1.9 Cell Structure and Microscopy: 30-minute Pack

AQA 8464 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A student is preparing a temporary mount of some plant cells to view using a light microscope (required practical).

(a) State the purpose of using a mounted needle when lowering the coverslip onto the sample. **(1)**

(b) State the purpose of the coverslip. **(1)**

(c) State the purpose of using a small piece of paper towel to remove excess stain from the edge of the coverslip. **(1)**

(Total for Question 1 is 3 marks)

---

2 A student wants to observe onion epidermal cells using a light microscope (required practical).

(a) Describe how the student should prepare a temporary mount of the onion epidermal cells, from obtaining the sample to viewing it under the microscope. **(4)**

(Total for Question 2 is 4 marks)

© Revision Library | revisionlibrary.co.uk

3 A light microscope has an eyepiece lens and a set of interchangeable objective lenses.

(a) The eyepiece lens has a magnification of x10 and the objective lens in use has a magnification of x25. Calculate the total magnification of the microscope. **(2)**

(Total for Question 3 is 2 marks)

---

4 While preparing a slide, a student lowered the coverslip quickly instead of at an angle, and trapped an air bubble underneath it.

(a) Suggest how the student could tell the difference between a trapped air bubble and a cell when viewing the slide. **(1)**

(b) Suggest one change to the technique that would reduce the risk of trapping air bubbles in future. **(1)**

(c) Suggest why it can be useful to compare an observation made from an unfamiliar sample with a reference photograph taken by an experienced microscopist. **(1)**

(Total for Question 4 is 3 marks)

---

5 Compare the structure of a prokaryotic cell with the structure of a eukaryotic (animal) cell, and explain why an electron microscope allows more of a bacterial cell's internal structure to be seen than a light microscope does.

(Total for Question 5 is 6 marks)

© Revision Library | revisionlibrary.co.uk

6 Higher tier only. A student increases the magnification of a light microscope from x400 to x1500 while viewing a bacterial cell, but no extra detail becomes visible; the image just becomes larger and blurred.

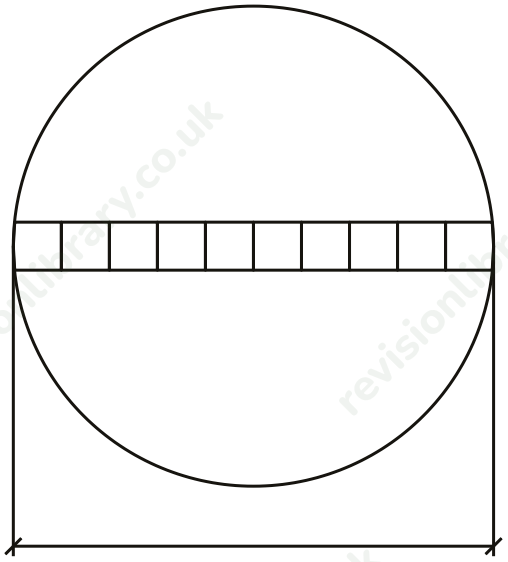
(a) Explain why increasing the magnification did not reveal any extra detail. **(3)**

(Total for Question 6 is 3 marks)

---

7 A student views a sample of onion epidermal cells under a light microscope.

(a) The diameter of the field of view is 1.5 mm. The student counts 10 onion cells lying end to end across the full diameter of the field of view. Estimate the mean length of one onion cell, giving your answer in micrometres (μm). **(2)**



(Total for Question 7 is 2 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 1.9 Cell Structure and Microscopy: 30-minute Pack

Question 1

(a) to lower the coverslip slowly/at an angle so that air bubbles are not trapped underneath, oe **B1**

(a) Answer: To lower the coverslip slowly and at an angle so air bubbles are not trapped.

(b) keeps the sample flat and in place, and protects the sample and the objective lens, oe **B1**

(b) Answer: Keeps the sample flat and in place, and protects the sample and the lens.

(c) draws excess stain/liquid away from under the coverslip so it does not obscure the view/pool on the slide, oe **B1**

(c) Answer: Removes excess stain so it does not obscure the view of the cells.

