

<b>1 (a) (i)</b>	maintain constant temperature/prevent heat from the lamp heating the water/absorbs heat from the lamp/heat shield ;  (thermometer) to measure/check/monitor/record, water ;  prevent temperature (change), influencing/affecting, the results / rate of photosynthesis ;  temperature is a, control(led)/standardised, variable ;	<b>[max 2]</b>	1 mark for 'controlling' 1 mark for 'measuring'
<b>(ii)</b>	maintain constant light intensity ;  (light meter) to measure/check/monitor/record, the light intensity ;		1 mark for 'controlling' 1 mark for 'measuring'

Question	Answers	Marks	Additional Guidance
1	prevent light intensity (change) influencing/affecting the, results/ rate of photosynthesis ;  make sure the lamp is always, in the same place/at right distance ;  light, intensity/level, is dependent on distance ;  light intensity is, a controlled/standardised, variable ;	[max 2]	A (ruler) to measure the distance between lamp and plant
(b) (i)	rate/photosynthesis/bubbles:  increases as carbon dioxide concentration increases and then, levels off AW ;  increases to 0.40 % ; A rate remains constant above 0.40%  little / slow, increase up to 0.1 % ; ora  one data quote with CO <sub>2</sub> concentration and rate with units ;	[max 3]	units must be used at least once anywhere in the answer to award marking points that require them  A bpm for bubbles per minute
(ii)	carbon dioxide/CO <sub>2</sub> , concentration/%/level/availability ;	[1]	R 'amount of carbon dioxide'
(iii)	ref to <u>limiting factor</u> in suitable context ;  carbon dioxide (concentration), is no longer limiting/AW ;  light, intensity/level, could be limiting/AW ;  reference to light providing <u>energy</u> for photosynthesis ;  temperature could be limiting/AW ;  reference to temperature influencing the activity of enzymes ;	[ma 4]	

Question	Answers	Marks	Additional Guidance
1	chloroplast / chlorophyll / number of leaves / size of plant, could be limiting factor ;		
(c)	measure <u>volume</u> (of oxygen / gas) ; use, inverted test-tube / measuring cylinder / syringe (barrel) ; reference to, graduations / markings ; <b>A</b> 'take readings from...' / 'record results...' filled with water ; gas collects at the top and pushes out the water / downward displacement of water ; gas syringe ; attached by (delivery) tube to, flask / AW ; oxygen sensor ; data logger for any other suitable electronic method ; reference to equilibration / described ; reference to time period ; <b>A</b> rate = volume divided by time	<b>[max 3]</b>	
(d) (i)	use / combustion / burning, of fossil fuels ; reason for increased demand for energy ; carbon dioxide from, volcanic activity / volcanoes ;	<b>[max 2]</b>	<b>A</b> named fossil fuel(s) <b>A</b> named example, e.g. increased use of cars / heating / air-conditioning

Question	Answers	Marks	Additional Guidance
1	deforestation ; burning of, forests / trees ;		
(ii)	carbon dioxide is a <u>greenhouse gas</u> ; (enhanced) <u>greenhouse effect</u> (in context of carbon dioxide) ; heat / infra-red / long wavelength radiation, radiated / emitted, from / absorbed / trapped / AW, by, carbon dioxide / greenhouse gases ; travels / AW, back to the surface ; heat cannot, leave (from the atmosphere) / pass into outer space ;	[ma 4]	<b>R</b> 'ozone causes greenhouse effect'  <b>A</b> reflected as an alternative to radiated  <b>ignore</b> UV light / visible light / (solar) radiation
		[Total: 21]	

2	(a) (i)	<i>Caenorhabditis</i> ;	[1]	
	(ii)	thread-like bodies / filamentous / filament-like ; unsegmented body ; hydrostatic skeleton ; body, tapers / is pointed, at, one / both, ends ; through gut / mouth and anus ; relatively large pharynx / sucking mouthparts ;	max [2]	
	(b)	prevents accumulation of dead matter / removes (organic) waste ; recycles nutrients / named nutrient(s) ; releases (carbon as) carbon dioxide ; (carbon dioxide) for photosynthesis ; decreases particle size of food for decomposers ; ref to energy flow in, food chain / food web / ecosystem ;	max [3]	<b>R</b> energy cycling / recycling
	(c) (i)	gametes from same individual ; self-fertilisation / described ; only new source of variation is mutation ; variation produced by meiosis ;	max [2]	
	(ii)	6 ;	[1]	

