

Transport across cell membranes 2

Level: CIE A Level 9700

Subject: Biology

Exam Board: Suitable for all boards

Topic: Transport across cell membranes 2

Type: Mark Scheme

To be used by all students preparing for CIE Biology A Level 9700 foundation or higher tier but also suitable for students of other boards.

Mark schemes

- 1**
- (a) Does not have the resolution / cannot distinguish between points this close together;
As light has longer wavelength;
The key ideas in marking this part of the question are resolution and wavelength. 2
- (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; 2
- [7]**
- 2**
- (a) 1. Cell wall not formed / production inhibited;
1. Q Accept: weakened cell wall, but do not accept 'cell wall is broken down'
2. Lower water potential in bacterium;
2. Accept: converse
2. Must be clear that the lower water potential is in the bacterium
3. Water enters and causes lysis / expansion / pressure; 2 max
- (b) Human cells lack enzyme (**B**) / have a different enzyme / produce different fatty acids
/ use different substrates;
Neutral: 'human cells do not have cell walls' as out of context 1
- (c) 1. Change in base sequence (of DNA / gene) leading to change in amino acid
sequence / primary structure (of enzyme);
1. Accept: different amino acids coded for
1. Reject: different amino acids produced
2. Change in hydrogen / ionic / disulphide bonds leading to change in the tertiary
structure / active site (of enzyme);
2. Neutral: alters 3D structure / 3D shape
3. Substrate not complementary / cannot bind (to enzyme / active site) / no
enzyme-substrate complexes form; 3
- [6]**



3

- (a) 1. Flatten / moves down;
1. Ignore: additional information about rib movements
2. (Diaphragm muscle) contracts; 2
- (b) 1. Diaphragm contracts / moves down / flattens;
Ignore refs to rib movement
2. Increases volume (of thorax) and decrease in pressure;
2. Accept pressure lower than atmospheric pressure
3. Air moves from high to lower pressure / down pressure gradient;
3. Reject: by diffusion 3
- (c) 1. Diffusion;
Accept down diffusion gradient
2. Across (alveoli) epithelium / (capillary) endothelium;
2. Accept: capillary epithelium / squamous cell 2 max

[7]

4

- (a) 2 marks for correct answer 0.2
Accept concentration \div time
- 1 mark for 6 / 30; 2
- (b) 1. (Uptake) decreases / slower, then no further uptake / uptake stops;
2. (Decreases) to 20 - 22 / no uptake after 20 / 22 minutes;
Accept: (only) 1.6 (arbitrary units) absorbed / (only) drops to 8.4
Is for correct use of data from graph 2
- (c) 1. Stops / reduces / inhibits respiration;
Accept: inhibits respiratory enzymes
2. No / less energy released / ATP produced;
Ignore: less energy produced / made
3. (ATP / energy needed) for active transport;
Accept ref to Na⁺ pump / description of active transport
Ignore consequences of less Na⁺ in cell 3

[7]



5

- (a) 1. Add Benedict's;
Hydrolyse with acid negates mp1
2. Heat;
Accept warm, but not an unqualified reference to water bath
3. Red / orange / yellow / green (shows reducing sugar present);
Accept brown
- (b) (i) 1. Starch hydrolysed / broken down / glucose / maltose produced;
Neutral: Sugar produced
2. Lower water potential;
3. Water enters by osmosis;
- (ii) Only 2 pHs studied / more pHs need to be tested;
Accept: different amylase may have a different optimum pH

3

3

1

[7]

6

- (a) Hydrolysis (reaction);
Accept phonetic spelling
- (b) 1. Too big / wrong shape;
Wrong charge - neutral
Accept insoluble
2. To fit / bind / pass through (membrane / into cell / through carrier / channel protein);
3. Carrier / channel protein;
Accept carrier / channel protein not present

1

3



(c) Foreign / (act as) antigen / non-self;
Reject foreign cells 1

(d) 1. Dose to be given;
Accept: interaction with other drugs

2. No (serious) side effects;

3. How effective;

4. Cost of drug; 2 max

[7]

7 (a) (i) 1. Increases (surface) area / inside surface exposed / more cells exposed / shorter distance for water to move;

2. Producing water loss;
Accept better answers, such as diffusion or osmosis relating to water loss. 2

(ii) 1. Sucrose solution / water / liquid (on the slices) would add to the mass / weight of the slices;

