

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Education
Advanced



CYD-BWYLLGOR ADDYSG CYMRU
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315/01

BIOLOGY BI5

P.M. FRIDAY, 22 June 2007

(2 hours)

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 in section A and B.

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.

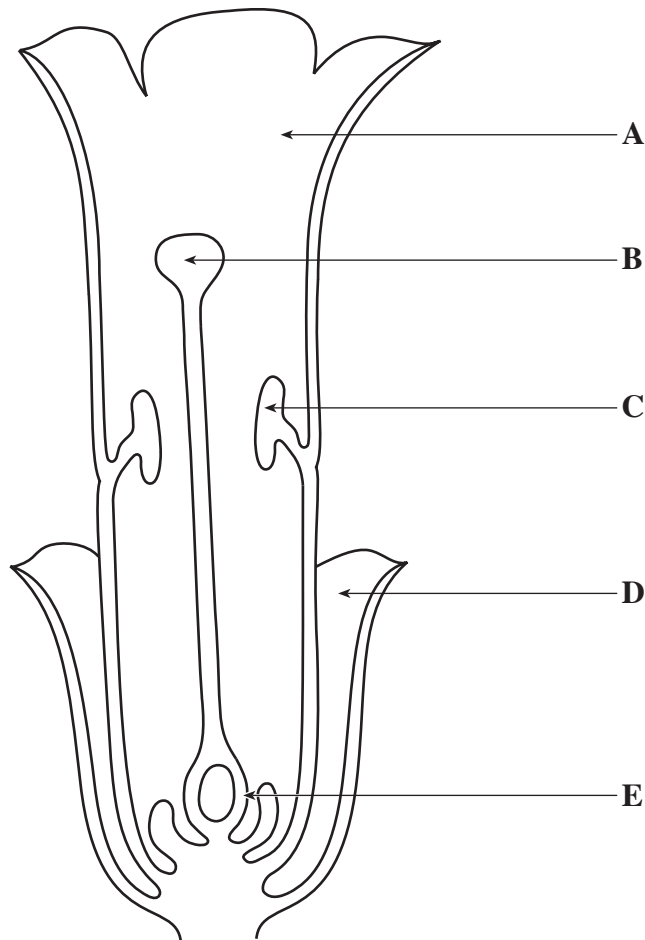
The quality of written communication will affect the awarding of marks.

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

SECTION A

Answer all questions

1. (a) The diagram represents a section of a flower.



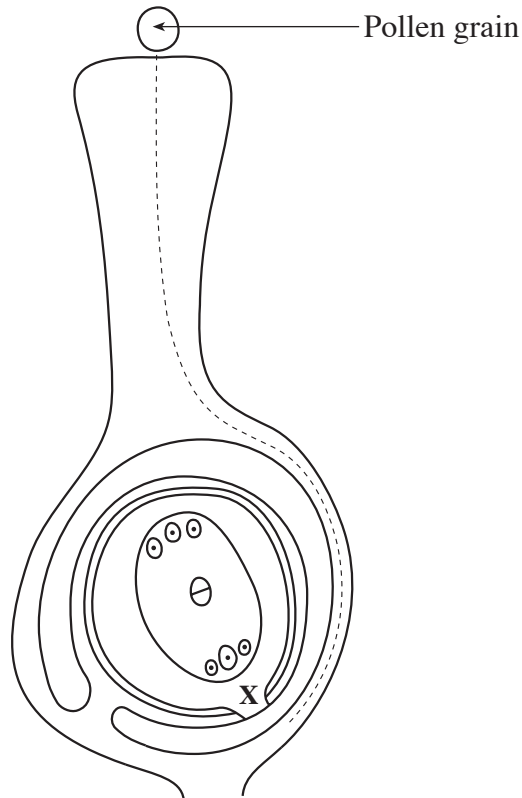
- (i) Name the parts of the flower labelled **A-E**. [5]

- A.
- B.
- C.
- D.
- E.

- (ii) Give **two** features, shown in the diagram, which suggest that the flower is insect pollinated rather than wind pollinated. [2]

- 1.
- 2.

