

| Question | | | Answers | | | Marks | Additional Guidance | | | | | | | | | | |
|------------------------------|--|---|---|--|---|--|---|--------------------------|---------------------|---|--|---|---|--|---------|--------------------------------|--|
| 1 | (a) | | E – cortex ; F – medulla ; G – <u>ureter</u> ; | | | [3] | | | | | | | | | | | |
| | (b) | (i) | <table><tr><td>process</td><td>letter</td><td></td></tr><tr><td>diffusion of oxygen</td><td>H ;</td><td><i>idea that</i> (oxygen) diffuses, from high concentration/to low concentration/down concentration gradient (into the cell) ;</td></tr><tr><td>active uptake of sodium ions</td><td>L ;</td><td><i>idea that</i> (sodium ions) are moved against their concentration gradient/from low to high concentration ;</td></tr></table> | | | process | letter | | diffusion of oxygen | H ; | <i>idea that</i> (oxygen) diffuses, from high concentration/to low concentration/down concentration gradient (into the cell) ; | active uptake of sodium ions | L ; | <i>idea that</i> (sodium ions) are moved against their concentration gradient/from low to high concentration ; | [4] | mark the columns independently | |
| process | letter | | | | | | | | | | | | | | | | |
| diffusion of oxygen | H ; | <i>idea that</i> (oxygen) diffuses, from high concentration/to low concentration/down concentration gradient (into the cell) ; | | | | | | | | | | | | | | | |
| active uptake of sodium ions | L ; | <i>idea that</i> (sodium ions) are moved against their concentration gradient/from low to high concentration ; | | | | | | | | | | | | | | | |
| | | (ii) | glomerulus ; | | | [1] | | | | | | | | | | | |
| | | (iii) | <table><tr><td>1</td><td>(glucose is reabsorbed) by active uptake/active transport (from filtrate) ;</td></tr><tr><td>2</td><td>against concentration gradient/from low to high concentration ;</td></tr><tr><td>3</td><td>using energy ;</td></tr><tr><td>4</td><td>as in L ;</td></tr></table> | 1 | (glucose is reabsorbed) by active uptake/active transport (from filtrate) ; | 2 | against concentration gradient/from low to high concentration ; | 3 | using energy ; | 4 | as in L ; | [max 2] | <i>ignore</i> diffusion of glucose R energy ‘produced’ | | | | |
| 1 | (glucose is reabsorbed) by active uptake/active transport (from filtrate) ; | | | | | | | | | | | | | | | | |
| 2 | against concentration gradient/from low to high concentration ; | | | | | | | | | | | | | | | | |
| 3 | using energy ; | | | | | | | | | | | | | | | | |
| 4 | as in L ; | | | | | | | | | | | | | | | | |
| | (c) | <table><tr><td>1</td><td>active uptake/active transport, of ions against the concentration gradient (into the root) ;</td></tr><tr><td>2</td><td>energy is needed for, active uptake/active transport ;</td></tr><tr><td>3</td><td>comes from respiration ;</td></tr><tr><td>4</td><td>water is absorbed, by osmosis/down water potential gradient ;</td></tr><tr><td>5</td><td>(osmosis/diffusion is a) passive process/does not need energy ;</td></tr><tr><td>6</td><td>diffusion of ions will occur until equilibrium ;</td></tr></table> | 1 | active uptake/active transport, of ions against the concentration gradient (into the root) ; | 2 | energy is needed for, active uptake/active transport ; | 3 | comes from respiration ; | 4 | water is absorbed, by osmosis/down water potential gradient ; | 5 | (osmosis/diffusion is a) passive process/does not need energy ; | 6 | diffusion of ions will occur until equilibrium ; | [max 3] | R energy ‘produced’ | |
| 1 | active uptake/active transport, of ions against the concentration gradient (into the root) ; | | | | | | | | | | | | | | | | |
| 2 | energy is needed for, active uptake/active transport ; | | | | | | | | | | | | | | | | |
| 3 | comes from respiration ; | | | | | | | | | | | | | | | | |
| 4 | water is absorbed, by osmosis/down water potential gradient ; | | | | | | | | | | | | | | | | |
| 5 | (osmosis/diffusion is a) passive process/does not need energy ; | | | | | | | | | | | | | | | | |
| 6 | diffusion of ions will occur until equilibrium ; | | | | | | | | | | | | | | | | |
| | | | | | | [Total: 13] | | | | | | | | | | | |

