Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

6124186229

BIOLOGY **9700/52**

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.

1 Fig. 1.1 shows apparatus that can be used to measure the loss of water vapour from leaves.

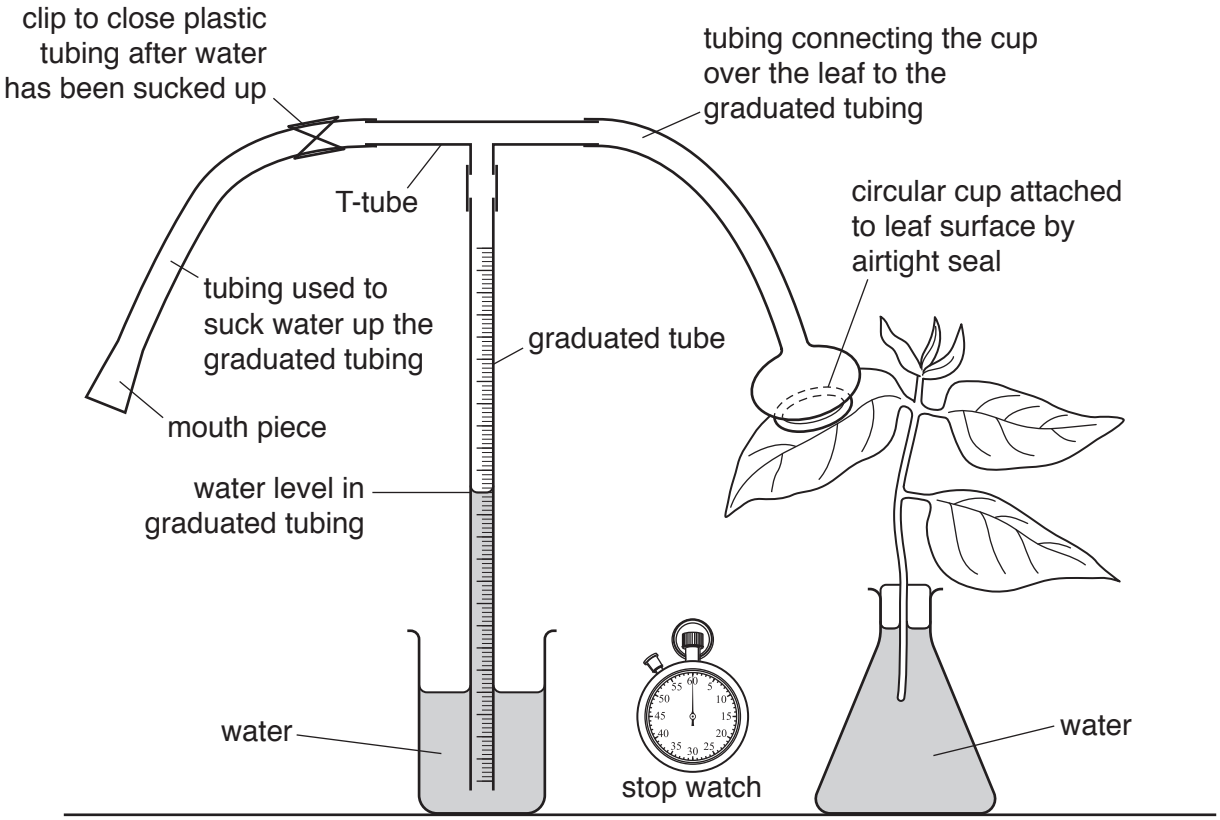

Fig. 1.1

The water vapour given out by the area of leaf under the cup increases the pressure inside the tubing, causing the water level in the graduated tube to go down.

Some students used the apparatus in Fig. 1.1 to test the hypothesis:

The loss of water vapour from the lower surface of the leaves of a plant is greater per unit time than the loss of water vapour from the upper surface of the leaves of the same plant.

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

independent variable .....

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dependent variable .....

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[2]

(ii) Describe a method by which the students could use the apparatus shown in Fig. 1.1 to measure loss of water vapour in order to test the hypothesis.

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

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(b) The hypothesis that the students tested was:

The loss of water vapour from the lower surface of the leaves of a plant is greater per unit time than the loss of water vapour from the upper surface of the leaves of the same plant.

The students decided that, to make a valid comparison, they needed to work out the water loss per unit time per unit area of leaf.

(i) Describe how the students obtained the measurement needed to work out the results as **per unit area** of leaf.

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(ii) Describe how the students could use this measurement and their results for the loss of water vapour to find out if their results support the hypothesis.

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(iii) Sketch a bar chart on Fig. 1.2 to show the results if the hypothesis was supported. You should include the axis labels and the units. [3]

Fig. 1.2

(c) The apparatus shown in Fig. 1.1 was used in another series of experiments to measure water vapour loss from the same leaf in different experimental conditions for the same period of time.

Table 1.1 shows the results.

