

1. (a) (i) Double layer of phospholipid molecules;
Detail of arrangement of phospholipids;
Intrinsic proteins/protein molecules passing right through;
Some with channels/pores;
Extrinsic proteins/proteins only in one layer/on surface;
Molecules can move in membrane/dynamic/membrane contains cholesterol;
Glycocalyx/carbohydrates attached to lipids/proteins; max 5
- (ii) Thicker;
Single layer/presence of fibrils in cell wall; plasmodesmata; 2
- (b) Non-polar/lipid soluble molecules move through phospholipid layer/bilayer;
Small molecules/water/gases move through phospholipid layer/bilayer;
Ions/water soluble substances move through channels in proteins;
Some proteins are gated;
Reference to diffusion;
Carriers identified as proteins;
Carriers associated with facilitated diffusion;
Carriers associated with active transport/transport with ATP/pumps;
Different cells have different proteins;
Correct reference to cytosis; max 6
- (c) Absence of nuclear envelope/membrane;
Membrane bounded organelles;
Such as mitochondria/chloroplast/vacuole/lysosome;
and membrane systems/endoplasmic reticulum/Golgi;
Mesosomes in prokaryotes; max 4

Quality of language

Aspect of work

- Grammar, punctuation and spelling of an acceptable standard 1
- Material presented in an appropriate scientific style with due regard to correct use of technical terms 1
- Argument clearly and logically presented 3

[20]

2. (a) (i) More “free” water molecules outside cell / in distilled water;
water molecules inside cell “bound” to solute molecules;
link between water molecules, pressure they exert and water potential;
water potential of distilled water =0;
presence of solute reduces water potential; max 2
- (ii) Partially permeable / only allows water molecules through /
does not allow solute molecules though; 1

- (b) Passive / does not require ATP; **R** energy not required
movement down gradient; **R** across
does not require carrier molecules / not facilitated; max 2 **[5]**
3. (a) (i) ((rate of) uptake / diffusion is proportional to)
$$\frac{\text{surface area} \times \text{difference in concentration}}{\text{thickness of membrane}};$$
 1
- (ii) Rate (of uptake) is proportional to concentration (of glucose); 1
- (b) (i) Facilitated diffusion involves carrier / protein molecules (in membrane);
(free proteins / carriers) still available as more glucose added /
glucose is a limiting factor / eq; 2
- (ii) Carrier / protein molecules saturated / limiting factor; 1 **[5]**
4. (a) Condensation;
removal of water molecule;
from amino and carboxyl groups;
forming peptide bonds;
same amino acids in same sequence;
bonds form between R-groups/side chains;
e.g. sulphur-containing amino acids / ionic bonds / hydrogen bonds;
bonds form in same place; max. 6
- (b) Allows passage of charged particles / ions;
allows passage of water soluble / large molecules;
channel proteins / proteins with pores;
specificity related to diameter / charge;
carrier proteins;
specificity lined to shape of receptor sites;
functions by changing shape / conformation;
- facilitated diffusion with concentration gradient;
active transport against concentration gradient;
active transport requiring energy / ATP; max. 7

- (c) Glucagon has specific shape / structure;
receptor molecules with specific receptor sites;
concept of fitting;
glucagon receptors only on liver cells; max. 4 [17]
5. (a) (i) Transfers phosphate; 1
(ii) Enzyme - active site;
Substrate – Complementary shape/structure
Shape/structure allows fitting/bending/
formation of E-S complex; 2
- (b) Water/solute potential in cells of lens becomes more negative/decreases;
water enters by osmosis/diffusion; 2
- (c) (i) Both involve loss of water molecule/condensation; 1
(ii) $C_{12}H_{22}O_{11}$; 1
- (d) Diagram showing phospholipid bilayer, molecules correctly orientated,
2 tails labelled;
protein passing through the membrane;
carbohydrate attached to one side of protein; 3 [10]
6. (a) Osmosis only involves movement of water;
Facilitated diffusion involves proteins / carriers; 2
- (b) Organelle A / mitochondria site of respiration;
Release energy / produce ATP; (**R** make energy in context of this point)
Energy / ATP necessary for active transport;
To move substances against concentration gradient; max. 3
- (c) Presence of microvilli / folded membrane increases surface area;
(**R** if organelle incorrectly identified)
Removal of glucose out of cell increases / maintains concentration gradient; 2 [7]