(b) The diagram below represents the female reproductive system of this flower.



(i) Describe how the pollen tube passes through the tissues as indicated by the dotted line. [3]

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(ii) Name the region labelled X through which the pollen tube enters. [1]

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(iii) After fertilisation the structure will develop into the fruit and seed. Use the letters below to label, on the diagram, the regions that will develop into the following: [4]

- A Fruit
- B Testa
- C Endosperm
- D Embryo plant

(Total 15 Marks)

Turn over.

2. (a) Complete the following table to show the classification of the Tiger, *Panthera tigris*. [6]

Kingdom	Animalia
Phylum	
Class	
	Carnivora
	Felidae
Genus	
Species	

- (b) Suggest how DNA data can provide evidence for the evolutionary relationship between organisms. [1]

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(Total 7 marks)

3. In guinea pigs, black coat colour is dominant to brown and short hair is dominant to long. These characters are not linked. Pure breeding, long haired, brown, male guinea pigs were crossed with pure breeding, short haired, black guinea pigs.

- (a) Complete the genetic diagram showing the result of this cross. [5]

Use the following symbols to represent the alleles:

Black coat **B**

Brown coat **b**

Short hair **H**

Long hair **h**

Parental phenotypes	Long haired brown	Short haired black
Parental genotypes
Gametes

F1 genotypes

F1 phenotypes

(b) A guinea pig breeder crossed guinea pigs which were heterozygous for both alleles. Give the genotype of the gametes produced by these animals and the possible genotype and phenotype of the offspring.

Genotype of gametes [1]

All genotypes of offspring	Phenotype of offspring	[8]
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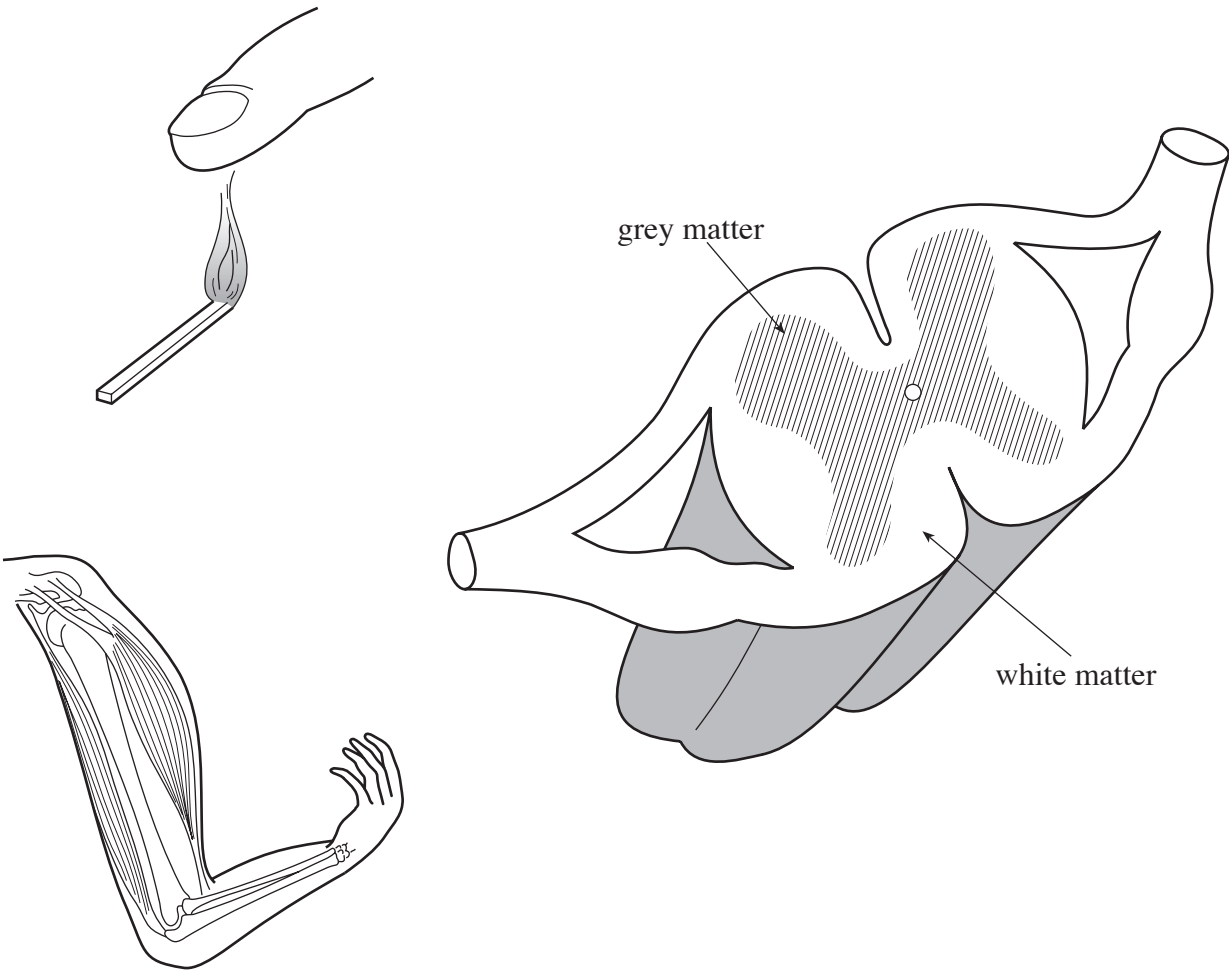
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(Total 14 marks)

