

FOR OFFICIAL USE

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Total Marks

0300/402

NATIONAL
QUALIFICATIONS
2001

MONDAY, 21 MAY
10.50 AM - 12.20 PM

BIOLOGY
STANDARD GRADE
Credit Level

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

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Scottish candidate number

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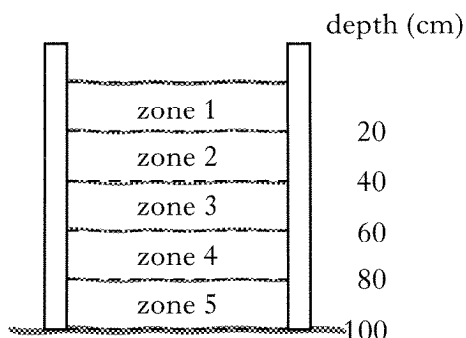
Number of seat

- 1 All questions should be attempted.
- 2 The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, and must be written clearly and legibly in ink.
- 3 Rough work, if any should be necessary, as well as the fair copy, is to be written in this book. Additional spaces for answers and for rough work will be found at the end of the book. Rough work should be scored through when the fair copy has been written.
- 4 Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.

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



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

The results are shown in the table below.

| <i>Animal</i> | <i>Average biomass of animals (mg/l)</i> | | | | |
|---------------|--|--------|--------|--------|--------|
| | 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

(b) 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

(d) What trend is shown by the total animal biomass as the depth increases?

1

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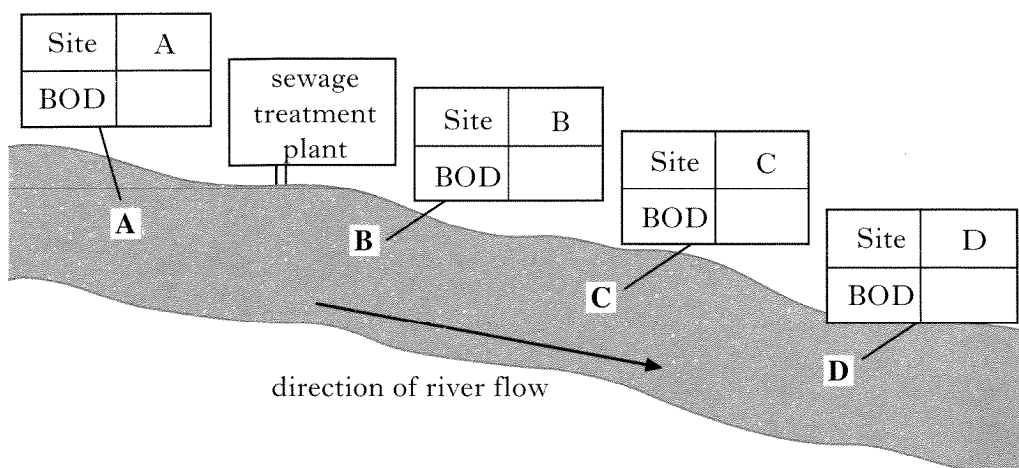
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2. The Biochemical Oxygen Demand (BOD) indicates the level of the organic matter in water samples. The more organic matter present, the higher the BOD.

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.

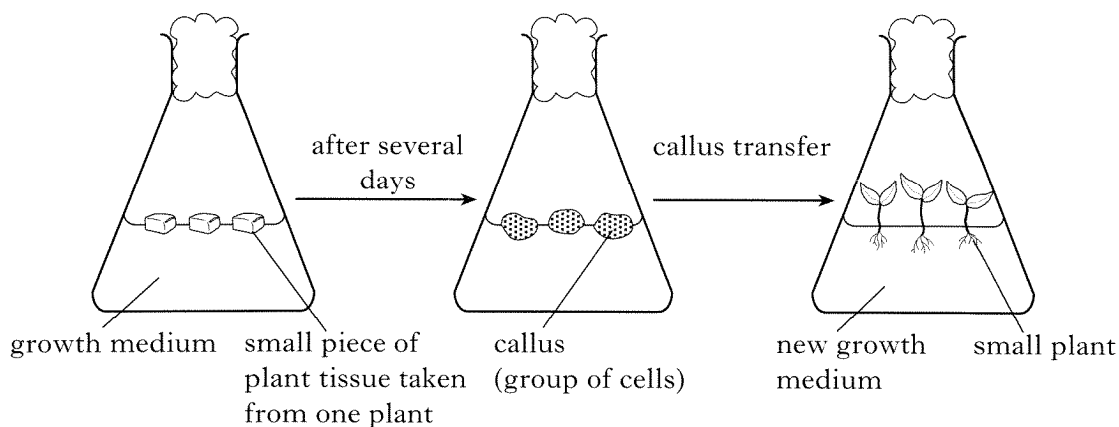
- (c) What term is used for a type of organism whose presence or absence gives information about pollution levels?

