

Contents

1	Cell structure	3
1.1	The microscope in cell studies	3
1.2	Cells as the basic units of living organisms	35
2	Biological molecules	95
2.1	Testing for biological molecules	95
2.2	Carbohydrates and lipids	112
2.3	Proteins and water	160
3	Enzymes	207
3.1	Mode of action of enzymes	207
3.2	Factors that affect enzyme action	231
4	Cell membranes and transport	257
4.1	Fluid mosaic membranes	257
4.2	Movement of substances into and out of cells	284
5	The mitotic cell cycle	313
5.1	Replication and division of nuclei and cells	313
5.2	Chromosome behaviour in mitosis	343
6	Nucleic acids and protein synthesis	357
6.1	Structure and replication of DNA	357
6.2	Protein synthesis	391
7	Transport in plants	409
7.1	Structure of transport tissues	409
7.2	Transport mechanisms	442
8	Transport in mammals	487
8.1	The circulatory system	487
8.2	The heart	538
9	Gas exchange and smoking	561
9.1	The gas exchange system	561
9.2	Smoking	592
10	Infectious disease	609
10.1	Infectious diseases	609
10.2	Antibiotics	631
11	Immunity	643
11.1	The immune system	643
11.2	Antibodies and vaccination	658

12 Energy and respiration	685
12.1 Energy	685
12.2 Respiration	687
13 Photosynthesis	689
13.1 Photosynthesis as an energy transfer process	689
13.2 Adaptations for photosynthesis	691
14 Inherited change	693
14.1 Passage of information from parent to offspring	693
14.2 The roles of genes in determining the phenotype	694
15 Selection and evolution	695
15.1 Natural and artificial selection	695
16 Biodiversity, classification and conservation	697
16.1 Biodiversity	697
16.2 Conservation	698
17 Genetic technology	699
17.1 Genetically modified organisms in agriculture	699
A Answers	701

Chapter 1

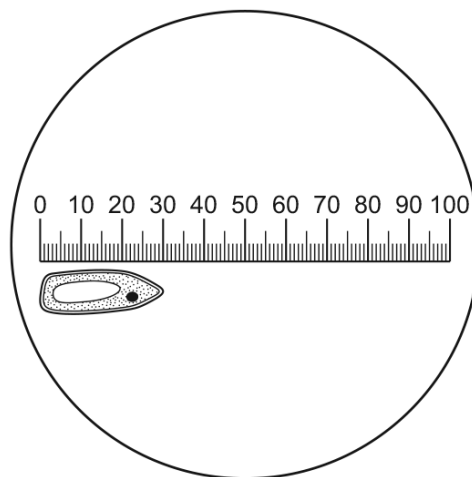
Cell structure

1.1 The microscope in cell studies

1. 9700_m20_qp_12 Q: 1

The diagram shows an eyepiece graticule and cell viewed through a microscope. When the eyepiece graticule was calibrated at this magnification, the whole length of the graticule shown covered 12 divisions of a stage micrometer scale.

There were 100 divisions in 10 mm of the stage micrometer.

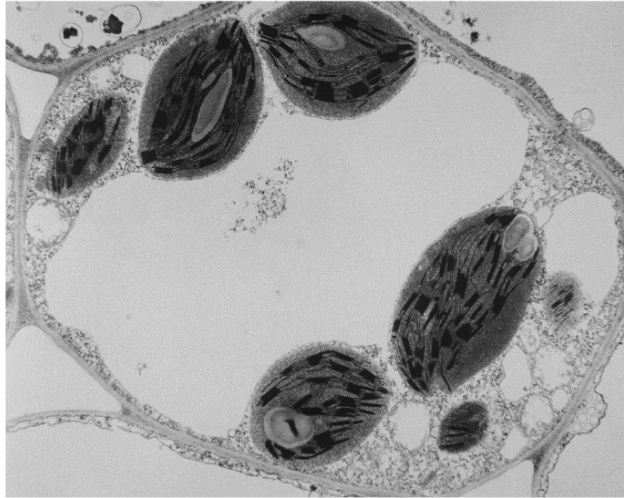


What is the actual length of the cell?

- A** $2.5\mu\text{m}$ **B** $3.6\mu\text{m}$ **C** $360\mu\text{m}$ **D** 3mm

2. 9700_s20_qp_11 Q: 1

The photomicrograph shows the ultrastructure of part of a cell.



