CAMBRIDGE INTERNATIONAL AS & A LEVEL BIOLOGY · 9700

BIOLOGY



MARK SCHEME

1 CELL STRUCTURE

SCORE	PERCENTAGE
/	%

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Paper 1 Multiple Choice Answers: Cell Structure

Question	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
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

Paper 1 Multiple Choice Answers: Cell Structure (continued)

Question	Paper	Q. No.	Answer
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
84	9700_s20_qp_13	5	B
85	9700_w20_qp_11	3	C
86	9700_w20_qp_11	4	C
87	9700_w20_qp_11	5	A
88	9700_w20_qp_11	6	D
89	9700_w20_qp_12	3	D
90	9700_w20_qp_12	4	D
91	9700_w20_qp_12	5	A
92	9700_w20_qp_12	6	B

Paper 1 Multiple Choice Answers: Cell Structure (continued)

Question	Paper	Q. No.	Answer
93	9700_w20_qp_13	3	B
94	9700_w20_qp_13	4	D
95	9700_w20_qp_13	5	A
96	9700_w20_qp_13	6	D
97	9700_m19_qp_12	4	A
98	9700_m19_qp_12	5	A
99	9700_m19_qp_12	6	C
100	9700_s19_qp_11	2	C
101	9700_s19_qp_11	3	A
102	9700_s19_qp_11	4	B
103	9700_s19_qp_11	5	A
104	9700_s19_qp_11	6	B
105	9700_s19_qp_12	3	D
106	9700_s19_qp_12	4	B
107	9700_s19_qp_13	3	C
108	9700_s19_qp_13	4	C
109	9700_s19_qp_13	5	D
110	9700_s19_qp_13	6	D
111	9700_w19_qp_11	1	C
112	9700_w19_qp_11	2	B
113	9700_w19_qp_11	4	C
114	9700_w19_qp_11	5	A
115	9700_w19_qp_12	3	C
116	9700_w19_qp_12	4	A
117	9700_w19_qp_12	5	C
118	9700_w19_qp_12	6	A
119	9700_w19_qp_13	1	C
120	9700_w19_qp_13	3	A
121	9700_w19_qp_13	4	D
122	9700_w19_qp_13	5	D
123	9700_m18_qp_12	4	C
124	9700_m18_qp_12	5	B
125	9700_m18_qp_12	6	D
126	9700_s18_qp_11	4	B
127	9700_s18_qp_11	5	C
128	9700_s18_qp_12	1	A
129	9700_s18_qp_12	3	B
130	9700_s18_qp_12	4	B
131	9700_s18_qp_12	5	A
132	9700_s18_qp_13	2	A
133	9700_s18_qp_13	3	B
134	9700_s18_qp_13	5	D
135	9700_s18_qp_13	6	B
136	9700_w18_qp_11	3	C
137	9700_w18_qp_11	4	B
138	9700_w18_qp_11	5	A

Paper 1 Multiple Choice Answers: Cell Structure (continued)

Question	Paper	Q. No.	Answer
139	9700_w18_qp_12	1	B
140	9700_w18_qp_12	3	A
141	9700_w18_qp_12	4	B
142	9700_w18_qp_12	5	B
143	9700_w18_qp_12	6	C
144	9700_w18_qp_13	4	B
145	9700_w18_qp_13	5	A
146	9700_w18_qp_13	6	D
147	9700_m17_qp_12	1	C
148	9700_m17_qp_12	4	A
149	9700_m17_qp_12	5	B
150	9700_m17_qp_12	6	D
151	9700_s17_qp_11	2	C
152	9700_s17_qp_11	3	C
153	9700_s17_qp_11	5	B
154	9700_s17_qp_11	6	A
155	9700_s17_qp_12	1	C
156	9700_s17_qp_12	2	D
157	9700_s17_qp_12	4	A
158	9700_s17_qp_13	1	A
159	9700_s17_qp_13	3	C
160	9700_s17_qp_13	4	B
161	9700_w17_qp_11	2	C
162	9700_w17_qp_11	3	A
163	9700_w17_qp_12	2	D
164	9700_w17_qp_12	3	B
165	9700_w17_qp_12	4	B
166	9700_w17_qp_12	5	A
167	9700_w17_qp_12	6	A
168	9700_w17_qp_13	3	C
169	9700_w17_qp_13	4	C
170	9700_w17_qp_13	5	A
171	9700_m16_qp_12	2	B
172	9700_m16_qp_12	3	C
173	9700_m16_qp_12	4	D
174	9700_m16_qp_12	5	A
175	9700_s16_qp_11	1	D
176	9700_s16_qp_11	3	B
177	9700_s16_qp_11	4	D
178	9700_s16_qp_11	5	A
179	9700_s16_qp_12	2	D
180	9700_s16_qp_12	3	C
181	9700_s16_qp_12	4	D
182	9700_s16_qp_13	2	A
183	9700_s16_qp_13	3	B
184	9700_s16_qp_13	4	B

Paper 1 Multiple Choice Answers: Cell Structure (continued)

Question	Paper	Q. No.	Answer
185	9700_s16_qp_13	5	A
186	9700_w16_qp_11	2	B
187	9700_w16_qp_11	3	A
188	9700_w16_qp_11	4	C
189	9700_w16_qp_11	5	C
190	9700_w16_qp_12	3	C
191	9700_w16_qp_12	5	B
192	9700_w16_qp_12	6	B
193	9700_w16_qp_13	1	B
194	9700_w16_qp_13	4	B
195	9700_w16_qp_13	5	B
196	9700_s15_qp_11	2	D
197	9700_s15_qp_11	4	A
198	9700_s15_qp_11	5	D
199	9700_s15_qp_12	3	C
200	9700_s15_qp_12	4	B
201	9700_s15_qp_12	5	C
202	9700_s15_qp_12	6	B
203	9700_s15_qp_13	1	A
204	9700_s15_qp_13	6	B
205	9700_w15_qp_11	1	B
206	9700_w15_qp_11	6	B
207	9700_w15_qp_12	1	B
208	9700_w15_qp_12	3	C
209	9700_w15_qp_12	4	C
210	9700_w15_qp_12	5	B
211	9700_w15_qp_13	1	B
212	9700_w15_qp_13	3	C
213	9700_w15_qp_13	4	B
214	9700_w15_qp_13	5	A
215	9700_w15_qp_13	6	C

