GCSE Biology Trilogy (H)



Required Practical Question Book

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| **Name:** | **Class:** | **Teacher:** |

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**Required Practical 1: Microscopy**

**Use a light microscope to observe, draw and label a selection of plant and animal cells.**

1. The image below shows some muscle cells from the wall of the stomach, as seen through a light microscope.



(a)     Describe the function of muscle cells in the wall of the stomach.

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 **(2)**

(b)     **Figure above** is highly magnified. The scale bar in **Figure above** represents 0.1 mm.

Use a ruler to measure the length of the scale bar and then calculate the magnification of **Figure above**.

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Magnification = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ times

**(2)**

(c)     The muscle cells in **Figure above** contain many mitochondria.

What is the function of mitochondria?

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 **(2)**

(d)     The muscle cells also contain many ribosomes. The ribosomes cannot be seen in **Figure above**.

(i)      What is the function of a ribosome?

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**(1)**

(ii)     Suggest why the ribosomes **cannot** be seen through a light microscope.

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**(1)**

1. The image below shows part of the surface of a leaf.



The length and width of this piece of leaf surface are both 0.1 mm.

(a)      Calculate the number of stomata per mm2 of this leaf surface.

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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ per mm2

**(2)**

1. (a)     The cheek cell in **Figure 2** is magnified 250 times.

The width of the cell is shown by the line **D** to **E**.

**Figure 2**



Calculate the width of the cheek cell in micrometres (µm).

Complete the following steps.

Measure the width of the cell using a ruler        \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mm

Use the equation to work out the real width of the cell in mm:

**real size   =**                           \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mm

Convert mm to µm                                           \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ µm

**(3)**

(b)     A red blood cell is 8 µm in diameter.

A bacterial cell is 40 times smaller.

Calculate the diameter of the bacterial cell.

|  |  |
| --- | --- |
| Tick **one** box. |   |
|   0.02 µm | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/QSP181F03_files/img03.png |
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|   2.0 µm | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/QSP181F03_files/img03.png |
| 20.0 µm | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/QSP181F03_files/img03.png |

**(1)**

1. The photograph shows a red blood cell.



 (a)     The average diameter of a real red blood cell is 0.008 millimetres.
On the photograph, the diameter of the red blood cell is 100 millimetres.

          Use the formula to calculate the magnification of the photograph.

Diameter on photograph = Real diameter × Magnification

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Magnification = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

**Required Practical 2: Osmosis**

**Investigate the effect of a range of concentrations of salt/sugar solutions on the mass of plant tissue.**

1. A student investigated the effect of different sugar solutions on potato tissue.

This is the method used.

1.        Add 30 cm3 of 0.8 mol dm−3 sugar solution to a boiling tube.

2.        Repeat step **1** with equal volumes of 0.6, 0.4 and 0.2 mol dm−3 sugar solutions.

3.        Use water to give a concentration of 0.0 mol dm−3.

4.        Cut five cylinders of potato of equal size using a cork borer.

5.        Weigh each potato cylinder and place one in each tube.

6.        Remove the potato cylinders from the solutions after 24 hours.

7.        Dry each potato cylinder with a paper towel.

8.        Reweigh the potato cylinders.

The table below shows the results.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Concentration of sugar solution in mol dm−3** | **Startingmass in g** | **Final massin g** | **Change ofmass in g** | **Percentage(%) change** |
| 0.0 | 1.30 | 1.51 |  0.21 | 16.2 |
| 0.2 | 1.35 | 1.50 |  0.15 | **X** |
| 0.4 | 1.30 | 1.35 |  0.05 |  3.8 |
| 0.6 | 1.34 | 1.28 | −0.06 | −4.5 |
| 0.8 | 1.22 | 1.11 | −0.11 | −9.0 |

(a)     Calculate the value of **X** in the table above.

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Percentage change in mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ %

**(2)**

(b)     Why did the student calculate the percentage change in mass as well as the change in grams?

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**(1)**

(c)     Complete the graph using data from the table above.

•        Choose a suitable scale and label for the *x*-axis.

•        Plot the percentage (%) change in mass.

•        Draw a line of best fit.



**(4)**

(d)     Use your graph to estimate the concentration of the solution inside the potato cells.

Concentration = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mol dm−3

**(1)**

(e)     The results in the table above show the percentage change in mass of the potato cylinders.

Explain why the percentage change results are positive **and** negative.

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 **(3)**

(f)     Suggest **two** possible sources of error in the method given above.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

1. Some students set up this experiment to investigate osmosis. They filled two pieces of visking tubing with different liquids and left them both in a beaker of *5%*sucrose solution for an hour.