2. Would vary;
Ignore references to reliability 2

(b) This is initial mass / the time is too short for water to have left / the time is too short for osmosis / have not been treated; 1

(c) 1. Percentage loss in mass increases with time;

2. Texture decreases then levels out;
Only credit answers that refer to decreasing and levelling out.

3. (Texture levels out) after first 2 hours; 3



- (d) 1. Plot graph of percentage loss in mass against time;
2. Draw curve (of best fit);
Although curve is the technical term accept references to line etc
3. Extrapolate / record when no further change in mass / record when curve flattens out;

3

[11]

- 8** (a) (i) Diffusion;
Ignore references to structures, membrane components etc
Allow simple diffusion
Reject facilitated diffusion
- (ii) 1. (Thin / flat body) so short distance for diffusion / short diffusion pathway;
Ignore references to membrane, wall, body surface
2. (Thin / flat body so) large surface area to volume ratio;
'It' refers to flatworm's body

1

2

- (b) (i) A group of tissues;
Ignore references to function Group = more than one

1

- (ii) 1. (Carbon dioxide enters) via stomata;
Reject stroma
2. (Stomata opened by) guard cells;
3. Diffuses through air spaces;
Allow concentration gradient. Reject along gradient unless direction made clear
4. Down diffusion gradient;

3 max

[7]

- 9** (a) (i) 1. Allows results to be compared;
2. Because initial masses may have been different;
- (ii) 1. Quantitative measure (of cooking);
2. Ensures all cooked to same extent as not all turkey pieces same shape / thickness;
2 Emphasis here must be on being cooked to the same extent. Do not accept reference to all being cooked.

2

2



- (iii) 1. (Yes) Loss of water results in loss in mass;
2. (No) Loss of other substances / other substances being burnt;
No marks should be given for "Yes" or "No"

2

- (b) 1. Water potential in brine lower than in cells / meat;
Accept water potential more negative or converse answers
2. Water would move out of the meat / water does not move out of the meat;

2

[8]

10

- (a) (i) 1. Water potential same (inside and outside) / no water potential gradient;
Accept symbol Ψ or abbreviation WP as alternatives to water potential.
2. Water does not enter / leave spores;
3. By osmosis / prevents osmotic damage;
Answer must refer to osmosis.

2 max

- (ii) Prevents growth (before ready) / stops growth of (other) microorganisms / slows enzyme action / prevents enzymes being denatured;

1

- (b) 1. Nitrogen / N / sulfur / S;
2. Catalase is a protein / catalase is made up of amino acids / enzymes are proteins / enzymes are made up of amino acids;
Specific reference needed to proteins or amino acids.

2

- (c) 1. Prevents contamination by (other) microorganisms;
Accept alternatives such as microbes, bacteria, other fungi.
2. Which also produce the enzyme / catalase / which would produce substances that affect catalase;

2

- (d) (i) 90 hours;
Hours must be specified in answer to (c)

1

- (ii) 70 – 80 (hours);
*Allow with no reference to units.
Incorrect units negates answer.*

1



- (e)
1. Extra steps (with intracellular enzymes);
 2. Cells have to be broken open;
 3. Cell walls / bits of cells have to be removed / separated from enzyme;
 4. Needs to be separated from all the other enzymes in the cell;

2 max

[11]

- 11**
1. Vaccines contain antigens / dead / weakened pathogens / antigens dead / weakened pathogens are injected;

Ignore references to T or B cells.

2. Memory cells made;
3. On second exposure memory cells produce antibodies / become active / recognise pathogens;

3. Idea of memory cells responding.

4. Rapidly produce antibodies / produces more antibodies;

4. Production of antibodies must be qualified for mark. Underlined ideas essential.

5. Antibodies destroy pathogens;

5. Accept bacteria / viruses etc but not disease

[5]

- 12**
- (a) Nitrification;

Accept nitrifying.

Do not accept nitrogen fixing.