Answers

1. 9700_s17_ms_21 Q: 1

(a)	**A** chloroplast / mitochondrion ; **B** chromosome(s) / chromatid / chromatin ; **C** Golgi (body / apparatus / complex) ; **D** nucleolus ;	**4**
(b)	*max 1 if only written about prokaryote wall or only about plant wall* **1** prokaryote cell wall has, peptidoglycan / murein ; **2** plant cell wall has, cellulose / polymer of β glucose ; **I** lignin **3** AVP ; e.g. prokaryote wall is made of chains crossed linked by, peptides / amino acids hydrogen bonds between cellulose molecules (within microfibrils) in plant cell wall **A** cellulose chains other components such as pectins / hemicelluloses in plant cell walls	**max 2**

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2. 9700_s17_ms_22 Q: 1

(a) *one mark per blank box* **5**

type of cell	function of cell	example of organelle required to carry out function
palisade mesophyll	photosynthesis ; **A** (absorb light to) synthesise, organic compounds / glucose / starch (from inorganic compounds)	chloroplast
Leydig	synthesis of steroid hormones	smooth endoplasmic reticulum ; **A** SER / smooth ER
plasma cell ; **A** B-cell / white blood cell / leucocyte / (B-) lymphocyte / agranulocyte **R** T lymphocyte / granulocyte / phagocyte / macrophage / neutrophil	production of secretory vesicles containing antibody	Golgi body
root hair cell	active uptake of nitrates	mitochondrion ; **A** cell surface / plasma, membrane **A** cell membrane
pancreas acinar	synthesis of enzymes	rough endoplasmic reticulum ; **A** RER / rough ER **A** ribosomes **A** mitochondrion

(b) **I** functions of individual tissues **max 4**
if all cell types named as single cell, allow max 1 for named tissue types

(organ because more than one tissue type)
three named tissue types ; ; ;

endothelium **A** squamous epithelium
A endothelial cells
A epithelial cells

smooth muscle **A** smooth muscle cells
connective tissue
elastic tissue **A** elastic fibres
R elastin / elastic muscle
fibrous tissue **A** collagen **A** collagen fibres
nervous tissue **A** nerve cells

blood **A** blood cells
only in context of vasa vasorum

general function
transports / carries / AW, blood ; **A** delivers **R** pumps blood **I** provides

detail ; e.g. to tissues / to body cells / to body / away from heart / AW
R to lungs
(blood) is oxygenated / contains oxygen

Total: **9**

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3. 9700_w17_ms_23 Q: 1

(a)	actual length = image length / magnification ; **A** A = I / M M = I / A I = A × M or magnification triangle 2.5 (μm) ;; *for 40 mm **X–Y** length* **A** 2.6 (*for 40 / 41 mm*) **A** 2.4 (*for 38 / 39 mm*) *max 1 for* *incorrect or no answer but correct calculation e.g. 40 000 ÷ 16 000* *correct answer but to more than one decimal place* *correct measurement and correct calculation but incorrect conversion*	**3**
(b)(i)	mitochondrion ; **A** mitochondria *max 1 for function* produces / makes / synthesises / provides / AW, ATP **or** releases / provides / supplies, energy **or** aerobic respiration ; AVP ; e.g. part of the urea cycle β-oxidation of fat oxidative phosphorylation	**2**
(b)(ii)	rough endoplasmic reticulum ; **A** rough ER **I** RER ribosomes are attached ; *accept mp2 if organelle identified as endoplasmic reticulum / RER*	**2**

4. 9700_m16_ms_22 Q: 2

(a) magnification = $\frac{\text{image length}}{\text{actual length}}$ / AW ; **A** M = I / A **or** M = O / A

correct calculation or to 2 or 3 significant figures using the correct calculation

(×) 2778 / 2780 / 2800 ; ; (for 25 mm) **A** ± 1 mm in measurement

one mark if correct measurement stated and divided by actual size but incorrect answer owing to, rounding up error / incorrect conversion factor

(25 000 / 9.0) ;

[3]

(b) spherical / spheroid / AW ;

(nuclear) envelope / two (nuclear) membranes / double membrane ;
(containing) nuclear pores ;

(contains) chromatin / chromosomes ;
DNA and, proteins / histones ;

contains, nucleolus / nucleoli
or
nucleolus is / nucleoli are, dark(er) staining / spherical / defined ;

AVP ; e.g. outer membrane continuous with RER
heterochromatin and euchromatin
contains nucleoplasm

[max 3]

[Total: 6]

5. 9700_w15_ms_21 Q: 1

(a) ATP production ; **A** supply energy (to the cell / for cell reactions) **R** energy production
(site of) aerobic respiration / oxidative phosphorylation ;
AVP ; e.g. lipid metabolism / beta oxidation [max 1]

(b) crista / cristae / inner membrane ; [1]

(c) (×) 48 571 **or** (×) 50 000 ;;

$\frac{34\,000}{0.7}$ **or** $\frac{35\,000}{0.7}$

if answer incorrect award one mark for:
correct measurement (34 or 35 mm) and correct formula used (M= I/A), as above but incorrect conversion to μm
or
correct calculation but units given
or
correct calculation but decimal places given [2]

