

Unit 1: Principles and Applications of Biology I

Tutorial 3

ULTRASTRUCTURE OF EUKARYOTIC CELLS

LEARNING AIM A: Understand the microscopic structure and the functions of eukaryotic cells and tissues

Skills	Analysis, problem solving
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Microscopic measurements and calculations

When looking at the ultrastructure of cells through a microscope, there are two factors that affect the clarity and the amount of detail that can be seen:

- **Magnification** – this is a measure of how much bigger the image is, compared to the actual size of the object.
- **Resolution** (resolving power of the microscope) – the minimum distance apart that two objects can be and still be distinguished as separate objects. Resolution affects the amount of detail that can be seen in an image.

The table below shows the international units of measurement and includes the units of measurement used when working in microscopy:

Units of length (International System)		
Unit	Metres	Equivalent to
1 metre (m)	1 m	1000 millimetres
1 millimetre (mm)	10^{-3} m	1000 micrometres
1 micrometre (μm)	10^{-6} m	1000 nanometres
1 nanometre (nm)	10^{-9} m	1000 picometres

Questions

- Convert the following measurements into micrometres (μm):
 - 0.25 mm
 - 2.1 mm
 - 0.06 mm
 - 0.16 mm

2. Convert the following measurements into millimetres (mm):
 - a. 10 μm
 - b. 2.7 μm
 - c. 1.2 μm
 - d. 200 nm

3. A plant cell measures 100 μm in length. What is this measurement in millimetres?

4. A virus measures 100 nm in diameter. What is its diameter in micrometres (μm)?

5. A bacterium measures 0.89 μm in length. What is its length in nanometres (nm)?

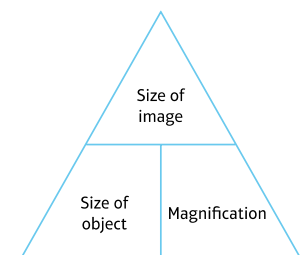
6. A plant cell is 100 μm in length. An image of it obtained using a light microscope measures 1.5 mm. Calculate the magnification.

Magnification, size of image and size of object are linked. It is useful to think of the relationship in a triangle formula:

The triangle shows that:

$$\text{size of image} = \text{size of object} \times \text{magnification}$$

$$\text{size of object} = \text{size of image} \div \text{magnification}$$



7. In an electron micrograph, a nucleus measures 15 mm. Its actual size is 5 μm . Calculate the magnification.

8. An image of an amoeba (single-celled organism) is 20 mm in length. The scale provided on the image shows that 10 mm = 100 μm . Calculate the size of the amoeba in μm .

9. A virus measures 0.02 μm . Calculate the size of the image if it is magnified 150 000 \times . Show your answer in mm.