Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

9973451659

BIOLOGY **9700/53**

Paper 5 Planning, Analysis and Evaluation **October/November 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **10** printed pages and **2** blank pages.

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CAMBRIDGE International Examinations

1 Transpiration in plants can be investigated using a potometer, which measures water uptake by plants. Fig. 1.1 shows a potometer that was used by a student.

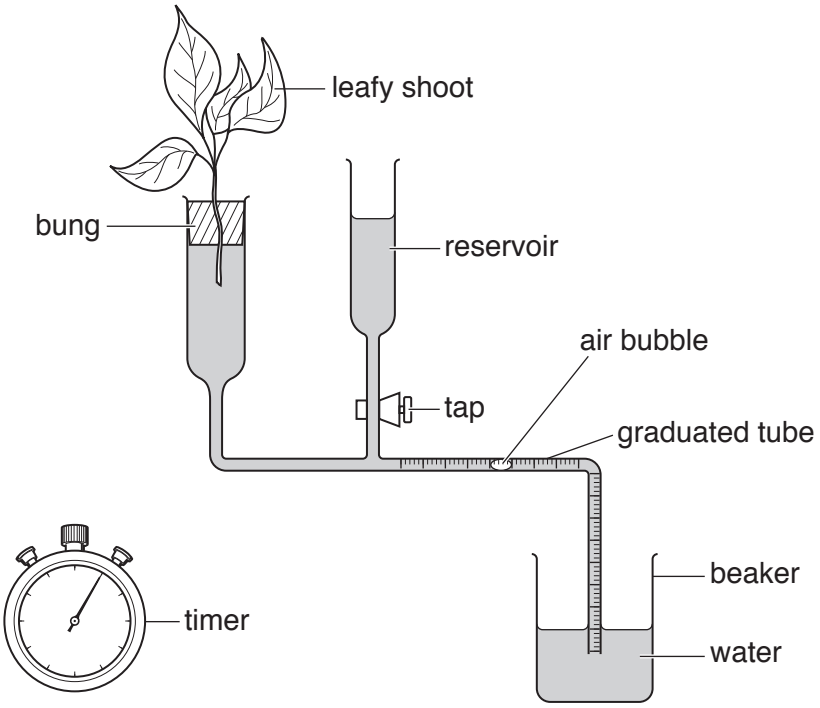


Fig. 1.1

As water is lost by the leaves through transpiration, the air bubble moves along the graduated tube.

The student used this apparatus to investigate the effect of light intensity on the rate of transpiration in plants.

(a) (i) State the independent variable **and** the dependent variable in this investigation.

independent .....

dependent .....

[2]

(ii) List **three** variables that should be controlled in this investigation **and** describe how the student could standardise **two** of these variables.

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.....[3]

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(b) Describe how the student could set up and use the potometer shown in Fig. 1.1 to investigate the rate of transpiration at different light intensities.

Your method should be set out in a logical way and be detailed enough to let another person follow it.

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(c) The student carried out further experiments, using the same apparatus, to investigate the effect of two different environmental carbon dioxide concentrations on the rate of transpiration. These experiments were carried out at a high light intensity and at a low light intensity.

The leafy shoots used in the experiments were taken from the same plant and each shoot had five leaves.

The student calculated the percentage reduction in the transpiration rate from 50 ppm to 730 ppm of carbon dioxide at low light intensities.

The results are shown in Table 1.1.

Table 1.1

concentration of carbon dioxide / ppm	light intensity	transpiration rate / g dm^{-3} hr^{-1}	percentage reduction in transpiration rate from 50 ppm to 730 ppm of carbon dioxide
50	low	1.28	36.7
730	low	0.81	
50	high	3.03	
730	high	2.12	

ppm = parts per million

(i) Complete Table 1.1 by calculating the percentage reduction in transpiration rate from 50 ppm to 730 ppm of carbon dioxide at the **high light intensity**.

Show your working.

[2]

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(ii) The student concluded that, as carbon dioxide concentration increased, the transpiration rate in plants decreased at all light intensities.

Explain why this conclusion may **not** be valid.

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.....[2]

[Total: 15]

2 Resistance to antibiotics within a population of bacteria is due to selection pressure. This can be linked to the use of antibiotics by patients.

A study was carried out into the link between antibiotic use and the presence of resistant *Escherichia coli (E. coli*) populations in human communities.

- Over 30 000 patients were involved in the study.
- Only patients attending large medical clinics took part in the study.
- The number of prescriptions issued by each clinic was used as an estimate of antibiotic use.
- Urine from patients attending the clinics was used as a possible source of antibiotic resistant *E. coli*.
- Antibiotic resistance of *E. coli* in the urine samples was measured using the disc diffusion method.

