



Drawing graphs, analysing & interpreting information from experimental results, variables, controls and reliability

Graphs

Remember the **SLURP** rule.

Copy labels directly from the table column headings. Do not miss out anything, including the units.

You must put a starting value in the origin for each individual axis. This might be a zero, but not always.

Use a ruler to help you plot your points this will reduce the risk of you skipping boxes.

Remember each box on a scale must be the same value. If you have 10 boxes between 0 and 1 you must have 10 boxes between 1 and 2, 2 and 3 and so on.

Relationships

As one thing changes it affects another. You must mention both.

Variables

The only variable that can be changed is the one being investigated. Constant variables, you need to give an example not already mentioned in the question text or diagram. **Do not use the word amount.** You must say the **volume** of solution... or **the pH** of..... or the **concentration** of the the **mass** of etc.....

Control

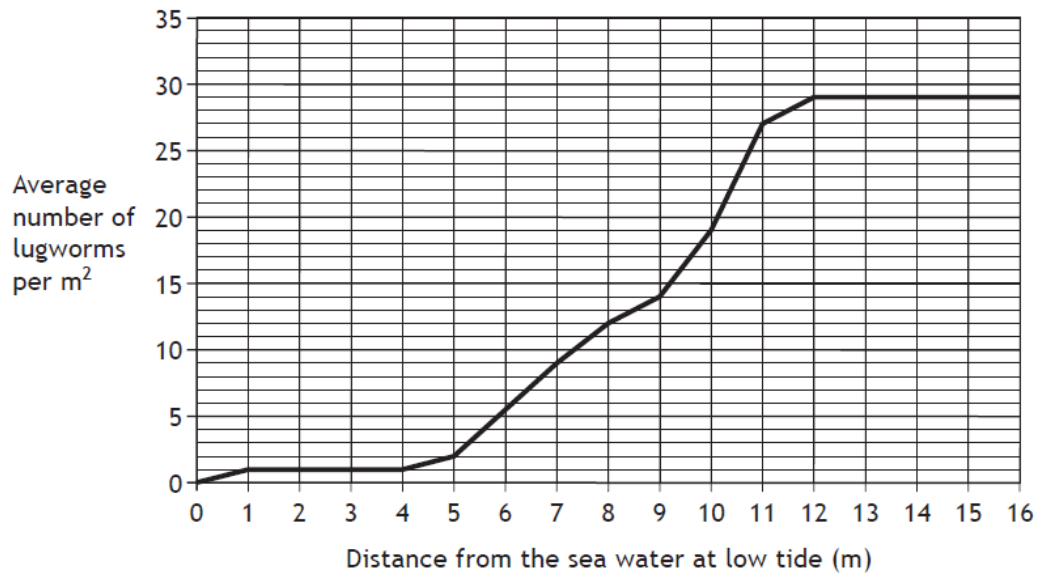
A control is set up to make a comparison. You must state that everything is set up exactly as in the experiment but without the variable being investigated. A control shows that the variable being investigated is responsible for the results.

Reliability

The results can be made more reliable by repeating the experiment in exactly the same way.



1.



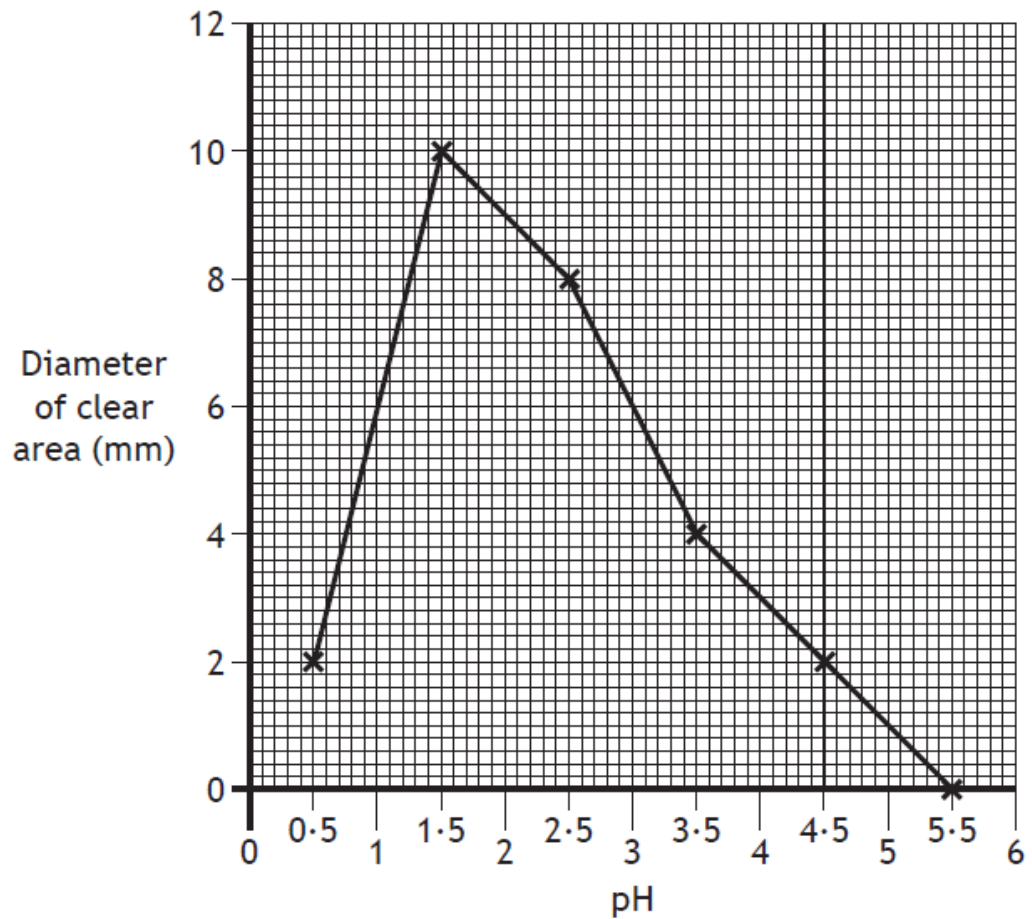
Calculate how many times greater the average number of lugworms at 11 metres is compared to 7 metres from the seawater at low tide.



2. An investigation was carried out into the effect of pH on the activity of the enzyme pepsin.

When the protein is broken down, cloudy agar becomes clear.

The results are shown in the graph.



Calculate how many times more active the enzyme is at pH 2.5 than at pH 4.5.



3. Certain varieties of potato plant are eaten by beetles, reducing the yield of potatoes. A beetle-resistant variety of potato plant was developed.

In an investigation, the beetle-resistant variety was grown outdoors in one field and the non-resistant variety grown in another.

The yields of both varieties were recorded and the results are shown in the graph below.



Calculate the difference in yield between the two varieties.

