Mark schemes

Q1.

(a) 1. Resolution (too) low;

2. Because wavelength of light is (too) long;

2

(b) 1. Lysosomes;

2. Fuse with vesicle;

Accept phagosome for vesicle

3. (Releases) hydrolytic enzymes;

Accept lysozymes for "hydrolytic enzymes"

Accept 'Ribosomes/ Rough endoplasmic reticulum form hydrolytic enzymes = 2 marks

Accept 'Golgi body forms lysosomes' = 2 marks

Accept 'Golgi body / ribosomes / rough endoplasmic reticulum' for 1 mark if no other mark awarded.

3

(c) Correct answer for 2 marks = 32;;

Accept for 1 mark,
29 000 (correct conversion to μm)

OR

32.2 (correct answer but incorrect significant figures)

OR

$$\text{Actual} = \frac{\text{Image}}{\text{Magnification}}$$

OR

An incorrect answer that shows division by 900

2

Q2.

(a) 1. Cell**(**-surface**)** membrane;

2. Ribosomes;

Ignore 70S

3. Cytoplasm;

4. DNA;

2 max

(b) Mark in pairs: 1 **and** 2 **OR** 3 **and** 4

1. (Amino acids used in) protein synthesis;
   Accept for 'protein synthesis', translation

2. (So) more enzymes (for DNA/plasmid replication)

   OR

   (So) more DNA polymerase;

3. (Amino acids used in) respiration;

4. (So) more energy/ATP (for DNA/plasmid replication);

2

(c) 1. Circular DNA is bigger/heavier/denser;

2. (Because band) moved further/is lower (in tube)/closer to bottom (of tube);
   Accept converse for plasmids

2

Q3.

(a) 1. Break open cells/tissue **and** filter

OR

Grind/blend cells/tissue/leaves **and** filter;
*Accept homogenise **and** filter*

2. In cold, same water potential/concentration, pH controlled solution;
   Accept for 'same water potential/ concentration', isotonic
   Accept for 'pH controlled', buffered

3. Centrifuge/spin and remove nuclei/cell debris;

4. (Centrifuge/spin) at high(er) speed, chloroplasts settle out;

4

(b) Mark in pairs, 1 **and** 2 OR 3 **and** 4

1. DNA;

2. Is not associated with protein/histones **but** nuclear DNA is

OR

Is circular **but** nuclear DNA is linear

OR

Is shorter than nuclear DNA;

3. Ribosomes;

4. Are small**er** than cytoplasmic ribosomes;
   Accept: 70S ribosomes in chloroplast, but 80S ribosomes in cytoplasm

2

(c) Correct answer for 1 mark, 36:1;

1

Q4.

(c) 1. Magnification (figures) show **A** is bigger than **B**;

2. **A** has a nucleus whereas **B** has free DNA;

3. **A** has mitochondria whereas **B** does not;

4. **A** has Golgi body/endoplasmic reticulum whereas **B** does not;

5. **A** has no cell wall whereas **B** has a murein/glycoprotein cell wall;
   Accept peptidoglycan

6. **A** has no capsule whereas **B** has a capsule;

7. **A** has DNA is bound to histones/proteins whereas **B** has DNA not associated with histones/proteins

   OR

   A has linear DNA whereas **B** has circular DNA;

8. **A** has larger ribosomes;
   Accept in all marking points, animal/eukaryote for A and prokaryote/ bacterium for B

5 max

Q5.

(a) 1. DNA in nucleus is code (for protein);

2. Ribosomes/rough endoplasmic reticulum produce (protein);
   Accept rER for 'rough endoplasmic reticulum'

3. Mitochondria produce ATP (for protein synthesis);

4. Golgi apparatus package/modify;

   OR

   Carbohydrate added/glycoprotein produced by Golgi apparatus;
   Accept body for 'apparatus'

5. Vesicles transport

OR

Rough endoplasmic reticulum transports;

6. (Vesicles) fuse with cell(-surface) membrane;
Accept exocytosis at cell membrane

4 max

(b) A section/slice (so nucleus in another part of cell)

OR

(Nucleus) not stained;

1

(c) **S** = Vacuole

T = Chloroplast;
Reject thylakoid/granum
Reject incorrect spelling

1

(d) High**er** resolution

OR

View internal structures;

1

(e) Correct answer of 4.71×10^7 for **2 marks**;;

Accept for 1 mark
Any answer showing conversion factor of 100 000 000 / 10^8
OR
Correct answer for any number divided by 150 eg
70.65 ÷ 150 / 0.471
OR
Any answer including digits 471 in this order, irrespective of position of decimal place

2

[9]

Q6.

