

2.5 STUDYING CELLS – MARK SCHEMES

Q1.

- (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]**

Q2.

- (a) (i) microvilli; (*reject brush border*) 1
- (ii) increased surface area (for diffusion); 1
- (b) (i) $\frac{16 \times (1000)}{0.1}$ principle of $\frac{\text{measuring scale bar}}{\text{dividing by 0.1}}$; 1
(15–17 tolerance)
 160000;
(correct answer award 2 marks)

- | | | |
|--|---|-----|
| | 2 | |
| (ii) electron microscope has a greater resolving power / objects closer together can be distinguished; electron (beams) have a shorter wavelength; | 2 | |
| (c) short diffusion pathway / short pathway to the centre / large SA:V ratio for faster, more diffusion; | 1 | [7] |

Q3.

- | | | |
|---|-------|-----|
| (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] |

Q4.

- | | | |
|--|---|--|
| (a) Single layer of cells / few layers of cells;

So that light that can pass through / cells absorb light; | 2 | |
| (b) Method of determining area of field of view / area seen using microscope;

Count number of stomata in field of view;

Repeats and calculation of mean; | 3 | |
| (c) Water <u>vapour</u> accumulates / increased humidity / reduced air movement (around stomata);

Water potential / diffusion gradient reduced; | | |

Q5.

(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

Q6.

(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]

Q7.

(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]

Q8.

(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]

Q9.

(a) (Group of) similar / identical cells / cells with a common origin;

Q *Ignore references to function*

1

(b) (i) Add iodine / stain specific for starch to the slide / cells / tissue / add iodine / stain specific for starch and examine under microscope;

Blue-black / blue / black / purple;

Reject sample

2

- (ii) Need a single layer of cells / only a few cells thick / not too many layers / detail obscured by cells underneath;

Light must be able to pass through;

2

- (c) Both are polymers / made of monomers;

Joined by condensation / molecules can be broken down by hydrolysis;

Both have 1-4 links;

Contain C(arbon), H(ydrogen) and O(xygen) / both made up of glucose;

Both insoluble;

Both contain glycosidic bonds;

Accept other valid answers.

Ignore ref to unbranched.

2 max

[7]

Q10.

- (a) Electron microscope has higher resolution (than optical microscope).

1

- (b) Cytoplasm of red blood cell filled with haemoglobin.

1

- (c) 1. Membrane has phospholipid bilayer;

2. Stain binds to phosphate / glycerol;

3. On inside and outside of membrane.

Accept phospholipid head / protein

3

- (d) 1. Carrier / channel protein;

2. (Protein) specific / complementary to substance;

3. Substance moves down concentration gradient;

Allow down electrochemical gradient

Reject 'along' concentration gradient

3

[8]

Q11.

- (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:

correct measured length

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

2

[7]

Q12.

(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 30 μ m for 1 mark

2

[5]

Q13.

- (a) X = mitochondria;
Y = (rough) endoplasmic reticulum;
Accept ribosomes/ER/RER for Y
Reject smooth endoplasmic reticulum for Y 2
- (b) (i) (Sections cut at) different angles/in different planes;
Ignore name given to organelle 1
- (ii) Z modifies/packages/transportes/secretetes mucus/ Z adds sugars to proteins;
X provides ATP/energy (for this);
Accept makes in relation to Z but not X
Ignore names of organelles if function correct 2

[5]

Q14.

- (a) (i) homogeniser / blender / pestle and mortar / description
e.g. grind with sand; 1
- (ii) centrifuge / description e.g. spin at high speeds; 1
- (b) (i) chloroplast; 1

[3]

Q15.

