

Microscopes

Question Paper 2

| | |
|-------------------|-----------------------|
| Level | International A Level |
| Subject | Biology |
| Exam Board | CIE |
| Topic | Microscopes |
| Sub Topic | |
| Booklet | Multiple Choice |
| Paper Type | Question Paper 2 |

Time Allowed : 44 minutes

Score : / 36

Percentage : /100

Grade Boundaries:

| A* | A | B | C | D | E | U |
|------|--------|-----|-------|-------|-----|------|
| >85% | '77.5% | 70% | 62.5% | 57.5% | 45% | <45% |

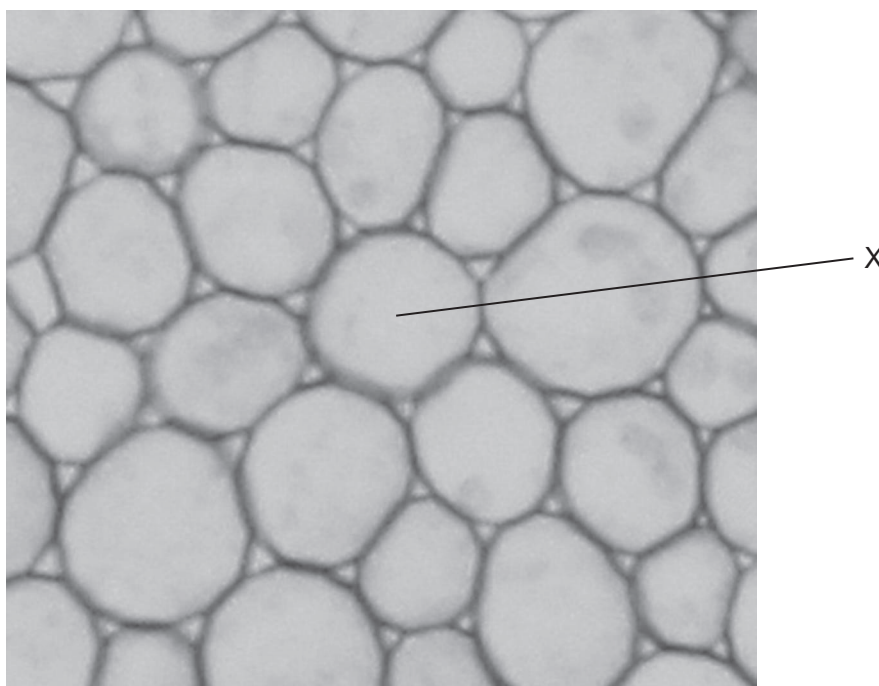
1 Red blood cells have a diameter of 7000 nm.

Pancreatic cells have a diameter of diameter 35 μm .

What is correct about the relative sizes of these cells?

- A The red blood cells are 5 times larger.
- B The red blood cells are 50 times larger.
- C The red blood cells are 5 times smaller.
- D The red blood cells are 50 times smaller.

2 A group of students were asked to look at the photomicrograph of a cross-section of unfamiliar material and make observations.



They described X as

- 1 circular
- 2 a hollow tube
- 3 a spherical structure

Which description(s) are correct?

- A 1, 2 and 3
- B 1 and 2 only
- C 1 only
- D 3 only

- 3 Which cell structure can be seen **only** with an electron microscope?
- A cell wall
 - B chromosome
 - C nucleolus
 - D ribosome
- 4 Which statement is **not** correct in its description of a light microscope or an electron microscope?
- A A light microscope has a maximum resolution of $0.2\ \mu\text{m}$.
 - B An electron microscope has a maximum resolution of $0.05\ \text{nm}$.
 - C A light microscope can resolve specimens as small as $200\ \text{nm}$ in diameter.
 - D An electron microscope can resolve specimens as small as $0.5\ \text{nm}$ in diameter.
- 5 Which structure is measured in the units shown using a light microscope?

| | structure | unit |
|---|-----------------------|---------------|
| A | cell surface membrane | nm |
| B | cell wall | nm |
| C | chloroplast | μm |
| D | ribosome | μm |

- 6 A student studied two photographs, at the same magnification, of a palisade mesophyll cell, one using a light microscope and the other using an electron microscope.

