Question			Answer	Marks	Guidance
1	(a)	(i)	**1** (hormone) binds to <u>receptor</u> **;** **2** causing **,** cascade of events / enzyme reactions **;** **3** may involve switching **,** on / off, genes **;** **4** only **,** present / needed **,** in small **,** concentrations / quantities (to have an effect) **;** **5** may have effect on more than one **,** location / target tissue **;** **6** *idea that* effect may involve interaction of more than one hormone **;**	**2 max**	**IGNORE** prompt lines and mark as prose **1 ACCEPT (**hormone) complementary shape to <u>receptor</u> **1 ACCEPT** attach **1 IGNORE** fit **3 CREDIT** ref to changing gene expression
1	(a)	(ii)	**1** (most) plant cells retain ability to differentiate / <u>totipotent</u> **;** **2** plants have **,** meristems / meristematic tissue **;** **3** *idea that* plant cells can de-differentiate and then differentiate into a different cell type; **4** (most) animal cells are **,** differentiated / not totipotent / not pluripotent / only able to differentiate into the same type(s) of cell / are multipotent;	**2 max**	**2 ACCEPT** named meristematic tissue e.g. shoot apex / root apex / cambium **4 ACCEPT** 'stem cells found in few (named) tissues' 'bone marrow cells only differentiate into blood cells'

Question			Answer	Marks	Guidance
1	(a)	(iii)	**1** (inter-species / triploid) hybrids **,** are sterile / cannot reproduce sexually;		**1** **CREDIT** hybrid from named examples e.g. einkorn (wheat) x **,** wild / goat **,** grass emmer (wheat) x wild grass
			2 polyploidy (in the hybrid) provides duplicate of each chromosome **;**		**2** **IGNORE** ref to 'more than two sets of chromosomes' as this is given in Q
			3 (polyploidy) allows the hybrid to **,** carry out meiosis / form gametes **or** (polyploidy) restores fertility / overcomes sterility **;**		**3** **ACCEPT** 'chromosome number doubling restores fertility' **3** **ACCEPT** can reproduce sexually
			4 (hybrids are) <u>reproductively isolated</u> (from other species);		**4** **ACCEPT** gametes incompatible with other species
			5 increased, cell size / grain size, increases yield;		**5** **ACCEPT** seed size
			6 sterile hybrids expensive for farming (especially in developing countries);		
			7 (plants) stronger/more vigorous/ healthier;		**7** must be a comparative statement **7 ACCEPT** less prone to disease / greater hybrid vigour **7 IGNORE** pest resistance
				2 max	

Question			Answer	Marks	Guidance
1	(b)		*cress seedlings* **C1** apical cells / apex/ tip(of shoot), produce **,** auxin / IAA **;** **C2** diffusion / active transport (down shoot / through parenchyma) **;** **C3** greater auxin (concentration) on shaded side of stem **;** **C4** auxin causes cell wall loosening **;** **C5** auxin causes cell **,** elongation / expansion **;** **C6** further detail of changes in cell **wall** ; *Human* **H1** retina / rods / receptors**,** detect light / AW **;** **H2** action potentials/ depolarisation/nervous impulse**,** along sensory neurone (membrane) **;** **H3** intermediate neurone (in brain) **/** (somatic) motor neurone / neuromuscular junction **;** **H4** correct ref to detail of synaptic transmission**;** **H5** depolarisation / contraction, of muscle fibre(s); **H6** correct ref to detail of muscle contraction;	**7 max**	**C1 ACCEPT** secretes /releases **C2 CREDIT** PIN (polar auxin transport) **C3 ACCEPT** auxin, moves to / collects on, shaded side **C3 IGNORE** found on shaded side **C4 ACCEPT** cell walls become,stretchy / less rigid **C4 IGNORE** weakened cell walls **C6** e.g. H^+ ions pumped into cell wall / low pH to allow enzymes to work / bonds broken within cellulose in wall **H1 IGNORE** ref to cones **H2 / H3 DO NOT CREDIT signals / messages** **H2 IGNORE** ref to optic nerve **H3 CREDIT** ref to relay neurone **H5 ACCEPT** muscle cell **H6** e.g. actin and myosin slide over each other
			Total	**13**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>
<table>
<tr><th>biological principle</th><th>letter</th></tr>
<tr><td>artificial selection</td><td>E</td></tr>
<tr><td>predator-prey interaction</td><td>G</td></tr>
<tr><td>apical dominance</td><td>B</td></tr>
<tr><td>nitrogen fixation and nitrification</td><td>D</td></tr>
<tr><td>reproductive cloning</td><td>A / F</td></tr>
<tr><td>positive chemotaxis</td><td>H</td></tr>
<tr><td>decomposition</td><td>C / D</td></tr>
<tr><td>commercial use of plant hormones</td><td>F</td></tr>
</table>
;
;
;
;
;
;
;
;
</td><td>8</td><td>Award 1 mark per row.

Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</td></tr>
<tr><td></td><td>(b)</td><td></td><td>respiration / decomposition / decay / ripening ;

<u>interspecific competition</u> ;

(positive) <u>phototropi</u>sm ;

<u>succession</u> ;</td><td>4</td><td>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks

ACCEPT metabolism / metabolic reactions

DO NOT CREDIT negative phototropism
DO NOT CREDIT trophism (as ambiguous with trophic)</td></tr>
</table>

Question			Answer	Marks	Guidance
	(c)		*animals = primary consumers* **1** keep animals, warm / indoors **;** **2** reduce animal movement **;** **3** feed animals high, protein / energy, food **;** **4** vaccination / (routine) antibiotics, for animals **;** **5** selective breeding / genetic engineering**,** for improved animals **;** **6** slaughter just before, mature / full size **;**	3	**2 ACCEPT** zero grazing idea **3 ACCEPT** growth-enhancing food additives **4 IGNORE** hormones **5 ACCEPT** description of improvement, e.g. disease resistant, faster-growing, higher yielding
			Total	**15**	

Question			Answer	Marks	Guidance
3	(a)	(i)	ecology ;	1	**First Answer**
		(ii)	abiotic ;	1	**First Answer**
		(iii)	ecosystem ;	1	**First Answer**
	(b)		(interspecific) competition ; species 1 and species 2 named ; description of interaction ; trophic / predator-prey / predation / parasitism / grazing / herbivory ; species 1 and species 2 named ; description of interaction ; mutualistic / mutualism ; species 1 and species 2 named ; description of interaction ;	6	**Mark the first suggestion on each numbered line only, max 3 for each, therefore max 6 overall.** **ACCEPT** English or scientific names for species (genus name alone acceptable and does not need capital letter) and accept phonetic spelling. **DO NOT ACCEPT** intraspecific eg eat, same / named, food OR occupy same niche *'Red and grey squirrels compete for the same food '* = 3 marks **IGNORE** grass, worms, **ACCEPT** symbiosis / symbiotic / commensalism **IGNORE** legumes and nitrogen-fixing bacteria if no species identified eg could include pollination, seed dispersal

Question			Answer	Marks	Guidance
	(c)	(i)	auxin / IAA **;** (positive) <u>phototropism</u> **;** 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** phototrophic / thigmotrophic (but penalise once) **IGNORE** move, grow **IGNORE** nutrients
		(ii)	less auxin / auxin production stopped **;** <u>apical dominance</u>, stopped / removed **;** side shoots grow / lateral buds develop / ora **;** plant becomes bushy **;**	3 max	**CREDIT** axillary buds **IGNORE** side leaves

