OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY 2806/01

Unifying Concepts in Biology

Wednesday **23 JANUARY 2002** Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces on the question paper.
- Read each question carefully before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- An insert is provided for Fig. 3.1, question 3.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	12	
2	12	
3	14	
4	8	
5	14	
TOTAL	60	

This question paper consists of 12 printed pages and an insert.

Registered Charity Number: 1066969
[Turn over

Answer **all** the questions.

1 At the bottom of the oceans there is no light and the temperature is constant at about 4 °C. In some parts of both the Pacific and the Atlantic oceans, there are holes or cracks in the ocean floor, called volcanic vents, through which hot water escapes from the Earth's crust. This water is rich in sulphide ions. The sulphide ions are oxidised by several species of bacteria and this provides a source of energy. This leads to the reduction of carbon dioxide and organic molecules are synthesised. Some of these bacteria remain active, fix carbon and reproduce at temperatures above 110 °C. Most organisms, especially eukaryotes, are unable to survive prolonged exposure to temperatures greater than about 50 °C.

(a) With reference to the passage above,

(i) explain why the bacteria have carboxylase enzymes;

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.....[2]

(ii) explain why the structure of these enzymes would be **stabilised** by disulphide bonds rather than by hydrogen bonds.

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.....[2]

(b) Suggest why enzymes extracted from these bacteria may have industrial applications.

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The groups of volcanic vents are widely separated. The ocean floor surrounding each group of vents has a large and diverse community of animals. These include primary consumers, secondary consumers and decomposers. Areas of the deep ocean floor that are not close to vents have few organisms.

(c) Explain why there are few organisms in areas that are **not** close to a vent.

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.....[2]

(d) State the food source of the primary consumers **near** a vent. Explain your answer.

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.....[2]

Each group of volcanic vents has some species which are not found elsewhere.

(e) Suggest why this is the case.

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.....[2]

[Total : 12]

2 Ultra violet (UV) radiation is an important component of solar radiation. UV photons have shorter wavelengths and more energy than those of visible light. UV can be a cause of mutation in cells.

If radiation of a known wavelength is passed through a solution of a substance under standard conditions, the intensity of the beam can be measured before and after it has passed through the solution. The readings can be used to calculate the percentage of energy in the beam that has been absorbed by the solution.

If the procedure is repeated using a range of different wavelengths, a graph may be drawn of wavelength against the percentage of the available energy absorbed.

Fig. 2.1 shows the absorbance of UV radiation by a solution of DNA.

