

1. (a)

✗	✓
✗	✓
✓	✗

(All symbols in a column need to be correct for a mark)

2

(b) (i) chloroplast;
grana / thylakoids;

2

(ii) nucleus;
chromosomes / chromatin / chromatids;

2

[6]2. (a) (i) ATP used;
movement is against a concentration gradient;

2

(ii) stops / less movement of ions;
movement of ions needs ATP;
ATP / production linked to respiration /
electron carrier system;

max. 2

(b) (i) greater concentration difference / increased gradient therefore more
molecules move in external concentration limiting factor /
increased concentration increases rate;

1

(ii) (limit imposed in situation B by)
limited number of molecules can move through the pores in unit time /
pores are full / number of pores is limiting factor;

1

[6]

3.

A	Ribosomes	Making proteins/ assembling amino acid chain/ protein synthesis	1 mark
B	Mitochondria	Respiration/ formation of ATP/ Krebs cycle/ Oxidative phosphorylation;	1 mark
C	Nuclei	DNA/RNA synthesis/ controls protein production/ cell activity/ carries genetic information;	1 mark
	1 mark		

[4]4. (a) 4 micrometres = 2 marks (*Allow 3.9 - 4.1*)
Correct method of scaling, but incorrect conversion to micrometres = 1

2

(b) (i) not in nucleus / single (loop) chromosome.

1

- (ii) not attached to ER / smaller (70S). 1
- (iii) not in mitochondria / attached to mesosomes. 1
- (c) increases concentration (of solutes) inside bacteria / decreases water potential inside bacteria; less / no net water loss to external solution or uptake of water to more conc. solution inside. 2
- 5.** (a) Bacteria do not have a nucleus/nuclear membrane, eukaryote does; Bacteria do not have membrane-bound organelles, eukaryote does; Bacteria do not have mitochondria, eukaryote does; Bacteria has 70S/smaller ribosomes, eukaryote has 80S/larger; Bacteria] cell-, have murein/peptidoglycan cell wall, eukaryotes do not-. Bacterial cells are very much smaller than eukaryotic cells; Bacteria have circular DNA, eukaryotes have linear DNA; Bacteria may have capsules, eukaryotes do not; 2
- (b) (i) flagellum
(ii) ribosome
(iii) plasmid 3
- 6.** (a) (i) Crista 1
(ii) (Mitochondria) provide energy / ATP; liver cells have high energy requirement for metabolism- reactions specific liver function, eg. glycogen synthesis or deamination (*not just: active transport/ growth*) 2
(iii) Principle - protein synthesis; Function of protein in mitochondria - e.g. synthesis of (respiratory) enzymes / growth / repair / replication.
or:
DNA has genetic information;
ribosomes produce proteins / allows replication of mitochondria. 2
- (b) Maintain concentrations/water potential same inside & outside (cells / mitochondria) / prevent osmosis; Prevent bursting / shrinkage of mitochondria/organelles (*not cells*) 2

[7]

[5]

- (c) Eukaryotic ribosomes denser/ heavier (*not just „larger“*). 1 [8]
7. (a) Faster gas exchange / diffusion;
Large / big / increased surface area / shorter pathway for gas exchange / Hb not too far from membrane;
(*NOT more / bigger / greater / easier / more efficient*)
OR
Increases flexibility;
To pass through capillaries; 2
- (b) Protein synthesis / Cell division / Mitosis; (*NOT Meiosis*) 1
- (c) (i) Monolayer;
Tails up / heads in water;
(*NOT completely submerged or floating in air*) 2
- (ii) 0.5 / ½;
Phospholipids are arranged in a bilayer; 2 [7]
8. (a) (i) Nucleus; 1
- (ii) Correct answer ($3\mu\text{m} = 2$ marks)
error with measurement, but clearly derived by dividing drawing size by magnification = 1 mark; 2
- (b) (i) Ice-cold – prevents enzymes working/autolysis/self digestion;
(ii) Isotonic – prevents osmotic effects to organelles/osmosis/bursting/
shrinking; 2
- (c) A;
Nucleus is largest/densest/heaviest organelle (sediments first/lowest spin speed);
(Reject reference to plant organelles/cell wall) 2
- (d) O₂ uptake / ATP production / CO₂ production (not respiration / heat); 1 [8]

