

Q1.

3 (a)	Correct letter order on Question Paper: A - nucleus; C - mitochondria; B - RER; D - Golgi apparatus; E - cell surface membrane; <i>R. process statements instead of letters</i>	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)	<i>assume answer is about red blood cells unless indicated otherwise</i> 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.

Question Expected Answers

Marks

- 4 (a) (i) A transcription; (ignore mRNA synthesis)
 B translation;
 C exocytosis; R secretion
 (ii) D (sub unit of) ribosome
 E Golgi apparatus/body;
 (iii) F mRNA;

[max 3]

[2]

[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	<i>to be added</i>		

[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.

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 \times 1000, divided by actual size
e.g. 100 mm \times 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.

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]

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
	<i>all 3 for one mark</i> 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 centriole A centrosome			animal ;
	<i>both for one mark</i> 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.

- 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 SER or 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.g.
 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.

(b) (i) 2 marks for correct answer
x 30 000 ;;
(image length = 60 mm) 60 000 μ m / 2 μ m 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 5.0 μ m ;
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 (0.0005 μ m) and LM is 200 nm (0.2 μ m)
A 0.5 to 1 nm (0.001 μ m)
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]

(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]

- (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	<u>nucleus</u> ; 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) <i>allow ecf for nucleolus</i>
B	mitochondrion ; A mitochondria	provides / synthesises / produces / makes, <u>ATP</u> (for antibody synthesis / exocytosis) ; <i>treat as neutral other uses of ATP</i> <i>allow ecf for lysosomes</i>
C	<u>rough</u> endoplasmic reticulum ; ignore RER	synthesis / modification / processing / transport, of, antibody / protein / polypeptide ; A translation <i>allow ecf for Golgi or SER or ER</i>

[max 6]

Q14.

- (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 ; [3]
C = nucleolus ; **A** nucleus

- (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.

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

R - flagellum; A flagella

S - (loop/circular) DNA; A nucleoid

R plasmid R chromosome

[Total 14]

3

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

mitochondrion; A mitochondria

lysosome(s);

endoplasmic reticulum/fixer/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.

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]

Q21.

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

[3]

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 <i>allow ER if rough / RER stated in next column(s) R SER</i>	small quantity / AW A few, less	large quantity / AW ; A many, more
ribosomes	few <i>or</i> ref. to free	many ; <i>or</i> 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 ;

- (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]

(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.

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

(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.

- 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
 $\frac{20\ 000}{0.5} / \text{AW}$ or $\frac{89\ (000)}{20\ (000)} \times 0.5 = 2.225$, $\frac{89\ 000}{2.225}$ **A** $\frac{90\ 000}{2.25}$
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

D	smooth endoplasmic reticulum R SER or smooth ER	lipid / sterol / cholesterol / steroid, synthesis ; <i>ecf if SER, or Golgi is named organelle</i>
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) <i>ecf if RER</i>
F	Golgi (body / complex / apparatus)	one from ; modification of protein glycosylation / described modification of lipid pack(ing)ing (of), protein / lipids production of, (Golgi / secretory) vesicles / lysosomes ignore synthesis of protein <i>allow ecf if smooth endoplasmic reticulum</i>
G	lysosome or Golgi / secretory, vesicle	contains /storage of, hydrolytic / digestive, enzymes <i>or if Golgi vesicle</i> 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]

- (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 /

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

$\times 1600$;

A in range of $\times 1400$ to $\times 1800$

(8 000 / $5 \mu\text{m}$)

7 000 / $5 \mu\text{m}$ = (1400)

9 000 / 5 = (1800)

award one mark if correctly measured and divided by $5 \mu\text{m}$ but incorrectly converted
award one mark if incorrect measurement (e.g. whole cell) but correct formula used
(i.e. divided by $5 \mu\text{m}$)

[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(ing)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

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** endoplasmic
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]

- (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]

(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]

