Mark schemes

Q1.

(a) 1. (Virus) attachment protein attaches to (cell) receptors;

2. (Viral) nucleic acid enters into cell;

Accept DNA or RNA or genetic material for nucleic acid

Ignore genetic information

Accept inserted or injected or 'taken up by' or 'moves into' or 'released into' for enters

3. (Viral) nucleic acid replicated (in cell)

OR

(Viral) reverse transcriptase produces DNA from RNA;

Accept DNA or RNA or genetic material for nucleic acid

Ignore genetic information

4. (Viral) protein is produced;

Accept capsid or capsomere for protein

5. (Viral components) assembled and released (from cell);

4 max

(b) Virus (replication has) killed bacteria/cells (in clear zones);

Accept lysed or destroyed or burst for killed

1

(c) Clear zones increase (in size)

OR

More clear zones (form)

OR

Clear zones merge

OR

One big clear zone;

Accept area for zone

Ignore references to cloudiness

1

(d) 1. Cytokinesis

OR

Telophase;

Ignore mitosis

2. Division of cytoplasm

OR

Pinching of cell(-surface) membrane

OR

New cell(-surface) membrane forming

OR

Chromosomes are not visible;

Ignore reference to nucleus/nuclei or any named organelle

Accept separating or splitting for division

Accept a description of pinching eg inward movement of cell membrane

Accept chromosomes are not condensed or uncondensed or less distinct or long and thin or uncoiled for not visible

2

[8]

Q2.

(a) Max **two marks** for prophase

(In prophase)

1. Chromosomes/chromatids (continue to) condense;
   Accept chromatin for chromosomes
   *Accept shorten **OR** thicken **OR** coils **OR** a description of condensing for condense*

2. Chromosomes/chromatids (become/are) visible;
   *Accept appear **OR** form **OR** present **OR** distinct for visible*

3. Chromosomes attach to spindle (fibres)

   OR

   Chromatids attach to spindle (fibres)

   OR

   Centromeres attach to spindle (fibres);

(In anaphase)

4. Centromeres divide/split;

5. Chromosomes/chromatids moved/pulled to opposite poles/sides/ends;
   Reject homologous chromosomes moved to opposite sides

4 max

(b) Number of cells in mitosis ÷ Total number of cells (in field of view);
   Accept cells 'with visible chromosomes' for 'in mitosis'
   Reject if x100

1

(c) 1. Strong/significant negative (correlation);

2. (Because probability of) correlation occurring by chance is less than / < 0.05 / 5%

OR

(Because) more than / > 0.95 / 95% (probability) that correlation is not due to chance;

Accept relationship for correlation

*Reject 'statistical test' **OR** 'results' **OR** 'differences' are significant/not due to chance*

3. Reject null hypothesis;

2 max

(d) 1. More/larger proportion of cells in mitosis closer to tip

OR

Fewer/lower proportion of cells in mitosis further from tip;

2. More/larger proportion of cells in interphase further from tip

OR

Fewer/smaller proportion of cells in interphase closer to tip;

3. No cells in mitosis at/after 2 (mm)

OR

All cells in interphase at/after 2 (mm);

Ignore references to cytokinesis

Accept a named stage of mitosis

*Accept G1 **OR** S **OR** G2 for interphase*

3

[10]

Q3.

(a) To break down links between cells/cell walls

OR

To separate cells/cell walls

OR

To break down/hydrolyse cellulose/cell wall

OR

Allowing the stain to pass/diffuse into the cells

OR

Allowing the cells to be (more easily) squashed

OR

To stop mitosis;

Accept: To stop mitosis continuing
Accept: To stop cell division
Accept: To stop the cell cycle
Ignore references to enzymes

1

(b) 1. Eye protection;
Accept wear goggles

2. Gloves;

3. Add <u>water</u> to spills (immediately);

4. Do not pour away down sink;
Ignore references to using dilute acid

2 max

(c) 1. There is no difference between the mitotic index (at 200 and 300 μm);
Ignore reference to 'significant'
Reject correlation

2. t-test;

2

(d) Correct answer within the range 19.95 to 20.03= **2 marks**;;

Incorrect answer of 57 or 57.2 (correct unit conversion and correct division) = **1 mark**

OR

Incorrect answer of 2×10^{-5} (no unit conversion, correct division and correct × 0.35) = **1 mark**

OR

Incorrect answer of 2×10^{x} except 20 e.g.0.2/2/200/2000 (incorrect conversion, correct division and ^{x} 0.35); = **1 mark**

2

(e) **Max 2** from

1. Roots/plant of the same age;
2. Same growing conditions (for all roots);
   Accept description of growing conditions
3. Same distance from root tip;
4. Same time in acid

OR

Same temperature of acid;

5. Same concentration of acid;
6. Same pressure of squash;
7. Several fields of view (for each species);
8. Same time of day;

2 max

[9]

Q4.