1

- (b) 1. Uptake (by roots) involves active transport;

Reject all references to bacteria

2. Requires ATP / aerobic respiration;

2

- (c) (i) 1. Not enough time / fast flow washes bacteria away;

*“Not enough time for bacteria to convert all the ammonia to nitrate”
gains 2 marks*

2. (Not all / less) ammonia converted to nitrate / less nitrification;

2



- (ii) 1. Algal bloom / increase in algae blocks light / plants / algae die;
2. Decomposers / saprobionts / bacteria break down dead plant materials;
3. Bacteria / decomposers / saprobionts use up oxygen in respiration / increase BOD causing fish to die;
3. *Accept alternatives such as microbes / saprophytes.*

3

[8]

13

- (a) 1. Uses energy / ATP;
2. Against concentration gradient / low to high concentration;
3. Does not use channel proteins / only uses carrier proteins;
Assume "it" refers to active transport.
1. *Facilitated diffusion is passive - neutral*
2. *Along / across concentration gradient - neutral*
Accept up / down concentration gradient
Accept AT does not need concentration gradient.

2 max

- (b) (i) To see the effect of the drug / effect not due to anything else in the tablet;
Neutral "to compare results"

(ii) Placebo / dummy drug / tablet without drug;
(Otherwise) treated the same;
No drug - neutral
Accept: Example e.g. tablet given at same time

(c) Decrease for 3 hours;
Accept decreases from 1 - 4 hours

1

2

1

[6]

14

- (a) (i) Hydrolysis;
Accept phonetic spelling.
Ignore reaction.

(ii) (Alpha) glucose;
Accept α glucose.
Reject β glucose / beta glucose

1

1



(b) (i) Add Benedict's (reagent) and heat / warm;

Red / orange / yellow / green (colour);

Reject Add HCl

Accept brown, reject other colours

2

(ii) 2 products / 2 sugars produced;

*Look for idea of **two***

Accept named monosaccharides produced.

"More" insufficient for mark

Neutral if incorrect products named

Neutral "lactose is a polysaccharide"

Neutral "lactose is not a reducing sugar"

Neutral: Reference to surface area.

1

(c) 1. Galactose is a similar shape / structure to lactose / both complementary;

Q Reject: Same shape / structure

2. (Inhibitor / Galactose) fits into / enters / binds with active site (of enzyme);

Accept blocks active site

3. Prevents / less substrate fitting into / binding with (active site) / fewer or no E-S complexes;

Look for principles:

1. Shape

2. Binding to active site

3. Consequence

2 max

[7]

15

(a) Cell wall;

Starch (store);

Chloroplast;

Accept: phonetic spelling

2 max

(b) Insoluble;

Reduces / 'stops' water entry / osmosis / does not affect water potential / is osmotically inactive;

Accept: description for first point e.g. 'does not dissolve'.

2



(c) Light sensitive eyespot / eyespot detects light;

Flagellum enables movement towards light;

Chloroplast / chlorophyll absorbs light / for photosynthesis;

Do not penalise references to 'many chloroplasts'.

3

[7]

16

(a) Water will affect the mass / only want to measure water taken up or lost;

Amount of water on cylinders varies / ensures same amount of water on outside;

Neutral: removes water

Accept: '(sodium chloride) solution' for water

Do not accept 'sodium chloride'

Neutral: refs. to fair testing

2

(b) 4 cm^3 (of 1.0 mol dm^{-3} sodium chloride solution) and 16 cm^3 (of distilled water);

Reject: factors and multiples of these figures e.g. 2 cm^3 and 8 cm^3 , as final volume should be 20 cm^3

1

(c) Allows comparison / shows proportional change;

Idea that cylinders have different starting masses / weights;

Reject: if comparison is in context of the start and final mass of the same cylinder

Neutral: different masses

Neutral: different starting sizes

2

(d) (Allows) anomalies to be identified / ignored / effect of anomalies to be reduced / effect of variation in data to be minimised;

Makes the average / mean / line of best fit more reliable / allows concordant results;

Accept: 'outliers' instead of anomalies

Q *Reject: abnormalities*

Reject: idea of not recording anomalies / preventing anomalies from occurring

Accept: 'cancels out anomalies' as bottom line response

Q *Reject: makes the average / mean more accurate*

Neutral: makes the average / mean more valid

Neutral: makes 'it' / results / conclusion more reliable

2

(e) $0.35 \text{ (mol dm}^{-3}\text{)}$

1

[8]



17 (a) 1. (Simple / facilitated) diffusion from high to low concentration / down concentration gradient;

