Required Practical Review

SCIENCE WELLSWAY MULTI ACADEMY TRUST

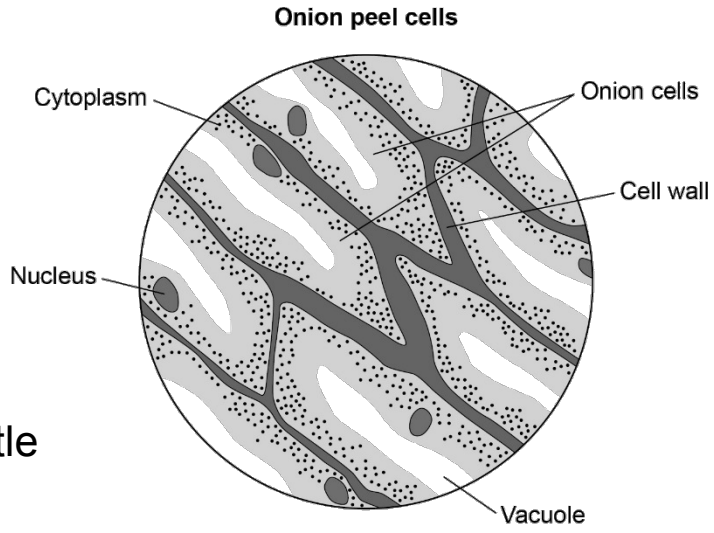
Biology Practical - **Using a light microscope to observe, draw and label cells in an onion skin**

Video link: https://www.youtube.com/watch?v=jBVxo5T-ZQM&t=153s
GCSE pod: https://members.gcsepod.com/pupils/assignments/assignment/407568

Know it
How to use a light microscope to observe, draw and label cells in an onion skin

You are provided with the following:

- a small piece of onion
- a knife
- a white tile
- forceps
- a microscope slide
- a coverslip
- a microscope
- iodine solution in a dropping bottle
- prepared animal and plant cells
- Perspex ruler.

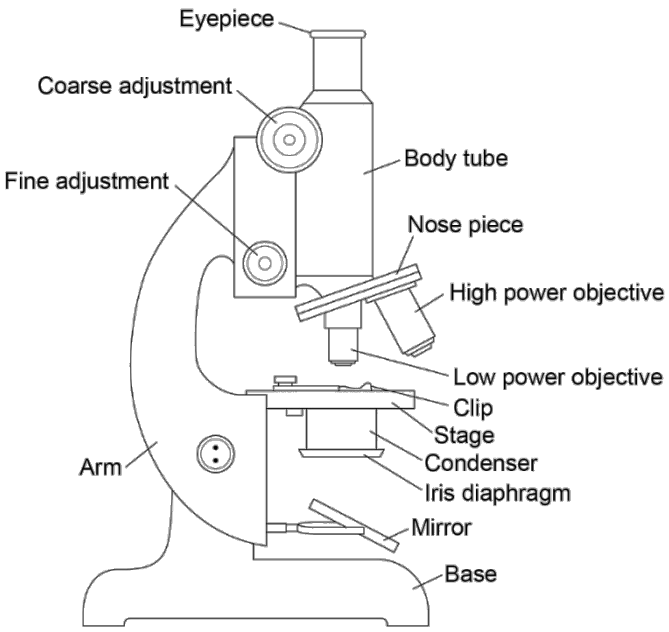


Read these instructions carefully before you start work.

1. Use a dropping pipette to put one drop of water onto a microscope slide.
2. Peel off a thin layer of epidermal tissue from the inner surface.
3. Use forceps to put this thin layer on to the drop of water that you have placed on the microscope slide.
4. Put two drops of iodine solution onto the onion tissue.
5. Carefully lower a coverslip onto the slide. Do this by:
   - placing one edge of the coverslip on the slide
   - use the forceps to lower the other edge onto the slide
6. Put the slide on the microscope stage.

Using the microscope to look at animal and plant cells

7. Use the lowest power objective lens, turn the coarse adjustment knob until the cells come into focus.
8. Now rotate the nosepiece to use a higher power objective lens.
9. Use the fine adjustment knob to bring the cells into a clear focus and use the low-power objective (totalling ×40 magnification) to look at the cells.
10. When you have found some onion epidermal cells, switch to a higher power (×100 or ×400 magnification).
11. Make a clear, **labelled drawing** of some of these cells. Make sure that you draw and label any component parts of the cell.



12. **Write the magnification underneath your drawing**.

Calculating the size of a single cell

13. Carefully place a Perspex ruler on top of your prepared slide so that it sits above a layer of onion epidermal tissue.
14. Place the ruler and the slide back on to the stage of the microscope.
15. Rotate the nosepiece to use medium power objective (totalling x100 magnification).

