1. Cell Structure

1.2 Cells as the Basic Units of Living Organisms

Paper 2

Marking Scheme

Q1.

(b)(i)	*each organelle must be drawn in the cytoplasm and labelled for a mark* *max 2 if organelles are drawn correctly but not labelled or are not labelled correctly* *labels must clearly identify the organelles* **R** *any 3D drawings* mitochondrion with two membranes and at least one crista ; rough endoplasmic reticulum with at least one cisterna (two lines close together) and ribosomes attached on the outside ; **R** if any ribosomes completely inside the organelle smooth endoplasmic reticulum with at least one tube with no ribosomes ; **A** RER and SER as labels **A** if RER or SER attached to nuclear envelope	**3**
(b)(ii)	Golgi body / dictyosome ; **A** Golgi, apparatus / complex *plus any **one** from:* modifies / processes, protein(s) / polypeptide(s) / lipid(s) ; **A** any suitable type of modification or a description e.g. glycosylation / addition of sugars forming tertiary or quaternary structures packaging of proteins into (Golgi) vesicles ; **I** transports AVP ; e.g. forming lysosomes / cell wall enzymes assembled	**2**

Q2.

(b)(i)	9+2, pattern / arrangement / structure ; composed of microtubules ; AVP ; e.g. *ref. to* dynein 'arms' / AW outer 9 are, pairs of microtubules / doublets, and central two are single	**2**
(b)(ii)	*idea that* each cilium / structure **X**, is surrounded by cell (surface) membrane (so contents are inside the, cell / cytoplasm) ;	**1**

Q3.

(a)(i)	*one mark each correct row* **cell structure** / **function** nucleolus ; / manufactures ribosomal subunits from proteins and ribosomal RNA smooth endoplasmic reticulum ; **R** endoplastic / synthesises triglycerides and other lipids pair of centrioles ; **R** centrosomes / organise microtubules of the cell cytoskeleton	**3**
(a)(ii)	*structures should be labelled and drawn with enough detail not to be mistaken for another structure* *all three correct = 2 marks* *one or two correct = 1 mark* *all three structures correctly drawn but no labels = 1 mark* • roughly spherical organelle within the nucleus labelled as nucleolus • minimum of one single membrane-bound tubular sac labelled as, smooth endoplasmic reticulum / smooth ER / SER **R** if dots (ribosomes) drawn and resembles RER • two, short lines or cylinders, not parallel to each other labelled as (pair of) centrioles **R** if inside the nucleus	**2**

Q4.

<table>
<tr><td>(c)(i)</td><td>any one from:

because bacteria have cell walls (only) of, murein / peptidoglycan ;

because chitin is not found in bacterial cell walls ;

A chitin / β-D-glucans, <u>main / major / AW</u> component of fungal cell walls</td><td>1</td></tr>
<tr><td>(c)(ii)</td><td>
<table>
<tr><th>structural feature of P. jirovecii</th><th>function</th><th>present (✓) or absent (x) in bacterial cells</th></tr>
<tr><td>ribosomes</td><td>protein synthesis</td><td>✓</td></tr>
<tr><td>smooth endoplasmic reticulum</td><td>lipid / cholesterol / steroid, synthesis / metabolism

AVP ; detoxification
I carbohydrate metabolism</td><td>x</td></tr>
<tr><td>Golgi body</td><td>modification of proteins and lipids</td><td>x</td></tr>
<tr><td>mitochondrion / mitochondria</td><td>aerobic respiration</td><td>x</td></tr>
</table>
one mark each correct column ;;;

assume a tick that has been crossed is a cross ✗</td><td>3</td></tr>
</table>

Q5.

<table>
<tr><td>(a)</td><td>
<table>
<tr><th rowspan="2">organelle</th><th colspan="3">cell type</th></tr>
<tr><th>animal cells</th><th>plant cells</th><th>prokaryotic cells</th></tr>
<tr><td>nucleus</td><td>✓</td><td>✓</td><td>×</td></tr>
<tr><td>large permanent vacuole</td><td>×</td><td>✓</td><td>× ;</td></tr>
<tr><td>rough endoplasmic reticulum</td><td>✓</td><td>✓</td><td>× ;</td></tr>
<tr><td>Golgi body</td><td>✓</td><td>✓</td><td>× ;</td></tr>
<tr><td>centrioles</td><td>✓</td><td>×</td><td>× ;</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>(b)(i)</td><td>microvilli ;</td><td>1</td></tr>
<tr><td>(b)(ii)</td><td>site of aerobic respiration, so
produces / provides, ATP ;
A provides energy
R produces energy

use of ATP in context of absorption of digested food
for, active transport / (idea of) absorption against a concentration gradient
or
endocytosis / pinocytosis; A bulk transport into cell(s) ;</td><td>2</td></tr>
</table>

Q6.