[Turn over

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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.



- (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?

1

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

1

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6. (continued)

(c) Between which two sample times would the volunteer's blood have contained the lowest concentration of ADH?

Tick the correct box.

- 0 – 30 minutes
- 30 – 60 minutes
- 60 – 90 minutes
- 90 – 120 minutes

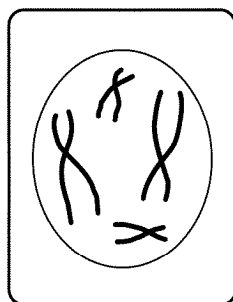
(d) Describe the relationship between the volume of urine passed and its salt concentration.

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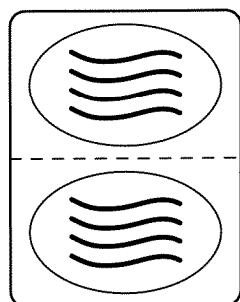
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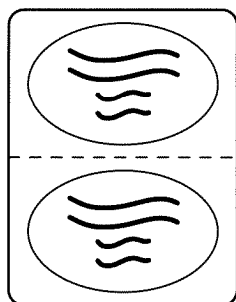
9. The diagram below represents a cell in an early stage of mitosis.

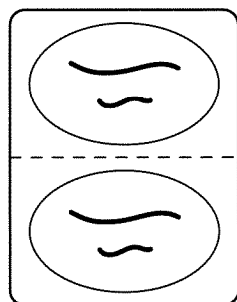


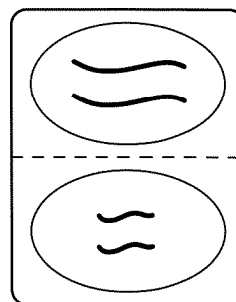
Which of the following diagrams represents the chromosomes you would expect to find in the nuclei of the daughter cells at the end of mitosis?

Tick the correct box.









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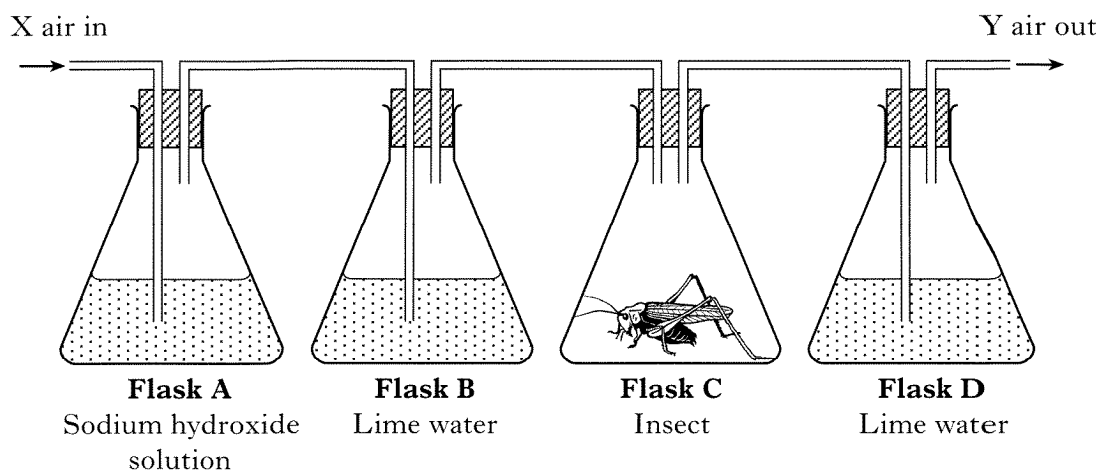
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10. The following experiment was set up.

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.



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

1

(b) (i) The lime water in Flask D turned cloudy after one hour.
Give a valid conclusion which could be drawn from this result.