9. (a) A mitochondrion; 1
 B nucleus; 1
 C endoplasmic reticulum rough ER / ER; 1
(reject smooth ER, ribosomes neutral)
- (b) ref to proteins / glycoproteins / enzymes / lipids / hormones;
 ref to **fate** of proteins / glycoproteins / enzymes / lipids / hormones; (**linked to previous mark e.g. vesicles / exocytosis / packaging / synthesis / processing modifying**)
If neither of these: reference to vesicles / exocytosis / packaging / synthesis processing /modifying gains 1 mark
(Max 1 mark if incorrect function given) 2
- (c) 30 000 - 34 000 gains 2 marks;; 2
If neither of these: evidence of sensible measured diameter ÷ actual (0.0005 mm) gains 1 mark
- [7]
10. (a) (i) microvilli; *(reject brush border)* 1
 (ii) increased surface area (for diffusion); 1
- (b) (i) $\frac{16 \times (1000)}{0.1}$ / principle of $\frac{\text{measuring scale bar}}{\text{dividing by 0.1}}$; (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]
11. (a) phospholipids in a double layer / area covered is twice total surface area of red blood cells;
 evidence of calculation of number \times surface area ($4.74 \times 10^9 \times 99.4 \mu\text{m}^2$) /
 calculation of area of 1 cell $\frac{0.92}{4.74 \times 10^{-9}}$;
 $0.471 \text{ m}^2 \approx 0.5 \times 0.92 \text{ m}^2 / 194 \mu\text{m} \approx 2 \times 99.4$; 3

- (b) EITHER feature + explanation
 red blood cells do not contain organelles / nucleus;
 so only surface membrane / no internal membranes in macerate;
 OR
 red blood cells have simple / regular / spherical shape;
 so easy to calculate surface area;
 OR
any two features, e.g.
 simple / regular shape;
 all same size; 2 [5]
12. (a) (i) **A** = phospholipid
B = protein; (*both correct*) 1
- (ii) allows movement of lipid soluble/non-polar molecules/named
 e.g. water/gases;
 prevents movement of water soluble/polar molecules/named
 e.g. ions / amino acids;
 idea of selection / membrane partially/differentially permeable/
 large molecules do not move through, small molecules do;
 (*accept semi-permeable*) 2 max
- (b) (i) diffusion (*reject facilitated*) 1
- (ii) higher rate of exchange/diffusion;
 prevents cooling of the blood / prevents increase in viscosity; 2
- (iii) concentration gradient maintained / equilibrium never achieved;
 blood always meets fluid with lower concentration of urea;
 diffusion/exchange along the whole length of surface; 2 max
- (iv) $0.2 \times 60 = 12 \text{ dm}^3 \text{ h}^{-1}$; (*principle: volume per hour*)
 $12 \times 5 = 60 \text{ dm}^3$; (*correct answer 2 marks*) 2 [10]
13. (a) A mitochondria;
 B ribosomes (*accept ribosomes and rER*); 2
- (b) idea of sections or cuts;
 idea of mitochondria orientated differently or in different positions /
 description of 3D structure of mitochondria, e.g. sausage-shaped; 2

- (c) translation / protein/polypeptide synthesis; 1
- (d) provide/produce energy or ATP (*reject create energy*);
 (*disqualify first mark if 'for respiration'*)
 high respiration (rate) (*accept lots*);
 for active uptake / transport (*accept description*);
 absorption of digested food/substances/products/correctly named product
 (*only accept monosaccharides, amino acids, dipeptides*); 3 max
- [8]**
14. (a) B; 2
 D;
- (b) idea of molecules/named molecules moving = Fluid; 2
 idea of both proteins and phospholipids = Mosaic;
- (c) slow rise, sharp rise, levelling off (*reject ,becomes constant'*);
diffusion rate increases / description of diffusion rate,
 e.g. increase in kinetic energy increases loss of ions; 1
 sharp rise / above 50°C proteins are denatured;
 levelling off due to concentration of chloride ions in water becoming
 equal / maximum loss of Cl⁻ ions; 2 max
- [7]**
15. (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
 (ii) (outer) membrane breaks down / inner membranes/grana separate;
 solution has a higher/less negative water potential;
 (*accept description of relative concentrations*)
 water moves into organelle/chloroplast by osmosis / from higher to
 lower water potential / into more concentrated solution; (*reject into cell*)
 organelle swells/increase in pressure and bursts; 4
- [7]**