(a) *one mark each row to max 3*
or = *requires either root apical meristem or root cap cells statement*

root apical meristem cells		***root cap cells***
(some) cells in, mitosis / different stages of cell cycle ;	**or**	no cells in mitosis / all cells in interphase ; **A** no chromosomes visible / only chromatin visible
(some) cells in, prophase / metaphase / telophase ; **A** chromosomes visible (in some cells)		N/A
(generally) smaller (size) ; **A** less cytoplasm	**or**	(generally) larger (size) ; **A** more cytoplasm
larger nucleus in proportion to, size of cell / quantity of cytoplasm ;	**or**	smaller nucleus in proportion to, size of cell / quantity of cytoplasm ;
nucleoli / nucleolus, (more) visible / prominent / AW ;	**or**	nucleoli / nucleolus, not visible / not prominent / AW ;
(generally all) cuboidal / same shape ; **A** rectangular / regular (shape)	**or**	variety of shapes / shape described ; **A** irregular / circular
ref. arrangement of cells ; e.g. rows / chains / tightly packed / compact / uniform / regular	**or**	*ref.* arrangement of cells ; e.g. irregular / loosely packed / more intercellular spaces
AVP ; e.g. all / more, cells have nuclei cells not, sloughing off / detaching	**or**	AVP ; e.g. some have no nucleus some cells, sloughing off / detaching

3

Q7.

(a)(i)	 label line to any part of nucleolus ; *must touch an area of nucleolus*	**1**
(a)(ii)	*any **two** from:* suggestion for structure as a flagellum ; **R** microvillus **A** cilium / undulipodium presence of microtubules ; presence of 9 + 2 (microtubule) arrangement / pattern, (in cross section) ; AVP ; e.g. *ref. to* location on outer part of cell (so can move) / AW circular cross section suggests tubular structure (hence flagellum) / AW e.g. looks cylindrical	**2**

(a)(iii)	*any **three** from:* *eukaryote because presence of* (true) nucleus / nuclear envelope / nuclear membranes ; mitochondrion ; *if mp1 **and** 2 not gained, allow* double membrane-bound structures nucleolus ; chromatin ; (**X**) has 9+2 pattern of microtubules ; **A** *ref. to* cytoskeleton / microtubules **X** / AW, covered by cell (surface) membrane ; endoplasmic reticulum ; **I** rough / smooth **I** ER / SER / RER **A** Golgi body *not prokaryote because* absence of cell wall ; **I** does not have peptidoglycan cell wall (size) greater than 5 µm ; **A** larger than (typical) prokaryote / bacterial cell **A** valid calculated size using scale bar *if stated as a prokaryote, read whole response and if all ideas refer correctly to eukaryotic structures, allow max 1*	**3**

Q8.

<table>
<tr><td>(a)(i)</td><td>any one from:

<u>no chloroplasts</u> (present) ;

presence of (many) small vacuoles / no large vacuole / no central vacuole ;

central nucleus
or
nucleus not located at the, edge / periphery ;</td><td>1</td></tr>
<tr><td>(a)(ii)</td><td>one mark per row ;;;;
If 0 marks, allow 1 mark if name of cell structure column completed correctly
<table>
<tr><th>function</th><th>name of cell structure</th><th>letter on Fig.1.1</th></tr>
<tr><td>gas exchange</td><td>cell <u>surface</u> membrane
I phospholipid bilayer

mitochondrial membrane(s)</td><td>A

E</td></tr>
<tr><td>production of subunits of ribosomes</td><td>nucleolus / nucleoli</td><td>C</td></tr>
<tr><td>active transport of ions</td><td>cell <u>surface</u> membrane
ecf for cell membrane
or
tonoplast / vacuolar membrane
or
mitochondrial membrane(s)
or
nuclear envelope
A nuclear membrane(s)</td><td>A