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|-------|-------|-----------------------|-----|--|
| 2 (a) | | | [5] | |
| | stage | Process | | |
| | P | nitrogen fixation ; | | |
| | Q | protein synthesis ; | | |
| | R | feeding / digestion ; | | |
| | S | deamination | | |
| | T | nitrification ; | | |
| | U | denitrification ; | | |

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|-------------------------------------|---|---------|-----------------------------------|
| 2 (b) 1 2 3 4 | plants from irradiated seeds had more nodules ; plants from irradiated seeds had nodules with more mass ; comparative data quote for number ; comparative data quote for dry mass of nodules ; | [max 3] | Units are required at least once. |
| (c) | mutation ; change in, gene(s) / DNA ; | [2] | |
| (d) 1 2 3 4 5 6 7 | choose plants with desired feature(s) ; cross / breed plants ; any detail ; e.g. bagging flowers, transfer of pollen with paintbrush collect seeds ; grow seeds and check plants for features ; cross plants showing features with original variety ; keep crossing and selecting ; | [max 4] | |
| (e) 1 2 3 4 | <u>genetic engineering</u> / <u>genetic modification</u> ; introduced a gene from a different species ; results, after one generation ; any detail of method involved e.g. use of vector / plasmid ; | [max 2] | |
| (f) 1 2 3 4 | fix nitrogen ; products of fixation / nitrates provide a source of protein ; increases nitrogen in soil when beans decay ; maintain / higher, yields (of maize) ; | [max 2] | |
| | [Total: 18] | | |

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|----------|-----|--|--|---------|---|
| 3 | (a) | 1 | root hairs ; | [max 3] | A down a water potential gradient ignore water concentration R dilute and concentrated A semi-permeable / selectively permeable |
| | | 2 | water moves from high(er) <u>water potential</u> to low(er) <u>water potential</u> ; | | |
| | | 3 | osmosis ; | | |
| | | 4 | through partially permeable <u>membrane</u> ; | | |
| | | 5 | ref. to protein pores ; | | |
| | | | | | |
| | (b) | 1 | large surface area ; | [max 3] | A minerals for ions A thin wall as 'cell' is in the question A active, uptake / transport, uses energy A active uptake R if water also taken up by active uptake A 'moving against concentration gradient' for active transport |
| | | 2 | thin (cell) walls ; | | |
| | | 3 | (many) mitochondria ; | | |
| | | 4 | ref. respiration ; | | |
| | | 5 | provide / release, energy, for active transport ; | | |
| | | 6 | proteins / carriers / channels, for, diffusion / active transport (of ions) ; | | |
| | | | | | |
| | (c) | <i>in appropriate boxes</i> | | [2] | A ecf if half incorrect diploid number <i>only allow ecf if both diploid numbers are the same</i> |
| | | adult and zygote = 90 ; ovum = 45 ; | | | |
| | | | | | |

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|----------|-----|--|-------------|--|
| 3 | (d) | <p><i>advantages for plants</i></p> <p>only one, parent / plant ; fast / new plants establish themselves quickly ; (potential) rapid spread close to parent / AW ; less energy required ; no wastage of gametes ; (if parent well adapted) offspring will be adapted to surroundings ; plants grow in a suitable place / no wastage ; AVP ; e.g. greater chance of reproduction</p> | [max 2] | <p>R refs to number of plants produced R 'does not require male and female gametes' A 'more likely to leave offspring' idea</p> <p>ignore refs to avoiding mutations unqualified</p> <p>A 'good' traits / e.g., passed on R 'good' genes</p> <p><i>do not accept advantages for humans</i></p> |
| | | <p><i>disadvantage for plants</i></p> <p>plants too crowded / overcrowding ; (lots of) competition for resources ; little / no, (genetic) variation ; disease transmitted directly to offspring ; less evolution / less able to adapt ; (all identical so) can be wiped out by the same disease ; no / little, dispersal ; AVP ;</p> | [max 1] | <p><i>genetic or infectious disease</i></p> <p>A 'disease can spread easily'</p> |
| | | | | |
| | | | [Total: 11] | |