

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

BIOLOGY

2801

Biology Foundation

Wednesday **10 JANUARY 2001** Afternoon 1 hour 30 minutes

Candidates answer on the question paper.

Additional materials:
Electronic Calculator

Candidate Name	Centre Number	Candidate Number										
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TIME 1 hour 30 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 the spaces on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is 90.
- You will be awarded marks for the quality of written communication where an answer requires a piece of extended writing.
- You may use an electronic calculator.
- You are advised to show all the steps in calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	16	
2	10	
3	14	
4	16	
5	10	
6	14	
7	10	
TOTAL	90	

This question paper consists of 16 printed pages.

Answer all questions.

1 Some cells divide by mitosis.

(a) (i) Describe the products of mitosis.

.....

.....

.....

.....[2]

(ii) State **two** processes in which mitosis occurs in humans.

1

2[2]

The diploid number of the gorilla is 48.

(b) State the number of chromosomes which would be found in the following cells of the gorilla.

brain cell

epithelial cell

sperm

muscle cell

[4]

Fig. 1.1 lists six of the events that take place during mitotic cell division. Each event is identified by a letter.

- | | |
|----------|---------------------------------|
| A | chromatids separate |
| B | centromeres divide |
| C | chromosomes become visible |
| D | nuclear membrane disintegrates |
| E | chromosomes align at equator |
| F | cytoplasm divides (cytokinesis) |

Fig. 1.1

- (c) List the letters shown in Fig. 1.1 in the order in which the events occur during a mitotic cell division. The first one has been entered for you.

..... **C** [5]

Cancer is caused by uncontrolled mitotic cell division.

- (d) State **three** factors which can increase the chances of cancerous growth.

1

2

3 [3]

[Total : 16]

- 2 (a) (i) State the components needed to synthesise a triglyceride.

.....
.....[2]

- (ii) Name the chemical reaction by which these components are joined.

.....[1]

- (b) State **one** function of triglycerides in living organisms.

.....
.....[1]

Lipase is an enzyme that catalyses the hydrolysis of triglycerides. It is a soluble globular protein. The function of an enzyme depends upon the precise nature of its tertiary structure. Fig. 2.1 represents the structure of an enzyme. The black strips represent the disulphide bonds which help to stabilise its tertiary structure.

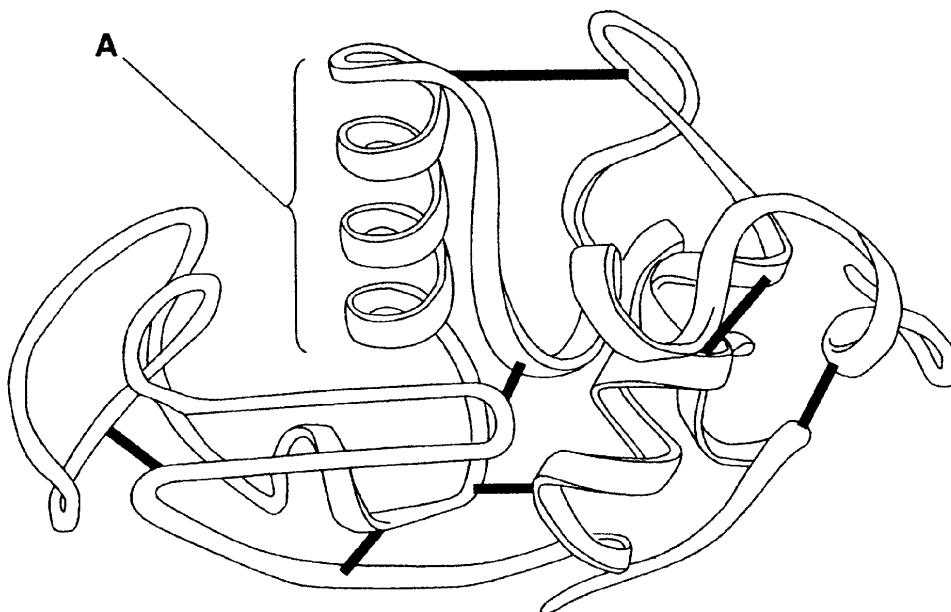


Fig. 2.1

(c) (i) Describe the nature of the disulphide bonds that help to stabilise the tertiary structure of a protein such as lipase.