F

E

B</td></tr>
<tr><td>aerobic respiration</td><td>mitochondrion / mitochondria</td><td>E</td></tr>
</table></td><td>4</td></tr>
<tr><td>(b)(i)</td><td>endocytosis / pinocytosis ; R phagocytosis</td><td>1</td></tr>
</table>

<table>
<tr><td>(b)(ii)</td><td>any three from:

1 <u>hydrolysis</u> / use water to break bonds ; A ref. to hydrolytic enzymes

2 (action of) protease(s) / peptidases / proteolytic enzyme(s) ;

3 peptide bonds broken ;
R if part of a list with other bonds not found in proteins, such as glycosidic, ester, phosphodiester

4 to form, peptides / amino acids ;</td><td>3</td></tr>
<tr><td>(c)</td><td>1 formation of phagolysosomes / described ;
A fusion with, phagosomes / phagocytic vesicle or vacuole

2 breakdown / digestion, of, pathogen / bacteria / microorganisms / AW ;
A kill / destroy, pathogen / bacteria / microorganisms / AW

one from:
3 (by) two named enzymes ;
e.g. lysozyme, protease, lipase, carbohydrase, nuclease

4 any two named substrates that are hydrolysed ;
e.g. polysaccharides, peptidoglycans, proteins, lipids, glycogen, nucleic acid(s)

5 to form, harmless / useful / soluble / AW, products ;

I ref. to breakdown of organelles</td><td>2</td></tr>
</table>

Q9.

(c)(i)	*any **three** from:* **I** Golgi body / lysosome / vesicle *mp1 and mp2 complete term needed either in the text or labelled* 1 smooth endoplasmic reticulum labelled on Fig. 3.2 and detail ; e.g. for, lipid / triglyceride / cholesterol, synthesis tubular appearance / no ribosomes 2 rough endoplasmic reticulum labelled on Fig. 3.2 and detail ; e.g. for protein, synthesis / AW **A** for enzyme synthesis flattened (sac) appearance ribosomes **A** ribosome(s) labelled and for (plasma) protein synthesis 3 mitochondrion labelled on Fig. 3.2 and detail ; e.g. many mitochondria for (aerobic) respiration produce ATP / provide energy, (for hepatocyte reactions) **R** generate / make, energy double membrane / presence of cristae *allow if one mitochondrion is correctly labelled and one of the 'circular' mitochondria has a different label e.g lysosome* 4 presence of glycogen granule(s) as, energy / glucose, store ; **A** releases / provides, glucose 5 presence of lipid droplet(s), as energy store ; **A** provides fatty acids **A** provides components for cholesterol synthesis *penalise once (from mp1, 2, or 3) if diagram not labelled but structures named correctly and correct detail given*	

(c)(ii)	*any **one** from:* **I** *ref. to* staining or size mitochondrion, bound by / has, double membrane / two membranes ; **I** peroxisome has (only) one membrane peroxisome no cristae / mitochondrion has cristae ; **R** cisternae peroxisome spherical shape and mitochondria, different shapes / AW ; **I** if only peroxisome shape stated **A** circular *for spherical* **A** description e.g. 'sausage' shape	**1**
(c)(iii)	*any **two** from:* *mitochondrion (ora for peroxisomes)* has, DNA / genes (coding for enzymes) ; **R** linear DNA **A** genetic, material / information, qualified with, transcription / *ref. to* mRNA / coding for enzymes (70S) ribosomes (site of enzyme synthesis) ; **R** 80S ribosomes has the enzymes for, transcription / translation, (to synthesise enzymes) ; can produce ATP (for enzyme synthesis) ; **R** produce energy **I** has ATP AVP ; ; *other suggestions* e.g. has (chaperone) proteins involved in, folding / formation of tertiary structure ATP cannot enter peroxisome to provide energy source peroxisome has enzymes that cause degradation of, one / or more, substance(s) involved in protein synthesis	**2**

(c)(iv)	*any **two** from:* (peroxisome) membrane bound, so rest of cell protected (from hydrogen peroxide) ; **A** hydrogen peroxide can have toxic effects on (rest of) cell / AW (peroxisome) acts as a compartment / specific area / contained, for, more efficient breakdown of hydrogen peroxide / control of reactions ; high concentration of enzyme in one location ; **A** more enzyme-substrate complexes can form provides, optimum / AW, conditions, for (other peroxisome) reactions ; production of oxygen as by-product, so useful for, peroxisome reactions requiring oxygen / mitochondrial function / aerobic respiration ; AVP ; e.g. isolates (peroxisomes) enzymes from rest of cell	**2**

Q10.