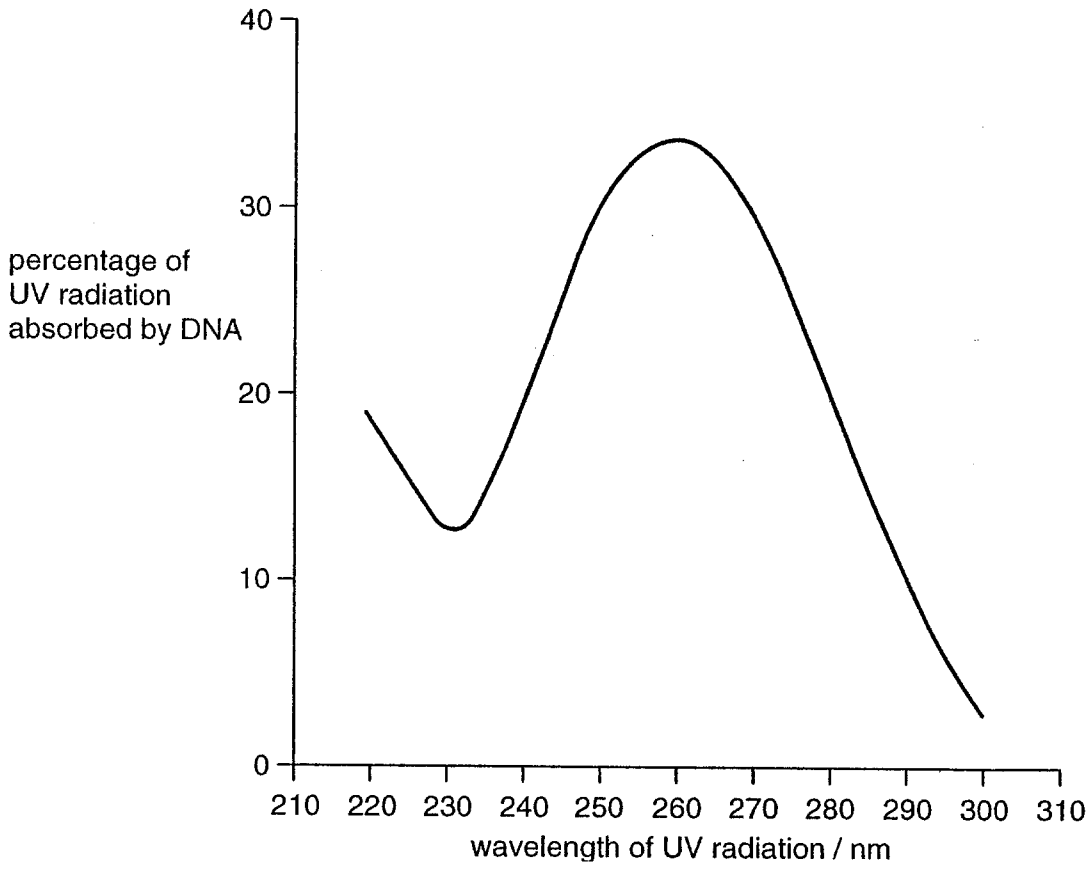

Fig. 2.1

(a) With reference to Fig. 2.1,

(i) state the UV wavelength that is most strongly absorbed by DNA;

.....[1]

(ii) explain why a source of UV radiation with a wavelength between 285 and 300 nm would be relatively ineffective in producing mutations.

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.....[3]

Skin cancer (malignant melanoma) is associated with exposure to UV in sunlight. This condition is more common in people who have been frequently exposed to direct sunlight.

(b) Explain how UV may cause skin cancer.

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.....[3]

(c) Suggest why skin cancer is more common in people who have pale coloured skin and who do not tan easily after exposure to the sun.

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.....[2]

The intensity of UV in solar radiation, especially in the Southern Hemisphere, has increased as a result of destruction of ozone in the upper atmosphere. This may increase the occurrence of mutations in animal and plant populations.

(d) Discuss whether an increase in the occurrence of mutation will lead to an increase in phenotypic variation in such populations.

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.....[3]

[Total : 12]

3 Fig. 3.1 is provided for you on an insert. It shows the nitrogen cycle of a dairy farm. Some of the processes linking the components of the cycle have been numbered, for example, process 1 represents cows producing milk. Letters indicate inputs to the cycle, for example, **W** is cattle food brought onto the farm.

(a) With reference to Fig. 3.1,

(i) name processes 2, 3 and 4;

2 .....

3 .....

4 .....[3]

(ii) name **two** nitrogen containing compounds, other than proteins and amino acids, that are found in plants.

1. .....

2. .....[2]

(b) Discuss whether it would be desirable for the environment and whether it would be economically practicable, to run a dairy farm without any of the inputs **W**, **X**, **Y** and **Z**. *(In this question, 1 mark is available for the quality of written communication.)*

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INSERT

Wednesday **23 JANUARY 2002** Morning 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

This insert contains Fig. 3.1 for Question 3.

This insert consists of 2 printed pages.