- (a) Any **five** from:
- Cell homogenisation to break open cells;
1. Accept suitable method of breaking open cells.
 - Filter to remove (large) debris / whole cells;
2. Reject removes cell walls.
 - Use isotonic solution to prevent damage to mitochondria / organelles;
3. Ignore to prevent damage to cells.
 - Keep cold to prevent / reduce damage by enzymes / use buffer to prevent protein / enzyme denaturation;
 - Centrifuge (at lower speed / 1000 g) to separate nuclei / cell fragments / heavy organelles;
5. Ignore incorrect numerical values.
 - Re-spin (supernatant / after nuclei / pellet removed) at higher speed to get mitochondria in pellet / at bottom.

6. Must have location
Reject ref to plant cell organelles only once

5 max

(b) Principles:

1. Electrons pass through / enter (thin) specimen;
2. Denser parts absorb more electrons;
3. (So) denser parts appear darker;
4. Electrons have short wavelength so give high resolution;

Principles:

Allow maximum of 3 marks

Limitations:

5. Cannot look at living material / Must be in a vacuum;
6. Specimen must be (very) thin;
7. Artefacts present;
8. Complex staining method / complex / long preparation time;
9. Image not in 3D / only 2D images produced.

Limitations:

Context of limitation must be clear, not simply explaining how TEM works

E.g "allows you to see organelles as a thin section is used" is not a limitation

Allow maximum of 3 marks

Ignore ref to colour

5 max

[10]

Q16.

Advantages:

- 1 Small objects can be seen;
- 2 TEM has high resolution as wavelength of electrons shorter;
Accept better

Limitations:

- 3 Cannot look at living cells as cells must be in a vacuum / must cut section / thin specimen;
- 4 Preparation may create artefact
- 5 Does not produce colour image;

[5]

Q17.

(a) 1. DNA replicated;

Reject: DNA replication in the wrong stage

2. (Involving) specific / accurate / complementary base-pairing;
Accept: semi conservative replication

3. (Ref to) two identical / sister chromatids;

4. Each chromatid / moves / is separated to (opposite) poles / ends of cell.
Reject: meiosis / homologous chromosomes / crossing over
Note: sister chromatids move to opposite poles / ends = 2 marks for mp 3 and mp 4
Reject: events in wrong phase / stage 4
- (b) (i) 1. To allow (more) light through;
Accept: transparent
2. A single / few layer(s) of cells to be viewed.
Accept: (thin) for better / easier stain penetration 2
- (ii) 1. More / faster mitosis / division near tip / at 0.2 mm;
Neutral: references to largest mitotic index
2. (Almost) no mitosis / division at / after 1.6 mm from tip;
Accept: cell division for mitosis
Penalise once for references to meiosis
3. (So) roots grow by mitosis / adding new cells to the tip.
Accept: growth occurs at / near / just behind the tip (of the root)
Accept: converse arguments 2 max

[8]

Q18.

- (a) (i) Chloroplast; 1
- (ii) Photosynthesis;
 Uses light (energy);
 To produce carbohydrates / starch / glucose / sugars / ATP / reduced NADP;
Note that candidates cannot be expected to have a detailed knowledge of photosynthesis. max 2
- (b) (i) **A**; 1
- (ii) **C**; 1
- (c) (i) Slows enzymes / prevents enzymes being denatured / prevents / stops self-digestion;
Ignore references to bacteria. Reject enzymes not working 1
- (ii) To remove organelle C / nuclei;
 Which are larger / more dense; 2

[8]

Q19.

- (a) (i) A mitochondrion and B nucleus;
(*need both for one mark*) 1
- (ii) increased surface area;
for respiration / enzymes; 2
- (b) *any suitable feature*
e.g. plasmid / capsule / 70S ribosomes / smaller
ribosomes / complex cell wall / mesosome / no nucleus; 1
- (c) use of differential centrifugation / or description;
first / low-spin pellet discarded / spin at low speed to remove cell
wall material / cell debris;
supernatant re-spun at higher speed / until pellet with chloroplasts is found;
method of identifying chloroplasts e.g. microscopy; 3 max

[7]**Q20.**

- (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]