

Candidate Name	Centre Number	Candidate Number
		2



GCE A level

1074/01

BIOLOGY – BY4

A.M. WEDNESDAY, 16 June 2010

1³/₄ hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	11	
2	9	
3	7	
4	13	
5	11	
6	5	
7	14	
8	10	
Total	80	

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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.

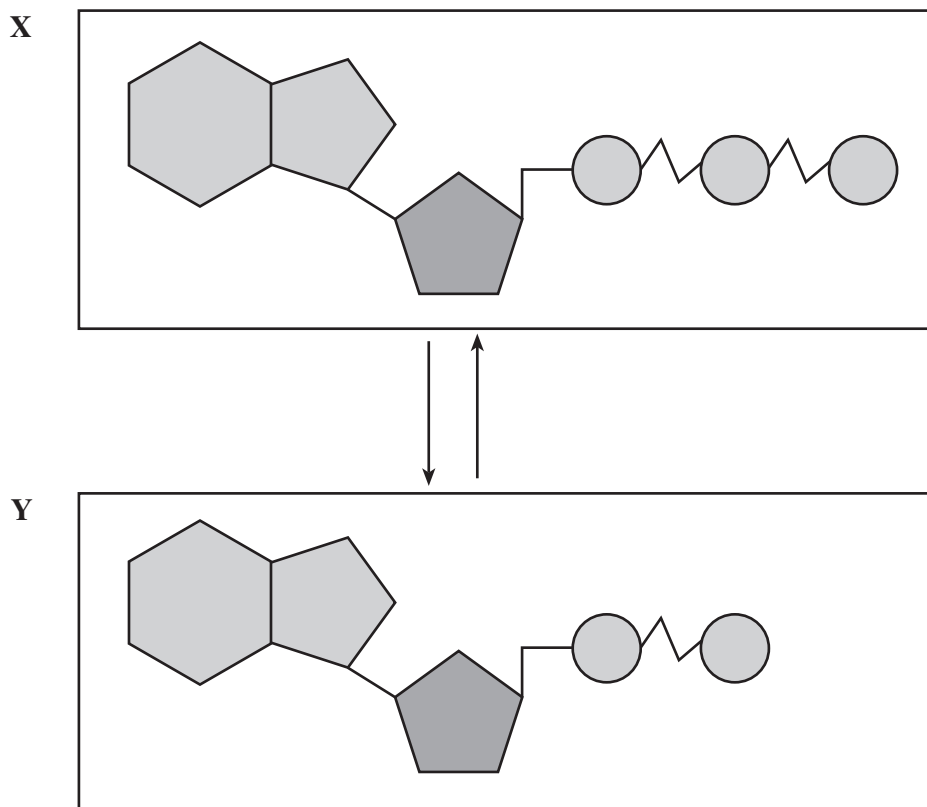
INFORMATION FOR CANDIDATES

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.

1. The diagram below shows the inter-conversion of two molecules.



(a) (i) Identify molecules **X** and **Y** [1]

X

Y

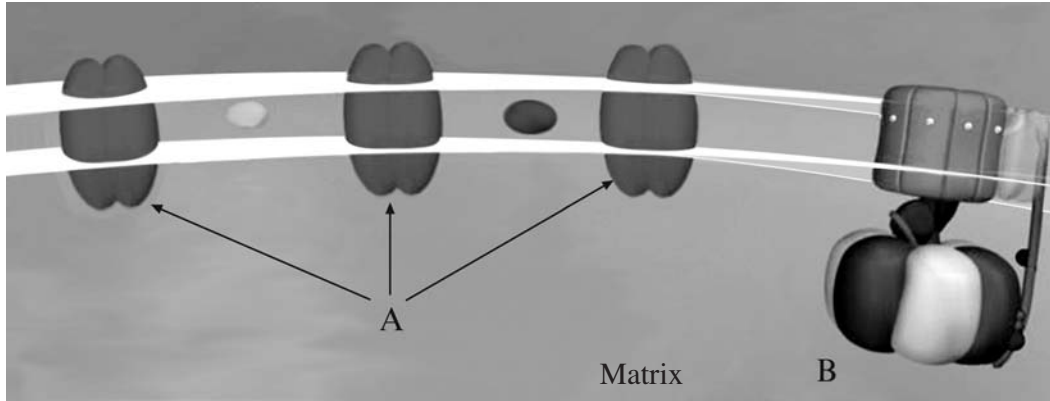
(ii) Give **two** examples of cellular activities where **X** would be converted to **Y**. [2]

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(iii) Name the enzyme required to convert **Y** to **X**. [1]

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(b) The diagram below shows the components involved in a sequence of events on the inner mitochondrial membrane.