(d) **1** resolution / resolving power, too low ;
2 further detail ; e.g. only 250 nm resolution
resolution only half wavelength of light
wavelength of light, too long / not short enough
width of membranes only 7 nm ;
3 (such) thin sections not possible ;
4 inner membrane / cristae / internal structure, could not be seen ;
5 magnification this high not possible ;
mp1 and mp5 allow correct comparative statement with electron microscope [max 2]

(e) circular DNA ;
small / similar, size ; **A** 0.5–15 μm
70S / small(er) / 18 nm, ribosomes ;
AVP ; e.g. binary fission / naked DNA [max 2]

[Total: 8]

Chapter 1

CELLS

1.	D
2.	A
3.	C
4.	B
5.	A
6.	B
7.	C
8.	C
9.	B
10.	C
11.	A
12.	C
13.	B
14.	B
15.	C
16.	B
17.	D
18.	C
19.	B
20.	A
21.	A
22.	C
23.	B
24.	C
25.	B
26.	C
27.	D
28.	C
29.	D
30.	C
31.	C
32.	C
33.	D

34.	B
35.	C
36.	D
37.	B
38.	D
39.	D
40.	C
41.	C
42.	A
43.	C
44.	D
45.	
46.	
47.	
48.	C
49.	B
50.	A
51.	A
52.	A
53.	D
54.	D
55.	C
56.	C
57.	C
58.	D
59.	C
60.	D
61.	B
62.	D
63.	B
64.	D
65.	C
66.	C
67.	D
68.	A
69.	A

70.	A
71.	B
72.	A
73.	B
74.	C
75.	A
76.	D
77.	C
78.	C
79.	D
80.	D
81.	B
82.	A
83.	A
84.	B
85.	D
86.	B
87.	C
88.	A
89.	B
90.	A
91.	B
92.	A
93.	D
94.	C
95.	C
96.	A
97.	A
98.	C
99.	A
100.	C

Q1.

3 (a)	Correct letter order **on** Question Paper: A - nucleus; C - mitochondria; B - RER; D - Golgi apparatus; E - cell surface membrane; *R. process statements instead of letters*	**max 4**
(b)	secrete/release/produce/make antibodies; A. immunoglobulins R. memory cells unless linked to antibody production	1
(c)	nucleus/nuclear envelope/nuclear membranes/nucleolus; no cell wall; have organelles/named visible organelles; (golgi/mitochondrion/ RER) R. more organelles larger (cell); fixed ribosomes/ribosomes attached to E.R./no free ribosomes;	**max 2**
		[Total 7]

*

Q2.

Question	Expected Answers	Marks
4 (a)	calculation = 40 000 / 2.5 / suitable alternative; answer = x 16 000; **A** 15 500 -> 16 500	2
(b)	chlorophyll C; cellulose B; DNA D; phospholipid C / F;	4
(c)	*assume answer is about red blood cells unless indicated otherwise* no nucleus; no cell wall; no vacuole; **R** smaller vacuoles no. organelles / named organelle visible in fig. 4.1; **A** only chloroplasts / mitochondria / ribosomes **R** refs to shape	3 max

Q3.

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Question			Expected Answers	Marks
4	(a)	(i)	**A** transcription; (ignore mRNA synthesis)	
			B translation;	
			C exocytosis; **R** secretion	**[max 3]**
		(ii)	**D** (sub unit of) ribosome	
			E Golgi apparatus/body;	**[2]**
		(iii)	**F** mRNA;	**[1]**

Q4.

1 (a)

	cell **A**	cell **B**	cell **C**
name of cell	phagocyte / neutrophil / AW;	squamous epithelial (cell) / endothelial (cell);	
function of cell			transports, oxygen / carbon dioxide;
diameter / µm	*to be added*		

[4]

(b) **D** mitochondrion;
E lysosome / (Golgi) vesicle; **R** vacuole
F nucleus; **[3]**

Q5.

1 (a)

function	Structure
facilitated diffusion of glucose	**B**
creates a current to move mucus	**A** ;
aerobic respiration	**C** ;
makes ribosomes	**E/C** ;
a site of transcription	**G/E/C** ;
packages proteins into lysosomes	**J** ;

[5]

Q6.

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2 **(a)** **A** – nuclear, membrane / envelope ; **R** nucleus (unqualified)
B – mitochondrion ; **A** crista(e)
C – (Golgi) vesicle / (small) vacuole ; **A** lysosome [3]

(b) (during), mitosis / meiosis / nuclear division ; ignore 'cell division' / phases
replicate, after / before, each division ; **A** at interphase
move / separate, to poles ;
assemble / organise, microtubules ;
centre for growth of / forms, spindle fibres / for formation of spindle / AW ;
modified centrioles found elsewhere such as in flagella / cilia ; [3 max]

(c) (EM has) greater / higher, resolution / resolving power ; **ora**
explanation of resolution as ability to differentiate between two points (close together) ;
width of membranes is 7 nm (±1) ;
(resolution of) LM is 200 nm (0.2 µm) and EM is 0.5 nm (0.0005 µm) ;
A 0.5 to 1 nm (0.001 µm)
ref to shorter wavelength ; **ora**
resolution is equal to half the wavelength ; [3 max]

Q7.

1 **(a)** **(i)** (*nuclear envelope*) drawn with two membranes and a space and at least one nuclear pore ;
(mitochondrion) two membranes with at least one crista attached or unattached ;
mitochondrion drawn smaller than nucleus ; ora

if wrongly labelled or both labels omitted, penalise once [3]

(ii) (to nearest whole number) (x) 2857 ;; **A** 2829 – 2886

allow one mark for correct working if answer incorrect / not to whole number / no answer
length of scale bar in mm × 1000, divided by actual size
e.g. 100 mm × 1000 / 35 *(scale bar 99–101 mm)* [2]

(b) cell / plasma / cell surface, membrane(s) ; **R** membranes
cytoplasm / cytosol ;
ribosomes / 70S ribosomes / 18nm ribosomes ; **R** 80S / 20nm / larger, ribosomes
DNA / genes ; **A** chromosome [3 max]

Q8.