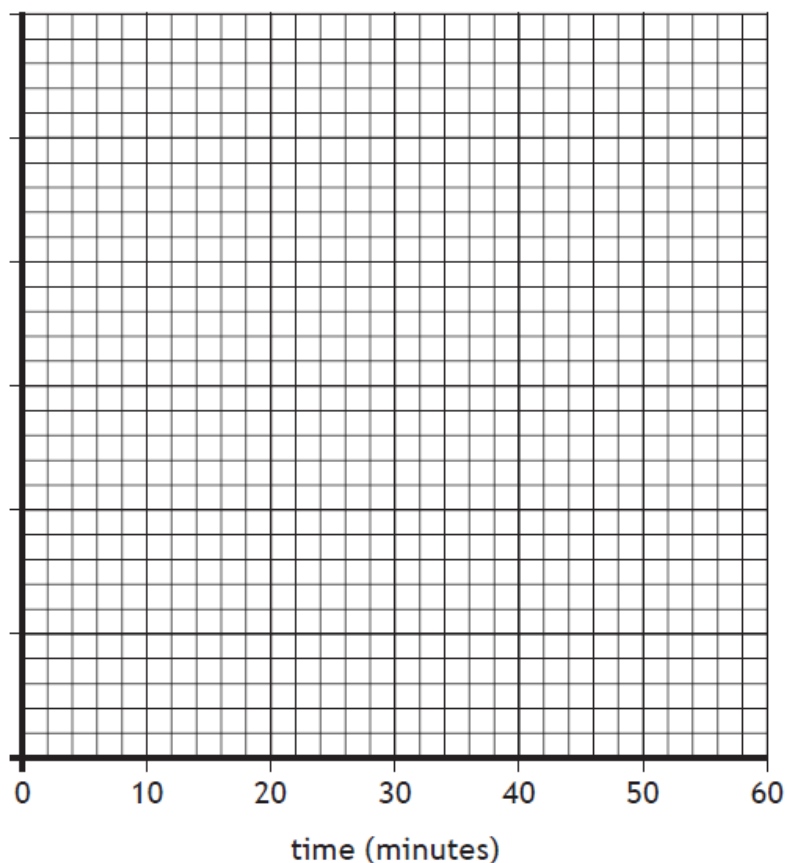


4. An investigation was carried out into the respiration of yeast. A dough was made containing live yeast and left in optimum conditions. As the yeast respired, the carbon dioxide produced caused the dough to rise. The volume of the dough was measured every 10 minutes for 60 minutes. The results are shown in the table.

Time (minutes)	Volume of dough (cm ³)
10	8
20	14
30	22
40	26
50	28
60	28

- (i) On the grid, complete the vertical axis and plot a line graph to show the effect of time on the volume of dough.

2

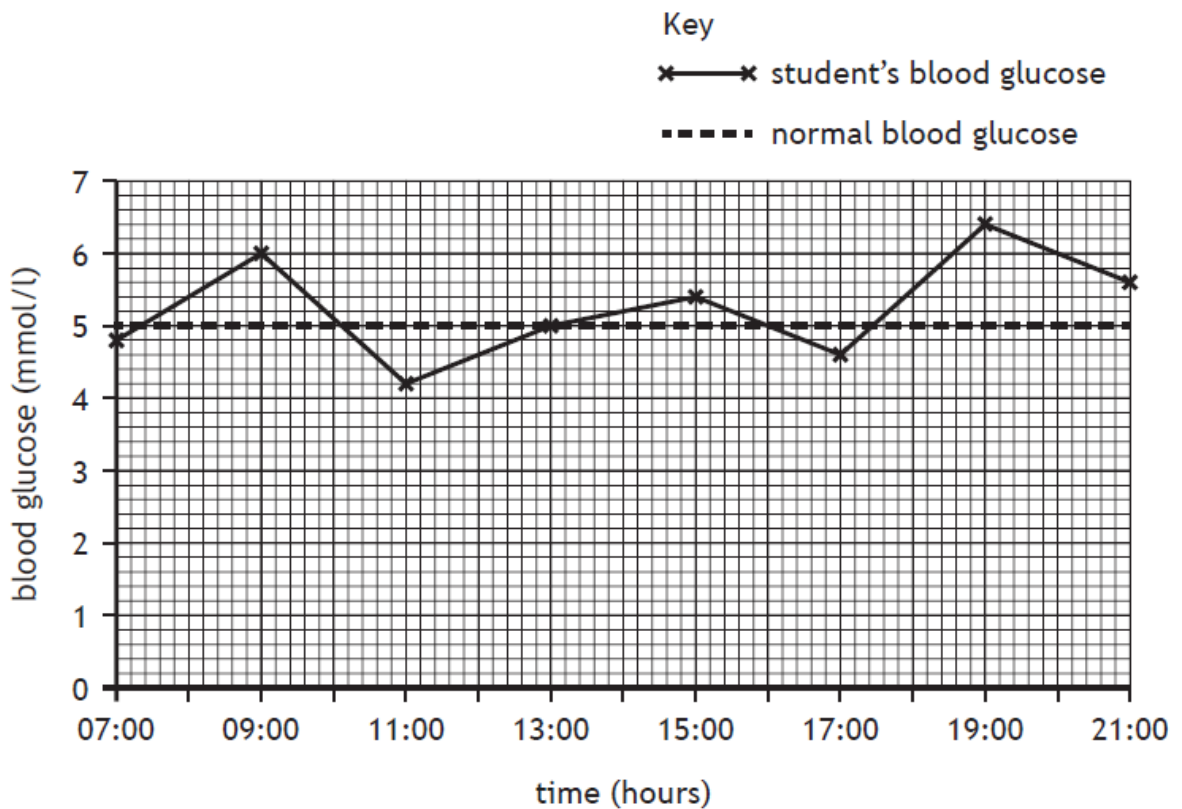




- (ii) Predict the volume of dough at 50 minutes if the experiment was carried out at a lower temperature. 1
Give a reason for your answer. 1

5. As part of a study into the health of a group of students, blood glucose readings were taken over a period of time.

The graph shows the readings for one of the students.



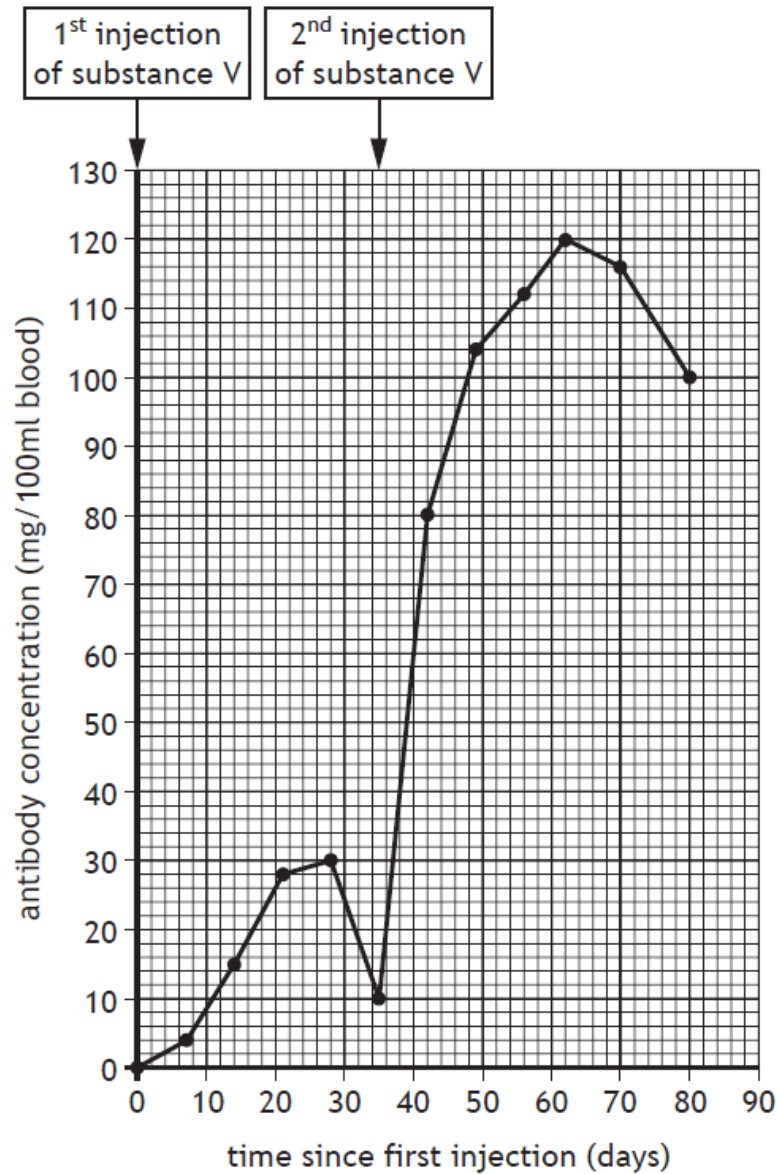
- (a) Identify the time when this student's blood glucose reached its maximum value.

1



6. In a study, volunteers were injected with substance V on day 0 and again on day 35. Substance V causes antibodies to be produced.

