Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Education
Advanced

CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Addysg Gyffredinol
Uwch

314/01

BIOLOGY

MODULE BI4

A.M. WEDNESDAY, 24 January 2007

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

(i) vector, [1]

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(ii) peristalsis, [1]

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(iii) passive immunity. [1]

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(b) State the result of a deficiency of each of the following in living organisms.

(i) Magnesium in plants, [1]

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(ii) Nitrogen in plants, [1]

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(iii) Vitamin C in humans. [1]

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[Total 6 marks]

2. *(a)* Describe the role of B-lymphocytes in the immune system. [4]

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(b) Edward Jenner pioneered vaccination in Britain. He based his experimental work on the folk-lore that milkmaids who had contracted cowpox, a mild viral infection caught from infected cows, did not then contract smallpox.

Jenner deliberately infected an eight year old boy with material from a cowpox sore. After becoming ill with cowpox, the boy recovered. Jenner then infected him with smallpox and the boy was protected so did not become ill. Despite criticism from the scientific community, this type of vaccination became compulsory in 1853.

(i) Explain why catching cowpox gave protection against smallpox. [2]

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(ii) Comment on the methods, including the ethical aspects, that Jenner used when carrying out his pioneering work. [2]

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(c) During the winter months, many elderly and 'at risk' patients become very ill with pneumonia (caused by *Streptococcus pneumoniae*) and also influenza. The National Health Service in Wales recommends that these patients should be protected from these diseases by vaccination.

- Vaccine against influenza needs to be given each year.
- Vaccine against pneumonia protects against 96% of the causes of pneumonia and needs only to be given once in a person's lifetime.

Explain why vaccination programmes for influenza and pneumonia are different. [3]

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[Total 11 marks]

3. *(a)* Describe the digestion of carbohydrate in the alimentary canal. [5]

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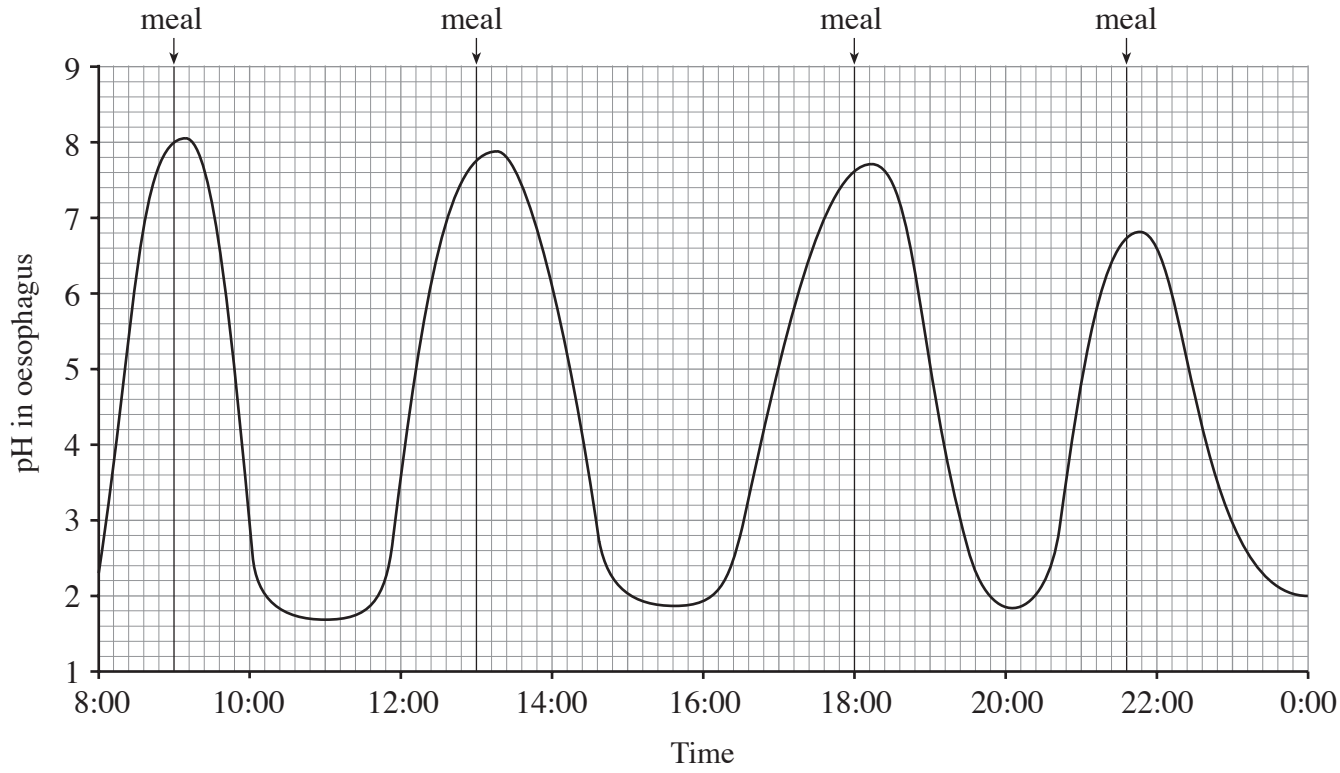
(b) Some people continually overproduce acid in the stomach. During acid reflux, the acidic contents of the stomach move up into the oesophagus, causing irritation and damage to the cells lining the oesophagus. Acid reflux is one cause of 'heartburn'.
A pH probe was used to discover whether a patient's 'heartburn' was caused by acid reflux. This probe monitored the pH in the oesophagus from 8am to midnight. The results are shown below.



