QUESTIONSHEET 1

(a) (i) increased solute pressure;
lowers their water potential;
thus water enters by osmosis; **max 2**

(ii) inner wall has extra thickening/uneven wall thickening;
causes differential expansion when cytoplasm presses on it (opening stoma); **2**

(b) process which returns system to the norm/equilibrium;
drying of cells leads to stomatal closure/converse;
fall in CO_2 concentration leads to stomatal opening/converse; **max 3**

(c) loss of water kills plants/reduces leaf surface area/reduces light absorption;
but stomata must be open for entry/exit of CO_2 /O_2;
also transpiration stream enables transport of salts /transpiration has a cooling function; **max 2**

TOTAL 9

QUESTIONSHEET 2

(a) obtain epidermal strip/impression using nail varnish or similar;
observe under low power light microscope with eyepiece/slide grid/micrometer;
count number of stomata in stated area;
repeat to obtain mean; **4**

(b) (i) B;
similar stomatal density on both surfaces in B; **2**

(ii) A;
has lowest stomata density/least stomata;
thus less chance of water loss occurring too quickly/less chance of wilting; **2**

TOTAL 8

QUESTIONSHEET 3

(a) X = tracheid;
Y = vessel; **2**

(b) large leaf surface area and many stomata;
result in much water loss by transpiration;
this must be replaced from transpiration stream;
vessels can transport greater volumes/faster than tracheids; **4**

(c) (i) phloem;
sieve tube;
companion cell; **3**

(ii) the bulk transport of materials from one point to another;
as a result of pressure difference between the two points; **2**

TOTAL 11

QUESTIONSHEET 4

(a) (i) potometer; **1**
(ii) the rate of water uptake by the shoot; **1**
(iii) movement of bubble indicates volume of water taken up by the shoot; **1**

(b) (i) cut shoot underwater;
keeping leaves dry;
set up complete apparatus underwater;
keep all joints air tight/prevent unwanted bubbles entering; **max 3**

(ii) use a fan at different speeds for air currents;
allow at least 15 minutes to acclimatise;
set air bubble to start of scale using water in reservoir (and tap);
measure distance air bubble moves in a specific time;
repeat 3 times at each air speed and calculate means; **max 4**

TOTAL 10

QUESTIONSHEET 5

(a) (i) A = vessel/vessel unit;
B = tracheid; **2**

(ii) xylem; **1**

(iii) parenchyma;
fibre/sclerenchymatous fibre; **2**

(iv) lignin;
to allow elongation during stem growth/if it was solid it would not stretch; **2**

(b) (i) conduction of water <u>and</u> salts;
mechanical support;

(ii) cell contents have died so it is hollow allowing water flow;
end cell walls have broken down forming a continuous tube giving unimpeded water passage;
lignin gives rigidity giving some mechanical strength/keeping tube open; **3**

TOTAL 12

QUESTIONSHEET 6

(a) (i) A = guard cells;
B = accessory cells of stoma;
C = epidermal cells; **3**

(ii) to allow stomata to close to reduce water/transpiration loss/preventing wilting;
to allow stomata to open to enable transpiration for cooling; } (to allow transpiration = 1)

to enable oxygen entry through stomata for respiration;
to enable carbon dioxide entry through stomata for photosynthesis; } (to allow gas exchange = 1) **4**

(iii) cells A can photosynthesise and thus accumulate sugars/use up CO_2 ;
which initiates the mechanism for stomatal opening; **2**

(b) (i) $\frac{4 \times 1.000}{0.0105}$; = 381 (stomata mm^2) ; (units in the question so not essential in the answer) **2**

(ii) assumption that the stomata are randomly distributed (and they may not be); **1**

TOTAL 12

QUESTIONSHEET 7

(a) (i) in angiosperms main xylem conducting tissue is vessels;
where as in gymnosperms it is tracheids;
angiosperms have broader leaves/more stomata than gymnosperms; **max 2**

(ii) removal of bark removes phloem;
responsible for transport of sugars to fruit;
to enable fuit development/formation of food store in fruit; **max 2**

