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

Paper Reference(s)

6104/01

Examiner's use only

Team Leader's use only

Edexcel GCE

Biology

Biology (Human)

Advanced

Unit 4A Core and Option

Microbiology and Biotechnology

Friday 13 June 2008 – Afternoon

Time: 1 hour 30 minutes

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 NINE 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.

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Answer ALL questions in the spaces provided.

1. The table below refers to some features of mammalian hormones. Complete the table by writing the most appropriate word, or words, in the empty boxes.

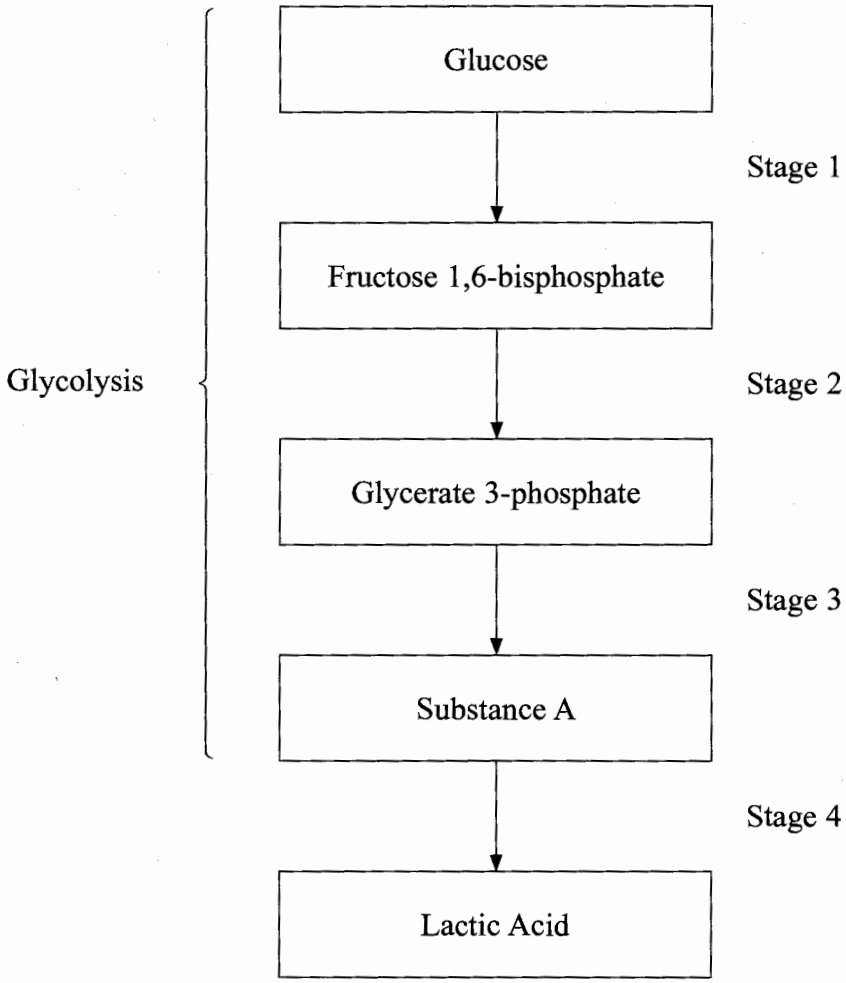
Hormone	Site of secretion	One function
	Pancreas	Raises blood glucose concentration
	Posterior pituitary gland	Contraction of uterine muscle
Luteinising hormone		Release of secondary oocyte
Adrenaline	Adrenal gland	

Q1

(Total 4 marks)

Leave blank

2. (a) The diagram below shows some of the stages of anaerobic respiration in a muscle cell.



(i) Name substance A.

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(1)

(ii) State which of the stages shown in the diagram:

Uses ATP .....

Produces ATP .....

(2)

Leave blank

(b) The Krebs cycle occurs during aerobic respiration and is an example of a metabolic pathway.

(i) Explain why the Krebs cycle is described as a metabolic pathway.