The graph shows the antibody concentration in the blood of one of the volunteers in response to the two injections.



- (a) Identify the maximum antibody concentration following the first injection, but before the second.

1

_____ mg/100 ml

- (b) Calculate the number of days after the second injection that it took for the antibody concentration to reach its maximum value.

1



- (c) The second injection caused a higher concentration of antibody to be produced than the first.

Give two other differences in the antibody production in response to the two injections.

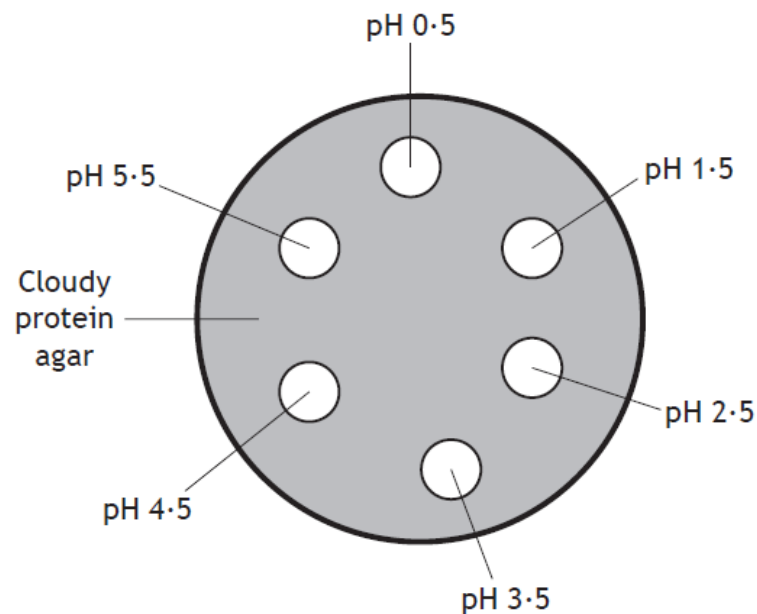
2

- (d) If the trend continues as shown in the graph, predict the antibody concentration on day 90.

1

7. An investigation was carried out into the effect of pH on the activity of the enzyme pepsin.

A Petri dish was filled with cloudy protein agar. Six holes were made in the agar and each was filled with pepsin solution at the pH values shown.



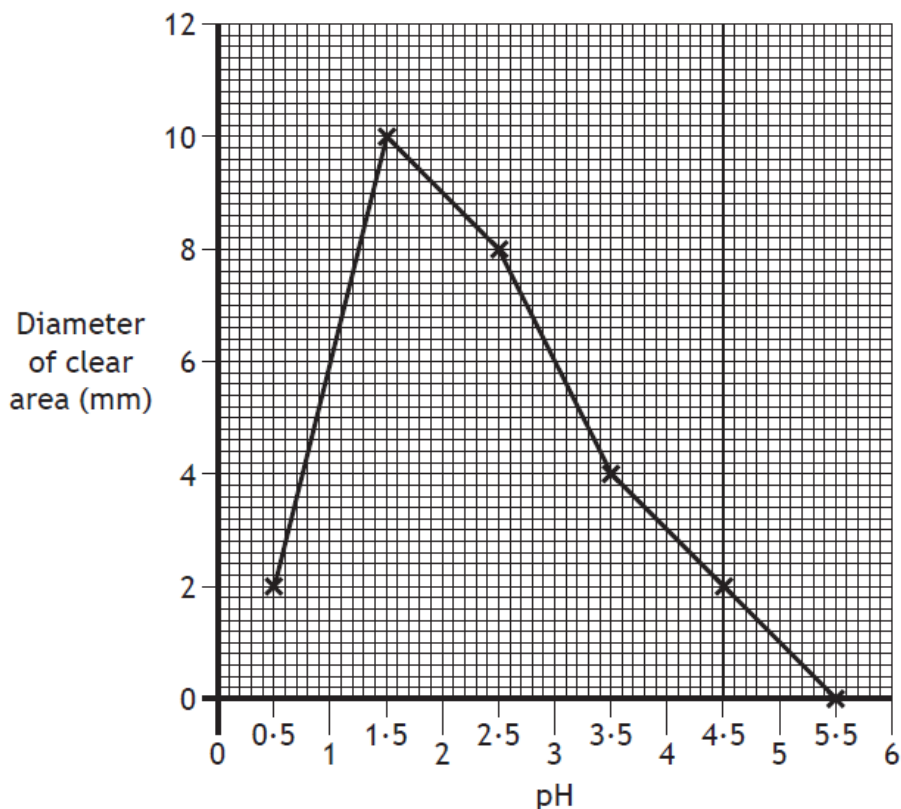


7 continued

When the protein is broken down, cloudy agar becomes clear.

The dish was examined after 24 hours and the diameter of the clear area around each hole was measured. The larger the clear area, the more active the enzyme.

The results are shown in the graph.



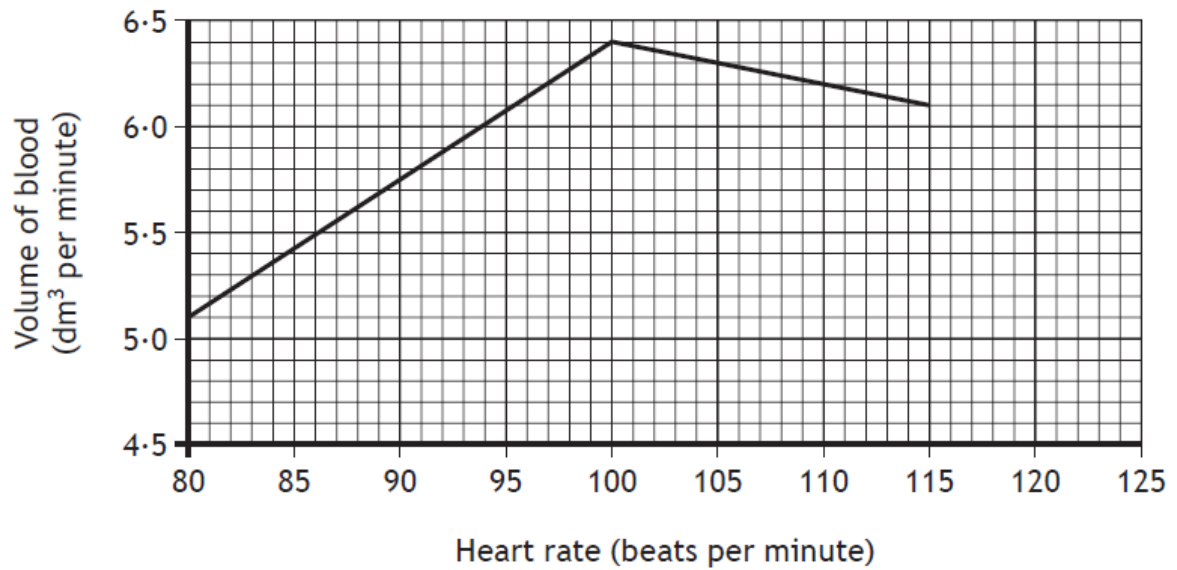
- (a) (i) Identify the optimum pH for pepsin in this experiment. 1

pH _____

- (b) State two variables which should be controlled to make this experiment valid. 2