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1 **(a)** **(i)** *Golgi body*

at least three unlinked cisternae drawn in cytoplasm ;
secretory vesicles forming at the side of the Golgi ;

exocytosis

vesicle shown fused to cell surface membrane ; **R** if add arrows pointing towards cell contents [3]

(ii) (to nearest whole micrometre) 5(μm) ;;

allow one mark for correct working if answer is incorrect / not to whole number / no answer

length of bar / 8000
e.g. $\frac{4\text{ cm}}{8000}$ $\frac{40\text{ mm}}{8000}$ $\frac{40000\mu\text{m}}{8000}$ **A** +/- 1mm on length of bar [2]

(b) capsule / slime layer ;
cell wall ; **R** cellulose / chitin, cell wall
flagellum (of flagellin) ;
DNA free in cytoplasm / loop of DNA / circular DNA / nucleoid / plasmid ;
DNA, naked / without histones ;
only, smaller / 70S / 18nm, ribosomes ; **A** only one type of ribosome
mesosome ; [3 max]

Q9.

1 **(a)** *plant cell because presence of*

cell wall ;	**A** cellulose cell wall	**R** incorrect cell wall materials
plasmodesma ;	**A** plasmodesmata	
tonoplast ;	**A** vacuolar membrane	
large/central, vacuole ;	***ignore*** permanent	[2 max]

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name of organelle	diagram of organelle(s) as seen under the electron microscope (not to scale)	one function of organelle	cell type(s) in which organelle is located
	all 3 for one mark oval/circular shape and two membranes close together and inner membrane infolded as two or more cristae ;	aerobic respiration/ATP, production/synthesis ; A oxidative phosphorylation A ref. β oxidation fats A ref. urea/ornithine cycle R *any answer that refers to* synthesis/production, of energy	
centrioles ; A centricle A centrosome			animal ;
	both for one mark two membranes and ribosomes on external surface ; R *if ribosomes are excessively large*		animal and plant/both ;
		processing/modification/AW/ packaging, of, proteins/ molecules ; A description of modification e.g. glycosylation A production of, secretory/ Golgi, vesicles A production of lysosomes R protein synthesis	
chloroplast ;			

[8]

[Total: 10]

Q10.

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1 **(a)** **A** nucleus ; **A** (eu)chromatin **R** nucleolus
B mitochondrion ; **A** mitochondria
C (rough) endoplasmic reticulum ; **A** (R)ER **R** smooth/S [3]

(b) **(i)** protein/polypeptide, synthesis/AW ; **A** protein, transport/modification
A ecf if **C** is identified as Golgi or SERor ribosomes in **1 (a)** [1]

(ii) *ignore refs to magnification*
resolution/resolving power, low(er) ; ora
200 nm compared to 0.5 nm ; **A** resolution quoted in range 100-300 to 0.2-1.0 nm
ref. to visibility of structure **C** ; e.gs.
wavelength of light longer than size of, ribosomes/membrane
ribosomes/membrane, cannot be seen as less than 200nm diameter
ribosomes only 20–30 nm diameter **A** 15–20 nm
membranes 7–10 nm thick
small size linked to explanation of resolution [2 max]

(c) *any one relevant disadvantage e.g.*

only dead specimens can be viewed ;
mounted in vacuum/pre-treatment, may distort delicate structures ; **A** artefacts
expensive, qualified ; e.g. to buy, maintain, increased cost electricity, costs associated with, time/training
requires, more electrical power ;
requires stable, high voltage supplies/currents ;
sensitive to external magnetic fields ;
difficult to operate/requires technical training ;
samples more difficult to prepare ; **A** examples e.g. thin sections
lengthy preparation time ;
monochrome/black and white only ;
not portable/can only be used in specific locations (e.g. with voltage supplies) ; [1 max]

(d) *allow +/- 1 mm in reading the line*
award two marks if correct answer is given

20 000/6 µm = (3333.3)	**A** 19 000/6 = (3 166.7)	**A** 21 000/6 = (3 500.0)
3 333 (x);;	**A** 3 167 (x)	**A** 3 500n(x)

award one mark if answer is given to one or more decimal places or
award one mark if correctly measured and divided by 6 µm but incorrectly converted [2 max]

[Total: 9]

Q11.

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(b) (i) *2 marks for correct answer*
x 30 000 ;;
(image length = 60 mm) 60 000μm / 2μm **A** 59 / 61 mm (29 500 / 30 500)
1 mark if incorrect answer e.g. not converted correctly, but measurement and method correct [2]

(ii) *any 3 relevant e.g.*
DNA not surrounded by, nuclear, envelope / membrane ; AW
A no (true) nucleus
circular DNA ; **A** loop
DNA not complexed with histone proteins ; **A** naked DNA
(only) 70S / smaller / 18nm, ribosomes ; **A** ribosomes not attached to membranes
no double membrane-bound organelles; **A** no, mitochondria / chloroplasts
absence of named organelle ; e.g. Golgi apparatus, ER / RER / SER
if previous mp not given, **A** no membrane-bound organelles
capsule / slime layer ;
very small diameter / 0.5 to 5.0μm ;
cell wall of, murein / peptidoglycan ;

examples of other relevant points
pili / pilus ;
no 9+2 microtubule arrangement ;
flagellum not covered by cell surface membrane ;
presence of plasmids ; [max 3]

Q12.