    Adjust the position of the ruler until it lines up with a continuous group of cells across 1 mm of the ruler. 1mm = 1000 microns (μm)

16. Count the number of cells across the 1000 μm sample.
17. Calculate the size of a single onion cell in microns using the formula by dividing the number of cells counted by the length of the tissue sampled. In this case, the length of the tissue sampled is 1000 μm:

$$\text{Length of cell in } \mu\text{m} = \frac{\text{Number of cells counted in sample}}{1000\ \mu\text{m}}$$

18. Write the actual length of the cell on the diagram you have drawn.
19. You can draw a 500 micron scale bar by using the following equation

$$\text{Scale bar length} = \frac{\text{Drawn length of cell in } \mu\text{m} \times 500}{\text{Actual length of cell in } \mu\text{m}}$$

Review it

Up to grade 4

1. Identify the magnification calculation formula and the three ways the formula can be arranged. (use the triangle to help)

2. Review unit conversions, how many micrometres are in a millimetre?

3. Describe how you would observe onion skin cells using a microscope

Grade 5-7

1. If a cell is 0.001mm in diameter, calculate the size of the cell in micrometre ?

2. If the nucleus of a cell measures 1µm in diameter when observed using x400 magnification. Calculate the actual size of the nucleus.

3. What is the difference between a light and and an electron microscope?

Grade 7+

1. Evaluate the use of light and electron microscopes to observe cells.

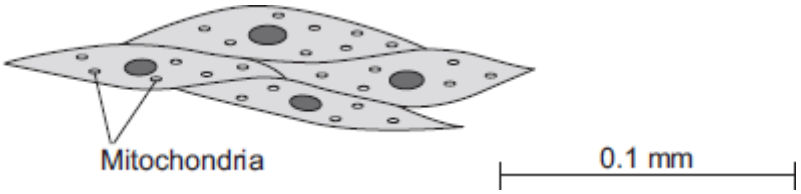
2. Define the terms, magnification and resolution and relate them to the light and electron microscope.

Test it

Answer the exam questions below in your book.

Q1.

The image below shows some muscle cells from the wall of the stomach, as seen through a light microscope.



(a) Describe the function of muscle cells in the wall of the stomach.

(2)

(b) **Figure above** is highly magnified.

The scale bar in **Figure above** represents 0.1 mm.

Use a ruler to measure the length of the scale bar and then calculate the magnification of **Figure above**.

Magnification = _____ times

(2)

(c) The muscle cells in **Figure above** contain many mitochondria.

What is the function of mitochondria? **(2)**

(d) The muscle cells also contain many ribosomes. The ribosomes cannot be seen in **Figure above**.

(i) What is the function of a ribosome?

(1)

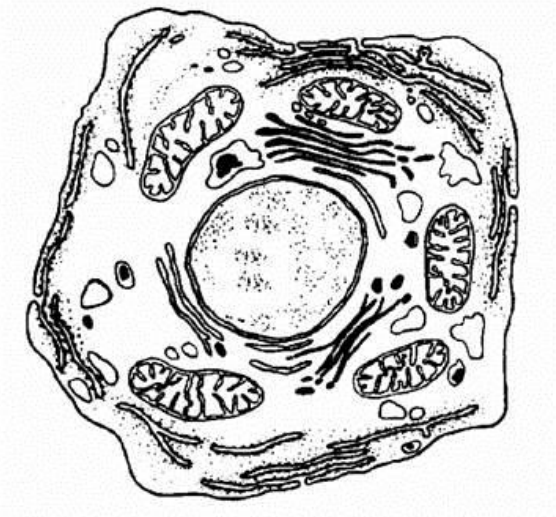
(ii) Suggest why the ribosomes **cannot** be seen through a light microscope.

(1)

(Total 8 marks)

Q2.

The drawing shows an animal cell, seen at a very high magnification using an electron microscope.



(a) (i) Label a mitochondrion [plural = mitochondria]. **(1)**

(ii) What happens in the mitochondria? **(1)**

(b) (i) Name and label the structure where you would find chromosomes. **(1)**

(ii) What are chromosomes made of? **(1)**

(c) What controls the rate of chemical reactions in the cytoplasm? **(1)**

(Total 5 marks)

Mark it

Q1.

