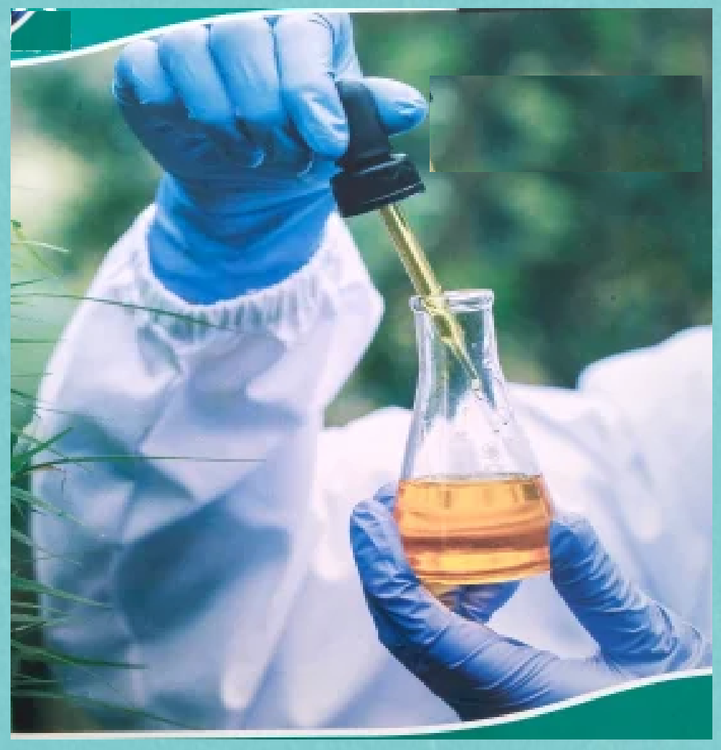

WAKATA PUBLISHERS

UCLSE NEW CURRICULUM BIOLOGY PRACTICAL WORK BOOK

UCLSE
New Curriculum
Biology

Practical Workbook

WAKATA

Contents

Introduction to New Curriculum Biology Practical

Practical skills form the backbone of any Biology course. It is hoped that by using this book, you will gain confidence in this exciting and essential area of study. This book has been written to prepare Uganda Certificate of Lower Secondary Education (UCLSE) Biology students for the practical paper.

For this practical paper, you need to be able to demonstrate a wide range of practical skills. Through the various investigations and accompanying questions you can build and refine your abilities so that you gain enthusiasm in tackling laboratory work. Aside from the necessary exam preparation, these interesting and enjoyable investigations are intended to kindle a passion for practical Biology.

Great care has been taken to ensure that this book contains work that is safe and accessible for you to complete. Before attempting any of these activities, though make sure that you have read the safety section and are following the safety regulations of the place where you study.

Skills

Assessment Objective 3 (AO3) 'Experimental and Investigative skills' of the UCLSE is about your ability to work as a scientist. Each aspect of the AO3 has been broken and listed for you below.

- Demonstrate knowledge of how to safely use techniques.
- Demonstrate knowledge of how to use apparatus and materials.
- Demonstrate knowledge of how to follow a sequence of instructions where appropriate.
- Plan experiments and investigations.
- Make and record estimates.
- Interpret experimental observations and data.
- Evaluate methods.
- Suggest possible improvements to methods.
- Constructing own table.
- Drawing / analysing a graph.
- Planning safety of an investigation.
- Mathematical calculations.

Practical investigation 3. Observing plant cells

Objective

This investigation aims to develop your basic microscope skills in order to safely observe plant cells using a light microscope. You will observe some of the different structures in these cells and relate them to their functions.