Turn over.

4. The diagram represents the spinal cord and structures involved in the hand withdrawal reflex (not drawn to scale).



(a) Draw and **label** on the diagram a sensory, relay and motor neurone involved in the reflex action when a hand is withdrawn from a hot object. [3]

(b) Why is white matter white? [1]

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(c) Explain, giving **two** reasons, why nerve impulses can only travel in one direction. [2]

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(d) Humans can be affected by a condition known as multiple sclerosis (MS). In this condition T cells of the immune system attack and destroy the myelin sheath. Explain how this will affect the rate of transmission of the nerve impulse. [4]

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(Total 10 marks)

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

Any diagrams included in your answer must be fully annotated.

Either, (a) Describe the mechanisms by which populations can evolve into new species. [10]

Or (b) Describe and explain the changes which occur to the glomerular filtrate as it passes from the Bowman’s capsule to the ureter. [10]

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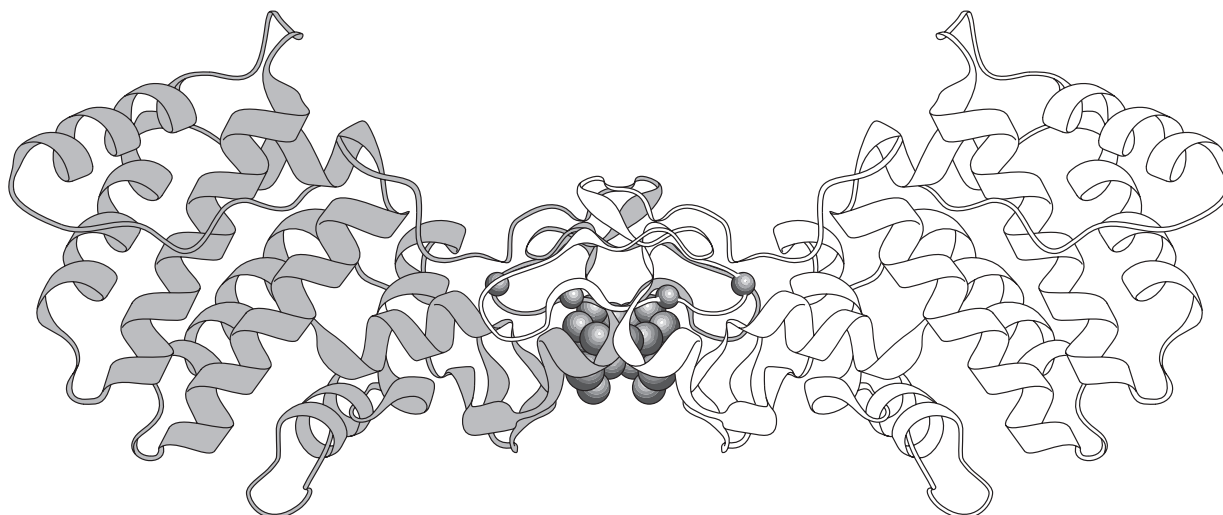
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(Total 10 marks)
Turn over.

