

Centre No.						Paper Reference						Surname	Initial(s)	
Candidate No.						6	1	0	4	/	0	1	Signature	

Paper Reference(s)

6104/01

Edexcel GCE

Biology

Biology (Human)

Advanced

Unit 4A Core and Option

Microbiology and Biotechnology

Tuesday 24 January 2006 – Morning

Time: 1 hour 30 minutes

Examiner's use only

--	--	--

Team Leader's use only

--	--	--

Question Number	Leave Blank
1	
2	
3	
4	
5	
Paper 11 Total	
6	
7	
8	
9	
Paper 12 Total	
Total	

Materials required for examination

Ruler

Items included with question papers

Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.

The paper reference is shown above. Check that you have the correct question paper.

Answer ALL questions in the spaces provided in this booklet.

Show all the steps in any calculations and state the units. Calculators may be used.

Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for the individual questions and parts of questions are shown in round brackets: e.g. (2).

The total mark for this question paper is 70.

Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking into account your use of grammar, punctuation and spelling.

This publication may be reproduced only in accordance with Edexcel Limited copyright policy.
©2006 Edexcel Limited.

Printer's Log. No.
N23411A

W850/R6104/57570 7/7/7/3/4400

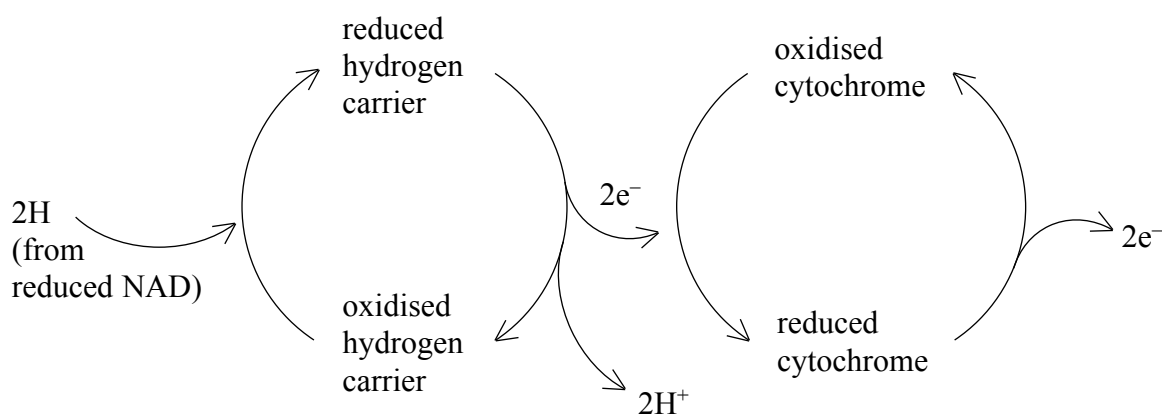


Turn over



Answer ALL questions in the spaces provided.

1. The diagram below summarises some of the stages of a metabolic pathway responsible for generating ATP in mitochondria.



(a) (i) Name the metabolic pathway shown in this diagram.

.....
(1)

(ii) Name the type of enzyme involved in this pathway and explain its role.

.....
.....
.....
.....
.....
.....
(2)

(b) Explain what happens to the electrons released at the end of this pathway.

.....
.....
.....
.....
.....
.....
(2)

(Total 5 marks)

