GCSE to A-Level Biology Transition

Lesson number: 11

Title: Formulae and rearranging

Lesson 11 – Formulae and rearranging

Lesson objective:

- Rearrange an equation to calculate the answer to a question

STARTER

What is the equation triangle for magnification?

3.2 Rearranging formulae

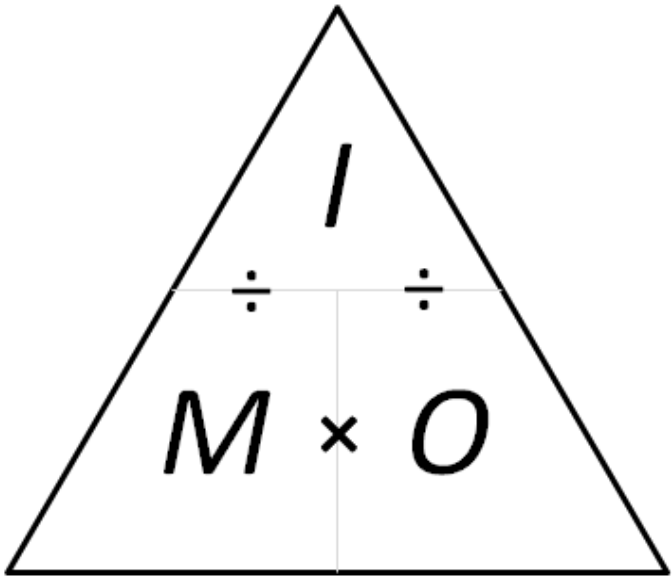
Sometimes you will need to rearrange an equation to calculate the answer to a question.

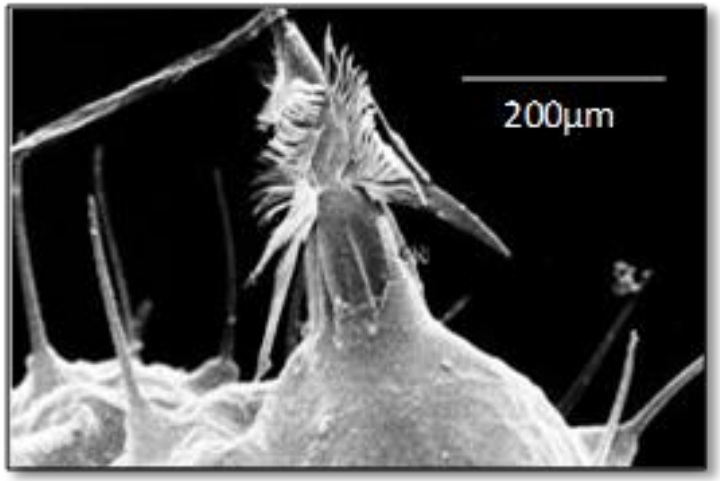
For example, the relationship between magnification, image size, and actual size of specimens in micrographs usually uses the equation $M = \frac{I}{O}$, where M is magnification, I is size of the image, and O = actual size of the object.

You can use the algebra you have learnt in Maths to rearrange equations, or you can use a triangle like the one shown.

Cover the quantity you want to find. This leaves you with either a fraction or a multiplication:

$M = I \div O$ $O = I \div M$ $I = M \times O$





1.)This image shows a stinger from a Jellyfish.

a.) What microscope was used to create the image?

.....[1]

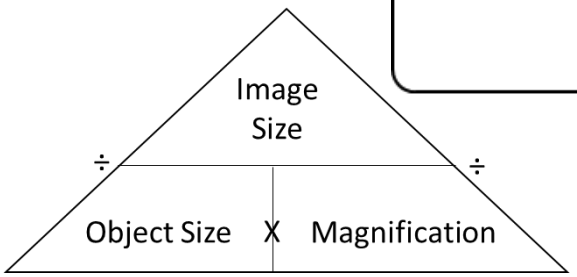
b.) Measure the scale bar in mm and then convert this to µm.