(i) Name this sequence of events. [1]

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(ii) Identify structures A and B. [2]

A

B

(iii) As electrons are transferred along this membrane energy is made available. Using the information in the diagram above, explain how this energy is used to produce molecule X shown in the diagram opposite. [4]

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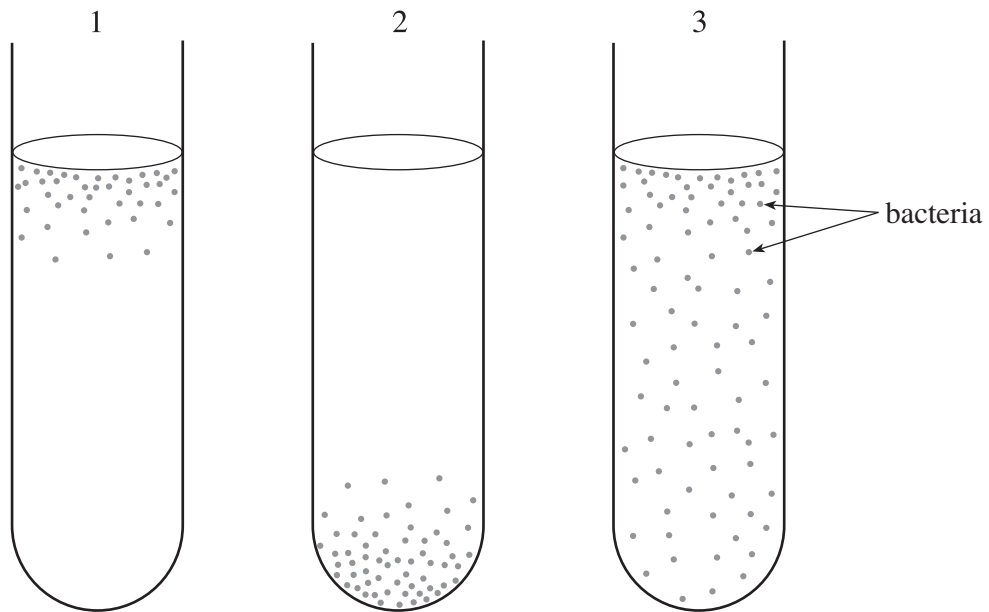
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(Total 11 marks)

2. (a) Many bacteria have precise metabolic requirements for oxygen. Aerobic and anaerobic bacteria can be identified by growing them in liquid culture. The results of one such experiment are shown below. The growth media was the same in all tubes.



Give the correct biological term for each of these types of bacteria from their position in the growth tubes and give a reason for each answer. [6]

Tube 1

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Tube 2

.....

Tube 3

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- (b) Some anaerobic bacteria, such as *Clostridium perfringens* (gas gangrene), produce toxins which are highly dangerous to organisms including humans if a wound becomes infected. Hyperbaric oxygen therapy is one method used in the treatment of such infections. This involves 2 to 4 daily sessions with the whole body exposed to oxygen in a chamber for 150 minutes at 3.0 atmospheres (three times normal atmospheric pressure). Suggest how such treatment is successful for treating these infections. [2]

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- (c) Apart from oxygen requirements list **three** other requirements for microbial growth. [1]

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3. Muscle cells were broken up and separated into fractions. Samples of each fraction were incubated with (i) glucose and (ii) pyruvate (pyruvic acid). Tests were carried out for the production of carbon dioxide and lactate (lactic acid) in each sample. The results are given in the table below.

<i>Cell fraction</i>	<i>Incubated with glucose</i>		<i>Incubated with pyruvate</i>	
	<i>Carbon dioxide</i>	<i>Lactate</i>	<i>Carbon dioxide</i>	<i>Lactate</i>
Ribosomes	absent	absent	absent	absent
Mitochondria	absent	absent	produced	absent
Cytoplasmic residue	absent	produced	absent	absent

- (a) Using your knowledge of respiration explain the results obtained with each cell fraction.