2 (a) **1** electron microscope has, higher / AW, resolution (than LM) / ora ;
2 explanation of resolution as ability to differentiate between two points (close together) ;
3 ref. to (internal) membranes (of **A** and **B**) which cannot be seen in LM ;
A named membranes e.g. cristae, grana
4 AVP ; e.g.
(resolution of) EM is 0.5 nm (0.0005μm) and LM is 200 nm (0.2μm)
A 0.5 to 1 nm (0.001μm)
resolution is equal to half the wavelength (of medium used)
ref. to shorter / AW, wavelength (of electrons) / ora (must have a comparison)
ref. to, width of membranes / distance apart of membranes, e.g. width of membranes in A and B is 7 nm (+/– 1) [max 3]

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(b) **C** – rough endoplasmic reticulum ; *penalise once only for ER instead of endoplasmic reticulum*
D – ribosome ; **A** ribosomes ignore 70S
E – smooth endoplasmic reticulum ; **A** smooth ER *if full term used for* ***C***

award one mark if ***E*** *= rough endoplasmic reticulum and*
C *= smooth endoplasmic reticulum* [3]

(c) *any one relevant e.g.*

store of / holds, cell sap ; **R** if contains organelles
store of / holds, water / ions / named ion(s) / minerals / salts / pigments / (named) sugars ;
R substances / molecules
R storage unqualified
pushes chloroplast to edge of cell ;
gives, turgidity / turgor pressure / hydrostatic pressure / support / AW ;
A makes, firm / rigid
A controls / maintains, turgidity
R gives shape / strengthen
store of / holds, waste (products)

R reactions occur in vacuole, unqualified [1]

(d) *no marks for identifying* ***F*** *and* ***G***
if only ***F*** *or* ***G*** *described max 3*
if ***F*** *and* ***G*** *incorrectly identified, accept mark points correctly linked to membrane and wall to max 3*

1 **F** partially permeable A selectively permeable
and **G** (fully / freely / AW), permeable / porous ;

F *is partially permeable cell surface membrane*
2 phospholipid (bilayer);
3 permeable to, lipid-soluble molecules / oxygen ;
A other terms for lipid-soluble
treat reference to water as neutral
4 impermeable to, water-soluble / AW, molecules / ions / AW ;
A other terms for water-soluble
treat reference to water as neutral
5 aquaporins / proteins, provide (increased) permeability to water ;
6 transport proteins provide permeability to, ions / polar molecules ;
A channel / pore / carrier, proteins

G is permeable cell wall
7 cellulose ;
8 fibres ;
9 ref. to, spaces / gaps / holes / pores, (between, fibres / other cell wall components) ; [max 4]

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(e) 1 allows transport of, water / sucrose / amino acids / organic substances / ions /minerals / salts / lipids / hormones / ATP, (from cell to cell / between cells) ;
R if linked to an incorrect transport mechanism e.g. sucrose moves by osmosis
2 without crossing, membranes / walls ; **A** without going through protein channels
3 this is movement through the symplast ;
4 any e.g. ; companion cell to (phloem) sieve tube (element / cell)
between mesophyll cells
mesophyll cell to companion cell
cortical cell to cortical cell / across cells of the cortex
cortical cell to endodermal cell
endodermal cell to, pericycle cell / xylem / phloem
ignore between sieve tube elements
5 allows, communication / signalling, between cells ; [max 3]

[Total: 14]

Q13.

2 **(a)** *allow immunoglobulin for antibody*

structure	name of structure	function of structure within plasma cell
A	nucleus ; **A** (eu)chromatin **R** heterochromatin **R** chromosome	ref. gene(s) / genetic information / genetic material / DNA, (coding) for, antibody / protein / polypeptide ; transcription (occurring) / mRNA synthesis ; AW (ref. antibodies) *allow ecf for nucleolus*
B	mitochondrion ; **A** mitochondria	provides / synthesises / produces / makes, ATP (for antibody synthesis / exocytosis) ; *treat as neutral other uses of ATP* *allow ecf for lysosomes*
C	rough endoplasmic reticulum ; ignore RER	synthesis / modification / processing / transport, of, antibody / protein / polypeptide ; **A** translation *allow ecf for Golgi or SER or ER*

[max 6]

Q14.

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(b) *look for ora*

1 can observe living tissue ; **A** observing processes (e.g. like mitosis)

2 ref. portability ; e.g. ref. to size, easy to move, no requirement for special room (e.g. vibration-free)

3 ease of use, qualified ; e.g. no technical training required, slide preparation easier, takes less time

4 see (actual / natural / real-life) colour ;

5 ref. to, differential staining / staining particular types of tissue ;

6 fewer problems with artefacts ;

7 lower cost of, purchase / maintenance / running / AW ; [max 2]

Q15.

1 **(a)** **A** = chloroplast ; **A** granum / grana
B = (intercellular) air space ;
C = nucleolus ; **A** nucleus [3]

(b) *two marks for correct answer*
9(μm) ;;
award one mark if not to nearest micrometre, 9.3/9.28
or correct measurement incorrectly converted but correct formula used
64/65/66 mm ÷ 7000 [2]

Q16.

(b) *malarial parasite has*
nucleus / nuclear membrane / nuclear envelope;
mitochondria;
membranous organelles; R. ribosomes R. nucleolus **2 max**

Q17.

1 **(a)** **(i)** **A** - Golgi (body/apparatus)/dictyosome; **R** Golgi vesicles

B - (rough) endoplasmic reticulum/ER/RER; **R** SER

C - mitochondrion/mitochondrial, matrix/envelope; **3**

(ii) sieve plate(s); **1**

(iii) sucrose/amino acid(s)/named amino acid; **R** sugar, glucose **1**

Q18.

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[Total 14]

4 (a) Q - cell wall; **R** cellulose cell wall

R - flagellum; **A** flagella

S - (loop/circular) DNA; **A** nucleoid

R plasmid **R** chromosome **3**

(b) nucleus/nuclear membrane/nuclear envelope/linear DNA/chromosome/ nucleolus;

mitochondrion; **A** mitochondria

lysosome(s);

endoplasmic reticulum/fixed/larger/80S, ribosomes;

Golgi (apparatus/body);

centriole(s);

R membrane based organelles **3 max**

Q19.