(iii) movement/uptake/loading of sucrose from mesophyll cells to phloem is active/requires ATP;
metabolic inhibitors stop respiration/prevent ATP manufacture; **2**

TOTAL 6

QUESTIONSHEET 8

(a) for storage;
to provide energy for fruit/tomato development;
to make fruits/tomatoes attractive to animals;
for animal dispersal; **max 3**

(b) end walls of sieve tube elements are perforated/ref to sieve plates;
cytoplasm of sieve tube element is thin/peripheral/contains few organelles/has no nucleus;
cellulose cell walls allow exchange of substances across them;
ref to elongated sieve tubes; **max 3**

TOTAL 6

QUESTIONSHEET 9

(a) A: piliferous layer; (reject 'epidermis')
B: endodermis;
C: xylem;
D: phloem;
E: root hair; **5**

(b) (i) B Function: control entry of water/salts into xylem ;
Adaptation: Casparian strip/ligin deposit in walls/on radial walls (blocks apoplastic path); **2**

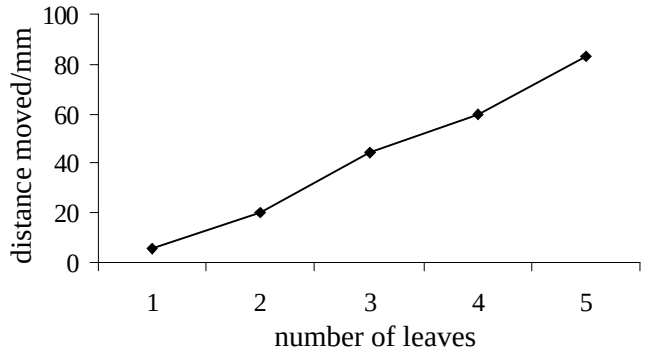
(ii) E Function: absorb water/salts;
Adaptation: large surface area/single cells/extensions of piliferous layer; **2**

TOTAL 9

QUESTIONSHEET 10

(a) ensure all apparatus is full of water/contains no air;
cut shoot under water;
use grease/vaseline in all joints to prevent leakage;
keep leaves dry; **max 2**

(b) (i)



one for correct scale;
one for correct labelled axes; (no. of leaves on X-axis)
one for correct plot; **4**
one for joining points with a ruled straight line; (IOB recommendations)

(ii) distance moved by bubble decreases as number of leaves decreases;
as less water is lost from leaves by transpiration;
less water is drawn up the stem/xylem;
less water absorbed by shoot; **max 3**

(iii) that water uptake equals water lost from leaves; **1**

TOTAL 10

QUESTIONSHEET 11

(a) thick epidermis on lower/abaxial/outer surface;
prevents diffusion of water;

no stomata on abaxial/lower/outer surface;
reduces evaporation/transpiration/diffusion loss of water;

leaf is rolled; confines/protects inner tissues/reduces/reduces diffusion gradient;

hairs; reduce air movement;

large epidermal/hinge cells; shrink to roll leaf when transpiration high;

sunken stomata; reduces transpiration; (any two pairs of mark points) **max 4**

(b) water evaporates from mesophyll cells into air spaces;
diffuses out of stoma;
loss of water from cells reduces their water potential relative to adjacent cell;
water moves from cell with higher water potential to cell with lower water potential (etc);
water drawn into mesophyll cells from xylem;
water drawn up xylem;
cohesive force between water molecules;
adhesion force between water molecules and xylem cells;
ref to water drawn across root cortex from root hairs to xylem;
ref apoplast/symplast/vacuolar pathways; **max 6**

TOTAL 10

QUESTIONSHEET 12

(a) defoliation causes sugar concentration to fall;
suggests the source is the leaves; **2**

(b) sugars move from sources/leaves to sinks/storage areas/main stems;
sugars actively taken up by phloem companion cells;
and passed to sieve tubes;
water follows osmotically/along water potential gradient;
creates hydrostatic pressure;
sugars removed from phloem at sink and water follows;
hydrostatic pressure difference between source and sink creates mass flow; **max 4**

TOTAL 6