Ribosomes [1]

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Mitochondria [2]

.....

.....

Cytoplasmic residue [2]

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- (b) Explain why no carbon dioxide is evolved when cyanide is added to the mitochondrial fraction prior to incubation. [2]

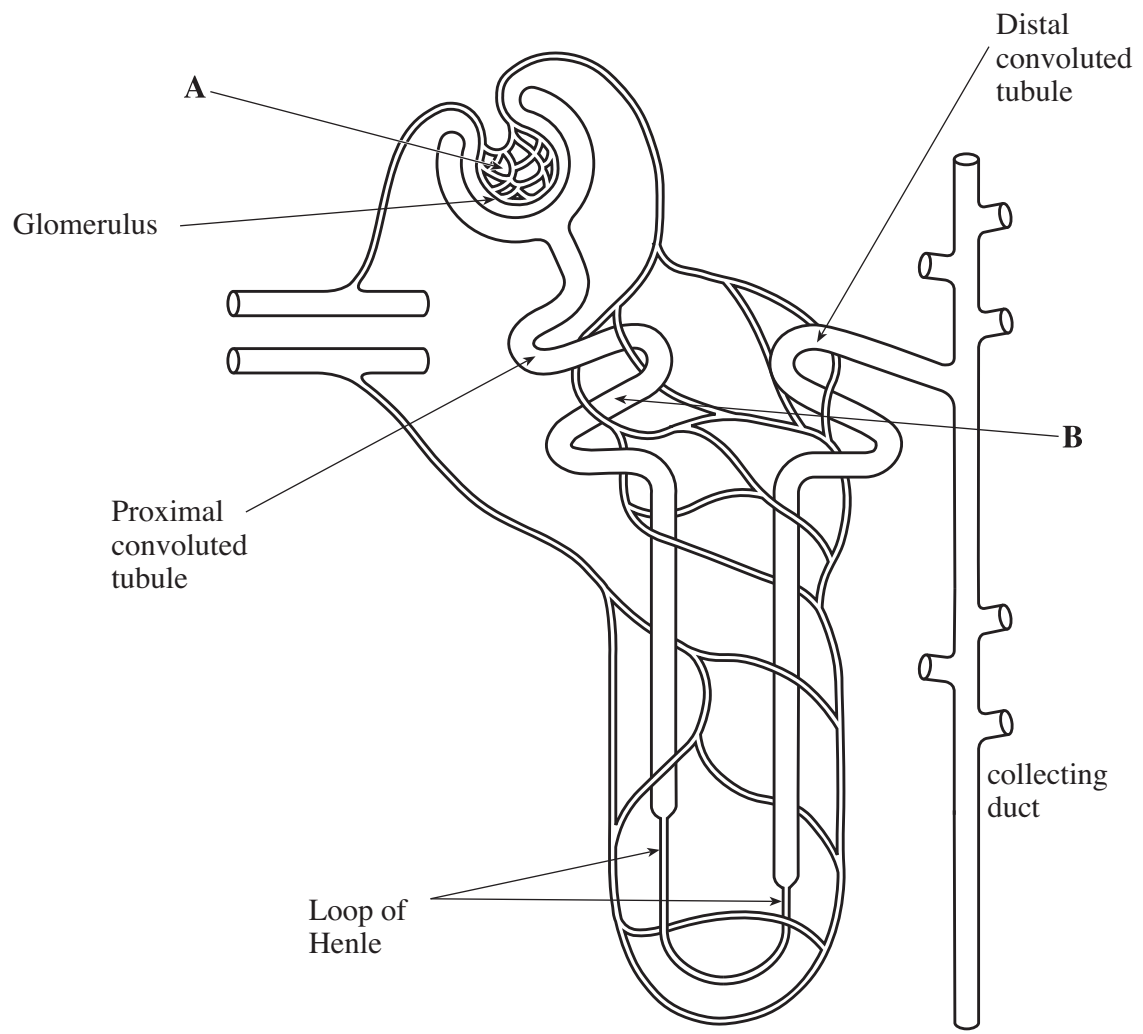
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(Total 7 marks)

4. The diagram below shows a diagram of a kidney tubule or nephron.



(a) Describe briefly the process being carried out at A.