The student observed:

- 1 the cisternae of the Golgi apparatus
- 2 the grana in the chloroplasts
- 3 the two membranes of the nuclear envelope
- 4 the vacuole enclosed by a tonoplast.

Which features can only be seen because of the higher resolution of the electron microscope?

- A 1, 2 and 3 only
- B 1, 2 and 4 only
- C 1, 3 and 4 only
- D 2, 3 and 4 only

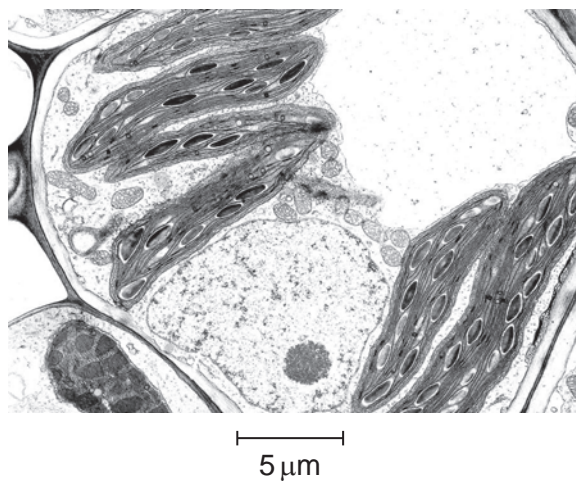
- 7 What is **not** a limitation of an electron microscope?

- A Electrons do not travel far in air so the whole system must be in a vacuum.
- B The electron beam cannot penetrate far into biological material.
- C The typical specimen viewed in a vacuum must be dehydrated.
- D There is an increase in resolution and magnification compared with the light microscope.

- 8 Which statement about the light microscope is correct?

- A As the smallest distance to see two points as distinct separate points decreases, the resolution also decreases.
- B If the resolution is 220 nm, then a bacterium 0.2 μm in diameter will not be visible.
- C If the wavelength of light is 600 nm, then two membranes 300 nm apart will be visible as two distinct membranes.
- D Using visible light of a longer wavelength, such as red light, will improve the resolution.

- 9 The diagram shows the ultrastructure of a cell from a dicotyledonous leaf.



What is the magnification?

- A** ×280 **B** ×2800 **C** ×3570 **D** ×7000
- 10 Which eyepiece and objective lens combination of a light microscope enables you to see the greatest number of cells in the field of view?

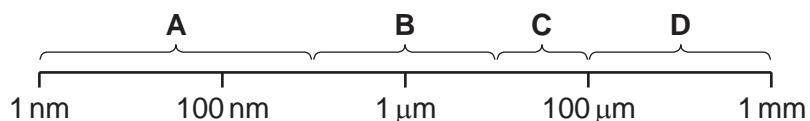
| | eyepiece lens | objective lens |
|----------|---------------|----------------|
| A | ×5 | ×10 |
| B | ×5 | ×40 |
| C | ×10 | ×10 |
| D | ×10 | ×40 |