Question		Expected Answers	Marks
1	(a)	**A** – Golgi, body/apparatus/complex; **B** - Nucleolus; **C** – Mitochondrion.	[3]

Q20.

[Total: 5]

2 (a) nucleus/nuclear membrane/nuclear envelope/nucleolus;
ER/SER/RER;
Golgi (body/apparatus)/lysosomes;
larger ribosomes/80S ribosomes;
linear DNA/chromosomes/protein + DNA (in chromosomes);
mitochondrion/mitochondria;
cell wall made of cellulose; **R** cell wall unqualified
microtubules; **A** spindle fibres/centriole
large vacuole/tonoplast;
plasmodesmata; **[max 3]**

(b) high(er) resolution;
because of shorter wavelength;
more detail can be seen/much clearer, at the same magnification/can see two points that are close together/quote appropriate figs;
can see cell structures, that are not visible in the LM/
A e.g. ribosomes/membranes;
can see detail of structures just visible in LM with e.g.
A mitochondrion/chloroplast; **[max 2]**

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Q21.

3 (a) **A** to cilia; **R** basal body
B to nuclear membrane;
C to ER; **[3]**
must have label lines which touch appropriate place

Q22.

1 **(a)** no membrane-bound organelles / no named organelle(s) ;
murein / peptidoglycan, in cell wall ;
smaller / 70s / 18nm, ribosomes ;
no nucleus / no nucleolus / no nuclear envelope ;
loop of DNA / circular DNA / no chromosomes / naked DNA / no histones ;
mesosome ;
plasmid ;
capsule ; **A** slime / mucilage, around cell wall ; [3 max]

Q23.

1 **(a)** *check column **A** and **B** for correct ref. to feature if not clear in first column e.g. gives description*

feature	phagocyte (**A**)	plasma cell (**B**)
rough endoplasmic reticulum / RER *allow ER if rough / RER stated in next column(s)* **R** SER	small quantity / AW **A** few, less	large quantity / AW ; **A** many, more
ribosomes	few *or* ref. to free	many ; *or* not free / fixed
lysosomes	some / present / ✓	none / absent / x ;
vacuoles / vesicles / phagosomes	some / present / ✓	none / absent / x ;
nucleus	lobed / AW **A** irregular, not round **R** curved, elongated, no definite shape	round / not lobed / not irregular / AW ; **A** spherical, circular
Golgi (body)	absent / x	present / ✓ ;
plasma / cell (surface), membrane	with, endocytotic / pinocytotic / phagocytic / exocytotic, vesicles / vacuoles **A** invaginations, infoldings **R** indentations	without, endocytotic / pinocytotic / phagocytic / exocytotic, vesicles / vacuoles **A** no invaginations, no infoldings **R** no indentations
mitochondria	less / few / 3	more / many / 7 ;

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(b) (to nearest whole number) (x) 6000 ;; **A** 5900 – 6100
allow 1 mark for correct working if answer incorrect / not to whole number
e.g. length of scale bar in mm × 1000, divide by actual size
60 mm × 1000 / 10 **A** 59 – 61 mm [2]

Q24.

(c) lysosomes fuse with, vacuole / vesicle / phagosome ;
A form secondary lysosomes
lysosomes contain, enzymes / named digestive enzyme ;
(catalyse) hydrolysis / digestion ; **A** breakdown
(digests / breaks down) protein / murein (or peptidoglycan) / carbohydrate / lipid / phospholipid / nucleic acid / DNA / RNA ;
named bond ; e.g. peptide, glycosidic, ester, phosphodiester [4 max]

Q25.

5 **(a)** **(i)** **H** nucleolus ;
J Golgi (body / apparatus) ;
K cell wall ; **R** murein / peptidoglycan **ignore** cellulose or chitin
L vacuolar membrane / vacuole ; **A** tonoplast **R** cell sap [4 max]

(ii) no double membrane-bound organelles ;
no, nucleus / nuclear membrane / nuclear envelope / nucleolus ;
A DNA lies free in the cytoplasm
no mitochondrion ;
mesosomes ;
no (large) vacuole ;
no, ER / RER / SER ;
no Golgi (body / apparatus) ;
smaller / 70S / 18nm, ribosomes ;
cell wall made of, murein / peptidoglycan / different compounds (from eukaryote) ;
circular DNA / plasmid(s) / no linear DNA ;
no histones / not complexed with proteins ; **A** naked DNA / no chromosomes
AVP ; e.g. pili / no 9+2 microtubule pattern [2 max]

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(b) nucleus, transcription / described as DNA to complementary RNA code / AW ;

nuclear pore, mRNA to, cytoplasm / ribosome / RER ;
RER / ribosome, assembly of amino acids / translation / polypeptide *or* protein synthesis ;
RER, transports protein to Golgi (apparatus / body) / modifies protein ;

Golgi adds, carbohydrates / sugars, to proteins ; **A** glycosylation
A post translational modification / other e.g.s
Golgi, packages protein / makes vesicle(s) ;

(Golgi) vesicle fuses with cell (surface) membrane ;

mitochondrion, provides / produces / synthesises, ATP *in correct context* ; [4 max]

[Total: 10]

Q26.

(c)

function	letter from Fig. 5.1
organelle that contains DNA	H
structure that transports cell wall material to the cell surface membrane	A
site of transcription	H
site of ribosome synthesis	J
site of photosynthesis	D

[4]

(d) polypeptide / protein, in (cisternae of) RER ;
to Golgi (apparatus / AW) ;
modification / glycosylation / packaging ;
vesicle(s) formed / transport in vesicle ; **A** vacuole
membrane of vesicle fuses with cell surface membrane ;
exocytosis / described ; [max 3]

Q27.

