

**Answer ALL questions in Section 1 and Section 2.
Write your answers in the spaces provided.**

SECTION 1

- 1** (a) Record your experimental results of pH, plant height and average plant height in a suitable table, using the space provided.

(3)

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(b) State **two** other observations you made about the plants you measured.

(2)

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(c) Describe how you made sure the heights of the plants were measured accurately.

(3)

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(d) Explain how rinsing the pH probe with distilled water made sure you obtained accurate pH measurements.

(3)

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(e) Calculate the percentage error of a plant height measurement you made.

(1)

Percentage error =

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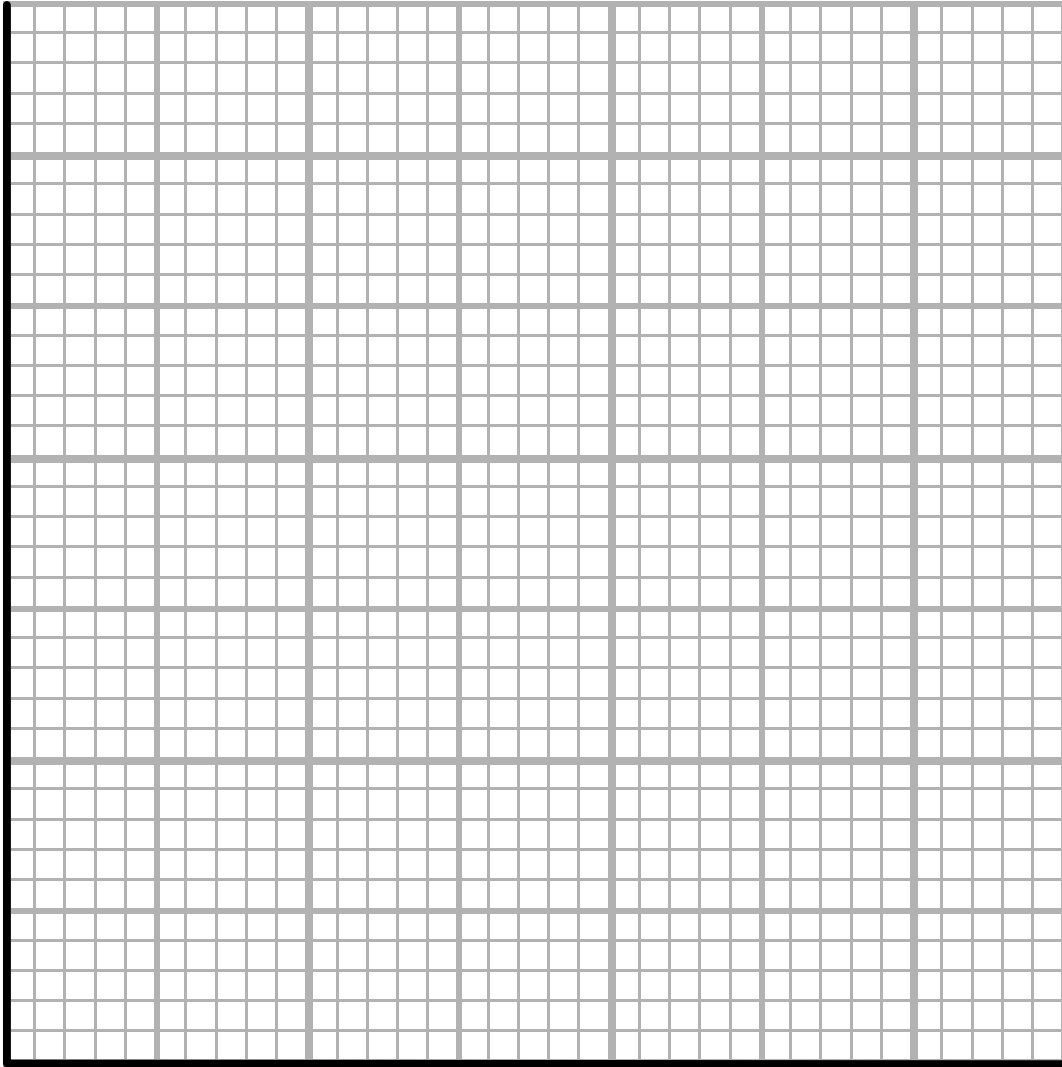
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(f) Plot a line graph of average plant height against soil pH.