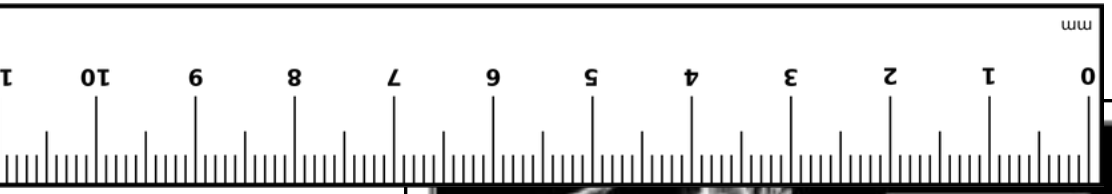
Ruler shown on next slide

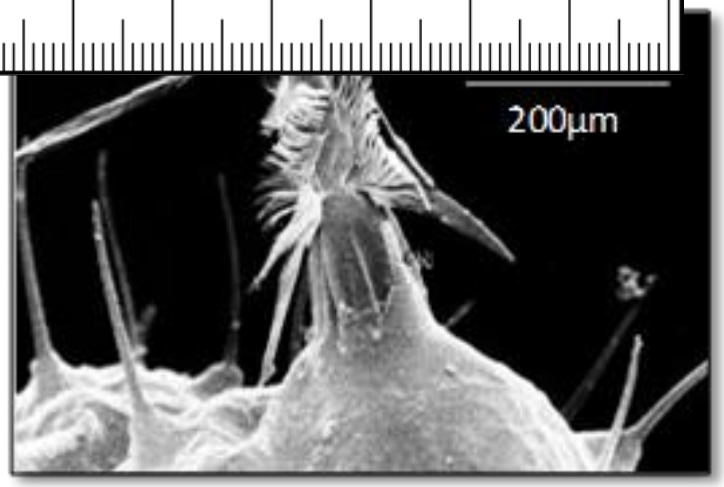
.....mm → .....µm [1]

b.) Now use this and the formula at the top of the page to calculate how many times the image has been magnified. Show your working for one of the marks.

..... [2]







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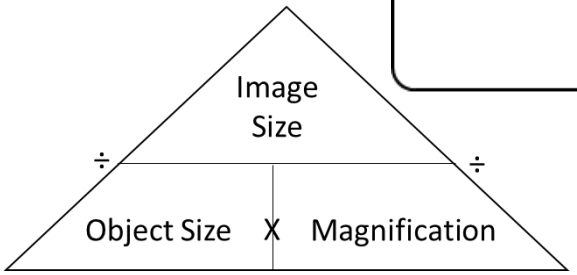
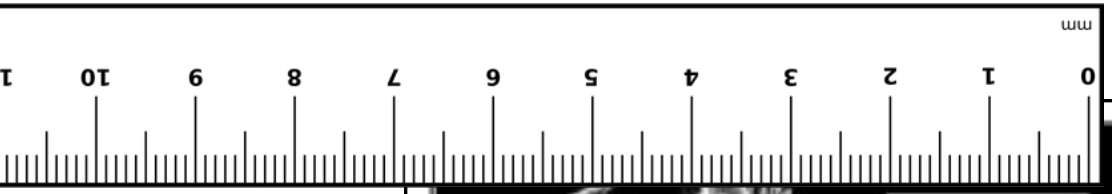
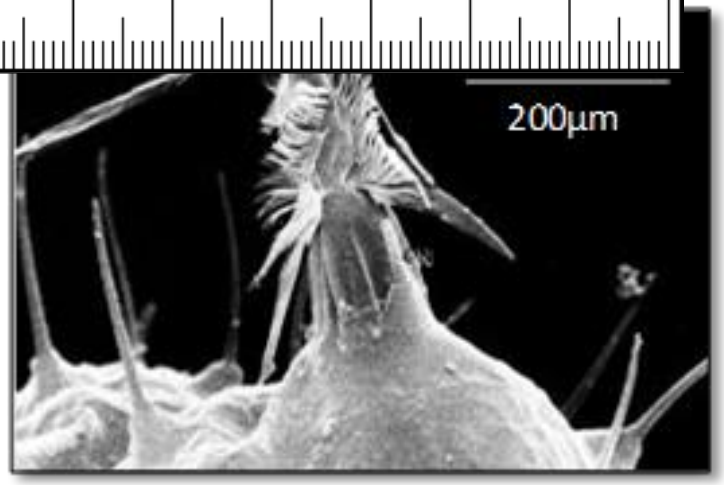






1.)This image shows a stinger from a Jellyfish.

a.) What microscope was used to create the image?

Scanning Electron Microscope (SEM) .....[1]

b.) Measure the scale bar in mm and then convert this to µm.