1

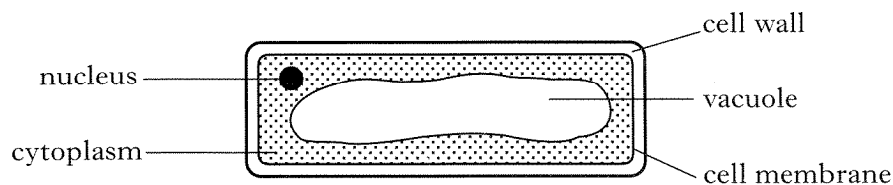
(ii) Predict how the results would differ if two insects were put into Flask C.

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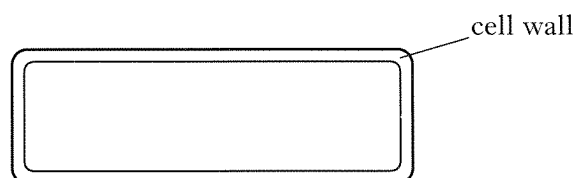
11. (a) (i) Tissue from an onion root was placed in water. The diagram below represents a cell from the tissue.



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) Underline one alternative in each group to make the following sentence correct.

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

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

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

| | | | |
|----------|---------|-----------|-------------|
| A | B | C | D |
| trachea | mucus | diaphragm | cilia |
| E | 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 _____

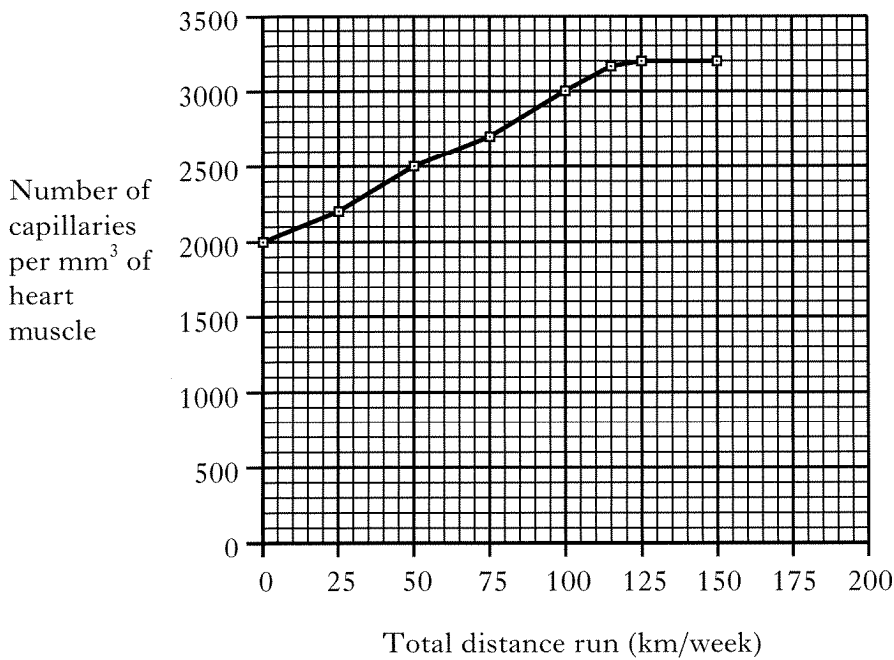
1

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

Letter _____ and letter _____

1

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



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12. (b) (continued)

- (i) Describe the relationship between the distance run per week and the number of capillaries in the heart muscle.

- (ii) What was the percentage increase in the number of capillaries per mm³ of heart muscle when the distance run each week was increased from 50 to 100 km?

Space for calculation

_____ %

- (c) (i) Training increases the efficiency of the heart.
Explain how an increased number of capillaries in the heart muscle contributes to its efficiency.