7. (a) (Crush in) ethanol / alcohol;
Add (to) water (*Order of adding is critical for this point*);
Emulsion / white colour; 3
- (b) (i) Glycerol / glyceride; 1
(ii) Phospholipid has phosphate / phospholipid only has two fatty acids; 1
(iii) Phosphorus / P; 1
- (c) (i) Both membranes contain phospholipid / lipid (bilayer); 1
(ii) Glucose unable to pass through artificial membrane as not lipid soluble;
Glucose transported by proteins;
(Proteins) found in plasma membrane /
not found in artificial membrane; max 2

[9]

8. 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) C₁₂ ;
H₂₂O₁₁ ; 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]

9. (a) Lumen high

| | | | | |
|------------|---|--|---|---|
| | Cell low Blood high; | | 1 | |
| (b) | Surface area Difference in concentration Thickness | high high low; | 1 | |
| (c) | (i) | Microvilli / description give large surface area; <i>Only accept description if it refers to the membrane</i> | 1 | |
| | (ii) | Increase / maintain diffusion gradient / difference in concentration; | 1 | |
| (d) | Rate of diffusion increases as temperature rises; (Molecules) have more (kinetic) energy; Molecules move faster; <i>Award credit only to answers which relate to diffusion</i> | | 2 max | |
| 10. | (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 |

[6]

- (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]

11. (a) Bilayer / two molecules thick;
 "Heads" / hydrophilic parts outwards / "Tails" / hydrophobic
 parts inward;
*Credit information provided in a diagram, labelling essential
 for second marking point.*
Reject 'water loving' / 'water hating'. 2
- (b) Only parts of membrane with receptors / molecules into which
 surface proteins will fit / recognition / binding sites; 1
- (c) Endocytosis / phagocytosis / pinocytosis;
Reject 'cytosis'. 1
- (d) (i) Lysosome; 1
- (ii) Enzymes;
 Digests / breaks down / hydrolyses (other molecules);
Reject 'cholesterol'. 2

[7]

12. *Three marks for three of:*

- Amino acids removed from cell (into blood stream) by active transport;
 ATP used for active transport;
 Maintains a low concentration in cell;
 Idea of concentration gradient between ileum and cell;
 Entry by facilitated diffusion;

3 max

[3]

13. (a) (i) 31/31.2; 1
- (ii) Ratio would be less/smaller;
Cell is thin / has large surface area / (adapted) for diffusion; 2
Accept converse. Must relate to concept of ratio.
- (b) (i) 6; 1
- (ii) 11; 1
- (c) Water potential inside vesicle more negative/lower;
Water moves into vesicle by osmosis/diffusion; 2
- (d) Mitochondria supply energy/ATP;
For active transport / absorption against concentration gradient / synthesis /
anabolism / exocytosis / pinocytosis; 2
Do not credit references to making, creating or producing energy.
- (e) 1 Phospholipids forming bilayer/two layers;
2 Details of arrangement with “heads” on the outside;
3 Two types of protein specified;
e.g. passing right through or confined to one layer /
extrinsic or intrinsic /
channel proteins and carrier proteins /
two functional types
4 Reference to other molecule e.g. cholesterol or glycoprotein;
5 Substances move down concentration gradient/from high to low concentration;
Reject references to across or along a gradient
6 Water/ions through channel proteins/pores;
7 Small/lipid soluble molecules/examples pass between phospholipids/through
phospholipid layer;
8 Carrier proteins involved with facilitated diffusion;
Ignore references to active transport.
Credit information in diagrams. max 6
14. (a) More (kinetic) energy;
Molecules are moving faster; 2
Ignore references to collisions

[15]

(b)

2

| Feature | Efficient absorption of digested food from the small intestine | Reducing water loss from a leaf |
|-------------------------------|--|---------------------------------|
| Surface area | maximum | minimum |
| Difference in concentration | maximum | minimum |
| Thickness of exchange surface | minimum | maximum |

Mark for each correct column, one mark each.

