

GCSE Combined Science: Trilogy

Worksheet: Microscopy

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Microscopy

NAME _____ **CLASS** _____ **DATE** _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Microscopes are used to look at cells.

0 1 . 1

Which equation is correct?

Tick (✓) **one** box.

magnification = size of image ÷ size of real object

☐

magnification = size of real object ÷ size of image

☐

magnification = size of image × size of real object

☐

magnification = size of image – size of real object

☐

[1 mark]

0 1 . 2

A light microscope has an eyepiece lens with a magnification of ×10 and an objective lens with a magnification of ×40.

Calculate the total magnification.

.....

.....

.....

Magnification =

[1 mark]

0 1 . 3

The image of a cell is 20 mm wide. The magnification is $\times 400$.
Calculate the real width of the cell in mm.

.....

.....

.....

.....

Real width = mm

[2 marks]

0 1 . 4

Give the real width of the cell in micrometres (μm).
1 mm = 1000 μm

.....

.....

.....

Real width = μm

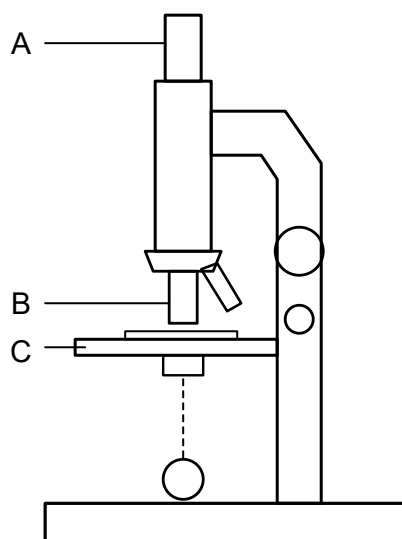
[1 mark]

.....

0 2

Figure 1 shows a light microscope.

Figure 1



0 2 . 1

Name the parts labelled **A**, **B** and **C**.

.....

.....

.....

.....

.....

.....

[3 marks]

0 2 . 2

A student is looking at a new slide.
Which objective lens should the student use first?

Tick (✓) **one** box.

×4

×10

×40

×100

☐

☐

☐

☐

[1 mark]

0 2 . 3

The eyepiece lens has a magnification of $\times 15$.
Calculate the total magnification when the $\times 40$ objective lens is used.

.....

.....

.....

Total magnification =

[1 mark]

0 2 . 4

Which structure could the student see using this light microscope?

Tick (✓) **one** box.

A plasmid in a bacterium

☐

A ribosome

☐

The inner membranes of a mitochondrion

☐

The nucleus of a cheek cell

☐

[1 mark]

0 3

A student used a light microscope to look at some cells.

0 3 . 1

The eyepiece lens had a magnification of $\times 10$. The objective lens had a magnification of $\times 4$.

Calculate the total magnification.

.....

.....

.....

Total magnification =

[1 mark]

0 3 . 2

The student made a drawing of one of the cells. The cell in the drawing was 16 mm wide. The real width of the cell was 0.04 mm.

Calculate the magnification of the drawing.

Use the equation: magnification = size of image ÷ size of real object

.....

.....

.....

.....

Magnification =

[2 marks]

0 4

A student used a light microscope to look at different cells.

1 mm = 1000 μm

0 4 . 1

The image of a red blood cell was 8 mm in diameter. The magnification was $\times 1000$.

Calculate the real diameter of the red blood cell in μm .

.....

.....

.....

.....

.....

Real diameter = μm

[3 marks]

0 4 . 2

The real diameter of a pollen grain was $35\text{ }\mu\text{m}$. The image of the pollen grain was 14 mm in diameter.
Calculate the magnification of the image.

.....

.....

.....

.....

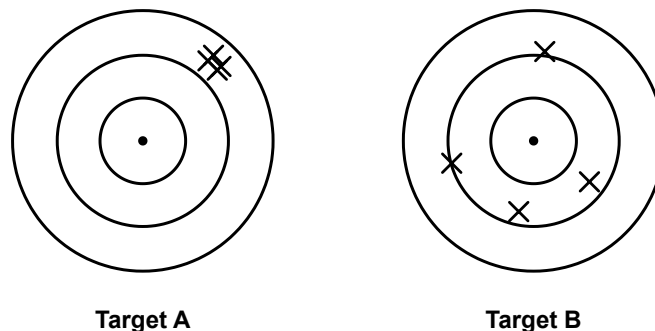
Magnification =

[2 marks]

0 5

A student used a calibrated eyepiece graticule ($1\text{ division} = 4\text{ }\mu\text{m}$) to measure the lengths of onion epidermal cells. For every cell, the student lined up one end of the cell with the 1 mark on the eyepiece scale, instead of the 0 mark, and then recorded the reading at the other end of the cell as its length. Figure 2 shows two targets representing repeated attempts by two other students, A and B, to measure the same known length using this microscope: each cross is one measurement, and the centre of the target is the true value.