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1 (a) (i) transcription first process and exocytosis final process ;
correct order for remaining three processes (3, 4, 2) ;
accept words and mixture of words and letters [2]

(ii)

F ;
A / D
A ;
C
D ;

events	order of events	cell location (letter)	
exocytosis	**5**	**F**	cell membrane ;
protein modification	**3**	**A / D** **A+D**	Golgi and/or RER ,
secretory vesicle formation	**4**	**A**	Golgi ;
transcription	**1**	**C**	nucleus ,
translation	**2**	**D**	RER ;

[3]

(b) 1 vesicle / vacuole, moves towards, cell, surface / membrane ;
A plasma membrane **R** if lysosome
2 fusion / described, of vesicle with membrane ; **R** attach / bind / combine
3 ref. to (fluid nature of) phospholipids ;
4 contents / AW, secreted / released / exported / removed / emptied / excreted ;
A waste material / digested material
5 active process / energy-requiring / ATP used / AW ;
R 'active transport' **R** endocytosis [max 3]

Q28.

6 (a) line to nucleolus labelled **C** ;
line to Golgi apparatus labelled **D** ; **R** to vesicle
line to mitochondrion labelled **E** ; [3]

Q29.

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1 **(a)** 40 000 ;;
if no answer, incorrect answer or answer to too many significant figures, award one mark for correct measurement – 2 cm / 20 mm / 20 000 µm divided by 0.5
20 000 / AW or 89 (000) × 0.5 = 2.225, 89 000 / 2.225 **A** 90 000 / 2.25
A correct use of standard form [2]

(b) *Mark the first answer on each line if more than one;*
If one answer line or two answers left blank, mark first three answers that stand.

features must be structures present in animal cells (look for the positive)

mitochondrion / mitochondria ;
nucleus / nuclear membrane / nuclear envelope ; ***ignore*** 'lying free'
nucleolus ;
DNA associated with, histone(s) / protein(s) ; **A** chromosomes / linear DNA
ignore 'not naked DNA'
(smooth / rough) endoplasmic reticulum ; **A** ER / SER / RER ;
Golgi (body / apparatus / complex) ;
lysosomes / Golgi vesicles / secretory vesicles ;
ignore (double) membrane-bound organelles
large(r) / 80S, ribosomes ; **A** anything between 20 and 30 nm centrioles ;
AVP ; e.g. cytoskeleton, (9 + 2) microtubules, microfilaments, proteasome, peroxisome, cilium / cilia, flagellum / flagella [max 3]

(c) cells not sectioned in LS ; **ora**
A cross-section shown / depends on angle of cut / cut in different planes / end view [1]

Q30.

1 **(a)** *one mark per row*
penalise once for stated ecf and then mark to max 4 [6]

	name of organelle	function
A	*cell surface membrane*	*control of movement of substances into and out of the cell*
B	nucleolus	production of, ribosomes / rRNA / tRNA ;
C	mitochondrion **A** mitochondria	one from ; aerobic respiration ATP synthesis/ production / AW link reaction Krebs cycle oxidative phosphorylation **R** produces energy / ATP energy

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D	smooth endoplasmic reticulum **R** SER or smooth ER	lipid / sterol / cholesterol / steroid, synthesis ; *ecf if SER, or Golgi is named organelle*
E	rough endoplasmic reticulum **R** RER or rough ER	one from ; protein / polypeptide, synthesis translation modification of protein / described (e.g. folding, glycosylation) protein transport (to Golgi) *ecf if RER*
F	Golgi (body / complex /apparatus)	one from ; modification of protein glycosylation / described modification of lipid pack(aq)ing (of), protein / lipids production of, (Golgi / secretory) vesicles / lysosomes *Ignore* synthesis of protein *allow ecf if smooth endoplasmic reticulum*
G	lysosome *or* Golgi / secretory, vesicle	contains /storage of, hydrolytic / digestive, enzymes *or if Golgi vesicle* transfer / transport, of, protein / lipids ;

Q31.

1 **(a)** *electron microscope*
accept ora for light microscope
1 higher resolution / better resolving power;
A high *only if further detail confirms understanding*
2 more easily able to distinguish between two (separate) points / AW;
A *if no comparative but mp 1 or relevant point in mp 3 gained*
3 **AVP**; able to see points closer together than 200 nm **A** range 100 – 300 nm
can see points up to 0.5 nm (0.0005 μm) apart but LM is 200 nm (0.2 μm) **A** range 0.2 – 1.0 nm
electrons have shorter wavelength (than light)
wavelength of electrons shorter than size of additional structures seen [max 2]

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(b) *each feature must be briefly qualified to gain max 3*
penalise once if feature correct but not correctly qualified / or not qualified

1 detail of mitochondria; e.g. inner membrane / crista(e)
double membrane
ribosomes
(circular) DNA

2 detail of chloroplasts; e.g. double membrane
internal membranes
thylakoid(s) / grana / intergrana / lamellae
ribosomes

3 ribosomes, qualified; e.g. visible as small dots
scattered throughout / in cytoplasm
on RER

4 smooth endoplasmic reticulum / SER, qualified; e.g. no ribosomes / tubular / membranous

5 rough endoplasmic reticulum / RER, qualified; e.g. ribosomes / membranous / flattened cisternae;

4/5 endoplasmic reticulum / ER, qualified; e.g. smooth and rough / membranous / throughout cytoplasm

6 Golgi vesicles / secretory vesicles / lysosomes qualified;
e.g. forming from Golgi
ref. exocytosis (not for lysosomes)
seen as (small) sacs / AW
membranous

7 heterochromatin darker staining / euchromatin lighter staining;
A chromosomes seen as heterochromatin and euchromatin

8 nucleus has, nuclear envelope / two membranes;

9 nuclear pores in nuclear envelope;

10 cell surface membrane, qualified; e.g. to the inside of the cell wall

11 *idea that* (cell) membranes are visible, qualified; e.g. thin / round / within organelles /

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(c) *award two marks if correct answer is given, only one mark if μm (units) given*

× 1600::
A in range of × 1400 to × 1800

(8 000 / 5 μm)
7 000 / 5 μm = (1400)
9 000 / 5 = (1800)

award one mark if correctly measured and divided by 5 μm but incorrectly converted
award one mark if incorrect measurement (e.g. whole cell) but correct formula used (i.e. divided by 5 μm) [2]

Q32.

