FOR OFFICIAL USE			

KU	PS

Total Marks

## 0300/402

2001

NATIONAL MONDAY, 21 MAY QUALIFICATIONS 10.50 AM - 12.20 PM

**BIOLOGY** STANDARD GRADE Credit Level

Full name of centre	Town
Forename(s)	Surname
Date of birth  Day Month Year Scottish candidate number	Number of seat
<ol> <li>All questions should be attempted.</li> <li>The questions may be answered in any order buspaces provided in this answer book, and must be to the control of the control o</li></ol>	
3 Rough work, if any should be necessary, as well book. Additional spaces for answers and for rough book. Rough work should be scored through when	gh work will be found at the end of the
4 Before leaving the examination room you must giv not, you may lose all the marks for this paper.	e this book to the invigilator. If you do

Marks	KU	PS

1. A garden compost heap was marked off into five zones as shown below.

	depth (cm)
zone 1	
zone 2	20
zone 3	40
zone 4	60
zone 5	80
Variable Marie Control of the Contro	······I ()()

Three samples were removed from each zone and the average biomass of animals was calculated.

The results are shown in the table below.

Animal		Average biomass of animals (mg/l)				
Animai	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	
Earthworms	300	114	96	51	36	
Slugs	258	63	54	0	0	
Woodlice	204	87	75	33	6	
Centipedes	9	18	18	15	12	
Insects	6	6	3	0	0	
Mites	12	12	6	3	3	
Total	789	300	252	102	57	

(a)	Which animal contributes most biomass to the whole compost heap?		
		1	
. ,	What percentage of the total animal biomass of the compost heap is composed of insects?		
	Space for calculation		
	%	1	
(c)	Why were three samples taken from each zone?		
		1	
( <i>d</i> )	What trend is shown by the total animal biomass as the depth increases?	_	
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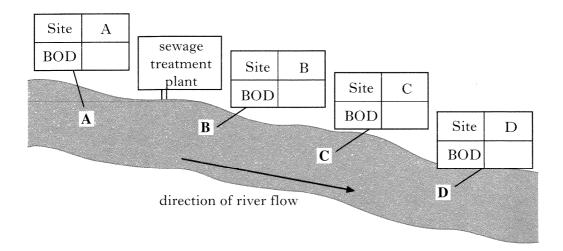
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2. The Biochemical Oxygen Demand (BOD) indicates the level of the organic matter in water samples. The more organic matter present, the higher the BOD.

The diagram shows four sites on a river where water was sampled and the BOD measured. The sewage treatment plant was not working and untreated sewage was flowing into the river.

The following BODs were obtained: 8, 30, 93 and 126.

(a) Complete the diagram by writing the correct BOD at each sample site.



(b) The BOD measures how much oxygen is used by microorganisms in the water.

Explain why a high organic matter content in the water will result in a high BOD.

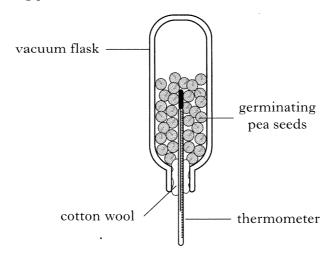
(c) What term is used for a type of organism whose presence or absence gives information about pollution levels?

[Turn over

[0300/402]

Page three

3. The diagram below represents part of an investigation into heat production by germinating pea seeds.



The temperature inside the flask was recorded for 72 hours.

The results are shown below.

Time (hours)	Temperature (°C)
0	18
12	26
24	40
36	48
48	50
60	52
72	54

(a)	Calculate the average temperature rise	e per	hour
	Space for calculation		

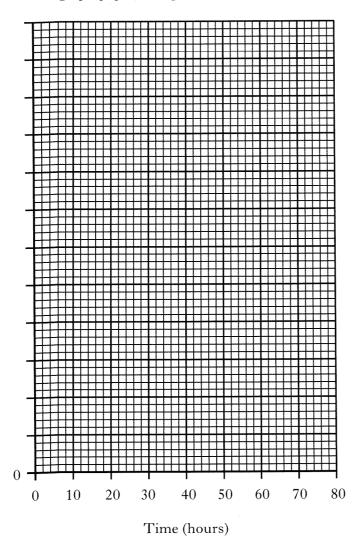
Average	temperature rise	$^{\circ}\mathrm{C}$	per hour

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#### 3. (continued)

(b) On the grid below, complete the Y-axis and plot a **line graph** of the results.