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(1)

(ii) State precisely where in the cell the Krebs cycle occurs.

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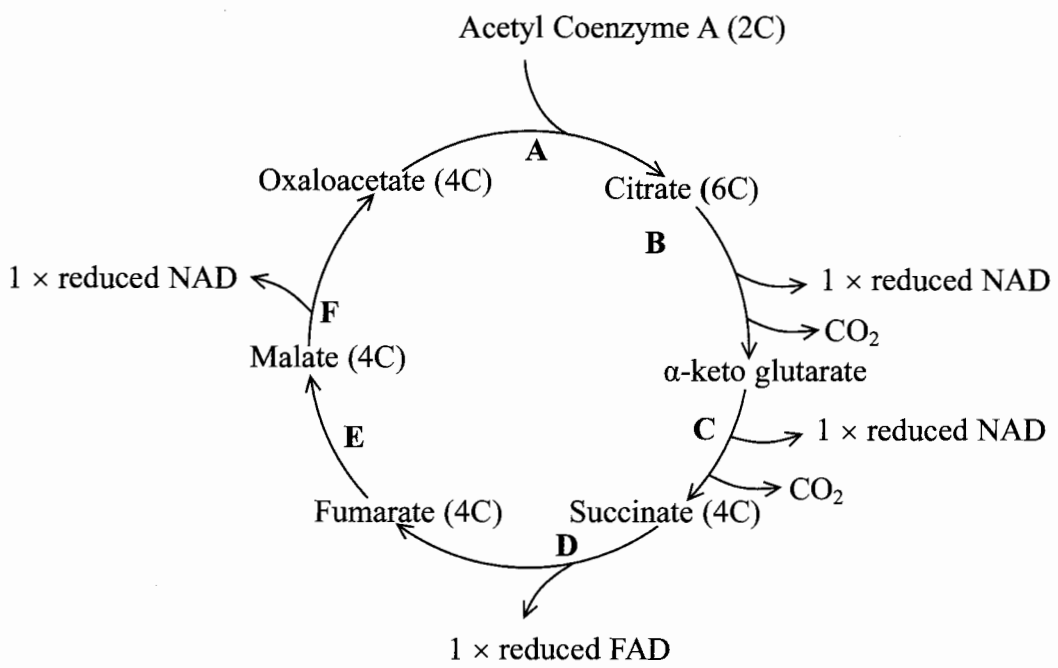
(1)

(c) The diagram below shows some of the stages that occur in the Krebs cycle.



Oxidoreductase enzymes are involved in some of the reactions in the Krebs cycle. Using the letters A to F and the information given in the diagram, list **all** the stages that involve an oxidoreductase enzyme.

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(1)

Q2

(Total 6 marks)

Leave blank

3. Detection of light occurs in both mammals and flowering plants.

(a) In humans, the central region of the retina has very few rod cells. However, in a dog about 80–90% of the photoreceptors in the central region of the retina are rod cells. Suggest **one** advantage to a dog of having more rod cells in this region of the retina.

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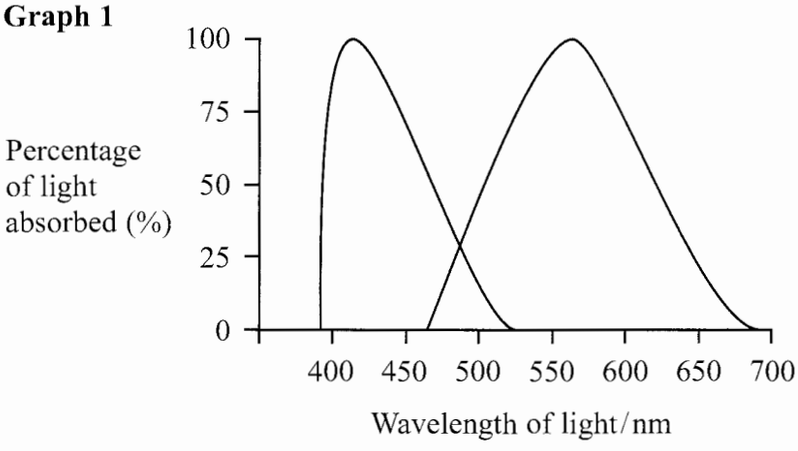
(3)

