

Cell structure 1

Level: AQA A Level 7402

Subject: Biology

Exam Board: Suitable for all boards

Topic: Cell structure 1

Type: Mark Scheme

To be used by all students preparing for AQA A Level Biology 7402 foundation or higher tier but also suitable for students of other boards.



Mark schemes

1	(a)	Differentiation / specialisation	1	
	(b)	(i)	(cellulose) <u>Cell</u> wall;	1
		(ii)	Two marks for correct answer 2350–2500;; <i>Accept measured and real lengths in different units for one mark.</i> One mark for a measured length divided by real length;	2
	(iii)	<u>Chloroplasts</u> absorb <u>light</u> ; <i>Q Do not accept chlorophyll as alternative to chloroplasts</i> Or Large vacuole pushes <u>chloroplasts</u> to edge (of cell); Or Thin / permeable (cell) wall to absorb carbon dioxide;	1 max	
			[5]	
2	(a)	(i)	Crista / <u>inner</u> membrane;	1
		(ii)	Matrix;	1
	(b)	B;	1	
	(c)	(i)	Reduce / prevent <u>enzyme</u> activity;	1
		(ii)	Prevents osmosis / no (net) movement of water; So organelle / named organelle does not burst / shrivel; <i>Q Allow reference to cell rather than organelle for first mark point only.</i> <i>Regard damage as neutral</i>	2
(d)	(Mitochondria) use aerobic respiration; Mitochondria produce ATP / release energy required for <u>muscles</u> (to contract); <i>Q Do not accept reference to making / producing energy.</i>	2		
		[8]		



3 (a) $\times 20\ 000$
Accept range from 18 000 to 22 000 1

(b)

✓	
✓	
	✓

1 mark for each correct column 2

- (c) 1. DNA contains thymine **and** RNA contains uracil;
2. DNA contains deoxyribose **and** RNA contains ribose. 2

[5]

4 (a) 1. Starch formed from α -glucose but cellulose formed from β -glucose;
2. Position of hydrogen and hydroxyl groups on carbon atom 1 inverted. 2

- (b) 1. Insoluble;
2. Don't affect water potential;

OR

3. Helical;

Accept form spirals

4. Compact;

OR

5. Large molecule;
6. Cannot leave cell. 2

- (c) 1. Long and straight chains;
2. Become linked together by many hydrogen bonds to form fibrils;
3. Provide strength (to cell wall). 3

[7]



- 5 (a) 1. (If injected into egg), gene gets into all / most of cells of silkworm;
2. So gets into cells that make silk.

2

- (b) 1. Not all eggs will successfully take up the plasmid;
2. Silkworms that have taken up gene will glow.

2

(c) Promoter (region / gene).

1

- (d) 1. So that protein can be harvested;
2. Fibres in other cells might cause harm.

2

[7]

- 6 (a) 1. Add drop of water to (glass) slide;
2. Obtain thin section (of plant tissue) and place on slide / float on drop of water;
3. Stain with / add iodine in potassium iodide.

3. *Allow any appropriate method that avoids trapping air bubbles*

4. Lower cover slip using mounted needle.

4

- (b) 1. **W** – chloroplast, photosynthesis;
2. **Z** – nucleus, contains DNA / chromosomes / holds genetic information of cell.

2

- (c) 1. High resolution;
2. Can see internal structure of organelles.

2

(d) Length of bar in mm \times 1000.

1

[9]

- 7 (a)

Feature	Bacterium	Human immunodeficiency virus (HIV) particle
RNA	✓	✓
Cell wall	✓	
Enzyme molecules	✓	✓
Capsid		✓

1 mark for each correct vertical column

2



- (b) 1. (Complementary) nucleotides/bases pair
OR
A to T **and** C to G;
Ignore '(DNA polymerase) forms base pairs/nucleotide pairs'
2. DNA polymerase;
3. Nucleotides join together (to form new strand)/phosphodiester bonds form;
Ignore '(DNA polymerase) forms base pairs/nucleotide pairs'
*If clearly writing rote answer about DNA replication **2 max** e.g. helicase or separating strands*