.....
.....
.....
.....
.....[2]

(ii) Name **two other** types of bonding that help to stabilise tertiary structure.

1
2[2]

Region **A** on Fig. 2.1 is a secondary structure.

(d) Describe the nature of region **A**.

.....
.....
.....
.....[2]

[Total : 10]

- 3 (a) Explain the meaning of the terms *producer* and *trophic level*.

producer

.....

.....

trophic level

.....

.....[4]

Table 3.1 shows the estimated energy content for four trophic levels of a grassland ecosystem.

Table 3.1

	energy content / kJ m^{-2}
producers	5600
herbivores	125
omnivores	15
carnivores	10

- (b) (i) Calculate the percentage energy decrease between the producers and herbivores. (Show your working and give your answer to the nearest whole number.)

.....

.....

.....[2]

(ii) Explain why the energy content of the herbivores is less than that of the producers.

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[4]

(c) Suggest **two** factors which might **reduce** the productivity of the producers.

1

2 [2]

(d) Suggest

(i) why it can be a problem placing omnivores into a trophic level;

.....
.....
.....

[1]

(ii) a reason for the difference in energy content between the omnivores and the carnivores in this ecosystem.

.....
.....
.....
.....

[1]

[Total : 14]

4 Amylase is an enzyme which catalyses the hydrolysis of starch to maltose.

(a) (i) Name the bond which must be broken by this enzyme.

.....[1]

(ii) Name the reagent that you would use to carry out a test for starch.

.....[1]

(iii) State the colour you would expect to see if you carried out the test before and after the action of the enzyme.

before

after[2]

In an investigation into the action of amylase, equal volumes of enzyme solution and starch solution were mixed. The quantity of maltose produced was measured during the course of two separate experiments, one carried out at 18 °C and the other at 23 °C. The results are shown in Fig. 4.1.