(i) Suggest how the stomach contents are normally prevented from moving up into the oesophagus. [1]

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(ii) State **three** functions of the acid secreted in the stomach. [3]

1. .....

2. .....

3. .....

(iii) Why are cells lining the stomach not affected by acid in the same way as the cells lining the oesophagus? [1]

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(iv) Suggest an explanation for the pH values observed in the **oesophagus** up to an hour **after** a meal is eaten. [2]

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[Total 12 marks]

4. Septicaemia is a condition in which bacteria move from a localised infection into the bloodstream where they multiply rapidly. Here their toxins accumulate, causing severe damage to vital organs. The bacterium *Listeria monocytogenes* is one of a large number of bacteria that are known to cause septicaemia. It is a Gram positive bacillus that is a facultative anaerobe.

(a) (i) State the shape of *Listeria monocytogenes*. [1]

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(ii) State what is meant by the term 'facultative anaerobe'. [1]

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(iii) Complete the following passage. [2]

The Gram staining technique distinguishes between Gram negative and Gram positive bacteria. Gram positive bacteria retain the stain of crystal violet and appear the colour ..... whilst Gram negative bacteria appear ..... due to the counterstain.

(b) Bacterial infections, such as septicaemia, are treated with antibiotics. Care needs to be taken to prescribe a suitable antibiotic as the effectiveness of an antibiotic in a given situation depends upon the type of bacterium involved and the mode of action of the antibiotic.

(i) Describe how penicillin is more effective against Gram positive rather than Gram negative bacteria. [5]

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(ii) Suggest why antibiotics that act on protein synthesis are described as 'broad spectrum'. [2]

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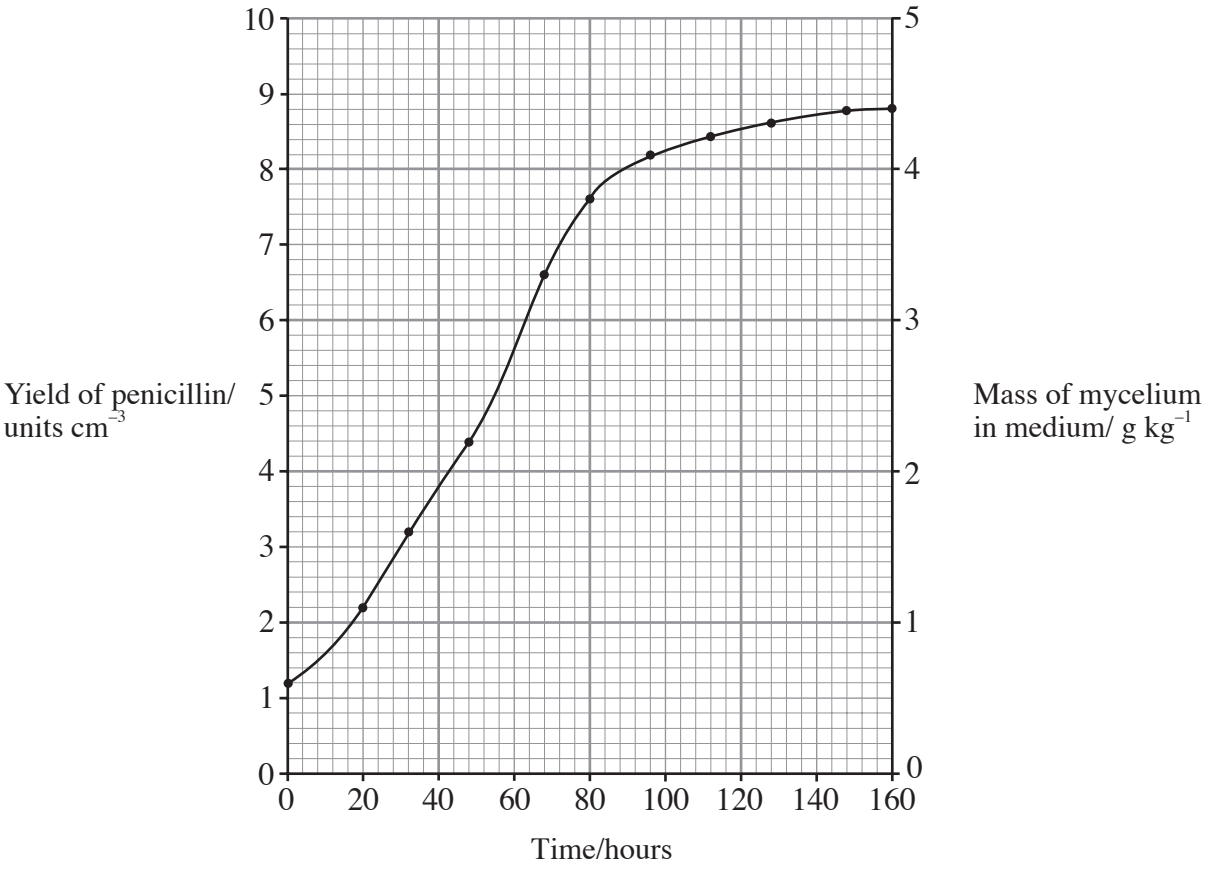
(c) Penicillin is produced by batch fermentation.
The graph below shows the mass of fungal mycelium in the fermenter during the process and the table shows the yield of penicillin at intervals during the process.

