

## Measurements in Microscopy

1. Express the following measurements in micrometres:

- a. 5cm
- b. 25cm
- c. 100nm

2. Express the following measurements in nanometres:

- a. 0.5mm
- b. 0.4 $\mu\text{m}$
- c. 0.1cm

3. Which row (A,B,C or D) shows the most appropriate units to use when measuring the size of different samples.

	height of person	length of leaf	diameter of artery	length of cell
<b>A</b>	metres	millimetres	centimetres	micrometres
<b>B</b>	metres	millimetres	millimetres	micrometres
<b>C</b>	metres	centimetres	micrometres	millimetres
<b>D</b>	metres	centimetres	millimetres	nanometres

4. Draw up a table to show each of the following measurements in metres (m), millimetres (mm), and micrometres ( $\mu\text{m}$ ) use standard form where appropriate

	metres	millimetres	micrometres
5 $\mu\text{m}$			
0.3m			
23mm			
75 $\mu\text{m}$			

5. Rewrite the following in standard form:

- a. 1942 kg
- b. 0.007 m
- c. 0.034 s
- d. 440 mm

6. Different units are used when measuring biological specimens.

In which rows are the same measurements correctly expressed in each of the units shown in the column headings?

	mm	$\mu\text{m}$	nm
1	1.0	$1.0 \times 10^3$	$1.0 \times 10^6$
2	2.5	$2.5 \times 10^3$	$2.5 \times 10^6$
3	5.0	$5.0 \times 10^4$	$5.0 \times 10^7$
4	25.0	$2.5 \times 10^4$	$2.5 \times 10^7$

- A** 1, 2, 3 and 4  
**B** 1, 2 and 4 only  
**C** 1 and 2 only  
**D** 3 and 4 only

7. Calculate the following:

- Calculate the magnification of a plant cell, if the image size appears to be  $8000\mu\text{m}$  and the actual size of a plant cell is  $200\mu\text{m}$ .
- Calculate the magnification of a red blood cell, if the image size appears to be  $68\text{mm}$  and the actual size of a red blood cell is  $100\mu\text{m}$ .
- Calculate the magnification of an animal cells nucleus, if the image size appears to be  $16\text{mm}$  and the actual size of an animal cell nucleus is  $160\text{nm}$ .
- Calculate the actual size of a plant cell if the image is  $32\text{mm}$  and the magnification is  $\times 160$ . Give your answer in  $\mu\text{m}$ .
- Calculate the actual size of a sperm cell if the image is  $4.8\text{cm}$  and the magnification is  $\times 600$ . Give your answer in  $\mu\text{m}$ .
- Calculate the thickness of a cell membrane if the image is  $0.1\text{mm}$  and the magnification is  $\times 20,000$ . Give your answer in  $\text{nm}$ .
- Calculate the size of a mitochondria if the image is  $8\text{mm}$  and the magnification is  $\times 5000$ . Give your answer in  $\text{m}$  and in standard form.

## Answers

1. Express the following measurements in micrometres:

d.  $5\text{cm} = 50,000\mu\text{m}$

e.  $25\text{cm} = 250,000\mu\text{m}$

f.  $100\text{nm} = 0.1\mu\text{m}$

2. Express the following measurements in nanometres:

d.  $0.5\text{mm} = 500,000\text{nm}$

e.  $0.4\mu\text{m} = 400\text{nm}$

f.  $0.1\text{cm} = 1,000,000\text{nm}$

3. Which row (A,B,C or D) shows the most appropriate units to use when measuring the size of different samples. = B

	height of person	length of leaf	diameter of artery	length of cell
A	metres	millimetres	centimetres	micrometres
B	metres	millimetres	millimetres	micrometres
C	metres	centimetres	micrometres	millimetres
D	metres	centimetres	millimetres	nanometres

4. Draw up a table to show each of the following measurements in metres (m), millimetres (mm), and micrometres ( $\mu\text{m}$ ) use standard form where appropriate

5.

	metres	millimetres	micrometres
$5\mu\text{m}$	0.000005	0.005	5
$0.3\text{m}$	0.3	300	300,000
$23\text{mm}$	0.027	23	23,000
$75\mu\text{m}$	0.000075	0.075	75

6. Rewrite the following in standard form:

a.  $1942\text{ kg} = 1.942 \times 10^3$

b.  $0.007\text{ m} = 7 \times 10^{-3}$

c.  $0.034\text{ s} = 3.4 \times 10^{-2}$

d.  $440\text{ mm} = 4.4 \times 10^2$

7. Different units are used when measuring biological specimens.

In which rows are the same measurements correctly expressed in each of the units shown in the column headings?

	mm	$\mu\text{m}$	nm
1	1.0	$1.0 \times 10^3$	$1.0 \times 10^6$
2	2.5	$2.5 \times 10^3$	$2.5 \times 10^6$
3	5.0	$5.0 \times 10^4$	$5.0 \times 10^7$
4	25.0	$2.5 \times 10^4$	$2.5 \times 10^7$

- A** 1, 2, 3 and 4  
**B** 1, 2 and 4 only  
**C** 1 and 2 only  
**D** 3 and 4 only

Answer = B

8. Calculate the following:

- a. Calculate the magnification of a plant cell, if the image size appears to be  $8000\mu\text{m}$  and the actual size of a plant cell is  $200\mu\text{m}$ .

$$8000\mu\text{m} \div 200\mu\text{m} = \underline{\mathbf{x40}}$$

- b. Calculate the magnification of a red blood cell, if the image size appears to be  $68\text{mm}$  and the actual size of a red blood cell is  $100\mu\text{m}$

$$68\text{mm} \times 1000 = 68,000\mu\text{m}$$
$$68,000\mu\text{m} \div 100\mu\text{m} = \underline{\mathbf{x680}}$$

- c. Calculate the magnification of an animal cells nucleus, if the image size appears to be  $16\text{mm}$  and the actual size of an animal cell nucleus is  $160\text{nm}$

$$16\text{mm} \times 1000 \times 1000 = 16,000,000\text{nm}$$
$$16,000,000\text{nm} \div 160\text{nm} = \underline{\mathbf{x100,000}}$$

- d. Calculate the actual size of a plant cell if the image is  $32\text{mm}$  and the magnification is  $\times 160$ . Give your answer in  $\mu\text{m}$ .

$$32 \div 160 = 0.2\text{mm}$$
$$0.2\text{mm} \times 1000 = \underline{\mathbf{200\mu\text{m}}}$$

- e. Calculate the actual size of a sperm cell if the image is 4.8cm and the magnification is x600. Give your answer in  $\mu\text{m}$ .

$$4.8 \div 600 = 0.008\text{cm}$$

$$0.008\text{cm} \times 10 = 0.08\text{mm}$$

$$0.08\text{mm} \times 1000 = \underline{80\mu\text{m}}$$

- f. Calculate the thickness of a cell membrane if the image is 0.1mm and the magnification is x20,000. Give your answer in nm.

$$0.1\text{mm} \div 20,000 = 0.000005\text{mm}$$

$$0.000005\text{mm} \times 1000 = 0.005\mu\text{m}$$

$$0.005\mu\text{m} \times 1000\text{nm} = \underline{5\text{nm}}$$

- g. Calculate the size of a mitochondria if the image is 8mm and the magnification is x5000. Give your answer in m and in standard form.

$$8\text{mm} \div 5000 = 0.0016\text{mm}$$

$$0.0016\text{mm} \div 1000 = 0.0000016\text{m which in standard form} = \underline{1.6 \times 10^{-6}}$$