2 (iii)	<p><b>P meiosis</b></p> <p>reduction division / chromosome number is halved ;</p> <p>prevents doubling of chromosome number, with each generation / when gametes fuse together / at fertilisation ;</p> <p>ref to haploid (cells / gametes / sex cells) ; gamete / sex cell, production ;</p> <p><b>Q mitosis</b></p> <p>growth is taking place ; producing (genetically) identical cells ; more diploid cells ;</p>	max [3]	producing haploid gametes = 2
(d)	<p>in chromosomes ; in the nucleus ; in mitochondria ;</p>	max [2]	<b>A</b> in plasmids ;

Question		Marks	Additional Guidance
3 (a) (i)	xylem;	1	
(ii)	<p>thick/lignified, cell walls; for support;</p> <p>lignin; cell walls are waterproof/no water leaks out;</p> <p>long/hollow/no cytoplasm/no organelles/no end walls; water passes through easily/low resistance (to flow);</p> <p>pits; for lateral movement;</p> <p>AVP;;</p>	max 2	one feature linked to a reason max 1 for feature
(b)	<ol style="list-style-type: none"> <li>1 transpiration/transpiration pull;</li> <li>2 creates a, tension/negative pressure;</li> <li>3 water potential gradient;</li> <li>4 osmosis into leaf cells;</li> <li>5 continuous column of water;</li> <li>6 cohesion of water molecules/described;</li> <li>7 adhesion of water to, cell wall/xylem;</li> <li>8 water evaporates, into airspaces (in mesophyll);</li> <li>9 water (vapour), diffuses/passes, out through stomata;</li> <li>10 root pressure;</li> </ol>	max 4	<p>I water into roots I water concentration</p> <p>A evaporates</p>

Question		Marks	Additional Guidance
3 (c) (i)	<p>1 two peaks;  2 at 10h, and 14/15h;  3 no water conduction before 4h;  4 slow/gradual, increase from 4h to 6h/7h;  5 maximum water conduction rate of 2.4dm<sup>3</sup> per hour;  6 steep increase in rate of water conduction at 7h/7.5h;  7 decrease in rate of water conduction after 14.5 – 15h;  8 any other data quote;</p>	max 3	<p>Correct units (dm<sup>3</sup> per hour) for water conduction must be stated at least once. If no units at all, only penalise once.</p> <p>A at 15h</p>
(ii)	add the volume (of water conducted) for each hour / calculate area under curve / AW;	1	A half hour
(iii)	<p>possible reasons:  different rates of transpiration;  different numbers of leaves / different surface areas;  different rates of evaporation;</p> <p>factors affecting transpiration:  (sun)light / shade;  temperature / heat;  humidity;  wind speed;</p> <p>different species;  different diameters of xylem / AW;  any feature of leaf structure;  e.g. thickness of cuticle / stomatal density / hairs</p> <p>length of roots;  different ages;  AVP;</p>	max 3	

Question		Marks	Additional Guidance
3 (d)	<p>abiotic:            increase in carbon dioxide, concentration/production;            decrease in oxygen, concentration/production;            increased soil erosion;            reduced soil fertility;            less soil water/faster flow of water from the land;            increased, flooding/landslips;            disrupts water cycle;            greater exposure/AW;</p> <p>biotic:            habitat/ecosystem, loss;            disruption to, food chain/food webs;            less biodiversity;            extinction described;            seeds germinate/seedlings grow/regeneration;</p> <p>AVP;</p>	<p><b>max 4</b></p>	<p>I global warming/greenhouse effect            A less decomposition I desertification</p> <p>A silting of rivers</p> <p>A 'loss of/no, food'            A 'species die out'/local extinction</p> <p>examples of AVP:            organisms exposed to greater, grazing/            predation</p>
		<b>[Total: 18]</b>	