Question	Marking guidance	Mark	Comments
1(a)(i)	Taxis;	1	Ignore references to positive and negative, and prefixes such as photo- Accept taxes/tactic Allow phonetic spelling
1(a)(ii)	Moves towards stimulus/towards light;	1	Direction must be correct.
1(b)	Gravity; Antennae involved; Doesn't show light is involved/doesn't respond to light as they are unable to see/as eyes are covered;	3	Accept geotaxis
1(c)	Helps them to leave the soil/ground/reach the surface; Disperse/produce new colonies; Avoid competition;	2 max	

<table>
<tr><th>Question</th><th>Marking guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>2(a)</td><td><table>
<tr><td>DNA</td><td>✓</td><td>2</td></tr>
<tr><td>mRNA</td><td>x</td><td>1</td></tr>
<tr><td>tRNA</td><td>✓</td><td>1</td></tr>
</table></td><td>2</td><td>One mark for each correct column
Regard blank as incorrect in the context of this question
Accept numbers written out: two, one, one</td></tr>
<tr><td>2(b)(i)</td><td>Marking principles
1 mark for complete piece transcribed;

1 mark for complementary bases from sequence transcribed;</td><td>2</td><td>Correct answer
UGU CAU GAA UGC UAG

but allow 1 mark for complementary bases from section transcribed, providing all four bases are involved</td></tr>
<tr><td>2(b)(ii)</td><td>Marking principle
1 mark for bases corresponding to exons taken from 2(b)(i)</td><td>1</td><td>Correct answer
UGU UGC UAG
If sequence is incorrect in 2(b)(i), award mark if section is from exons. Ignore gaps.</td></tr>
</table>

Question	Marking guidance	Mark	Comments
3(a)	(Ion) channel proteins open; Sodium in; Changes membrane potential/makes inside of axon less negative/positive/depolarisation/ reaches threshold; More channels open/positive feedback;	3 max	Accept other phrases for ion channel proteins providing that it is clear that it is something through which ions pass. Reject carrier. First marking point relates to opening. Third point must relate to more (channels) opening.
3(b)	Potassium channels open; Potassium out; Sodium channels close;	3	Do not penalise candidate who refers to sodium or potassium. Ions are mentioned in question. Reject pump
3(c)	Pump/active transport/transport against concentration gradient; Of sodium from axon/sodium out/of potassium in;	2	Do not penalise candidate who refers to sodium or potassium. Ions are mentioned in question

Question 4: N/A

Question	Marking guidance	Mark	Comments
5(a)	RNA polymerase;	1	DNA polymerase is incorrect Ignore references to RNA dependent or DNA dependent Allow phonetic spelling
5(b)(i)	(Receptor/transcription factor) binds to promoter; Stimulates RNA polymerase/enzyme X; Transcribes gene/increase transcription;	2 max	
5(b)(ii)	Other cells do not have the/oestrogen/ ERα receptors;	1	But do not accept receptors in general.
5(c)	Similar shape to oestrogen; Binds receptor/prevents oestrogen binding; Receptor not activated/will not attach to promoter/no transcription;	2 max	Accept alternative Complementary to oestrogen; Binds to oestrogen; Will not fit receptor;

Question 6: N/A

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Question	Marking guidance	Mark	Comments
7 (a) (i)	Contains more/large amount of succinic dehydrogenase; (Slow fibres) have lots of mitochondria/ (slow fibres) respire aerobically;	2	Accept “the enzyme” since only one being discussed
7 (a) (ii)	Near edge/outside; Short distance for diffusion of oxygen/Allows rapid diffusion/more diffusion of oxygen; Oxygen used by mitochondria/electron transfer system in mitochondria;	3	 Ignore glucose Accept carbon dioxide Accept effect of carbon dioxide on cell e.g. carbon dioxide changes pH/carbon dioxide affects enzymes
7 (b) (i)	Measure with graticule/eyepiece scale; Calibrate against something of known size: ***OR*** Estimate/measure field diameter with a scale; Estimate number of fibres to cover diameter;	2	Q Last point could be a calibrated slide/haemocytometer/red blood cell or reasonable alternative Accept Mount on ruler/haemocytometer/graph paper; use this to measure size; Note position of ruler must be specified and correct
7 (b) (ii)	Equivalent measurements taken; At random to avoid bias/avoid choice of particular fibres; Large number to be representative/minimise effect of extremes/of anomalies;	2 max	As a stained slide is provided reject references to safety. Ignore reliable