8. The graph shows the effect of changes in heart rate on the volume of blood pumped by the left ventricle.



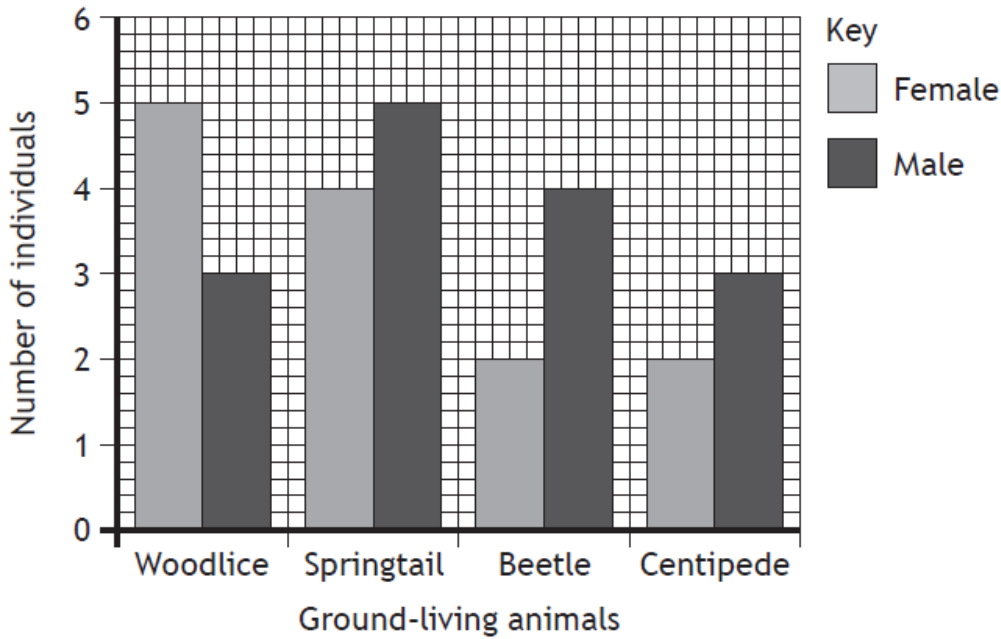
- (i) Describe the relationship between heart rate and volume of blood pumped by the left ventricle. 2
- (ii) Predict the volume of blood pumped by the left ventricle at 120 beats per minute. 1



9.

In an investigation into ground-living animals in a woodland, a group of students collected and counted the animals they found.

The students sorted the animals into male and female, counted them and recorded the results in a bar graph.



(a)

- 1 Identify the animal which had the greatest overall abundance. 1

- 2 The students concluded that males were always more abundant than females.

Identify the animal for which this is not true. 1

- (b) It was decided that the samples were not fully representative of the area.

Suggest how the investigation could be improved. 1



9 continued

(b) The distribution of organisms may be affected by abiotic factors.

The table shows the results of a study into the effect of soil moisture levels on the distribution of three species of plant.

Sample site	Soil moisture (units)	Number of plants		
		Species E	Species F	Species G
1	20.2	11	15	12
2	23.4	13	14	11
3	22.1	12	16	10
4	24.5	15	17	15
5	26.6	18	13	12
6	28.4	19	15	14

State which species has its distribution most affected by the soil moisture levels.

1

10. A student set up an investigation into the effect of temperature on the rate of photosynthesis in a green plant, by measuring the volume of oxygen released in one hour.

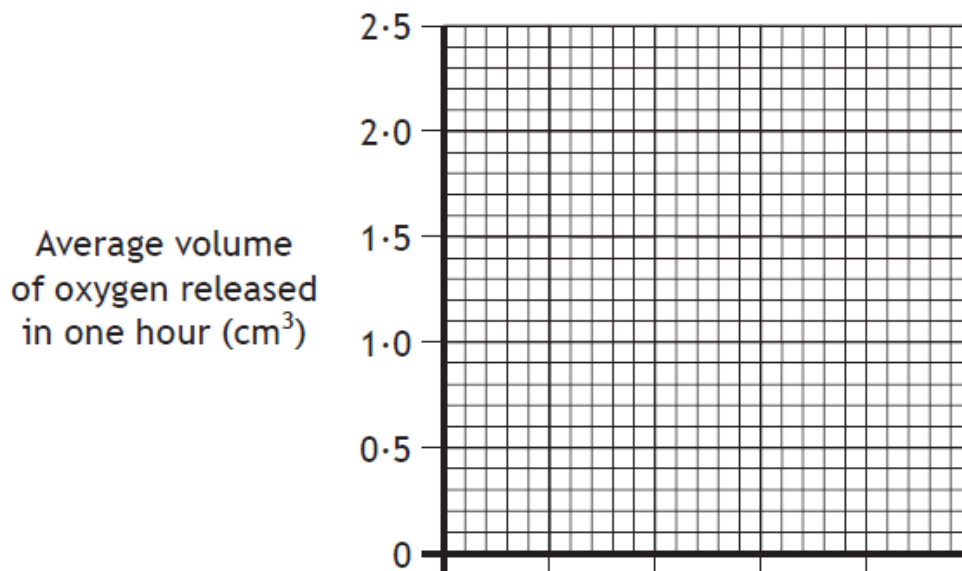
The results are shown in the table.

Temperature (°C)	Volume of oxygen released in one hour (cm ³)		
	Experiment 1	Experiment 2	Average
10	0.7	0.5	0.6
20	1.6	1.4	1.5
30	2.7	1.9	2.3
40	2.0	2.6	2.3
50	0.3	0.5	0.4

10 continued

- (a) On the grid, plot a line graph to show the effect of temperature on the average volume of oxygen released in one hour.

2



- (b) Predict the average volume of oxygen released in one hour if the experiment was carried out at a temperature of 60 °C.

1

11. Catalase, an enzyme found in living tissues, is involved in the breakdown of hydrogen peroxide into water and oxygen.

In an investigation, catalase was extracted in solution from a variety of tissues and used to soak paper discs. These discs were then dropped into beakers of hydrogen peroxide, as shown in Diagram 1. As the oxygen was released the discs returned to the surface, as shown in Diagram 2.

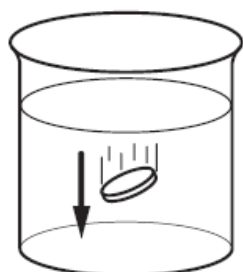


Diagram 1

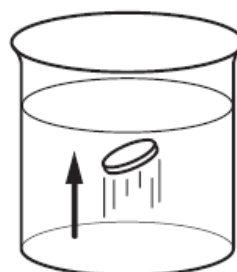


Diagram 2



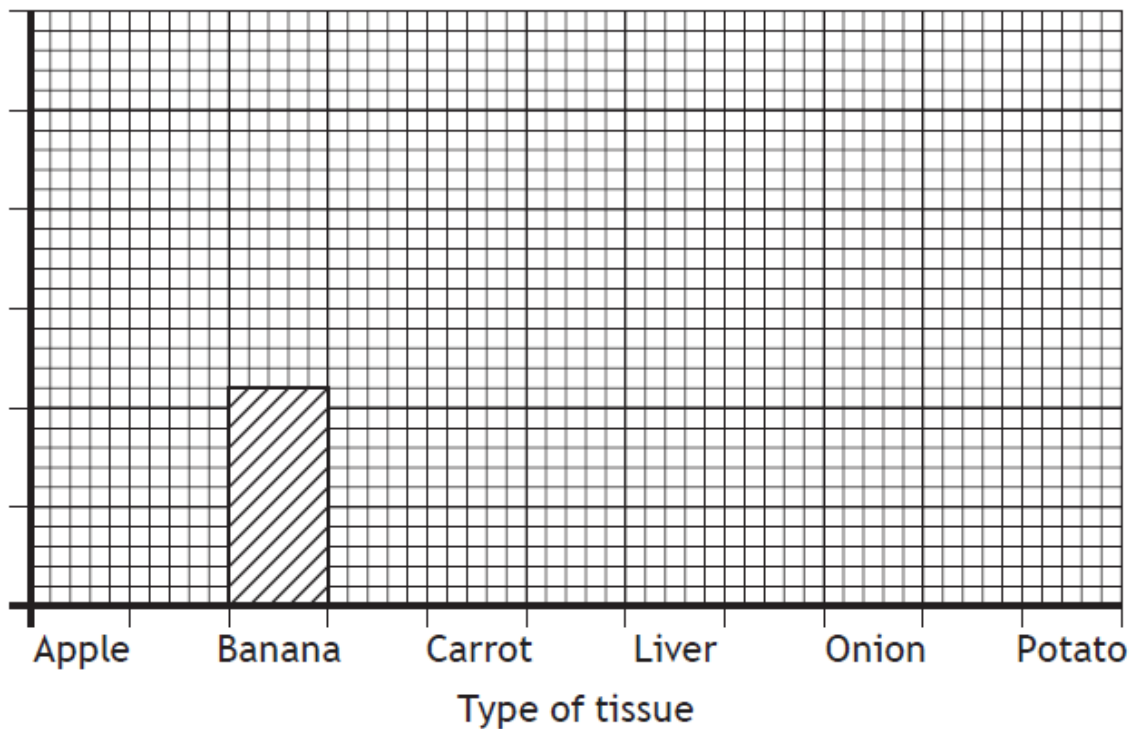
11 continued

The time taken for these discs to return to the surface was recorded and shown in the table.