Table 1.1

experimental condition	distance moved by water column /cm per unit time				
	trial 1	trial 2	trial 3	trial 4	trial 5
high light intensity	7.3	7.5	7.8	6.2	7.0
no light	0.0	0.0	1.5	0.2	0.0
high temperature	4.4	2.8	3.2	4.8	3.1
strong air current	1.5	2.4	1.1	0.9	1.0

(i) **On Table 1.1**, draw circles around **two** of the values that may be anomalous. [2]

(ii) The aperture of stomata affects the loss of water vapour.

State **one** conclusion that can be made about the effect of experimental conditions on the aperture of stomata in this plant.

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[Total: 19]

[Turn over

2 Antibiotic resistance of pathogenic bacteria is a worldwide cause for concern. Investigations into the use of antibiotics and their effects use an international unit of measurement, called the defined daily dose (DDD).

The DDD represents the assumed average dose for a drug per day being used to treat a specific disease in adults.

A study investigated the antibiotic resistance of *Streptococcus pneumoniae*. The study was carried out in some European countries and the percentage of *S. pneumoniae* resistant to the antibiotics penicillin and macrolide was determined.

The results are shown in Table 2.1.

Table 2.1

country	DDD per 1000 people per day		percentage of resistant *S. pneumoniae*	
	penicillin	macrolide	penicillin	macrolide
Netherlands	9	1	1	5
Denmark	11	2	2	2
Sweden	13	1	4	3
Germany	14	2	7	9
UK	14	3	11	19
Austria	18	4	12	11
Italy	24	5	13	29
Portugal	29	4	29	9
France	37	6	43	53
Spain	33	6	50	36

(a) (i) State **two** conclusions that can be made about the quantity of these antibiotics used and the percentage of *S. pneumoniae* resistant to these two types of antibiotic.

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[2]

(ii) Calculate the ratio of penicillin use between Spain and the Netherlands.

ratio .....[1]

(b) To find the strength of the relationship between antibiotic use and the percentage resistance in *S. pneumoniae*, a linear correlation test was used. The probability for each value was found using the critical values from a probability table.

(i) State **two** reasons why this statistical test is suitable for these data.

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(ii) The results of the test are shown in Table 2.2.

Table 2.2

type of antibiotic	Pearson's linear correlation coefficient (r)	level of significance (p)
penicillin	0.95	< 0.01
macrolide	0.86	< 0.01

State what the values in Table 2.2 indicate about the relationship between antibiotic use and antibiotic resistance in *S. pneumoniae*.

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(c) The disc diffusion method is used to test the effectiveness of different concentrations of antibiotics. Fig. 2.1 shows the results of a disc diffusion test.

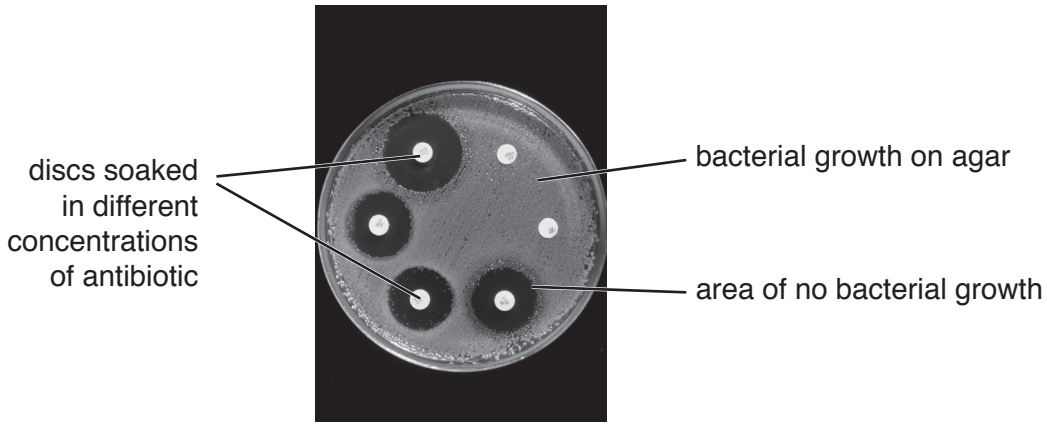

Fig. 2.1

Starting with a stock solution of an antibiotic, outline how you would make a serial dilution to produce a range of concentrations of the antibiotic.

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(d) The disc diffusion test is also used to test for antibiotic resistance. The test may take about five days to complete.

Escherichia coli is a common bacterium in the human intestines that can develop antibiotic resistance and transmit it to other bacteria. It is present in faeces and can also be present in waste water that is discharged into rivers.

Environmental agencies test samples of waste water for antibiotic resistant bacteria. This can be done with the disc diffusion method. A new test was developed to allow estimates of antibiotic-resistant *E. coli* to be obtained within 24 hours.

Suggest **two** criteria that environmental agencies could apply when assessing the new test to see whether it is suitable.

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[Total: 11]