          (a)     Describe and explain the likely results after one hour.

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 **(6)**

**Required Practical 3: Enzymes**

**Investigate the effect of pH on the rate of reaction of amylase enzyme.**

1. Fresh milk is a mixture of compounds including fat, protein and about 5 % lactose sugar. Lactose must be digested by the enzyme lactase, before the products can be absorbed.

Lactase can be added to fresh milk to pre-digest the lactose. This makes ‘lactose-free’ milk, which is suitable for people who do not produce enough lactase of their own.

A student investigated the effect of changing pH and temperature on the digestion of lactose in milk.

The results are shown in **Tables** **1** and **2**.

|  |  |  |
| --- | --- | --- |
| **Table 1Effect of pH** |   | **Table 2Effect of temperature** |
| **pH** | **Time taken todigest lactose inminutes** |   | **Temperaturein°C** | **Time taken todigest lactosein minutes** |
| 4.0 | 20 |   | 30 | 20 |
| 5.0 | 18 |   | 35 | 14 |
| 6.0 | 13 |   | 40 | 11 |
| 7.0 | 7 |   | 45 | 6 |
| 8.0 | 5 |   | 50 | 12 |
| 9.0 | 6 |   | 55 | 23 |

(a)     The label on a carton of lactose-free milk states: ‘Lactase is normally produced in the stomach of mammals.’ The results in **Table 1** show that this statement is unlikely to be true.

Explain how.

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**(2)**

(b)     Explain as fully as you can the results shown in **Table 2**.

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**(3)**

1. Some students investigated the effect of pH on the digestion of boiled egg white by an enzyme called pepsin. Egg white contains protein.

The students:

•        put a glass tube containing boiled egg white into a test tube

•        added a solution containing pepsin at pH 7

•        set up six more tubes with solutions of pepsin at different pH values

•        left the test tubes for 24 hours at room temperature.

The image below shows one of the test tubes, at the start and at the end of the 24 hours.



                                          At start                                   24 hours later

(a)     (i)      Name the product of protein digestion.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     What type of enzyme digests protein?

Tick () **one** box.

|  |  |
| --- | --- |
| amylase | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/Q14S2F07_files/img02.png |
| lipase | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/Q14S2F07_files/img02.png |
| protease | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/Q14S2F07_files/img02.png |

**(1)**

(b)     The egg white in each tube was 50 mm long at the start of the investigation.
The table below shows the students’ results.

|  |  |
| --- | --- |
| **pH** | **Length in mm of boiled egg white after 24 hours** |
| 1 | 38 |
| 2 | 20 |
| 3 | 34 |
| 4 | 45 |
| 5 | 50 |
| 6 | 50 |
| 7 | 50 |

(i)      At which pH did the pepsin work best?

pH \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     The answer you gave in part **(b)(i)** may not be the exact pH at which pepsin works best.

What could the students do to find a more accurate value for this pH?

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 **(2)**

(iii)     There was no change in the length of the egg white from pH 5 to pH 7.

Explain why.

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 **(2)**

(c)     Pepsin is made by the stomach.

Name the acid made by the stomach which allows pepsin to work well.

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**(1)**

**Required Practical 4: Food Tests**

**Use qualitative reagents to test for a range of carbohydrates, lipids and proteins.**

1. A nutritional drink was said to contain simple sugars and protein.

Describe how you could find out if these food substances were present in the drink.

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**(6)**

1. Complete the table below using your knowledge of food tests.

|  |  |  |
| --- | --- | --- |
| Test | Solution | Result if present |
| Starch |  |  |
| Sugar |  |  |
| Lipid |  |  |
| Protein |  |  |

**(8)**

**Required Practical 5: Photosynthesis**

**Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as**

**pondweed.**

1. **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Light intensity, carbon dioxide concentration and temperature are three factors that affect the rate of photosynthesis.

How would you investigate the effect of **light intensity** on the rate of photosynthesis?

The image below shows some of the apparatus you might use.



You should include details of:

•        how you would set up the apparatus and the materials you would use

•        the measurements you would make

•        how you could make this a fair test.

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**(6)**

1. A student investigated the effect of temperature on the rate of photosynthesis in pondweed.

The diagram shows the way the experiment was set up.



(a)     The student needed to control some variables to make the investigation fair.

State **two** of these variables.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(b)     The bubbles of gas are produced only while photosynthesis is taking place.

What **two** measurements would the student make to calculate the rate of photosynthesis?

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(c)     The graph shows the effect of temperature on the rate of photosynthesis.



