

(b) (i) State **two** variables, other than temperature, that could affect this investigation.

(2)

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(ii) Suggest how **one** of the variables you have stated in (b)(i) could be controlled. Describe what effect it could have on the results if it was not controlled.

(2)

Variable

How to control the variable

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Effect on the results if the variable is not controlled

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(c) When seeds are placed in conditions suitable for germination, there is a delay of several hours before respiration can be detected. Suggest an explanation, in terms of metabolic processes, that might account for this delay.

(3)

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(Total for Question 1 = 12 marks)



- 2 Ultraviolet (UV) light can be used to kill microorganisms. A student decided to investigate the effect of UV light on the survival of bacteria.

The student spread bacteria on three agar plates. Each plate was then exposed to UV light for one minute. She placed the agar plates in an incubator.

After 48 hours, she recorded the number of bacterial colonies on each plate.

The procedure was repeated for exposure times of 2, 3, 4 and 5 minutes.

A copy of her raw results is shown below.

1 minute exposure to UV light: 302, 282 and 322 colonies
2 minutes exposure to UV light: 187, 215 and 231 colonies
3 minutes exposure to UV light: 174, 108 and 129 colonies
4 minutes exposure to UV light: 70, 94 and 82 colonies
5 minutes exposure to UV light: 37, 47 and 21 colonies

- (a) Write a suitable null hypothesis for this investigation.

(2)

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(b) Calculate the mean number of bacterial colonies for each UV exposure time.

(2)

Mean number of bacterial colonies after 1 minute UV exposure

Mean number of bacterial colonies after 2 minutes UV exposure

Mean number of bacterial colonies after 3 minutes UV exposure

Mean number of bacterial colonies after 4 minutes UV exposure

Mean number of bacterial colonies after 5 minutes UV exposure

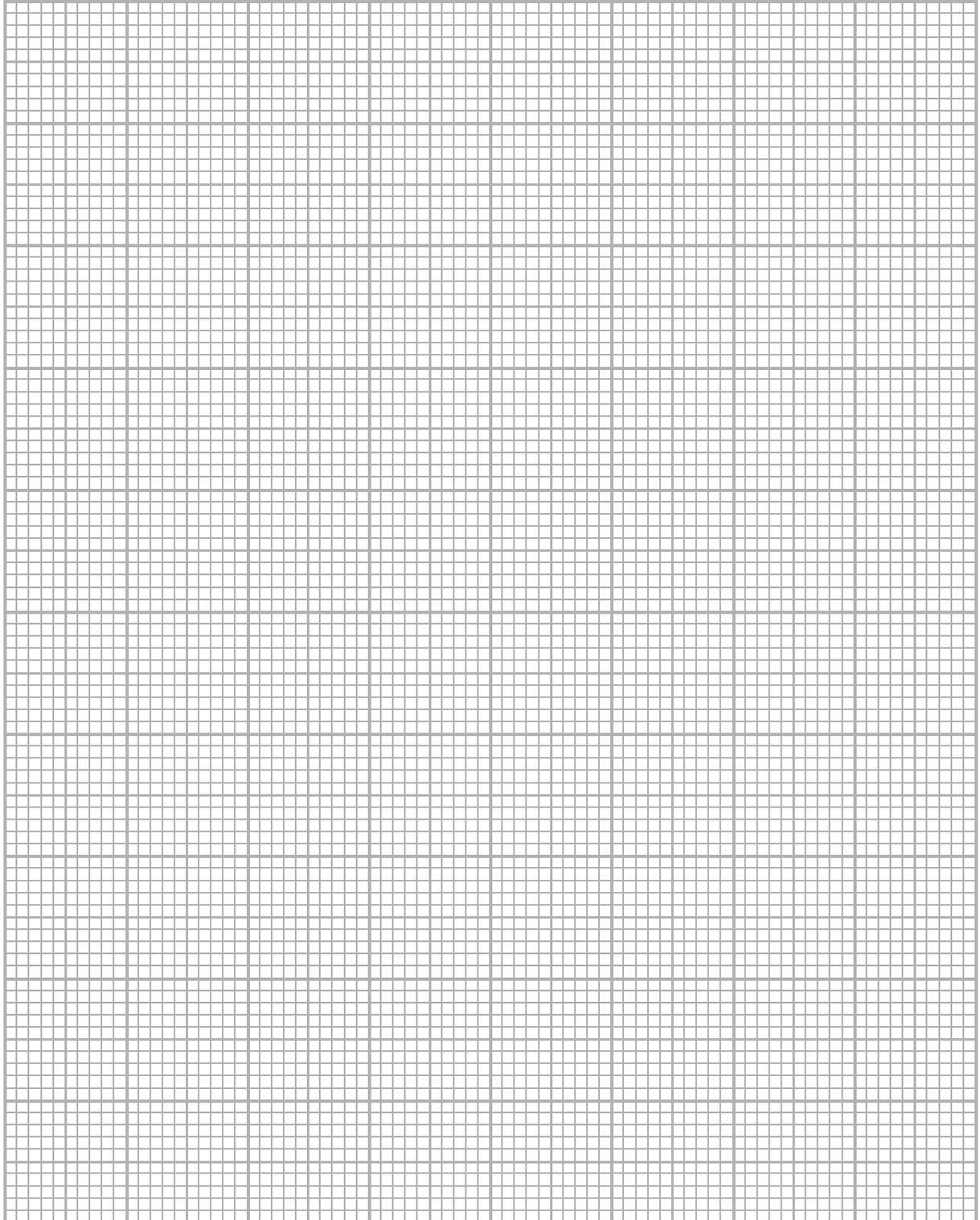
(c) Prepare a suitable table showing the **raw data and your calculated values** for the mean number of bacterial colonies.

(2)



(d) On the graph paper below, draw a suitable graph to show the effect of UV light on the survival of bacteria. Include on your graph an indication of the variability of this data.

(3)



- (e) The student used a statistical test to investigate the significance of the correlation between the exposure time to UV light and the number of bacterial colonies.

A negative correlation with a value of -0.99 was found.

The table below shows the **critical values** for a significance level of $p = 0.05$ when using this statistical test.

Number of means	Critical values for a significance level of $p = 0.05$
4	1.00
5	0.90
6	0.83
7	0.71
8	0.64
9	0.60

What conclusion can be drawn from the results of this investigation?

Use the information given and the graph you have drawn to explain your answer.

(4)

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3 Alpha-amylase is an enzyme that hydrolyses glycosidic bonds in starch.

The pigeon pea plant (*Cajanus cajan*), shown in the photograph below, produces an inhibitor of alpha-amylase. This inhibitor reduces the activity of alpha-amylase.



Magnification $\times 1$

Plan an investigation to determine which part of this plant is the best source of the inhibitor.

Your answer should give details under the following headings.

- (a) A consideration of whether there are any safety or ethical issues that you would need to take into account.

(2)

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(b) A description of appropriate preliminary practical work that you might undertake to ensure your proposed method would provide meaningful data.

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