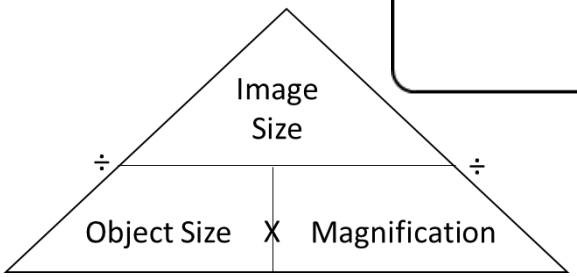
20 .....mm → 20 000 .....µm [1]

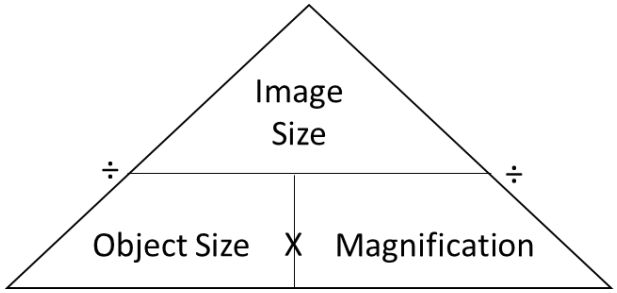
b.) Now use this and the formula at the top of the page to calculate how many times the image has been magnified. Show your working for one of the marks.

$$\text{Magnification} = \frac{\text{Image}}{\text{object}} = \frac{20\,000}{200}$$

= 100 x

..... [2]





2.)This image shows a red blood cell balanced atop a needle.

A Red Blood Cell has an average diameter (width) of 6µm.

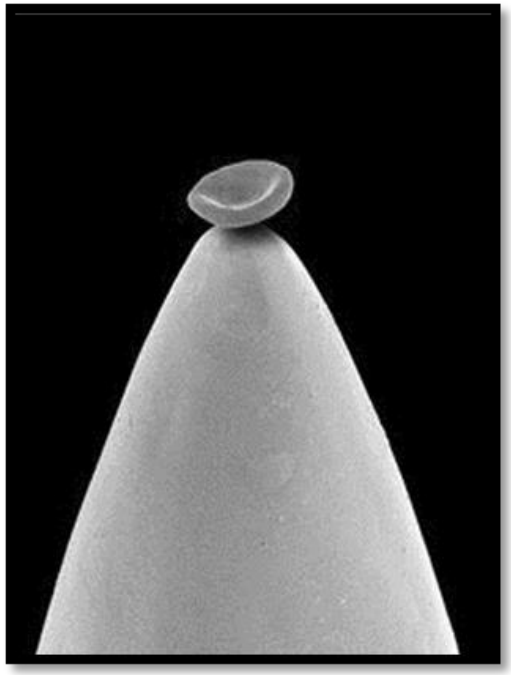
a.) What microscope was used to create the image?

……[1]

b.) Measure the width of the cell in the image in millimetres.

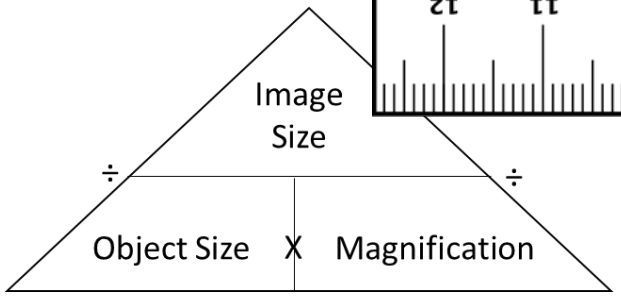
Ruler shown on next slide

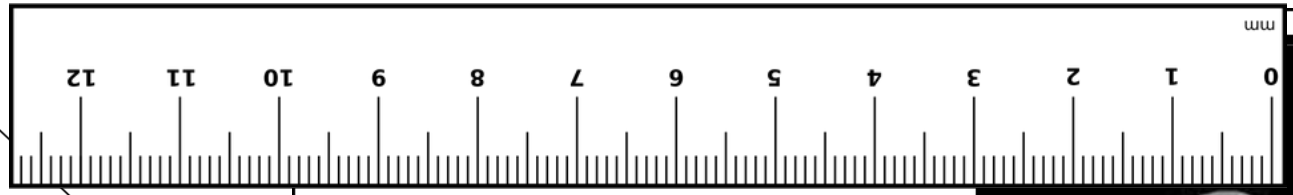
…… mm



c.) Now use this, the average diameter and the formula at the top of the page to calculate how many times the image has been magnified. Show your working for one of the marks.

…… [2]





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a.) What microscope was used to create the image?