(a)	**X** (nucleolus) synthesis / AW of, ribosomal subunits / ribosomes ; **A** synthesis of organelles that are the sites of protein synthesis **Y** (chromatin) contains gene(s), coding for the polypeptide(s) / AW ; **A** site, of transcription / for production of mRNA	**2**

Q11.

(a)(i)	exocytosis ;	**1**
(a)(ii)	***one** mark per row*	**4**

cell structure in Fig. 2.1	name of cell structure	function of cell structure in plasma cell
P	nucleolus	production / assembly, of (sub-units of) ribosomes ; **A** manufacture, ribosomal RNA / rRNA / transfer RNA / tRNA
Q	mitochondrion	**R** *if answer refers to, ATP / energy, for aerobic respiration* aerobic respiration ; **A** oxidative phosphorylation **A** provide, ATP / energy **A** produce / AW, ATP
R	rough endoplasmic reticulum **R** rough ER / RER / ribosome	protein / antibody, synthesis / transport ; **A** synthesis of, polypeptide(s) / heavy and light chains **A** (post-translational) modification of, polypeptide / protein / antibody *allow example* **A** forms (transport) vesicles
S	Golgi body **A** Golgi, complex / apparatus	**I** lipids (post-translational) modification of, polypeptide / protein / antibody *allow example* **or** packaging, qualified ; e.g. packaging of antibodies / protein, into vesicles **A** formation of, vesicles / (primary) lysosomes

Q12.

(a)	**S** = protein ; **A** amino acid **R** protein coat **I** capsomere **T** = capsid ; **A** protein coat **R** capsomere	**2**

(d)	presence of (viral), envelope / (outer) membrane / phospholipid bilayer ; ref. fluid / flexible ; ref. to preparation (for electron microscopy) ; e.g. distortion / squashed / artefact **I** ref. to use of the microscope e.g. electron beam affects AVP ; e.g. *suggestion of* variation in tegument protein, number / arrangement / organisation / AW	**2**

(e)	*similarity, one mark:* both have DNA (double stranded, naked / no histones) ; **A** DNA plus neutral feature e.g. not surrounded by a nuclear envelope **I** both have genes **I** components of DNA e.g. deoxyribose / nucleotides / phosphates **R** both have, single stranded / circular, DNA **R** both have, DNA free in the cytoplasm / DNA and RNA *difference, one mark:* bacterial DNA, circular / closed loop (v HCMV linear) **I** ref. to naked DNA **R** if comparison for HCMV is incorrect e.g. multilayered **or** bacteria (can also) have, plasmid DNA / plasmids **R** if implied that bacterial DNA is only plasmid DNA **or** bacterial DNA (also) has genes for, metabolism / AW **ora** **or** bacterial DNA free in cytoplasm but HCMV DNA surrounded by, capsid / protein coat / **T** ;	**2**

Q13.

(a)(i)	**A** mitochondrion ; **B** rough endoplasmic reticulum ; **A** ribosome / 80S ribosome	**2**
(a)(ii)	*any **three** from:* (more efficient) synthesis / metabolism / AW, of named product ; e.g. lipid / named lipid phospholipid steroid / steroid hormone / named, e.g. oestrogen / testosterone sterol / cholesterol **I** ref. to storage other function ; e.g. detoxification *max **two** from:* *idea that* synthesis of products / AW, is a pathway / requires more than one enzyme ; further detail ; e.g. enzymes of same pathway are, close together / in clusters products of one reaction are substrates of the next *suggestion that* membrane gives enzymes, more stability / greater protection (from degradation) ; AVP ; e.g. *idea of* greater efficiency as enzyme held so that active site faces substrates in lumen *suggestion that* allows reactions to occur on cytoplasmic side of membrane *suggestion that* allows reaction to continue / complete, in SER transport vesicles	**3**

Q14.