Time/hours	*Yield of penicillin/units cm^{-3}*
20	0
36	0.8
48	2.0
68	4.4
80	6.0
96	7.6
112	8.4
128	9.2
148	9.4
160	9.5

(i) Plot the information from the table on the graph. [2]



(ii) Explain why penicillin begins to be produced after 20 hours. [1]

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(iii) How does this reflect the need of the organism when free-living? [1]

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(iv) Give **two** reasons why sterile air is introduced into the fermenter. [2]

1. .....

2. .....

(v) State **two** factors that need to be monitored during the process. [2]

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(Total 19 marks)

5. *(a)* The pigments for photosynthesis are held in chloroplasts. The pigments are chlorophyll a, chlorophyll b and accessory pigments, such as carotenoids.

(i) State precisely where in the chloroplast the pigments are found. [1]

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(ii) Name the specific pigment that loses an electron in the light dependent reaction. [1]

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(iii) What is the function of the accessory pigments? [2]

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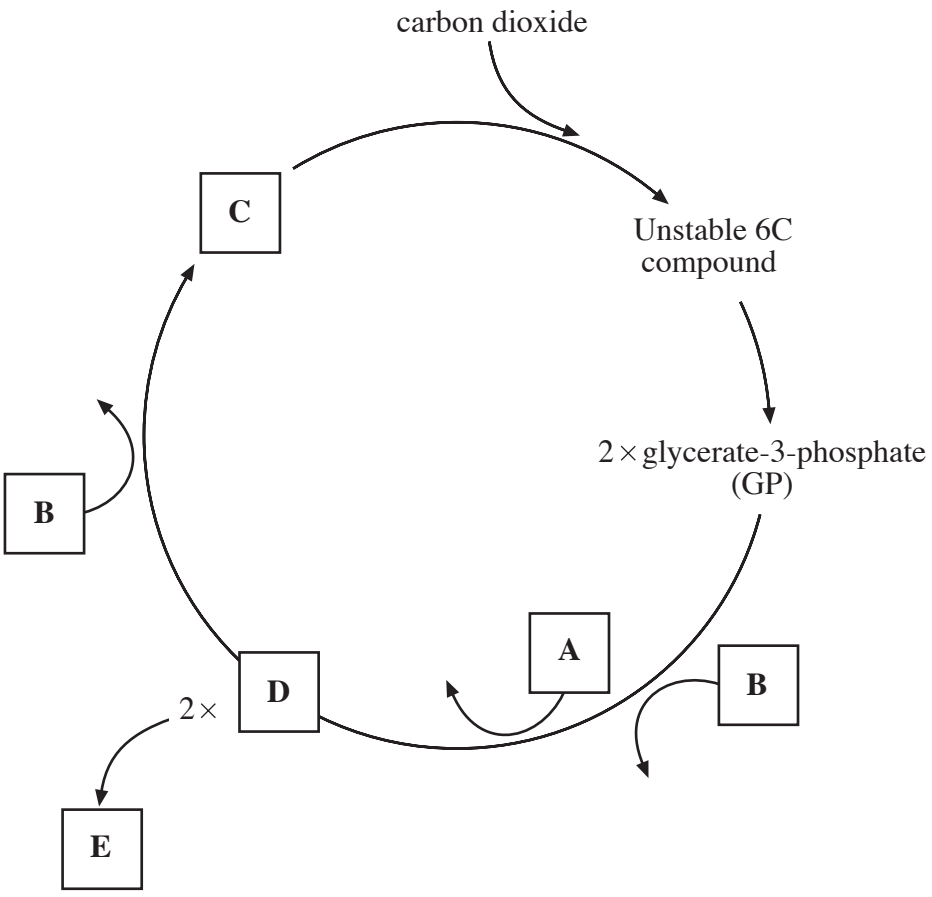
(b) The diagram below is an outline of some of the stages of the Calvin cycle.



