

Question		Answer	Marks	Guidance
1	(a)	<p>1 mutation ;</p> <p>2 <u>meiosis</u> ;</p> <p>3 cross(ing)-over ;</p> <p>4 between non-sister chromatids ;</p> <p>5 (in) <u>prophase I</u> ;</p> <p>6 independent / random , assortment / segregation ;</p> <p>7 (in) <u>metaphase</u> ;</p> <p>8 <i>idea of</i> random , fertilisation / fusion of gametes ;</p> <p>9 AVP ;</p>	5	<p>1 CREDI in context of gene or chromosome mutation ACCEPT a suitable description e.g. change in DNA base sequence / non-disjunction</p> <p>2 DO NOT CREDIT incorrect spelling of meiosis</p> <p>3 ACC PT formation of chiasmata</p> <p>4 DO NOT CREDI sister here (CON) but IGNORE sister for mp 3 and mp 5</p> <p>5 needs to be in context of 3 or 4</p> <p>6 ACC PT description e.g. random alignment of bivalents</p> <p>7 needs to be in context of 6 metaphase I (chromosomes) or I I (chromatids) IGNORE anaphase</p> <p>8 CREDI description relating to plant (as Q states rhubarb) e.g. any pollen grain could land on any stigma / any pollen grain could reach any ovule</p> <p>9 ref. epigenetics</p>

Question		answer	Marks	Guidance
	(b) (i)	reproductive ; <u>cloning</u> ;	2	ACCEPT 'whole organism'
	(b) (ii)	(callus / plant) tissue culture / micropropagation ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT tissue culturing / micropropagating IGNORE cloning
	(b) (iii)	<i>they have different (qualitatively or quantitatively)</i> 1 genes / DNA / alleles / genotypes ; 2 repressor proteins ; 3 enzymes ; 4 protein folding / tertiary structure / thermostability ; 5 (plant) growth regulators / hormones ;	2	Mark the first 2 suggestions. Must have 'different' idea at least ONCE e.g. higher / only one of them has x 3 CREDIT different enzymes or different amounts 4 CREDIT enzyme activity at different temperatures 5 ACCEPT PGRs / named hormones eg gibberellins
	(c) (iv)	1 (test) different varieties ; 2 several plants or leaves (of each) / repeat readings ; 3 same age ; 4 same soil , type / mineral content / pH ; 5 same light , exposure / conditions ; 6 same , watering regime / temperature / <u>CO₂ concentration</u> ;	5	1 ACCEPT 'Timperley Early' and 'Victoria' IGNORE species 2 ACCEPT three or more CREDIT 'control / controlled' for 'same' in mps 3,4,5,6 & 7 4 IGNORE soil nutrient level or content 5 CREDIT light intensity / wavelength / duration IGNORE amount of light <i>If none of mps 4-6 awarded</i>

Question		Answer	Marks	Guidance
		<p>7 same, preparation or testing procedure detail ; (e.g. leaf mass / volume of solvent / soaking time / temperature)</p> <p>8 test / measure, (oxalic) acid concentration / acidity / pH / H⁺ ion concentration ;</p> <p>9 detail of measuring method ;</p>		<p>ACCEPT 'grown under same conditions' for 1 mark and dot for QWC if stated as controlled</p> <p>7 IGNORE amount (of solvent / water / ethanol / alcohol) or size (of leaf). Procedure can be liquidising/pestle and mortar, stated same for each.</p> <p>8 IGNORE amount / content / how much (of acid or H⁺ ions) except for QWC</p> <p>9 e.g. pH probe universal indicator (not litmus) titration IGNORE colorimetry</p>
		QWC ;	1	<p>Award if variables correctly identified as <u>independent</u> (1 only) and <u>controlled</u> (any of 3/4/5/6/7) and <u>dependent</u> (8 only).</p>

Question		Answer	Marks	Guidance
(c)	(ii)	<p>1 bacteria / fungi ;</p> <p>2 <i>idea of external digestion</i> ;</p> <p>3 by , enzymes / named enzymes ;</p> <p>4 absorption of breakdown products ;</p> <p>5 release of carbon dioxide and water ;</p> <p>6 (breakdown of protein) makes , ammonium , ions / compounds or NH_4^+ ;</p>	3	<p>1 DO NOT CREDIT wrong bacteria eg nitrogen fixing, nitrifying, denitrifying, <i>Rhizobium, Nitrosomonas, Nitrobacter</i></p> <p>2 CREDIT saprotrophic / saprophytic / saprobiotic ACCEPT 'breaking down' for digestion e.g. cellulase / lignase</p> <p>3</p> <p>6 CREDIT ammonification IGNORE ammonia / nitrates</p>
(d)		<p>auxin / IAA ;</p> <p>not destroyed by light / more present in dark ;</p> <p>moves down from shoot tip / uniformly distributed ;</p> <p>(causes) <u>cell</u> elongation ;</p>	2	IGNORE gibberellins and references to phototropism and more light on one side
		Total	21	

Question		Expected Answers	Marks	Additional Guidance
2	(a)	124 (%) / 123.7 (%) ; ;	2	<ul style="list-style-type: none"> • Correct answer = 2 marks $(208 - 93) \div 93 \times 100$ • ACCEPT 55 (%) / 55.3 (%) for 2 marks $(208 - 93) \div 208 \times 100$ • Correct numerical answer but inappropriate units (eg 124 μm) = 1 mark • If answer not rounded correctly (to nearest whole number or to 1 dp) or if answer incorrect, then allow 1 mark for seeing either 115 or $(208 - 93)$