(a)(i)	no, nucleic acid / genetic material / DNA / RNA ; no, capsid / protein coat ; **A** no capsomeres only some viruses have envelopes ;	**2**

Q15.

(c)(i)	lysosome ;	**1**

Q16.

(d)(i)	nuclear pore ; **A** nuclear pores	**1**

Q17.

(a)	plasmodesma ; *plus any one from* **R** if stated as apoplast 1 allows / AW, symplast, pathway / movement ; 2 allows transport of / AW, water / sucrose / sugars / amino acids / organic substances / ions / mineral salts (**A** minerals) / lipids / assimilates / hormones / cell signalling molecules ; *in context of* between cells **I** substance unqualified **I** osmosis of water if in a longer list where other substances are named correctly **R** osmosis of water *if this is the only item noted* 3 cell to cell / AW, communication / signalling ; **A** cell communication	**2**

(b)(i)	*any one from* (only) polypeptides / proteins, synthesised at ribosomes ; carbohydrates / polysaccharides, not synthesised at ribosomes ; enzymes, for synthesis / required, not located at ribosomes ;	**1**

Q18.

(b)(i)	DNA – **A** / **B** / **C** ; cellulose – **E** ; phospholipid – **A** / **C** ; histone proteins – **A** / **B** ;	**4**
(b)(ii)	chloroplast / mitochondrion ;	**1**

Q19.

(a)	**A** rough endoplasmic reticulum ; **E** Golgi, body / apparatus / complex ;	**2**
(b)	transport from, (R)ER / ribosomes, to Golgi ; **A** from **A** to **E** **A** transport from Golgi to, cell surface membrane / phagosome **A** separate, acid hydrolases / enzymes, from, rest of cell / AW	**1**

(d)	*any three from* **1** break down / digest / destroy, bacteria / pathogen(s) ; **2** break down / digest / destroy, (worn out / defective / AW), organelles / named organelle (in animal cell) ; **A** autophagy **3** catalyse / speed up, hydrolysis ; **4** any **two** named substrates ; e.g. (any named) polysaccharides / proteins / (phospho)lipids / (named) nucleic acids **5** *idea that* recycle / reuse, biological molecules within cell ; **6** (macrophage / phagocyte) cut up to present antigen ;	**3**

Q20.

(a) *one mark max for each feature* — **3**

feature common to bacterial and plant cells	bacterial cell	plant cell
cell surface membrane	contain hopanoids	contains cholesterol
ribosome	70S / smaller / 18-20nm **I** no 80S ribosomes	80S / larger / 22-30nm ; **A** and 70S
DNA **max 1 mark** *must be across the dotted rows*	circular / closed loop **I** ref. to plasmids	linear ; AW
	naked **A** no histones	(complexed) with, histones / (basic) proteins ;
	free in, cytoplasm / cytosol **A** not enclosed / AW, by nuclear envelope **A** found in nucleoid region	enclosed by / AW, nuclear envelope ; **A** in a nucleus
cell wall	(mainly composed of) peptidoglycan / murein	(mainly composed of) cellulose ;

(c) **I** *ref. to* light absorption — **1**

*any **one** from:*
chloroplasts at periphery because
pushed by vacuole ;
vacuole is, turgid / filled with cell sap ;
(large permanent) vacuole is in the centre (of the cell) ;

Q21.

(a)(i) **X** nucleus ;
Y chloroplast ;
Z vacuole ; — **3**

(a)(ii) *any **two** from:* — **2**

no, large / permanent, vacuole / (temporary) small vacuoles ;
this is in context of large permanent vacuole

no, chloroplast / chloroplasts ;

no cell wall ;
no plasmodesmata ;

glycogen granules
or
no, starch, granules / grains ;

nucleus, (more) central / AW ; **A** nucleus not at, periphery / edge, of cell

centrioles (present) ;

AVP ; e.g. fewer Golgi bodies

Q22.

(a)	*any two from* protein coat / capsid ; **A** capsomeres nucleic acid core / DNA or RNA ; acellular / AW ;	**2**

Q23.

(a)	much / AW, rough endoplasmic reticulum / rough ER / RER for, polypeptide / protein / collagen, synthesis ; **A** for translation many mitochondria provide, energy / ATP, for, polypeptide / protein / collagen, synthesis ; large nucleus indicates, active cell / (much) transcription ;	**2**

Q24.

