

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

9. (a) (i) Transmission electron microscope/TEM; 1  
(ii) Shows detail of.../enables...to be seen; 1  
*(Answer needs to refer to evidence from diagram.)*
- (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

**[10]**

- 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

- (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;  
 To move substances against concentration gradient; max 2  
 [*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
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

[11]

[7]



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

[7]