(b) Humans have three types of cone cell. However, dogs only have two types of cone cell. **Graph 1** below shows the percentage of light, of different wavelengths, absorbed by the pigments in the two types of cone cell in a dog's retina.
Graph 2 shows the percentage of light, of different wavelengths, absorbed by the pigments in the three types of cone cell in a human's retina.
Table 1 shows the colour of light of different wavelengths.

Graph 1



Graph 2

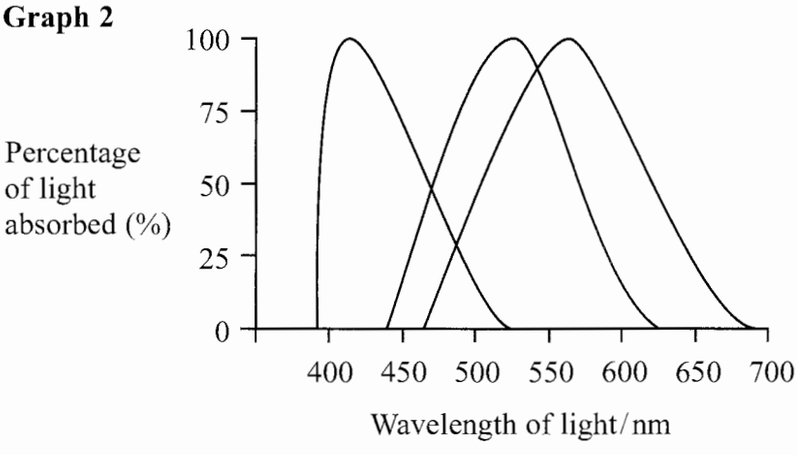


Table 1

Wavelength/nm	Colour
400	Violet
475	Blue
510	Green
570	Yellow
590	Orange
650	Red

N 2 9 2 4 7 A 0 6 2 4

6

N 2 9 2 4 7 A 0 6 2 4

Leave blank

Three balls, that differed only in their colour, were placed in front of a dog and a human. One ball was red, one yellow and one orange. Using this data, explain why only the human would be able to detect a difference between the colour of the three balls.

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(2)

(c) Describe the detection of light in flowering plants.

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(3)

Q3

(Total 8 marks)

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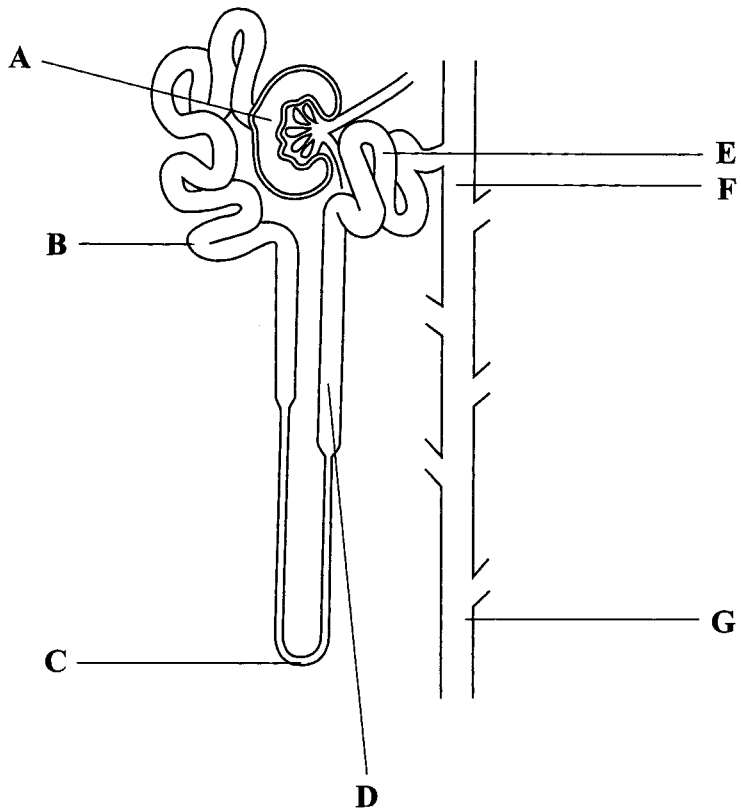
4. (a) The diagram below represents a nephron (kidney tubule).