Equipment

- Light microscope
- Microscope slide
- Cover slip
- Forceps
- Scalpel
- Safety spectacles
- Staining solution (1% methylene blue or iodine)
- Sample of onion (or similar)
- Mounted needle
- Filter paper or paper towel

Method

(a) Set up your microscope safely as shown by your teacher.
(b) Remove a small piece of the single, inner layer of onion cells (the epidermis) using a scalpel and forceps.
(c) Place the layer of epithelial cells onto the microscope slide with no folds.
(d) Add a drop of the staining solution to the onion sample. Excess solution can be removed by using filter paper or a paper towel.
(e) Place the cover slip onto the sample by lowering at an angle with a mounted needle (or similar) as shown in Figure (a). `
(f) Tap the cover slip lightly with the end of a pencil.
(g) Place the specimen onto the microscope stage.
(h) Allow light to shine onto the specimen and begin at the lowest magnification.
(i) Slowly turn the focusing wheel until you begin to see your specimen.
(j) Use the fine focusing wheel to sharpen the image.
(k) Sketch a diagram of what you can see through the lens.
(l) Repeat using different magnifications – move upwards through the different magnifications of your microscope to see more detail at each level.

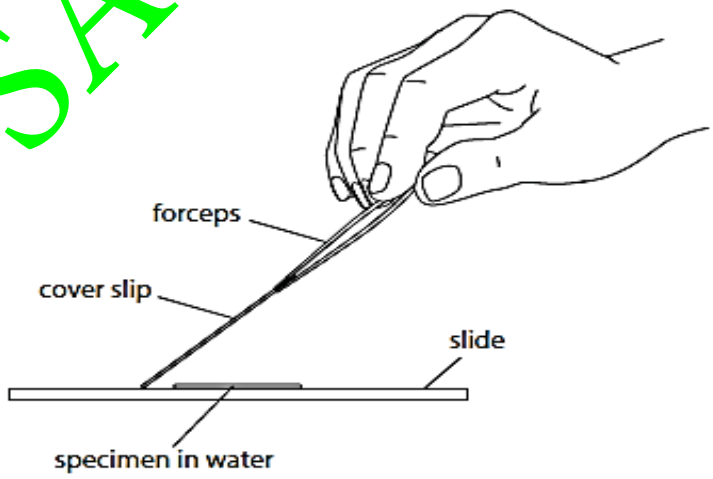

Fig (a)

Exam style questions

Experiment 1

Yeast is a single-celled organism that is used in bread-making and brewing.

You will investigate the process of respiration using an active yeast culture.

The active yeast culture has been prepared in a glucose solution and has been kept in a warm environment. The glucose was dissolved in cooled, boiled water (boiling removed the gases from the water) before the yeast was added.

- Put on the eye protection provided.
- Stir the contents of the container labelled **yeast culture**.
- Using the syringe, measure 10 cm^3 of yeast culture and place into each of the test-tubes, labelled **A** and **B**.
- Place test-tubes **A** and **B** in the beaker of warm water. They **must** remain in the warm water throughout this investigation.
- Using the dropping pipette, carefully introduce drops of oil down the inside of test-tube **B** onto the surface of the yeast culture, until a complete layer, covering the surface, is formed.
- Remove the film that is covering the test-tubes containing the hydrogen carbonate indicator solution.
- Set up the apparatus provided as shown in Fig. **1**. Make sure that the open end of the delivery tube is below the surface of the hydrogen carbonate solution.

CARE IS NEEDED WHEN INSERTING THE BUNG INTO TEST-TUBES **A** AND **B**.