Q1



Leave
blank

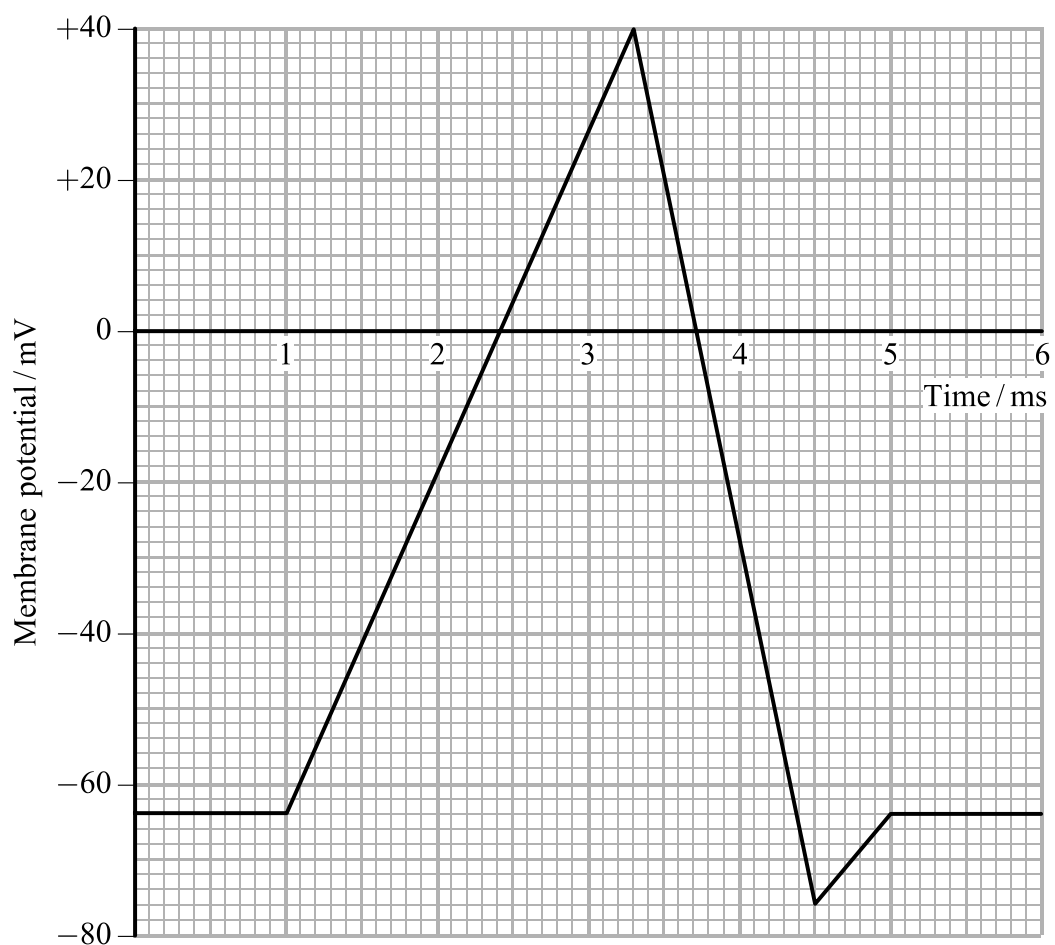
BLANK PAGE



3

Turn over

2. (a) The graph below shows the changes in membrane potential of a myelinated nerve fibre when a nerve impulse travels along it. The maximum depolarisation in the nerve fibre is +40 mV.



- (i) On the graph, draw an arrow to show the time when the sodium ion channels open. (1)
- (ii) Explain the meaning of the term **myelinated**.

.....

.....

.....

.....

.....

.....

(2)