(3)



(g) Describe, using the graph, how the change in soil pH affected the height of the plants you measured.

(3)

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(Total for Question 1 = 18 marks)





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- 2 (a) Your colleague carried out a similar investigation on soil from three other areas in the small, inner city nature reserve.

Your colleague planted three seeds in each soil sample.

The table shows the height of the plants grown in these soil samples.

	height of plant (mm)			
	test 1	test 2	test 3	mean
area 1	7.0	9.0	8.0	8.0
area 2	22.0	24.0	26.0	
area 3	12.0	10.0	15.0	12.3

- (i) Calculate the mean for area 2.

Show your working.

(1)

Mean =

- (ii) Calculate the standard deviation for area 2.

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{N - 1}}$$

Show your working.

(5)

Standard deviation =



(b) Your colleague used a quadrat to estimate grass cover in each area.

The percentage grass cover for the three areas is shown in the table.

area	grass cover %
1	25
2	80
3	30

(i) Give **two** reasons why the grass cover might be different in each area.

(2)

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(ii) Your colleague carries out an investigation into grass cover in the small, inner city nature reserve every year.

Their results from previous years meant they expected area 1 to have 35% grass cover.

Complete the table.

(1)

	grass cover %	no grass cover %
observed		
expected	35	

(iii) Determine, using the chi squared test, if the results are consistent with those expected.

$$\text{Use } X^2 = \sum \frac{(O - E)^2}{E}$$

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The chi squared distribution table is given.

		<i>p</i>
		0.05
degrees of freedom	1	3.841
	2	5.991
	3	7.815
	4	9.488
	5	11.070

Show your working.

(5)

(Total for Question 2 = 14 marks)



3 (a) (i) Weather is a variable that you cannot control.

Explain why this was not a factor in your investigation when comparing the different areas of the small, inner city nature reserve.

(2)

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(ii) Identify **two** other variables in your investigation that cannot be controlled.

(2)

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(b) Explain **two** ways you could extend your investigation to provide stronger support for your conclusions about the effect of soil pH on plant growth.

(4)

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(Total for Question 3 = 8 marks)

TOTAL FOR SECTION 1 = 40 MARKS

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Question 4 begins on the next page



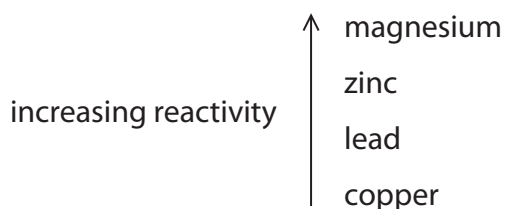
SECTION 2

4 Reactivity of metals.

A more reactive metal will displace a less reactive metal in solution.

This displacement reaction can release thermal energy.

Part of the reactivity series of metals is shown.



You have been asked to write a plan to investigate whether the displacement reactions between these metals and different metal salt solutions release thermal energy.

The metal salt solutions are magnesium sulfate, zinc sulfate, lead nitrate and copper sulfate.

Your plan should include the following details:

- a hypothesis
- selection and justification of equipment, techniques or standard procedures
- health and safety associated with the investigation
- methods for data collection and analysis to test the hypothesis including:
 - quantities to be measured
 - number and range of measurements to be taken
 - how equipment may be used
 - control variables
 - brief method for data collection analysis.

(12)

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5 When metals react with hydrochloric acid, a salt and hydrogen gas are produced.

A learner investigated the reactivity series by reacting metals with hydrochloric acid.

Here is the learner's method:

- place magnesium ribbon in a boiling tube
- add hydrochloric acid
- count the number of bubbles of hydrogen produced
- repeat for aluminium, calcium granules, copper, iron and zinc.

The results of the learner's investigation are shown in the table.

metal	number of bubbles
magnesium	72
aluminium	6
calcium	97
copper	0
iron	19
zinc	46

The learner concludes that the metals in order of reactivity are:

Most reactive calcium
 magnesium
 zinc
 iron
 aluminium
Least reactive copper

Evaluate the learner's investigation.

Your answer should make reference to the:

- method of the experiment
- results collected
- conclusion made.

(8)

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(Total for Question 5 = 8 marks)

TOTAL FOR SECTION 2 = 20 MARKS

TOTAL FOR PAPER = 60 MARKS



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