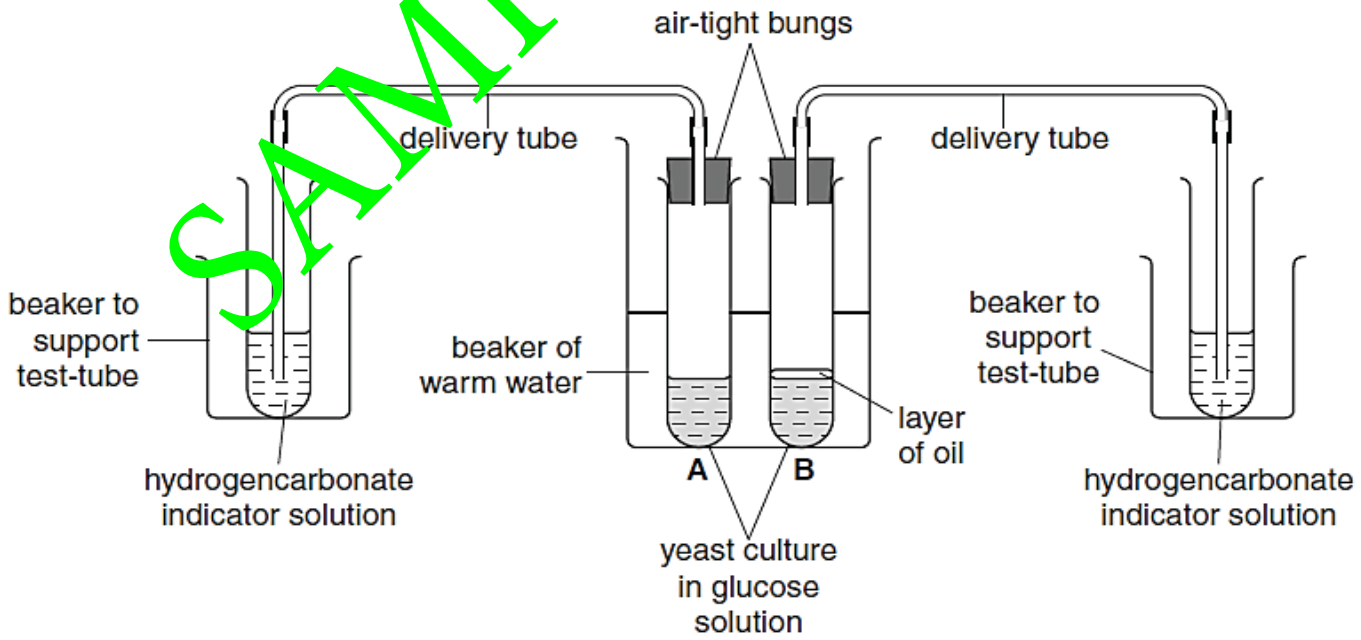

Fig. 1.

(a) **(i)** Describe the colour of the hydrogencarbonate indicator solution and what you observe in the yeast cultures.

hydrogencarbonate indicator solution ……

……

yeast cultures ……

……

Every five minutes for ten minutes (0, 5 and 10 minutes), you are going to observe and record the number of bubbles released from test-tubes **A** and **B** into the hydrogencarbonate indicator solution in one minute **and** the colour of the hydrogencarbonate indicator solution

(ii) Prepare a table to record these results and observations.

(iii) Now, count the number of bubbles and observe the colour.

Record these results and observations in your table. These are the results for 0 minutes.

Repeat this after 5 and 10 minutes.

(iv) Compare the appearance of the yeast cultures in test-tubes **A** and **B**.

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(v) Describe **and** explain the results and observations shown in your table.

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(b) Explain why:

(i) the yeast culture was stirred at the beginning of the investigation

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(ii) the oil was introduced into test-tube **B**

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(iii) the test-tubes containing the yeast culture were kept in a container of warm water.

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(iv) Compare the appearance of the yeast cultures in test-tubes **A** and **B**.

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(v) Describe **and** explain the results and observations shown in your table.

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(i) the yeast culture was stirred at the beginning of the investigation

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(ii) the oil was introduced into test-tube **B**

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(iii) the test-tubes containing the yeast culture were kept in a container of warm water.

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(c) Suggest **two** sources of error in this investigation. For each source of error, suggest an improvement to reduce this source of error.

source of error ……

……

improvement ……..…….……

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source of error ……..……

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improvement ……..…….……

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(d) Fig. **1.2** shows yeast as seen using a microscope.

