Microscopes & Magnification

GCSE Biology Revision Workbook

Name: _____

Date: _____

Class: _____

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Practice Questions: Grades 4 to 5

Topic 1: Microscopic Units

1. Name the three main units used to measure cells and microorganisms.

[3 marks]

_____

2. State which unit is smaller: a micrometre or a nanometre.

[1 mark]

_____

Topic 2: Orders of Magnitude

3. What is meant by 'order of magnitude'?

[1 mark]

_____

_____

4. How many orders of magnitude larger is 1 mm compared to 1 μm?

[1 mark]

_____

Topic 3: Types of Microscopes

5. Name two types of microscopes used in Biology.

[2 marks]

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_____

6. State one advantage of an electron microscope over a light microscope.

[1 mark]

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_____

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Practice Questions: Grades 6 to 7

Topic 4: Core Practical - Using Microscopes

7. A student is preparing a slide to view onion cells under a light microscope.

Describe the steps the student should take to prepare the slide.

[4 marks]

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8. Explain why iodine solution is often used when viewing plant cells under a microscope.

[2 marks]

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Topic 5: Magnification Calculations

9. A cell has an actual length of 0.04 mm. Under a microscope, the image measures 8 mm. Calculate the magnification.

[3 marks]

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_____

10. A bacterium is magnified ×50,000. The image size is 10 mm. Calculate the actual size of the bacterium in micrometres (μm).

[4 marks]

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_____

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Topic 6: Standard Form for Biology

11. Write 0.000025 metres in standard form.

[1 mark]

_____

12. A mitochondrion has a length of 2×10^{-6} m. Convert this to micrometres (μm).

[2 marks]

_____

_____

Practice Questions: Grades 8-9

13. Compare the advantages and limitations of light microscopes and electron microscopes. In your answer, consider magnification, resolution, and practical uses.

[6 marks]

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14. A scientist observes a virus particle using an electron microscope at ×100,000 magnification. The image measures 3 cm. Calculate the actual size of the virus in nanometres. Show all your working.

[5 marks]

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_____

_____

_____

15. Resolution is the ability to distinguish between two separate points.

Explain why electron microscopes have a much higher resolution than light microscopes.

[3 marks]

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Mark Scheme

Mark scheme guidance:

- MP (Marking Point): Each step in your method that can earn a mark.
- ECF (Error Carried Forward): You can still get marks if you make a mistake early on in a calculation, but use the correct method afterwards.
- (In brackets): This part isn't needed to get the mark, but it might help show your thinking.
- OOWTTE (Or Words To That Effect): You don't have to use exact wording—the answer can be awarded a mark if it conveys this scientific meaning/understanding.
- / (Slash): Shows alternative correct answers or methods. If two options are separated by a slash, they count as the same marking point—so you can only get one mark for them.

Question	Mark Scheme	Additional Guidance	Marks
1	Millimetre (mm) Micrometre (μm) Nanometre (nm)		(1 mark) (1 mark) (1 mark)
2	Nanometre / nm		(1 mark)
3	A power of 10 / a factor of 10 difference		(1 mark)
4	3 orders of magnitude / 10^3 / x1000		(1 mark)
5	Light microscope Electron microscope		(1 mark) (1 mark)
6	Higher magnification / Higher resolution / Can see smaller structures	OOWTTE	
7	Peel a thin layer of onion (epidermis) Place on a glass slide Add a drop of water / iodine stain Lower a coverslip (at an angle to avoid air bubbles) Place slide on microscope stage and adjust objective lenses Turn light on/adjust mirror Adjust (fine/coarse) focus knobs		(1 mark) (1 mark) (1 mark) (1 mark)

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Question	Mark Scheme	Additional Guidance	Marks
8	It stains the cells / makes them more visible Shows cell structures / nucleus more clearly		(1 mark) (1 mark)
9	Magnification = Image size ÷ Actual size 8 ÷ 0.04 = (×)200	Full marks for (x)200 no working.	(1 mark) (1 mark) (1 mark)
10	Actual size = Image size ÷ Magnification (1 mark) 10 ÷ 50,000 = 0.0002 mm (1 mark) Convert to µm: 0.0002 × 1000 (1 mark) = 0.2 µm (1 mark)	Full marks for 0.2(µm) no working. ECF: award maximum 3 marks for answer resulting from incorrect conversion of mm to µm if MP1 and MP2 are correct. ECF: award maximum 2 marks for incorrect equation applied if MP3 and MP4 are correct, resulting from incorrect calculation for MP2.	(1 mark) (1 mark) (1 mark) (1 mark)
11	2.5×10^{-5} m		(1 mark)
12	Multiply by 10^6 / 1,000,000 2 µm		(1 mark) (1 mark)
13	Light microscope: lower magnification (max ~×2000) Electron microscope: much higher magnification (over ×500,000) Light microscope: can view living specimens / colour Electron microscope: higher resolution / see more detail / see organelles Light microscope: cheaper / easier to use / portable Electron microscope: requires dead/treated specimens / expensive / specialist training		(1 mark) (1 mark) (1 mark) (1 mark) (1 mark) (1 mark)

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14	Convert image to mm: 3 cm = 30 mm Actual size = Image ÷ Magnification 30 ÷ 100,000 = 0.0003 mm Convert to nm: 0.0003 mm × 1,000,000 = 300 nm	Full marks for 300 (nm) no working. ECF: Award maximum 4 marks for answer resulting from incorrect conversion of cm to mm (e.g. using 3 mm instead of 30 mm) if MP2, MP3, MP4, and MP5 are correct. ECF: Award maximum 3 marks for incorrect calculation in MP3 (e.g. decimal error) if MP1, MP2, and MP4 are correct. ECF: Award maximum 2 marks for incorrect equation applied (e.g. multiplying instead of dividing) if MP4 and MP5 are correct, resulting from incorrect calculation for MP2. ECF: Award maximum 1 mark for correct conversion from mm to nm (MP4) if all previous steps are incorrect but conversion factor is correctly applied to a wrong value.	(1 mark) (1 mark) (1 mark) (1 mark) (1 mark)
15	Electron microscopes use electrons/ electron beams instead of light Electrons have a much shorter wavelength than light Shorter wavelength allows finer detail to be resolved / distinguished / produces a higher resolution image		(1 mark) (1 mark) (1 mark)

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