The disc diffusion method measures sensitivity of bacteria to an antibiotic. A bacterial population with low sensitivity to an antibiotic is resistant to that antibiotic.

In the disc diffusion method a Petri dish is filled with nutrient agar and urine samples containing *E. coli* are spread evenly across the agar.

Discs containing different antibiotics are placed on top of the agar. A lid is put on the Petri dish and the plate is incubated overnight.

Fig. 2.1 shows an example of a Petri dish from the study after incubation.

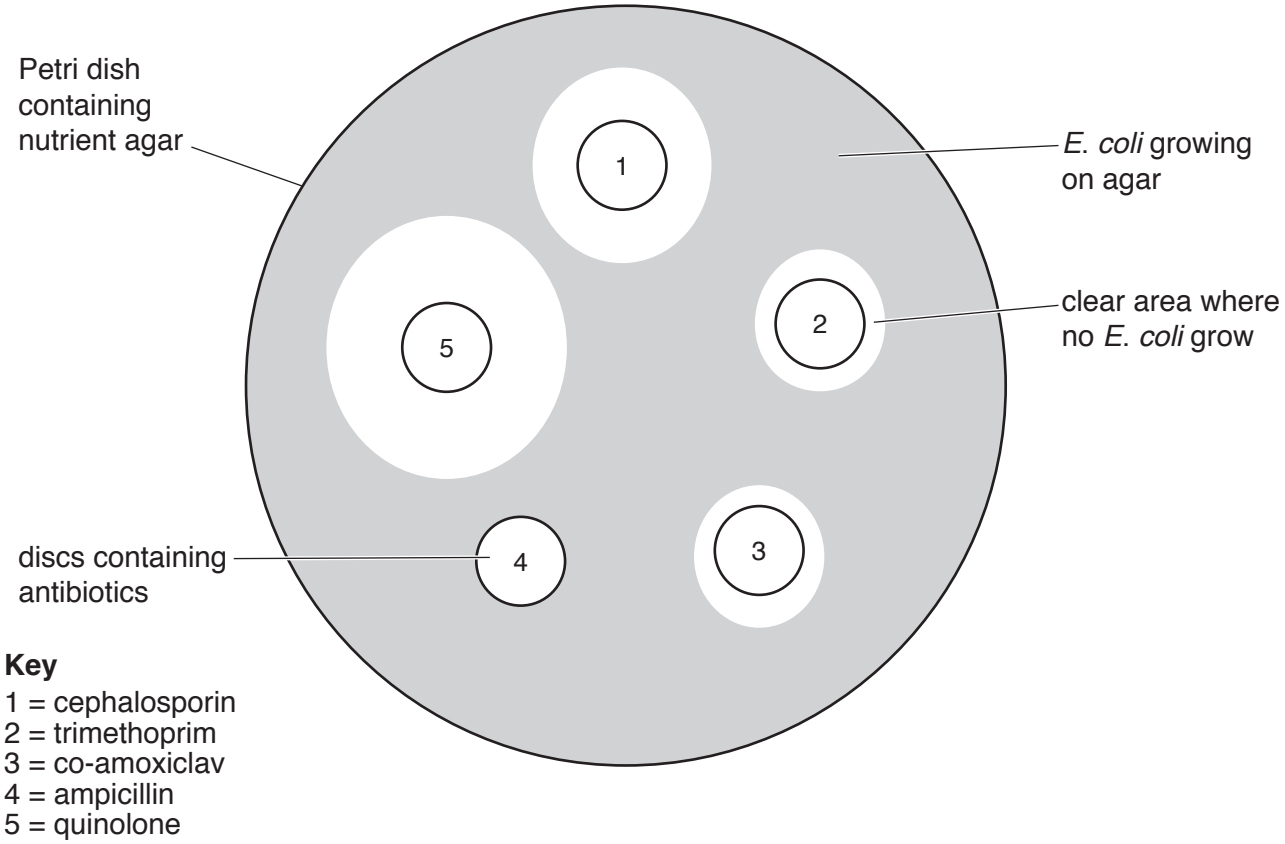


Fig. 2.1

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(a) (i) Suggest two variables that need to be standardised when using the disc diffusion method in this study.

1 .....

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2 .....

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[2]

(ii) Describe how you would determine the sensitivity of *E. coli* to each antibiotic.

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(b) Table 2.1 shows the results of this investigation.