- (c) (i) Greater the concentration difference/gradient, faster rate of entry/diffusion; 1
(ii) Curve flattens out;
Channel/carrier proteins / carriers;
Become limiting; max 2

[7]

15. (a) (Small alveoli with) large surface area;
For diffusion; 2
- (b) (i) Epithelium / epithelial/squamous/pavement cells;
Reject endothelium. 1
- (ii) 0.11 μm ; 1
- (c) (i) Less oxygen / more carbon dioxide / more water vapour; 1
Two differences required, but only one mark for this part of the question.
- (ii) Gas exchange takes place in alveoli / does not take place in trachea; 1
- (d) (i) Pulmonary artery; 1
- (ii) Concentrations reach equilibrium/become equal;
Diffusion occurs when there is a concentration gradient (so some will remain in blood);
OR
Lung cells/vessel cells respire;
Add/produce carbon dioxide; 2

[9]

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
17. (a) (i) Active transport;
Low to high concentration / against concentration gradient; 2
Reject answers relating only to high concentration in cell
- (ii) Rate of movement / diffusion proportional to concentration gradient/
difference in concentration;
High concentration of potassium ions inside cell compared to outside; 2
Must mention high concentration. Ignore reference to other factors if reasoning is appropriate.
- (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

[7]

- (d) Pore between sterol molecules lined with polyene antibiotic;
Hydrophobic region next to sterol; 2
- 18.** (a) greater rate of oxygen consumption/leads to greater rate of respiration
and greater rate of uptake; [11]
- (allow this mark even if spread through account but
cause and effect must be within the correct context)*
- oxygen required for respiration;
respiration produces ATP/releases energy;
(ignore ref to producing or making energy)
potassium ions taken up by active transport/against concentration gradient; 4
- (b) (i) 0.25 (mol dm⁻³); 1
- (ii) 1 mark Incorrect answer but derived from ratio of 1.2 and initial
length of 90 mm
2 marks Correct answer of 108 mm; 2
- (iii) water potential inside potato higher/less negative than in solution;
water moves out by osmosis; 2
- 19.** (a) Measure diameter of field with ruler; And proportion taken up by
the cell; or Measure length with (eyepiece) graticule/eyepiece scale;
Calibrated against stage micrometer/something of known length; 2
- Reject divide apparent length by magnification*
- (b) Membrane/cytoplasm shrinks/pulls away from cell wall/cell
plasmolysed/ goes flaccid; Water moves down water potential
gradient/to lower/more negative water potential; By osmosis; 3
- (c) (i) Reaches equilibrium/no further/maximum change in length; 1
- Reject osmosis takes time*
- (ii) Line/curve of best fit; Extrapolate (and read off)/
find where it crosses x-axis; 2

[9]

- (iii) Greater decrease/length smaller; More water removed;
Greater difference in water potential/cell with higher/less
negative water potential; Starch is insoluble/has no effect
on osmosis
- max 2
- [10]**
20. (a) partially/selectively permeable *accept semi-permeable*
allows water to pass through but not potassium nitrate/solute; 1
- (b) potassium nitrate (solution);
cell wall permeable; 2
- (c) water potential more negative/lower in cell E; water removed;
greater solute/sap concentration (in cell); 3
- [6]**
21. (a) Molecules within the membrane able to move;
mixture of phospholipid and protein / arrangement of protein; 2
- (b) Carriers / reference to transport role;
receptors / antigens / reference to recognition;
enzyme; max. 2
- (c) Selectivity;
stops the loss of water soluble / polar molecules from inside the cell;
e.g. enzyme;
OR converse
allows movement of lipid soluble / non polar molecules;
e.g. vitamins; max. 2
- (d) (i) Arrows from high to low water potential; 1
- (ii) Water potential is lower / more negative ; 1
- [8]**
22. (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]**
23. (i) 0.28; 1
- (ii) uptake by active transport; use energy / ATP from respiration; amount absorbed by experimental plants is due to diffusion; max 2
- (iii) concentration falls so rate of diffusion falls; active transport involves carrier/membrane proteins; more potassium ions so more chance of collisions with carriers max 2
- [5]**
24. (a) In first part of the curve concentration of glucose in surrounding medium limiting/rate of uptake dependent on glucose; More glucose molecules, more protein carriers occupied; In second part number of proteins/carriers limiting/working at full capacity; All carriers occupied; max 3
- (b) (i) Temperature; Would increase the rate of movement/kinetic energy of molecules/ gives more chance of colliding with carrier; or Temperature/pH; Denature protein carriers; or Number of red blood cells; More uptake because greater surface area/more carriers; or Oxygen; Linked to ATP/energy/respiration and active transport; 2
- (ii) Concept of shape of different molecules/receptor site; Concept of fit determining specificity; More carriers for glucose; max 2
- [7]**