[3]

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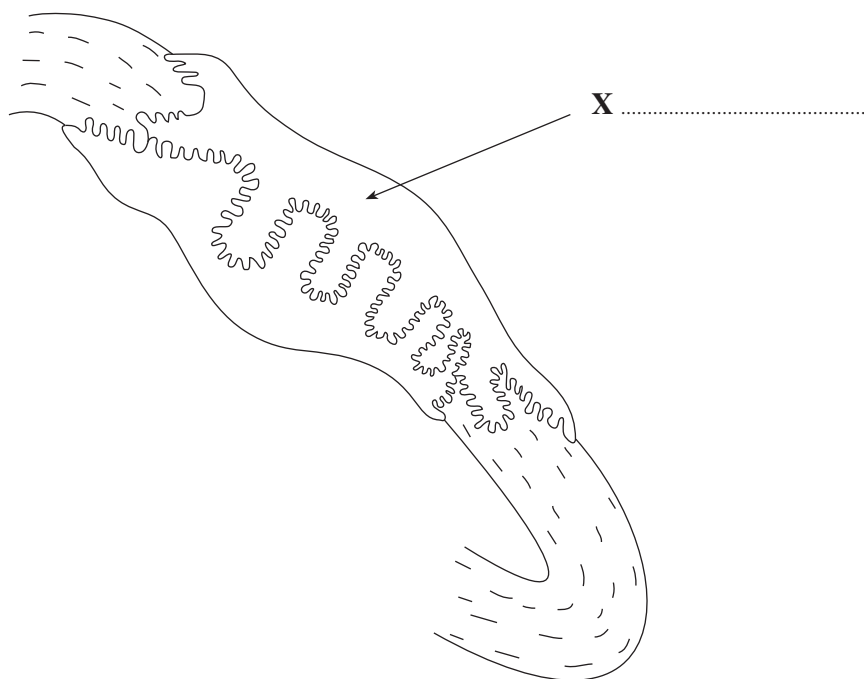
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(b) The diagram below shows a section of capillary from region **A** of the nephron.



- (i) Label **X** on the diagram. [1]
- (ii) What important feature is shown by the capillary? [1]

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(c) (i) Name the process being carried out at **B** of the nephron. [1]

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(ii) Tick the correct boxes below to show how each molecule moves into the bloodstream at **B**. [3]

<i>Molecule</i>	<i>Transport mechanism</i>		
	<i>Facilitated Diffusion</i>	<i>Active Transport</i>	<i>Osmosis</i>
Glucose			
Amino Acids			
Water			
Sodium ions			

(d) The Loop of Henle is important in producing a medulla with a low water potential. This allows the movement of water from the collecting duct under hormonal control. For the mammals listed below, explain the difference in length of this structure. [3]