SECTION B*Answer all questions*

6. When HIV (the virus which can cause AIDS) infects a cell the enzyme reverse transcriptase, which is found in this type of virus, copies the single RNA strand of the virus into a double strand of viral DNA. The viral DNA is then joined into the host chromosomal DNA which allows the host cellular processes to make multiple copies of the viral DNA. There has been much scientific interest in the structure of reverse transcriptase and a simplified diagram of this structure is shown.



- (a) (i) Name the substrate of this enzyme. [1]

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- (ii) Name the region on the enzyme where the substrate binds. [1]

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- (iii) What evidence from the diagram shows that the enzyme has a secondary and a tertiary structure? [2]

Secondary

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Tertiary

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(b) (i) Explain why the enzyme is referred to as a reverse transcriptase. [2]

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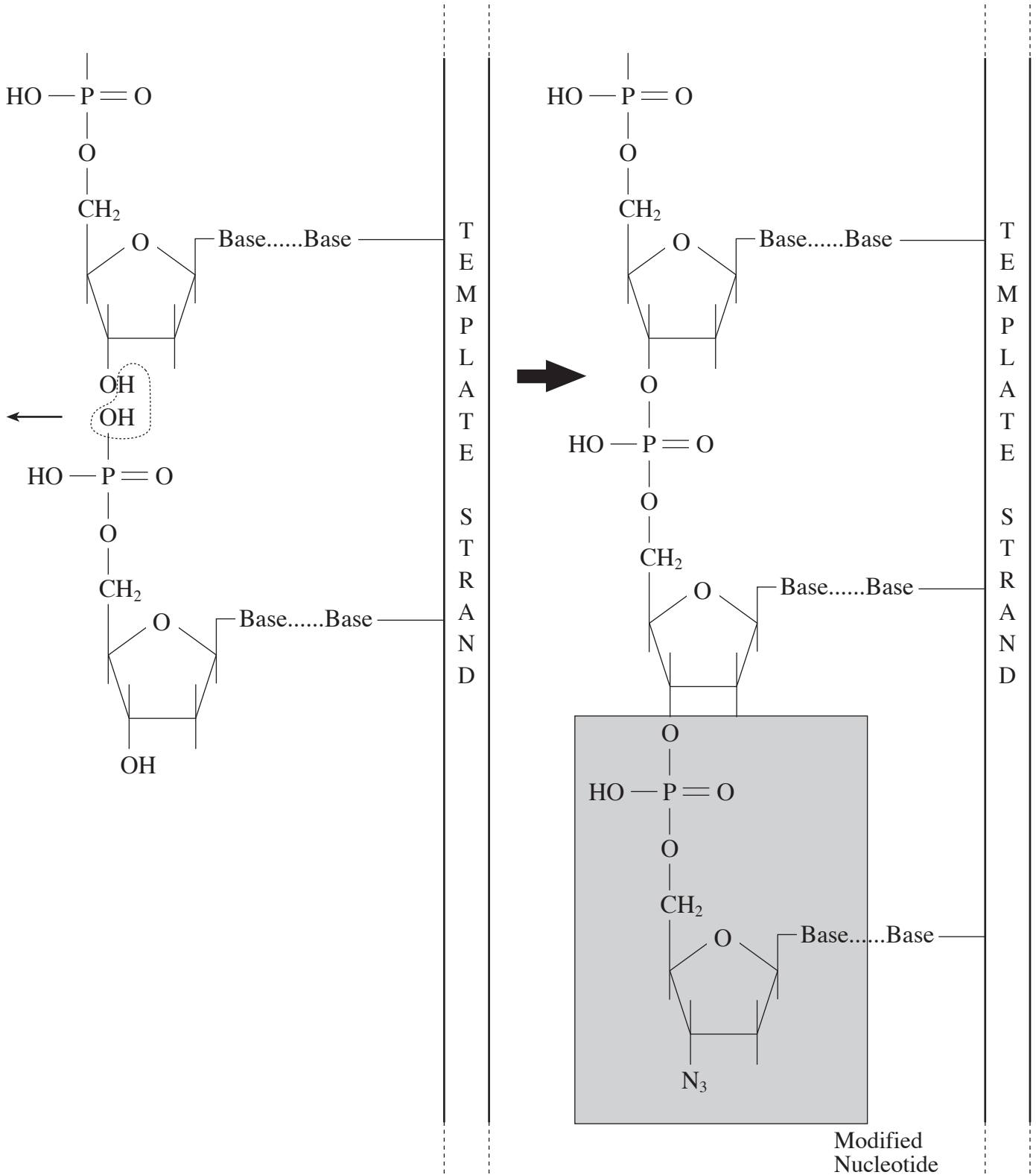
(ii) When DNA is made in this way mistakes are made and as many as 1 in 2000 nucleotides may be incorrect. What will be the result of these errors and what is the importance of this to the scientists who are trying to produce a vaccine against this virus? [3]