11 Plant cells are fixed, stained and viewed through a light microscope.

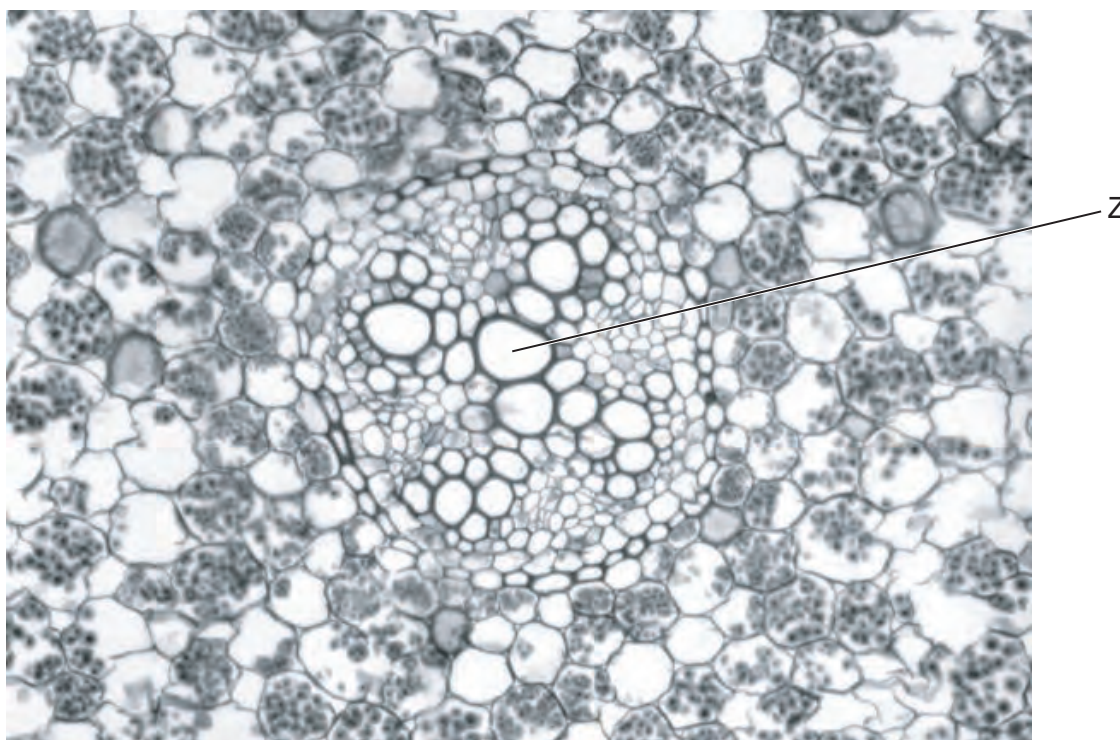
What would be clearly visible at x400 magnification?

- A cristae of mitochondria
- B grana of chloroplasts
- C nucleoli
- D ribosomes

12 Which size range would include most prokaryotic cells?



13 The photomicrograph shows some plant tissues and the magnification is $\times 200$.



What is the diameter of the cell marked Z?

- A $5\ \mu\text{m}$
- B $10\ \mu\text{m}$
- C $50\ \mu\text{m}$
- D $100\ \mu\text{m}$

- 14 The same plant cells were viewed by a student using an electron microscope and a light microscope.

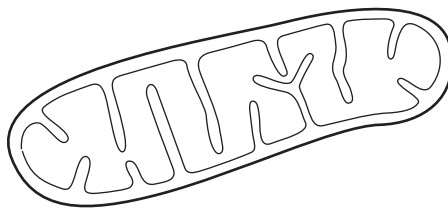
The electron microscope used a magnification of $\times 1000$.

The light microscope used a $\times 10$ eyepiece lens and a $\times 100$ objective lens.

The student concluded that the image of the plant cell obtained using the electron microscope was clearer and more detailed than the image obtained using the light microscope.

Which explanation supports this conclusion?

- A The electron microscope had a poorer resolution than the light microscope, but was better able to distinguish between two separate points.
 - B The magnification used in the two microscopes was the same, but the electron microscope had a better resolution than the light microscope.
 - C The student used the electron microscope at a higher magnification than the light microscope which led to an improved resolution.
 - D The two microscopes had the same resolution, but the magnification used in the electron microscope gave an image that was ten times larger than the light microscope.
- 15 The diagram shows an organelle drawn at a magnification of $\times 20\,000$.