(i) Name the parts labelled **A** and **B**.

A .....

B .....

(1)

(ii) All the glucose in region A is reabsorbed back into the bloodstream as the fluid in the nephron passes from region A to region B. Explain how this glucose reabsorption occurs.

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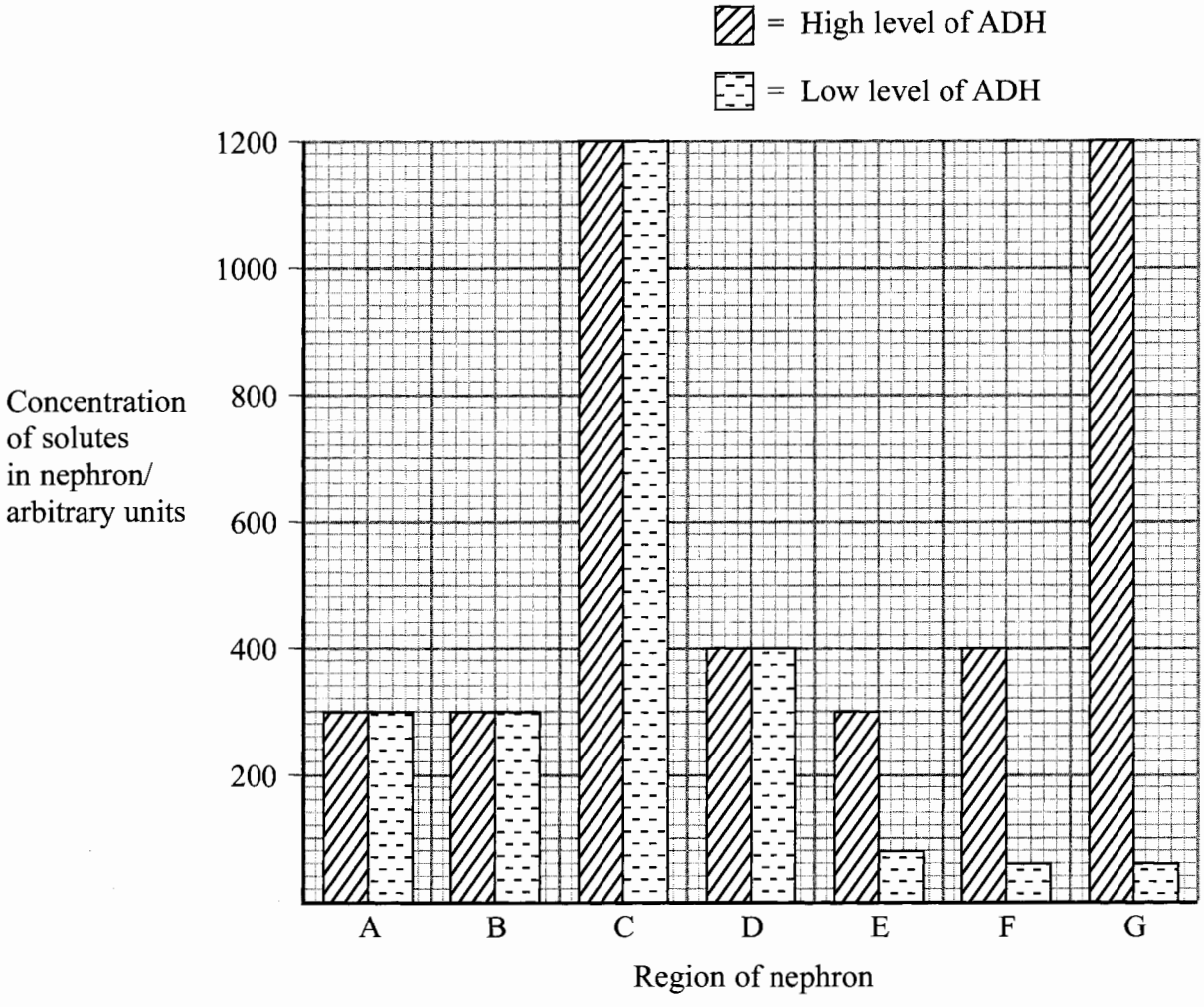
(2)