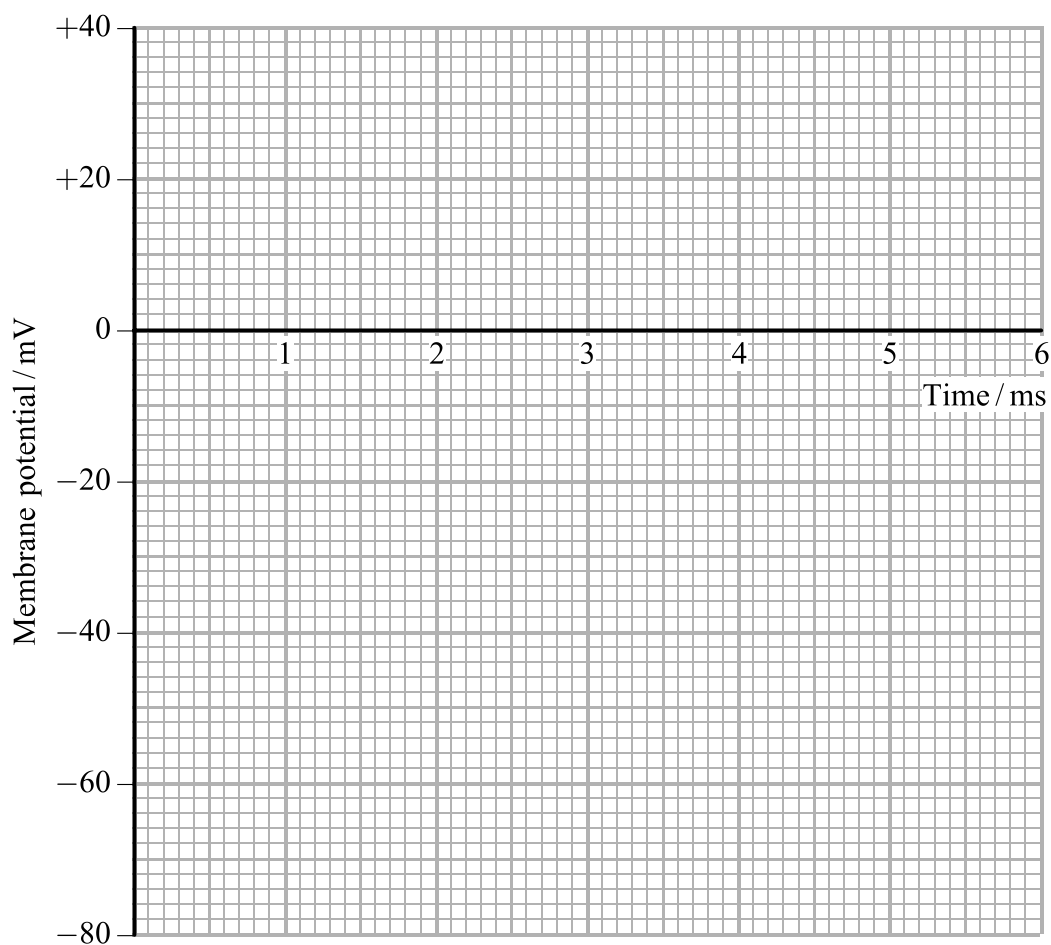
Leave blank

(iii) State what effect myelination has on the speed of conduction.

.....
.....

(1)

(b) On the graph below show the changes in membrane potential of a nerve fibre, with a resting potential of -60mV and a maximum depolarisation of $+35\text{mV}$, during the passage of an impulse.



(2)

Q2

(Total 6 marks)



3. (a) Explain what is meant by the term **hormone**.

.....

.....

.....

.....

.....

.....

.....

.....

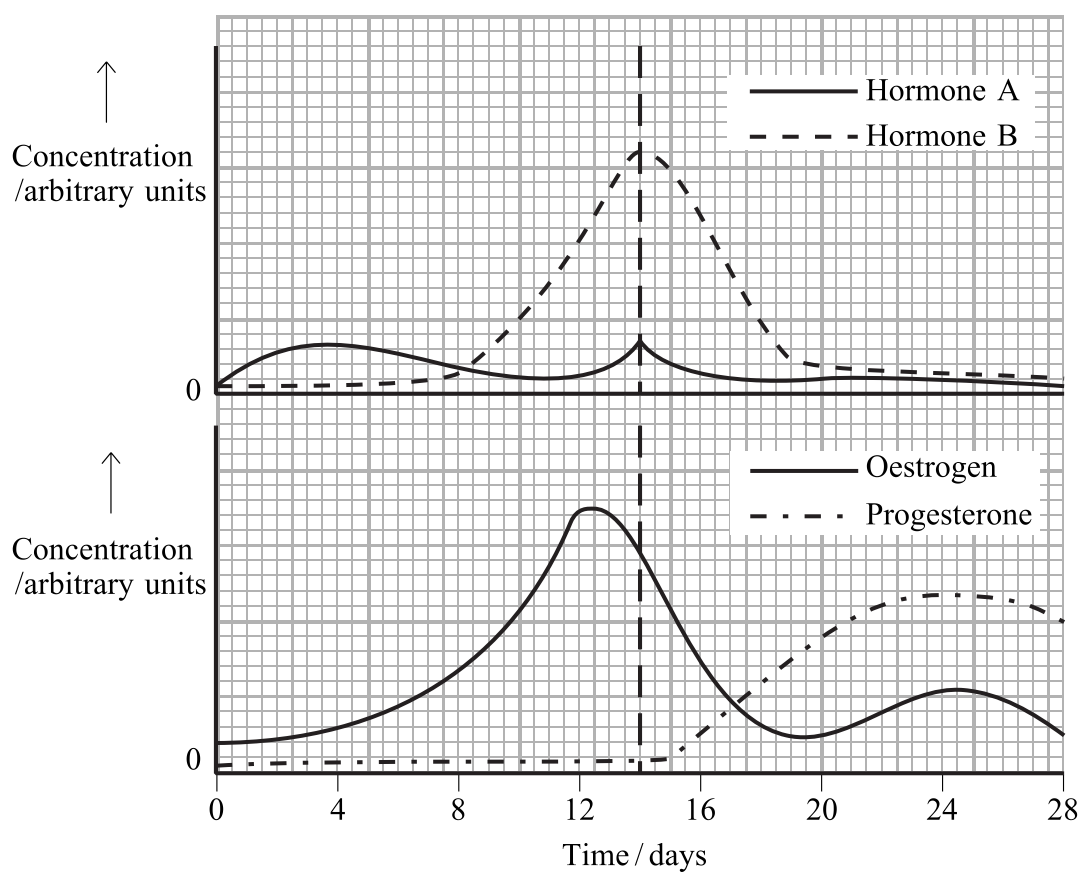
.....