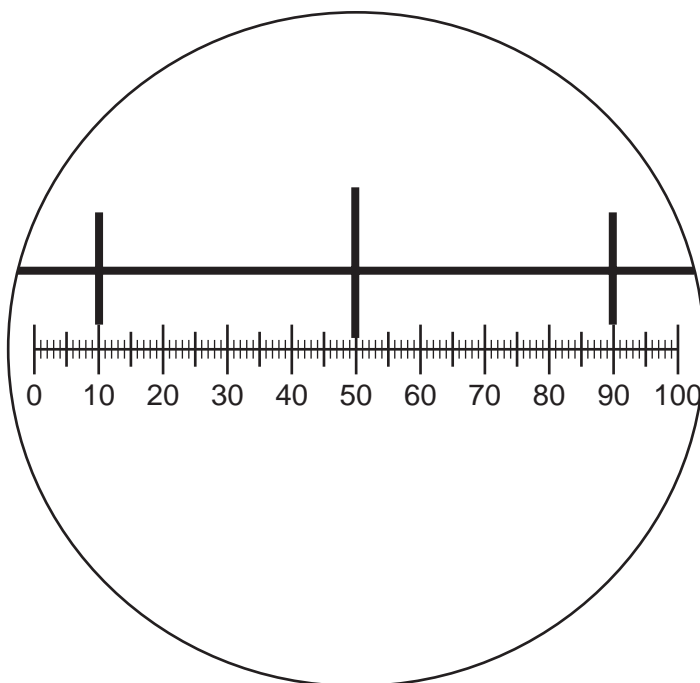
What is the maximum length of the organelle?

- A $3 \times 10^{-1} \mu\text{m}$ B $3 \times 10^0 \mu\text{m}$ C $3 \times 10^1 \mu\text{m}$ D $3 \times 10^2 \mu\text{m}$

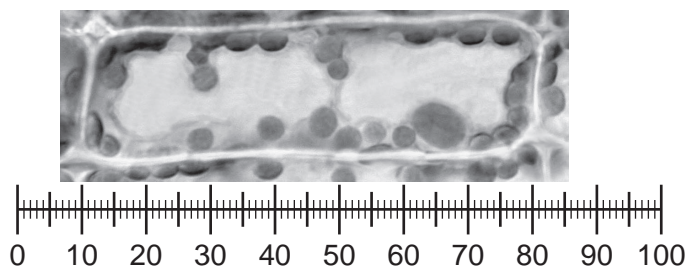
16 What is the diameter of a typical prokaryote, such as *Streptococcus*?

- A 7.5×10^1 nm
- B 7.5×10^2 nm
- C 7.5×10^0 μm
- D 7.5×10^1 μm

17 The diagram shows a stage micrometer on which the small divisions are 0.1 mm. It is viewed through an eyepiece containing a graticule.



The stage micrometer is replaced by a slide of a plant cell.



What is the length of the nucleus?

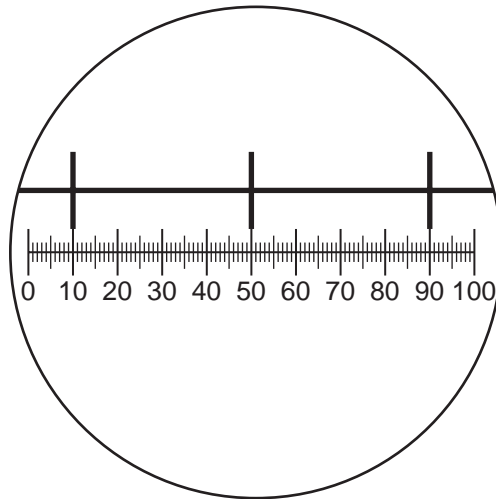
- A 0.8 mm
- B 8 μm
- C 25 μm
- D 200 μm

- 18 Which of the cell organelles, when appropriately stained, will be clearly visible under the high power ($\times 400$) of the light microscope?

| | lysosomes | endoplasmic reticulum | mitochondria | chloroplasts |
|----------|-----------|-----------------------|--------------|--------------|
| A | ✓ | ✓ | x | x |
| B | ✓ | x | ✓ | x |
| C | x | ✓ | ✓ | ✓ |
| D | x | x | x | ✓ |

key
 ✓ = visible
 x = not visible

- 19 The diagram shows a stage micrometer, with divisions 0.1 mm apart, viewed through an eyepiece containing a graticule.