Type of tissue	Time for disc to return to the surface (s)
Apple	108
Banana	44
Carrot	68
Liver	8
Onion	70
Potato	72

- (a) On the grid below, complete the vertical axis and the remaining bars to show the time taken for the discs to return to the surface, for each tissue.

2





11 continued

- (b) The aim of the experiment was to investigate catalase activity in a variety of tissues.

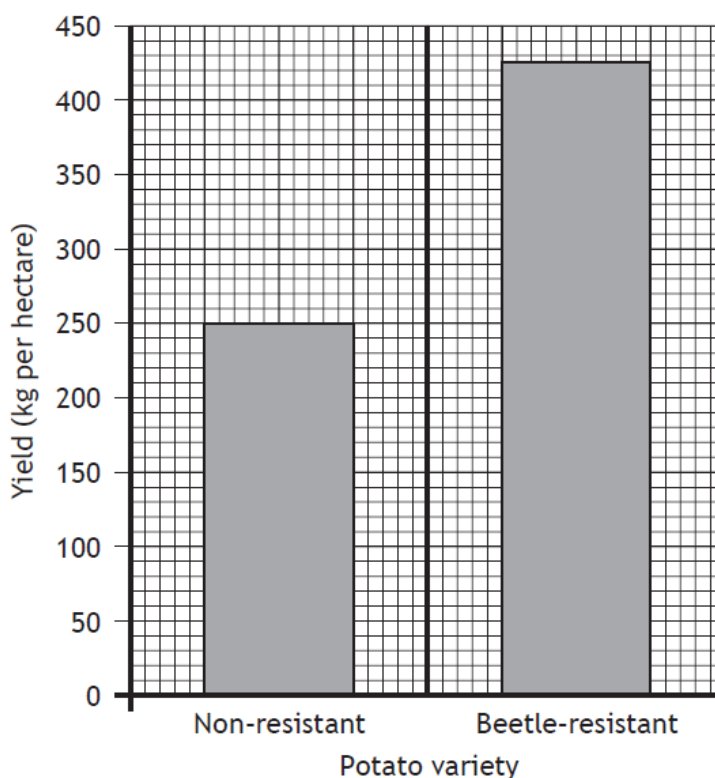
Using the information given, write an appropriate conclusion for this experiment.

1

12. Certain varieties of potato plant are eaten by beetles, reducing the yield of potatoes. A beetle-resistant variety of potato plant was developed.

In an investigation, the beetle-resistant variety was grown outdoors in one field and the non-resistant variety grown in another.

The yields of both varieties were recorded and the results are shown in the graph below.



- (a) Describe how the reliability of these results could be increased.

1

- (b) Identify a variable that would have to be kept the same between the two fields to ensure the results were valid.

1

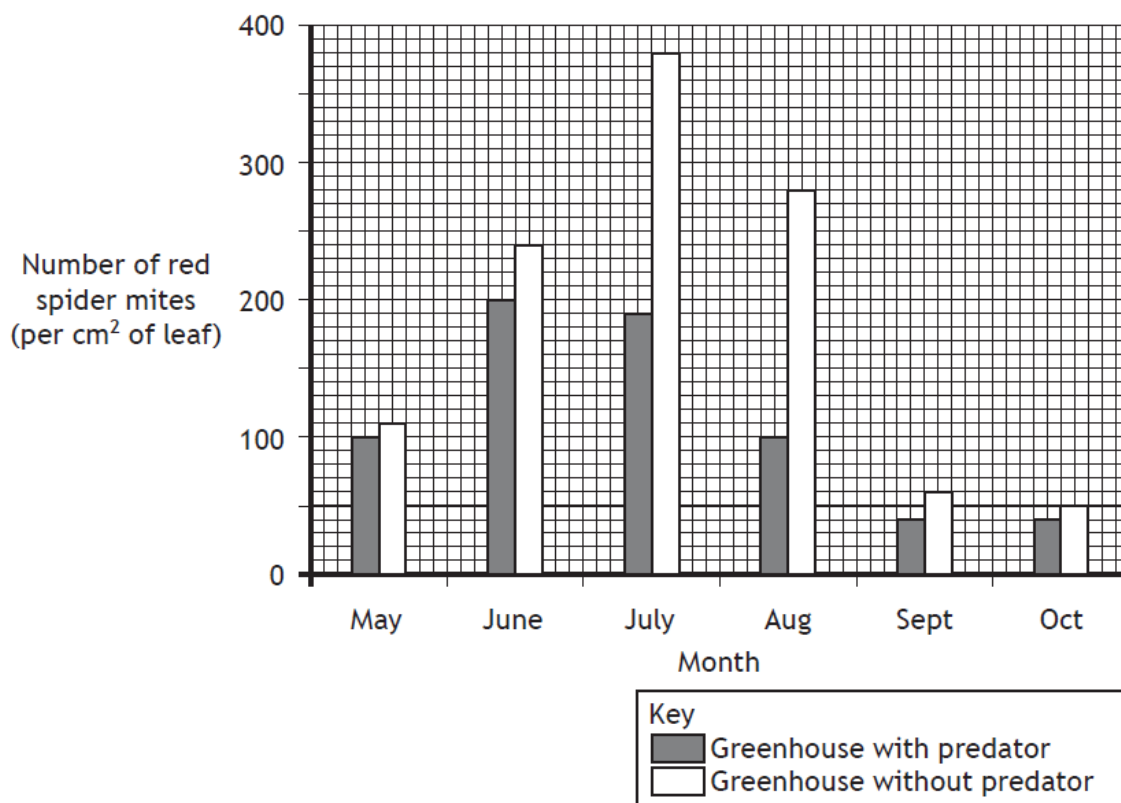
13.

Red spider mites are a common pest which destroy tomato plants. Some of the mites are resistant to chemical pesticides.



Tomato growers aimed to investigate whether a predator would reduce the spider mite numbers in their greenhouses. Two identical greenhouses were used and the predator was released into only one greenhouse.

The results are shown in the graph below.



(i) With reference to the aim of this investigation, give the conclusion that the tomato growers would have drawn from these results. 1

(ii) The greenhouse containing tomato plants without predators was included as a control experiment.

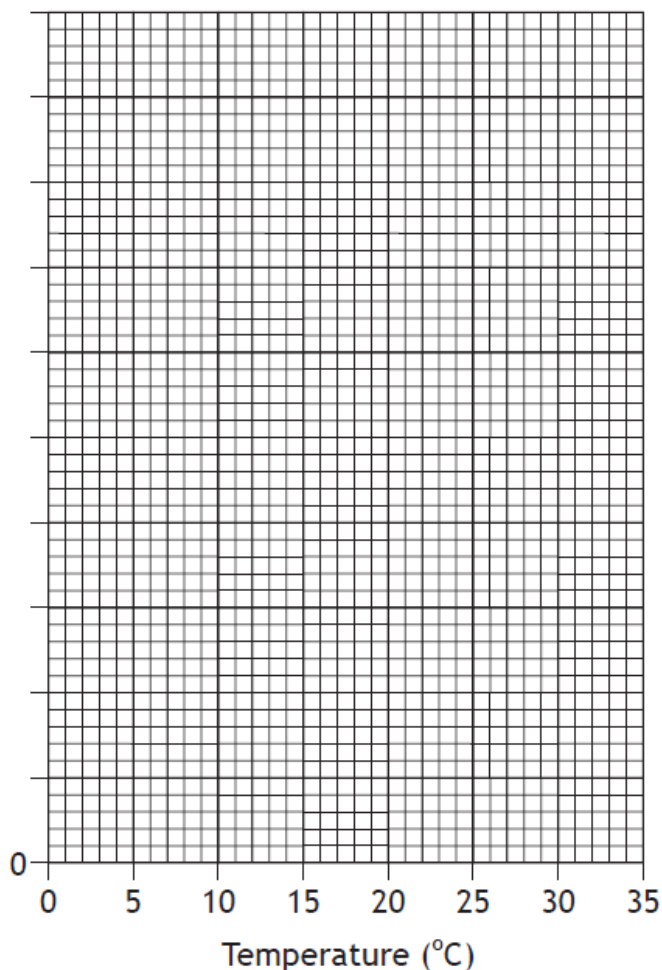
State the purpose of the control in this investigation. 1



14. An experiment was set up to find out the optimum temperature for the growth of tomatoes in a glasshouse. The following table gives the results of this experiment.

