

- 1 (a) (i) maintaining cell turgidity ;
preventing wilting ;
transport of named materials (minerals / amino acids / sugars) ;
medium for enzyme action ;
raw material for photosynthesis ; [max. 3]
- (ii) salt concentration in soil is higher than in roots AW ;
ref. to water potential is greater in root cells than in soil / w.p gradient
goes from cells to soil AW;
so water is drawn out of roots + by osmosis ;
cells become flaccid ;
plant wilts ;
plant lacks water ; [max. 3]
- (b) (i) active transport ; [1]
- (ii) growth would be slower ;
because some of the plant's energy would be used in active transport ; [2]
- (iii) (ACCEPT OTHER NUTRIENTS AND FUNCTIONS)
magnesium ;
ref. to the formation of chlorophyll ;
nitrate ;
ref. to growth / formation of amino acids or protein ; [4]
- (c) the removal of a gene from one species ;
and its insertion into another species ;
(in article) genes are modified, not transferred AW ;
Ⓐ other valid arguments [3]
- (d) ref. to leaching of minerals AW ;
ref. to eutrophication + of rivers / lakes ;
ref. to soil erosion ;
creation of water shortage ;
ref. to soil + becomes infertile / lacks minerals ; [max. 2]
- [max. 18]**

2 (a) (i) (resistance) has increased / more resistant ;
 ref. to doubled every 2 years / x 4 over 5 years / 20% more bacteria
 are resistant / 400% increase in resistance / exponential rise /
 geometric rise ; **A** figures quoted e.g. 7, 14, 28 (+1 -1 on figure) 2

(ii)
 i. ref. to mutation / variation / DNA change ;
 ii. (new strain) has resistance ; linked to i. **A** refs to immunity
 iii. (new strain) not killed by treatment ;
 iv. ref. to natural selection / survival of fittest / less competition for
 resistant bacteria if most of normal bacteria have died ;
 v. (new strain) reproduces ;
 vi. increased numbers of population have resistance ;
 vii. ref. to over-prescription / not completing antibiotic course ;
 viii. ref. to use in animal husbandry ; max. 4

(b) yoghurt ;
 cheese ;
 curds / sour milk ;
 tofu ;
 single cell protein / SCP ; max. 1

(ii)
 i. ref. to nitrogen-fixing bacteria ; I refs to being in root nodules
 ii. change nitrogen into + nitrate / ammonium salts ; **A** ammonia
 iii. ref. to role of saprophytes / decay / decomposition / release of
 nutrients or named minerals AW ;
 iv. ref. to nitrifying bacteria ;
 v. ref. to nitrification / conversion of ammonia to nitrates AW ; max. 3

(c)

| description of the stage | number of the stage |
|---|---------------------|
| all the plasmids are removed from the bacterial cell | 5; |
| a chromosome is removed from a healthy human cell | 2; |
| plasmids are returned to the bacterial cell | 8; |
| restriction endonuclease enzyme is used | 3 / 6; |
| bacterial cells are allowed to reproduce in a fermenter | 9; |

5

total max. 15

- 3 (a) (i) ref. to recent meal / intake of carbohydrate food AW ; [1]
- (ii) pancreas ; [1]
- (iii) ref. to glucose absorbed from blood ;
 ref. to conversion to glycogen ;
 ref. to increased rate of respiration ; [max. 2]
- (iv) homeostasis ; [1]
- (b) intake by mouth would result in digestion in the stomach AW ;
 due to presence of + protease / pepsin ; [2]
- (ii) insulin gene removed from human + DNA / chromosome ;
 ref. to restriction + endonuclease / enzyme ;
 ref. to plasmid cut open AW ;
 ref. to use of ligase + in placing insulin gene into plasmid ;
 ref. to formation of recombinant DNA ;
 ref. to insertion of plasmid into host bacterial cell AW ;
 ref. to culture of bacteria ;
 ref. to use of + fermenter / bioreactor ; [max. 4]
- [max. 11]