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

Wednesday 23 January 2008 – 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. Write your answers in the spaces provided in this question paper.
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)**.
There are 9 questions in this question paper. 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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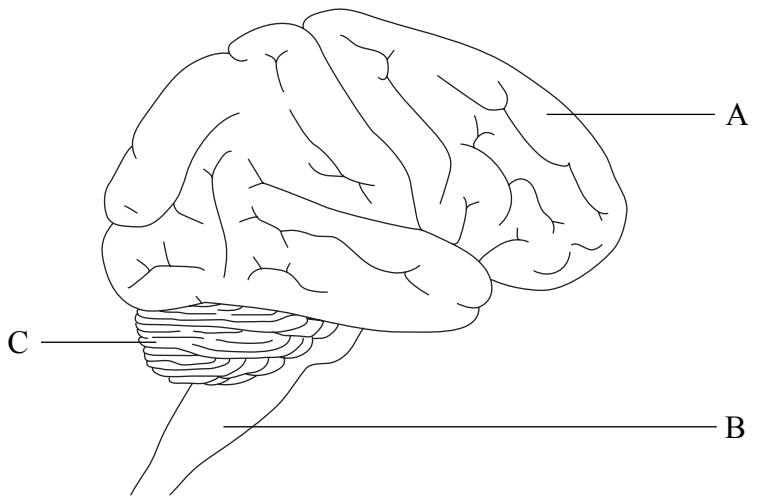
Answer ALL questions in the spaces provided.

1. The diagram below shows a human brain seen from the side.



(a) Name the parts labelled **B** and **C**.

B .....

C .....

(2)

(b) Give **two** functions of the part labelled **A**.

1 .....

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2 .....

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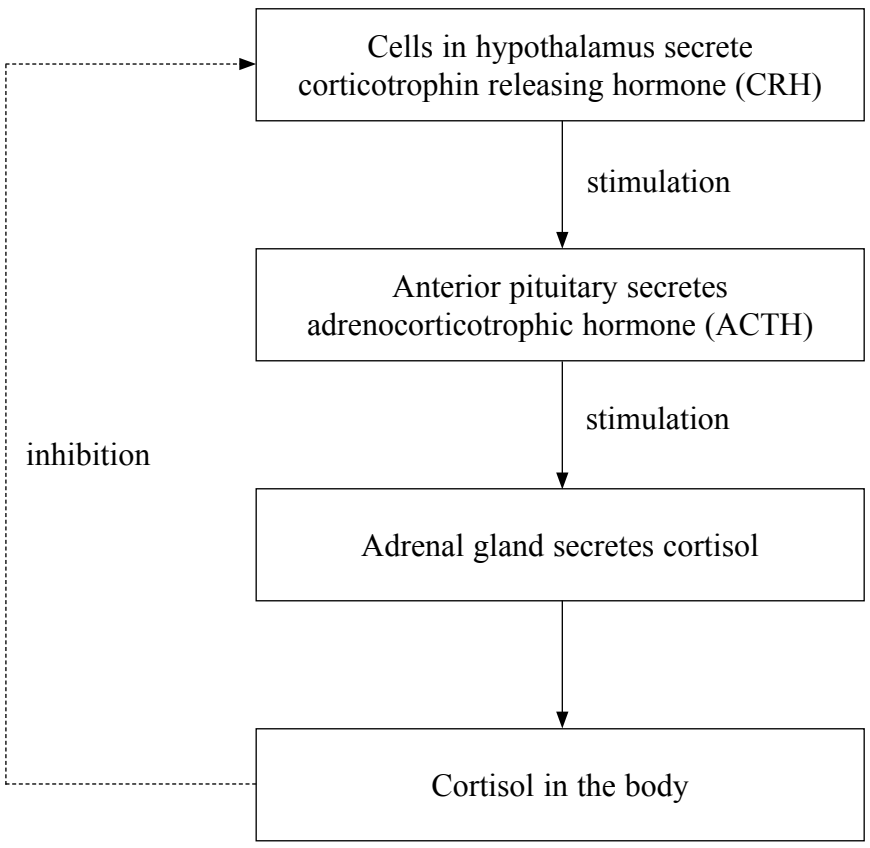
(2)

Q1

(Total 4 marks)

Leave blank

2. Cortisol is a hormone secreted by the adrenal gland and has many functions in the body. The diagram below shows how the secretion of cortisol is controlled.



