

1. (a) (i) Ability to distinguish points (close together); 1
 (ii) Electrons have a shorter wavelength; 1
- (b) (i) Golgi / nucleus / mitochondrion / endoplasmic reticulum /
 chromosome / larger ribosomes;
R Membrane – bound structure 1
 (ii) Capsule / cell wall / flagellum / mesosome /
 plasmid / nucleoid / circular DNA; 1
- (c) Formation / packaging of glycoproteins / glycolipids /
 secretion / modification of proteins/
 formation of lysosomes / membranes / vesicles; 1

[5]

2. (a)

Feature	Epithelial cell from small intestine	Prokaryotic cell
Golgi apparatus	✓	
Mitochondrion	✓	
Nuclear envelope	✓	
Plasmid		✓
Ribosome	✓	✓

Mark down, one mark for each correct column; 2

- (b) (i) Electron microscope with better resolution/ able
 to distinguish between points closer together;
 (Beam of electrons) with shorter wavelength; 2
 (Ignore refs. to higher magnification/ more detail)
 (A reverse argument for light microscope)
- (ii) Processes involved in preparation alter/distort cell contents/
 introduction of artefacts; 1

[5]

3. (a) Answer within limits of 6.3 - 6.7;;
(if outside these limits, answer involving division
of actual length by 6000 1 mark) 2
- (b) Nitrogen), Carbon), Hydrogen) and Oxygen); 1
- (c) (i) In bacterial cell, DNA / genetic material / naked /
not associated with protein / not in chromosomes/
DNA in loop / plasmid / DNA not in nucleus; 1
- (ii) In bacterial cell organelles / named examples /
not surrounded by membranes / bacteria only have
a plasma membrane / no endoplasmic reticulum / have mesosomes; 1
- [5]
4. (a) Nuclear pore; 1
- (b) Making/synthesising proteins/translation; 1
- (c) Z packages/modifies/stores / transports proteins; 1
- (d) Allow 2 marks for correct answer 1.3 – 1.4 μm
Allow 1 mark for incorrect answer if measured length by 30 000 2
- [5]
5. (a) (i) Microvillus/microvilli/brush border;
R Villus/villi 1
- (ii) Photograph (b) is taken with an electron microscope;
greater resolution (and therefore more detail seen);
requires thin specimen so section must be cut through cell;
electron microscope uses shorter λ ; (allow converse points) max. 2
- (b) Presence of microvilli;
increase SA for absorption / diffusion active transport;
presence of mitochondria;
produce ATP for active transport / transport against concentration
gradient; 4

	(c)	(i)	Answer obtained by dividing actual length by magnification; and correctly expressed in micrometres;	2	
		(ii)	Method involving Lengths of cell in two photographs compared; and related to magnification of photograph b; (eg ratio $\times 10\ 000$)	2	[11]
6.	(a)	(i)	Cooling / inhibitors; stops / slows reactions;	2	
		(ii)	Isotonic / same Ψ / same Ψ as (as mitochondria); ref to osmosis / no (net) water movement / prevent bursting prevent shrinkage;	2	
	(b)		Mitochondria and bacteria approximately same size / same density / mass / weight;	1	[5]
7.	(a)		Presence of nucleus / nuclear envelope / membrane bounded organelles/ specified organelles,	1	
	(b)	(i)	Converted to proteins; Involvement of ribosomes (on rough endoplasmic reticulum);	2	
		(ii)	Arrow from plasma membrane to rough endoplasmic reticulum; to Golgi apparatus; to vesicles and out of cell;	3	
		(iii)	Exocytosis;	1	[7]
8.	(a)		Remove / separate debris / cell walls / intact cells; (Ignore references to impurities and foreign bodies)	1	
	(b)	(i)	Nucleus;	1	
		(ii)	Ribosomes / endoplasmic reticulum;	1	
	(c)		High(er) / less negative; So water moves in (to mitochondria),	2	[5]

9. (a) (i) Transmission electron microscope/TEM; 1
(ii) Shows detail of.../enables...to be seen;
(Answer needs to refer to evidence from diagram.) 1
- (b) (Mitochondria) are site of respiration;
Release energy / produce ATP;
To move substances against concentration gradient /
active transport requires energy / ATP;
*Do not allow credit for mitochondria making energy or
references to diffusion* max 2
- (c) Correct answer of 40 000 = 1 mark
Correct method = 1 mark 2

[6]

10. Quality of written communication should be considered in crediting points in the marking scheme. In order to gain credit, answers must be expressed logically in clear, scientific terms.

- (a) (i) Made up of two sugar units / monosaccharides; **R** Two glucose units 1
(ii) Correct bond circled; 1
(iii) C_{12} ;
 $H_{22}O_{11}$; 2
- (b) A.T. involves carriers / proteins;
Molecules will have a different shape;
(Only those absorbed) will fit; 2
- (c) Lactose produces a lower / more negative water potential;
So water moves into the intestine / less water absorbed;
By osmosis / diffusion / down concentration gradient;
Note: concentration gradient must be defined. 3
- (d) 1 Prokaryotic cells do not have a nucleus / have genetic material
in cytoplasm;
2 DNA in loop / ring;
3 Not associated with proteins / do not have chromosomes /
chromatin / do not divide by mitosis;
4 Smaller ribosomes;
5 No membrane-bound organelles;
6 Such as mitochondria / lysosomes / endoplasmic reticulum /
Golgi / chloroplasts;
7 Prokaryotic cells may have mesosomes;
8 Prokaryotic cells smaller;
9 May be enclosed by capsule; max 6

[15]