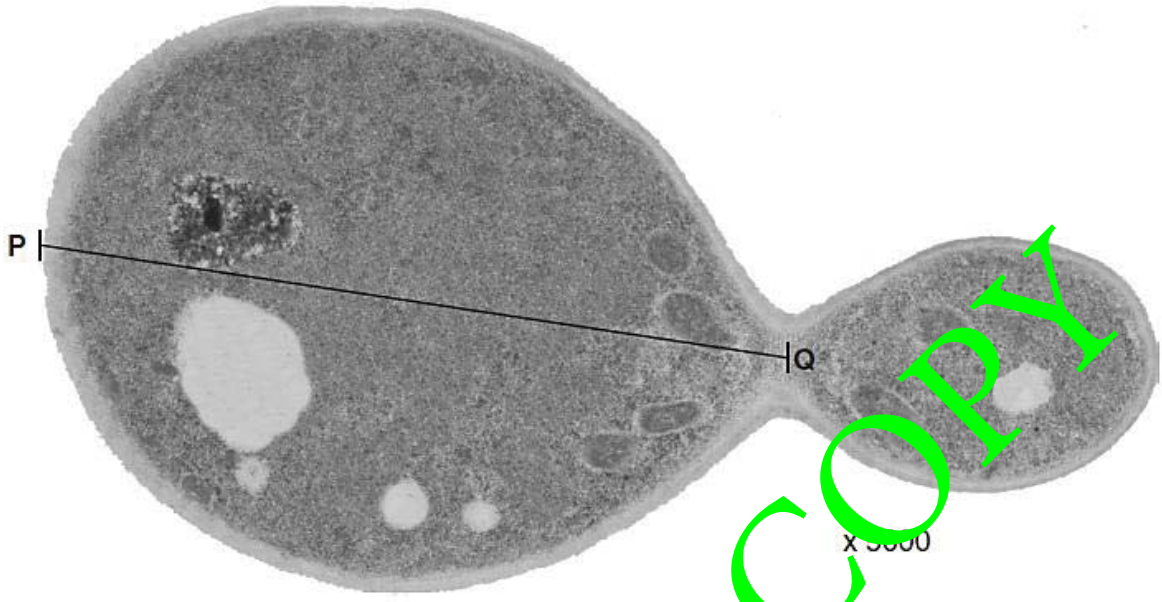

Fig. 1.2

(i) Describe what is occurring in Fig. **1.2**

……..…….……

(ii) You are going to calculate the actual length of a yeast cell shown in Fig. **1.2**.

Measure the length of line **PQ**.

length of line **PQ** …… mm

Calculate the actual length of the cell.

Show your working.

actual length of cell ……mm

Experiment 3

You are going to investigate the effect of different concentrations of sucrose solution on the movement of water into and out of potato cells by osmosis.

Water enters cells if the solution outside the cells is less concentrated than the solution inside the cells.

Water exits cells if the solution outside the cells is more concentrated than the solution inside the cells.

You are provided with four potato sticks, which have been cut to the same length.

Read all the instructions but DO NOT CARRY THEM OUT until you have drawn a table for your results in the space provided in (a)(ii).

Step 1 Measure each of the potato sticks. Record the results in your table in **(a)(ii)**.

Step 2 Place one potato stick into each of the solutions in the large test-tubes labelled **A**, **B**, **C** and **D**.

Immediately observe what happens to each of the potato sticks.
(a) (i) Record your observations

Potato stick in solution **A** ……..

Potato stick in solution **B** ……..

Potato stick in solution **C** ……..

Potato stick in solution **D** ……..

Step 3 Leave the potato sticks for **30** minutes. While you are waiting continue with the other questions.

Step 4 Use a marker pen to divide the white tile into four sections and label them **A**, **B**, **C** and **D**.

Step 5 After 30 minutes pour the contents of the large test-tube **A** into the beaker labelled waste.
Place the potato stick on to the white tile in the section labelled **A**.

Step 6 Measure the length of the potato stick and record the results in your table in **(a)(ii)**.

Step 7 Repeat steps 5 and 6 for large test-tube **B.**

Step 8 Repeat steps 5 and 6 for large test-tube **C**.

Step 9 Repeat steps 5 and 6 for large test-tube **D**.

(ii) Prepare a table to record your results in the space provided.
Your table should show:

- the length of the potato sticks at the start
- the length of the potato sticks after 30 minutes
- the change in length of the potato sticks.

(iii) Pick up and examine each potato stick. State **two** physical differences, other than size, that you observe when comparing the four potato sticks.

1 ……

2 ……

(b) (i) Use all the information and your table of results to identify the solutions **A**, **B**, **C** and **D**. Write your answers in Table **3.1**.

Table 3.1

Relative concentration of sucrose solution	Test – tube letter
least concentrated ↓ Most concentrated	

(ii) Explain how your results support your answer to part **(b)(i)**.

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(iii) Identify **one** source of error with the method and suggest an improvement.

error ……

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improvement ……

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(iv) State **one** of the controlled variables for this investigation.