(a) Using the information in the diagram, explain how the control of cortisol secretion illustrates the principle of negative feedback.

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(3)

Leave blank

(b) Name **one** hormone, other than ACTH, released by the anterior pituitary gland.

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(1)

(c) State **three** ways in which hormonal control differs from nervous control.

1 .....

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2 .....

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3 .....

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(3)

Q2

(Total 7 marks)

Leave blank

3. (a) When an action potential arrives at a synaptic knob, acetylcholine is released. Describe how acetylcholine is released into the synaptic cleft.

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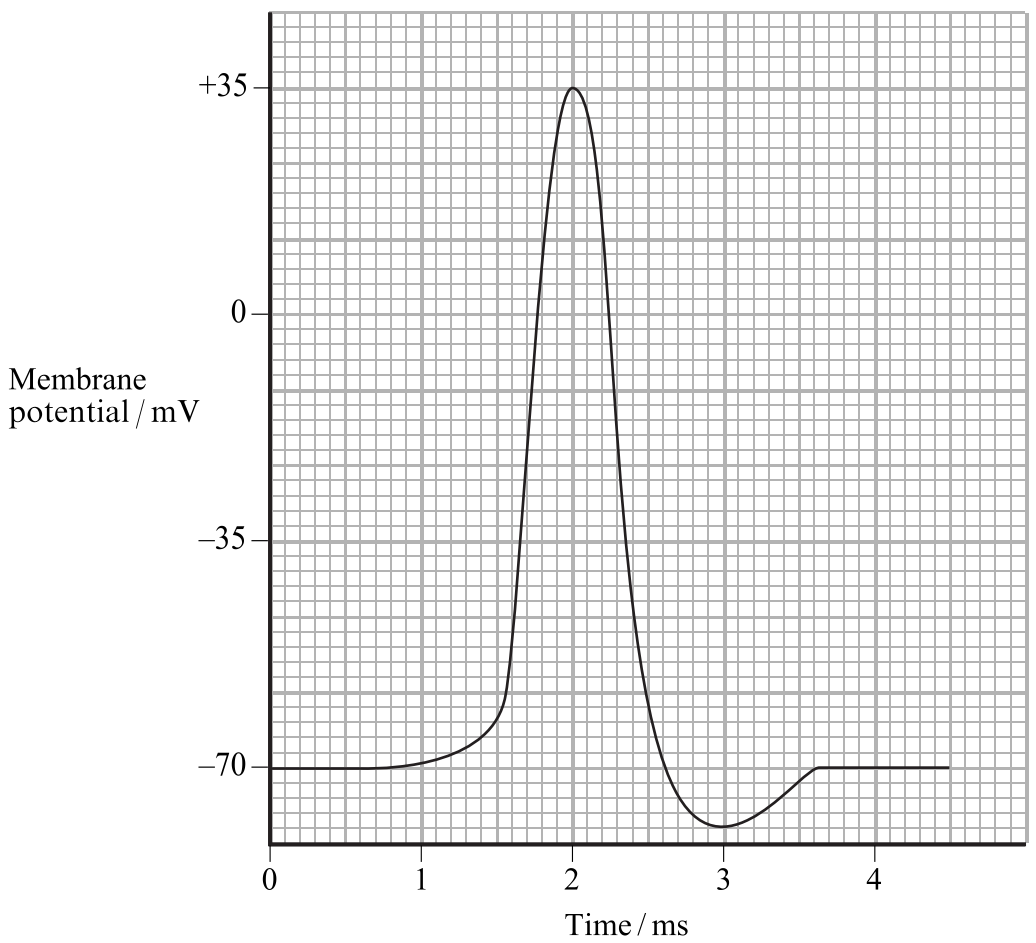
(3)

(b) The graph below shows a recording of an action potential produced after the binding of acetylcholine to receptors on a post-synaptic membrane.



(i) Use the graph to state the time at which the sodium channels open to allow an increased flow of sodium ions into the neurone.

..... ms

(1)

Leave blank

(ii) Use the graph to state the time at which the hyperpolarisation is at its greatest.

..... ms
(1)

(iii) Calculate the number of action potentials that could occur in one second if the stimulus is maintained. Show your working.

