

Movement of substances

Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Cell Membranes and Transport
Sub Topic	Movement of substances
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : 74 minutes

Score : / 61

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) (i) transcription first process and exocytosis final process ;
correct order for remaining three processes (3, 4, 2) ; [2]
accept words and mixture of words and letters

(ii)

F ;
A / D
A ;
C
D ;

events	order of events	cell location (letter)
exocytosis	5	cell membrane ;
protein modification	3	A / D A+D Golgi and/or RER ,
secretory vesicle formation	4	Golgi ;
transcription	1	nucleus ,
translation	2	RER ;

[3]

- (b) 1 vesicle / vacuole, moves towards, cell, surface / membrane ;
A plasma membrane R if lysosome
2 fusion / described, of vesicle with membrane ; R attach / bind / combine
3 ref. to (fluid nature of) phospholipids ;
4 contents / AW, secreted / released / exported / removed / emptied / excreted ;
A waste material / digested material
5 active process / energy-requiring / ATP used / AW ;
R 'active transport' R endocytosis [max 3]

- (c) (i) AUG ; [1]

- (ii) 1 secondary structure / α -helix / β -(pleated) sheet ;
2 tertiary structure / description / folding / complex 3D shape ;
3 formation of named bond(s) ; R if peptide bond in list
4 quaternary structure / description (e.g. assembly of polypeptides) ;
5 glycosylation / formation of glycoproteins / addition of carbohydrate(s) or sugar(s) ;
R hydrocarbon chain
6 addition of, non-protein portion(s) / prosthetic group(s) / named example ;
A haem / iron / Fe / copper / Cu / magnesium / Mg / AW
7 removal of some amino acids ; R one amino acid
8 polypeptide(s) cut into two or more pieces ;
9 AVP ; e.g. ref. to exposure to water molecules and folding
R ref. to amino acids coded for by stop codons [max 2]

[Total: 11]

- 2 (a) **G** to cells in centre ;
 R to surrounding white area ; [2]
- (b) ADH ; [1]
- (c) (i) (too) large / MM > 68 000 ;
 to pass through basement membrane ; **R** gaps / wall [2]
- (ii) reabsorbed ;
 in proximal convoluted tubule ; [2]
- (iii) 1. more urea in urine than in filtrate / ora ; **A** comparative figs
 2. water is reabsorbe ;
 3. in, distal convoluted tubule / collecting duc ;
 4. mo urea stays in urine ; **R** all urea stays
 5. other substances are reabsorbe ; [2 max]

[Total:9]

CHEMISTRY ONLINE
— TUITION —

Question	Expected Answers	Marks
3 (a)	control / maintain, water / solute, concentration / potential ; of, body fluids / internal environment / cells ;	2
(b)	<ol style="list-style-type: none"> 1 B / C, lower ψ than A ; <i>accept C lower ψ than B</i> <i>accept ψ gets more negative as fluid moves down descending limb</i> 2 comparative figs ; 3 water moves out by, diffusion / osmosis ; 4 into, medulla tissue / tissue fluid ; 5 D / E, higher ψ than C ; <i>accept ψ gets less negative as fluid moves up ascending limb</i> 6 comparative figs ; 7 Na^+ / Cl^-, move out ; 8 into, medulla tissue / tissue fluid ; 9 by active transport ; 10 A and E same ψ / AW ; <i>penalise once for no units</i> <i>allow either 4 or 8</i> 	5 max
(c)	receptor – hypothalamus ; effector – pituitary gland / cells or walls of collecting duct ; R anterior pituitary	2

[Total: 9]

CHEMISTRY ONLINE
— TUITION —

4 (a)

structural feature	triglyceride	phospholipid
phosphate (group)/contains phosphorus	✗	✓
nitrogen	✗	✓
charged / polar	✗	✓
(number of) fatty acids	3	2
number of ester bonds	3	2
number of phosphate ester bonds	0	
<i>award one mark for any of the following comparisons</i>		
number of double bonds (in hydrocarbon chain)	0	1
number of saturated fatty acids / ORA	3	1
presence of double bonds	✗	✓
presence of unsaturated fatty acids	✗	✓

These are alternatives – award on mark only

[max 2]

(b) *answer may be phrased in the context of amylase/trypsin ignore anything before Golgi, e.g. shuttle vesicles from RER*

- 1 vesicles, form from / 'pinch off', Golgi (apparatus / body / complex) ;
- 2 vesicles moves, through cytoplasm / to cell (surface) or plasma membrane ;
- 3 role of cytoskeleton / microtubules in movement of vesicles ;
- 4 energy / ATP, is required (movement of vesicles / fusion with membrane) ;
- 5 vesicle fuses with / AW, cell (surface) / plasma, membrane ;
I bind / attach A join / merge / becomes part of
- 6 exocytosis / vesicle 'opens up' so that enzyme molecules are released ;
- 7 ref to fluid nature of, membranes / phospholipid bilayer, that makes this possible ;

[max 4]

(c)

role of water	property of water
solvent for glucose and ions	dipolar / polar ; A description of polarity of water
transport in the xylem	hydrogen bonding ; I cohesion / adhesion
helps to decrease body temperature in humans	high latent heat of vapourisation / high specific heat (capacity) / high enthalpy heat of vapourisation / lots of energy required for evaporation ;