(a)(iii)	**I** *ref. to* replication or cytokinesis *any **two** from:* provides energy ; movement of centrioles to poles ; spindle formation / organisation of microtubules (for spindle) ; movement of chromosomes to the, spindle equator / AW ; separation of, (daughter) chromosomes / (sister) chromatids, to opposite poles (of the cell) / during anaphase ; AW AVP ; e.g. (for) condensation / AW, of, chromatin / chromosomes	**2**
(b)	*assume reference to binary fission unless stated otherwise* *any **two** from:* DNA replication ; **A** *idea* of, doubling / duplicating, DNA cell, elongation / gets longer ; **A** cell increases in size cell wall formation ; (includes) cytokinesis / described ; *max 1 if two ideas correct describing events that only occur in mitosis*	**2**

Q25.

(a)(i)	plasmodesmata ;	**1**
(a)(ii)	*any **two** from:* *ref. to* connecting two cells ; *in context of connecting cytoplasm* (facilitate) movement of substances between cells ; **A** named substances *ref. to* symplast pathway ; cell to cell communication / passage of cell signalling molecules ; AVP ; e.g. removes the need to cross the partially permeable cell surface membrane (when moving between cells) increases the rate of movement of substances between cells	**2**
(b)(i)	protein coat / capsid ; DNA or RNA / nucleic acid ; **A** genetic material ref. to some viruses have envelope ;	**2**

Q26.

(b)(i)	label line to any area of the nucleus ;	**1**
(b)(ii)	correct formula ; e.g. actual diameter = image length / magnification 15 (∝m) ;	**2**
(b)(iii)	*any one valid suggestion* ; e.g. *idea of* only very thin section of cell mitochondria found in other sections	**1**

Q27.

(d)	*drawing max 2:* regular shaped cell and cell wall drawn in ; central vacuole drawn ; *labels:* *max 2 if animal structures also labelled* *max 1 for labels if incorrect non-cellular structure included* *e.g. vascular bundle / stoma* large / permanent, vacuole ; **A** central vacuole **A** vacuole *if clearly drawn as large* tonoplast ; **R** *if drawn as double membrane* (cellulose) cell wall ; **R** chitin / murein plasmodesma(ta) ; chloroplast ; **A** granum / thylakoid *i.e. chloroplast not labelled but internal structures correctly labelled* **A** if drawn with a single or double membrane starch, grain / granule ; **A** amyloplast	**5**

Q28.

(b)(i)	**X** – site of synthesis of, (light and heavy) polypeptides ; **A** protein(s) **A** transport / modification, of, polypeptides / proteins **A** assembly of polypeptides / translation **R** answers that name the Golgi body **Y** – production of ATP ; **R** 'produce / create / AW, energy' **A** release of energy / provide energy	**2**

Q29.

(b)	*any one from:* Golgi (body / complex / apparatus) ; rough endoplasmic reticulum ; **A** rough ER / RER **R** SER **I** ER	**1**

Q30.

(a)	*max 3* if any membrane-bound organelles drawn inside cell e.g. nucleus, Golgi body, mitochondrion, lysosome, ER, a large vacuole BUT **I** vesicle / small vacuoles **I** detail of cell wall / cell surface membrane around flagellar area *four from:* cell wall ; *must add another line to diagram* **R** cellulose cell wall cell (surface) membrane ; **A** plasma membrane *label line to the inside of cell wall* **I** if outer line labelled as cell membrane DNA ; **A** bacterial chromosome / nucleoid *as label* *allow one or two circular molecules (circle, loop, ball of string, tangled)* **R** *if obviously linear* **R** if label includes, histones / histone proteins / chromatin **R** if nuclear, envelope / membrane, shown **R** if nucleolus shown or labelled ribosomes ; **R** 80S ribosomes *shown as, dots / small spheres* cytoplasm / cytosol ; plasmid ; *smaller than DNA, circular* AVP ; e.g. 70S / smaller / 17–20 nm, *for ribosome* murein / peptidoglycan (for cell wall – allow even if cell wall label not added) pilus /pili *drawn as external hair-like structure(s)* basal granule *at base of flagellum* capsule drawn to outside *(some do have a capsule)*	**4**

Q31.