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(c) Another investigation was carried out into the effect of different concentrations of sucrose solution on potato sticks.

In this investigation students decided to measure the change in mass rather than the change in length.

The students followed a similar method to the one in your investigation but they left the potato sticks to soak for three hours instead of 30 minutes.

(i) Suggest why the students left the potato sticks in the solutions for three hours instead of 30 minutes.

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(ii) The students dried the potato sticks on paper towels before measuring the mass of each potato stick.

Suggest why this step was **not** important in your investigation, where length was measured.

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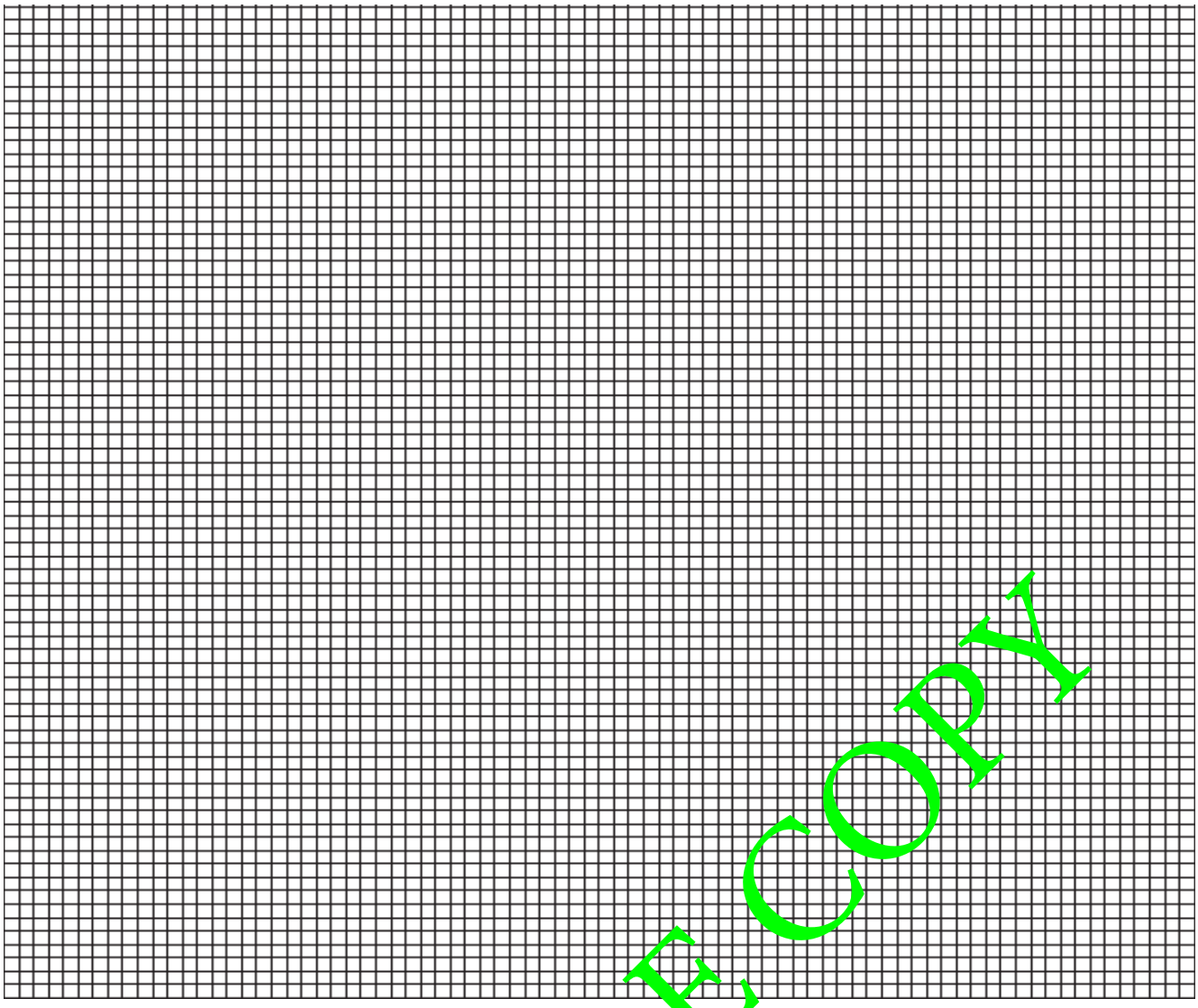
Table **3.2** shows their results

Table 3.2

concentration of sucrose solution (g per dm^3)	percentage change in mass
0	29.5
70	12.0
140	-3.0
210	-15.0
280	-26.0
350	-29.5

(iii) Using Table **3**.2, plot a graph on the grid to show the effect of the concentration of sucrose solution on the percentage change in mass.



