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Exam Practice contents

Microscopy

NAILIT!

Magnification means how much larger the image is than the specimen.

Resolution (or **resolving power**) means how easily two points on the specimen can be distinguished from one another. The higher the resolution, the sharper the image will be.

Most cells are too small to be seen with the naked eye, so to get an understanding of what is happening inside cells we need microscopes. Microscopes have developed over the years to give higher magnifications and greater clarity.

Light microscopy

Light microscopes use light in order to view specimens. These have a low magnification and resolution (×1 500 and 200 nm), which means that the details within sub-cellular structures cannot be easily seen.

Electron microscopy

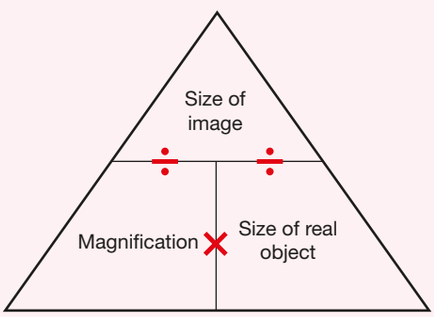
Electron microscopes use electrons to see the surface of cells, or inside the cells. These have a very high magnification and resolution (×500 000 and 0.1 nm). The sub-cellular structures within cells can be seen in detail.

MATHS SKILLS

The magnification of the cell can be worked out using the formula:

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

This can also be shown as a magnification triangle:



Remember 1 mm = 1 000 µm

WORKIT!

A cell that is 17 micrometers (µm) in diameter appears to be 3.4 cm in diameter when viewed through a microscope. Calculate the magnification. (3 marks)

First write the formula:

$$\text{Magnification} = \frac{\text{size of image}}{\text{size of real object}} = \frac{3.4\text{ cm}}{17\,\mu\text{m}}\ (1)$$

Then make sure that both measurements are in the same units. In this case, it will be easier to put them both into µm.

$$\text{Magnification} = \frac{34\,000\,\mu\text{m}}{17\,\mu\text{m}}\ (1)$$

Then do the division:

$$\text{Magnification} = \times 2\,000\ (1)$$

NAILIT!

You should be able to write your answer in standard form.

Standard form is a way of writing very large numbers. For example:

15 000 000 is 1.5×10^7

CHECKIT!

1. Give two advantages of using an electron microscope to view cells.
2. Calculate the magnification of a cell that is 12 µm wide and appears 3 cm wide under the microscope.
3. A cell 4 µm wide was magnified 12 000 times. Rearrange the magnification formula to work out the size of the image. Write your answer in µm using standard form.

Culturing microorganisms

Microorganisms grow rapidly provided they have plenty of nutrients and oxygen, and are at the optimum temperature and pH. It is important that the microorganism in your culture is the one you want, so aseptic techniques are used to keep out other microorganisms.

Bacterial reproduction

Bacteria reproduce by a process called binary fission. This is a form of simple division, where the bacterium doubles in size and then divides into two daughter cells. Some bacteria can divide in as little as 20 minutes. Bacteria can be grown in a nutrient broth (or culture media) or on an agar plate. These both contain all of the nutrients that the bacteria need to live.

Aseptic techniques

Bacteria are used to test the effectiveness of disinfectants and antibiotics. Therefore it is important that bacteria are not contaminated with other microorganisms. To prevent contamination, aseptic techniques are used. These include:

- sterilising all Petri dishes and culture media
- sterilising inoculation loops by passing them through a flame
- securing the lid of the Petri dish with tape and storing it upside down
- not incubating bacterial cultures above 25°C.

Practical Skills

Preparing an uncontaminated culture

1. Wear a lab coat and gloves.
2. Take a sterilised Petri dish or conical flask containing culture media.
3. Pass an inoculation loop through a Bunsen flame, cool, and then dip it into culture media containing your desired bacteria.
4. Using the inoculation loop, spread the bacterial sample over the surface of the Petri dish, or place inside the conical flask and stir. Quickly replace the lid.
5. Pass the inoculation loop through the flame again to sterilise it.
6. Secure the lid of the Petri dish or conical flask with tape. Place the Petri dish upside down.
7. Leave the bacterial culture to grow at a maximum temperature of 25°C.

NAILIT!

Growing bacterial cultures below 25°C will slow down their rate of reproduction. This is safer to use in schools and colleges.

DOIT!

Make cue cards of these seven steps and jumble them up. Practise putting the cards in the correct order.