25. (a) (i) Enter by active transport/moved against concentration gradient;
Mitochondria provide ATP/energy from respiration; 2
- (ii) Higher concentration of sodium ions in contractile vacuole;
More negative water potential in vacuole;
Water moves into vacuole by osmosis; 3
- Concentration must be qualified and reference made either to water or sodium ions. Accept reverse argument.*
- (b) Sea water has same concentration/water potential as cytoplasm;
Therefore no gain of water/amount of water entering is same as amount leaving; 2
26. (a) (i) to allow aerobic respiration/respiration in mitochondria;
providing ATP; 3
- (ii) to prevent denaturation of / provide optimum pH for enzymes/
protein carriers 3
- (b) Glucose - active transport;
absorption much less in poisoned gut;
Fructose - diffusion;
absorption rates similar in normal and poisoned gut; 4
27. (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
28. (a) Active transport requires energy / uses ATP;
moves substances against concentration gradient. 2
- (b) Carrier protein (in membrane); (*accept: channel/pore/intrinsic proteins;*

[7]

[7]

[7]

reject: extrinsic protein, or just 'protein');
 ion transported by change of shape / „flipping“ of carrier protein;
 energy used to attach ion to carrier protein / .change shape. (*not just 'ATP provides energy'*)

max 2

- (c) (i) 930 1
- (ii) Carrier proteins different or specific / ref to potassium (or other) carrier / ions moved independently;
 more potassium than other ions transported;
 different degrees of concentration of ions.
 (*not just 'moved against concentration gradient'*) max 2

[7]

29. (a) (i) 6 : 1 and 2 : 1
 (*Accept 54:27; reject 6 and 2*) 1
- (ii) 4.85 / 4.9 and 1.09 / 1.1 1
- (b) (i) Same volume of potato / only surface area different 1
- (ii) Potato (cubes) have lower/more negative water potential;
 so water enters cubes (by osmosis). 2
- (iii) Larger surface area (: volume ratio) of smaller cubes (for osmosis). 1

[6]

30. (a) Phospholipids and proteins;
 Phospholipid bilayer;
 Arrangement of phospholipid molecules „Tails to tails“;
 „Floating“(protein) molecules / molecules can move in membrane;
Intrinsic proteins extend through bilayer;
Extrinsic proteins in outer layer only;
 (*Ref. to intrinsic and extrinsic, unqualified, gains 1 mark*);
 Detail of channel proteins / protein shapes / glycoproteins;
 Presence of cholesterol. 5
- (b) (i) Random movement of oxygen molecules;
 (Net) movement from high to lower concentration;
 Molecules can pass between phospholipid molecules / through bilayer;
 Rate dependent on concentration gradient.
- (ii) Movement from high to lower concentration;
 Use of carrier / channel / intrinsic protein;
 Proteins specific (to glucose);
 Changes shape of protein and passes through channel / membrane;
 No energy/ATP needed.