Registered Charity Number: 1066969
[Turn over

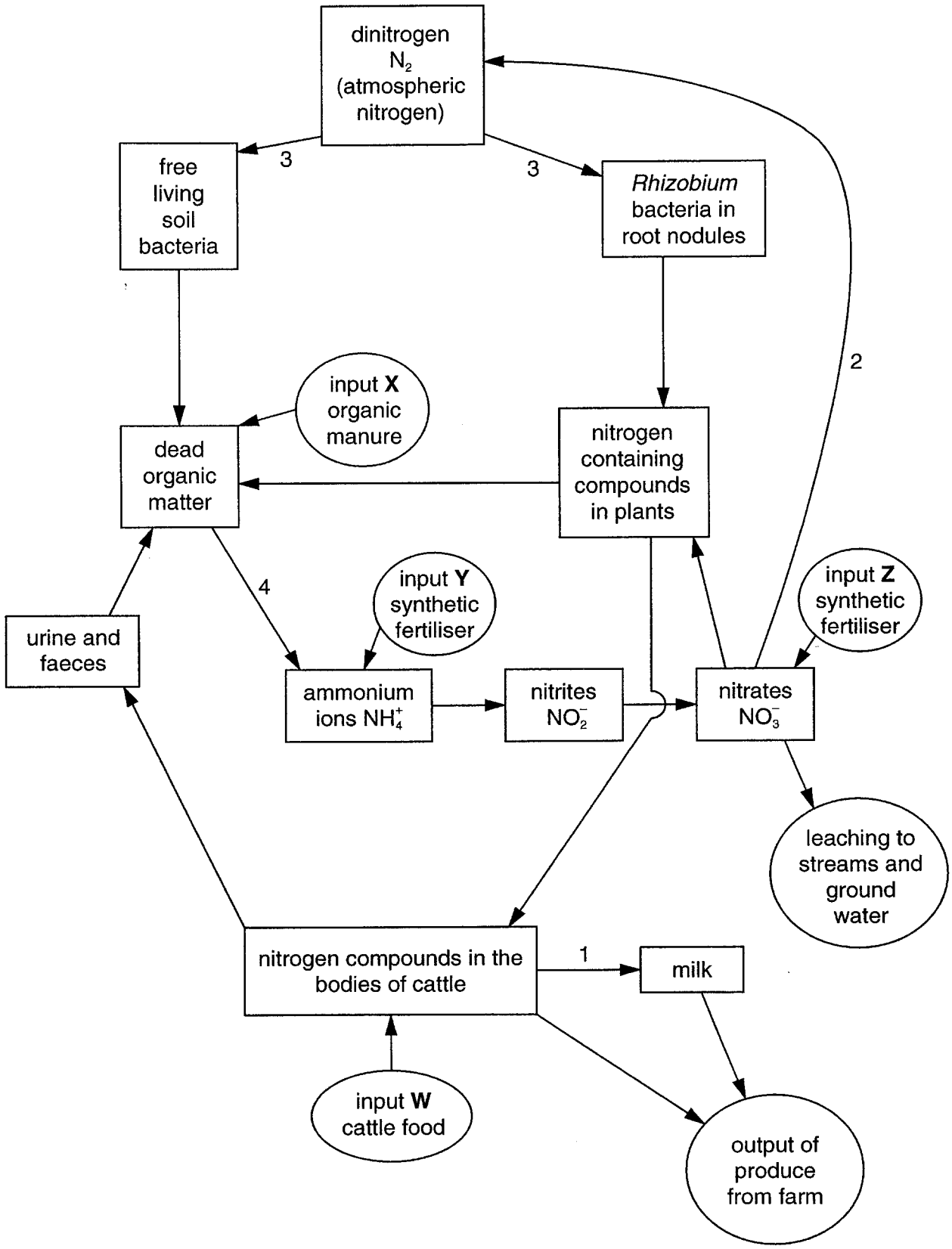
dinitrogen N_2 (atmospheric nitrogen)
free living soil bacteria
3
3
Rhizobium bacteria in root nodules
2
input **X** organic manure
dead organic matter
nitrogen containing compounds in plants
4
input **Y** synthetic fertiliser
input **Z** synthetic fertiliser
urine and faeces
ammonium ions NH_4^+
nitrites NO_2^-
nitrates NO_3^-
leaching to streams and ground water
nitrogen compounds in the bodies of cattle
1
milk
input **W** cattle food
output of produce from farm

Fig. 3.1

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.....[9]

[Total : 14]

[Turn over

4 A drop of a solution containing *Escherichia coli* bacteria was spread over the surface of nutrient agar in a petri dish, labelled dish **A** (see Fig. 4.2 below). Each cell in the original drop reproduced to form a colony of cells on the agar surface.

A sterile wooden cylinder, over which a sterile felt cloth had been stretched, was lightly pressed onto the surface of the agar in dish **A** so that cells were picked up from each *E. coli* colony. This procedure is shown in Fig. 4.1.