Otter

Human

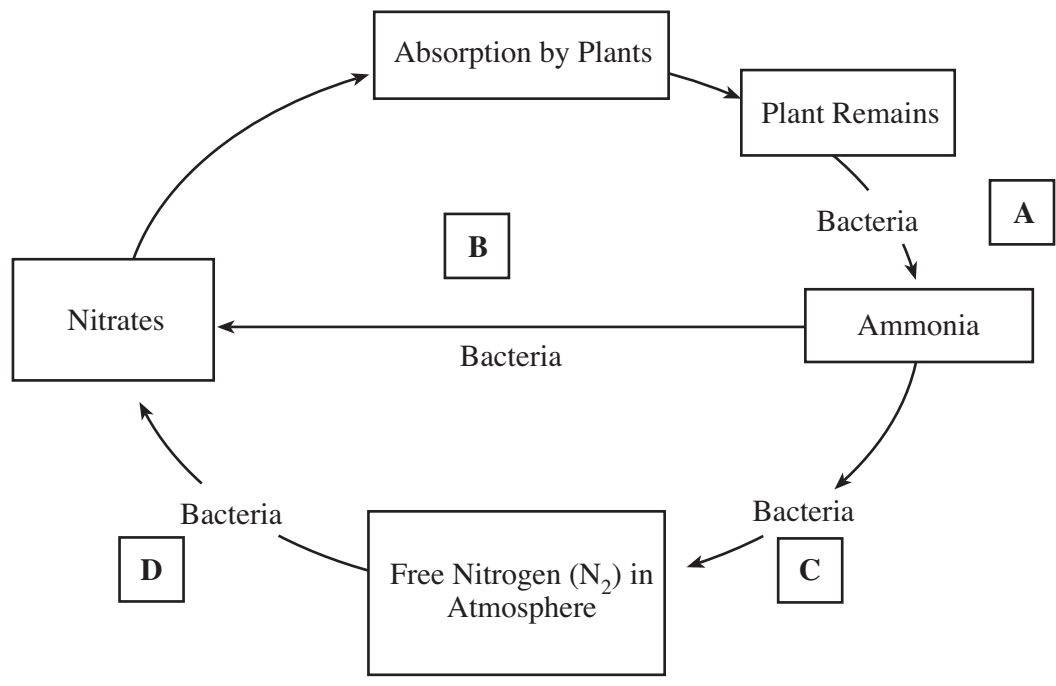
Camel

(e) There is a medical condition (diabetes insipidus) where the body produces large quantities of dilute urine containing no glucose. With reference to hormonal control, suggest why this occurs. [1]

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(Total 13 marks)

5. The following diagram shows a simplified diagram of the nitrogen cycle.



(a) Name the process at **A**. [1]

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(b) Name **two** bacteria involved in process **B**. [2]

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(c) Name process **C** and state the condition in which this process is most likely to occur. [2]

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- (d) Most nitrogen-fixing bacteria form symbiotic associations with leguminous plants, where they are provided with nutrients by the plant and protected from oxygen. Oxygen inhibits the enzyme (nitrogenase) required for **nitrogen fixation**.

Azotobacter are free-living in soil and have the ability to fix atmospheric nitrogen by converting it to ammonia. Like other nitrogenases, *Azotobacter* nitrogenase is oxygen-sensitive, but it is believed that the extremely high respiration rate of *Azotobacter* protects the nitrogenase.

- (i) Name the bacteria which form the symbiotic relationship with leguminous plants. [1]

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- (ii) A type of haemoglobin is present in root nodules. How does this limit the exposure of bacteria in the root nodule to oxygen? [1]

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- (e) Using your knowledge of respiration, suggest how the high metabolic rate of *Azotobacter* would protect nitrogenase from oxygen. [2]

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- (f) *Drosera* (Sundew) is a genus of plants which lives in some waterlogged soils. The plant is able to trap and digest insects on its sticky leaves. Suggest why this is vital to the survival of the plants. [2]

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(Total 11 marks)

6. An experiment was carried out to determine the environmental factor which triggers flowering in a species of plant. The plant was exposed to a number of different periods of this factor whether it flowered or not was recorded.

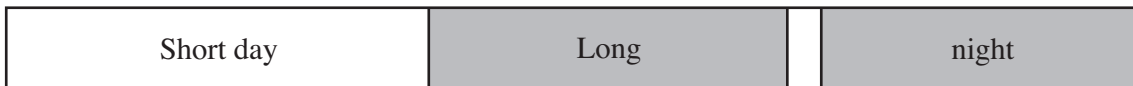
Experiment 1



Experiment 2



Experiment 3



Long night interrupted by a period exposed to light.

Results

Experiment 1 No flowering
 Experiment 2 Plant flowered
 Experiment 3 No flowering

- (a) Explain these results using your knowledge of phytochromes. [3]

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- (b) Using the results above, what category of plant is this? [1]