The same eyepiece is now used to examine a blood smear.

How many graticule divisions will cover the diameter of a white cell of $10\ \mu\text{m}$?

- A** 1 **B** 4 **C** 10 **D** 20

20 Which steps are needed to find the actual width of a xylem vessel viewed in transverse section using a $\times 40$ objective lens?

- 1 Convert from mm to μm by multiplying by 10^{-3} .
- 2 Calibrate the eyepiece graticule using a stage micrometer on $\times 10$ objective lens.
- 3 Measure the width of the xylem vessel using an eyepiece graticule.
- 4 Multiply the number of eyepiece graticule units by the calibration of the eyepiece graticule.

- A** 1, 2, 3 and 4
B 2, 3 and 4 only
C 1 and 2 only
D 3 and 4 only

21 A specimen is viewed under a microscope using green light with a wavelength of 510 nm.

If the same specimen is viewed under the same conditions, but using red light with a wavelength of 650 nm instead, what effect will this have on the magnification and on the resolution of the microscope?

| | magnification | resolution |
|----------|------------------|------------|
| A | decreased | decreased |
| B | increased | increased |
| C | remains the same | decreased |
| D | remains the same | increased |

22 The diameter of living cells varies considerably.

The typical diameters are

a eukaryote, such as a white blood cell $1.5 \times 10^1 \mu\text{m}$

a prokaryote, such as *Streptococcus* $7.5 \times 10^2 \text{nm}$

Use these measurements to find the maximum number of each cell type which could fit along a line 1 cm long.

| | number of white blood cells | number of <i>Streptococcus</i> cells |
|----------|-----------------------------|--------------------------------------|
| A | 6.7×10^3 | 1.3×10^5 |
| B | 6.7×10^2 | 1.3×10^4 |
| C | 6.7×10^1 | 1.3×10^3 |
| D | 6.7×10^0 | 1.3×10^2 |

23 Which cell structure can be seen only with an electron microscope?

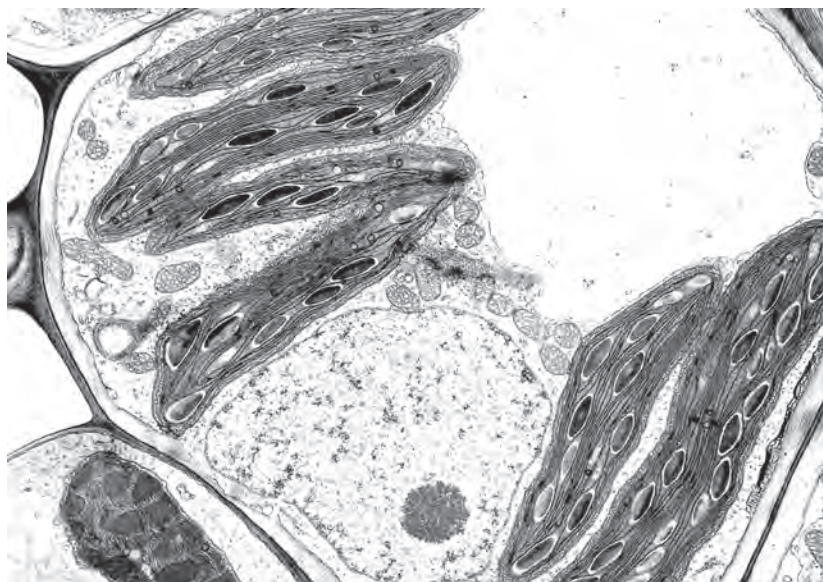
- A** cell surface membrane
- B** chromosome
- C** nucleolus
- D** vacuole

24 A lymphocyte has a diameter of 1×10^{-2} millimetres (mm).

What is the diameter in nanometres (nm)?