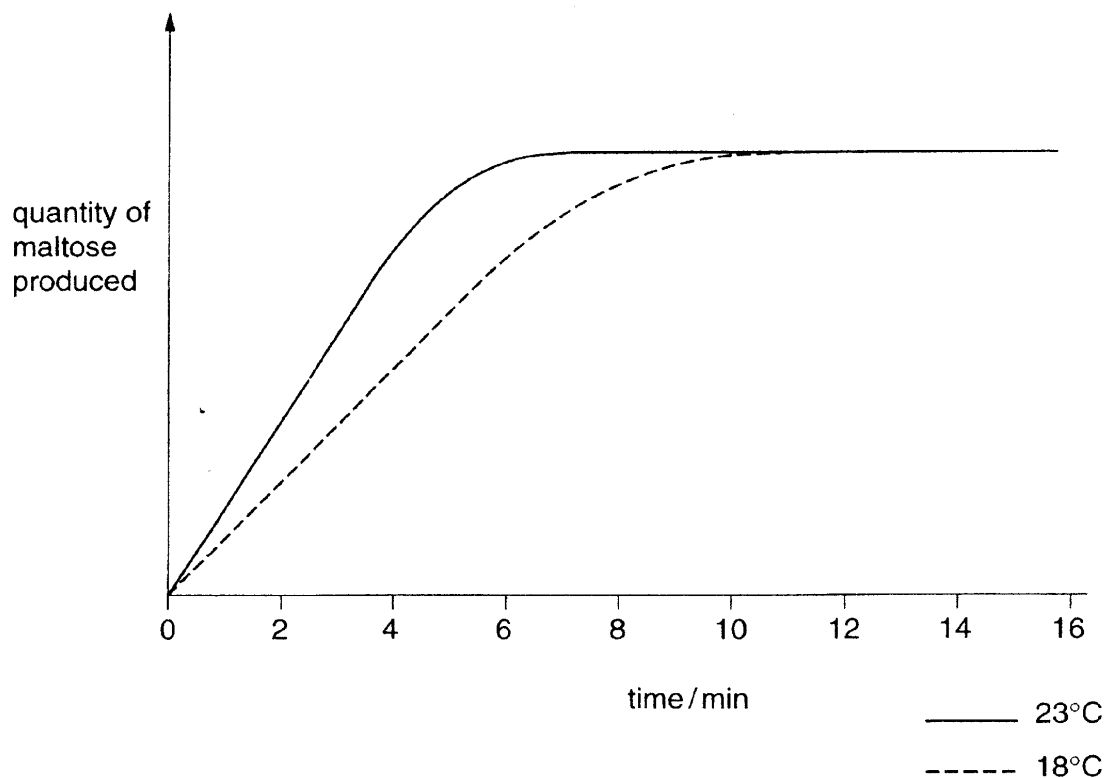


Fig. 4.1

(b) (i) Explain why the quantity of maltose produced eventually became constant.

.....
.....[1]

(ii) Explain why, after 4 minutes, more maltose had been produced at 23 °C than at 18 °C.

.....
.....
.....[2]

The experiment was repeated with the same volume and concentration of amylase, but with a higher concentration of starch solution.

(c) Sketch, on Fig. 4.1, the curve you would expect to obtain if the experiment were repeated at 23 °C with an increased starch concentration. [2]

(d) Explain the effects of reversible inhibitors on the rate of enzyme activity. (You may use annotated diagrams to assist your explanation if you wish.)

(In this question, 1 mark is available for the quality of written communication.)

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[7]

[Total : 16]

5 The table below compares the features of typical eukaryotic and prokaryotic cells.

(a) Complete the table by placing one of the following, as appropriate, in each empty box in the table:

- a tick (✓)
- a cross (✗)
- the words "sometimes present"

One of the two boxes in each row has been completed for you.

	eukaryotic cell	prokaryotic cell
cell wall	sometimes present	✓
nuclear envelope	✓	
Golgi apparatus		✗
flagellum	sometimes present	
ribosomes		✓
carries out respiration	✓	
chloroplast	sometimes present	

[6]

(b) (i) Explain the meaning of the term *tissue*.

.....

.....

.....

.....[2]

(ii) State **one** example of a plant tissue.

.....[1]

(iii) State **one** example of an animal tissue.

.....[1]

[Total : 10]

- 6 Fig. 6.1 outlines the way in which the gene for human factor VIII, a protein which is necessary for the clotting of blood, is incorporated into bacterial DNA and inserted into a bacterium.