Question	Marking guidance	Mark	Comments
8 (a) (i)	Eaten; Containing carbohydrate/sugar; Glucose absorbed from intestine/into blood; Long time after insulin injection/needs more insulin/has not taken insulin; Does not convert glucose to glycogen/glucose not taken up from blood;	2 max	
8 (a) (ii)	Shows positive correlation/directly proportional; A range of results for a particular value/values (for different colours) overlap; Urine test only an arbitrary scale/not directly related to concentration/colour is subjective/few colour values;	3	Accept description
8 (b)	Glycogen to glucose/glycogenolysis; By activating enzymes; Gluconeogenesis;	2 max	If name incorrect this disqualifies. Allow explanation in terms of glucose from a non-carbohydrate/named non-carbohydrate source.

Question	Part	Marking Guidance	Mark	Comments
9 (a)		Krebs cycle/link reaction/pyruvate to acetylcoenzyme A;	1	**Q** Accept valid alternative for any of these steps.
	(b)	(Respiratory reactions controlled by) enzymes; Rate decreases as less kinetic energy/fewer collisions (between substrate and active site) fewer E-S complexes formed;	2	
	(c)	Requires hydrogen/electrons / is reduction; Hydrogens from reduced NAD/reduced NAD reduces (pyruvic acid) / reduced NAD oxidised;	2	Information may be on diagram
	(d)	Respiring anaerobically; (Anaerobic respiration/respiration with nitrogen) less efficient/produces less ATP; More anaerobic respiration/ more glucose/substrate must be respired to produce same amount of ATP (so more carbon dioxide produced);	3	

Question	Part	Marking Guidance	Mark	Comments
10	(a)	1 Light (energy) excites/raises energy level of electrons in chlorophyll; 2 Electrons pass down electron transfer chain; 3 (Electrons) reduce carriers/passage involves redox reactions; 4 Electron transfer chain / role of chain associated with chloroplast membranes / in thylakoids / grana; 5 Energy released / carriers at decreasing energy levels; 6 ATP generated from ADP and phosphate/P_i / phosphorylation of ATP;	5 max	**Q** Accept any reasonable alternative for electron transfer chain. Example such as chemiosmosis;
10	(b)	1 Some light energy fails to strike/is reflected/not of appropriate wavelength; 2 Efficiency of photosynthesis in plants is low/approximately 2% efficient; 3 Respiratory loss / excretion / faeces / not eaten; 4 Loss as heat; 5 Efficiency of transfer to consumers greater than transfer to producers/approximately 10%; 6 Efficiency lower in older animals/herbivores/ primary consumers/warm blooded animals/homoiotherms; 7 Carnivores use more of their food than herbivores;	6 max	**Q** Accept figures below 5%. Accept figures over 5% but below 10% if clearly related to maximum efficiency.

10	(c)	1 Slaughtered when still growing/before maturity/while young so more energy transferred to biomass/tissue/production; 2 Fed on concentrate /controlled diet /controlled conditions/so higher proportion of (digested) food absorbed/lower proportion lost in faeces / valid reason for addition; 3 Movement restricted so less respiratory loss / less energy used; 4 Kept inside/heating/shelter / confined so less heat loss / no predators; 5 Genetically selected for high productivity;	4 max	**Q** The principle here is one mark for identifying a relevant point and offering an explanation. Accept other equivalent answers.