3

- (c) 1. DNA double stranded/double helix **and** mRNA single-stranded;
Contrast requires both parts of the statement
2. DNA (very) long **and** RNA short;
Accept 'RNA shorter' or 'DNA bigger/longer'
3. Thymine/T in DNA **and** uracil/U in RNA;
4. Deoxyribose in DNA **and** ribose in RNA;
R Deoxyribonucleic/ ribonucleic acid
Ignore ref. to histones
Ignore ref. to helix and straight chain alone
5. DNA has base pairing **and** mRNA doesn't/ DNA has hydrogen bonding and mRNA doesn't;
6. DNA has introns/non-coding sequences **and** mRNA doesn't;
Ignore ref to splicing

3 max

[8]

8

- (a) 1. From ADP and phosphate;
Accept P_i/PO_4^{3-} / (P)
Reject P/Phosphorus
Reject use of water in the reaction
2. By ATP synthase;
3. During respiration/photosynthesis;

2 max

- (b) 1. To provide energy for other reactions/named process;
Reject 'produce' energy
2. To add phosphate to other substances **and** make them more reactive/change their shape;

2

- (c) (Can see) 3D image;

1

- (d) Crista/cristae;

Ignore matrix

1



- (e) Value between 20,750 (83mm) and 21,250 (85mm) two marks;;
Formula given/used but calculation wrong, award 1 mark

$$\text{Magnification} = \frac{\text{image size}}{\text{Object size}}$$

(Large number divided by 4)

2

[8]

9

- (a)

White blood cell		✓	✓
Bacteria cell	✓	✓	

2

- (b) 2.80 (µm);;

Answer in range 2.76–2.83 scores 2 marks

If length incorrect but divided by 30 000, allow 1 mark

2

- (c) (i) Circular DNA / smaller/70S ribosomes / no introns / no histones/proteins associated with DNA;

Ignore reference to plasmids

1

- (ii) 1. Able to respire aerobically;
2. So make (more) ATP/ release (more) energy;

Reject 'producing energy' unqualified

2

[7]



10

- (a) 1. Thin slice/section;
- 2. Put on slide in water / solution / stain;
- 3. Add cover slip;

Accept: 'between two slides'

Max 2

- (b) 200 (µm);;

OR

- 1. Divide image length by key length eg $64/16 = 4$;
- 2. Multiply by 50 eg 4×50 ;

Accept for 2 marks answers in the range of 185-217 (µm)

Max 1 mark for responses not within the range

Accept: measurements in the ranges 63-65mm and 15-17mm

2

- (c) 1. Select large number of cells / select cells at random;

Accept: > 3 for "large number"

Accept: many fields of view for 'large number of cells'

Accept: all cells in field of view

- 2. Count number of chloroplasts;
- 3. Divide number of chloroplasts by number of cells;

Ignore: 'calculate the mean'

3

[7]

11

- (a)

Protein synthesis	L;
Modifies protein	H;
Aerobic respiration	N;

3

- (b) 1800–2200;

1.8, 2.0 or 2.2 in working or answer = 1 mark.

Ignore units in answer.

1 mark for an incorrect answer in which student clearly divides measured length by actual length (of scale).

Accept I / A or I / O for 1 mark but ignore triangle.

Accept approx 60mm divided by 30µm for 1 mark

2

[5]

12

- (a) 1. Large / dense / heavy cells;
- 2. Form pellet / move to bottom of tube (when centrifuged);
- 3. Liquid / supernatant can be removed.

Must refer to whole cells.

3



(b) Break down cells / cell parts / toxins.
Idea of 'break down / digestion' needed, not just damage

1

(c) 1. To stop / reduce them being damaged / destroyed / killed;
Reject (to stop) bacteria being denatured.

2. By stomach acid.
Must be in context of stomach.

2

(d) 1. More cell damage when both present / A;

2. Some cell damage when either there on their own / some cell damage in B and C;
MP1 and MP2 – figures given from the graph are insufficient.