Leave blank

(b) The graph below shows the concentration of solutes in the fluid in the nephron in each of the labelled regions shown in the diagram. The graph shows the concentration of solutes when there is a high level of ADH (antidiuretic hormone) in the blood and when there is a low level of ADH in the blood.



(i) Calculate the percentage decrease in the concentration of solutes between regions A and G when there is a **low** level of ADH in the blood. Show your working.

..... %

(3)

Leave blank

(ii) The concentration of solutes in the fluid changes as it passes from region A to region G. Compare the changes that occur when the level of ADH in the blood is high with changes that occur when the level of ADH is low.

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(3)

(iii) Use the information in the graph to explain how a rise in the level of ADH results in the production of a more concentrated urine.

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(3)

Q4

(Total 12 marks)

Leave blank

5. Give an account of the structure and functions of sensory, relay and effector (motor) neurones.

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Q5

(Total 10 marks)

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N 2 9 2 4 7 A 0 1 4 2 4

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Option A: Microbiology and Biotechnology

6. The table below refers to some structures of microorganisms. Complete the table by writing the name of the type of microorganism possessing each structure in the empty boxes.

Structure	Type of microorganism
Nucleus	
Capsid	
Flagellum	
Peptidoglycan (murein) cell wall	

Q6

(Total 4 marks)

Leave blank

7. (a) In the culturing of microorganisms, explain what is meant by each of the following terms.

Selective media .....

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Indicator media .....

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(3)

(b) By taking into account the type of respiration and the carbon and nitrogen sources of specific microorganisms, it is possible to design growth media that will favour the growth of one particular microorganism.

A group of students investigating bacteria in soil was looking at the occurrence of four types of bacteria. The type of bacteria, the carbon and nitrogen sources and the type of respiration are shown in the table below.

Type of bacteria	**Carbon source**	**Nitrogen source**	**Type of respiration**
Azotobacter	Organic	Nitrogen gas	Aerobic
Clostridium	Organic	Nitrogen gas	Anaerobic
Nitrosomonas	Carbon dioxide	Ammonium ions	Aerobic
Nitrobacter	Carbon dioxide	Nitrite ions	Aerobic

The students were able to use the information in the table to obtain pure cultures of each type of bacteria. The diagram opposite shows the apparatus used to grow the bacteria in a liquid medium. The constituents of the medium and the gases piped into the medium can be changed to favour the growth of one type of bacterium and prevent the growth of the other three.