(a) Row 2;

1

(b) **D** - Granum/grana/thylakoid(s);

E - starch/lipid;
Accept oil for E

2

(c)
Accept converse in context of electron microscope

1. Light has long(er) wavelength;
   Ignore: optical microscope has long(er) wavelength.

2. (So) low(er) resolution;
   Accept poor resolution
   Ignore: weaker resolution
   Ignore references to magnification
   Accept correct references to values for resolution.
   E.g optical 0.2μm – 0.3 μm

2

(d) (70S) Ribosome;
   Reject: (80S) Ribosome

1

(e) Correct answer of 7455 = 2 marks;;

Accept for 1 mark answers in range:

7717.5 to 7718 (44.1% of 17500)

If incorrect answer, accept for 1 mark working shows an attempt to subtract 262.5

2

(f) 1. (Ice) cold to prevent/reduce enzyme activity;
   For 1, 2 and 3 reject context of cell

2. Buffered to prevent denaturing of enzyme/protein;
   Accept description of buffer.
   Accept: prevent change of tertiary structure.

3. Same water potential/ Ψ to prevent lysis/bursting (of organelle);
   Accept: isotonic for same water potential.
   Reject: references to turgor or plasmolysis or crenation.

3

[11]

Q7.

(a)

Cell wall component	Plants	Algae	Fungi	Prokaryotes
Cellulose	✓	✓		
Murein				✓
Chitin			✓	

1st 2 columns correct (Plants and Algae) = 1 mark
3rd column correct (Fungi) = 1 mark
4th column correct (Prokaryotes) = 1 mark
Accept alternative symbols that clearly indicate the box but are not ticks eg X.

If answer clearly crossed out read box as blank.

3

Q8.

(c) 1. No sketched / hanging / crossing lines / shading;

Ignore stippling

2. Must look similar;
3. Matrix **and** crista correctly labelled;

Ignore any other labels

4. Correct scale stated (x 62 800);

Accept other suitable scale given

4

Q9.

(a) W – (cell surface) membrane
X – cell wall
Y – capsule
Z – flagellum

Four correct = 2 marks.

Three or two correct = 1 mark.

Y - Ignore references to slime/mucus

Y - Reject capsid

Z - accept flagella

2

(b) W - Phospholipids;
X - Murein / glycoprotein;

X - Accept peptidoglycans.

Accept phonetic spellings

2

(c) Binary fission;

Reject binary fusion

1

Q10.

(a) B;

A;

E;

3

Q11.

(d) For correct answer of 40 (µm) award 2 marks;
Evidence of division by 500: award 1 mark

Allow tolerance of 0.5mm i.e. 20±0.5mm

2

(e) 1. Scanning electron (microscope);
2. 3D (image);

Accept SE(M)

2. Ignore any other correct features

2

Q12.

(a) 1. TEM use electrons **and** optical use light;
2. TEM allows a greater resolution;
3. (So with TEM) smaller organelles / named cell structure can be observed
OR
greater detail in organelles / named cell structure can be observed;
4. TEM view only dead / dehydrated specimens **and** optical (can) view live specimens;
5. TEM does not show colour **and** optical (can);
6. TEM requires thinner specimens;
7. TEM requires a more complex/time consuming preparation;
8. TEM focuses using magnets **and** optical uses (glass) lenses;

3. 'clearer' is not equivalent to 'detail'

4. Accept 'Only optical can view live specimens'

5. Accept 'Only optical can show colour'

7. Accept 'TEM requires a more difficult preparation'

Ignore references to artefacts

6 max

Q13.

(a)

The bacteriophage has a capsid and the bacterium has a cell-surface membrane;	✓

Third box down

Reject if more than one box with tick. Ignore crossed-out ticks

Accept tick to right or left of correct box

1

(b) Correct number of times between
13.0 / 12.96 **and** 13.9 / 13.92 scores 2 marks;
One mark if correct sizes in ranges of
150.7nm to 154.4nm / 0.151µm to 0.154µm
and 1953.5nm to 2097.6nm / 1.954µm to 2.098µm;

***Both** lengths required for 1 mark credit*

Accept refs to 150 / 0.15 and 2000 / 2

Ignore number of sig fig

2

Q14.

(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]

Q15.

(a) × 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]

Q16.

(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

Q17.

(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]

Q19.

(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 × 1000.

1

[9]