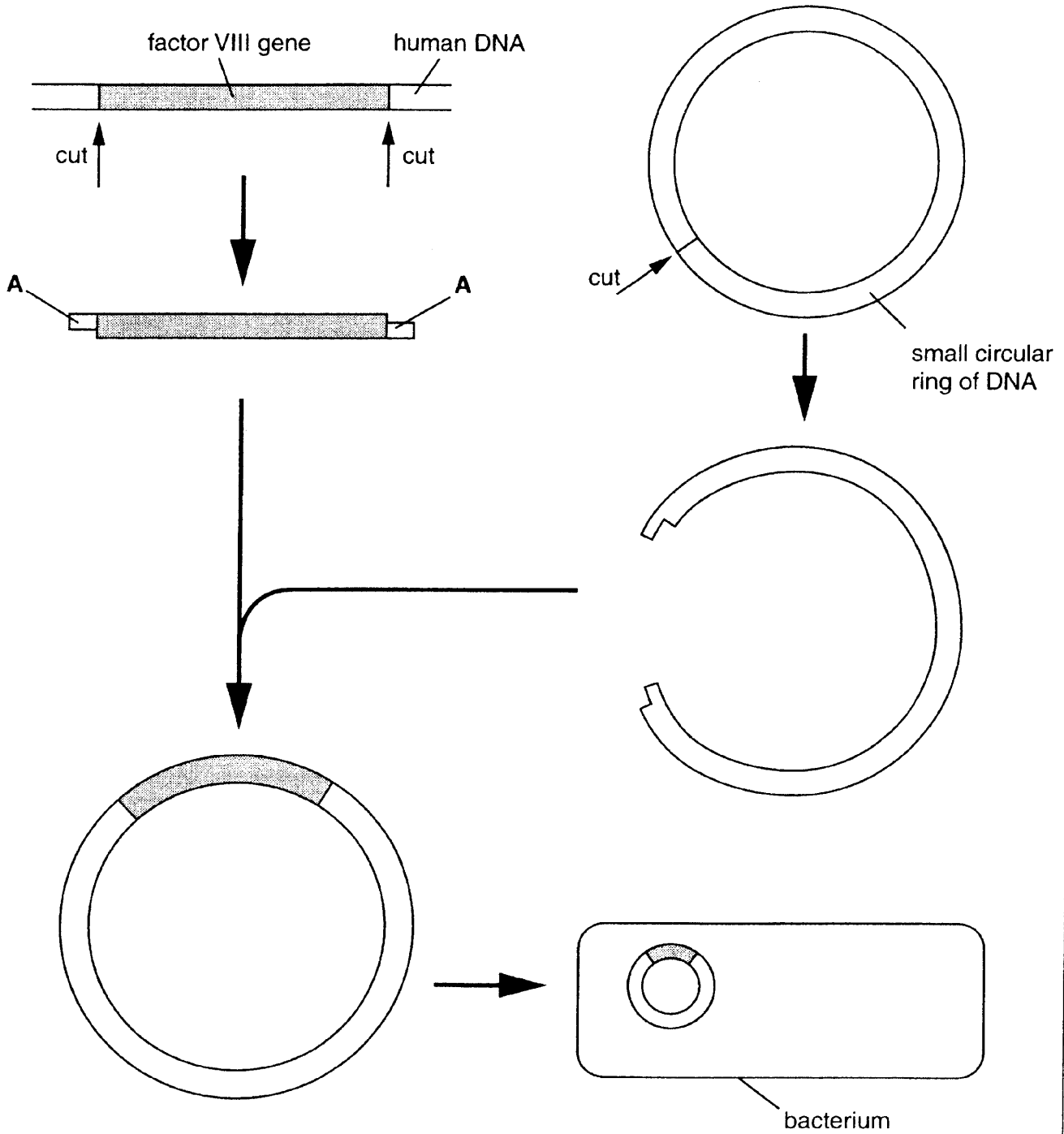


Fig. 6.1

(a) With reference to Fig. 6.1, state

(i) the type of enzyme used to cut the factor VIII gene from human DNA;
.....[1]

(ii) the name of the small circular ring of DNA;
.....[1]

(iii) the term used to describe the regions labelled A;
.....[1]

(iv) why these regions have been added to the factor VIII gene;
.....
.....[1]

(v) the word used to describe the bacterial DNA which now contains the human factor VIII gene.
.....[1]

(b) Suggest why it is considered better to use genetic engineering as a source of human factor VIII rather than material obtained from human blood.
.....
.....[1]

- (c) Describe how DNA replicates. (You may use annotated diagrams to assist your explanation if you wish.)

(In this question, 1 mark is available for the quality of written communication.)

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[8]

[Total : 14]

7 Active transport and facilitated diffusion are two ways by which substances cross plasma (cell surface) membranes.

(a) State **one** difference and **one** similarity between active transport and facilitated diffusion.

difference
.....[1]

similarity
.....[1]

Vitamins C and D are essential for the correct functioning of the human body. They are, therefore, taken into cells but take different routes across the plasma (cell surface) membrane. Vitamin C is water-soluble while Vitamin D is lipid-soluble.

(b) Explain how the structure of the plasma (cell surface) membrane determines the route taken by each of these vitamins.

Vitamin C

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Vitamin D

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.....
.....[4]

Excessive concentrations of salt in the blood and tissue fluid can cause serious damage to cells.

(c) Explain the effects of a high concentration of salt on animal cells.

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.....[4]

[Total : 10]