Q Do not allow across / along / with concentration gradient

2. Small / non-polar / lipid-soluble molecules pass via phospholipids / bilayer;

Reject: named molecule passing through membrane by an incorrect route

Accept: diagrams if annotated

OR

Large / polar / water-soluble molecules go through proteins;

3. Water moves by osmosis / from high water potential to low water potential / from less to more negative water potential;

4. Active transport is movement from low to high concentration / against concentration gradient;

Only penalise once if active transport is not named

e.g. 'movement against the concentration gradient involves proteins and requires ATP' = 2 marks

5. Active transport / facilitated diffusion involves proteins / carriers;

Accept: facilitated diffusion involves channels

Reject: active transport involves channels

6. Active transport requires energy / ATP;

7. Ref. to Na⁺ / glucose co-transport;

Credit ref. to endo / exocytosis as an alternative

5 max

(b) 1. Many alveoli / alveoli walls folded provide a large surface area;

Neutral: alveoli provide a large surface area

2. Many capillaries provide a large surface area;

3. (So) fast diffusion;

Neutral: greater / better diffusion

Neutral: fast gas exchange

Allow 'fast diffusion' only once

4. Alveoli or capillary walls / epithelium / lining are thin / short distance between alveoli and blood;

Reject: thin membranes / cell walls

Accept: one cell thick for 'thin'



5. Flattened / squamous epithelium;
Accept: endothelial
6. (So) short diffusion distance / pathway;
7. (So) fast diffusion;
8. Ventilation / circulation;
Accept: descriptions for ventilation / circulation
9. Maintains a diffusion / concentration gradient;
10. (So) fast diffusion;
*Do not double penalise if description lacks detail
e.g. thin membranes so a short diffusion distance = 1 mark*

5 max

[10]

18

- (a) (i) (Lactose +) Water; → (Glucose +) Galactose;
Accept: H₂O for water

2

- (ii) Hydrolysis;
Accept: if phonetically correct

1

- (b) (i) (Add Biuret reagent to both solutions) – no mark;
Neutral: positive / negative result

Lactase / enzyme will give purple / lilac / mauve;
Neutral: incorrect reference to the method

OR

Lactose / reducing sugar will not give purple / lilac / mauve / will remain blue;

1

- (ii) Lactase / enzyme is a protein;
Accept: lactase / enzyme contains peptide bonds

1

[5]

19

Affects germination of Y more than (germination of) X;

After four days:

No effect on (germination of) X up to 15 (mmol dm⁻³) and then constant decrease /
(causes) sharp decrease in (germination of) Y up to 15 (mmol dm⁻³) and then more gradual decrease;



After eight days:

Decrease in (germination of) X up to 45 (mmol dm⁻³) and then no further decrease / sharp decrease in (germination of) Y up to 15 (mmol dm⁻³) and then more gradual decrease;

[3]

20

(a) (i) 1.08;

Must be to 3 significant figures, as in the table

1

(ii) Allows comparison / shows proportional change;

Neutral: sizes / amounts

Idea that discs had different starting masses / weights;

Neutral: different masses

2

(iii) (Allows)

Accept: outliers instead of anomalies

Anomalies to be identified / effect of anomalies to be reduced / effect of variation in data to be minimised;

Reject: idea of not recording anomalies / preventing anomalies from occurring

A mean to be calculated;

Neutral: average

2

(b) (i) Plot (sodium chloride) concentration against ratio / draw line of best fit;

Reject: if wrong axes or type of graph

Find (sodium chloride concentration from the graph) where the ratio is 1 / there is no change in mass;

2

(ii) Line / curve of best fit is more reliable / precise;

Neutral: graph

Intercept / point where line crosses axis is more reliable / precise;

Reject: references to 'more accurate'

OR

Can plot SD values / error bars;

(To show) variability about the mean / how spread out the results are;

2

[9]



- 21** (a) (Blood) plasma; 1
- (b) More / larger proteins / less urea / carbon dioxide / more glucose / amino acids / fatty acids / oxygen / high(hydrostatic) pressure;
Q Reference to blood cells / water potential = neutral
Q No Protein should not be credited 1
- (c) (i) Contracts;
Q Do not accept pumping of heart / heart beating 1
- (ii) Loss of fluid / volume;
Friction / resistance (of capillary wall);
Q Reference to a narrow lumen is not sufficient to gain a mark unless friction or resistance is mentioned. 1 max
- (d) Water potential (in capillary) not as low / is higher / less negative / water potential gradient is reduced;
More tissue fluid formed (at arteriole end);
Less / no water absorbed (into blood capillary) by osmosis; (into blood capillary);
Q The last two marking points must be in context of movement into the blood capillary 3