(Additional graph paper, if required, will be found on page 27.)



2

(c) It was concluded that germinating seeds release heat energy.

Describe **one** way in which a control experiment should be kept the same as the first experiment, and **one** way in which it should differ, to make this conclusion valid.

Kent the same

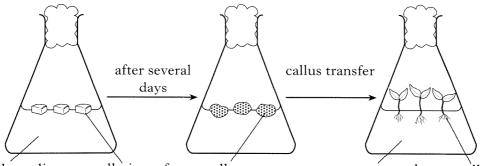
Made different \_\_\_\_\_

2

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	TH	IIS
	MAR	GIN
Marks	KU	PS

4. After a new variety of rose has been developed, large numbers are produced for sale by artificial propagation techniques involving asexual reproduction. The diagram shows artificial propagation by tissue culture.



growth medium small piece of plant tissue taken (group of cells)

from one plant

callus

small plant new growth medium

(a) What method of reproduction would have been used to develop the new variety of rose?

1

(b) What name is given to a group such as the small plants produced by tissue culture?

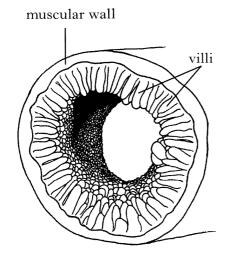
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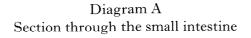
(c) Runners and tubers are examples of natural asexual reproduction. Describe an advantage of asexual reproduction to plants.

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5. The diagrams below show villi in the small intestine of a mammal.





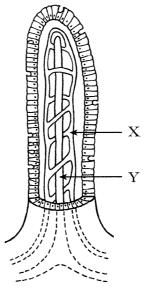


Diagram B A single villus

(a) State how the arrangement of villi, shown in **Diagram A**, increases the efficiency of absorption of digested foods.

(b) Name the two structures, labelled X and Y on **Diagram B**, which transport digested food away from the intestine.

X \_\_\_\_\_

Y

1

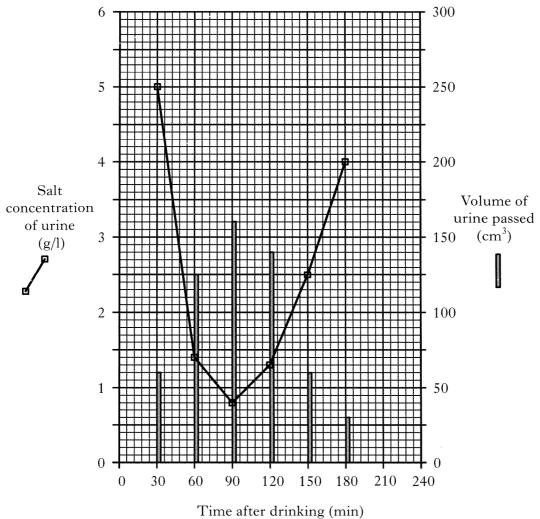
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[Turn over

6. A volunteer was given 1 litre of water to drink. Every 30 minutes for the next three hours, urine was collected and its volume and salt concentration were measured.

The results are shown on the graph below.



(a) What was the total volume of urine passed during this investigation? Space for calculation

\_\_\_\_cm<sup>3</sup>

1

(b) Using the data in the diagram, predict the salt concentration of a urine sample taken at 210 minutes.