Question			Answer	Marks	Guidance
	(d)		**1** tape measure / rope, laid **;** **2** line / belt, <u>transect</u> **;** **3** continuous / interrupted / AW **;** **4** (use quadrat to) record percentage cover of plants **;** **5** (use quadrat with) ACFOR scale **;** **6** point quadrat use described **;** **7** use of key to identify species **;** **8** data recording sheets prepared in advance **;** QWC – sequencing of steps in procedure **;**	5 max 1	 **3** record all species touching line = continuous line quadrats end to end = continuous belt OR at selected intervals only = interrupted **4 ACCEPT** description = number of squares with species (>half covered) **5 DO NOT ACCEPT** record abundance One point from **1 - 3** before a point from **4** to **8**
			Total	**22**	

Question			Expected Answers		Marks	Additional Guidance	
4	(a)	(i)	*2nd messenger* cAMP / cyclic AMP / cyclic adenosine monophosphate ; *1st messenger* adrenaline / adrenalin ;		2	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** CAMP / camp **DO NOT CREDIT** adenine monophosphate **IGNORE** chemicals not named in Fig. 5.1	
	(a)	(ii)	**1**	glycogen ⟶ glucose / glycogenolysis ;	1 max	*1*	**DO NOT CREDIT** gluconeogenesis / glycogenesis
			2	by hydrolysis ;		*2*	This term must be used, or a derived term.
			3	*correct ref to* protein kinase / glycogen phosphorylase kinase (activates glycogen phosphorylase) ***or*** glycogen phosphorylase (stimulates conversion of glycogen) ***or*** inhibition of glycogen synthase (preventing glucose conversion to glycogen) ;		*3*	

Question			Expected Answers		Marks	Additional Guidance
4	(a)	(iii)				**IGNORE** reasons not related to adrenaline (as Q specifies 'how the adrenaline molecule can cause ...') **IGNORE** descriptions of stated effects in different tissues as Q asks *how* adrenaline causes these different effects
			1	different tissues have different (types of adrenaline) receptors **;**		***1***
			2	(causing) cAMP concentration to increase or decrease **;**		***2*** **ACCEPT** adenyl cyclase / cAMP **,** inhibited
			3	second messenger (may be) different **;**		***3***
			4	cAMP / second messenger **,** activates **,** different / other **,** enzymes / enzyme reactions (in different target cells) **;**	**2 max**	***4***

Question			Expected Answers		Marks	Additional Guidance
4	(b)		1	**adrenalin(e)** increases , heart rate / stroke volume / cardiac output ;		*1*
			2	**cardiovascular centre** in **medulla oblongata** ;		*2* **ACCEPT** 'cardiac' instead of cardiovascular but not for QWC
			3	*idea of* nervous connection to , SAN / **sino-atrial node** ;		*3* **ACCEPT** SAN for mp 3 but not for QWC
			4	(which) controls frequency of waves of , excitation / depolarisation ;		*4* **CREDIT** in relation to mp 2 or mp 3
			5	**vagus** / **parasympathetic** , nerve decreases heart rate ;		*5* **ONLY CREDIT** vagus ***or*** parasympathetic for QWC
			6	**accelerator** / **sympathetic** , nerve increases heart rate ;		*6* **ONLY CREDIT** accelerator ***or*** sympathetic for QWC **ACCEPT** phrenic nerve
			7	high blood pressure detected by , stretch receptors / baroreceptors ;		*7* **DO NOT CREDIT** proprioreceptor
			8	low blood pH / increased levels of blood CO_2 , detected by **chemoreceptors** ;		*8*
			9	(receptors) in , aorta / **carotid** sinus / carotid arteries ;	**4 max**	*9*
			QWC – technical terms used appropriately with correct spelling ;		**1**	Correct use of **adrenalin(e)** (**Identify using the tick 1** ✓**1** AND MUST BE INCLUDED FOR QWC TO BE AWARDED) **plus** use of **2** terms from: **cardiovascular centre, sino-atrial node, carotid, chemoreceptor** **medulla oblongata, vagus or parasympathetic, accelerator or sympathetic,** **You should use the GREEN DOT to identify the remaining QWC terms that you are crediting.** **Please insert a QWC symbol next to the PENCIL ICON, followed by a tick (✓) if QWC has been awarded or a cross (×) if QWC has not been awarded**
				TOTAL	**10**	