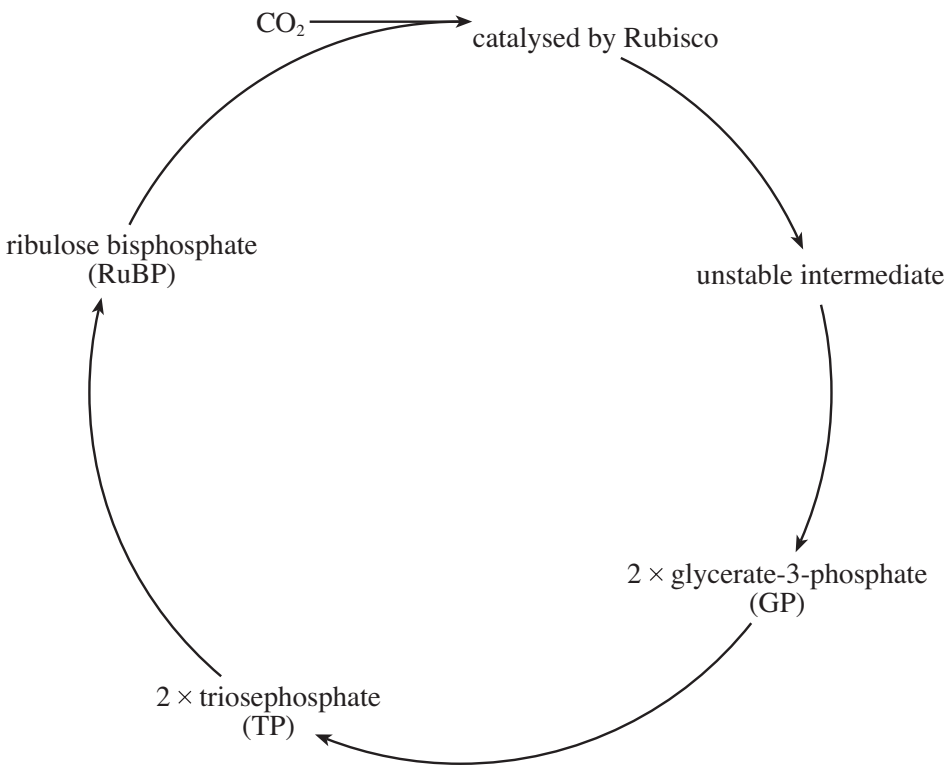
(c) The Calvin cycle is outlined in the diagram below.



Complete the diagram to show

(i) where reduced NADP is required; [1]

(ii) where ATP is required; [2]

(iii) a 3-carbon compound; [1]

(iv) a 5-carbon compound. [1]

(d) The enzyme Rubisco is able to catalyse more than one reaction. In addition to its role in the Calvin cycle, it is also able to catalyse the combination of oxygen with ribulose bisphosphate. This has the effect of the cells taking up oxygen and releasing carbon dioxide when exposed to very bright light. This process is known as photorespiration.

Using this information, suggest why photorespiration is a disadvantage to the plant. [3]

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(Total 16 marks)

6. Answer **one** of the following questions.
Any diagrams included in your answer must be fully annotated.

Either, *(a)* Describe the digestion of protein and the fate of the products of protein digestion. [10]

Or *(b)* Describe the industrial production of penicillin. [10]

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(Total 10 marks)