Predicted salt concentration \_\_\_\_\_ g/l

			Marks	KU	PS
6. (	(cor	ntinued)			
(	(c)	Between which two sample times would the volunteer's blood have contained the lowest concentration of ADH?			a course
		Tick the correct box.			minute para de sorre y
		0 – 30 minutes			
		30 – 60 minutes			1000-100-100-100-100-100-100-100-100-10
		60 – 90 minutes			
		90 – 120 minutes	1		
(	( <i>d</i> )	Describe the relationship between the volume of urine passed and its salt concentration.		And the second s	
			1		
,			1		
		[Tur	n over		
				and the state of t	
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terti	e, roach and trout are freshv lisation of their eggs.	water fish whic	ch reproduce by exter	rnal		
	lt pike range from 100–150 c			s an		
	age of 100 000 eggs which are e It trout and roach are each fi			the		
same	e number of eggs as pike on av female.					
Tro	ut produce the biggest eggs at m.	5 mm diameter,	whilst roach eggs are o	only		
(a)	Complete the following table data using the above informat		able column headings	and		
	Fish					
	Pike					-
	Trout					
	Roach					
				3		-
	Give a reason for your answer	· 			A A A A A A A A A A A A A A A A A A A	
	Reason					
				2		
(c)	Fertilisation in land living ani	mals is internal				
(c)	Fertilisation in land living ani Explain the importance of thi					
(c)			•			- Additional and the second se
(c)			•	1		
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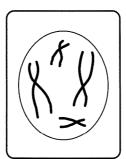
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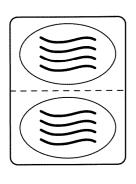
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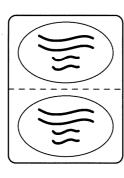
		Marks	KU	PS
8. Rea	d the passage below and answer the questions which follow it.			
nest long mov win sucl	ds migrate for the breeding season to areas with good food supplies and ting places. They go elsewhere for the winter because conditions are no ger suitable. We see millions of insect-eaters such as swifts and swallows ving into Britain in summer, but migrating south to warmer climates in ter because they cannot survive without insect food. Resident species has robins and blackbirds eat insects in summer and switch to a different d resource in winter and so do not migrate.			
mig Oth	me wildfowl and waders need to leave Britain in summer to breed but grate here in winter to feed on the invertebrates present in our estuaries. Her migrants, both in spring and autumn, use our islands as stopovers to during their long migrations north and south.			
cha	ere have been changes in bird distribution relating to factors like climatic nges. This has probably been responsible for redwings and fieldfares, ch are normally migrants, establishing resident populations in Britain.			
(a)	Give <b>one</b> reason why some birds migrate to Britain to breed.	1		
( <i>b</i> )	Give <b>one</b> reason why some birds migrate to Britain for the winter.	1		
(c)	Name one resident and one migrant species which eats insects.			
	Resident species			
	Migrant species	<b>1</b>		
( <i>d</i> )	Explain why some species may be seen in Britain for short periods at two different times of the year.			
	·	1		
(e)	What explanation is suggested in the passage for the resident populations of redwings and fieldfares in Britain?			
		1		
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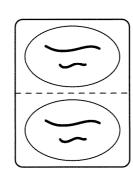
9. The diagram below represents a cell in an early stage of mitosis.

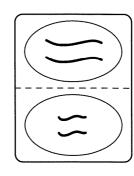


Which of the following diagrams represents the chromosomes you would expect to find in the nuclei of the daughter cells at the end of mitosis? *Tick the correct box*.









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	MAR	GIN	
Marks	KU	PS	

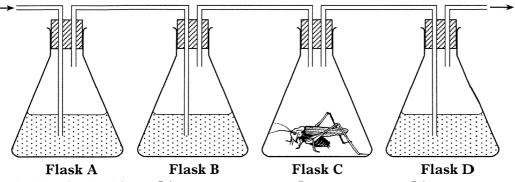
10. The following experiment was set up.

Sodium hydroxide solution absorbs carbon dioxide from air.

Lime water turns from clear to cloudy in the presence of carbon dioxide.

Air is drawn through the apparatus from X to Y, passing through each flask in turn.

X air in Y air out



Sodium hydroxide solution

Lime water

Insect

Lime water

(a) What should happen to the lime water in Flask B?

(i) The lime water in Flask D turned cloudy after one hour. (*b*)

Give a valid conclusion which could be drawn from this result.

(ii) Predict how the results would differ if two insects were put into Flask C.

[Turn over

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1

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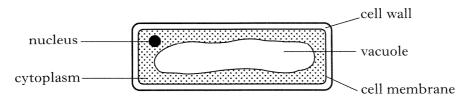
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PS

Marks	KU

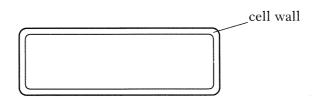
11. (a) (i) Tissue from an onion root was placed in water. The diagram below represents a cell from the tissue.



The tissue was then transferred into a very concentrated salt solution for one hour.