[3]

[Total: 9]

CHEMISTRY ONLINE
— TUITION —

- 5 (a) **P** – moves, polar substances/hydrophilic molecules/ions, through membrane/in or out (of cells) ;
A facilitated diffusion/active transport/described
- Q** – receptor/recognition site/cell recognition/binding site ;
A cell adhesion/‘receives’ named signal
A stabilises membrane (as forms hydrogen bonds with water)
- R** – regulates/AW, fluidity of, membrane/(phospholipid) bilayer ;
A contributes to hydrophobic layer/impermeability to ions [3]
- (b) 7.0 nm ; [1]
- (c) *fluid*
idea of phospholipid (and protein) molecules, move about/diffuse (within their monolayer) ;
- mosaic to max 1*
 protein (molecules), interspersed/scattered/not a complete layer/AW ;
 different/AW, proteins (molecules) ; [max 2]
- (d) 1 water molecules are polar ;
R hydrophilic/charged
- 2 *idea that* few polar molecules pass through the phospholipid (bilayer) ;
ora for non-polar molecules
A none pass/repelled
- 3 core of membrane/phospholipid tails, are hydrophobic ;
A hydrophobic core
- 4 channels (through aquaporins), are hydrophilic ;
A core of channel proteins/described as R-groups of amino acids
- 5 (aquaporins) increase permeability of membrane to water ;
- 6 example ;
 e.g. root hairs/small intestine epithelium/nephron
- 7 role of water in a cell ;
 e.g. solvent/reactant/reaction medium/turgidity or support in plant cell
ignore references to osmosis/bursting/crenation/regulation 3]

[Total: 9]

- 6 (a) 1 electron microscope has, higher / AW, resolution (than LM) / ora ;
 2 explanation of resolution as ability to differentiate between two points (close together) ;
 3 ref. to (internal) membranes (of **A** and **B**) which cannot be seen in LM ;
 A named membranes e.g. cristae, grana
 4 AVP ; e.g.
 (resolution of) EM is 0.5 nm (0.0005 μ m) and LM is 200 nm (0.2 μ m)
 A 0.5 to 1 nm (0.001 μ m)
 resolution is equal to half the wavelength (of medium used)
 ref. to shorter / AW, wavelength (of electrons) / ora (must have a comparison)
 ref. to, width of membranes / distance apart of membranes, e.g. width of membranes
 in A and B is 7 nm (+/- 1) [max 3]
- (b) **C** – rough endoplasmic reticulum ; *penalise once only for ER instead of endoplasmic reticulum*
D – ribosome ; **A** ribosomes ignore 70S
E – smooth endoplasmic reticulum ; **A** smooth ER if full term used for **C**
*award one mark if **E** = rough endoplasmic reticulum and **C** = smooth endoplasmic reticulum* [3]
- (c) any one relevant e.g.
 store of / holds, cell sap ; **R** if contains organelles
 store of / holds, water / ions / named ion(s) / minerals / salts / pigments / (named) sugars ;
 R substances / molecules
 R storage unqualified
 pushes chloroplast to edge of cell ;
 gives, turgidity / turgor pressure / hydrostatic pressure / support / AW ;
 A makes, firm / rigid
 A controls / maintains, turgidity
 R gives shape / strengthen
 store of / holds, waste (products)
R reactions occur in vacuole, unqualified [1]

(d) no marks for identifying **F** and **G**

if only **F** or **G** described max 3

if **F** and **G** incorrectly identified, accept mark points correctly linked to membrane and wall to max 3

- 1 **F** partially permeable A selectively permeable
and G (fully / freely / AW), permeable / porous ;

***F** is partially permeable cell surface membrane*

- 2 phospholipid (bilayer);
3 permeable to, lipid-soluble molecules / oxygen ;
 A other terms for lipid-soluble
 treat reference to water as neutral
4 impermeable to, water-soluble / AW, molecules / ions / AW ;
 A other terms for water-soluble
 treat reference to water as neutral
5 aquaporins / proteins, provide (increased) permeability to water ;
6 transport proteins provide permeability to, ions / polar molecules ;
 A channel / pore / carrier, proteins

G is permeable cell wall

- 7 cellulose ;
8 fibres ;
9 ref. to, spaces / gaps / holes / pores, (between, fibres / other cell wall components) ;

[max 4]

- (e) 1 allows transport of, water / sucrose / amino acids / organic substances / ions / minerals / salts / lipids / hormones / ATP, (from cell to cell / between cells) ;

R if linked to an incorrect transport mechanism e.g. sucrose moves by osmosis

- 2 without crossing, membranes / walls ; **A** without going through protein channels
3 this is movement through the symplast ;
4 any e.g. ; companion cell to (phloem) sieve tube (element / cell)
 between mesophyll cells
 mesophyll cell to companion cell
 cortical cell to cortical cell / across cells of the cortex
 cortical cell to endodermal cell
 endodermal cell to, pericycle cell / xylem / phloem
 ignore between sieve tube elements

- 5 allows, communication / signalling, between cells ;

[max 3]

[Total: 14]