

G623: Cells and Molecules Worksheets

In these tasks candidates will investigate the structures found within cells and find out the role each structure plays in the successful functioning of the cell.

Candidates will produce and use prepared slides of cellular tissue and observe them using a light microscope. They will consider the similarities and differences in the ways that light and electron microscopes work.

Worksheet A:

Candidates will produce a temporary mount of an onion scale leaf and a cheek epithelial cell for observation using a light microscope. An appropriate risk assessment must be made before cheek cells are prepared for observation (a sample taken from a yeast culture may be used as an alternative tissue sample to cheek epithelial cells).

Candidates will make labelled drawings as a record of the observations made.

Worksheet B:

Candidates will use an eye piece graticule to determine the relative sizes of the cells in each of the two temporary mounts. They will use a stage micrometer to determine the actual average dimension of the cells in each of the two temporary mounts.

Worksheet C:

Candidates will design and produce a leaflet or PowerPoint slides which describe and explain the similarities and differences in the way light and electron microscopes function. Their target audience is Year 12 non-scientists.

Worksheet D:

Candidates will produce a report on the structures of plant and animal cells as seen using an electron microscope. They will describe the roles of the cellular organelles found in plant and animal cells.

G623: Cells and Molecules – Worksheet A

Unit Name: Cells and Molecules	Unit Number: G623
Assignment Title: The Structure of the Cell	Assignment: G623 Worksheet A
Date Set:	Due Date:

Vocational Brief:

It is possible to observe cells in a temporary mount using a light microscope. A temporary mount involves presenting the specimen on a microscope slide in a drop of water or glycerine. The specimen is covered by a cover slip and may be stained. Labelled pencil drawings of the cells are used as a record of any observations made.

Task:

Produce temporary mounts of

- (ii) an onion scale leaf and
- (ii) cheek epithelial cells (a sample taken from a yeast culture may be used instead).

In this task you are required to:

- identify hazards and carry out a risk assessment
- follow the Practical Instructions given – *The Structure of Cells*
- record your observations.

Make labelled drawings as a record of the observations made.

Resources:

- Microscope slides
- Cover slips
- Optical microscope
- Light source
- Mounted needle
- Scalpel
- Forceps
- Pipette
- Iodine solution
- Methylene blue (for epithelial cheek cells)
- Lactophenol (for yeast cell sample)
- Onion
- Disinfectant hand wash to enable cheek cell extraction
- Yeast suspension

G623: Cells and Molecules – Worksheet A

Practical Instructions

Practical Instructions - The Structure of the Cell

Produce temporary mounts of (i) onion scale leaf and (ii) epithelial cheek cells (a sample taken from a yeast culture as an alternative). Make labelled drawings as a record of the observations made.

Complete a risk assessment before starting the investigation.

(i) Onion scale leaf

1. Cut a wedge from an onion.
2. Pull off a piece of the inner scale leaf.
3. Mount the tissue in iodine solution on a clean microscope slide.
4. Cover the tissue with a cover slip (try not to trap air bubbles under the cover slip).
5. Observe the tissue under low power using an appropriate objective lens on the microscope.
6. Choose a cell that appears to be coloured.
7. Observe the cell under high power.
8. Draw the cell including as many of the structures inside the cell as you can see.
9. Label the:
 - nucleus
 - nuclear membrane
 - nucleoplasm
 - granular cytoplasm
 - cell vacuole
 - vacuolar membrane
 - cell wall.

(ii) Epithelial cheek cells

1. Use a clean finger to gently scrape the inside of your cheek. Place this onto a clean microscope slide.
2. Add a drop of iodine solution.
3. Cover with a cover slip.
4. Observe the slide under low power, then high power.
5. Use a clean finger to gently scrape the inside of your cheek. Place this onto a second clean microscope slide.
6. Add a drop of methylene blue solution.
7. Cover with a cover slip.
8. Observe the slide under low power, then high power.
9. Using information from both slides (and what you have learnt from the onion cell) draw a cheek cell, labelling as many structures as you can.

Alternative

(ii) Yeast cells

1. Place a small drop of diluted yeast suspension onto a microscope slide.
2. Add a drop of iodine solution.
3. Cover with a cover slip.
4. Observe the slide under low power, then high power.
5. Place a small drop of diluted yeast suspension onto a second clean microscope slide.
6. Add a drop of lactophenol. Cover with a cover slip.
7. Observe the slide under low power, then high power.
8. Using information from both slides (and what you have learnt from the onion cell) draw a yeast cell, labelling as many structures as you can.