Which statement about the type of cell shown in the photomicrograph is correct?

- A It is a plant cell because it has both chloroplasts and a nucleus.
- B It is a plant cell because it has chloroplasts.
- C It is an animal cell because it has a cell membrane.
- D It is an animal cell because it has mitochondria.

3. 9700_s20_qp_11 Q: 3

A student examined a slide of human blood with a light microscope and made a careful drawing of the different cell types. The student used an eyepiece graticule so that the relative sizes of the different cell types were drawn accurately.

In the drawing:

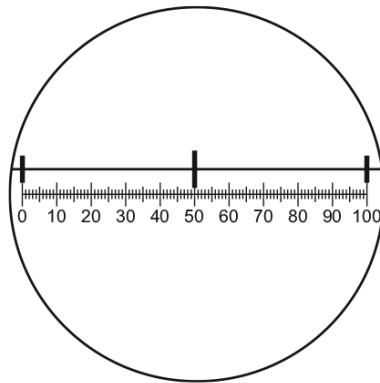
- red blood cells were 7 mm in diameter
- lymphocytes were 6 mm in diameter
- neutrophils were 14 mm in diameter.

What is the linear magnification of the drawing?

- A** $\times 10$ **B** $\times 40$ **C** $\times 100$ **D** $\times 1000$
-

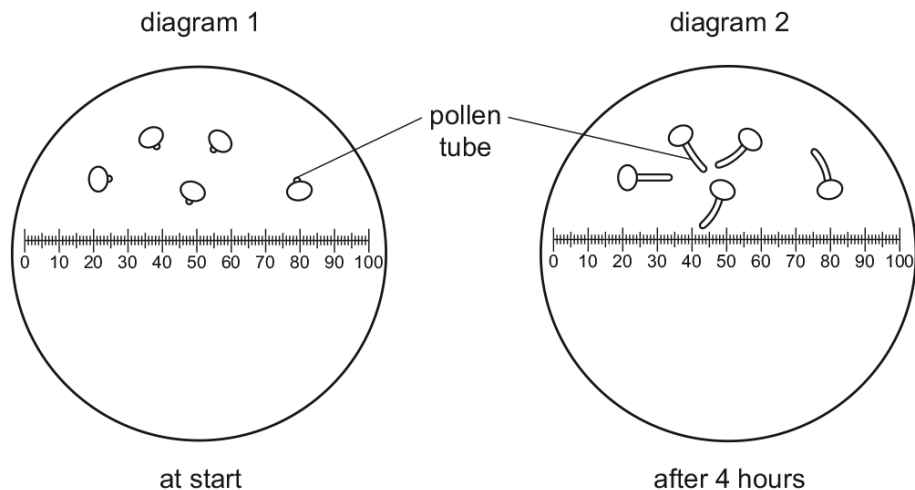
4. 9700_s20_qp_11 Q: 4

The diagram shows a graduated slide, with divisions of 0.1mm viewed using an eyepiece graticule.



Pollen grains were grown in a sugar solution and viewed using the eyepiece graticule.

Diagram 1 shows the pollen grains at the start. Diagram 2 shows the pollen grains after four hours.



What is the growth rate of the pollen tubes?

- A** $5\ \mu\text{mh}^{-1}$ **B** $10\ \mu\text{mh}^{-1}$ **C** $5\ \text{mmh}^{-1}$ **D** $10\ \text{mmh}^{-1}$

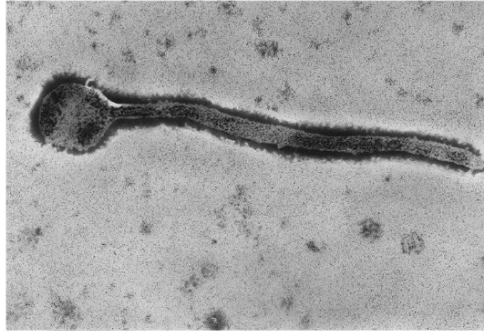
5. 9700_s20_qp_12 Q: 1

What is the definition of the resolution of a light microscope?

- A** the degree of sharpness produced by the microscope
B the greatest distance between two objects visible in the same field of view
C the minimum distance that allows two objects to be viewed as separate
D the size of the smallest object visible using the microscope

6. 9700_s20_qp_12 Q: 2

The electron micrograph shows a type of virus at a magnification of $\times 30\,000$.



What is the length of the virus?