[7]

- 22** (a) No effect on dry mass / small increase in dry mass;
Decrease in fresh mass;
Ignore reference to figures. 2
- (b) Water potential inside tomato plant becomes higher / less negative;
Water drawn out of tomato plants / more difficult for tomato plants to take up water;
By osmosis;
Most of the fresh mass is (mass of) water; 3 max

[5]



- 23** (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
- 24** (a) (i) Many people do not go to the doctor; 1
- (ii) 36000;
No marks awarded for working here as calculation is very straightforward 1
- (b) Same sugars / antigens on bacteria / nerve cells;
Do not accept references to same shape as equivalent to complementary.
Bind with antibody / form antigen-antibody complex;
Reject react
Have complementary shape / fit binding site;
Reject active site 3
- (c) Diaphragm will not move down / flatten / contract;
Ignore references to breathing out
Thoracic cavity / lung volume not increased so cannot breathe in; 2
- 25** (a) (i) no cell wall / only has (plasma) membrane; 1
- (ii) has capsule / slime layer; 1
- (b) correct approach which makes use of scalebar; *ignore reference to units.* 1

[7]

[7]



(c) cellulose / starch / amylose / amylopectin; 1

(d) (i) water potential lower / more negative in cell;
(water enters by) osmosis; 2

(ii) plant cell wall made of a different substance / cellulose / penicillin
does not affect cellulose; 1

[7]

26

(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;
Reject divide apparent length by magnification 2

(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;
Reject osmosis takes time 1

(ii) Line / curve of best fit; Extrapolate (and read off) / find where it crosses x-axis; 2

(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]

27

(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]



28

- (a) Several / more than one polypeptide chain in molecule;
Evidence must only relate to 4^o structure 1
- (b) Chemical bonds formed between sulphur-containing groups /
R-groups / form stronger disulphide bonds;
Bind chain(s) to each other; 2
- (c) Different number / sequences of amino acids;
Bonds in different places which gives different shape; 2
- (d) Outer layer of skin cells are dead / do not respire
Do not contain mitochondria / do not produce ATP / release energy;
Cells do not have required proteins / carriers; 3
- (e) Advantages:
- 1 Small objects can be seen;
 - 2 TEM has high resolution as wavelength of electrons shorter;
Accept better
- Limitations:
- 3 Cannot look at living cells as cells must be in a vacuum;
 - 4 must cut section / thin specimen;
 - 5 Preparation may create artefact
 - 6 Does not produce colour image;

6

[14]

29

- (a) greater rate of oxygen consumption / leads to greater rate of respiration and greater rate of uptake;
(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
- 30** (a) antibiotic has diffused / spread / moved into agar;
killed / inhibited bacteria; 2
- (b) largest clear area / inhibition zone / killed the most bacteria; 1
- (c) disrupts cell wall / prevents cell wall synthesis;
stops DNA replication; 2
- [9]
- [5]



31

- (a) (i) Made of (different) tissues / more than one tissue; 1
- (ii) 1. (Muscle) contracts;
Assume that 'they' or 'it' = muscle
2. (Arteriole) narrows / constricts / reduces size of lumen / vessel / vasoconstriction;
Ignore: references to pressure
Q *Correct context for muscle contracts, vessel constricts* 2
- (b) (i) Short diffusion distance / pathway;
Accept: thin diffusion pathway 1
- (ii) (More) time for exchange / diffusion (of substances);
Accept: example of more time for specific substance to be exchanged 1
- (c) 1. Water potential (in capillary) not as low / is higher / less negative / water potential gradient is reduced;
Accept: 'blood or plasma' instead of 'capillary'
2. Less / no water removed (into capillary);
Accept converse: water remains in the tissue
3. By osmosis (into capillary);
Q *Marking points 2. and 3. must be in the context of movement into the capillary*
Neutral: reference to more tissue fluid being formed as in the question stem
Neutral: reference to lymphatic drainage 3

[8]