(iv) Use your graph to find the concentration of sucrose solution that would cause **no change** in mass of the potato stick.
Mark this concentration on your graph with a + and record the concentration.
Include the unit

……

(v) Students tested other potatoes and found different values for the concentration of sucrose solution that would cause no change in mass.

Suggest **one** reason for this.

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Experiment 22

You are provided with a dish of seedlings that have germinated and then grown for 3–5 days.

You are going to measure the heights of six seedlings and calculate their mean height.

(a) (i) In the space below, construct a table to record your results.

Select six seedlings from the dish and measure the height of each stem to the nearest millimetre.

Enter your results in the table.

Calculate the mean height and record it in your table.

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(ii) State **two** possible sources of error in measuring the seedlings.

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(iii) Use the apparatus provided to cut or crush some of the seedlings. Add drops of iodine solution to the cut or crushed seedlings.

Record your observations and conclusion from this test.

observations……

……

conclusion ……

In another investigation, some students calculated the mean heights of some seedlings as they grew. They recorded their results.

Grown for 6 days mean height 8 mm.

Grown for 10 days mean height 23 mm.

Grown for 12 days mean height 27 mm.

Grown for 15 days mean height 32 mm.

Grown for 20 days mean height 36 mm.

Grown for 23 days mean height 37 mm.

(b) **(i)** On the grid on the next page, construct a line graph to show the relationship between time and mean height for these seedlings. Join your points with ruled lines.

(ii) Use the graph to describe the growth of these seedlings.

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(iii) Use the graph to state the time period during which the rate of growth of the seedlings was greatest.

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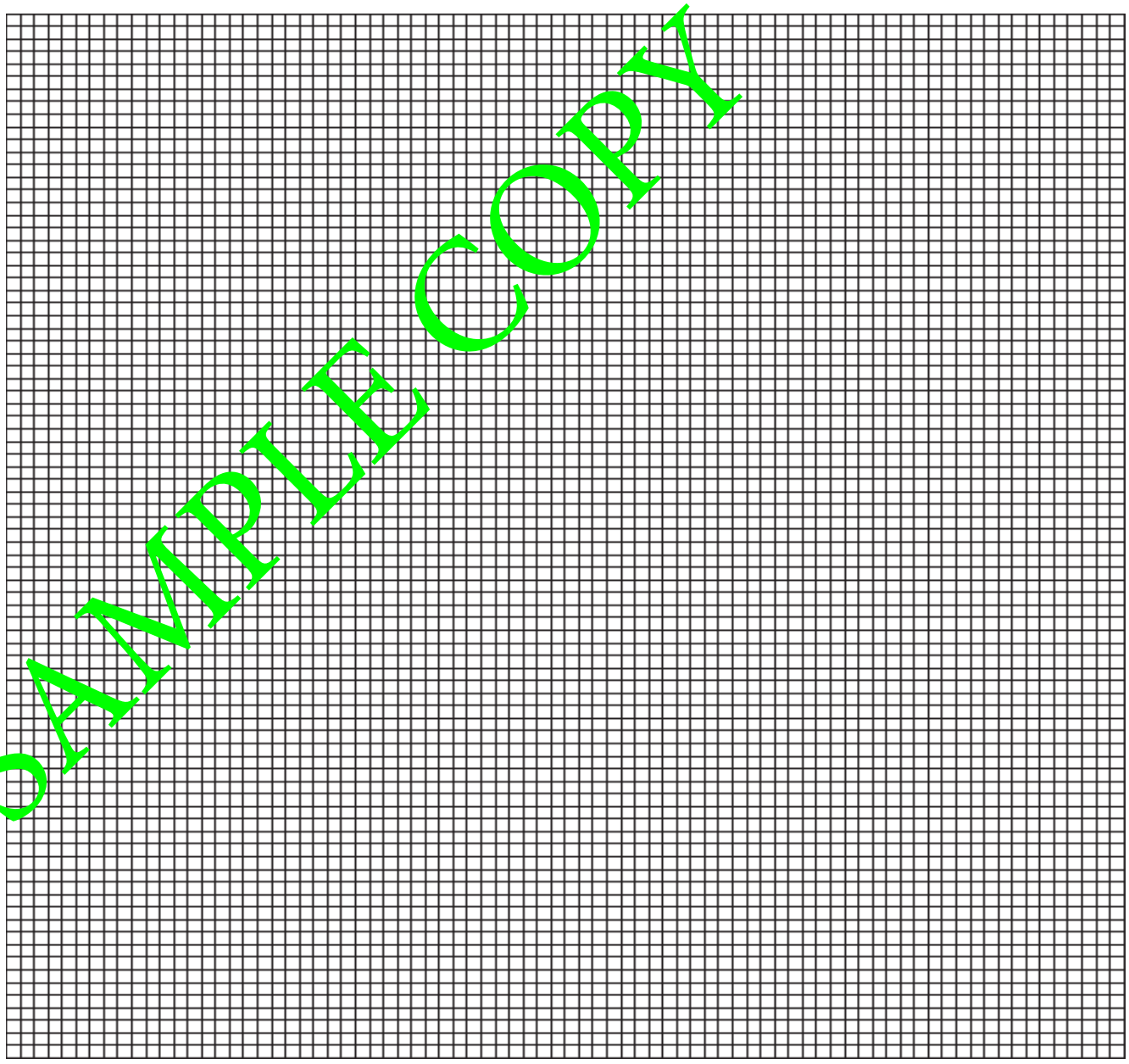