(a)	one mark for each label to correct structure on Fig. 1.1 ; ; ; *tonoplast line to anywhere on the vacuolar membrane* **R** if two or more different structures stated for a single label	**3**

(c)	*two from:* rough endoplasmic reticulum ; **A** rough ER / RER smooth endoplasmic reticulum ; **A** smooth ER / SER endoplasmic reticulum ; *acceptable only if the other structure is <u>not</u> SER / RER* 80S / larger, ribosomes ; **A** 25–30 nm range plasmodesma(ta) ; microtubules ; **A** microfilaments **A** cytoskeleton lysosome(s) ; Golgi (body / apparatus / complex) ; secretory / Golgi, vesicles ; AVP ; ; e.g. chromatin EM detail of chloroplast EM detail of mitochondrion **A** mitochondrion nuclear pore nuclear envelope **R** nuclear membrane	**2**

Q32.

(a)(i)	*answers must be comparative* *one from:* *idea that* the sections are orientated differently / cut in different planes / cut at different angles / AW ; **A** is a cross section / AW, and **B** is a longitudinal section / AW mitochondria show a variety of, sizes / shapes ; mitochondria, are flexible / change shape ; **A** and **B** are of, different ages / stages of development ;	**1**
(a)(ii)	*two from:* replace, old / worn out / damaged, mitochondria ; require more mitochondria as cells, enlarge / grow ; more mitochondria are needed, for new cells / when cell divides ; **A** so numbers remain the same in the new cells / after cell division **A** *idea that* mitochondria are shared out (between daughter cells) (mitochondria) provide (most), energy / ATP ; **I** cell needs (much) energy without stating mitochondria provide energy **R** energy production **I** uses of energy	**2**
(b)	*two from:* nuclear envelope shown as two membranes with closed ends and a gap ; label to nuclear pore ;	**2**
(c)	*four from:* 1 contains / AW, chromosomes / chromatin / DNA / genes / genetic material / inherited material / genetic information ; 2 (coded) information for synthesis of, polypeptides / proteins ; **A** controls protein synthesis 3 ref. to sequence(s) of bases (in DNA) ; 4 transcription (of genes) / production of mRNA ; 5 contains nucleolus ; 6 manufacture of ribosomal sub-units ; **A** makes ribosomes 7 *idea that* DNA is protected from degradation / enzymes / AW ; 8 AVP ; e.g. responds to signals that control, gene expression / AW post-transcription modification / modifies mRNA / any example repairs DNA **I** controls cell's activities **I** sends mRNA to cytoplasm / mRNA travels through nuclear pores	**4**

Q33.

(a)	*any three from* protein coat / capsid ; **I** protein layer nucleic acid ; DNA or RNA ; **R** in nucleus **I** in cytoplasm **I** *ref. to*, double / single, strand acellular / not made of cells ; **I** absence of named cell structures AVP ; e.g. *ref. to* capsomeres size 15 nm to 1000 nm *accept any in range* (some) are enveloped / have phospholipid bilayer **I** with glycoproteins	**3**

Q34.

(a)	*rough endoplasmic reticulum* protein / polypeptide / named protein, synthesis / transport / modification ; **A** post-translational modification / examples *named protein e.g. haemoglobin, carbonic anhydrase, membrane proteins* *Golgi body* modification / processing, of, proteins / lipids **A** post-translational modification / examples / makes proteins functional **or** packaging (molecules) into vesicles **or** formation of, Golgi / secretory, vesicles **or** forms (primary) lysosomes ; *centrioles* formation of, spindle fibres / spindle **or** microtubule organisation ;	**3**

Q35.

(a)(ii)	chloroplast / granum / thylakoid / middle lamella / large vacuole / nucleus at edge of cell ;	**1**
(a)(iii)	provide energy (for the cell) ; **R** produce energy any two examples ;; e.g. biosynthesis **A** named example active transport / proton pumping movement / described, e.g. movement of, vesicles / chromosomes endocytosis / exocytosis	**3**

Q36.

(a)	*any two from* cell wall made from, peptidoglycan / murein ; **A** not cellulose DNA free in the cytoplasm ; **or** circular / closed loop, of DNA ; **or** naked DNA / no histones ; 70s ribosomes ; AVP ; e.g. no membrane around flagellum **or** flagellum is <u>not</u> 9+2 (microtubule pattern) ;	**2**