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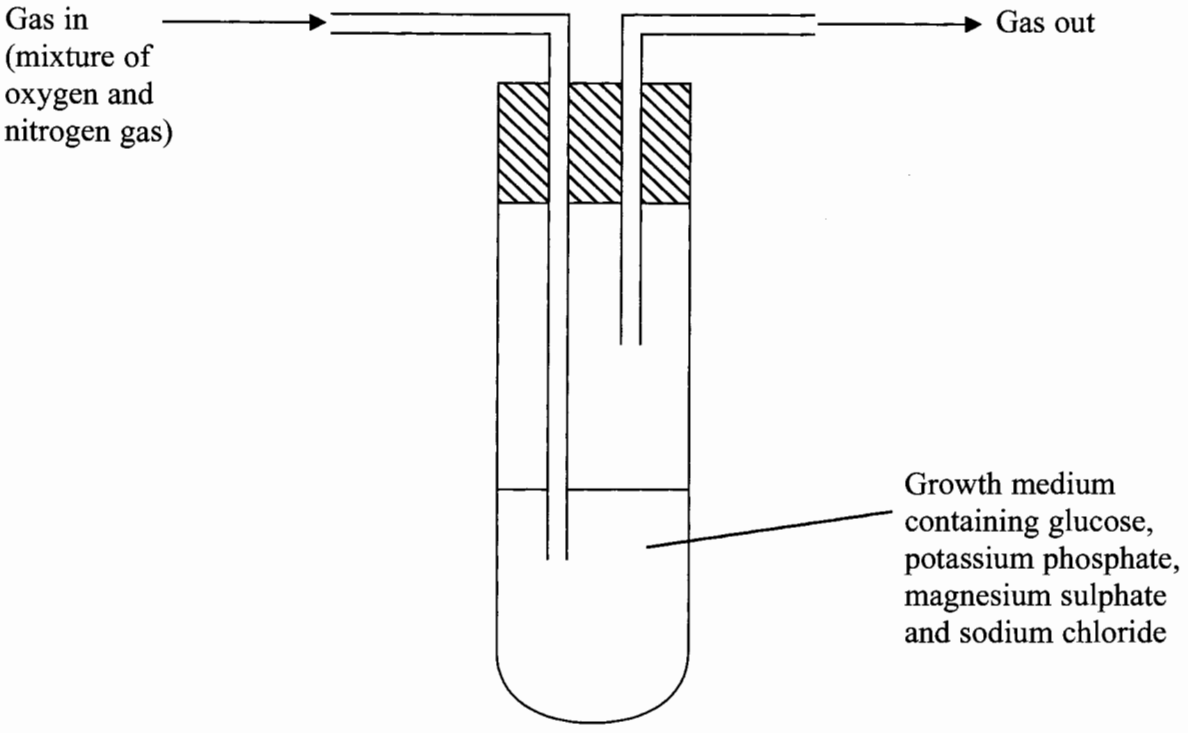

Using this apparatus, only one of the four types of bacteria will grow.
State which type of bacteria will grow and explain why the others will not grow.

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(3) Q7

(Total 6 marks)

Leave blank

8. (a) Describe how the antibiotic, penicillin, could be produced using a fermenter (bioreactor).

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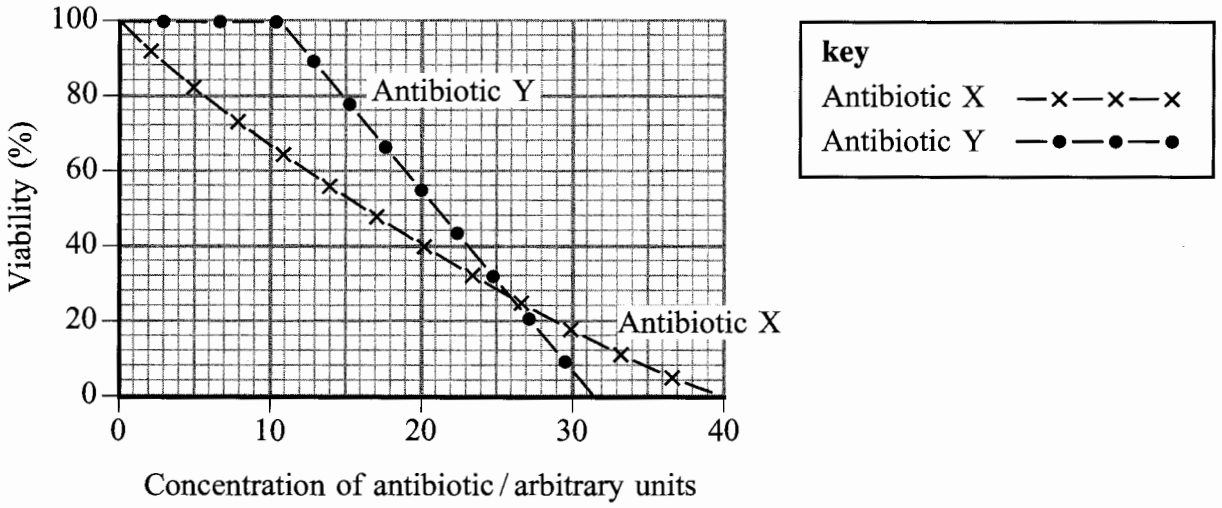
(4)