(i) **A** and **B** are products of the light dependent reaction.
Identify compounds **A** and **B**. [2]

A .....

B .....

(ii) State **one other** product of the light dependent reaction. [1]

.....

(iii) Identify compounds **C** and **D**. [2]

C .....

D .....

(iv) Name **one** compound that could be formed at **E**. [1]

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(c) The rate of photosynthesis can be limited by a number of factors.

(i) State what is meant by a 'limiting factor'. [1]

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(ii) Explain why temperature is an important limiting factor in photosynthesis. [2]

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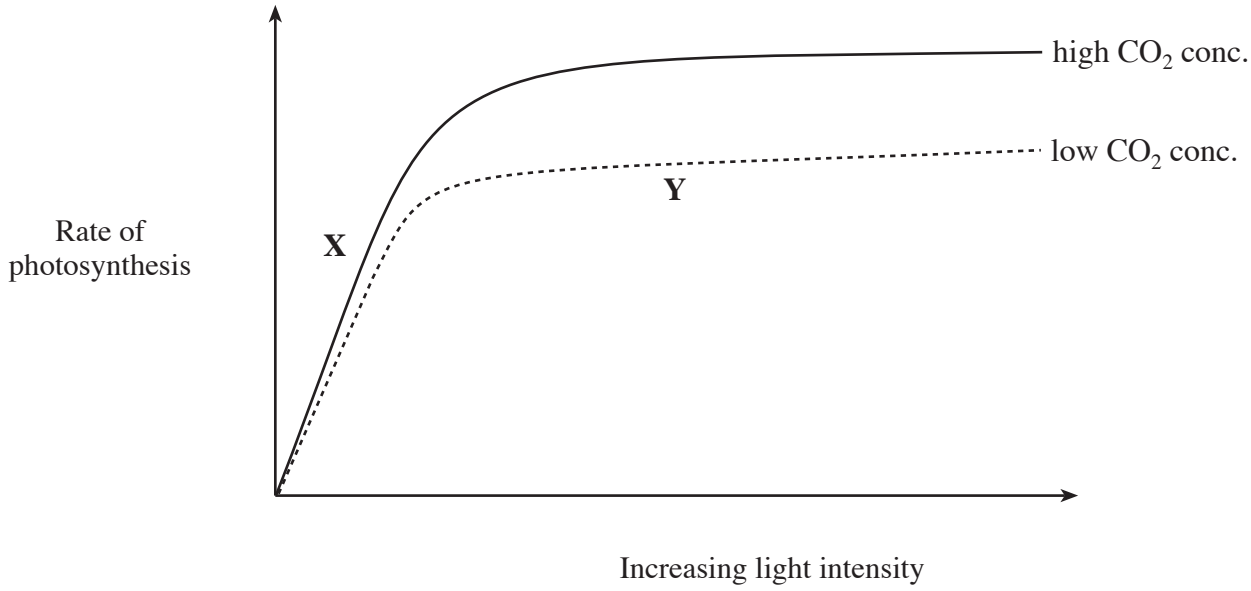
(iii) The graph below shows the effect of increasing light intensity on the rate of photosynthesis at low and high concentrations of carbon dioxide.



State which factors are limiting at **X** and **Y**. [2]

X .....

Y .....

(Total 15 marks)

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

Either, *(a)* Describe
(i) the Krebs cycle;
(ii) the formation of ATP in the electron transport chain.
[Details of glycolysis and the link reaction are not required.]

[12]

Or *(b)* Write an account to include the causative organism, symptoms, mode of transmission, treatment and prevention of the disease for
(i) cholera;
(ii) salmonellosis.

[12]

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(Total 12 marks)

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