Complete the diagram below to show the appearance of the onion cell contents after this time.

(An additional diagram is available, if required, on page 27.)



(ii) <u>Underline</u> **one** alternative in each group to make the following sentence correct.

In concentrated salt solution, water passes  $\begin{cases} into \\ out \ of \end{cases}$  an onion cell from a region of  $\begin{cases} high \\ low \end{cases}$  water concentration, to a region of  $\begin{cases} high \\ low \end{cases}$  water concentration with the cell membrane acting as a  $\begin{cases} selectively \\ fully \end{cases}$  permeable membrane.

(b) Explain the importance of diffusion for an onion root cell.

2

Marks KU PS

	e following table.					sults are :			
Se	alt solution	A	В	С	D	E			
	itial mass of potato linder (g)	10	10	10	10	10			
	nal mass of potato linder (g)	12.6	11.2	10.1	9.4	7.0			
(i)	The potato cylinde Suggest a reason fo		olotted d	lry befo	re each	weighing.	-	1	970
(ii)	Which salt solution Salt solution		highest	water c	oncentr	ation?		1	
(iii)	Calculate the perce in salt solution D.  Space for calculation		ecrease	in mass	of the	potato cy	ylinder		
								ROBBER	
	%							1	

(a) The grid below is about breathing and lungs.

A	В	<u>C</u> .	D
trachea	ea mucus diaphragm		cilia
Е	F	G	H
air sacs	bronchi	rib cage	capillaries

Use letters from the boxes to complete the following.

(i) Identify two structures which are supported by rings of cartilage.

Letter \_\_\_\_ and letter \_\_\_\_

1

(ii) Identify two structures which are used to change the volume of the lungs during breathing.

Letter \_\_\_\_ and letter \_\_\_\_

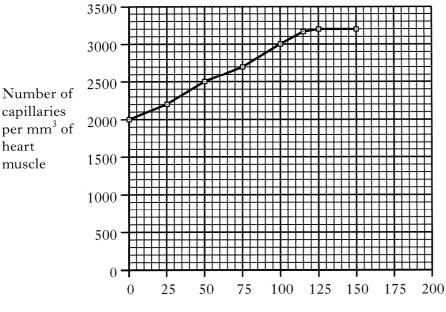
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(iii) Identify two features which can help prevent dust from reaching the air sacs.

Letter \_\_\_\_ and letter \_\_\_\_

1

The following graph shows the effect of a training programme on the number of blood capillaries in the heart muscle of an athlete.

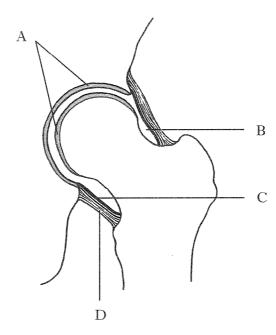


Total distance run (km/week)

heart muscle

			Marks	KU	PS
12. <i>(b)</i>	(con	tinued)			
	(i)	Describe the relationship between the distance run per week and the number of capillaries in the heart muscle.			AND A CO.
			2		
	(ii)	What was the percentage increase in the number of capillaries per mm <sup>3</sup> of heart muscle when the distance run each week was increased from 50 to 100 km?	3 <b>2</b> °		
		Space for calculation			
			1		
(c)	(i)	Training increases the efficiency of the heart.  Explain how an increased number of capillaries in the heart muscle contributes to its efficiency.			
			1		
	(ii)	In addition to improving the blood circulation, state <b>one</b> other way in which training improves the efficiency of the body.			
			1		
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13. The diagram shows a ball and socket joint.



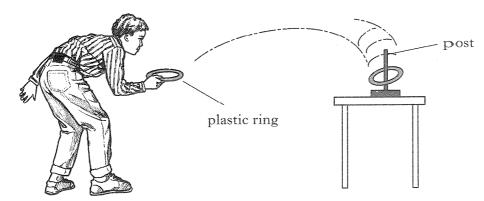
Complete the table with the letters, names and functions of the labelled structures in the joint.

Letter	Name of structure	Function
	synovial fluid	
С		produces synovial fluid
A		cushions the joint
		holds bones together

Marks

KU PS

**14.** An investigation was carried out to test the hypothesis that using both eyes increases the ability to judge distances.