Answer ..... action potentials per second.
(2)

(c) When a transmitter substance called gamma-aminobutyric acid (GABA) is released at a synapse, it causes chloride ion (Cl^-) channels and potassium ion (K^+) channels to open in the post-synaptic membrane. This results in chloride ions moving into the post-synaptic neurone and potassium ions moving out.

Explain why an action potential is less likely to develop when GABA is released at the same time as acetylcholine.

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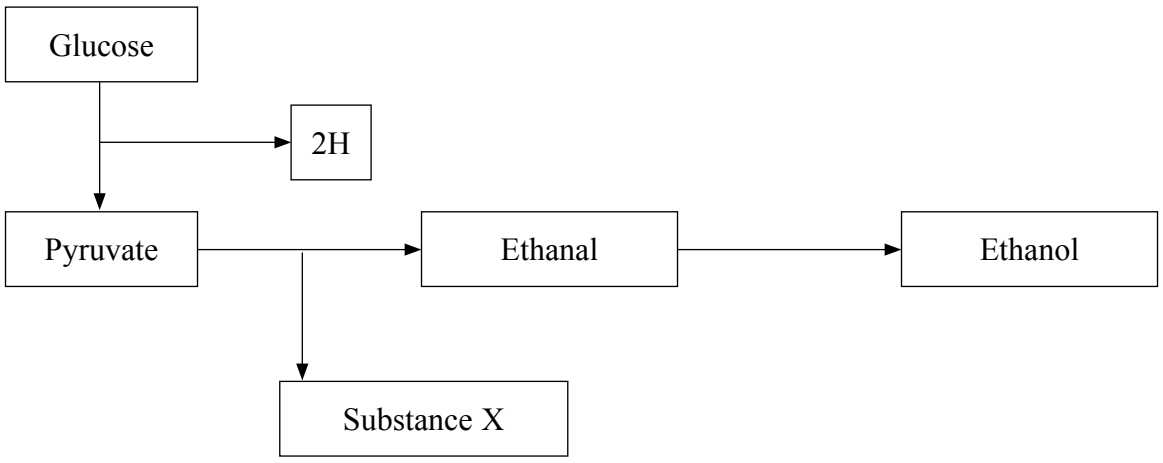
(2)

Q3

(Total 9 marks)

Leave blank

4. (a) The diagram below shows an outline of anaerobic respiration in a yeast cell.



(i) Name substance X.

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(1)

(ii) Explain why it is necessary for the cell to convert ethanal to ethanol.

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(2)