3. Standard deviation does not overlap for A with B and C so difference is real;
*MP3 and MP4 **both** aspects needed to gain mark.*

4. Standard deviations do overlap between B and C so no real difference.
MP3 and MP4 accept reference to significance / chance for 'real difference'

3 max

(e) 1. Enzyme (a protein) is broken down (so no enzyme activity);
Accept hydrolyse / digested for 'broken down'.

2. No toxin (as a result of protein-digesting enzyme activity);
Must be in the correct context.

3. (So) toxin is protein.
This must be stated, not inferred from use of 'protein-digesting enzyme'.

3

[12]

13 (a) 1. Bilayer;
Accept double layer
Accept drawing which shows bilayer

2. Hydrophobic / fatty acid / lipid (tails) to inside;

3. Polar / phosphate group / hydrophilic (head) to outside;
2. & 3. need labels
2. & 3. accept water loving or hating

2 max



- (b) (i) 1. (Rough endoplasmic reticulum has) ribosomes;
accept "contains / stores"
2. To make protein (which an enzyme is);
Accept amino acids joined together / (poly)peptide
Reject makes amino acids
Ignore glycoprotein

2

- (ii) (Golgi apparatus) modifies (protein)

OR

packages / put into (Golgi) vesicles

OR

transport to cell surface / vacuole;

Accept protein has sugar added

Reject protein synthesis

Accept lysosome formation

1

[5]

14

- (a) QWC

1. (Phagocyte engulfs) to form vacuole / vesicle / phagosome;
Accept surrounds bacteria with membrane
2. Lysosome empties contents into vacuole / vesicle / phagosome;
Accept joins / fuses
3. (Releasing) enzymes that digest / hydrolyse bacteria;
Ignore breakdown / destroy / lytic enzymes

3



(b) Two suitable structures;;

Examples,

1. Cell wall;
2. Capsule / slime layer;
3. Circular DNA;
Reject "circular chromosome"
4. Naked DNA / DNA without histones;
5. Flagellum;
6. Plasmid;
7. Pilus;
8. 70s / smaller ribosomes;
9. Mesosome;

2 max

[5]

15

(a) (i) **(Whole-cell vaccine),**

Accept converse statements for other vaccine

Reject references to the vaccine being alive or the disease reproducing etc

1. Heat(ing) supposed to kill bacteria;
2. Some might be alive / active / viable;
Accept active pathogens present
3. (If so) bacteria could reproduce;
4. Bacterium makes or contains toxin;
5. Toxin might not be affected / all destroyed by heat;
6. Bacteria or toxins attacking / killing person's cells;

3 max

(ii) **(Whole-cell vaccine),**

Ignore references to more / greater antigens unqualified. It is the variety of antigens that matters

1. (Contains) many different / greater range of antigens;
2. Each antigen causes its own immune response / production of / has a specific (type of) antibody;

2



- (b) 1. Only patients who had whooping cough have toxin / antibody / immune response;
Accept converse e.g. those without antibody had another disease
2. Toxin is an antigen and is (only) produced by this bacterium;
3. Leading to presence of specific antibody / only 4% had this antibody / 13% did not have antibody;

3

- (c) 1. There may not be large rises;
2. Might be the result of wrong diagnosis / reference to difference in figures / 13% diagnosed with whooping cough didn't have it;
Ignore reference to new strains or antigenic variability

2

[10]

- 16** (a) 1. **A:** phospholipid (layer);
1. Reject hydrophobic / hydrophilic phospholipid
2. **B:** pore / channel / pump / carrier / transmembrane / intrinsic / transport protein;
2. Ignore unqualified reference to protein

2

- (b) (i) Condensation (reaction);

1



- (ii) Organelle named; Function in protein production / secretion;