Four volunteers threw plastic rings at a post.

Each volunteer had 20 throws with no eyes covered, with one eye covered and with both eyes covered.

The results are shown on the table below.

T. T.	Number of successes out of 20 throws						
Volunteer	no eyes covered	right eye covered	left eye covered	both eyes covered			
1	8	3	3	1			
2	12	4	3	2			
3	6	2	3	0			
4	8	5	4	0			
Average	8.50	3.50	3.25				

(a)	Complete the table to show the average result with both eyes co	overed.
	Space for calculation	

1

(b) Name two variables concerning the apparatus for the experiment which must be kept the same throughout the investigation.

1 \_\_\_\_\_

2

(c) <u>Underline</u> **one** alternative in each group to make the following statements correct.

The variable tested in the investigation was the

 $\left\{ egin{array}{ll} \emph{diameter of the hoops} \\ \emph{number of successful throws} \\ \emph{number of eyes used} \end{array} \right\}.$  The hypothesis should be  $\left\{ egin{array}{ll} \emph{accepted} \\ \emph{rejected} \\ \emph{modified} \end{array} \right\}.$ 

[Turn over

									Marks	KU	PS
15.	(a)	true-	n investigation in breeding tall plants he $F_1$ plants were ta	s were cros							
		(i)	Using the symbol diagram with the	s <b>T</b> and <b>t</b>							
			Parental phenotyp	oes	Tall	×	Dwarf				
			Parental genotype	s .							
			F <sub>1</sub> phenotype			Tall					
			F <sub>1</sub> genotype						1		
		(ii)	If a second generation of pea plants was produced by allowing the $F_1$ generation to self-cross, what would be the expected ratio of phenotypes?								
			Space for working								
			Expected F <sub>2</sub> ratio	Tall	: I	Owarf					
					: .				1		
		(iii)	When the $F_2$ plant 180 dwarf plants.	ts were co	ounted,	there	were 720 tall	plants and			
		400	Calculate the actual ratio of tall plants to dwarf plants.								
	Space for calculation										
			Actual F <sub>2</sub> ratio	Tall	: I	Owarf					
					: .				1		
		(i+-)	Evaloin why those	roculto di	ffan fna	m the	ormontod notic				
	(iv) Explain why these results differ from the expected ratio.										
									1		
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<i>b</i> )	Tallness and dwarfness in pea plants is an example of discontinuous		
,	variation. Explain the meaning of this term.	•	
		1	
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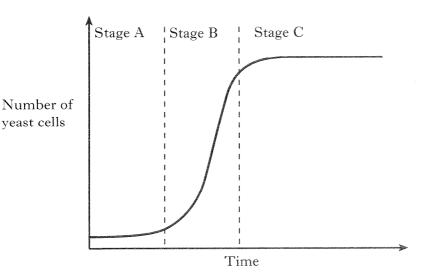
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[0300/402]

KU Marks PS16. (a) The following list describes some of the stages in the production of human insulin by genetically engineered bacteria. Stage 1 Stage 2 Insertion of the insulin gene into the chromosomal material of suitable bacteria. Stage 3 Bacteria reproduce rapidly, passing on the insulin gene. Stage 4 Stage 5 Extraction and purification of the insulin. In the spaces provided, describe stages 1 and 4. 2 Explain why there is an ever increasing need for insulin produced by bacteria. Year (b) Compared to selective breeding, state one advantage of genetic engineering as a way of improving the characteristics of a species. A STATE OF THE PERSON NAMED IN [0300/402] Page twenty-two

Marks KU PS

17. The graph shows the population growth of yeast cells in a fermenter.



(a) Which stage on the graph shows the fastest population growth?

Stage \_\_\_\_\_

April 1

(b) Describe the changes in population growth shown in Stage C on the graph, and give a reason for the changes.

Changes \_\_\_\_\_

100

Reason

1

(c) The fermenter was cleaned by steam sterilisation at 121 °C before it was used.

Name the structures, produced by bacteria and fungi, which could have survived if boiling water had been used for cleaning.