Figure 2



0 5 . 1

What type of error did the student make by lining up each cell with the 1 mark instead of the 0 mark?

Tick (✓) **one** box.

Anomalous result

Parallax error

Random error

Systematic error

☐

☐

☐

☐

[1 mark]

0 5 . 2

Explain how the student could correct the lengths already recorded. Give **one** example of a random error that could also affect this student's measurements.

.....

.....

.....

.....

[2 marks]

0 5 . 3

Target A in Figure 2 shows student A's repeated measurements; target B shows student B's. Which student's measurements are **precise but not accurate**, and which are **accurate but not precise**? Explain your answer.

.....

.....

.....

.....

.....

.....

[3 marks]

0 6

A scientist took an electron micrograph of a mitochondrion.
The image of the mitochondrion is 45 mm long. The magnification of the micrograph is $\times 30\,000$.

0 6 . 1

Calculate the real length of the mitochondrion in micrometres (μm).

.....

.....

.....

.....

.....

Real length = μm

[3 marks]

0 6 . 2

Give the real length of the mitochondrion in nanometres (nm).

$1\text{ }\mu\text{m} = 1000\text{ nm}$

.....

.....

.....

Real length = nm

[1 mark]

0 6 . 3

Give the real length of the mitochondrion in metres.

Give your answer in standard form.

.....

.....

.....

Real length = m

[1 mark]

0 6 . 4

The micrograph showed the folded membranes inside the mitochondrion.

Give **one** reason why these membranes cannot be seen with a light microscope.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Microscopy · 31 marks

Question 1 (5 marks)

01.1 [1 mark]

Correct: magnification = size of image $\div$ size of real object

01.2 [1 mark]

Answer: $\times 400$

- $(10 \times 40 =) 400$ ($\times$) (1)
-

01.3 [2 marks]

Answer: 0.05 mm

- $20 \div 400$ (1)
 - 0.05 (mm) (1)
-

Notes: An answer of 0.05 scores 2 marks.

01.4 [1 mark]

Answer: 50 μm

- 50 (μm) (1)
-

Notes: Allow ECF: their answer $\times 1000$.

Question 2 (6 marks)

02.1 [3 marks]

Answer: A eyepiece lens; B objective lens; C stage

- A – eyepiece (lens) (1)
 - B – objective (lens) (1)
 - C – stage (1)
-

02.2 [1 mark]

Correct: ×4

02.3 [1 mark]

Answer: ×600

- $(15 \times 40 =) 600 (\times) (1)$
-

02.4 [1 mark]

Correct: The nucleus of a cheek cell

Question 3 (3 marks)

03.1 [1 mark]

Answer: ×40

- $(10 \times 4 =) 40 (\times) (1)$
-

03.2 [2 marks]

Answer: ×400

- $16 \div 0.04 (1)$
- $400 (\times) (1)$

Notes: An answer of 400 scores 2 marks.

Question 4 (5 marks)

04.1 [3 marks]

Answer: 8 μm

- real size = size of image $\div$ magnification (1)
- $8 \div 1000 = 0.008$ (mm) (1)
- 8 (μm) (1)

Notes: An answer of 8 scores 3 marks. 0.008 scores 2 marks.

04.2 [2 marks]

Answer: $\times 400$

- 14 mm = 14 000 μm (1)
- $(14\,000 \div 35 =) 400$ ($\times$) (1)

Notes: An answer of 0.4 (units not converted) scores 0 marks.

Question 5 (6 marks)

05.1 [1 mark]

Correct: Systematic error

05.2 [2 marks]

- subtract 1 division (4 μm) from every recorded length (because every length is 1 division too large) (1)
- random error, e.g. it is difficult to judge exactly where the end of a cell lies each time, or the focus / the student's eye position changes slightly between readings (1)

Notes: For the first mark allow: re-measure every cell with one end lined up with the 0 mark.

05.3 [3 marks]

- student A: precise but not accurate — the crosses are close together (consistent) but far from the centre of the target (not close to the true value) (1)
 - student B: accurate but not precise — the crosses are spread out (not consistent) but centred around the middle of the target (their average is close to the true value) (1)
 - accuracy is how close a measurement is to the true value; precision is how close repeated measurements are to each other (1)
-

Question 6 (6 marks)

06.1 [3 marks]

Answer: 1.5 μm

- $45 \div 30\,000$ (1)
- $= 0.0015$ (mm) (1)
- 1.5 (μm) (1)

Notes: An answer of 1.5 scores 3 marks. 0.0015 scores 2 marks.

06.2 [1 mark]

Answer: 1500 nm

- 1500 (nm) (1)

Notes: Allow ECF.

06.3 [1 mark]

Answer: 1.5×10^{-6} m

- 1.5×10^{-6} (m) (1)

Notes: Allow ECF.

06.4 [1 mark]

- the resolution of a light microscope is too low / the membranes are too small / close together to be seen separately (1)

Notes: Ignore 'the magnification is too low' on its own.
