

# Transport mechanism

## Mark Scheme 1

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Transport in plants
Sub Topic	Transport mechanism
Booklet	Theory
Paper Type	Mark Scheme 1

Time Allowed : 66 minutes

Score : / 55

Percentage : /100

Grade Boundaries:

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

- 1 (a) (i) B ; [1]
- (ii) D ; [1]
- (iii) A ; [1]
- (b) (i) amylose/amylopectin/glycogen ; A starch [1]
- (ii) part 1 is saturated / part 2 is unsaturated ;  
part 1 has no double bonds / part 2 has one double bond ;  
part 1 has 27 hydrogens and part 2 has 25 ;  
A part 1 has more hydrogens ora [max 1]
- (iii) any two from:  
ionic / electrovalent (bond) ;  
hydrophobic (interaction) ;  
hydrogen (bond) ;  
disulfide (bond) ;  
A Van der Waal's (forces) [max 2]
- [Total: 7]

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2 (a) *max 3 if no attempt at comparison*

*evaporation*

- 1 formation of water vapour from water / conversion of water from liquid (form) to gas(eous form) ;
- 2 requires, energy / heat ;
- 3 (water loss) from, surface / cell walls, of (spongy) mesophyll (cells);

*transpiration*

- 4 idea of loss of water vapour, to external atmosphere / from the aerial parts of a plant ;  
**A** from leaves
- 5 ref. diffusion, down water potential gradient / from high to low water potential / from less negative to more negative water potential ; **A**  $\Psi$  for water potential
- 6 through stomata ;

*air spaces*

- 7 correct ref. to, intercellular / air, spaces ; e.g. evaporation into air spaces, diffusion from air spaces through stomata [max 4]

(b) (i) *max 3 if no attempt at explanation*

*penalise once for lack of units*

*mp for describing shown by (D)*

*mp for explaining shown by (E)*

*temperature*

- T1** (D) (mean) transpiration rate hot dry day lower than warm dry day ;  
**A** lower than warm rainy day **A** lowest rate
- T2** (D) comparative data quote to support ;
- T3** (E) stomata close to prevent excess water loss / excessive water loss causes closure of stomata ; **AW**

*humidity*

- H1** (D) (mean) transpiration rate warm dry day higher than warm rainy day ;  
**A** highest rate
- H2** (D) data quote to support ;
- H3** (E) decrease in / low, humidity increases rate of, transpiration / evaporation / diffusion ; ora
- H4** (E) more steep / **AW**, water potential gradient ;

*stomatal density*

- S1** (D) peach (mean) transpiration rate, lowest / lower than, apple / sour cherry ;
- S2** (D) data quote to support ;
- S3** (E) ref. (far) fewer stomata ( $\text{mm}^{-2}$ ) so less water (vapour) lost ;

**AVP ; e.g. ref. ABA and stomatal closure (T)**

less water (vapour) leaves plant as only cuticular transpiration possible (**T**)

ref. to higher rate for apple (dry days) and suggestion that stomata are larger [max 4]

- (b) (i) decreased / lower, rate during night ; ora  
stomata closed at night ; ora  
further detail ; e.g. closed to prevent water loss  
closed as no photosynthesis  
no light for photosynthesis  
open (during day) for, gas exchange / CO<sub>2</sub> in [3]
- (iii) peach / *Prunus persica* / *P. persica* ; [1]
- (c) (i) (repairing damaged DNA) reduces risk of cancer ; **A** prevents  
further detail ; *in context of reducing risk*  
e.g. because tobacco smoke contains mutagens  
because tobacco smoke contains carcinogens  
ref. to mutation (as result of damaged DNA) [2]
- (ii) reduces risk of, chronic bronchitis / emphysema / COPD ;  
further detail ; *in context of reducing risk*  
e.g. (reducing inflammation)  
reduces risk of infection  
prevents excess mucus production **R** if linked to emphysema  
prevents alveolar wall breakdown **R** if linked to bronchitis  
no / less, scar tissue forms [2]

[Total: 16]

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3 (a) potometer ; **A** transpirometer **R** photometer **R** spirometer

(b) *idea that*

water taken up may not all be lost in transpiration / transpiration is water loss (as water vapour) from (aerial parts / leaves, of) the plant ;

example of use of water taken up ;; e.g.

