

M1.

(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]**M2.(a)** Any **five** from:

1. Cell homogenisation to break open cells;
1. Accept suitable method of breaking open cells.
2. Filter to remove (large) debris / whole cells;
2. Reject removes cell walls.
3. Use isotonic solution to prevent damage to mitochondria / organelles;
3. Ignore to prevent damage to cells.
4. Keep cold to prevent / reduce damage by enzymes / use buffer to prevent protein / enzyme denaturation;
5. Centrifuge (at lower speed / 1000 g) to separate nuclei / cell fragments / heavy organelles;
5. Ignore incorrect numerical values.
6. 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]

M3.(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]

- M4.(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]

- M5.(a)**
1. Fields of view randomly chosen;
 2. Several fields of view;
 3. All same species (of animal / hamster);
*Reject general statements related to sample size. All mark points relate directly to information provided in Resource A.
Accept 'all (Mesocricetus) auratus'.*
 4. Same muscle / organ used / only diaphragm used;
 5. Used at least 8 (animals) in each (age) group.

4 max

- (b) (i) 15
*Correct answer = 2 marks.
Allow 1 mark for showing
 $69 \div 4.6$*

OR

answer of 10 / 10.1 (correct calculation using fast in error.)

2

- (ii) 1. (Calculation) used mean (number of capillaries);
 2. Variation in number of capillaries per fibre.
*Note: maximum of 1 mark for this question.
 Ignore reference to an anomaly or calculation errors.*

1 max

- (c) (i) (Removing diaphragm means) animals / hamsters are killed.

1

- (ii) 1. (Suggests) significant (difference) between young and adult;
MP1, MP2, MP4 and MP5 can include use of figures but check figures are used correctly.
2. (Suggests) not significant (difference) between adult and old;
Statements related to 'results being significant / not significant' do not meet the marking points. It is the difference that is significant or not. However, only penalise this error once.
3. For slow **and** fast fibres;
This MP can be given in the context of either MP1 or MP2 but only allow once. As well as this context there must be a reference to 'both' types of fibre.
4. (Suggests) significant (difference) between young and old for fast (fibres)
 OR
 (Suggests) not significant (difference) between young and old for slow (fibres);
All aspects of either approach required to gain credit.
5. (Suggests) significant (difference) where means \pm SD do not overlap
 OR
 (Suggests) not significant (difference) where means \pm SD overlap;
All aspects of either approach required to gain credit.
6. Stats test is required (to establish whether significant or not).

4 max

[12]

- M6.(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]