.....

.....

(3)

(b) Several hormones are involved in the control and coordination of the human menstrual cycle. The graph below shows the changes in the concentrations of these hormones during one cycle.



Leave
blank

(i) Name hormones A and B.

Hormone A

Hormone B

(2)

(ii) Using the information shown in the graph, describe and explain the relationship between the concentrations of Hormone A and oestrogen from day 0 to day 14.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(Total 9 marks)

Q3



4. (a) Explain how the loop of Henlé enables mammals to produce concentrated urine.

.....

.....

.....

.....

.....

.....

.....

.....

(3)

(b) The concentration of solutes in the urine and in the blood plasma can be expressed as a ratio. The table below shows the solute concentration ratios for a range of mammals from different habitats.

Mammal	Urine : blood plasma solute concentration ratio
Beaver	2 : 1
Cat	10 : 1
Hopping mouse	25 : 1
Human	4 : 1

Using the information in the table, suggest which mammal is best suited for life in a very dry habitat. Give an explanation for your answer.

.....

.....

.....

.....

.....

.....

.....

.....

(3)



Leave
blank

(c) Mammals excrete most of their waste nitrogen in the form of urea in their urine. Explain how urea is produced in the liver and how it is removed from the blood by ultrafiltration.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

Q4

(Total 10 marks)

--	--



Leave
blank

5. (a) Describe the structure of the spinal cord.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)



Leave
blank

(b) Nerve impulses travel across a synapse from a sensory neurone to a relay neurone in the spinal cord.

Describe how a nerve impulse is transmitted across a synapse.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6)

(Total 10 marks)

Q5

--	--



Leave
blank

BLANK PAGE



Leave
blank

Option A: Microbiology and Biotechnology.

6. The table below refers to the uses of microorganisms in the production of some foods and drink. Complete the table by writing the appropriate word or words in the spaces.

Type of food or drink	Microorganism used	Metabolite produced	Role of metabolite in food or drink production
Beer		Ethanol	Provides the alcohol content
Bread	Yeast	Carbon dioxide	
Yoghurt			Causes the yoghurt to thicken

(Total 4 marks)

Q6



7. A number of techniques used in microbiology practical work require the aseptic transfer of bacteria from a liquid culture to another type of culture.

(a) Name the most appropriate instrument used to transfer bacteria aseptically from a liquid culture to each of the following.

Liquid media

A spread plate

(2)

(b) Describe how agar plates are prepared.

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

(3)



Leave blank

(c) (i) Describe the technique of streak plating, including the precautions that need to be taken to ensure the technique is performed aseptically.

.....

.....

.....

.....

.....

.....

.....

.....

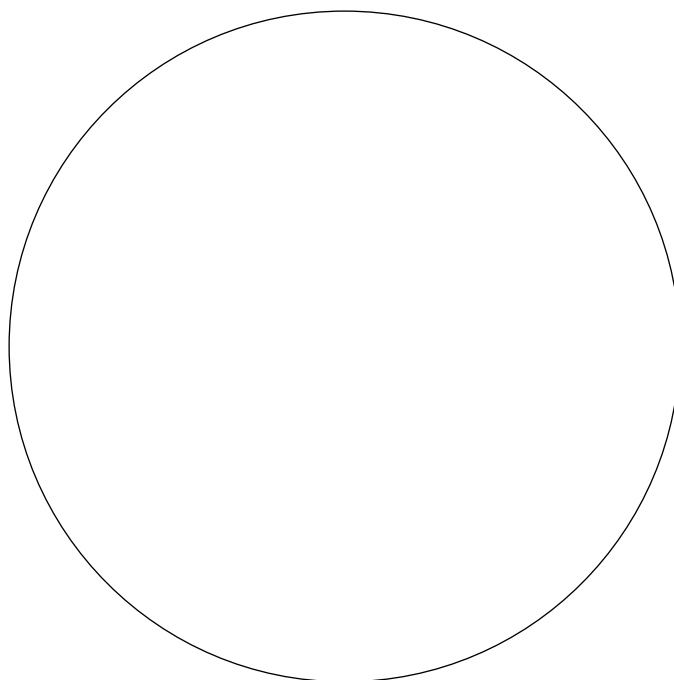
.....

