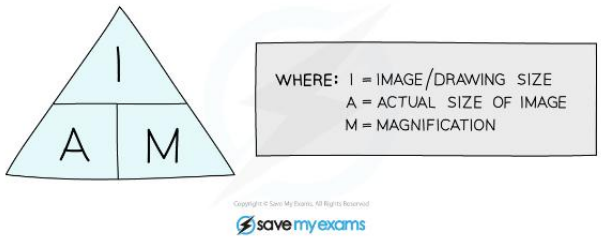
Model Answers: Hard

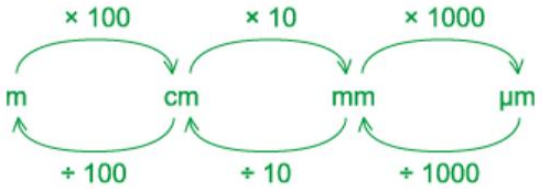
1

The correct answer is **C** because:

- The image would be measured in the smallest resolution possible, so the image would be measured in mm
- The equation is:



- The equation would rearrange to *M = I / A*
    - *I would be r, measured in mm, which would need to be converted into µm by multiplying r x 1000 (see below) and then dividing by A, in this case u, 6 µm*



- Substitution of the options would give the answer of **C**

A & B are incorrect as the image would be measured in the smallest resolution possible and this would be mm.

D is incorrect as **to convert units from mm to µm you need to multiply, not divide!**

2

The correct answer is **C** because:

- Each 0.1 mm on the stage micrometer has 40 small divisions on the eyepiece graticule
- Convert 0.1 mm into µm = 0.1 x 1000 = 100 µm
- Divide the length by the number of divisions to give the value for each small eyepiece division = 100/40 = 2.5 µm
- A chloroplast is 4 small eyepiece divisions long
- This means the width of the chloroplast is 10 µm (4 x 2.5 µm)

3

The correct answer is **C** because:

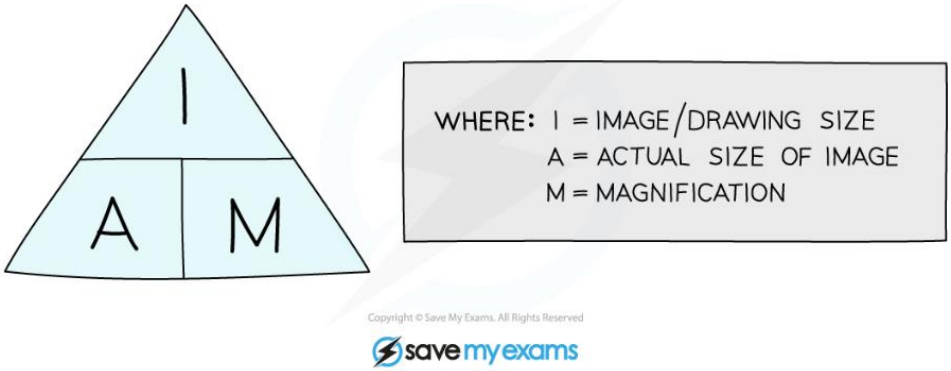
- Convert 1 cm into µm = 10 000 µm (1 cm = 10 mm, 1 mm = 1000 µm)
- Divide the size of the white blood cell into 10 000 = (10 000/15) = 666.67 = 667
    - White blood cell = 1.5×10^{1} µm = 15 µm
- Convert 667 to standard form = 6.7×10^{2}
- Divide the size of the *Streptococcus* cell into
  10 000 = (10 000/0.75) = 13333.3 = 13334

- *Streptococcus* cell = 7.5 x 10^2 nm = 750 nm = 0.75 µm
- Convert to standard form 1.3 x 10^4

4

The correct answer is **B** because:

- The image has a length of 150 mm or 150000 µm
- The actual size of the leaf is 7.5 mm or 7500 µm
- Use the equation



- $M = I/A$, M = 150000 / 7500
- The magnification is x20

5

The correct answer is **C** because:

- There are 40 eyepiece graticule divisions in 0.1mm
- Convert 0.1 mm into µm x 1000 = 100 µm
- Divide 100 µm by 40 to find the distance of 1 small division = 2.5 µm
- Divide the size of the cell by the distance of 1 small division=12.5/2.5=5

6

The correct answer is **B** because:

- Magnification will stay the same as the same eyepiece and objective lens are used
- The resolution will decrease; resolution decreases as the wavelength of the light increases (there is greater diffraction and therefore less ability to resolve fine details at wavelength increases)

A & D are incorrect as resolution will not increase with increasing wavelengths.

C is incorrect as the magnification will not change.

7

The correct answer is **D** because:

- There are 40 eyepiece graticule divisions in 0.1 mm
- Convert 0.1 mm into µm x 1000 = 100 µm
- Divide 100 µm by 40 to find the distance of 1 small division = 2.5 µm
- Multiply the number of eyepiece divisions by 2.5 = 4 x 2.5µm = 10 µm
- Convert to standard form (10 µm = 1.0 x 10^1µm)

8

The correct answer is **D** because:

- There are 40 eyepiece graticule divisions in 0.1 mm
- Convert 0.1 mm into µm x 1000 = 100 µm

- Divide 100 µm by 40 to find the distance of 1 small division = 2.5 µm
- Multiply 100 eyepiece divisions by 2.5 to give the diameter = 250 µm
- The radius is half the diameter of a circle = 125 µm

- Use the equation for the area of a circle r^2

9

The correct answer is **C** because:

- The total length of the stage micrometer is 50 x 0.04 mm = 2 mm
- This fits into 15 small divisions so 1 division is 2 mm / 15 = 0.13 mm
- The whole scale is 100 divisions so 0.13 mm x 100 = 13 mm