Question	Expected Answers	Marks	Additional Guidance
(b)	<p>1a <i>benefit</i> allows entry of more CO₂ ;</p> <p>2a <i>explanation</i> (CO₂) for , light-independent reaction / Calvin cycle or 2b light-dependent reaction is taking place quickly / reduced NADP building up / ATP building up or 2c CO₂ not as limiting (than when there are fewer stomata) or 2d <i>idea that</i> increases access to air spaces for distribution of CO₂ ;</p> <p>OR</p> <p>1b <i>benefit</i> reduces transpiration ;</p> <p>2e <i>explanation</i> <i>idea of</i> stomata sheltered from , air currents / heat (when on lower surface) or 2f <i>idea that</i> diffusion shells maintained ;</p>	2	<p>Read through complete answer. Award 2 marks if a benefit and explanation <u>are</u> correctly linked.</p> <p>If benefit and explanation <u>are not</u> correctly linked: Award Max 1 for <u>either</u> a benefit <u>or</u> an explanation.</p> <p>1a Must indicate the idea of <i>more and imply going in</i> eg 'allows more gas exchange so that there is more CO₂ for photosynthesis' the mention of gas exchange implies that the CO₂ must be going in</p> <p>2a DO NOT CREDIT 'CO₂ fixed' without further qualification (eg ref to Rubisco / GP formation)</p> <p>2b</p> <p>2c CREDIT with fewer stomata CO₂ is limiting</p> <p>2d</p> <p>1b DO NOT CREDIT description of transpiration ACCEPT 'plant less likely to wilt'</p> <p>2e</p> <p>2f</p>

Question		Expected Answers	Marks	Additional Guidance
(c)		<p>1 equal sample size for sun and shade leaves / increase sample size of shade leaves / greater numbers of sun and shade leaves ;</p> <p>2 measure thickness of cuticle / make cuticle observations quantitative ;</p> <p>3 record range / calculate SD / calculate SE / (named) statistical analysis ;</p> <p>4 record data on leaf, length / width / area / colour / chlorophyll content ;</p> <p>5 record data on , size of stomata / stomatal count on upper surface ;</p> <p>6 define what is a sun or shade leaf / measure light levels to classify type of leaf ;</p> <p>7 repeat / replicate , the (whole) experiment / using other plants of the same species ;</p>	<p>2 max</p>	<p>DO NOT CREDIT refs to controlling temperature or light or wind or time</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7 IGNORE ref to other species DO NOT CREDIT 'repeats' unqualified or implying the same individual plant</p>
		TOTAL	6	

Question			Answer	Marks	Guidance								
3	(a)	(i)	<table border="1"> <thead> <tr> <th></th> <th>Discontinuous</th> <th>Continuous</th> </tr> </thead> <tbody> <tr> <th>Species identified by letter</th> <td>S and T ;</td> <td>R ;</td> </tr> </tbody> </table>		Discontinuous	Continuous	Species identified by letter	S and T ;	R ;	2			
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Species identified by letter	S and T ;	R ;											
		(ii)	<p>statement 1 in S and T only ; statement 8 in S and T only ;</p> <p>statements 2 and 3 in R only ; statement 5 in R only ;</p> <p>statements 4 and 7 in T only ; statement 6 in S only ;</p>	6	<table border="1"> <thead> <tr> <th>Species</th> <th>Statement number(s)</th> </tr> </thead> <tbody> <tr> <td>R</td> <td>2 3 5</td> </tr> <tr> <td>S</td> <td>1 6 8</td> </tr> <tr> <td>T</td> <td>1 4 7 8</td> </tr> </tbody> </table>	Species	Statement number(s)	R	2 3 5	S	1 6 8	T	1 4 7 8
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Question	Answer	Marks	Guidance
(b)	<p><i>collection</i></p> <ol style="list-style-type: none"> 1. named equipment for collecting from, dogs / fields ; 2. get, large number / over 100 (fleas) ; 3. use several, dogs / fields ; 4. <i>idea of</i> random sampling (dogs / field) ; <p><i>testing</i></p> <ol style="list-style-type: none"> 5. (named) container ; 6. correct dose / range (of concentrations), tested ; 7. control without flea killer ; 8. delivery method described ; <p><i>processing</i></p> <ol style="list-style-type: none"> 9. leave for set time ; 10. count number of, dead / live, fleas (after testing) ; 11. calculate percentage (frequency) of, alive / dead / resistant / non-resistant ; 	6	<p>1 CREDIT pooter, forceps, tweezers, pipette, (flea) comb, sweep net, sticky traps, light traps (in correct context)</p> <p>5 CREDIT tank, jam jar, boiling tube, petri dish. 6 ACCEPT 'dose according to manufacturer's instructions' IGNORE same, volume / concentration</p> <p>8 e.g. flea-killer sprayed / left to evaporate from cotton wool / fed in blood or food</p> <p>9 ACCEPT leave for same amount of time 10 IGNORE how many were left, how many were resistant IGNORE identify – must be counting number</p>
	QWC ;	1	<p>Award if the first mark point awarded in each section is <u>in the correct section order.</u></p> <p>collection 1 to 4 then testing 5 to 8 then obtaining and processing results 9 to 11</p> <p><i>e.g. if the first mark of each section is awarded in the wrong order (such as mp 1, then mp 10, with nothing from the testing section inbetween) then do not award QWC</i></p>
	Total	15	