.....

.....

(3)

(ii) In the circle below, draw a diagram to show the streak pattern.



(1)

(Total 9 marks)

Q7



8. (a) Antibiotics are used to treat bacterial infections because they target bacterial cells and not the patient's cells.

Give **two** differences between a bacterial cell and a patient's cell.

- 1.
 -
 -
 -
 -
 -
- 2.
 -
 -
 -

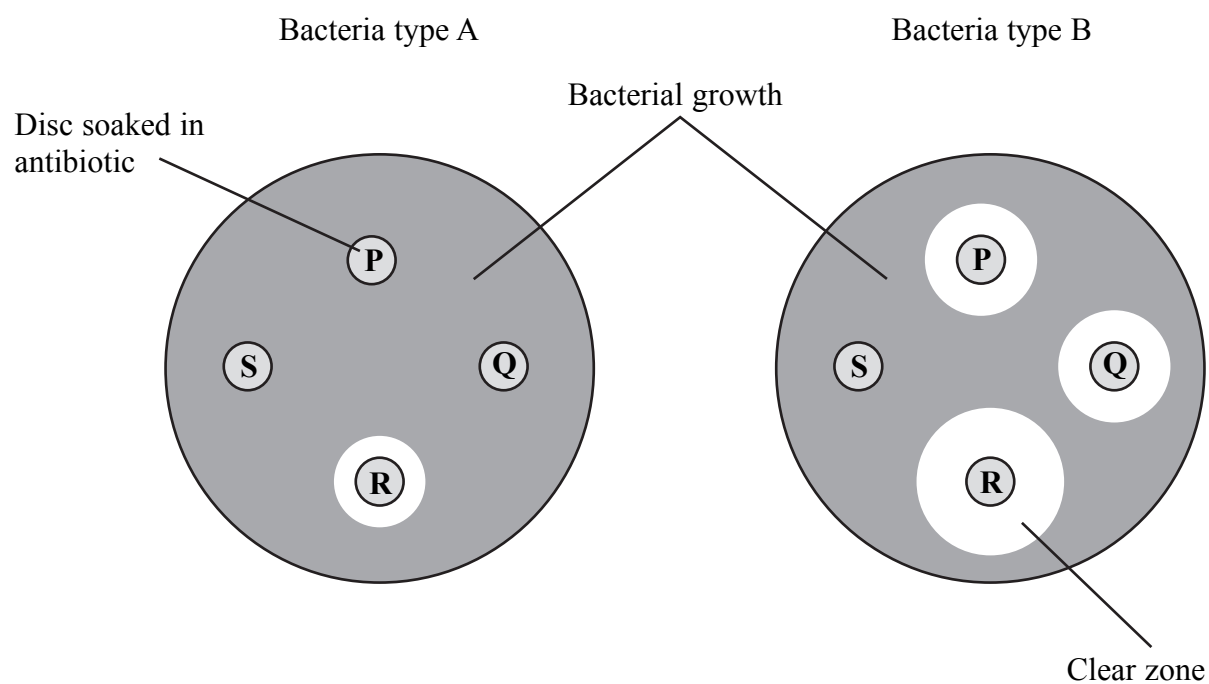
(2)

(b) A suspension of **Gram negative** bacteria (type A) was spread evenly over solid medium in a petri dish. One hour later, four discs were placed on the surface of the medium. Each disc had been soaked in a different antibiotic (antibiotics P, Q, R and S).

The procedure was repeated for another suspension of **Gram negative** bacteria (type B).

The cultures were then incubated for 48 hours.

The appearance of the cultures after incubating for 48 hours is shown below.



Leave
blank

- (i) Compare the sensitivity of the two types of bacteria to the antibiotics P, Q, R and S.

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

(2)

- (ii) Suggest which antibiotic is penicillin, explaining the reason for your choice.