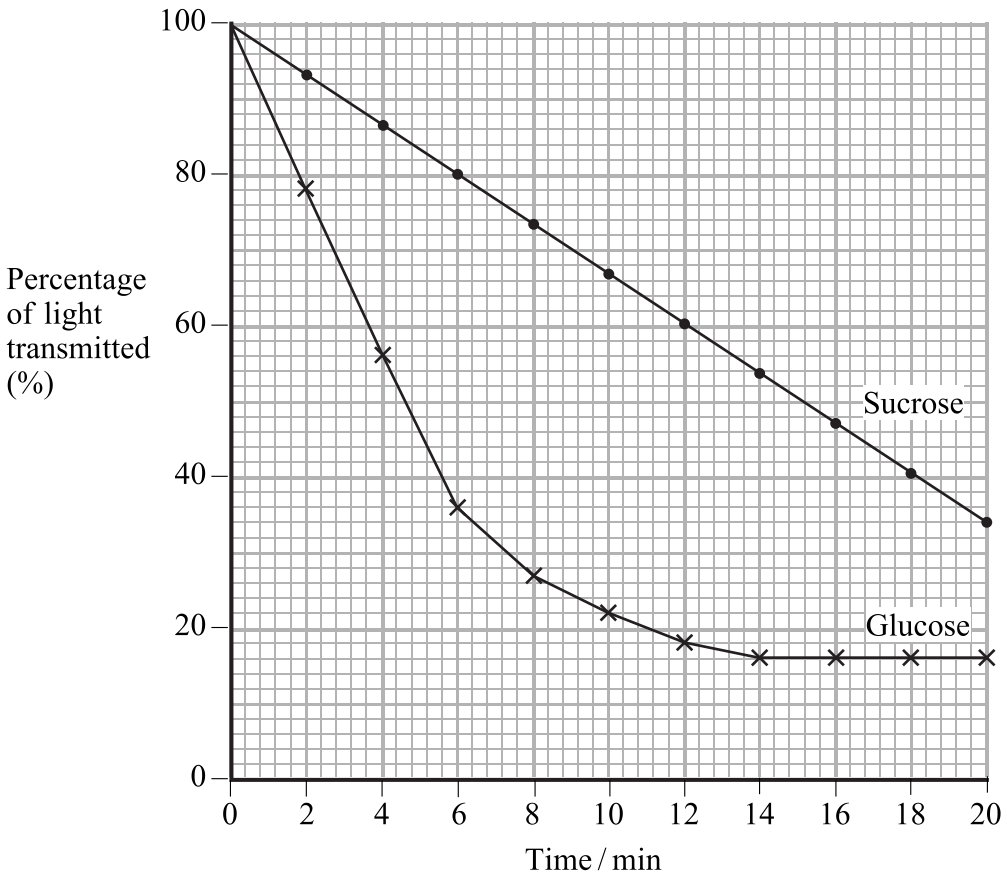
Leave blank

(b) A student carried out an investigation into the effect of glucose and sucrose on the rate of respiration of yeast cells. Triphenyl tetrazolium chloride (TTC) is an artificial hydrogen acceptor, which is colourless in the oxidised form and red when reduced. A colorimeter is an instrument used to measure the percentage of light transmitted through a liquid. In this investigation, when the TTC is fully oxidised 100% of the light is transmitted through the liquid. The darker the red colour of the TTC solution becomes, the lower the percentage of light transmitted.

Yeast cells were suspended in 0.5% glucose solution. The student set up a tube containing 10 cm^3 of this suspension and 1 cm^3 of TTC solution. The tube was covered and placed in a water bath for 20 minutes. During this time, the percentage of light transmitted through the solution was measured at two-minute intervals.

The experiment was repeated using yeast cells suspended in 0.5% sucrose solution.

The results of the investigation are shown in the graph below.



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(i) Describe the rate of respiration of yeast in the glucose solution during the 20 minutes of this investigation.

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(3)

(ii) State **one** way in which the rate of respiration of yeast in the sucrose solution differs from the rate in the glucose solution.

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(1)

(iii) Explain why the tubes were covered during this investigation.

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(2)

Leave blank

(iv) Explain why the student placed the tubes in a water bath.

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(2)

Q4

(Total 11 marks)

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5. Ultrafiltration and reabsorption occur in a mammalian kidney.

(a) Describe and explain the process of **ultrafiltration**.

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(4)

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(b) Describe and explain how solutes are reabsorbed from the proximal convoluted tubule.

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(5) **Q5**

(Total 9 marks)

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Option A: Microbiology and Biotechnology

6. The table below refers to features of λ (lambda) phage, tobacco mosaic virus (TMV) and human immunodeficiency virus (HIV). Complete the table by writing the most appropriate word or words in the boxes.

Feature	λ phage	TMV	HIV
Type of nucleic acid			
Shape of protein coat			

Q6

(Total 6 marks)