- (iii) Movement against concentration gradient;
 Use of carrier/channel/intrinsic/pump proteins;
 Protein specific (to ion);
 Energy / ATP required;
 Energy used to change shape of proteins / attach ion to protein;
 Ions moved through membrane as proteins change shape / position. max 9

[14]

QWC Award 1 or 0 according to criteria

31. (a) (i) X 6.2; 1

(ii) Active transport / active uptake; 1

(b) Ref. to carrier/intrinsic/pore/gate/transport/pump proteins;
 Ref. to different numbers of carrier proteins;
 Ref. to specificity / different types of carrier proteins;
 Ref. to charge / size of ion; 2 max

(c) For respiration;
 Energy for active transport; 1 max

[5]

32. (a) Osmosis transports water;
 Proteins / carrier molecules not used / occurs through
 phospholipid bilayer; 2

(b) Jam has a lower (more -ve) water potential than the
 bacterial cytoplasm;
 Water leaves the bacteria;
 Effect (of water loss) on bacteria e.g. killed / chemical reactions
 cannot occur; 3

[5]

33. (a)

| Function | Phospholipids | Protein |
|------------------------------|---------------|---------|
| May act as hormone receptors | X | ✓ |
| May act as enzymes | X | ✓ |
| Involved in active transport | X | ✓ |

; ;

Mark as columns. All correct for 1 mark.

2

(b) Active transport/uptake;

Ions accumulated/move/go against a concentration gradient/highER

Concentration (inside root hair) (not larger number) (minerals = neutral);

2

[4]

34. (a) (i) Initial mass of cylinders not identical;
To be able to directly compare the results;

2

(ii) From 0.3 mol dm^{-3} to 0.1 mol dm^{-3} water moves into potato cells;
By osmosis;
So mass increases;
More water has entered potato cells 0.1 mol dm^{-3} / converse;

4

(iii) 0.35;
No mass change/no net osmosis/
volume of water in = volume of water out;

2

(b) Range from -511 to -549 kPa;
Reason e.g. Water moves from A to B, so must be lower than -510 and
Water moves from B to C, so must be higher than -550 ;

2

[10]

35. (a) increased / large difference in concentration / high concentration gradient /
large or steep diffusion gradient;
increased / high temperature;
increased / high pressure;
increased / large surface area;
short diffusion path / decreased membrane width;

3 max

- (b) the larger (the diameter) of the hole the greater the volume / amount / rate of gas diffusing;
the smaller the hole the greater the volume / amount / rate of gas diffusing per cm² of hole / unit area; 2 [5]
36. (a) diffusion / movement of water;
through a partially-permeable membrane;
(from less negative Ψ) to more negative Ψ / (from higher Ψ) to lower Ψ ; 3
- (b) (i) 5.55 cm gains 2 marks;
(allow 5.5 or 5.6 only if supported by correct working)
else evidence of $5.0 \div 0.9$ gains 1 mark 2
- (ii) T anywhere to left of 0.3 M; 1
W at 0.3 M; 1 [7]
37. (a) (i) solution hypotonic / cell cytoplasm hypertonic / cell has more negative Ψ / cell has fewer water molecules;
(references to strengths of solutions neutral)
entry of water / osmosis (causes cells to swell);
(max 1 mark if no reference to hypotonic / hypertonic) 2
- (ii) solution isotonic / cell and solution have same Ψ / same number of water molecules;
no net entry / loss of water;
(max 1 mark for if no reference to isotonic) 2
- (b) (so much water entered that) cells burst; 1 [5]
38. (a) $Y \rightarrow X$ / -800 to -1200, from less negative Ψ to more negative Ψ / higher water potential to lower water potential; 1