- A 2.2×10^3 nm
- B 2.2×10^2 nm
- C 2.2×10^1 nm
- D 2.2×10^0 nm

7. 9700_s20_qp_13 Q: 1

A student was given a photomicrograph of a cell and told the magnification of the image.

The student was asked to calculate the actual size of the cell.

Which row in the table explains how to do this?

	measure the image in	convert to μm by multiplying by	rearrange the formula to
A	cm	1.0×10^4	$\frac{M}{I}$
B	cm	1.0×10^6	$I \times M$
C	mm	1.0×10^3	$\frac{I}{M}$
D	mm	1.0×10^4	$I \times M$

8. 9700_w20_qp_11 Q: 1

Which row shows the correct order of size of these cell structures?

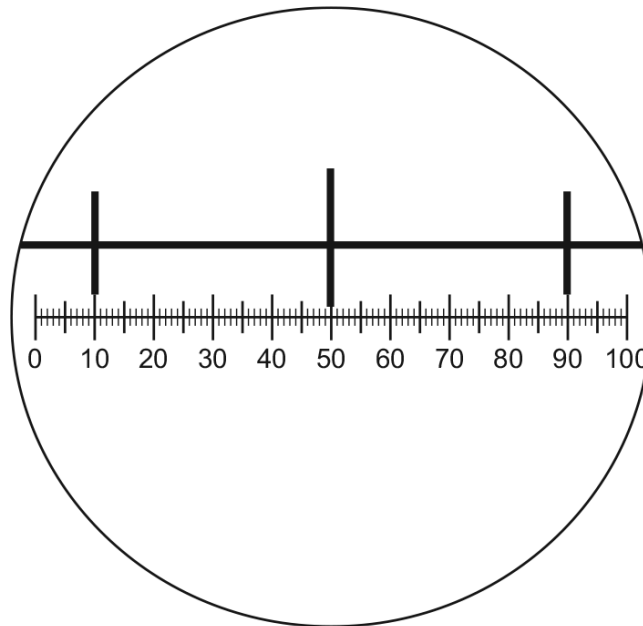
- 1 width of a mitochondrion
- 2 width of a ribosome
- 3 width of a cell surface membrane
- 4 width of a chloroplast

	largest		→	smallest	
A	1	4		2	3
B	1	4		3	2
C	4	1		2	3
D	4	2		1	3

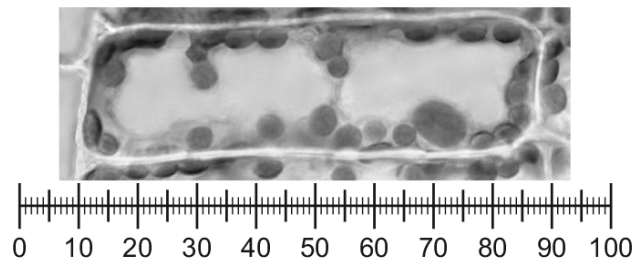
9. 9700_w20_qp_11 Q: 2

The diagram shows a stage micrometer scale viewed through an eyepiece containing a graticule.

The small divisions of the stage micrometer scale are 0.1 mm.



The stage micrometer scale is replaced by a slide of a plant cell.



What is the actual length of the nucleus in the plant cell?

- A** 8 μm **B** 25 μm **C** 200 μm **D** 0.8 mm

10. 9700_w20_qp_12 Q: 1

The size of the measles virus, *Morbillivirus*, is approximately 150 nm.

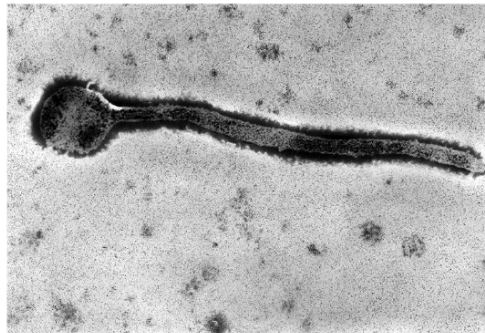
The *Mimivirus* is approximately 4.5 times larger than *Morbillivirus*, whilst the *Pandoravirus* is approximately 1.5 times larger than the *Mimivirus*.

Which viruses can be seen using a light microscope with a maximum resolution of $0.25\ \mu\text{m}$ and using an electron microscope?