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

(3)

Q8

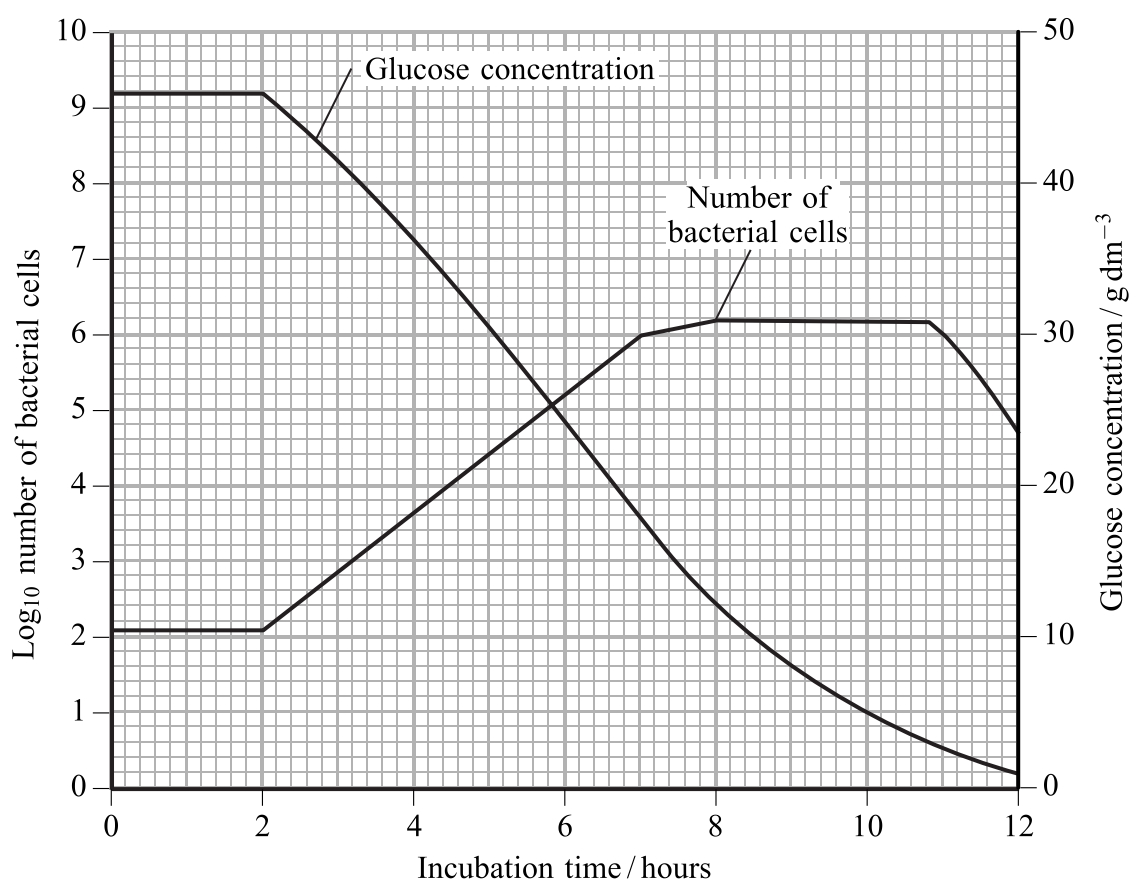
(Total 7 marks)



9. A laboratory fermenter was used to grow bacteria in a liquid medium containing glucose as the carbon source.

The growth of the bacteria over a 12 hour period was monitored by removing a 2 cm³ sample of the culture every 2 hours. The number of bacterial cells, the glucose concentration in the medium and the pH in each sample were determined.

The results are shown in the graph and table below.



Incubation time/hours	0	2	4	6	8	10	12
pH	7.0	6.8	6.4	5.9	5.6	5.5	5.5



Leave
blank

- (a) Describe the relationship between the numbers of bacterial cells in the culture and the glucose concentration in the medium from 0 to 9 hours.

.....

.....

.....

.....

.....

.....

.....

.....

(2)

- (b) Describe and explain the changes in the pH of the medium during the 12 hour incubation period.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(3)

QUESTION 9 CONTINUES ON PAGE 20



Leave blank

- (c) Calculate the number of generations of bacteria produced between 2 hours and 6 hours, using the formula below.

$$n = \frac{\log_{10} N_1 - \log_{10} N_0}{\log_{10} 2}$$

where n = number of generations
N₀ = number of cells at 2 hours
N₁ = number of cells at 6 hours
log₁₀2 = 0.301

Show your working

Number of generations =
(3)

- (d) Suggest how the growth of the bacteria could have been restarted at 9 hours, giving a reason for your answer.

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

(2)

Q9

(Total 10 marks)

TOTAL FOR PAPER: 70 MARKS

END