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(c) There are combinations of drugs which can be used to treat HIV infections. One group of these drugs are non-competitive inhibitors to reverse transcriptase. Describe the mode of action of such a drug. [3]

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- (d) To build its viral DNA, HIV uses nucleotides from the cell cytoplasm. Some drugs used to treat HIV are made from modified nucleotides. When these are incorporated into the growing DNA chain by the reverse transcriptase the next DNA nucleotide cannot be added and the newly made DNA strand is terminated early.



- (i) Describe how the deoxyribose sugar joins to the phosphate group of the next nucleotide. [2]

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- (ii) State why another DNA nucleotide cannot be added after the modified nucleotide. [2]

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- (e) There are other enzymes which are used by the virus to replicate and disperse itself from the host cell. Inhibition of these enzymes can be used to treat HIV infection.

Give the general name of the enzymes

- (i) used to hydrolyse a peptide bond to remove a group of amino acids from the end of a polypeptide chain; [1]

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- (ii) used to join the DNA strand, made by reverse transcriptase, into the chromosomal DNA of the host cell. [1]

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- (f) The percentage of each of the four types of nucleotide found in the RNA strand of an HIV particle is shown in the table. Complete the table to show the percentage of each type of nucleotide found in the single complementary DNA strand. [2]

<i>Nucleotide in viral RNA</i>	<i>% nucleotide in viral RNA</i>	<i>Nucleotide in single complementary strand DNA</i>	<i>% nucleotide in single complementary strand DNA</i>
cytosine	10		
guanine	40		
uracil	30		
adenine	20		

(Total 20 marks)

Turn over.

7. (a) (i) Carbon dioxide and atmospheric nitrogen can be fixed by living organisms. What is the meaning of the word *fixed* as used in this context? [1]

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(ii) Give **two** ways by which nitrogen is fixed. [1]

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(iii) Denitrifying bacteria are found in large numbers in anaerobic conditions. Insectivorous plants trap and digest small animals such as insects. Explain why these plants have a selective advantage in waterlogged soils. [2]

