

The microscope was invented in about 1590 by a Dutch spectacles maker called Zacharias Janssen. Since that time the microscope has helped scientists to discover what plants and animals are made up of and how cells work. A light microscope, like the ones most often used, can magnify things up to about $\times 1500$. Electron microscopes can magnify things up to about $\times 1\,500\,000$.

Using electron microscopes, scientists have been able to see what cytoplasm is made up of. It's not just jelly! It contains lots of very small parts called **organelles**. One of these organelles is the **mitochondrion**. Respiration happens inside the mitochondria. Other organelles are used to make new chemicals.

To measure the sizes of very small things, scientists have to use units that are smaller than millimetres. A **micrometre** (written ' μm ') is 1/1000th of a millimetre; that is $1\ \mu\text{m} = 0.001\ \text{mm}$. Animal cells are generally between 10 and 30 μm wide and plant cells are between 10 and 100 μm .



- 1 What sort of microscopes are most often used in schools and universities?
- 2 If a light microscope has an eyepiece lens of magnification $\times 15$, what magnification of objective lens would be needed to get a total magnification of $\times 1500$?
- 3 What would be the easiest type of microscope to use to look at:
 - a whole water fleas which are 3 mm long
 - b cell membranes?
- 4 Where are 'organelles' found?
- 5
 - a Name one type of 'organelle'.
 - b Say what this organelle does in the cell.
- 6
 - a How big is 1 mm in micrometres?
 - b What is the symbol for a micrometre?
- 7 In millimetres, what range of sizes do animal cells come in?
- 8 If a cell which is 20 μm wide is looked at with a magnification of $\times 1500$, how wide will it appear to be? Give your answer in the most convenient units.



literacy, knowledge, numeracy