1 *accept first on row*
accept phonetic spellings

A	*name*	mitochondrion ; **A** mitochondria
	function (site of) ;	ATP, synthesis / production / AW aerobic respiration link reaction Krebs cycle oxidative phosphorylation AVP **R** ATP energy
B	*name*	Golgi (apparatus / body / complex) ; **A** dictyosome **A** Golgi
	function (site of) ;	modification of protein / glycosylation / described modification of lipid pack(ag)ing (of), protein / lipids production of (Golgi / secretory) vesicles / lysosomes **ignore** synthesis of protein *(incorrect name)* *lysosome function* = contains / storage of hydrolytic / digestive, enzymes *Golgi / secretory, vesicles* = transport, protein / lipids

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C *name* chloroplast(s) ;

function (site of) ; photosynthesis
light-dependent, reactions / stage (of photosynthesis)
light, absorption / AW
light-independent, reactions / stage (of photosynthesis)
Calvin cycle
carbon fixation
photophosphorylation
A ATP synthesis
ignore *(treat as neutral) ref. to, glucose / oxygen, synthesis*
ignore *chlorophyll*
R light / dark, stage / reactions

D *name* rough endoplasmic reticulum ;
R RER or rough ER **R** endoplastic

function (site of) ; protein / polypeptide, synthesis
translation
modification of protein / described (e.g. folding)
protein transport (to Golgi)
(incorrect name)
smooth endoplasmic reticulum = lipid / steroid / cholesterol, synthesis / AW
endoplasmic reticulum = ecf as above for RER / SER

[Total: 8]

Q33.

4 **(a)** 1 mitochondrion ; **A** mitochondria
A outer mitochondrial membrane

2 produces / synthesises / AW, ATP ; **A** release / supply, ATP / energy
R produces energy
R ATP energy
or
for outer mitochondrial membrane allows exit of (synthesised) ATP to cell

3 example of use of ATP in liver cells ;
e.g. for synthesis of, cholesterol / glycogen / protein / biological molecules / polymers / AW
intracellular movement of vesicles
exocytosis / endocytosis / bulk transport
active transport [3]

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(b) (i) lipoproteins are soluble ;
cholesterol is not water-soluble ;
cholesterol surrounded by/lipoproteins have, phospholipid heads/proteins, that are hydrophilic ; AW
allows transport in blood ; [max 1]

(ii) *cholesterol needed for*
making/components of, membranes ;
membrane stability ;
regulating the fluidity of, membranes/phospholipid bilayer ;
production of, steroid hormones/named steroid hormone ;
AVP ; e.g. helps prevent entry of, ions/polar molecules [max 2]

(c) vesicles travel to cell surface membrane ; **A** travels through cytoplasm towards space between cells
exocytosis ;
vesicle/membrane, fusion (with cell surface membrane) ;
contents/cholesterol, released ; [max 2]

(d) glycosylation/adding sugar molecules to proteins/making glycoproteins ;
A modifying proteins
phosphorylating proteins ;
cutting/folding, proteins ;
assembly of polypeptides into proteins (with quaternary structure) ;
AVP ; e.g. lipid synthesis
ref. lysosome formation [max 1]

[Total: 9]

Q34.

4 (a) (i) *penalise once if the term genetic material is used instead of DNA*

1 no nuclear envelope / no (true) nucleus ;
A no nuclear membrane
A no nucleus envelope
A DNA free in cytoplasm ora
A DNA as nucleoid

2 DNA, loop / circular ;
A DNA not linear

3 DNA, not in chromosomes / DNA not associated with, histones / proteins ;
A naked DNA

4 no nucleolus ;

5 (presence of) plasmids ;

6 (only) have, 70S / small / 18–20 nm, ribosomes ;

7 presence of, capsule / slime layer ;

8 ref. small (cell) size / less than 5 μm / (only) 1 μm ;
A ora for eukaryotes [max 3]

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(ii) *plant cell*
cellulose ; *treat as neutral ref. to microfibrils / fibres*

bacterial cell
murein / peptidoglycan ;
A peptoglycan / polysaccharide and amino acid [2]

Q35.

(c) **I** *general references to LM v EM*
A ora *for electron microscope*

1 living cells can be viewed (with light microscope) ;
2 can watch the cell cycle happen (in real time / time lapse) / AW ;
3 all chromosomes can be seen (at once) ;
4 can see, whole chromosomes / all the stages of mitosis or cell cycle ;
5 do not need take sections to see mitosis ;
6 dyes / stains, can be used ; **I** ref. to natural colours of specimens
A ref. to fluorescence microscopy [max 3]

Q36.

4 **(a)** (15,000 / 0.5)
x 30,000; **[1]**

(b) starch grain;
grana / thylakoids / internal membranes;
shape, qualified; 'typical chloroplast shape' is minimum acceptable
length; **A** range of appropriate lengths, e.g. 5 to 10 µm **[max 2]**

(c) *make*
ATP; **A** combine with ADP
phospholipids;
DNA / RNA / nucleotides / named nucleotide;
phosphorylated sugars / triose phosphate; **[max 1]**

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