	<i>Morbillivirus</i>	<i>Mimivirus</i>	<i>Pandoravirus</i>	
A	✓	✓	✓	key ✓ = can be seen ✗ = cannot be seen
B	✗	✓	✓	
C	✗	✗	✓	
D	✗	✗	✗	

11. 9700_w20_qp_12 Q: 2

The electron micrograph shows a type of virus at a magnification of $\times 60\,000$.



What is the actual length of the virus?

- A** 1.1 nm **B** 11 nm **C** 110 nm **D** 1100 nm

12. 9700_w20_qp_13 Q: 1

What are the appropriate units for measuring diameters of alveoli, diameters of white blood cells and the width of cell walls?

	diameters of alveoli	diameters of white blood cells	width of cell walls
A	mm	mm	nm
B	mm	μm	μm
C	μm	mm	μm
D	μm	μm	nm

Appendix A

Answers

SN	Paper	Q. No.	Answer
1	9700_m20_qp_12	1	C
2	9700_s20_qp_11	1	B
3	9700_s20_qp_11	3	D
4	9700_s20_qp_11	4	A
5	9700_s20_qp_12	1	C
6	9700_s20_qp_12	2	A
7	9700_s20_qp_13	1	C
8	9700_w20_qp_11	1	C
9	9700_w20_qp_11	2	B
10	9700_w20_qp_12	1	B
11	9700_w20_qp_12	2	D
12	9700_w20_qp_13	1	D
13	9700_w20_qp_13	2	C
14	9700_m19_qp_12	1	A
15	9700_m19_qp_12	2	C
16	9700_m19_qp_12	3	C
17	9700_s19_qp_11	1	D
18	9700_s19_qp_12	1	D
19	9700_s19_qp_12	2	B
20	9700_s19_qp_13	1	D
21	9700_s19_qp_13	2	B
22	9700_w19_qp_11	3	D
23	9700_w19_qp_12	1	D
24	9700_w19_qp_12	2	C
25	9700_w19_qp_13	2	D
26	9700_m18_qp_12	1	D
27	9700_m18_qp_12	2	C
28	9700_m18_qp_12	3	A
29	9700_s18_qp_11	1	A
30	9700_s18_qp_11	2	B
31	9700_s18_qp_11	3	C
32	9700_s18_qp_12	2	B
33	9700_s18_qp_13	1	D
34	9700_w18_qp_11	1	C
35	9700_w18_qp_11	2	C
36	9700_w18_qp_12	2	D
37	9700_w18_qp_13	1	C
38	9700_w18_qp_13	2	C
39	9700_w18_qp_13	3	D
40	9700_m17_qp_12	2	C
41	9700_m17_qp_12	3	C

SN	Paper	Q. No.	Answer
42	9700_s17_qp_11	1	D
43	9700_s17_qp_11	4	D
44	9700_s17_qp_12	3	A
45	9700_s17_qp_13	2	C
46	9700_w17_qp_11	4	A
47	9700_w17_qp_11	5	B
48	9700_w17_qp_12	1	D
49	9700_w17_qp_13	1	B
50	9700_w17_qp_13	2	A
51	9700_m16_qp_12	1	C
52	9700_s16_qp_11	2	C
53	9700_s16_qp_12	1	D
54	9700_s16_qp_13	1	A
55	9700_w16_qp_11	1	D
56	9700_w16_qp_12	1	B
57	9700_w16_qp_12	2	C
58	9700_w16_qp_12	4	C
59	9700_w16_qp_13	2	B
60	9700_w16_qp_13	3	A
61	9700_s15_qp_11	1	C
62	9700_s15_qp_11	3	B
63	9700_s15_qp_11	6	B
64	9700_s15_qp_12	1	A
65	9700_s15_qp_12	2	C
66	9700_s15_qp_13	2	C
67	9700_w15_qp_11	2	A
68	9700_w15_qp_12	2	C
69	9700_w15_qp_13	2	B
70	9700_m20_qp_12	2	A
71	9700_m20_qp_12	3	C
72	9700_m20_qp_12	4	C
73	9700_m20_qp_12	5	D
74	9700_m20_qp_12	6	A
75	9700_s20_qp_11	2	A
76	9700_s20_qp_11	5	B
77	9700_s20_qp_12	3	B
78	9700_s20_qp_12	4	C
79	9700_s20_qp_12	5	D
80	9700_s20_qp_12	6	A
81	9700_s20_qp_13	2	B
82	9700_s20_qp_13	3	D
83	9700_s20_qp_13	4	C