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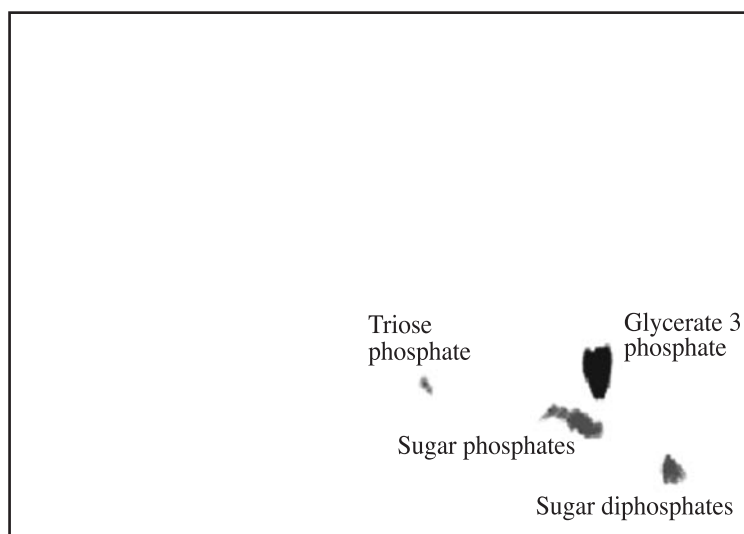
- (c) Suggest why horticulturalists need to know what conditions plants require to flower. [1]

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(Total 5 marks)

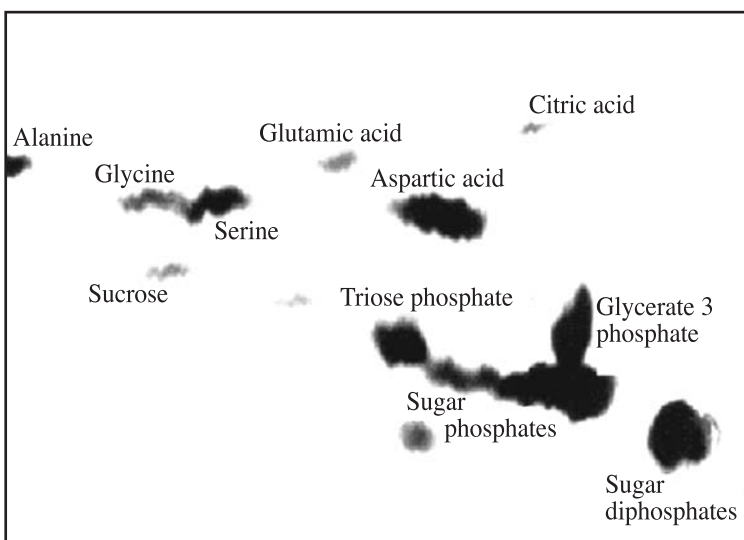
7. To investigate the sequence of events in the Calvin cycle, the following experiment was carried out.
1. The alga *Chlorella* was exposed to $^{14}\text{CO}_2$.
 2. After time intervals of 5 seconds and 30 seconds a sample of algae was added to hot ethanol to stop enzyme reactions in the cells.
 3. The radioactive compounds were separated by paper chromatography. Autoradiographs of the results are shown below.

The darker, more intense the spots, the more of that compound is present.



Chromatography paper showing radioactively labelled compounds extracted from *Chlorella* after 5 seconds photosynthesis with radioactive CO_2 .

- (a) Using your knowledge of the Calvin cycle explain the quantitative results of the autoradiograph after 5 seconds. [2]



Chromatography paper showing radioactively labelled compounds extracted from *Chlorella* after 30 seconds photosynthesis with radioactive CO_2 .

From Basham TA (1965) "Photosynthesis: The path of carbon." In *Plant Biochemistry*, 2nd ed., J Bonner & E Varner, eds. Academic Press NY pp. 875-902

Alanine, glycine, glutamic acid, serine and aspartic acid are all amino acids.

(b) What further information can be determined from the autoradiograph after 30 seconds? [3]

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(c) What further compounds would you expect to see after 300 seconds? [2]

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(d) The Calvin cycle depends on products of the light dependent stage of photosynthesis. Name these two products. [1]

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(e) The light dependent stage involves both cyclic and non-cyclic photophosphorylation. Explain what is meant by

(i) Cyclic photophosphorylation [2]

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(ii) Non-cyclic photophosphorylation [4]

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(Total 14 marks)

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

Either, (a) Describe the advantages and disadvantages of chemical and biological control. [10]

Or (b) Using a labelled diagram of a synapse, explain how impulses are transmitted across a synapse. [10]

Dotted lines for writing answers.

Examiner
only

A series of horizontal dotted lines intended for writing an answer.