- A** 1×10^1
- B** 1×10^2
- C** 1×10^3
- D** 1×10^4

25 The photomicrograph of a cell has a 2 cm scale line labelled 5 μm .



5 μm

What is the magnification of the photomicrograph?

- A** 1×10^3 **B** 2×10^3 **C** 4×10^3 **D** 5×10^3

26 Which eyepiece and objective lens combination enables you to see the greatest number of cells in the field of view?

| | eyepiece | objective |
|----------|-------------|-------------|
| A | $\times 5$ | $\times 10$ |
| B | $\times 10$ | $\times 10$ |
| C | $\times 5$ | $\times 40$ |
| D | $\times 10$ | $\times 40$ |

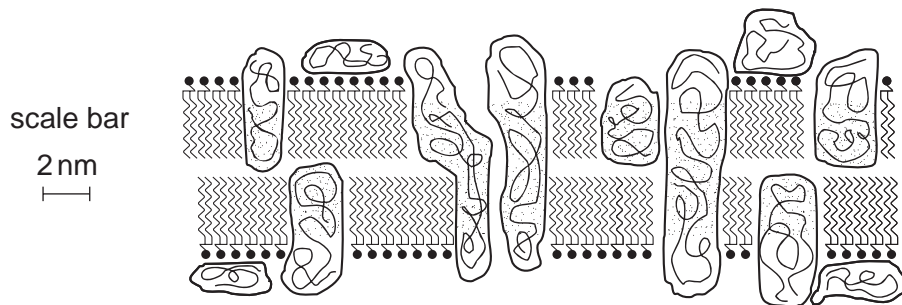
- 27 Mitochondria are thought to have evolved from prokaryotic cells that were ingested by an ancestral cell.

Which feature have the prokaryotes lost during their evolution into mitochondria?

- A cell wall
- B circular chromosome
- C endoplasmic reticulum
- D ribosomes

2

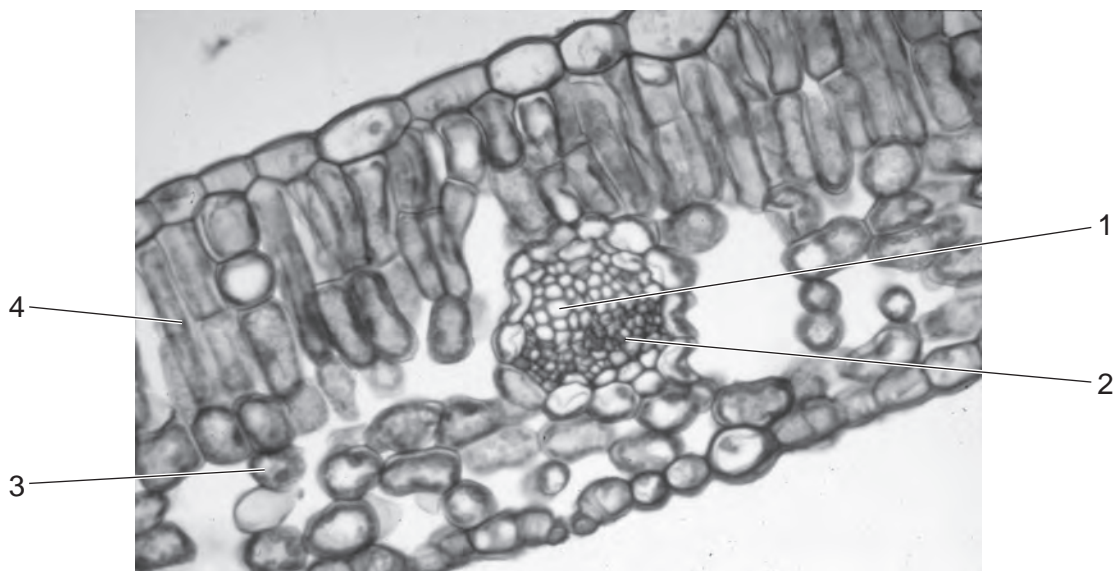
- 28 The diagram shows part of a membrane around a vacuole of a plant cell.