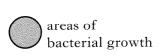
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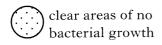
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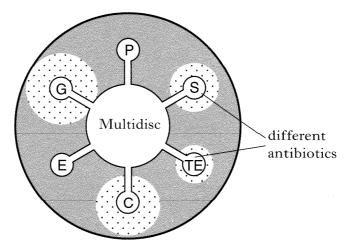
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A suspension of bacteria was spread evenly over the surface of a nutrient 18. agar in a petri dish.

A multidisc containing six different antibiotics was placed on the agar. The diagram below shows the appearance of the petri dish after it had been incubated for two days.







(a) Complete the table below to record the effectiveness of each antibiotic.

Antibiotics which had some effect	Antibiotics which had no effect

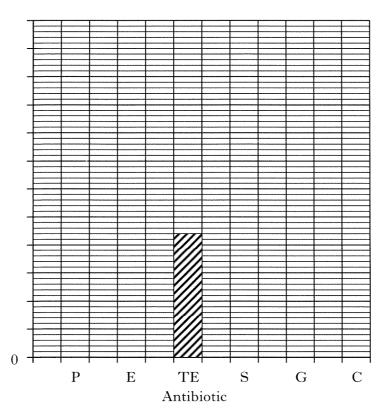
#### 18. (continued)

(b) The table below shows the results from a similar investigation with a different bacterium.

Antibiotic	Diameter of clear area (mm)		
P	0		
S	4.1		
TE	2.2		
C	5.0		
G	4.3		
E	0.5		

(i) Use the information from the table to complete the Y-axis and plotting of the bar chart on the grid below.

(An additional grid is available, if required, on page 28.)



(ii) Suggest the most effective antibiotic to use in the treatment of a patient infected with this bacterium.

Antibiotic \_\_\_\_\_

1

2

(c) Explain why a range of antibiotics is needed in the treatment of bacterial diseases.

1

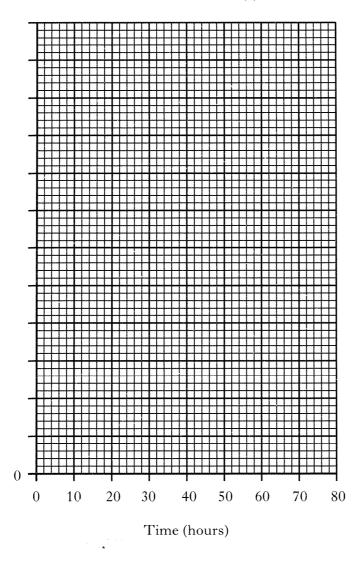
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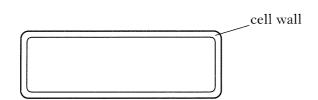
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		ı	MAR	GIN
		Marks	KU	PS
<b>19.</b> (a)	Commercial brewers provide the best growing conditions for yeast.	.1		
	Draw clear lines to link the growing condition required by yeast with method used to provide it.	th		
	Growing condition Method			
	Food supply sterilisation			
	1 ood supply stermsation			
	Suitable temperature thermostats			
	Lack of competition germinating barley grains	1		
( <i>b</i> )	Yeast cells can be measured in micrometres.			
	1 millimetre (mm) = 1000 micrometres ( $\mu$ m).		***************************************	
	If 20 yeast cells together measure 1 mm, what is the average si in micrometres of one yeast cell?	ze		
	Space for calculation			
	•			
	μm	1		
	•			
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### ADDITIONAL GRAPH PAPER FOR QUESTION 3(b)

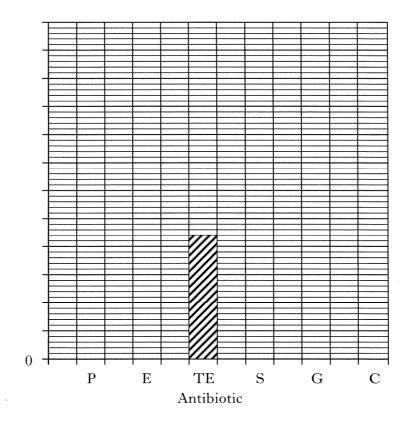


#### ADDITIONAL DIAGRAM FOR QUESTION 11(a)(i)



[Turn over

### ADDITIONAL GRID FOR QUESTION 18(b)(i)



# SPACE FOR ANSWERS AND FOR ROUGH WORKING

# SPACE FOR ANSWERS AND FOR ROUGH WORKING

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