Table 2.1

antibiotic	antibiotic use / prescriptions per thousand patients per year		percentage *E. coli* resistance	
	mean ($\overline{x}$)	standard deviation (s)	mean ($\overline{x}$)	standard deviation (s)
cephalosporin	107.0	83.0	6.5	3.5
trimethoprim	62.6	25.6	26.3	5.8
co-amoxiclav	75.5	43.9	8.4	5.7
ampicillin	351.9	171.1	53.2	7.2
quinolone	33.6	18.3	2.2	1.9

(i) Comment on the standard deviations for **antibiotic use** as shown in Table 2.1.

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(ii) Suggest two reasons why the number of prescriptions issued for antibiotics may **not** give an accurate measure of antibiotic use by patients.

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[2]

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(c) The number of prescriptions issued for antibiotics varied considerably between clinics.

The researchers wanted to find out whether there was a correlation between the number of prescriptions for each of the five antibiotics issued by a clinic and the percentage of urine samples containing resistant *E. coli*.

Spearman's rank correlation test was used for this analysis.

The results of this analysis are shown in Table 2.2.

Table 2.2

antibiotic	Spearman's rank correlation coefficient (r_s)
cephalosporin	0.30
trimethoprim	0.62
co-amoxiclav	0.23
ampicillin	0.71
quinolone	0.44

Table 2.3 shows the critical values for r_s at five levels of significance for the data collected in this study.

Table 2.3

level of significance (p)	0.20	0.10	0.05	0.02	0.01
critical value of r_s	0.240	0.306	0.362	0.425	0.467

(i) Suggest why the Spearman's rank correlation test was used in this study.

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.....[1]

(ii) State a null hypothesis for the Spearman's rank correlation test for this study.

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(iii) Using Table 2.2 and Table 2.3, identify which antibiotics showed a statistically significant correlation between the number of prescriptions and the presence of resistant strains of *E. coli* in urine samples. Give a reason for your answer.

antibiotics .....

reason .....

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[2]

(d) The percentage of patients with ampicillin-resistant *E. coli* infections varies with age and gender, as shown in Fig. 2.2.

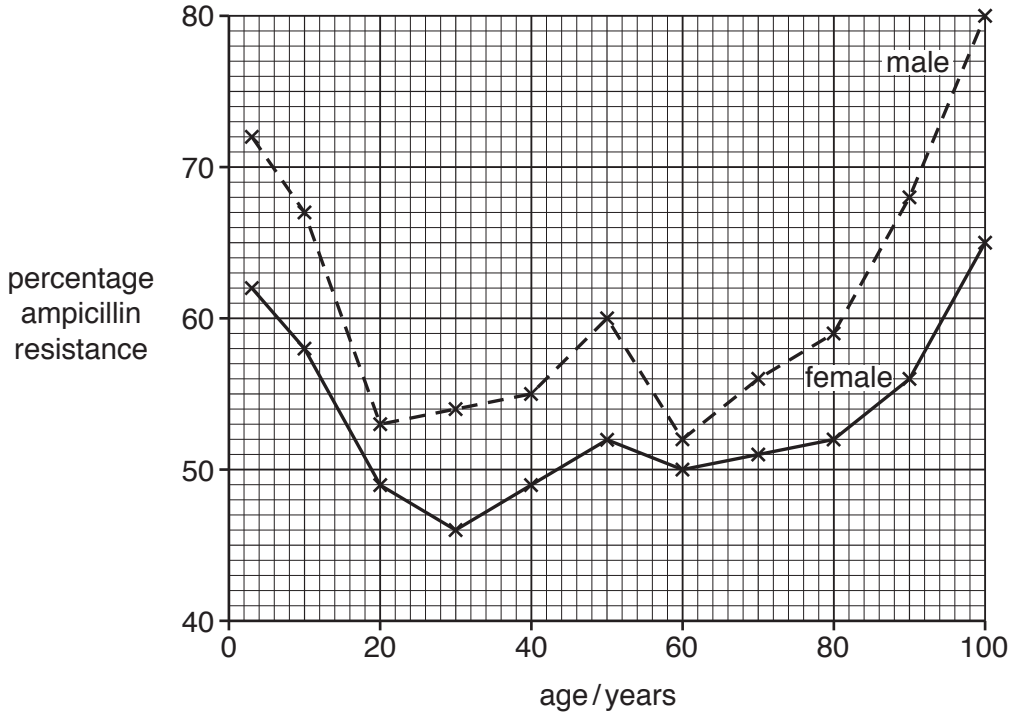


Fig. 2.2

Describe **and** explain the trends shown by these data.

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[Total: 15]

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