Function must be for organelle named

Incorrect organelle = 0

eg

1. Golgi (apparatus);
1. Accept smooth endoplasmic reticulum
2. Package / process proteins;

OR

3. Rough endoplasmic reticulum / ribosomes;
3. Accept alternative correct functions of rough endoplasmic reticulum. ER / RER is insufficient
3. Accept folding polypeptide / protein
4. Make polypeptide / protein / forming peptide bonds;

OR

5. Mitochondria;
6. Release of energy / make ATP;
6. Reject produce / make energy
6. Accept produce energy in the form of ATP

OR

7. Vesicles;
8. Secretion / transport of protein;

2

[5]

17

- (a) (i) Substance that causes an immune response / production of antibodies;

Ignore foreign / non-self

1

- (ii) 1. Not lipid soluble;
2. Too large (to diffuse through the membrane);
3. Antigens do not have the complementary shape / cannot bind to receptor / channel / carrier proteins (in membranes of other epithelial cells);

2 max



- (b) 1. (Vaccine contains) antigen / attenuated / dead pathogen;
1. Reject if in context of injection of vaccine
2. T-cells activate B-cells;
3. B-cells divide / form clone / undergo mitosis;
4. Plasma cells produce antibodies;
5. Memory cells produced meaning more antibodies / antibodies produced faster in secondary response / on reinfection;

5

[8]

18

- (a) (i) (Aerobic) respiration;
Accept ATP production / energy release
Reject anaerobic respiration
Reject energy production

1

- (ii) Golgi (apparatus / body);
Ignore smooth ER

1

- (b) ('It' = Optical microscope)
Ignore reference to magnification
1. Has low resolution / not high enough resolution;
Accept converse relating to EM
2. (Because) wavelength of light not short enough / too long;
Accept larger wavelength
Accept statements that microscopes have a wavelength

2

[4]

19

(a)

Statement	Starch	Cellulose	Glycogen
Found in plant cells	✓	✓	
Contains glycosidic bonds	✓	✓	✓
Contains β-glucose		✓	

One mark for each correct row

3



(b) Hydrolysis;

Accept: if phonetically correct

Do not accept: 'hydration'

1

(c) 1. Coiled / helical / spiral;

Feature = one mark

Explanation = one mark

Note: these are independent marking points

These must be related for both marks but can be in reverse order

2. (So) compact / tightly packed / can fit (lots) into a small space;

3. Insoluble;

4. (So) no osmotic effect / does not leave cell / does not affect water potential;

Accept: prevents osmosis

5. Large molecule / long chain;

6. (So) does not leave cell / contains large number of glucose units;

4. and 6. Accept: can't cross membranes

7. Branched chains;

8. (So) easy to remove glucose;

2 max

(d) Two marks for correct answer of 479 - 521;

*Accept: measured and actual lengths in different but correct units
for 1 mark*

One mark for incorrect answers in which candidate clearly divides measured length by actual length;

*The actual range is 23 - 25mm, If they just divide this by 48 they
gain 1 mark*

Just writing the formula is insufficient, numbers must be used

2

[8]

20

(a) (i) Golgi (apparatus / body);

1



- (ii)
1. Nucleus;
Accept: nucleolus / nuclear envelope / nuclear membranes
 2. Mitochondrion;
Accept cristae / mitochondrial membranes
 3. Endoplasmic reticulum / ER;
Ignore reference to rough / smooth
 4. Lysosome;
Reject lysozyme

2 max

- (b) (Aerobic) respiration / ATP production / provide energy;
Accept Krebs cycle / electron transport.
Ignore 'produces energy'
Reject anaerobic respiration
Ignore what energy is used for

1

- (c)
1. High / better resolution;
 2. Shorter wavelength;
 3. To see internal structures / organelles / named organelles;
Accept ultrastructure

2 max

[6]

21

- (a)
1. Mitochondria respire to release energy / produce ATP;
1. Do not credit make energy
 2. Transport against gradient;
2. Do not credit active transport as this is given in question.
2. Do not accept diffusion against.

OR

3. Infolding of membrane increases area;
3. Reject microvilli but if mentioned can still accept point 4.
4. More proteins for active transport;

2 max



(b) 1. Ribosomes make proteins / enzymes;
Ignore references to Golgi or rough ER.