(a) 1. Mass of DNA equals 1 (indicates) (early) interphase

OR

No cells with mass of DNA less than 1 (indicates) mitosis only type of division occurring;

Accept G1 phase

Accept no meiosis

2. Mass of DNA equals 2 (indicates) mitosis

OR

Mass of DNA equals 2 (indicates) each chromosome consists of 2 chromatids;

Accept G2 / any named phase of mitosis

3. Mass of DNA between 1 and 2 (indicates) some of the DNA has been replicated;

Accept S phase

3

(b) 1. Fewer cells with mass of DNA = 1

OR

More cells with mass of DNA between 1 and 2

OR

More cells with mass of DNA 2;

2. Cell division is faster/uncontrolled

OR

More mitosis/cell division/cell replication;

'Mass of DNA is higher' is insufficient

Ignore 'growth'

Accept 'uncontrolled mitosis'

2

(c) 1. (Chromosomes) condense;
Accept 'shorten' or 'thicken'

2. (Chromosomes) line up on equator/centre of cell

OR

(Chromosomes) attached to spindle;

2

(d) Correct answer of 20 = **2 marks**;;

1 mark for evidence of 2×10^{-8} (m s^{-1})

2

[9]

Q5.

(a) 1. 2 nuclei (in cells)

OR

Cells (stopped) at telophase;

2. Cytokinesis prevented

OR

Stopped (new) cell membrane forming

OR

Stopped cytoplasm dividing;

Accept cell membrane not dividing/splitting/ pinching (in the cell)

2

(b) 1. (MiTMAB) binds (to dynamin) other than the active site;

Accept (MiTMAB) binds to dynamin at an allosteric OR inhibitor site

2. Changes the shape of (dynamin) active site

OR

Changes the tertiary structure (of dynamin/ enzyme);

Accept denature for 'change in shape'

3. Not <u>complementary</u> so substrate does not bind (to active site)

OR

Not <u>complementary</u> so no/fewer enzyme-substrate complexes (form);

Accept ES complex in this instance

Ignore ESC

Accept fit OR attach for bind

3

(c) 1. (At) lowest concentrations (all) dynamin is not inhibited

OR

(At) lowest concentrations (MiTMAB) does not cause cell death/inhibit cytokinesis;

Accept graph readings in range 30 to 70 for lowest;

Accept 'has no effect' for 'cause cell death/inhibit cytokinesis'

Accept 'prevents inhibition of cell death' for 'causes cell death'

Accept 'cell replication' OR mitosis for cytokinesis

2. (As MiTMAB) concentration increases more dynamin is inhibited/inactive

OR

(As MiTMAB) concentration increases cell death increases

OR

(As MiTMAB) concentration increases cytokinesis decreases

OR

No change in cell number at 2000 (μg dm^{-3})

OR

No change in cell number at 0.0 (on y axis);

Accept 'cell replication' OR mitosis for cytokinesis

3. (At) highest (MiTMAB) concentrations all dynamin is inhibited

OR

(At) highest concentrations (MiTMAB) causes cell death

OR

(At) highest concentrations (MiTMAB) inhibits cytokinesis;

Accept 'prevents inhibition of cell death' for 'causes cell death'

Accept 'cell replication' OR mitosis for cytokinesis

Accept graph readings >2000 to 8000 for highest

(d) Correct answer in range 19.3 to 19.7 = **2 marks**;;

Accept for **1 mark** evidence of

70 **and** 2000 (correct readings from the graph) /

30 **and** 2000 (correct readings from the graph)

OR

1930 (correct increase in MiTMAB, 70 to 2000) /

1970 (correct increase in MiTMAB, 30 to 2000)

OR

Division by 100/multiplication by 0.01 (correct conversion to mass in 0.01 dm^3);

Correct answer

19.3 (is obtained from 70 and 2000)

19.7 (is obtained from 30 and 2000)

Accept for 1 mark, any value in range 30 to 70 ***and*** *2000*

Accept for 1 mark, any value in the range 1930 to 1970

2

[10]

Q6.