(i)     Name the factor that limits the rate of photosynthesis between the points labelled **A** and **B** on the graph.

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**(1)**

(ii)     Suggest which factor, carbon dioxide, oxygen or water, might limit the rate of photosynthesis between the points labelled **C** and **D** on the graph.

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**(1)**

1. The table shows the students’ results.

|  |  |  |
| --- | --- | --- |
|  | **Distance in cm** | **Number of bubblesper minute** |
|   | 10 | 84 |
|   | 15 | 84 |
|   | 20 | 76 |
|   | 40 | 52 |
|   | 50 | 26 |

(a)     At distances between 15 cm and 50 cm, light was a limiting factor for photosynthesis. What evidence is there for this in the table?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

**Required Practical 6: Reaction Time**

**Plan and carry out an investigation into the effect of a factor on human reaction time.**

1. Two students investigated reflex action times.

This is the method used.

1.      Student **A** sits with her elbow resting on the edge of a table.

2.      Student **B** holds a ruler with the bottom of the ruler level with the thumb of Student **A**.

3.      Student **B** drops the ruler.

4.      Student **A** catches the ruler and records the distance, as shown in the diagram below.

5.      Steps **1** to **4** were then repeated.



(a)     Suggest **two** ways the students could improve the method to make sure the test would give valid results.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(b)     The table below shows Student **A**’s results.

|  |  |
| --- | --- |
| **Test Number** | **Distance ruler dropped in mm** |
| 1 | 117 |
| 2 | 120 |
| 3 | 115 |
| 4 | 106 |
| 5 | 123 |
| 6 | 125 |
| 7 | 106 |

What is the **median** result?

|  |  |
| --- | --- |
| Tick **one** box. |   |
| 106 | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/QSP182H06_files/img02.png |
| 115 | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/QSP182H06_files/img02.png |
| 116 | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/QSP182H06_files/img02.png |
| 117 | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/QSP182H06_files/img02.png |
| 123 | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/QSP182H06_files/img02.png |

**(1)**

(c)     The mean distance the ruler was dropped is 116 mm.

Calculate the mean reaction time.

Use the equation:

**reaction time in s =** 

Give your answer to 3 significant figures

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Mean reaction time = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ s

**(3)**

(d)     The students then measured Student **A**’s reaction time using a computer program.

This is the method used.

1.       The computer shows a red box at the start.

2.       As soon as the box turns green the student has to press a key on the keyboard as fast as possible.

3.       The test is repeated five times and a mean reaction time is displayed.

Student **A**’s mean reaction time was 110 ms.

Using a computer program to measure reaction times is likely to be more valid than the method using a dropped ruler.

Give **two** reasons why.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(e)     A woman has a head injury.

Her symptoms include:

•        finding it difficult to name familiar objects

•        not being able to remember recent events.

Suggest which part of her brain has been damaged.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(f)     A man has a head injury.

He staggers and sways as he walks.

Suggest which part of his brain has been damaged.

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**(1)**

1. Car drivers need quick reactions to avoid accidents.

A student uses a computer program to measure reaction time.

The computer screen shows a traffic light on red. The traffic light then changes to green.

The diagram below shows the change the person sees on the computer screen.



When the traffic light changes to green the person has to click the computer mouse as quickly as possible.

The computer program works out the time taken to react to the light changing colour.

(a)    Special cells detect the change in colour.

(i)     What word is used to describe special cells that detect a change in the environment?

Draw a ring around the correct answer.



**(1)**

(ii)     Where in the body are the special cells that detect the change in colour of the traffic lights?

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**(1)**

(b)    The student used the computer program on one computer to measure the reaction times of people of different ages.

(i)     Give **one** variable the student should control so that a fair comparison can be made between the people of different ages.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(ii)     The student did each measurement three times to calculate a mean value.

The table shows the results.

|  |  |
| --- | --- |
| **Age in years** | **Mean reaction time in milliseconds** |
| 15 | 242 |
| 30 |   |
| 45 | 221 |
| 60 | 258 |
| 75 | 364 |
| 90 | 526 |

The reaction times for the 30-year-old person were **192**, **174** and **180** milliseconds.

Calculate the mean reaction time of the 30-year-old person.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mean reaction time = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ milliseconds

**(1)**

(iii)     Which **one** of the following is an advantage of repeating each test three times and **not** doing the test just once?

|  |  |
| --- | --- |
| Tick (✔) **one** box. |   |
| Any anomalies can be identified. | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/Q16S1F02_files/img03.png |
| The results will be more precise. | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/Q16S1F02_files/img03.png |
| There will be no errors. | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/Q16S1F02_files/img03.png |

**(1)**

(iv)    Some people think that old people should **not** be allowed to drive a car.