2. Enzymes are proteins;

OR

3. Mitochondria respire;

4. Release energy / produce ATP;

5. (Energy / ATP) for protein / enzyme synthesis;

2

(c) Microvilli increase area / have large area;

Ignore references to other properties of microvilli.

1

[5]

22

(a) 1. Granum / grana / thylakoid;

Ignore references to membranes, stacks or discs.

2. Stroma;

Allow phonetic spellings.

2

(b) 1. Absorbs / traps / uses light;

Light dependent reaction = marking point 1.

2. For photosynthesis;

3. Produces carbohydrates / sugars / lipids / protein;

Accept any named product of photosynthesis for marking point 3.

*Reference to light dependent and light independent reactions
= two marks*

2 max

(c) Correct answer in range of 2.53 - 2.66;

Any length divided by 30000 = 1 mark;

2

[6]

23

(a) (i) (Human cells) don't have a cell wall;

Accept "they" refers to human cells.

1

(ii) (Affects) protein synthesis;

Allow description e.g. 'amino acids not joined together / translation.

Reject: affects transcription.

1



- (b) 1. Mutation present / occurs;
Ignore antibiotic causes mutation.
2. Resistance gene / allele;
1. or 2.
Reference to immunity disqualifies first credited marking point.
3. Resistant bacteria (survive and) reproduce;
Reference to mitosis negates marking point 3.

2

[4]

24

- (a) (Plasma / cell) membrane;
Reject: nuclear membrane

1

- (b) Nucleus / nuclear envelope / nuclear membrane / nucleolus;
Accept: membrane-bound organelles only if an example has not been given

Mitochondrion;

(Smooth / rough) ER;

Lysosome;

Microvillus / brush border;

Neutral: villi

Golgi;

Linear / non-circular DNA / chromosome;

Neutral: DNA strands

80S / denser / heavier / larger ribosomes;

Neutral: ribosomes

2 max

- (c) (i) Higher resolution / higher (maximum) magnification / higher detail (of image);

OR

Allows internal details / structures within (cells) to be seen / cross section to be taken;

Accept: 'better' instead of 'higher'

Neutral: shorter wavelength

Reject: longer wavelength

Reject: can be used on living specimens

Q Do not accept 'clearer' image

1



- (ii) Thin sections do not need to be prepared / shows surface of specimen / can have 3-D images;

Accept: can be used on thick(er) specimens

Reject: can be used on living specimens

Neutral: refs. to staining / preparation / artefacts / colour

1

- (d) Two marks for correct answer of 0.42 – 0.46;;

One mark for incorrect answers in which candidate clearly divides measured width by magnification;

Correct answer = 2 marks outright

Accept: 0.4 or 0.5 only if working is correct for 2 marks

Do not award a mark for 0.4 or 0.5 if there is no working out

Ignore rounding up

2

- (e) As height increases, the number of deaths decrease / inversely proportional / negative correlation;

Correct reference to increase / decrease at 14-30m;

Accept: converse statement

Must give a trend and not simply give individual points

Do not penalise for 'more likely to get cholera'

2

[9]

25

- (a) Cell wall;

Starch (store);

Chloroplast;

Accept: phonetic spelling

2 max

- (b) Insoluble;

Reduces / 'stops' water entry / osmosis / does not affect water potential / is osmotically inactive;

Accept: description for first point e.g. 'does not dissolve'.

2

- (c) Light sensitive eyespot / eyespot detects light;

Flagellum enables movement towards light;

Chloroplast / chlorophyll absorbs light / for photosynthesis;

Do not penalise references to 'many chloroplasts'.