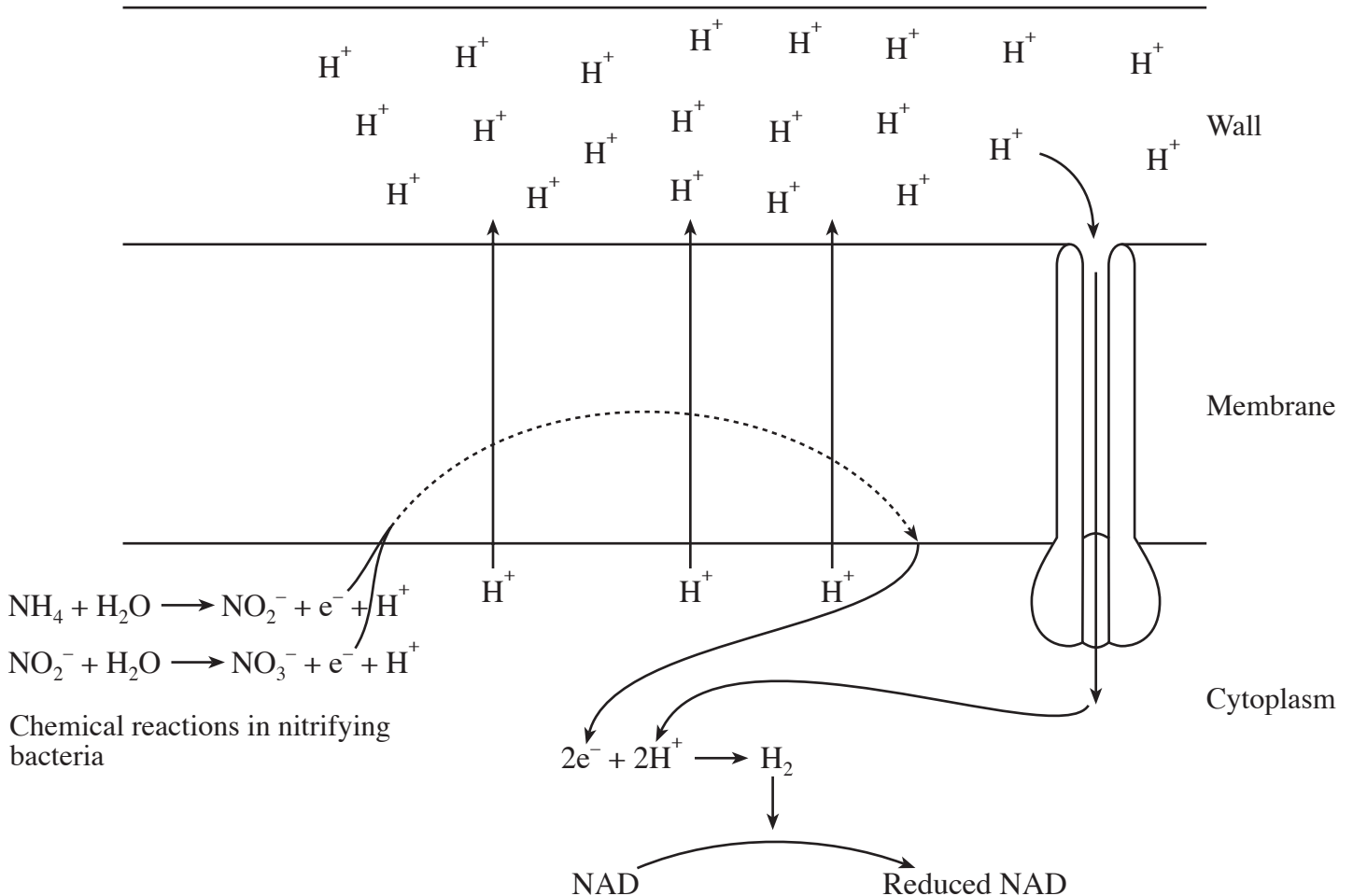
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(b) The diagram below represents the production of ATP and reduced NAD (NADH₂ / NADH H⁺) by nitrifying bacteria.



Use the information given in the diagram together with your knowledge of oxidative and photophosphorylation to answer the following:

(i) How do the nitrifying bacteria produce a source of electrons and protons (H^+)? [1]

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(ii) The electrons are passed along a series of chemicals in the membrane. What is the name given to these chemicals? [1]

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(iii) State what the energy released from the movement of these electrons is used for. [2]

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(iv) Describe how ATP is produced as a result of the reactions shown. [3]

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(c) From your knowledge of the light independent reactions of photosynthesis (Calvin cycle), suggest how the bacteria use the products of the reactions shown in the diagram. [3]

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