Question 2

(a) peel/cut a thin section of epidermal tissue from the inner surface of an onion, using forceps or a scalpel **B1**

(a) place the tissue sample flat in the centre of a clean microscope slide, and add a drop of water or iodine solution using a pipette **B1**

(a) lower a coverslip onto the sample at an angle, using a mounted needle, to avoid trapping air bubbles **B1**

(a) place the slide on the microscope stage and view under the lowest-power objective lens first, before increasing the magnification **B1**

(a) Answer: Peel a thin epidermal section, mount it in water/iodine on a slide, lower a coverslip at an angle with a mounted needle to avoid air bubbles, then view starting on the lowest magnification.

Question 3

(a) total magnification = eyepiece magnification x objective magnification, oe **M1**

(a) x250 cao **A1**

(a) Answer: x250

Question 4

(a) an air bubble appears as a distinct, dark-edged, round/circular shape with no cell structures (e.g. no nucleus/cell wall) visible inside it, oe **B1**

(a) Answer: An air bubble looks like a dark-outlined circular shape with no internal cell structures visible.

(b) lower the coverslip slowly, at an angle, starting from one edge (using a mounted needle), oe **B1**

(b) Answer: Lower the coverslip slowly, at an angle, starting from one edge, using a mounted needle.

(c) helps to check whether unusual/unexpected structures seen are genuine cell structures or artefacts (e.g. air bubbles, dirt, fibres), improving the reliability of the observation, oe **B1**

(c) Answer: It helps the student check whether what they saw is a real cell structure or an artefact, improving reliability.

Question 5

Level 3 A detailed, logically sequenced answer that compares at least three structural features of prokaryotic and eukaryotic cells AND gives a scientifically correct explanation of why electron microscopes reveal more internal detail than light microscopes, linking this to resolution/wavelength. **5-6**

Level 2 The answer compares some structural features of prokaryotic and eukaryotic cells and attempts an explanation of why electron microscopes show more detail, with some correct scientific ideas but limited linkage or detail. **3-4**

Level 1 One or two isolated relevant points are made about cell structure or about microscope technology, with little or no linkage between them. **1-2**

Level 0 No relevant content. **0**

Indicative content:

- Prokaryotic cells (e.g. bacteria) do not have a nucleus; their genetic material is a single loop of DNA free in the cytoplasm.
- Prokaryotic cells may also contain one or more small rings of DNA called plasmids.
- Prokaryotic cells do not have membrane-bound organelles such as mitochondria or chloroplasts.
- Prokaryotic cells are generally much smaller than eukaryotic cells.
- Eukaryotic (animal) cells have a nucleus enclosing the genetic material as linear chromosomes.
- Eukaryotic cells contain membrane-bound organelles, such as mitochondria (site of aerobic respiration).
- Light microscopes use visible light, which has a relatively long wavelength, limiting their resolution (the smallest distance apart two points can be and still be seen as separate) to around 200 nanometres.
- Electron microscopes use a beam of electrons, which have a much shorter wavelength than light, giving them a much higher resolution, able to distinguish points far less than 1 nanometre apart.
- This higher resolution means an electron microscope can reveal smaller sub-cellular structures (e.g. plasmids, ribosomes, detailed internal membranes) that appear as a single blurred point, or are invisible, using a light microscope.
- Simply increasing the magnification of a light microscope further would not reveal this detail, because its resolution is fixed by the wavelength of light used (empty magnification).

Question 6

(a) resolution is the ability to distinguish between (see as separate) two points that are very close together, oe **B1**

(a) a light microscope has a limited/fixed resolving power (about 200 nm), set by the wavelength of light used, oe **B1**

(a) increasing the magnification beyond this limit only makes the (already blurred) image bigger; it does not increase the resolution, so no new detail is revealed, oe **B1**

(a) Answer: Resolution (not just magnification) limits detail; a light microscope's resolving power is fixed by the wavelength of light (about 200 nm), so magnifying further just enlarges the blur without revealing new detail.

© Revision Library | revisionlibrary.co.uk

Question 7

(a) mean cell length = diameter of field of view / number of cells, oe (1.5 / 10) **M1**

(a) 150 µm cao (allow 0.15 mm) **A1**

(a) Answer: 150 µm (0.15 mm)

© Revision Library | revisionlibrary.co.uk