16. (a) (i) **D** plasmid / ribosome(s) / cytoplasm / storage granules;
(accept any sensible structure)
E (slime / mucous) capsule
OR
 slime / mucous layer; 2
 (ii) protection / maintain shape / prevent lysis / strength / support; 1
- (b) two of the following:
 nucleus;
OR
 nuclear envelope / mitochondria / chloroplasts / sER / rER /
 golgi apparatus / 80s ribosomes
 linear DNA / chromosomes / lysosomes / vacuole / vesicles /
cellulose cell wall; 2 max
- (c) (i) starch digested / broken down;
 by amylase / carbohydrase; 2
 (ii) any sensible suggestion e.g. no secretion of amylase /
 functional amylase /
 piece of fungus might have died; 1
(accept carbohydrase / enzyme for amylase)
(reject "no digestion" without qualification)
17. (i) cold - no / reduced enzyme action / e.g. stops autolysis;
(reject "cell activity reduced")
 isotonic - stops osmotic effects / description of effect on
 cells or organelles;
 buffer - prevents damage to enzymes / proteins; 3
 (ii) break open the cells / release the cell contents; 1
 (iii) supernatant / liquid above the pellet;
 spun at a high(er) speed; 2
(mark as independent points)

[8]

[6]

18. (a) feature and adaption; for example
1. phospholipid bilayer (as a barrier);
 2. forms a barrier to water soluble / charged substances / allows non-polar substances to pass
- OR
- maintains a different environment on each side / compartmentalisation;
3. bilayer is fluid;
 4. can bend to take up different shapes for phagocytosis / form vesicles / self repair;
 5. channel proteins (through the bilayer)/intrinsic protein;
 6. let water soluble/charged substances through / facilitated diffusion;
 7. carrier proteins (through the bilayer);
 8. allow facilitated diffusion / active transport;
 9. surface proteins / extrinsic proteins, glycoproteins / glycolipids;
 10. cell recognition / act as antigens / receptors;
 11. cholesterol;
 12. regulates fluidity / increases stability;
- 6 max
- principle mark (only for 5, 6, 7, 8)
 proteins transport material across the membrane
 3 features max
- (b) curve description:
1. Curve goes down when the poison is added and rises when ATP added; 1
- explanation:
2. Ion movement is by active transport;
 3. ATP / energy needed for active transport;
 4. respiration provides ATP / energy;
 5. poison inhibits/stops respiration / ATP production;
- 3 max
- [10]**
19. (a) (i) A mitochondrion and B nucleus; 1
(need both for one mark)
- (ii) increased surface area; 2
 for respiration/enzymes;
- (b) *any suitable feature* 1
 e.g. plasmid/capsule/70S ribosomes/smaller
 ribosomes/complex cell wall/mesosome/no nucleus;

- (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]

20. (a) *two of the following:*
 form(water) impermeable barrier to water-soluble substances / selectively
 permeable / allows non-polar molecules to pass through;
 allows cell to maintain different concentrations either side;
 makes membranes self-sealing/able to fuse with other
 membranes/able to form
 vesicles / gives flexibility/fluidity; 2 max

- (b) (surface/extrinsic protein) for cell recognition / binding to
 hormones/identification 1

- (c) (i) involves carrier/transmembrane/transport proteins;
 (*reject channel proteins*) 1

- (ii) requires energy/requires use of ATP / moves substances/ions/molecules
 against a concentration gradient; 1

- (iii) the curve levels off above a certain external concentration of substance;
 as channel proteins are saturated with molecules
 (and no more can be carried); 2

[7]

21. (a) 1 Cholera bacterium is prokaryote;
 2 Does not have a nucleus/nuclear envelope/ has DNA free in
 cytoplasm/has loop of DNA;

3 and 4 Any two from

No membrane-bound organelles/no mitochondria / no golgi/no
 endoplasmic reticulum/etc;

Maximum of 2 marks for points 3 and 4.

5 Small ribosomes only;

6 and 7 Any two from

Capsule/flagellum/plasmid / cell wall/etc;

5 max

Maximum of two marks for points 6 and 7.

(b) Advantages:

1 Small objects can be seen;

2 TEM has high resolution;

Accept better

3 Wavelength of electrons shorter;

Advantages: allow maximum of 3 marks.

Limitations:

4 Cannot look at living cells;

5 Must be in a vacuum;

6 Must cut section / thin specimen;

7 Preparation may create artefact

8 Does not produce colour image;

5 max

Limitations: allow maximum of 3 marks.

[10]