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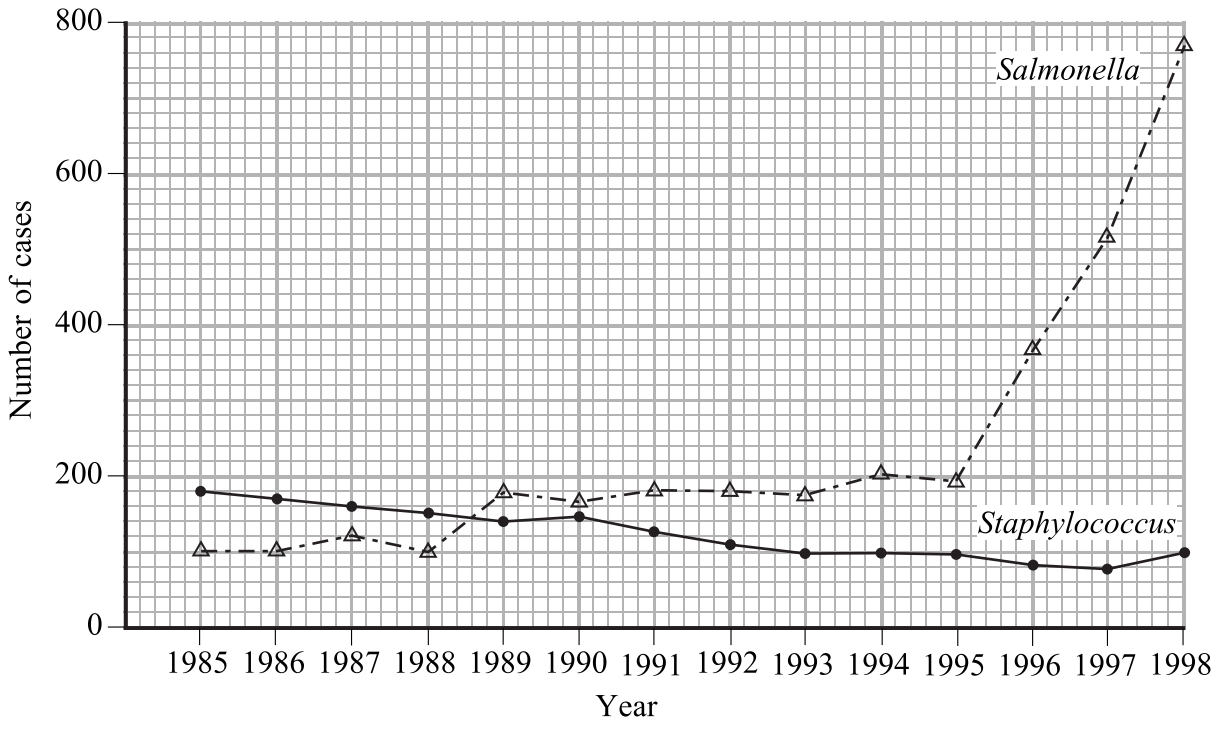
7. The graph below shows the number of cases of food poisoning caused by *Salmonella* and *Staphylococcus* in Japan between 1985 and 1998.



(a) For the years between 1985 and 1998, compare the number of cases of food poisoning caused by *Salmonella* with the number of cases of food poisoning caused by *Staphylococcus*.

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(3)

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(b) Food poisoning can be caused by the endotoxins of *Salmonella* and the exotoxins of *Staphylococcus*. State **two** differences between endotoxins and exotoxins.

1. .....

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2. .....

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(2)

Q7

(Total 5 marks)

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8. An experiment was carried out to investigate the incidence of antibiotic resistance in two species of bacteria, *Escherichia coli* (a Gram negative bacterium) and *Staphylococcus aureus* (a Gram positive bacterium).

These bacteria were isolated from 60 people and were tested for resistance to ampicillin and ampicillin S.

Bacteria	**Ampicillin**		**Ampicillin S**	
	Sensitive	**Resistant**	**Sensitive**	**Resistant**
E. coli	15	45	25	35
S. aureus	36	24	48	12

(a) Ampicillin and ampicillin S are antibiotics similar in structure to penicillin and which work in the same way as penicillin. From the data, it can be seen that ampicillin is much less effective against *E. coli* than *S. aureus*.

Explain this observation.

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(4)

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(b) Give an explanation for the spread of antibiotic resistance in *S. aureus.*

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(2)

(c) Using the data in the table, calculate the percentage increase in sensitivity of *S. aureus* to ampicillin S compared with ampicillin. Show your working.

Answer ..... %

(2)

(d) Some bacteria are resistant to antibiotics because they produce enzymes which break down the antibiotic. The addition of component S to ampicillin prevents the breakdown of ampicillin S.

Suggest how component S prevents the breakdown of ampicillin S by the bacterial enzyme.

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(1) **Q8**

(Total 9 marks)