<i>Temperature (°C)</i>	<i>Fresh mass of tomatoes (g/plant)</i>	<i>Dry mass of tomatoes (g/plant)</i>
14	1000	50
18	8300	415
22	9000	450
26	2200	110
32	1600	80

- (i) On the grid below, complete the vertical axis and plot a line graph to show the effect of temperature on the dry mass of tomatoes. 2





14 continued

- (ii) Above 26 °C the drop in the fresh mass of tomatoes continues at a steady rate.

Using the information in the table, predict the fresh mass of tomatoes which will be produced at 35 °C.

1

15. Students carried out an investigation into the effect of soil moisture on the percentage ground cover of moss in their school lawn.

A quadrat was used to estimate the percentage ground cover of moss at several sites. Soil moisture was also measured at each of the sites.

The results of the investigation are shown in the table.

Sample site	Average soil moisture (%)	Ground cover of moss (%)
1	18	86
2	14	70
3	15	80
4	11	58
5	13	65
6	12	60
7	22	98
8	30	99
9	35	100

- (a) Describe the relationship between average soil moisture and percentage ground cover of moss.

1

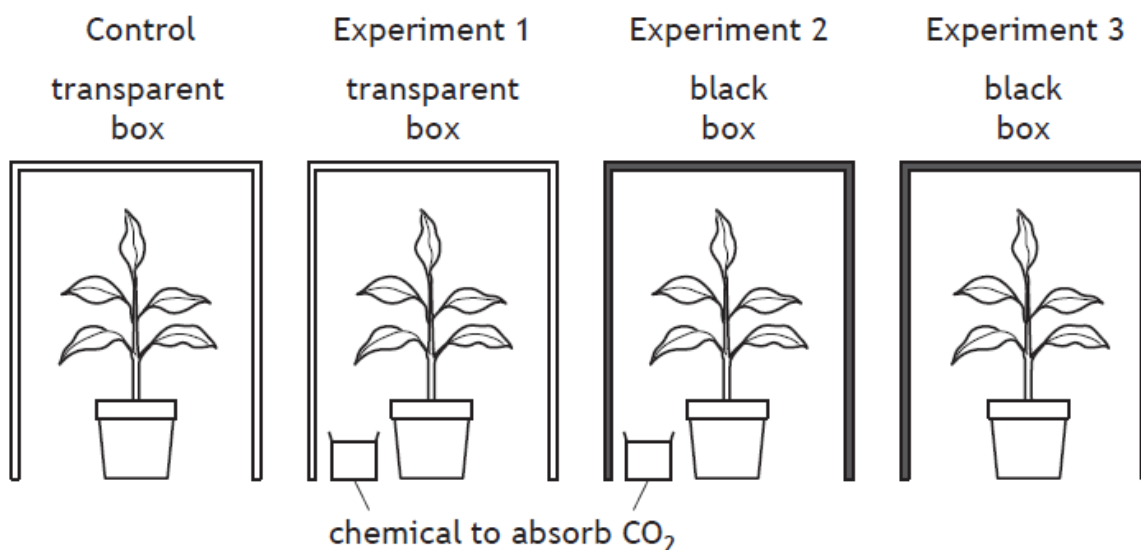
-
- (b) Describe how the reliability of these results could be increased.

1

16. An investigation was carried out into the conditions needed for photosynthesis.

Before starting the investigation, four plants were de-starched by placing them in the dark for 24 hours.

The plants were then placed in the conditions shown and then left for 48 hours.



The leaves of each plant were then tested for the presence of starch.

(a) (i) Tick the box(es) to show in which of the following starch would be present after 48 hours. 1

Control

Experiment 1

Experiment 2

Experiment 3

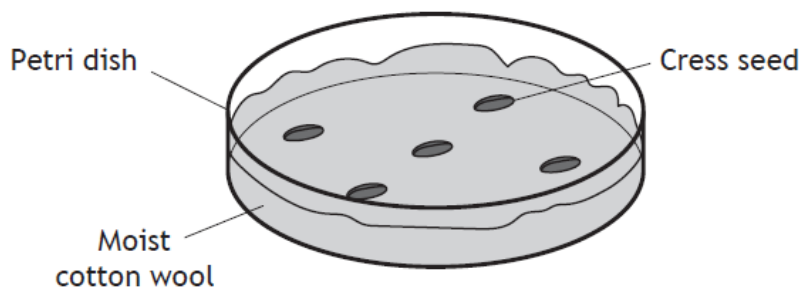
(ii) Explain the purpose of the control. 1

(iii) Explain why experiment 2 is invalid. 1

(iv) State the factor that is being investigated in experiment 3. 1

17. To investigate the effect of competition on the growth of cress seeds, five Petri dishes, labelled A–E, were set up and left for six days. Each dish contained a layer of moist cotton wool with different numbers of cress seeds sown evenly across its surface.

Dish A is shown in the diagram.

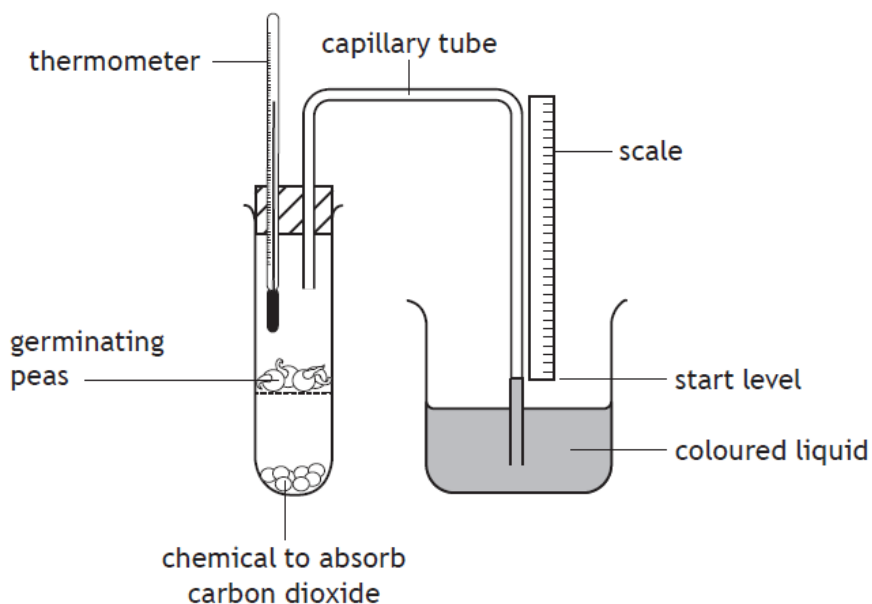


The results are shown in the table.

<i>Dish</i>	<i>Number of seeds sown</i>	<i>Number of seedlings surviving after six days</i>	<i>Percentage of seedlings surviving after six days</i>
A	5	5	100
B	10	10	100
C	20		95
D	40	34	85
E	80	60	75

Describe the relationship between the number of seeds sown and the percentage of seedlings surviving after six days.