(b) The graph below shows the effect of a range of concentrations of two antibiotics, antibiotic X and antibiotic Y, on the viability of *Escherichia coli (E. coli)* in a liquid culture. The viability was calculated by finding the percentage of cells in the culture that are living.



N 2 9 2 4 7 A 0 1 8 2 4

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(i) Describe how the percentage of viable (living) cells in the liquid culture could have been determined in this investigation.

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(4)

(ii) Compare the effects of the different concentrations of antibiotics X and Y on the viability of *E. coli*.

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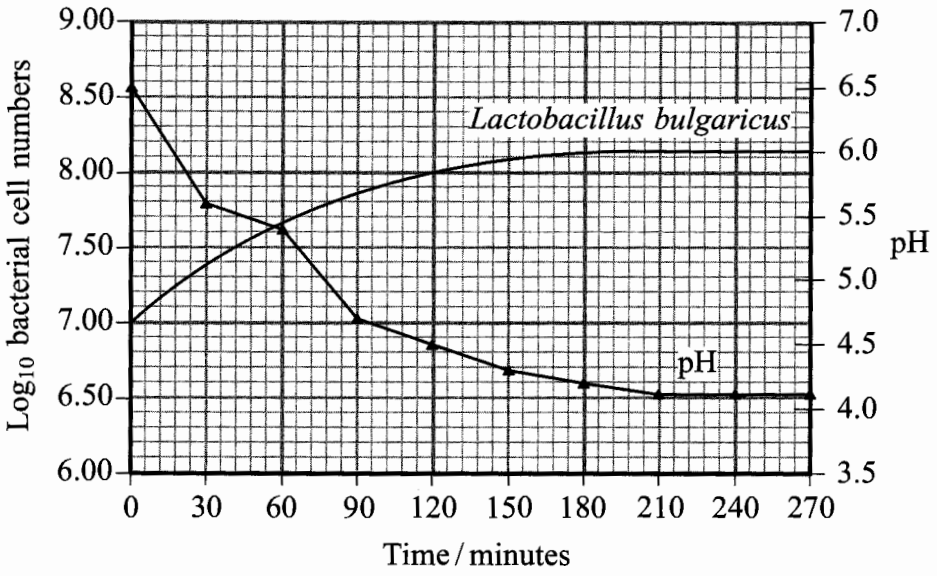
(3)

Q8

(Total 11 marks)

Leave blank

9. (a) During the production of yoghurt, the numbers of cells of the bacterium *Lactobacillus bulgaricus* change. The graph below shows the changes in the $\log_{10}$ numbers of this bacterium and the changes in the pH during incubation.



(i) Describe the relationship between the number of cells of *Lactobacillus bulgaricus* and the changes in the pH in the yoghurt.

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(3)

Leave blank

(ii) Calculate the number of generations of *Lactobacillus bulgaricus* produced during the first 120 minutes, using the formula below.

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

Where n is the number of generations
N_0 = number of generations at 0 hours
N_1 = number of generations at 120 minutes
$\log_{10} 2 = 0.301$

Show your working.

Number of generations = ...

(3)

(b) Describe the role of bacteria in the production of yoghurt.

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(3) Q9

(Total 9 marks)

TOTAL FOR PAPER: 70 MARKS

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N 2 9 2 4 7 A 0 2 2 2 4

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N 2 9 2 4 7 A 0 2 3 2 4

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