# Structure of transport tissues

## Mark Scheme 2

| | |
|---|---|
| **Level** | International A Level |
| **Subject** | Biology |
| **Exam Board** | CIE |
| **Topic** | Transport in plants |
| **Sub Topic** | Structure of transport tissues |
| **Booklet** | Theory |
| **Paper Type** | Mark Scheme 2 |

**Time Allowed :** **58 minutes**

**Score :** **/ 48**

**Percentage :** **/100**

**Grade Boundaries:**

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

1 **(a)** 9 µm **;;**
*award one mark if 8.9 or 9.1µm given*
*or*
*correct measurement is divided by the magnification (x 10 000) but conversion factor incorrect* [2]

**(b)** *explanation to max 4*
hydrogen ion / $H^+$, pumped / AW, out of, transfer cell / companion cell **;**
**R** if to sieve tube element
active / using ATP / energy requiring **;**
hydrogen ion gradient build-up **;** AW
hydrogen ions, co-transport / with / AW, sucrose **;** *in context of <u>into</u>, transfer / companion cells*
diffusion / facilitated diffusion (of hydrogen ions and sucrose) through co-transporter (membrane protein) **;**
**A** through membrane protein *if 'cotransport' already used*
sucrose, diffuses / AW, through plasmodesmata into sieve tube element **;**

*ref. to Fig. 5.1*
mitochondria for ATP production **;**
ref to infoldings of cell wall **;**
large surface area of cell membrane **;**
for more, protein pumps / co-transporter proteins **;** [max 5]

**(c)** *sucrose / assimilates / phoem sap, in sieve tube (elements) in, source / leaf*
low(ers) / less negative, water potential **;**
water enters, qualified **;** e.g. by osmosis / from surrounding tissue**;**

increases the <u>hydrostatic</u> pressure **;**

sucrose unloaded at sink **;**
lowers water potential in surrounding tissue **;**
water moves out and decreases <u>hydrostatic</u> pressure (in source) **;** *allow ecf if hydrostatic not used*

pressure difference (causes flow) **;**
(pressure difference) forces sap through sieve tubes / causes mass flow (towards sink) **;** AW [max 4]

**[Total: 11]**

2 **(a)** line to nucleolus labelled **C ;**
line to Golgi apparatus labelled **D ; R** to vesicle
line to mitochondrion labelled **E ;** [3]

**(b)** **1** hydrogen ion / $H^+$, pumped / AW, out of companion cell **; R** if to sieve tube element
**2** active / using ATP / energy requiring **;**
**3** against the concentration gradient **;**
**4** hydrogen ion gradient build-up **;** AW
**5** hydrogen ions, co-transport / with / AW, sucrose **;** *in context of <u>into</u> companion cells*
**6** <u>diffusion / facilitated diffusion</u> (of hydrogen ions and sucrose) through co-transporter (membrane protein) **; A** through membrane protein *if 'cotransport' already used*
**7** <u>diffusion</u> of sucrose into (phloem) sieve tube (cell) **;**
**8** via plasmodesmata **;** [max 4]

**[Total: 7]**

3 **(a)** $H^+$ pumped out ;
creates an $H^+$ gradient ;
sucrose moves in with $H^+$
co-transport / through co-transporter ;
energy / ATP, provided by mitochondria ;
sucrose diffuses down concentration gradient ;
through plasmodesmata ; [4 max]

**(b)** large surface area : volume ratio / to increase surface area ;
gives large surface area of membrane ;
(so) many, pumps *or* co-transporters ; [2 max]

**(c)** (i) higher / greater resolution / resolving power ; **ora**
**A** 0.5 nm (0.0005 μm) compared with 200 nm (0.02 μm)
because of shorter wavelength ; **A** smaller
more detail can be seen / much clearer (at the same magnification)
/ can see two points that are close together ;
can see cell structures that are not visible in the LM ;
**A** e.g. ribosomes / membranes
can see detail of structures just visible in LM with e.g. ;
**A** mitochondrion / chloroplast [2 max]

**(ii)** long (length greater than width) ;
sieve plates ;
sieve pores ;
some / less / peripheral, cytoplasm ;
no nucleus / fewer mitochondria / less ER ;
thin wall ; [2 max]

**[Total: 10]**

4 **(a** nucleus/nuclear membrane/nuclear envelope/nucleolus;
ER/SER/RER;
Golgi (body/apparatus)/lysosomes;
larger ribosomes/80S ribosomes;
linear DNA/chromosomes/protein + DNA (in chromosomes);
mitochondrion/mitochondria;
cell wall made of cellulose; **R** cell wall unqualified
microtubules; **A** spindle fibres/centriole
large vacuole/tonoplast;
plasmodesmata; **[max 3]**

**(b)** high(er) resolution;
because of shorter wavelength;
more detail can be seen/much clearer, at the same magnification/can see two points that are close together/quote appropriate figs;
can see cell structures, that are not visible in the LM/
**A** e.g. ribosomes/membranes;
can see detail of structures just visible in LM with e.g.
**A** mitochondrion/chloroplast; **[max 2]**

**(c)** nitrogen fixation; **A** fixes nitrogen
converts nitrogen to ammonia; **A** $NH_3/NH_4^+$
further detail; e.g. nitrogenase/anaerobic conditions/ATP needed/$H^+$ needed
ammonia converted to amino acid(s);
(amino acids) exported to cells of legume;
in return for carbohydrate/sugars/sucrose/glucose/fructose;
symbiosis/mutualism;
helps legume survive in areas with low, N/nitrates;
**A** competitive advantage **[max 3]**

**(d)** they have the same/similar function, to combine with oxygen;
idea of similar/same, primary sequence/sequence of amino acids;
idea of same/similar, tertiary structure/3D shape; **A** quaternary

common ancestry/both are eukaryotes,because they share some of the same genes; **[max 2]**

**[Total: 10]**

5 **(a) (i)** **A** - Golgi (body/apparatus)/dictyosome; **R** Golgi vesicles

**B** - (rough) endoplasmic reticulum/ER/RER; **R** SER

**C** - mitochondrion/mitochondrial, matrix/envelope; **3**

**(ii)** sieve plate(s); **1**

**(iii)** sucrose/amino acid(s)/named amino acid; **R** sugar, glucose **1**

**(b)** little/watery/peripheral, cytoplasm/no tonoplast/no vacuole/ few organelles/few ribosomes/so little resistance/AW e.g. easy transport/move more easily/minimum obstruction;

<u>pores</u> in sieve plate provide little resistance/permit continuous flow/allows movement/AW e.g. as above;

sieve plate braces/prevents cell bulging under pressure/collapsing;

plasmodesmata only between sieve tube element and companion cell allows pressure to build up;

plasmodesmata allows loading/AW e.g. sucrose to be transported in from <u>companion/transfer cell</u>;

(strong) cellulose walls prevent, excessive/too much, bulging/expansion;

mitochondria (and starchy plastids) for <u>ATP</u>, for repair/maintenance;

**R** reference to mitochondria in companion cells **3 max**

**(c)** sucrose/sugars/assimilates, are <u>pumped/loaded</u> (by companion cells);

reference to pumping $H^+$;

reference to co-transport/AW e.g. $H^+$ carry sucrose with them;

<u>mitochondria</u> provide, <u>ATP</u> for <u>active transport</u>; **2 max**

**[Total 10]**