18. A student investigated the effect of temperature on the rate of respiration in germinating (growing) peas. Using the arrangement shown, four respirometers labelled A–D were set up at the temperatures shown in the table below.



The level of the coloured liquid was measured on the scale at the start of the investigation and again after 20 minutes. The rise in liquid level was due to oxygen uptake by the germinating peas. The results are shown in the table.

<i>Respirometer</i>	<i>Temperature (°C)</i>	<i>Contents</i>	<i>Rise in liquid level (mm)</i>	<i>Rate of oxygen uptake (mm per minute)</i>
A	15	Germinating peas	14	0.7
B	15	Dead peas	0	0
C	25	Germinating peas	26	
D	25	Dead peas	0	0

Respirometers B and D were set up as control experiments.

Describe the purpose of the controls in this investigation.



19. Type 1 diabetes occurs if the body does not produce any or enough insulin.

People with Type 1 diabetes need to inject insulin.

The table contains information about some of the different types of insulin available.

<i>Type of insulin</i>	<i>Time for insulin to start working</i>	<i>Time for insulin levels to peak</i>	<i>Duration in blood (hours)</i>
P	1 hour	No peak	20–26
Q	1–3 hours	8 hours	12–16
R	30–60 minutes	2–4 hours	5–8
S	15 minutes	30–90 minutes	3–5

Using information from the table, answer the following questions.

(i) A fast acting type of insulin can be injected just before meals.

Identify the type of insulin that is best suited for this.

1

(ii) Another type of insulin can be injected once a day to provide a steady supply of insulin to the body.

Identify the type of insulin that would be most effective at doing this.

1



20. Levels of air pollution can be estimated by the presence or absence of organisms called lichens.

<i>Air pollution level</i>	<i>Most common type of lichen present</i>
Low	Shrubby
Medium	Leafy
High	Crusty

Environmental scientists carried out a study on lichen species at four different sites and obtained the results shown in the table below.

<i>Site</i>	<i>Number of lichen species present</i>		
	<i>Shrubby</i>	<i>Leafy</i>	<i>Crusty</i>
A	0	5	19
B	3	2	0
C	16	3	0
D	7	14	2

Site A had the highest levels of air pollution.

Using information from **both** tables, describe the evidence supporting this statement.



21. Nutritional information helps people make an informed choice about the food they eat.

Table 1 – Label from a bar of chocolate

<i>Nutritional information</i>	<i>per 100 g</i>	<i>per bar</i>	<i>% RI*</i>
Energy (kJ)	2251	630	7.5
Sugar	65 g	18 g	15.6
Protein	10 g	2.8 g	3
Total fat	25 g	7 g	10
Saturated fat	20 g	5.6 g	28
Salt	0.4g	0.1 g	1.7

*RI = Reference Intake (formerly “guideline daily amount”)

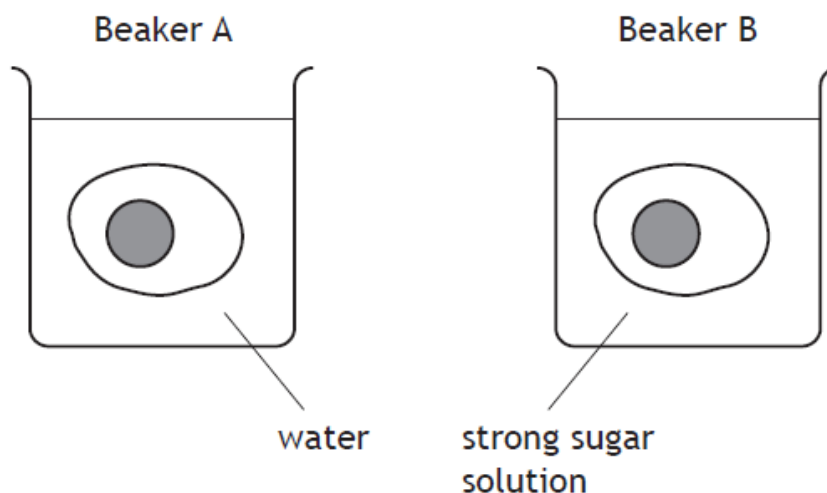
Table 2 – Guidelines on salt content

<i>Salt category</i>	<i>Salt content (g/100 g)</i>
High	More than 1.5
Medium	0.3 to 1.5
Low	Less than 0.3

Using information from Table 1 and Table 2, identify the salt category to which this chocolate bar belongs.

22. Shells can be removed from eggs by dissolving them in vinegar for 2–3 days. The egg contents remain inside a thin membrane.

In an investigation the shells from two eggs were removed. The eggs were then weighed and placed in beakers as shown below.



After 2 hours the eggs were removed from the beakers, blotted dry and reweighed. The results are shown in the following table.

<i>Beaker</i>	<i>Mass at start (g)</i>	<i>Mass after 2 hours (g)</i>	<i>Percentage change in mass</i>
A	54.0	67.5	
B	52.1	47.8	-8.2

Suggest why the eggs were blotted dry before being reweighed.

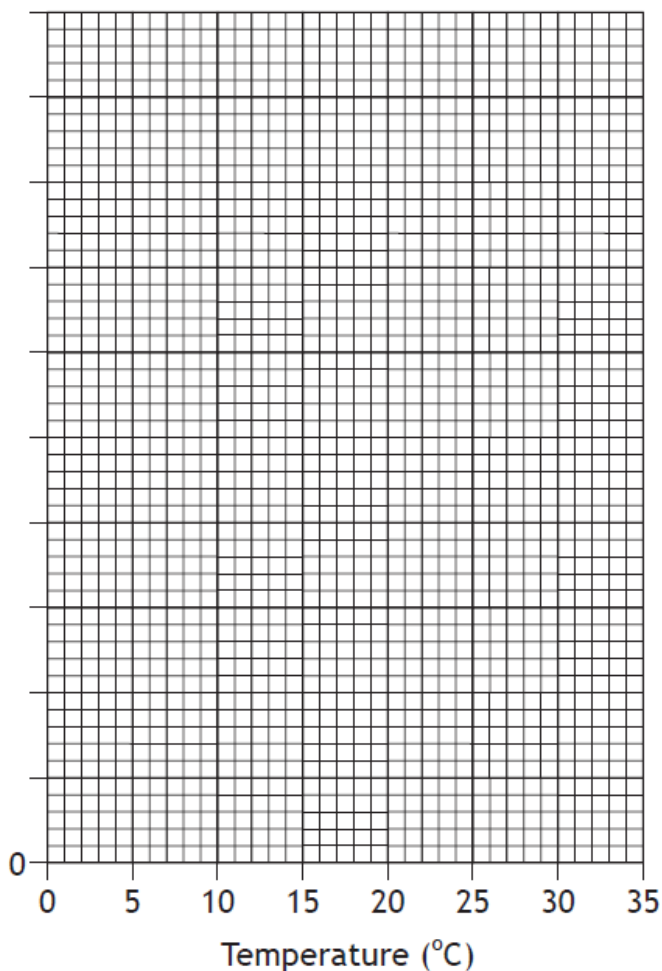
1



23. An experiment was set up to find out the optimum temperature for the growth of tomatoes in a glasshouse. The following table gives the results of this experiment.