What is the width of the membrane?

- A $7.5 \times 10^{-3} \text{ m}$
- B $7.5 \times 10^{-6} \text{ m}$
- C $7.5 \times 10^{-9} \text{ m}$
- D $7.5 \times 10^{-12} \text{ m}$

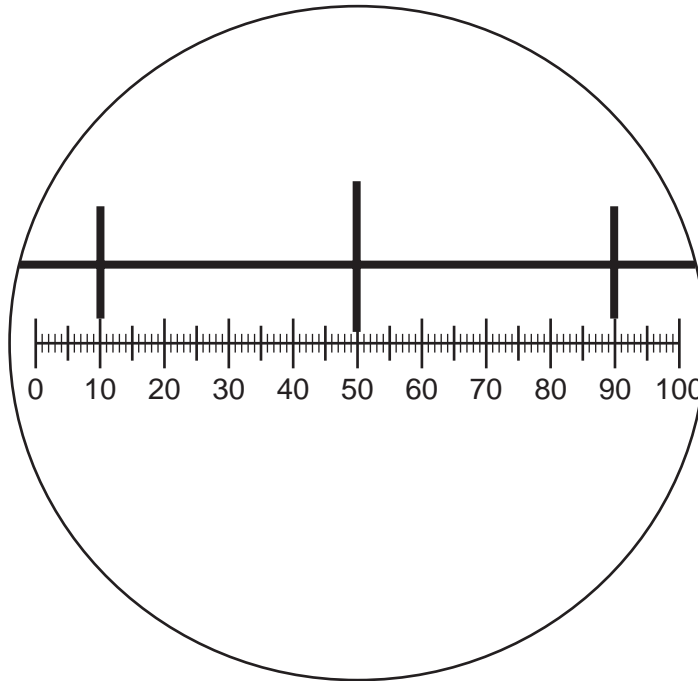
29 The diagram shows a transverse section of part of a dicotyledonous leaf.



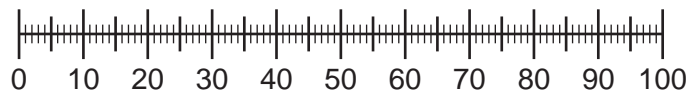
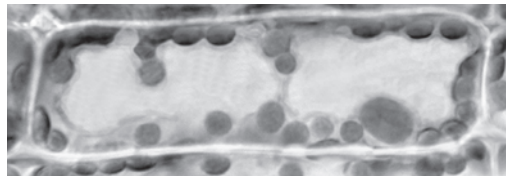
What are the correct labels for 1, 2, 3 and 4?

| | 1 | 2 | 3 | 4 |
|----------|--------|--------|--------------------|--------------------|
| A | phloem | xylem | palisade mesophyll | spongy mesophyll |
| B | phloem | xylem | spongy mesophyll | palisade mesophyll |
| C | xylem | phloem | palisade mesophyll | spongy mesophyll |
| D | xylem | phloem | spongy mesophyll | palisade mesophyll |

- 30 The diagram shows a stage micrometer on which the small divisions are 0.1 mm. It is viewed through an eyepiece containing a graticule.



The stage micrometer is replaced by a slide of a plant cell.

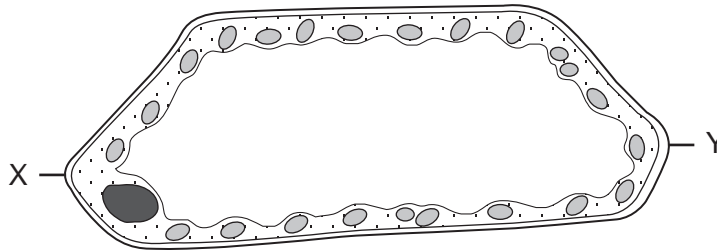


What is the width of a chloroplast?