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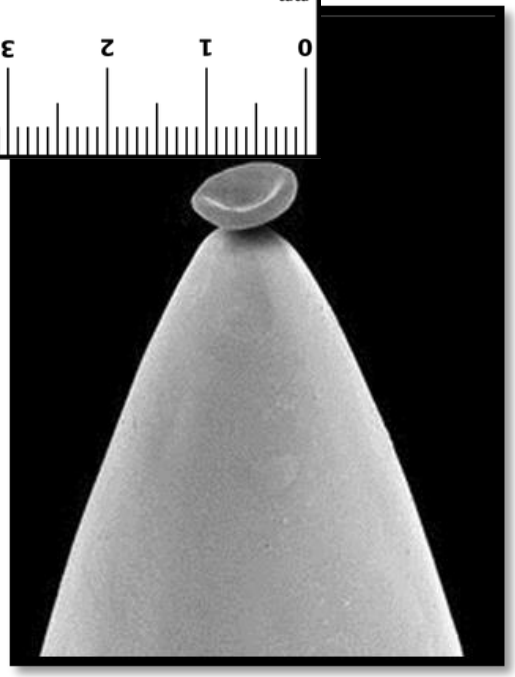
b.) Measure the width of the cell in the image in millimetres.

…… mm



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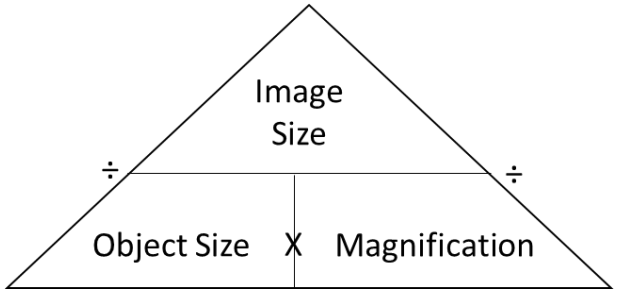

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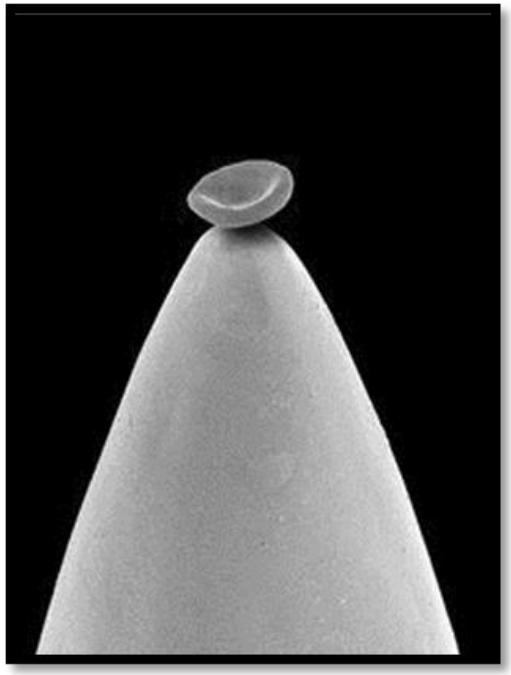


a.) What microscope was used to create the image?

Scanning Electron Microscope (SEM)

.....[1]

b.) Measure the width of the cell in the image in millimetres.

12 ..... mm

c.) Now use this, the average diameter and the formula at the top of the page to calculate how many times the image has been magnified. Show your working for one of the marks.

$$\text{Magnification} = \frac{\text{Image}}{\text{object}} = \frac{12\,000}{6}$$

= 2 000 x

..... [2]

3.) This final image shows a chloroplast from a plant cell.

a.) What kind of microscope was used to generate this image?

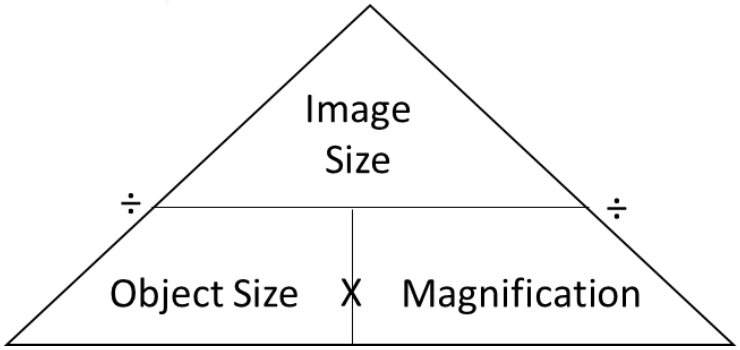
..... [1]

b.) What is the length of the chloroplast in:

Ruler shown on next slide

i.) mm? ..... → ii.) µm? ..... [1]

c.) If the microscope magnified the chloroplast 10 000 (ten thousand) times, what is the length of an actual chloroplast? Show your working.