photosynthesis

hydrolysis reactions

maintaining turgidity / AW

cell, elongation / increase in size

ref. to water uptake rate and transpiration rate differing because of (changing) environmental conditions ; **A** examples e.g. higher transpiration rate than uptake rate in hot and dry external conditions [max 2]

(c) (i) *if no mp 1 and 2, accept increased rate of transpiration for one mark*

1 increased rate of evaporation ; **A** description of evaporation

**R** evaporation, from leaf / from stomata / through stomata

2 increased rate of diffusion ; *in context of water vapour out through stomata*

3 (rise in temperature), lowers (relative) humidity / decreases water potential of air (outside leaf) ;

4, 5 AVP ;; e.g. increased kinetic energy

steeper water potential gradient established *in correct context*

details of cohesion-tension theory linked to increased, transpiration / water uptake, rate

increased rate of photosynthesis

replacing water lost from cells in leaf [max 3]

(ii) humidity ;

wind (speed) ; **A** air movements

light intensity ;

(air) pressure ; [max 2]

(d) 1 stomata (must be) open for, gas exchange / uptake of carbon dioxide ; **A** release of oxygen

2 carbon dioxide for photosynthesis ; **A** oxygen from photosynthesis (when rate exceeds rate of respiration)

3 (most) water vapour, diffuses / AW, out, via / AW, (open) stomata ;

**A** most transpiration occurs when stomata are open

**R** if incorrect transport mechanism used e.g. osmosis [3]

[Total: 11]

- 4 (a) (i) active, transport / uptake ; [1]  
 carrier / transport, protein ; **A** pump protein **R** channel protein  
 ref. (protein) changing shape / conformational change ;  
 ref to specificity ;  
 ATP / energy, required ; [max 2]
- (ii) ATP / ADP / DNA / RNA / nucleic acid / NADP / phospholipid ;  
**A** nucleotide / named nucleotide / nucleoside **A** phospholipid bilayer [1]
- (b) (i) W in the central X-shaped region ; [1]
- (ii) osmosis *in correct context* ; e.g. through, cell surface / partially permeable, membrane or  
 into, cytoplasm / cell  
 diffusion, into / through, cell walls ;  
 from (region of), high(er) / less negative, water potential, to (region of), low(er) / more  
 negative, water potential *or* down a water potential gradient ;  
 transpiration pull ; [max 2]
- (iii) through cortex / via cortical cells ;  
*apoplast pathway*  
 (by) via cell walls (of adjacent cells) ; **R** if named as symplast pathway ;  
*symplast pathway*  
 via cytoplasm and plasmodesmata ; **R** if named as apoplast pathway  
 ref. vacuolar pathway ;  
 ref. apoplast to symplast / pathway described, at endodermis ;  
 (via) passage cells ;  
 ref to, suberised / Casparian, strip ; *in correct context* [max 4]

**[Total: 11]**

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5 (a) (phloem) sieve plate ; [1]

(b) (i) sucrose / amino acids / named amino acid / AVP ; R sugar [1]

(ii) source – leaf / named photosynthetic part ;  
sink – roots / seeds / fruits / petals / bud / named non-photosynthetic part ; [2]

(c) accept, assimilate / named assimilate, throughout  
allow ecf from (b)(i)

- 1 + / protons, (move) out of companion cells by, active transport / AW ;  
R diffuse by active transport
- 2 + / protons, diffuse (back) in with / cotransport sucrose, into companion cells ;  
A description of (facilitated) diffusion  
R active transport  
ref. to companion cell required only once for mps 1 and 2
- 3 via, cotransporter / cotransporter described ;
- 4 sucrose, diffuses / AW, into (phloem) sieve, tube / element, via plasmodesmata ;
- 5 (entry of sucrose into sieve tube so) water potential lowers ;
- 6 water enters by osmosis ;
- 7 (hydrostatic) pressure builds up ; A pressure difference created
- 8 unloading at, sink / named sink, gives a difference in pressure (between source and sink) ; AW
- 9 (so) mass flow ; term to be used in context [max 5]

(d) any one relevant e.g.  
obtain, sucrose / amino acids / other named assimilate ; R nutrients unqualified  
pressure forces, sap / AW, into aphid ; [max 1]

[Total: 10]

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