- A** 5 μm **B** 10 μm **C** 50 μm **D** 100 μm

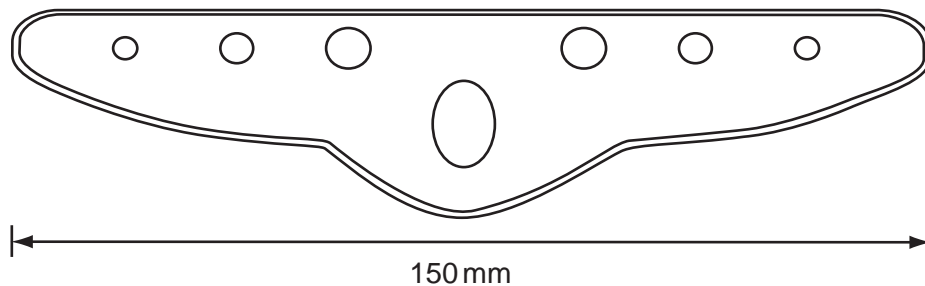
- 31 The diagram shows a high-power drawing of a plant cell.

The actual length of the cell between X and Y was $160\ \mu\text{m}$.



What is the magnification of the cell?

- A** $\times 50$ **B** $\times 100$ **C** $\times 500$ **D** $\times 1000$
- 32 The diagram is a plan of a transverse section through a leaf, drawn using a $\times 5$ eyepiece and a $\times 8$ objective lens of a microscope.



The actual distance across the leaf section is $7.5\ \text{mm}$. What is the magnification of the diagram?

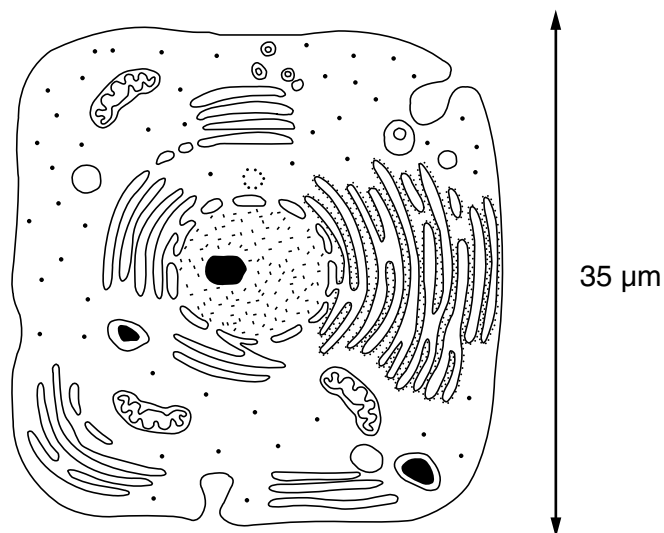
- A** $\times 5$ **B** $\times 8$ **C** $\times 20$ **D** $\times 40$
- 33 What describes the features of an electron microscope and its use?

| | maximum magnification | resolution / nm | specime used |
|----------|-----------------------|-----------------|--------------|
| A | $\times 2\ 500$ | 250 | dead |
| B | $\times 25\ 000$ | 0.5 | living |
| C | $\times 250\ 000$ | 0.5 | dead |
| D | $\times 500\ 000$ | 250 | living |

34 What is the resolution, in nanometres, of an electron microscope and of a light microscope?

| | electron microscope | light microscope |
|----------|---------------------|------------------|
| A | 0.5 | 20 |
| B | 0.5 | 200 |
| C | 5.0 | 20 |
| D | 5.0 | 200 |

35 The diagram shows a drawing of an electronmicrograph.



What is the approximate length of one mitochondrion in this cell?

- A** 5 to 6 μm
- B** 7 to 8 μm
- C** 8 to 10 μm
- D** 10 to 15 μm

- 36** What is meant by *resolution* in light microscopy?
- A** the product of the magnifications of the eyepiece and the objective lenses
 - B** the shortest distance between two objects that can be seen as separate
 - C** the size of the smallest object that can be seen
 - D** twice the wavelength of the light used to illuminate the specimen