

AQA Biology

GCSE Student calculation sheet

B1, Topic 1.1

Name Class Date

Magnification calculations

Specification reference:

- B1.1.5 Microscopy

Aims

The aim of this activity is to carry out calculations involving magnification, real size, and image size. You should be able to:

- recognise and use expressions in decimal form
- recognise expressions in standard form
- make order of magnitude calculations
- change the subject of an equation.

Learning outcomes

After completing this activity, you should be able to:

- calculate total magnification
- use the formula: $\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$
- measure the size of cells.

Introduction

Most cells are very small and can only be seen through a microscope. The cell image that you see through the microscope will be much larger than the object is in real-life, and so it can be hard to imagine exactly how small it actually is. However, if we know the magnification of the microscope then we can use the image size to calculate the actual size of the cell using the following formula:

$$\text{size of real object} = \frac{\text{size of image}}{\text{magnification}}$$

We can also rearrange this equation so that, if we need to, we can work out what the image size will be or what the magnification of the microscope is. These two equations are:

$$\text{size of image} = \text{magnification} \times \text{size of real object}$$

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

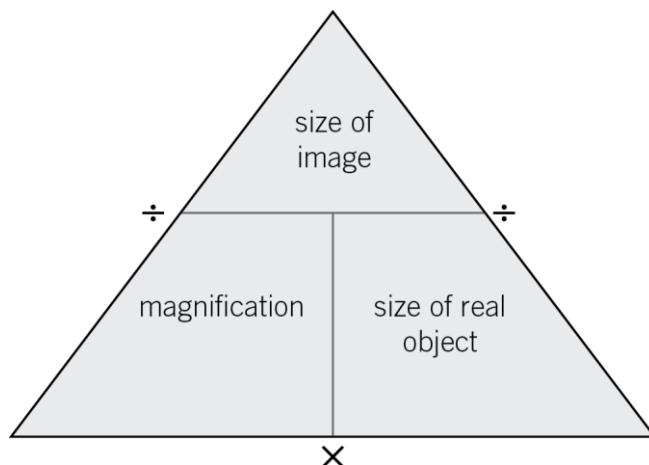
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As long as you know or can measure two of the factors, you can find the third.



Worked example

You are looking at onion cells under a microscope. The cells on the slide appear to measure 5 mm with a magnification of $\times 200$. What is the actual size of the cell in micrometres (μm)?

For this question you first need to find the correct formula from the ones given above. You are trying to find the specimen size and so the formula you need is:

$$\text{size of real object} = \frac{\text{size of image}}{\text{magnification}}$$

$$\text{size of real object} = \frac{5}{200} = 0.025 \text{ mm}$$

This answer is in mm, where 1 mm = 1000 micrometres (μm)

To convert to μm : $0.025 \times 1000 = 25 \mu\text{m}$

Questions

1 Work out the real size of these objects.

Size of image (mm)	Magnification	Size of real object (mm)
5	40	
10	1000	
12	60	
8	200	
15	500	

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- 2 Use the equations given to complete the table.

Size of image (mm)	Magnification	Size of real object (mm)
10		0.002
	400	0.05
6		0.006
	50	0.05
15		0.15

- 3 A student views the image of a cell magnified 40 000 times. The image is 50 mm long. Calculate the actual length of the sample in micrometres.

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- 4 A sperm cell has a tail 40 μm long and a student draws it 40 mm long. Calculate the magnification.

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- 5 A red blood cell is 7.5 μm in diameter. It is magnified 2000 times. Calculate the diameter of the image seen through the microscope in millimetres.

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- 6 A student views a cheek cell through a microscope. Look at the photo support sheet to see what the student observed.
- a Use the scale given to calculate the magnification.
 - b Deduce the size of a cheek cell.
- 7 Look at the photo support sheet. The onion cells shown have been magnified 80 times.
Calculate the actual height of an onion cell.