..... [2]

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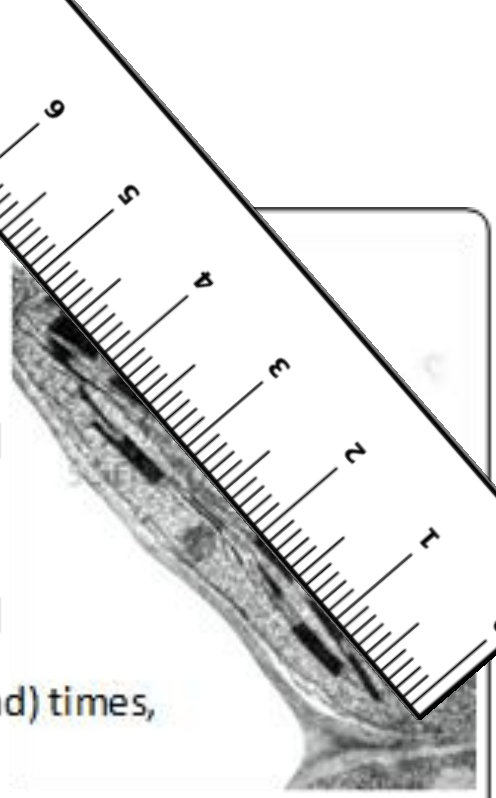

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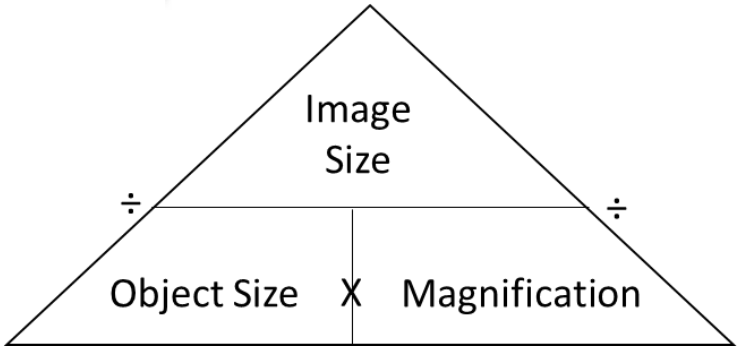
b.) What is the length of the chloroplast in:

i.) mm? ..... → ii.) µm? ..... [1]

c.) If the microscope magnified the chloroplast 10 000 (ten thousand) times, what is the length of an actual chloroplast? Show your working.

..... [2]



3.) This final image shows a chloroplast from a plant cell.

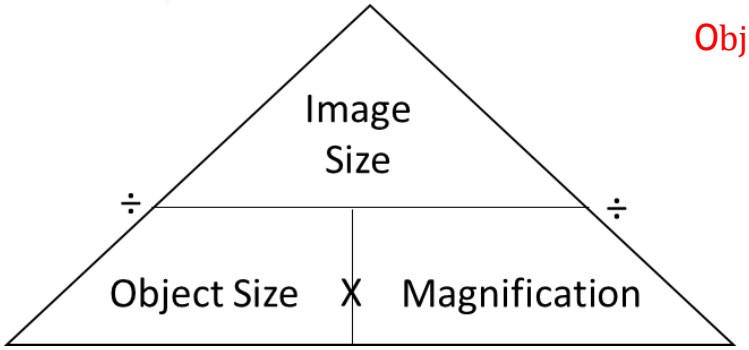
a.) What kind of microscope was used to generate this image?

Transmission Electron Microscope (SEM) [1]

b.) What is the length of the chloroplast in:

i.) mm? 50 → ii.) µm? 50 000 [1]

c.) If the microscope magnified the chloroplast 10 000 (ten thousand) times, what is the length of an actual chloroplast? Show your working.



$$\text{Object size} = \frac{\text{Image}}{\text{magnification}} = \frac{50\,000}{10\,000}$$

= 5µm [2]

Can you rearrange this?

Remember this equation from Bioenergetics / photosynthesis?

1. $light\ intensity = \frac{1}{distance^2}$

to make distance the subject of the equation?

Can you rearrange this?

1. $light\ intensity = \frac{1}{distance^2}$ to make distance the subject of the equation?

Light intensity x $distance^2 = 1$

$$distance^2 = \frac{1}{light\ intensity}$$

$$distance = \sqrt{(\frac{1}{light\ intensity})}$$