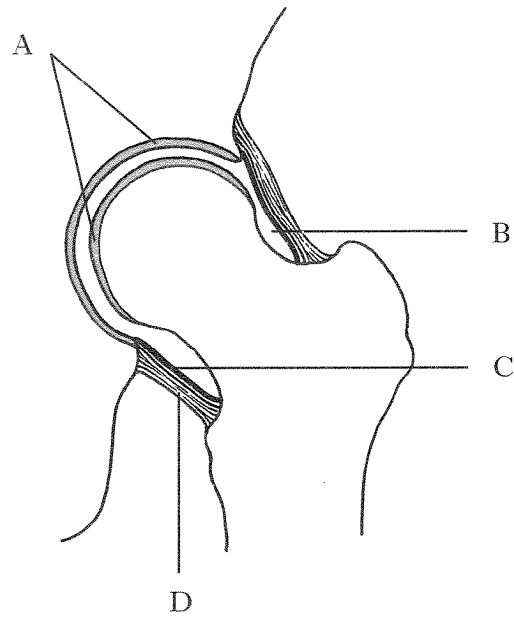
- (ii) In addition to improving the blood circulation, state **one** other way in which training improves the efficiency of the body.

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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.

| <i>Letter</i> | <i>Name of structure</i> | <i>Function</i> |
|---------------|--------------------------|-------------------------|
| | synovial fluid | |
| C | | produces synovial fluid |
| A | | cushions the joint |
| | | holds bones together |

3

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15. (a) In an investigation into the inheritance of height in pea plants, true-breeding tall plants were crossed with true-breeding dwarf plants. All the F₁ plants were tall.

(i) Using the symbols **T** and **t** for the alleles, complete the following diagram with the genotypes of the parents and the offspring.

Parental phenotypes **Tall** × **Dwarf**

Parental genotypes _____ _____

F₁ phenotype **Tall**

F₁ genotype _____

(ii) If a second generation of pea plants was produced by allowing the F₁ generation to self-cross, what would be the expected ratio of phenotypes?

Space for working

Expected F₂ ratio **Tall** : **Dwarf**

 _____ : _____

(iii) When the F₂ plants were counted, there were 720 tall plants and 180 dwarf plants.

Calculate the actual ratio of tall plants to dwarf plants.

Space for calculation

Actual F₂ ratio **Tall** : **Dwarf**

 _____ : _____

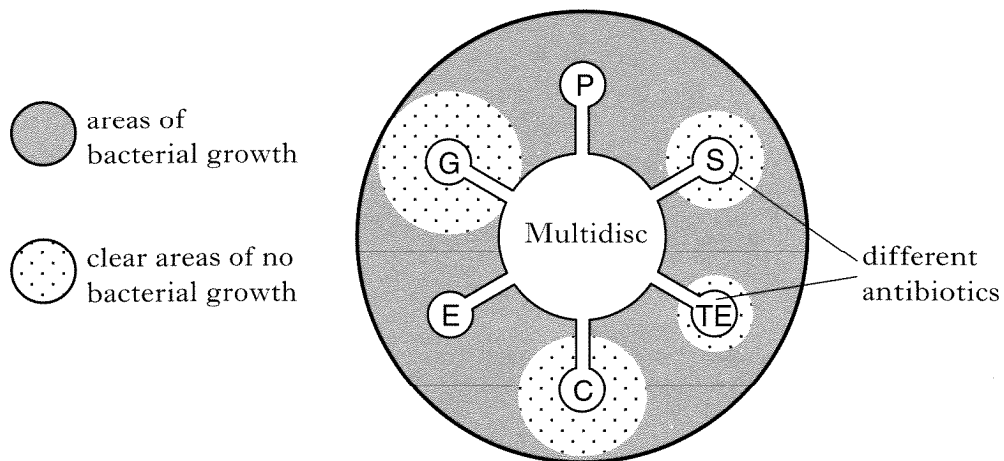
(iv) Explain why these results differ from the expected ratio.

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18. A suspension of bacteria was spread evenly over the surface of a nutrient 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.

