

Question	E	Answers	Marks	Additional Guidance
1 (a)	1 2 3	broad leaves ; network of veins ; five petals ;	[3]	
(b)	<i>one mark for mesophyll cells, one mark for guard cell</i>		[2]	NB: B + E = 1 mark F = 1 mark
	NB: Each extra tick (over 3) penalise by one mark			
	features	cells that carry out photosynthesis		
	A			
	B	✓		
	C			
	D			
	E	✓ ;		
	F	✓ ;		
G				

Question	E Answers	Marks	Additional Guidance
1 (c) 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	<p>upper epidermis is transparent / thin ; lets light through to palisade, cells / mesophyll ;</p> <p>palisade cells with many chloroplasts ; A lots of chlorophyll absorb as much light as possible / AW ;</p> <p>palisade cells arranged lengthways ; less cell walls to scatter light / AW ;</p> <p>palisade cells close together ; absorb as much light as possible ;</p> <p>spaces in spongy mesophyll ; allow (diffusion of) carbon dioxide to mesophyll cells ; A each cell has surface for gas exchange</p> <p>guard cells / stomata ; allow (diffusion of) carbon dioxide into leaf ;</p> <p>xylem ; to provide water (as raw material) ;</p> <p>phloem ; to remove products of photosynthesis ;</p>	[2 + 2]	<p>NB: Paired MPs (i.e. explanation must be linked to correct feature)</p> <p>If a letter is given rather than named feature then allow the explanation mark if relevant</p> <p>MP3 – need ref. to more, lots of / AW MP4 – light qualified – much as possible etc.</p>
(d) (i)	<p><u>sucrose</u> ; R sugar amino acids ; hormones / plant growth substances / auxin(s) ;</p>	[max 2]	
(ii)	<p>leaf ; two of the following for one mark stem, root, bud, flower, fruit, seed, storage organ ;</p>	[2]	
		[Total: 13]	

Question		Answers	Marks	Additional Guidance
2	(a)	root hairs ; large surface area ; water moves, from high water potential to low water potential / down water potential gradient ; by osmosis ; through partially permeable membrane ; protein pores ;	[max 3]	A water concentration
	(b)	(i)		
		decrease in growth ; description of curve ; e.g. sigmoid no growth at 600 units ; any other figure from the graph ;	[3]	MP2 linked with MP1 i.e. growth
		(ii)		
		1 salt lowers the water potential ; 2 plants absorb less water ; 3 loss of turgidity / AW ; 4 no water for new cells ; 5 no, elongation / AW, of cells ; 6 no / less, water for chemical reactions ; 7 no / less, water for photosynthesis ; 8 no / less, water for transport ; 9 stomata close ;	[max 4]	A hypertonic A water moves out
	(c)	pH 4.0 – phosphate ; pH 11.0 – iron ;	[2]	

Question		E	Answers	Marks	Additional Guidance
2	(d)		<p>each ion to max 3</p> <p><i>magnesium ions</i></p> <p>1 needed for making chlorophyll ; 2 without chlorophyll plant, not green / yellow ; 3 cannot absorb (much) light ; 4 little / no, (energy for) photosynthesis ; 5 little / no, sugars / organic compounds produced / energy available ;</p> <p><i>nitrate ions</i></p> <p>6 needed to make amino acids ; 7 amino acids to proteins ; 8 protein needed for growth ; 9 suitable use of protein ; e.g. membranes / enzym</p>	[max 4]	<p>A proteins or nucleic acids</p> <p>R 'hormones' A suitable use for nucleic acids e.g. genetic material</p>
			[Total: 16]		

3 (a) (i) nitrogen fixation / fixing ; [1]

(ii) decomposition / decay / putrefaction / rotting ;
deamination / ammonification ;
nitrification ; **A nitrifying** , oxidation of, ammonia / nitrite [2]

(b) *award two marks for correct answer (24), if answer incorrect or no answer award one mark for correct working, look out for x 100*

28.8 / 120 x 100 ;
24 (%) ; [2]

- 3 (c) proteins ;
enzymes ;
hormones ;
nucleic acid / DNA / RNA ;
membranes ;
muscle ;
growth / new cells / new tissues ;
repair / replacement ;
respiration / release energy ;
AVP ;
AVP ;

[2 max]

- (d) *in animals*
- 1 deamination ;
 - 2 ammonia ;
 - 3 urea ;
 - 4 lost in urine / excreted ;
 - 5 lost in faeces / egested / not absorbed;

in field

- 6 recycled / nitrification, to nitrate (ions) ;
- 7 nitrate, taken up / absorbed, by plants ;
- 8 denitrification / nitrate to nitrogen (gas) or N_2 ;
- 9 leached / run-off (from field), into, rivers / streams / lakes / freshwater ;
- 10 taken up / absorbed, by aquatic plants / algal bloom ;

[5 max]

- (e)
- 1 increase in (human) population / demand for energy ;
 - 2 combustion of, fossil fuels / named fossil fuel / wood ;
 - 3 industrialisation / factories / power stations ;
 - 4 transport ;
 - 5 intensive farming ;
 - 6 deforestation ;
 - 7 burning of forests ;
 - 8 less plant life to absorb carbon dioxide from the atmosphere ;
 - 9 ref to photosynthesis ;
 - 10 AVP ;

R increase in CO_2 because of respiration of humans

[2 max]

[Total: 14]

4 (a) (i)	<p>glass tank to max 1 acts as heat filter / absorbs heat from lamp / reduces heat effect of the lamp / AW ; maintain constant temperature / make sure temperature is not another variable ; syringe reposition the air bubble / return air bubble to top of tubing / put the bubble into the tube ;</p>	[2]	<p><i>must be about heat</i></p> <p>A readjust the bubble R refs. to water in the tube</p>
(ii)	<p>1 plant / photosynthesis, releases / produces, oxygen / gas(e) ; 2 oxygen is, by-product / waste product (of photosynthesis) ; 3 from splitting of water / photolysis ; 4 oxygen comes out of solution / AW ; 5 gas, collects / rises to the top ; 6 (gas) pushes water down the tube / displaces the water ;</p>	[3 max]	<p>R oxygen / gas, is product of respiration</p> <p><i>note that it is the water that is being pushed by the gas collecting at the top of the tube</i></p> <p>A gives pressure to force water down tube</p>
(b) (i)	1.4 ;	[1]	
(ii)	<p>all points plotted accurately ;</p> <p>curved or straight line of best fit / straight lines between points ; ignore if line continues beyond first and last points because of (c)(i) R if line goes to 0</p>	[2]	<p><i>allow a straight line of best fit that is close to the plotted points</i></p>
(c) (i)	6.0–7.0 ; R > 7.0 allow ecf from the graph if line goes to 0 0–0.6 ; R > 0.6	[2]	ignore what is shown by extrapolation on the graph unless awarding ecf from the graph
(ii)	<p>1 (increase distance gives) decrease light (intensity) ; ORA 2 ref. to <u>light energy</u> ; 3 absorbed by, chlorophyll / chloroplast ; 4 light (intensity) is <u>limiting</u> (factor) ;</p>	[3 max]	<p>A 'amount of light' in this answer A even if 'light' and 'energy' are separated in answer</p> <p><i>look for word 'limiting' do not allow 'limited'</i></p>
		[Total: 13]	