- (b) (i) takes salt (from the water)/stores/retains sugars/named solute; 1
- (ii) increasing solute concentration lowers water potential / water potential becomes more negative; 1
- (iii) water potential in cells is higher than the surrounding water;
water moves out of the cells;
by osmosis/diffusion;
water cannot be taken up by the plant/ plant loses water;
linked to metabolic reaction/photosynthesis;
(*reject cannot grow*) 4 max
- [7]**
- 39.** (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]**
- 40.** (a) passive/do not require energy/ATP;
movement down a concentration gradient / by diffusion;
go through phospholipid (bilayer) / not by protein/carriers;
(*not by active transport gains mark if no other mark awarded*) 2 max
- (b) active transport; 1
occurs when oxygen present because energy/respiration required,
or against a concentration gradient because there is no uptake in curve **Z**; 1
- (c) concentration inside cells higher than surrounding solution; 1
- (d) diffusion is proportional to the concentration gradient; 1
- [6]**
- 41.** (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
- 42.** (a) (i) potato more negative water potential/hypertonic;
(*accept more concentrated*)
water enters by osmosis;
cells extend/are turgid; 2 max
- (ii) little/no water remaining in potato/fully plasmolysed/all water
has moved out;
cell wall prevents further shrinkage/sucrose solution moves in;
or, water potentials are equal/equilibrium/isotonic;
no net movement of water/no further osmosis; 2
- (b) (i) faster rate (of decrease) in 0.8 mol dm^{-3} ; 1
- (ii) bigger water potential gradient/greater difference in water
potentials (between potato and surrounding solution); 1
- (c) (i) water moved into the solution from the potato;
solution diluted/becomes less concentrated; 2

[10]

- (ii) no net movement of water (in or out);
drops move up/less dense;
or, no net movement of water (in or out);
drop would not move/densities the same; 2 [10]
43. (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]
44. (a) (i) absorbed by diffusion;
no energy/ATP available / active transport requires energy/ATP; 2 max
(*disqualify energy made*)
(*allow energy reference in either (i) or (ii)*)
- (ii) absorbed by active transport; 1
- (b) (absorption by) diffusion no longer occurs / diffusion/movement
of ions equal in both directions; 2
because no concentration/diffusion gradient / reached equilibrium;
- (c) malonate fits into/blocks active site of enzyme / complementary to active site;
(prevents fitting neutral) 2
competes with substrate / is a competitive inhibitor / prevents substrate
forming enzyme-substrate complex; [7]
45. (a) cell has lower water potential than external medium;
so, water enters by osmosis; 2

- (b) (i) active transport;
by specific carrier proteins/pumps; 2
- (ii) sodium ions transported more into vacuole (than to outside);
because more sodium carrier proteins/pumps in vacuole membrane;
or
vacuole membrane less permeable to sodium ions/allows slower
sodium ion diffusion (back out);
membrane has fewer sodium channels; 2 max
- [6]**
46. (a) urea diffused into / entered the tubing;
urea hydrolysed / broken down (inside tubing);
ammonia increases pH / makes (solution) more alkaline;
indicator turns blue as pH above 8 / due to alkalinity / due to ammonia;
idea that outside stays yellow because urease does not pass out; 3 max
- (b) (i) add biuret solution / add sodium hydroxide + copper sulphate (solution);
(disqualify heat/boil, but accept warm)
violet/ lilac / purple colour; 2
- (ii) inside: protein present, as enzyme is protein;
outside: no protein, as urease/enzyme/protein unable to pass
through membrane/out; 2
- (accept correct result of biuret test as indicator of protein)*
- (c) method to maintain range of temperatures, e.g. water baths;
method to measure rate of activity - e.g. time taken to turn indicator blue;
*(principle - measure rate of activity over range of temperatures
= 1 mark, if neither point)*
other conditions kept constant / named examples, e.g. volumes of solutions,
starting pH, sample time;
method of refining optimum, e.g. repeats at narrower range; 3 max
- [10]**
47. (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]**
48. (a) Receptor;
Reference to tertiary structure of protein;
Complementary shape; 3
- Q Do not credit 'same shape' but allow suitable description of
complimentary shape.*
- (b) (i) Active transport;
Using ATP;
Carrier proteins; 3
- (ii) Water potential lowered in small intestine;
Osmotic loss of water; 2
- QWC First mark only credited if water potential is clearly
linked to intestine or blood*
- (c) Broken down by enzymes / not absorbed as molecules are too large; 1
- (d) Ensures memory cells produced; 1
- [10]**
49. (a) Lengthways/down the root;
Through one tissue only / through same part / same proportion of tissues; 2
- (b) To prevent the water from evaporating / prevent evaporation;
Changing the concentrations / water potential (of solution); 2

- (c) (i) Plot data on a graph;
Find (sucrose concentration) from the graph where the ratio is 1; 2
- (ii) No, because the results are given as a ratio/as a proportion of
initial length; 1

[7]

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