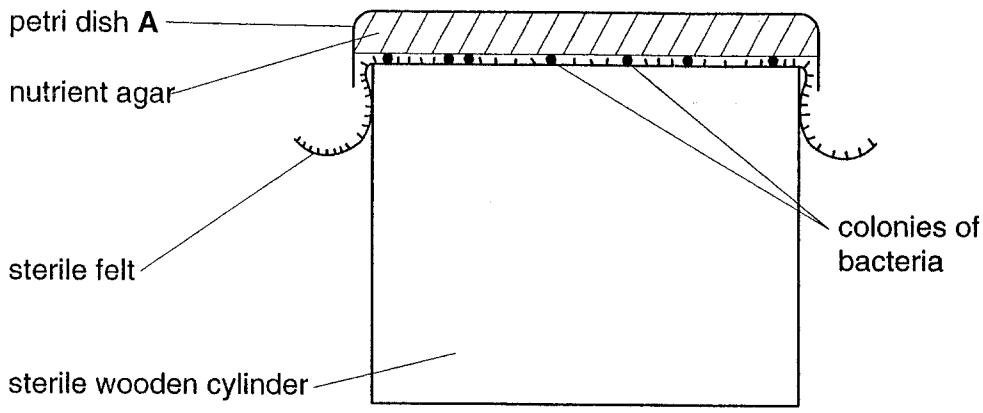

Fig. 4.1

The felt covered cylinder was then pressed onto the surface of sterile nutrient agar in several petri dishes, such as **B** and **C** shown in Fig. 4.2. Cells from each colony on dish **A** were transferred to corresponding positions on the new dishes. Some of these new dishes, such as **C**, had an antibiotic, streptomycin, added to the nutrient agar.

Typical results are shown in Fig. 4.2.

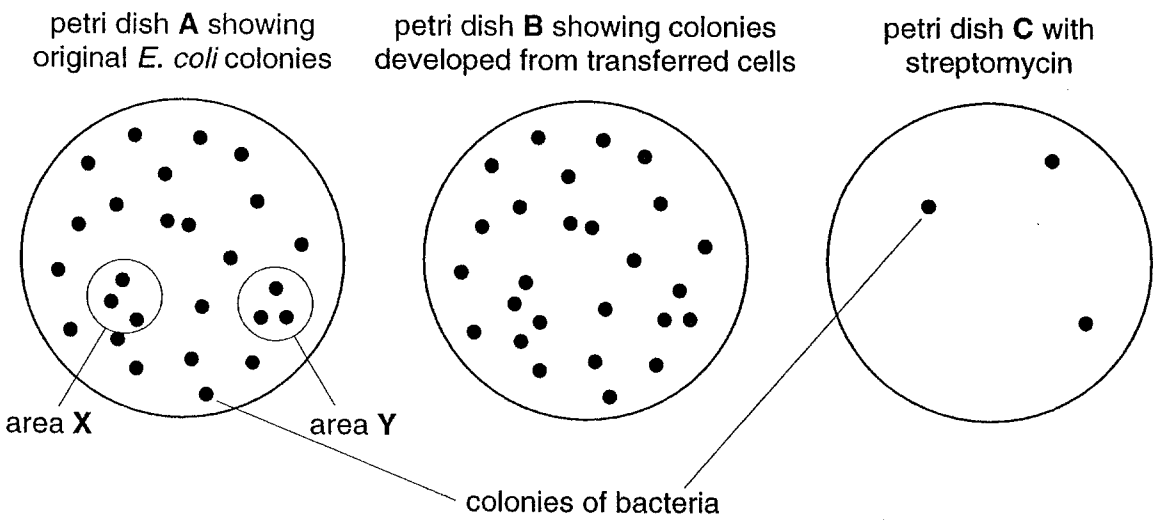

Fig. 4.2

(a) With reference to Fig. 4.2,

(i) explain the results shown by dishes **B** and **C**;

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.....[3]

(ii) explain why a swab taken from area **Y** on dish **A** would be likely to include streptomycin resistant cells, while the probability of finding streptomycin resistant cells in area **X** is low;

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(iii) explain why the swab taken from area **Y** would be unlikely to include cells resistant to the antibiotic penicillin.

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(b) Suggest some implications for users of antibiotics, of the experiment described above.

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[Total : 8]

5 Fig. 5.1 shows the structure of glycerol.

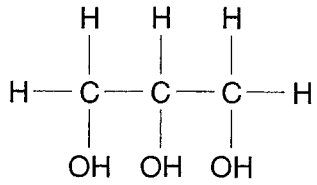

Fig. 5.1

Some molecules are produced by condensation reactions between glycerol and other compounds. The products of these reactions may have structural or storage roles in cells.

(a) Name a class of molecule, produced in this way, which has

(i) a storage role; .....

(ii) a structural role. .....[2]

In cells, more than one pathway may lead to the synthesis of glycerol.

(b) State, using an example, what is meant by a metabolic pathway.

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.....[3]

Glycerol molecules diffuse into cells more rapidly than glucose molecules.

(c) Suggest why this is so.

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Glucose and glycerol are present in the blood plasma of mammals.

(d) Explain why the concentration of substances in blood plasma is regulated.

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.....[7]

[Total : 14]