(a) contract / shorten

ignore relax

*do **not** allow expand*

1

to churn / move / mix food

accept peristalsis / mechanical digestion

ignore movement unqualified

1

(b) 400

acceptable range 390-410

allow 1 mark for answer in range of 39 to 41

allow 1 mark for answer in range of 3900 to 4100

2

(c) to transfer energy for use

allow to release / give / supply / provide energy

*do **not** allow to 'make' / ?produce' / 'create' energy*

allow to make ATP

ignore to store energy

1

by (aerobic) respiration **or** from glucose

*do **not** allow anaerobic*

*energy released **for** respiration = max 1 mark*

1

(d) (i) to make protein / enzyme

ignore 'antibody' or other named protein

1

(ii) too small / very small

allow light microscope does not have sufficient magnification / resolution

allow ribosomes are smaller than mitochondria

ignore not sensitive enough

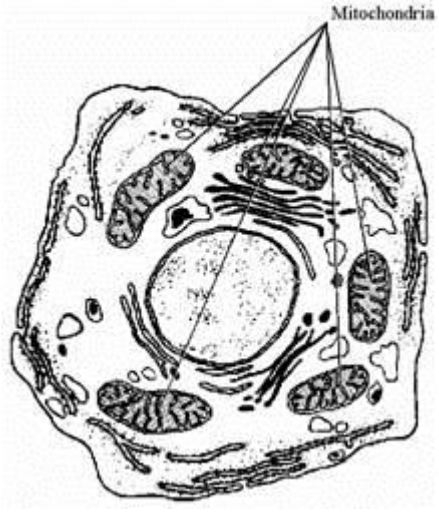
ignore ribosomes are transparent

1

[8]

Q2.

(a) (i)



award 1 mark for any of the mitochondria correctly labelled if a number are labelled and one is incorrect award 0 marks

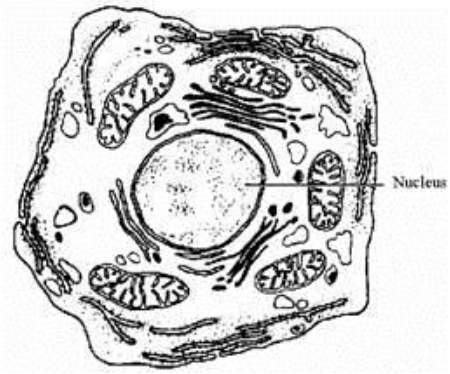
1

(ii) respiration **or** the release **or** transfer of energy **or** it contains the enzymes for respiration

*do **not** accept energy produced*

1

(b) (i) nucleus (named and correctly labelled)



*arrow **or** line must touch **or** go inside the nuclear membrane*

1

(ii) DNA **or** genes **or** nucleic acids

*accept protein **or** histones **or** nucleotides **or** ATGC*

1

(c) enzymes **or** nucleus

*do not accept factors that affect the rate rather than control it eg pH **or** temperature*

1

[5]

Examiner reports

Q1.

This question was about cell structure and function, based on a drawing of some muscle cells from the wall of the stomach.

(a) Just over two-thirds of students scored at least one mark for describing the function of the muscle cells either in terms of their ability to contract or with respect to their use in the stomach for churning food. Relatively few gave both points. A large number spoiled their answer by stating that the muscles 'contract and expand', while others clearly knew nothing about muscle and suggested they might 'secrete acid' or, alternatively, 'protect the body from acid'.

(b) The mathematical requirements given in section 3.7 of the Specification include the statement: *'All students should be able to.....Understand number size and scale and the quantitative relationship between units'*. A very common error in calculating the magnification of the drawing of the muscle cells was to mix units by measuring the scale bar as 4 centimetres (rather than 40 millimetres) and then dividing this by the 0.1 millimetres that it represented. This gave an answer of '40' instead of the correct 400. Despite the instruction in the question to '*use a ruler to measure the length of the scale bar...*', many students measured one or more of the cells in the diagram and scored no marks. Thus success in this question was limited, with only about a quarter scoring full marks.

(c) The function of mitochondria in respiration and in releasing energy was well known, although often only one of these points was made and many spoiled their answer by including the phrase 'making energy' which, of course, defies the fundamental physical law of conservation of energy. Another common error was to state that energy was released 'for respiration' rather than by *respiration*. Thus only one-third of students scored both of the marks available.

(d) (i) Around three quarters of students knew that ribosomes were the site of protein synthesis and that they were too small to be visible in a light microscope, although some suggested that they were merely 'transparent'.

(ii) Around three quarters of students knew that ribosomes were the site of protein synthesis and that they were too small to be visible in a light microscope, although some suggested that they were merely 'transparent'.

Q2.

Many candidates could not label a mitochondrion in part (a) and there were many references to energy being produced rather than released. Many candidates labelled the nucleus correctly, although some were distracted by the chromosome-like structures in the cytoplasm. Almost all knew what chromosomes were made of Most candidates answered part (c) correctly but some put factors affecting, rather than controlling, reactions.