Question Number	Answer	Additional guidance	Mark
1 (a)	1. reference to phytochrome ; 2. idea that day length is the environmental cue ; 3. ref to critical period / photoperiod ; 4. this is more than 12 hours light / less than 12 hours darkness / eq ; 5. idea that different wavelengths of light are involved OR Reference to interconversion of phytochromes e.g. because light supplies red light which converts P_R converted to P_{FR} ; 6. Ref to florigen ;		**(3)**

Question Number	Answer	Additional guidance	Mark
1 (b)(i)	Both 1. chemicals ; 2. produced in cells / eq ; 3. idea that they move away from site of production ; 4. effect may be distant from production site / eq ; 5. long-term / permanent effect / example quoted / eq ; 6. involved in gene activation /eq ;	5. ACCEPT both can control growth 6. CCEPT: Both can have an effect on gene inhibition	**(3)**

Question Number	Answer	Additional guidance	Mark
1 (b)(ii)	1. idea that weeds affected because e.g. more sensitive, take up more ; 2. idea that (auxin / IAA) causes cell elongation ;		**(2)**

Question Number	Answer	Additional guidance	Mark
2(a) (i)	(cut shoot) without IAA present / without agar blocks ;	ACCEPT - agar block with no IAA, empty agar block, agar block with water ACCEPT - auxin(s) as alternative to IAA	**(1)**

Question Number	Answer	Additional guidance	Mark
2(a) (ii)	1. (both sides of) shoot taller / eq ; 2. than the control / eq ; 3. both IAA's diffuse {down / out of agar / to zone of elongation} / eq ; 4. reference to cell elongation / eq ; 5. details of cell elongation / eq ; 6. shoot bends to the right / eq ; 7. (due to) more growth on {left side of shoot / side with artificial IAA} / eq ;	ACCEPT - auxin as alternative to IAA throughout ACCEPT 1 – grow {taller/higher/up/ towards the light} ACCEPT 3 – away from the light/agar block ACCEPT 6 - bends away from side with artificial IAA	**(5)**

Question Number	Answer	Additional guidance	Mark
2(b)	1. idea that IAA enters the cell ; 2. reference to movement within cell / IAA in cytoplasm to nucleus ; 3. effect when binds to transcription factor e.g. forms a transcription initiation complex or countering an inhibitor ; 4. reference to switching on gene ; 5. activity at promoter region / eq ; 6. allows formation of (m)RNA / eq ; 7. idea of translation produces protein ;	ACCEPT - auxin as alternative to IAA throughout ACCEPT 3 - joins to promoter region or activates transcription factor ACCEPT 5 – ref to RNA polymerase activity	**(4)**

Question Number	Correct Answer	Mark
3(a)	1. depolarisation of adjacent {membrane / eq} / eq ; 2. changes PD across membrane / eq ; 3. opens sodium {gates / eq} ; 4. sodium ions move into (the neurone) ;	**max (2)**

Question Number	Correct Answer	Mark
3(b)	**Position on diagram** / **Permeable to sodium ions** / **Permeable to potassium ions** A ☒ ; D ☒ ;	**(2)**

Question Number	Correct Answer	Mark
3(c)	1. correct {reference to / description of} diffusion gradient (of potassium ions) ; 2. correct {reference to / description of} electrochemical gradient ; 3. increased permeability (of membrane) to potassium ions / eq ; 4. reference to potassium {gates / eq} open / eq ; 5. reference to sodium {gates / eq} closed / eq ;	**max (3)**

Question Number	Correct Answer	Mark
3(d)	1. PD less negative / eq 2. idea that the membrane remains permeable to potassium ions ; 3. potassium ions {move because of charge difference / eq} ; 4. into {nerve cell / neurone / axon / eq} ; 5. idea that potassium ion is removing a positive charge (from the outside) ; 6. idea that equilibrium is established e.g. diffusion gradient balanced by potential difference ;	**max (3)**

Question Number	Answer	Additional guidance	Mark
4 (a)	<table><tr><th rowspan="2">Feature</th><th colspan="3">Type of neurone</th></tr><tr><th>Sensory</th><th>Relay</th><th>Motor</th></tr><tr><td>Found only in the central nervous system</td><td>☒</td><td>☒</td><td>☒;</td></tr><tr><td>Cell terminates at the effector</td><td>☒</td><td>☒</td><td>☒ ;</td></tr><tr><td>Pre-synaptic membrane not found in the central nervous system</td><td>☒</td><td>☒</td><td>☒ ;</td></tr><tr><td>impulse moves away from the receptor</td><td>☒ ;</td><td>☒</td><td>☒</td></tr></table>		(4)

Question Number	Answer	Additional guidance	Mark
4 (b)(i)	Hydrolysis / eq ;		(1)

Question Number	Answer	Additional guidance	Mark
4 (b)(ii)	1. Supplies energy to allow opsin <u>and</u> retinal to combine ; 2. To (re)form rhodopsin ; 3. Use in the transport of ions e.g. to allow Na^+ to be pumped out of cell ;	3. CCEPT role of ATP in calcium ion uptake	(2)

Question Number	Answer	Additional guidance	Mark
4 (b)(iii)	1. Reference to actin and myosin interacting ; 2. ATP binds to myosin head causing {bond / cross-bridge / eq} between actin and myosin to break / eq ; 3. ATP {breaks / hydrolyses} into ADP and P_i {releasing energy that is stored in myosin head / causing myosin head to reset / eq} ; 4. Myosin head binds to actin / {bond / cross-bridge forms} between actin and myosin / eq ; 5. P_i is released from myosin head / eq ; 6. Energy in myosin head causes it to move / eq ; 7. Idea that actin slides along ; 8. ADP is released at this time / eq ; 9. Role of ATP in transport of calcium ions back to sarcoplasm / eq ;		**(5)**