Temperature (°C)	Fresh mass of tomatoes (g/plant)	Dry mass of tomatoes (g/plant)
14	1000	50
18	8300	415
22	9000	450
26	2200	110
32	1600	80

(i) On the grid below, complete the vertical axis and plot a line graph to show the effect of temperature on the dry mass of tomatoes. 2



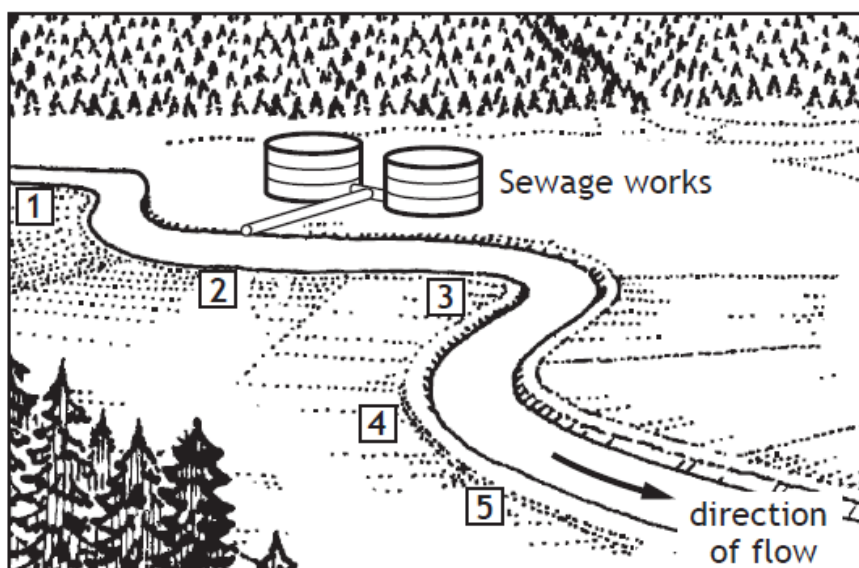
23 continued

- (ii) Above 26 °C the drop in the fresh mass of tomatoes continues at a steady rate.

Using the information in the table, predict the fresh mass of tomatoes which will be produced at 35 °C.

1

24. A river was sampled at five sites as shown in the diagram below.



The following tables show the results of analysing the samples at each site.

Table 1

Site	Oxygen levels (Units)	Number of bacteria per 100ml
1	1.2	500
2	0.04	150 000
3	0.40	12 680
4	0.54	3 400
5	1.12	1 250



24 continued

Table 2

Organism Present	Site 1	Site 2	Site 3	Site 4	Site 5
Mayfly nymphs	23	0	0	0	8
Stonefly nymphs	42	0	0	0	21
Caddis fly larvae	18	0	0	10	15
Fresh water shrimp	2	0	0	1	1
Blood worms	1	5	24	7	1
Sludge worms	1	67	43	9	0

- (a) (i) Using data from Table 1, describe the relationship between the number of bacteria and the oxygen level in the water. 1
- (ii) Methylene blue is a chemical which can be used to compare oxygen levels in the water. The lower the oxygen level, the faster methylene blue changes from blue to colourless.
A sample of water from each of the five sites was tested.
Predict which sample would lose its blue colour fastest. 1
- (b) Use data from Tables 1 and 2 to answer the following questions.
- (i) State which of the organisms in the samples would be found in areas of high oxygen content. 1
- (ii) Sewage in the river is a form of water pollution.
Describe the effect this pollution has on the number of different types of organisms in this river. 1



25. Five leaves were collected from a horizontal stem and another five from a vertical stem. The widths of the leaves were measured and the results are shown in the table below.

leaf	Leaf width (mm)	
	Horizontal stem	Vertical stem
1	52	32
2	60	34
3	56	35
4	50	44
5	52	35
average	54	

The results show that leaves from a horizontal stem are bigger than leaves from a vertical stem.

Give a reason why these results might not be reliable.

1

26. Researchers have discovered an advantageous genetic mutation that causes high bone density in humans.

One man in the USA was discovered to possess this mutation after he walked away without injury from a serious car crash. Further studies have found several members of the same extended family with this mutation.



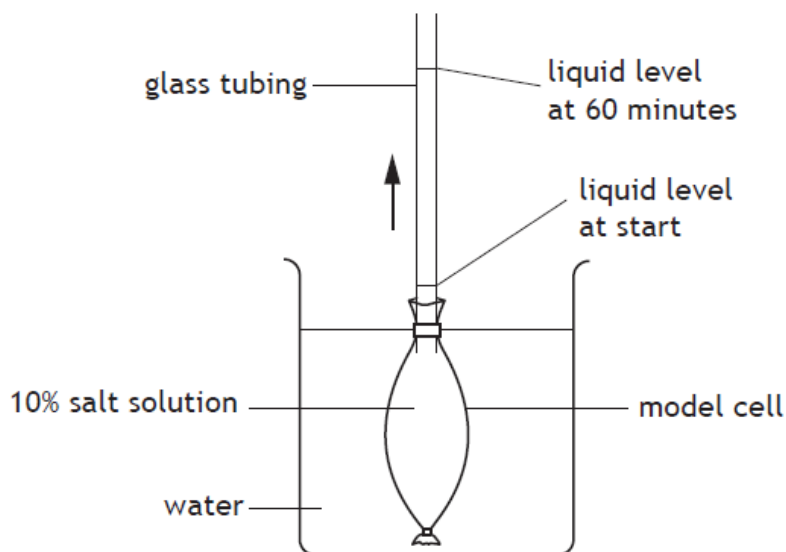
20 members of the family provided blood samples for DNA and biochemical testing. 7 of them were found to have high bone density. The same tests were performed on another group of 20 unrelated individuals with normal bone density.

The location of the gene mutation was able to be identified and it is hoped that the findings will help in developing medications to increase bone density for the treatment of conditions such as osteoporosis.

Explain why the biochemical tests were also performed on the 20 individuals with normal bone density.

1

27. The apparatus shown below was used to investigate the movement of water into and out of a model cell. The model cell had a selectively permeable membrane.



The liquid level in the glass tubing was measured every 10 minutes for 60 minutes.

The results are shown in the table below.

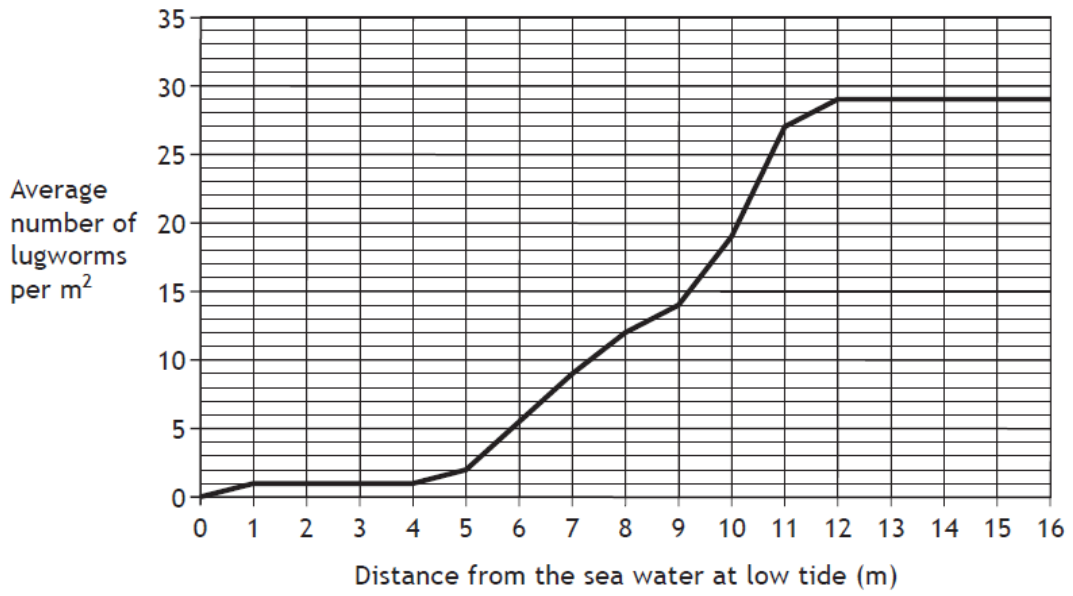
<i>Time (minutes)</i>	<i>Liquid level (mm)</i>
0	10
10	22
20	32
30	40
40	48
50	56
60	64

When the investigation was repeated, the average rate of movement of liquid was slower.

Suggest one difference in the way that the investigation was set up that could have caused this change in results.



28.



Describe the relationship between the distance from the seawater at low tide and the average number of lugworms per m².

2