Question	Marking Guidance	Mark	Comments
1(a)	<table><tr><td>✓</td><td>✓</td><td>✓</td><td></td></tr><tr><td></td><td></td><td></td><td>✓</td></tr><tr><td></td><td></td><td>✓</td><td>✓</td></tr></table>	4	One mark for each correct column Mark ticks only and ignore crosses
1(b)	1. Two marks for box round two hydrogens and one of theoxygens from OH groups on carbons 1 and 4;; 2. One mark from incorrect answer involving any two hydrogens and an oxygen from carbons 1 and 4;	2	Do not award marks if all atoms concerned are on same carbon atom or are on carbon atoms other than 1 and 4 or where the answer does not have two hydrogen and one oxygen
1(c)(i)	1. Holds chains/cellulose molecules together/forms cross links between chains/cellulose molecules/forms microfibrils; 2. Providing strength/rigidity (to cellulose/cell wall); 3. Hydrogen bonds strong in large numbers;	2 max	Principles here are first mark for where hydrogen bonds are formed and second for a consequence of this. Accept microfibres
1(c)(ii)	Compact/occupies small space/tightly packed;	1	Answer indicates depth required. Answers such as “good for storage”, “easily stored” or “small” are insufficient.

Question	Marking Guidance	Mark	Comments
2(a)	More that one polypeptide/chain;	1	Ignore references to haem/other groups
2(b)(i)	141;	1	
2(b)(ii)	1. Stop/start sequences; 2. Non coding DNA (in the gene)/introns/multiple repeats/junk DNA; 3. Two chains/a non-coding strand/complementary base pairs; 4. Addition of base by mutation;	2 max	Do not credit “some bases repeated”
2(c)	Different primary structure/amino acids/different number of polypeptide chains;	1	Question is about haemoglobin so do not credit differences in DNA
2(d)	1. Low partial pressure of oxygen; 2. In lungs; 3. (Llama) haemoglobin able to load more oxygen/(llama) haemoglobin saturated (at low/particular partial pressure of oxygen); 4. Higher affinity for oxygen;	3 max	The terms used in the graph (or near approximations) should be used in this answer. Ignore references to unloading The answer must relate to llamas

Question	Marking Guidance	Mark	Comments
3(a)	Kingdom, phylum and class;;	2	Lose 1 mark for each error (i.e. omission or incorrect response). Sequence not essential.
3(b)(i)	Shows evolutionary relationship;	1	
3(b)(ii)	26;	1	
3(c)(i)	1. Base sequence will be similar/some bases in common; 2. These bases will bind together/hydrogen bonds/complementary pairs;	2	Do not accept same here. Accept converse providing that it is clear that the converse argument is being made.
3(c)(ii)	1. Relationship is closer/more complementary bases/more base pairs; 2. More hydrogen bonds; 3. More heat energy needed (to separate bonds);	2 max	Do not allow stronger hydrogen bonds. Not higher temperature as this is in question.

Question	Marking Guidance	Mark	Comments
4(a)(i)	22;	1	
4(a)(ii)	1. Odd number of chromosomes/33 chromosomes (in leaf cell); 2. Chromosomes cannot pair/cannot undergo meiosis/would result in half chromosomes/cannot form haploid cells;	2	
4(b)(i)	Fast growth/ produces crop fast/produces large crop;	1	Do not insist on relative statement. Accept similar terms for fast. E.g. “better” growth Do not accept unqualified references to profit.
4(b)(ii)	Leaves less likely to break/higher breaking strength;	1	
4(c)	Low genetic diversity because they are produced by mitosis; Will all have the same DNA/genes/alleles/ will be <u>genetically</u> identical/will be clones; ***OR*** Low genetic diversity because they are not produced by meiosis; No crossing over/independent segregation/will not be <u>genetically</u> different;	2	Independent segregation is the specification term. Accept other such as random assortment.

Question	Marking Guidance	Mark	Comments
5(a)	Number of a/each (species);	1	Accept answers expressed differently providing they convey this information. Ignore extra information if it does not contradict answer.
5(b)	1. Lower diversity of plants/ few species of plants/less variety of plants/few plant layers; 2. Few sources/types of food/feeding sites; 3. Few habitats/ niches; 4. Fewer (species of) herbivore so few (species of) carnivores; 5. Aspect of agriculture (killing insects);	3 max	Must be a reference to species or kinds, not just fewer insects and fewer plants. Not less food.
5(c)(i)	Cannot predict/ do not know intermediate values;	1	
5(c)(ii)	To see what would happen/ compare <u>with</u> no management work/ to see if numbers fell anyway/ To show that it was not a factor;	1	Management as a term not required. Allow explanations.
5(d)	1. Total <u>number</u> of birds along ditch B/ditch with one side cleared greater than along ditch A/ditch with both sides cleared; 2. But only gives data for all birds/does not give data for species/data not about diversity; 3. Single ditch/single occasion/not repeated/no control;	3	Principles: Correct from evidence Total number not diversity Flaws in technique