Why is it more dangerous for old people to drive cars?

Use information from the table above to support your answer.

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**(2)**

**Required Practical 7: Field Investigations**

**Measure the population size of a common species in a habitat.**

**Use sampling techniques to investigate the effect of a factor on the distribution of this species.**

1. Some students wanted to find the number of thistle plants growing on a lawn.
The students placed 10 quadrats at different positions on the lawn.
Each quadrat measured 1 metre × 1 metre.
The students counted the number of thistle plants in each quadrat.

(a)     Which method should the students use to decide where to place the 10 quadrats?

Tick () **one** box.

|  |  |
| --- | --- |
| Place the quadrats as evenly as possible around the lawn. | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/Q13W2F04_files/img02.png |
| Place 5 quadrats in areas with many thistle plants and 5 quadrats in areas with only a few thistle plants. | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/Q13W2F04_files/img02.png |
| Place all the quadrats randomly on the lawn. | https://app.doublestruck.eu/content/AG_BLG/HTML/Q/Q13W2F04_files/img02.png |

**(1)**

(b)     The diagram shows the lawn with the positions of the thistle plants and the students’ 10 quadrats.



(i)      Complete the table to show:

•        how many thistle plants the students found in each of the first four quadrats

•        the total number of thistle plants found in all 10 quadrats.

|  |  |  |
| --- | --- | --- |
|  | **Quadratnumber** | **Number of thistleplants in eachquadrat** |
|   | 1 |   |
|   | 2 |   |
|   | 3 |   |
|   | 4 |   |
|   | 5 | 1 |
|   | 6 | 3 |
|   | 7 | 0 |
|   | 8 | 0 |
|   | 9 | 2 |
|   | 10 | 1 |
|   | Total |   |

**(2)**

(ii)     Calculate the mean number of thistle plants in one quadrat.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mean = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(iii)    The lawn measured 12 metres long and 10 metres wide.

Use your answer from part (b)(ii) to estimate the number of thistle plants on the lawn.

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Estimated number of thistle plants = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(c)     How could the students make their estimate more accurate?

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**(1)**

1. A grassy field on a farm measured 120 metres by 80 metres.

A student wanted to estimate the number of buttercup plants growing in the field.

The student found an area where buttercup plants were growing and placed a 1 m × 1 m quadrat in one position in that area.

**Figure 1** shows the buttercup plants in the quadrat.



The student said, 'This result shows that there are 115 200 buttercup plants in the field.'

(a)     (i)      How did the student calculate that there were 115 200 buttercup plants in the field?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(ii)     The student’s estimate of the number of buttercup plants in the field is probably not accurate. This is because the buttercup plants are not distributed evenly.

How would you improve the student’s method to give a more accurate estimate?

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**(2)**

(b)     Sunlight is one environmental factor that might affect the distribution of the buttercup plants.

(i)      Give **three other** environmental factors that might affect the distribution of the buttercup plants.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

1. At the seashore, the tide comes in and goes out twice each day.

Some students investigated whether two different species of seaweed could live only at certain positions on a rocky shore.
Seaweeds are plant-like organisms that make their food by photosynthesis.

**Figure 1** shows the two species of seaweed that the students investigated.

**Figure 1**

**Bladder wrack**                            **Sea lettuce**


  Holdfast
(fixes seaweed to the rock)

(a)     The students:

1    placed a 50-metre tape measure on the rocks at right angles to the sea

2    placed a quadrat next to the tape measure

3    recorded whether each species was present or not.

The students repeated steps 2 and 3 every metre down the shore.

**Figure 2** shows a section of the seashore and the students’ results.

**Figure 2**

                         **Section of the seashore**


                    metres

                    **Students’ results**


                        metres

(i)      The students placed the quadrat at regular intervals along a transect line rather than placing the quadrat at random positions anywhere on the rocky shore.

Explain why.

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**(2)**

(ii)     How could the students have improved their investigation to ensure that they produced valid data?

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**(2)**

(iii)     **Figure 2** is repeated here to help you answer this question.

**Figure 2**

                         **Section of the seashore**


                    metres

                    **Students’ results**


                        metres

The students concluded that bladder wrack is better adapted than sea lettuce to survive in dry conditions.

What is the evidence for this conclusion?

Use information from **Figure 2**.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(b)     The bladder wrack has many air bladders.
The air bladders help the bladder wrack to float upwards when the sea covers it.

Suggest how this helps the bladder wrack to survive.

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**(2)**