(iv) Use the data and your graph to calculate the rate of growth of the seedlings for the five days from day 15 to day 20.

Space for working.

rate ……

(v) State **two** variables that need to be controlled whilst growing these seedlings and explain why they need to be controlled.

variable 1 ……

variable 2 ……

explanation ……

……

The seeds needed water to germinate and for the seedlings to grow.

(c) Design an investigation to determine the effect of the pH of water on the growth (mean height) of seedlings. You should use seedlings grown in Petri dishes in a laboratory.

Experiment 31

(a)
- Place the slice of banana, **W1**, on the white tile and use the cotton-wool bud to smear iodine solution on half of the upper surface of the banana.
- Examine both the stained and unstained parts of the upper surface of the banana.

(i) Make a large, clear drawing of this upper surface of the banana to show its structure.
Labels are **not** required.

(ii) Draw part of the fruit wall ('skin', 'peel') of the banana, as seen through the hand lens, to show its pattern of veins (vascular bundles).
Labels are **not** required.

(iii) Calculate the magnification of your drawing in **(a) (i)**. Show clearly where you made a measurement on your drawing. Record your measurements and show all working clearly.

Magnification = ……..

(b) • Treat specimen **W2** with iodine solution in the same way as **W1**.
• Examine the specimen.

(i) State **two** ways in which the specimens can be seen to have a similar structure.

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(ii) Complete Table 31.1 to show three visible differences in the fruit wall (skin) of the two specimens.

Table 31.1

	specimen W1	**specimen W2**
1		
2		
3		

(iii) Complete Table 31.2 to show two visible differences in the internal structure of the two specimens.

Table 31.2

	specimen W1	specimen W2
1		
2		

(c) The starch content of bananas decreases as the bananas ripen. Design, but do not try to carry out, an investigation to determine if this decrease in starch concentration results in an increase in the concentration of reducing sugars.

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Experiment 32

You are provided with specimen **D5**. Using the hand lens provided observe specimen **D5**.

(a) (i) Make a large, detailed drawing to show the structure of specimen **D5**. Labels are **not** required.

(ii) Calculate the magnification of your drawing in **(a)(i)**.

Rule a line across your drawing to show where you measured.
Show your working clearly.

magnification ……..

(iii) Suggest how the structure of **D5** enables the seed to be more efficiently dispersed.

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