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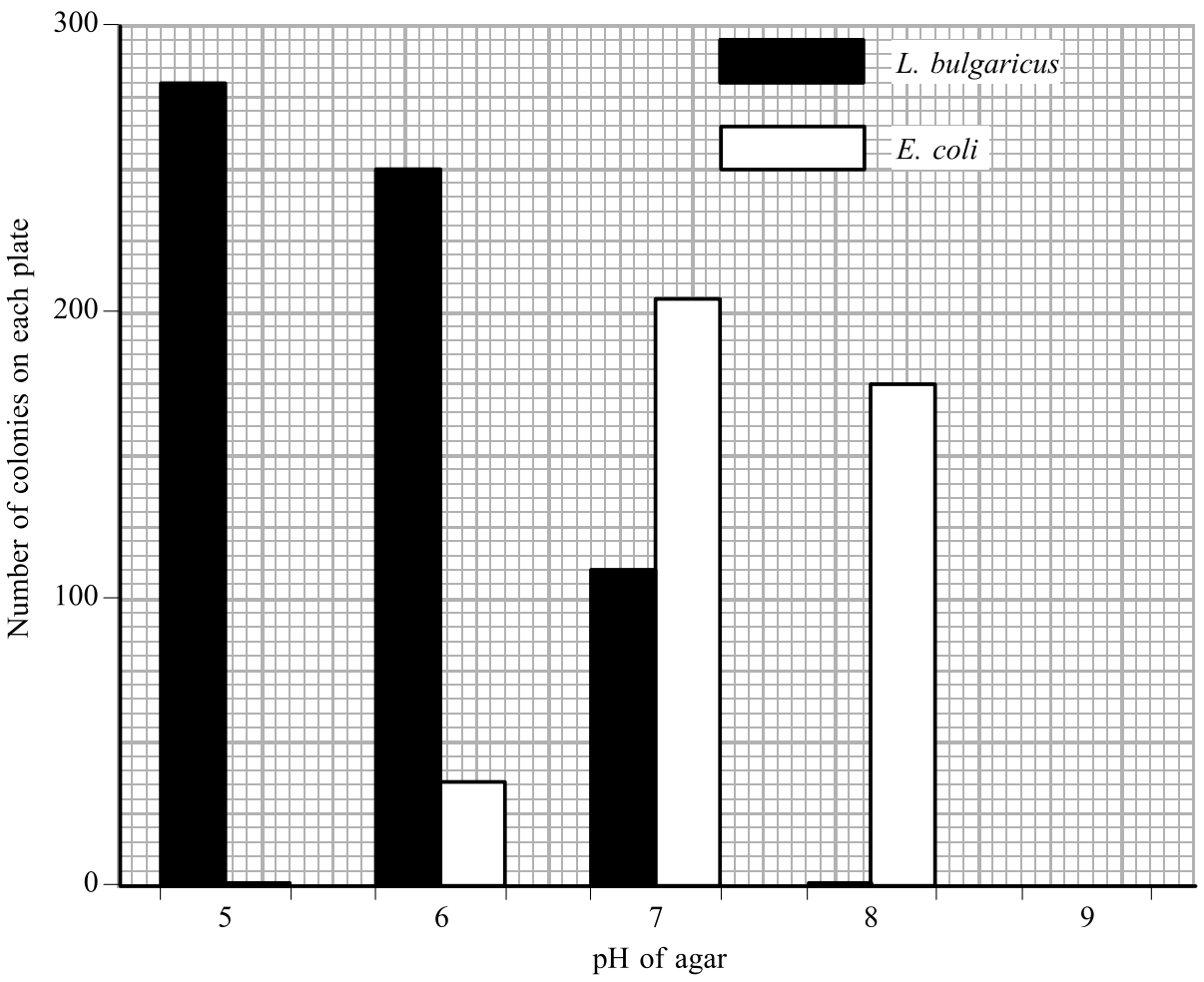
9. An investigation was carried out to study the effect of pH on the growth of *Escherichia coli* (*E. coli*) and *Lactobacillus bulgaricus* (*L. bulgaricus*).

Two sets of agar plates were prepared using agar at five different pHs (5, 6, 7, 8 and 9).

A stock suspension of *E. coli* was prepared and a 0.1 cm^3 sample was spread out over each of the agar plates. A stock suspension of *L. bulgaricus* containing the same number of cells as the suspension of *E. coli* was also prepared and 0.1 cm^3 samples were spread over a second set of agar plates.

Both sets of agar plates were incubated for two days and the number of colonies on each plate were counted.

The graph below shows the results of this investigation.



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(a) (i) Describe the effect of pH on the growth of *E. coli* and *L. bulgaricus*.

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(3)

(ii) Suggest an explanation for the effect of pH on the growth of both types of bacteria.

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(3)

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(b) Give two precautions that should have been taken during this investigation to ensure that the results were reliable. For each precaution given, explain how the results would have been affected if the precaution had not been taken.

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2 .....

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(4)

Q9

(Total 10 marks)

TOTAL FOR PAPER: 70 MARKS

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