(a) 1. Mass of cells/tissue

OR

Abnormal cells/tissue;

Accept idea of large number of cells in a lump/clump/cluster for 'mass'

2. Uncontrolled mitosis/cell division;

Ignore growth

2

(b) 1. Count cells in mitosis in field of view;

Max 1 if 'field of view' not mentioned

2. Divide this by total number of cells in field of view;

Max 1 if 'field of view' not mentioned

3. Repeat many/at least 5 times

OR

Select (fields of view) at random;

Accept 'multiple' for 'many'

Ignore 'several'

3

Ignore conversion of MI into a percentage.

[5]

Q7.

(a) 1. Attachment proteins attach to receptors;

For 'attachment protein' accept gp41/gp120/ glycoprotein but ignore 'receptor protein' (on virus)

Accept bind for attach

2. (Viral) nucleic acid enters cell;

Accept references to engulfment OR injection for enters

Ignore references to virus DNA/RNA incorporated into cell genome/nucleus/chromosomes

Accept RNA/DNA/genetic material for 'nucleic acid'.

3. Nucleic acid replicated in cell

OR

Reverse transcriptase makes DNA from RNA;

Accept RNA/DNA/genetic material for 'nucleic acid'.

4. Cell produces (viral) protein/capsid/enzymes;

Accept capsomeres OR reverse transcriptase for protein

5. Virus assembled and released (from cell);

Accept lysis OR burst OR bud off OR emerge for released

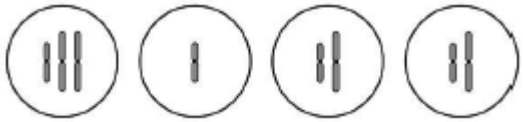
3 max

(b) One mark for each column;;

Feature	Cell cycle involving	
	Mitosis	Binary fission
Replication of linear DNA	✓	
Replication of circular DNA		✓
Produces 2 daughter cells	✓	✓
Produces 4 daughter cells		
Happens in prokaryotic cells		✓
Happens in eukaryotic cells	✓	

2

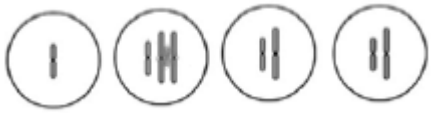
(c)



OR

OR

OR



1. 2 cells on left correct, ignore differences in chromosome length in drawn cells;

1. 2 cells on right correct, ignore differences in chromosome length in drawn cells;

2

(d) (Conclusion not valid because)

1. (MM1) 197/197.1;

and

2. (MM2) 83/82.8;

OR

Correct answer for 2 marks,

114 − 114.3 (correct difference between MM1 and MM2)

Accept for 1 mark

259.2 **and** 345.6 (using total population size)

OR

MM2 is 86/86.4 bigger (using population totals)

2

[9]

Q8.

(a) 1. To break down links between cells/cell walls
OR
To separate cells/cell walls
OR
To break down/hydrolyse cellulose/cell wall;
Ignore references to any bonds

2. Allowing the stain to pass/diffuse into the cells
OR
Allowing the cells to be (more easily) squashed;

3. To stop mitosis;
Accept to stop cell division/cell cycle

2 max

(b) 1. To create a single/thin layer of cells
OR
To spread out cells;

2. So that light could pass through;

2

(c) 1. Anaphase;
Reject 'Anaphase I (of meiosis)'

2. Chromatids moved/pulled to opposite poles/ends;
Accept 'chromosomes' for 'chromatids'
Reject homologous chromosomes for chromatids

2

(d) 0.1 / 0.13 / 0.128;
Accept any correct rounding of 0.128205128205128
Reject answers expressed as a percentage

1

(e) 1. (Garlic roots) are a different age
OR
(Garlic) grown in different conditions;
Accept suitable descriptions of conditions, eg in different temperatures

2. (Root tips) from different (garlic) plants/bulbs/species;

3. Single field of view is not representative of a root tip
OR
(Other) students may have looked at more fields of view
OR
(Other) students may have calculated a mean;
Accept 'samples' for 'fields of view'

4. (Different fields of view are from) different parts of the root tip;

Reject different sized fields of view

Reject different number of cells (per field of view)

5. Cells/roots undergo mitosis/cell division at different times/rates;

2 max

[9]