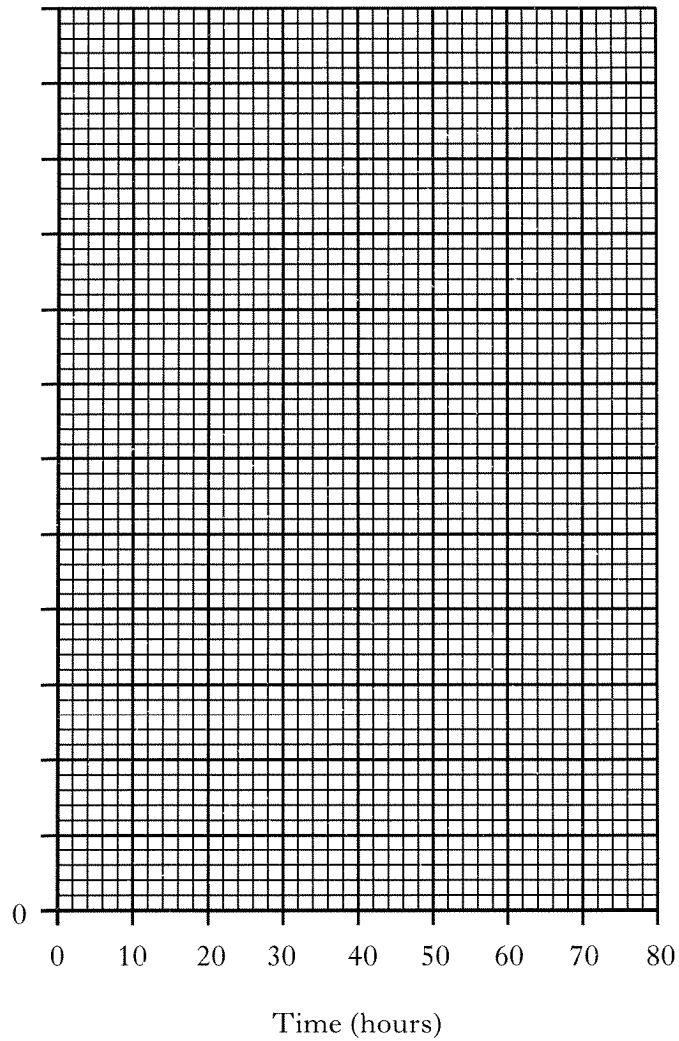


(a) Complete the table below to record the effectiveness of each antibiotic.

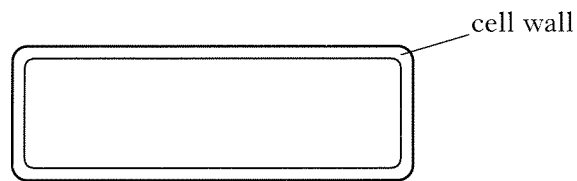
| <i>Antibiotics which had some effect</i> | <i>Antibiotics which had no effect</i> |
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ADDITIONAL GRAPH PAPER FOR QUESTION 3(b)

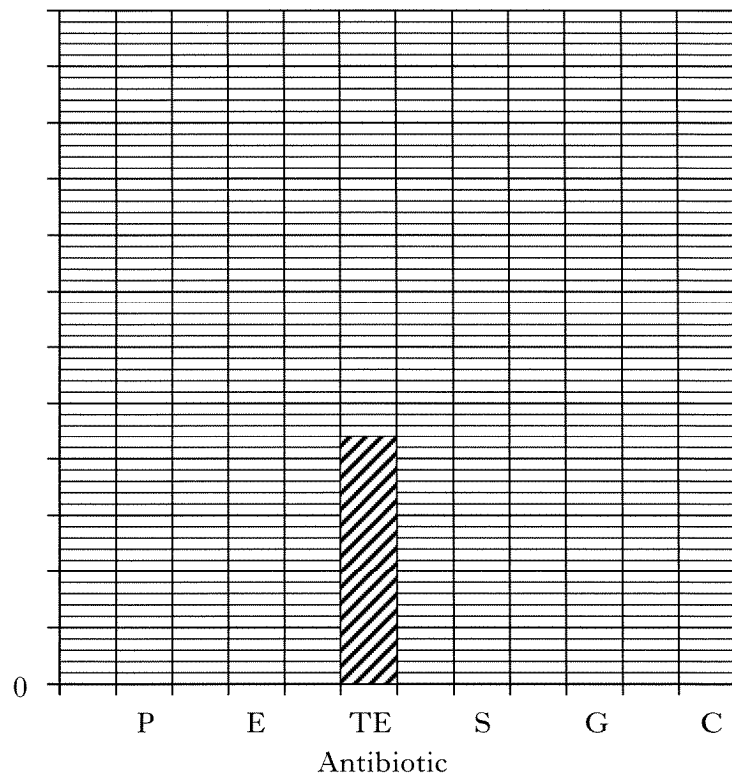


ADDITIONAL DIAGRAM FOR QUESTION 11(a)(i)



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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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