3

[7]



26

(a) Peptide;

Q Do not accept polypeptide
Neutral: covalent

1

(b) (F) H J E (K);

All three boxes correct = 2 marks
Two boxes correct = 1 mark

2

(c) (Site of aerobic) respiration;

Release ATP / energy for active transport / transport against the concentration gradient / protein synthesis / exocytosis;

Q Reject: anaerobic respiration

Q Reject: produces / makes energy

Accept: produces ATP for energy

Reject: produces ATP for respiration

Neutral: protein secretion

2

(d) (i) Breaks open cells / disrupts cell membrane / releases cell contents / releases organelles / break up cells;

Reject: breaks down cell wall

Neutral: separates the cells

Reject: breaks up cells so they can be separated

Reject: breaks up / separates organelles

1

(ii) Removes (cell) debris / complete cells / tissue;

Neutral: to isolate organelle **G** / mitochondria

Neutral: removes unwanted substances / impurities

Reject: removes organelles / cell walls

1

(iii) Reduces / prevents enzyme activity;

Reject: ref. to denaturation

1

(iv) Prevents osmosis / no (net) movement of water / water does not enter organelle / water does not leave organelle;

So organelle / named organelle is not damaged / does not burst / does not shrivel;

Neutral: ref. to water potential

Q Ref. to cells rather than organelles negates the second mark only

Reject: ref. to turgid / flaccid for second mark

Reject: organelle 'explodes' for second mark

2

[10]



27

Fatty acids used to make phospholipids;
Phospholipids in membranes;
More phospholipids more membranes made;

2 max

Fatty acids respired to release energy;
More triglycerides more energy released;
Energy used for cell production / production of named cell component;

Do not allow credit for 'making' energy

2 max

[4]

28

(a) (i) Mitochondrion;

Neutral: cristae

1

(ii) (Site of aerobic) respiration / ATP production / energy release;

Q Reject: anaerobic respiration

Q Reject: energy produced

Active transport / transport against the concentration gradient;

Accept: energy produced in the form of ATP

2

(b) 89 – 91 gains 2 marks;

Correct answer gains 2 marks outright

Principle of:

$\frac{\text{correct measured length}}{\text{magnification}}$ gains 1 mark;

89-91 (mm) / 1000 or 8.9-9.1 (cm) / 1000 gains 1 mark

2



(c) Suitable explanation given e.g.

Accept: converse arguments

Reduced surface area; (So) less absorption;

Neutral: structure Z incorrectly named

(Membrane-bound) enzymes less effective;

(So) proteins / polypeptides not digested;

Reduced surface area for absorption gains 2 marks

Cell membranes damaged;

(So) Fewer / less effective carrier / channel proteins;

Accept: references to diffusion and active transport for 'absorption'

Carrier / channel proteins damaged;

(So) less absorption;

Reject: active transport if linked to channel proteins



29

- (a) **B** Golgi (body / apparatus);
C Mitochondria / mitochondrion; 2

- (b) 1. Chloroplasts / plastids
2. Cell wall
3. Cell vacuole
4. Starch grains / amyloplasts;
Any 2 for 1 mark 1 max

- (c) 1. Ice-cold – Slows / stops enzyme activity to prevent digestion of organelles / mitochondria;
2. Buffered – Maintains pH so that enzymes / proteins are not denatured;
Reject reference to cells
3. Same water potential – Prevents osmosis so no lysis / shrinkage of organelles / mitochondria / **C**;
Ignore damage
For each mark must link reason to relevant property 3

- (d) 1. Break open cells / homogenise / produce homogenate;
2. Remove unbroken cells / larger debris; 2

- (e) Nucleus / nuclei; 1

- (f) Mitochondria / organelle **C** less dense than nucleus / organelle in first pellet;
Accept 'lighter' for less dense 1

[10]

30

- (a) 1. How to break open cells and remove debris;
2. Solution is cold / isotonic / buffered;
3. Second pellet is chloroplast. 3

- (b) 1. **A** stroma;
2. **B** granum.
Accept thylakoid 2



(c) $\left(\frac{\text{length of chloroplast}}{\text{length of bar}} \right) \mu\text{m}$

1

(d) **Two** of the following for **one** mark:

Mitochondrion / ribosome / endoplasmic reticulum / lysosome / cell-surface membrane.

1 max

[7]