

Question number	Answer	Marks	Guidance															
1 (a)	1 to cope with changing conditions / AW; 2 avoid abiotic stress; 3 to maximise photosynthesis or to obtain more, light / water / minerals; ora 4 avoid, herbivory / grazing; 5 to ensure, germination in suitable conditions / pollination / seed set / seed dispersal;	2 max	1 Looking for a general statement DO NOT CREDIT "adapt to change" 3 CREDIT named elements / ions IGNORE nutrients 4 methods of preventing grazing could include producing more toxins / more spines / encouraging stinging ants IGNORE predation 5 DO NOT CREDIT 'maximise reproduction' without further qualification															
1 (b) (i)	1 in water / in A / with no abscisic acid, germination increases as conc. GA increases; 2 when abscisic acid present / in B, no germination; 3 maximum germination 90% with 5 mol dm <sup>-3</sup> GA, in water / without abscisic acid; 4 2 comparative figures (x and y refs. plus units); 5 GA concentration increases, logarithmically / by a factor of 10, on x axis; 6 10 times more GA gives, 3 (conc 0.05 to 0.5) / 0.5 (conc 0.5 to 5), times more germination;	4 max	2 DO NOT CREDIT 'inhibits germination' (as this is a conclusion not a description) 3 ACCEPT 91% (± 2%) for 90% 4 EITHER compare A and B at the same GA conc OR two points on same line with units for both <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>GA conc (mol dm<sup>3</sup>)</th> <th>A (%)</th> <th>B (%)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>10 ± 2</td> <td>0</td> </tr> <tr> <td>0.05</td> <td>22 ± 2</td> <td>0</td> </tr> <tr> <td>0.5</td> <td>66 ± 2</td> <td>0</td> </tr> <tr> <td>5</td> <td>91 ± 2</td> <td>0</td> </tr> </tbody> </table>	GA conc (mol dm <sup>3</sup> )	A (%)	B (%)	0	10 ± 2	0	0.05	22 ± 2	0	0.5	66 ± 2	0	5	91 ± 2	0
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1 (b) (ii)	<i>gibberellin</i> hydrolysis of starch; glucose used for respiration; ATP/energy, required for germination; <i>abscisic acid</i> inhibits cell growth so germination;	4																
1 (b) (iii)	1 so temperature doesn't affect results / so only desired variable(s) changed / to show just the effect of plant hormones; 2 since temperature affects enzyme activity;	2 max	1 ACCEPT fair test IGNORE to control temperature / temperature is a															

	3 suitable / optimum, temperature for (lettuce) germination;		limiting factor / temperature is a controlled variable 2 CREDIT "optimum temperature for enzyme activity" or "this is the temperature when enzymes work best" 3 ACCEPT 'these' seeds
1 (b) (iv)	1 volumes of liquid(s); 2 ABA concentration; 3 oxygen availability; 4 age of seeds; 5 previous storage of seeds / viability idea; 6 genotype / variety, of seeds; 7 size / type of, petri dish / filter paper; 8 length of time experiment left for (before recording results); 9 space between seeds; 10 AVP;	3 max	Mark the FIRST suggestion on each numbered line DO NOT CREDIT conc, GA / giberrellin (as this is the independent variable) IGNORE number of seeds (as given in the question) 1 DO NOT CREDIT amounts / levels CREDIT volume of, water / GA / ABA 3 IGNORE carbon dioxide 6 CREDIT "from same batch of seeds" or "seeds from same plant" 10 e.g. light qualified (duration / intensity / wavelength) use of distilled water all lids, off / on
1 (c)	1 seedless, fruits / grapes; 2 weed killers; 3 rooting powder / to grow cuttings / used in tissue culture; 4 control fruit ripening; 5 controls fruit drop; 6 restrict hedge growth; 7 preserve, cut flowers / green vegetables; 8 specific example of improved fruit quality; 9 producing malt / in brewing; 10 AVP; 11 AVP;	2 max	Mark the FIRST TWO suggestions IGNORE the names of plant growth regulators 4 could be used to speed up or slow down 8 e.g. longer stalks on grapes longer apples 10 & 11 e.g. promoting sexual maturity in conifers promoting latex flow in rubber plants promoting sexual maturity in female cucumber plants

			longer nodes in sugar cane restricting growth in, chrysanthemums / other e.g.																																																		
2 (a)	auxin / IAA; (positive) phototropism; plants / shoots, bend towards light; etiolation / plants grow taller; climbing plants climb, up / over, other plants; (positive) thigmotropism / sense of touch; grow roots towards, water / minerals; allelopathy / description;	4 max	IGNORE other named hormones IGNORE apical dominance DO NOT ACCEPT phototropic / thigmotropic (but penalise once) IGNORE move, grow IGNORE nutrients																																																		
2 (b)	Auxins, apical dominance / tropisms / example described; gibberellins, growth / germination / flowering; ethylene, ripening / aging / abscission; abscisic acid, dormancy;	4																																																			
3 (a)	Not all plant hormones are responsible for plant growth; <i>idea that</i> hormones are chemical messengers; (role in) cell communication; reference to target cells; wide range of effects; long-term effects;	5																																																			
3 (b)	<table border="1"> <tr> <td>Gibberellin</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Auxin</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Cytokinins</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Ethylene</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>ABA</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Gibberellin										Auxin										Cytokinins										Ethylene										ABA										4	
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3 (c)	<i>Both</i> plant hormones; <i>auxins</i> apical dominance / growth of lateral buds suppressed; delays abscission; promotes cell elongation; <i>cytokinins</i> fruit growth; promotes abscission; promotes cell division;	6																																																			
4 (a) (i)	Control plants leaf, number and surface area, relatively constant; stressed plants leaf, number and surface area, decreased with time; figures quote;	3																																																			
4 (a) (ii)	Growth / development, reduced; lack of water caused stomatal closure; reduced carbon dioxide uptake; reduced photosynthesis;	3																																																			
4 (b)	Reduced auxin concentration due to lower light intensity (in the autumn); stimulates the production of ethene; ethene switches on genes; in cells of abscission zone; enzymes produced; (enzymes) digest cell walls (in cells of abscission zone);	5																																																			
4 (c)	Both result in loss of leaves; due to action of hormones; different hormones; abscisic acid in autumn leaves; ethene in water stressed leaves;	5																																																			