11. (a) **A** Carries the (genetic) code / genetic instructions / DNA /

- makes mRNA / transcription / makes ribosomes;
- B** Links amino acids / synthesises / makes protein;
- C** Involved in modifying / packaging protein / forms glycoproteins / forms vesicles; 3
- (b) (i) Mitochondrion;
0.01% as opposed to 0.003%;
Accept any valid approach but must be clear as to what the calculations relate 2
- (ii) With electron microscopes sections must be cut;
Cisternae are joined to each other;
Outside plane of section; 2 max
- (iii) Protein synthesis requires energy / ATP;
Mitochondria release energy / make ATP;
From respiration;
Do not award credit for second point if candidate refers to mitochondria making / producing energy 3
- 12.** (a) (i) The receptor / glucagon will have a particular shape / tertiary structure;
The other will fit / bind because of its shape; 2
- (ii) Cells in other parts of the body do not have these receptors /
Liver cells have these receptors; 1
- (b) Side chains / R-groups are different; 1
- (c) Tertiary structure changes / enzyme denatured / bonds broken;
Will affect active site (of enzyme);
Starch cannot bind / fit / form enzyme-substrate complex; 3
- (d) Keeps pH constant;
So proteins / enzymes in mitochondria not denatured / affected; 2

[10]

- (e) 1 Some proteins pass right through membrane;
 2 Some proteins associated with one layer;
 3 Involved in facilitated diffusion;
 4 Involved in active transport;
 5 Proteins act as carriers;
 6 Carrier changes shape / position;
 7 Proteins form channels / pores;
 8 Protein allows passage of water soluble molecules /
 charged particles / correct named example; 6 max **[15]**
- 13.** (a) (i) Short wavelength; [*Allow: Small wavelength*]
 Good/ high resolution; [*Allow: description of resolution*] 2
 (ii) Cut through a different plane; 1
- (b) (i) Mitochondria supply energy/ ATP;
 For active transport of mineral ions/
 Absorption of ions against concentration gradient;
 Movement/ contraction of muscles; 3
 [*Reject: thermodynamically incorrect answers about „making“
 or „producing“ energy*] **[6]**
- 14.** (a) (i) Other (membrane bound) organelles/nucleus not included; 1
 (ii) Folded inner membrane/Inner membrane forms cristae; 1
- (b) (i) 650; 1
 (ii) Microvilli; 1
- (c) (i) More mitochondrial membrane;
 Mitochondria produce ATP/release/transfer energy;
 From respiration; max 2
 To move substances against concentration gradient;
 [*Note: Do not credit “make” or “produce” energy for second point*]
- (ii) Large amount of rough endoplasmic reticulum;
 On which ribosomes are found;
 Enzymes are proteins;
 Protein synthesis/translation on ribosomes/rough er; max 3

- (d) 1 Phospholipid consists of glycerol;
 2 (To which are joined) two fatty acids;
 3 And phosphate;
 4 By condensation/elimination of water molecules;
 5 Arranged as bilayer in membrane;
 6 Head/phosphate hydrophilic/polar and tail/fatty acid
 hydrophobic/non-polar;
 7 Heads outside and tails attracted to each other/inside; max 6
- [15]**
15. (a) (i) Golgi; 1
 (ii) Exocytosis; 1
- (b) (i) Joining together of amino acids / synthesis/production of thyroglobulin /
 makes protein; 1
Do not credit synthesis of amino acids
 (ii) Electron microscope has high/greater resolution;
 Because it uses electrons;
 Which have smaller wave(length); max 2
- [5]**
16. (a) Does not have the resolution / cannot distinguish between points this close
 together;
 As light has longer wavelength; 2
*The key ideas in marking this part of the question are resolution
 and wavelength.*
- (b) Lipid soluble / small / non-polar / not charged; 1
- (c) (i) Concentration of sodium ions (outside cell);
 As concentration/independent variable increases so does the rate of
 diffusion; 2
- (ii) Sodium ions are passing through the channels/pores;
 At their maximum rate;
 Rate is limited by the number of sodium channels / another limiting
 factor; max 2
- [7]**

17. (a) (i) Active transport;
Low to high concentration / against concentration gradient;
Reject answers relating only to high concentration in cell 2
- (ii) Rate of movement / diffusion proportional to concentration gradient/
difference in concentration;
High concentration of potassium ions inside cell compared to outside;
*Must mention high concentration. Ignore reference to other factors if
reasoning is appropriate.* 2
- (b) (i)
$$\begin{array}{c} \text{O} \\ || \\ \text{C} - \text{N} \\ | \\ \text{H}; \end{array}$$
 1
- (ii) 10; 1
- (c) Action of vanilomycin depends on fluidity of membrane;
Fluidity reduced / not fluid at low temperatures;
Pore formed by gramicidin A remains in place / permanent; 3
- (d) Pore between sterol molecules lined with polyene antibiotic;
Hydrophobic region next to sterol; 2
- [11]
18. (a) removes debris/intact cells/sand;
which would contaminate sediment A/interfere with the results; 2
- (b) (i) nuclei; 1
- (ii) ribosomes/endoplasmic reticulum/membrane/Golgi; 1
- (c) density/size/mass/weight; 1
- (d) an electron microscope has a higher resolution;
electrons with shorter wavelength; 2
- [7]

19. (a) (i) break open cells / release cell contents; 1
- (ii) keep pH the same / controls pH;
prevent change to / denaturing of proteins/enzymes; 2
- (b) (i)
- | | | |
|-----------------|-------------|-------------|
| (supernatant) C | (pellet) B; | (pellet) A; |
|-----------------|-------------|-------------|
- 2
- (ii) site of respiration;
releases energy/ATP;
required for movement against concentration gradient; 2 max
*ignore first point for thermodynamically incorrect statements
such as "making energy".*

[7]