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 30µm 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 ÷ 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 <u>fast</u> (fibres)
OR
(Suggests) not significant (difference) between young and old for <u>slow</u> (fibres);

All aspects of either approach required to gain credit.

5. (Suggests) significant (difference) where means ± SD do not overlap
OR
(Suggests) not significant (difference) where means ± 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) $\left(\frac{length\ of\ chloroplast}{length\ of\ bar}\right)$ µm

1

(d) **Two** of the following for **one** mark:
Mitochondrion / ribosome / endoplasmic reticulum / lysosome / cell-surface membrane.

1 max

[7]