G623: Cells and Molecules – Worksheet B

Unit Name: Cells and Molecules	Unit Number: G623
Assignment Title: Measurement of Individual Cells	Assignment: G623 Worksheet B
Date Set:	Due Date:

Vocational Brief:

An important skill is the ability to accurately measure the size of cells on a microscope slide. You will use an eyepiece graticule to determine the relative sizes of the cells in each of the two temporary mounts of the onion scale leaf and the epithelial cheek cells (or cells taken from a yeast suspension). You will use a stage micrometer to determine the actual average dimension of the cells in each of the two temporary mounts.

Task:

An eyepiece graticule is a glass disc with a scale of arbitrary length (often 10mm) etched on it. It is placed inside the eyepiece of the microscope. When cells are viewed through the microscope, the eyepiece graticule scale is superimposed on the field of view.

The eyepiece graticule scale may be used to compare the sizes of cells observed under the same magnification using the same microscope.

1. Use the eyepiece graticule scale with a suitable objective lens (x10 or x40) to measure the size of a cell in the onion scale leaf.
2. Repeat this process for 5 different cells.
3. Record your results in a suitable table and calculate a mean.
4. Use the eyepiece graticule scale and the same objective lens to measure the size of an epithelial cheek cell (or yeast cell).
5. Repeat this process for 5 different cells.
6. Record your results in a suitable table and calculate a mean.
7. Compare the relative sizes of the onion leaf cell and the epithelial cheek (or yeast) cell. How easy or difficult was this?

A stage micrometer is used to calibrate the eyepiece graticule units to micrometres (μm), when actual dimensions of cells are needed or if different specimens at different magnifications are to be compared.

8. Use the x10 objective lens on the microscope. Place the stage micrometer on the stage of the microscope. Look through the microscope and focus on the stage micrometer so that the eyepiece graticule units are superimposed on the stage micrometer scale.

9. Count the number of stage micrometer divisions which cover the 100 eyepiece graticule units.
10. Calculate the length of each eyepiece graticule unit.
11. Repeat steps 8 and 9 using x40 objective lens.
12. Explain why the eyepiece graticule has to be calibrated for each objective lens on the microscope.
13. Now use the calibration data to convert the average relative size of the cells in the two temporary mounts to actual average dimensions in micrometers.

Resources:

- Optical microscope with eyepiece graticule
- Light source
- Temporary mounts from previous task
- Stage micrometer

G623: Cells and Molecules – Worksheet C

Unit Name: Cells and Molecules	Unit Number: G623
Assignment Title: Light and Electron Microscopy	Assignment: G623 Worksheet C
Date Set:	Due Date:

Vocational Brief:

Design and produce a leaflet or PowerPoint slides which describes the basic layout of light and electron microscopes and the way they function.

Clearly summarise the similarities and differences between them in a suitable format.

Target audience is Year 12 non–scientists.

Task:

Your leaflet/PowerPoint should include:

- the basic principles of light and electron microscopy
- a drawing of a light microscope in vertical section to show the position of the specimen on the stage, light source, position of the lenses and the pathway taken by light
- a drawing of an electron microscope in vertical section to show the position of the specimen, electron source, electromagnets, screen and the pathway taken by electrons
- function of the parts shown in each drawing
- a table, summarising differences between the light and electron microscopes
- a table summarising the advantages and disadvantages of the light and electron microscopes.

G623: Cells and Molecules – Worksheet D

Unit Name: Cells and Molecules	Unit Number: G623
Assignment Title: The structure of plant and animal cells and their organelles	Assignment: G623 Worksheet D
Date Set:	Due Date:

Vocational Brief:

Using a variety of sources, produce a detailed set of notes and illustrations to describe the structure and function of a typical plant and animal cell as seen by light and electron microscopy.

Task:

Your report should include:

- labelled drawings, photomicrographs and electron micrographs of plant and animal cells
- a list of structures visible in an electron micrograph that are not visible using a light microscope
- some reference to the size of cellular organelles
- reference to the function(s) of named structures found in plant and animal cells
- a table comparing the similarities and differences in the structure of plants and animal cells
- a bibliography/full list of secondary sources used, including web addresses and date of access.