Question	Marking Guidance	Mark	Comments
6(a)	1. Horizontal (gene) transmission; 2. (Gene passed by) conjugation/through pilus;	2	Vertical negates horizontal
6(b)	**Shape** 1. Different penicillin has different shape/structure/ enzyme/active site has specific shape/structure; **Binding** 2. No longer fits/binds to active site/not complementary to active site/does not form E-S complex; **Consequence** 3. (Different) penicillin not broken down;	3	Not different
6(c)(i)	1. Kills pathogenic/harmful bacteria/pathogens; 2. Disease less likely/improves health/animals healthier/reduces spread of infection; 3. Faster growth/more productive animals/more food converted to meat/greater survival/lower vet's bills/increased yield/less energy (for 'fighting infection');	2 max	Principles: Action of antibiotic Do not accept stops all disease Action on health Effect on production
6(c)(ii)	1. (Adding antibiotics) selects in favour of antibiotic resistance/resistant bacteria more likely to survive; 2. Increase in numbers/higher proportion of resistant bacteria; 3. May infect humans/may spread resistance to other species/ horizontal transfer;	2 max	Penalise immune only on the first occasion it occurs in this part of the question.

Question	Marking Guidance	Mark	Comments
7(a)(i)	Cells are in interphase;	1	Accept G phase/ S phase.
7(a)(ii)	Cells undergoing mitosis/in telophase/cytokinesis;	1	Accept all named stages but reject prophase, metaphase or anaphase on their own.
7(b)	1. 3 hours; 2. Time between beginnings/endings DNA replication/Increases/levelling outs of DNA concentration/for shape (of curve for replication) to be repeated; 3. (DNA) replication takes place once per cell cycle;	3	Allow close approximation where candidate attempts to be more accurate. Principle What is shown on the graph

Question	Marking Guidance	Mark	Comments
8(a)(i)	1. Removes water vapour/moisture/saturated air; 2. Increases water potential gradient/more diffusion/more evaporation;	2	
8(a)(ii)	1. Increases kinetic energy; 2. Water molecules move faster; 3. Increases diffusion/evaporation;	2 max	
8(b)(i)	Positive correlation/as light intensity increases so does rate of water movement/follows same pattern/directly proportional;	1	
8(b)(ii)	1. Stomata open; 2. Photosynthesis increases/transpiration increases; 3. More water pulled up; 4. Cohesion between water molecules/by cohesion tension;	2 max	
8(b)(iii)	1. Water pulled up trunk/moves up at fast rate; 2. (Water column under) tension; 3. Sticking/adhesion (between water and) cells/walls/xylem; 4. Pulls xylem in;	2 max	Adhesion is not a specification requirement. Accept cohesion in this context

8(c)	**Elastic tissue** 1 Elastic tissue stretches under pressure/when heart beats; 2 Recoils/springs back; 3 Evens out pressure/flow; **Muscle** 4 Muscle contracts; 5 Reduces diameter of lumen/vasoconstriction/constricts vessel; 6 Changes flow/pressure; **Epithelium** 7 Epithelium smooth; 8 Reduces friction/blood clots/less resistance;	6 max	Do not callow credit for expands/contracts/relaxes in this context. From a marking viewpoint ignore all specific references to arteries and arterioles. Consider all points as applying to both. 3. Do accept controls 4 – 6 Accept converse

Question	Marking Guidance	Mark	Comments
9(a)	(So results) can be compared/so measurement is the same each time/because eye is not perfectly round/uniform;	1	Accept eye opens to different amounts
9(b)(i)	1. Eye (diameter) is smaller and antennae longer; 2. Antennae detecting touch; 3. Data only refers to shrimps/data may not apply to all animals/only in one area;	2 max	The principle here is that candidate has recognised that both features confirm suggestion. Exact wording does not matter.
9(b)(ii)	1. Standard deviation gives a measure of spread/variation; 2. More standard deviations overlap, the less likely it is that differences are real/significant/the more likely they are caused by chance;	2	Do not accept range Accept converse. Although we are looking for the idea of significance, we cannot require this term.
9(c)(i)	Qualitative statement about difference in size/ difference in variation/ overlap in size; Quantitative statement about difference in size/ difference in variation/ overlap in size; Supported by relevant two sets of figures from graph;;	2	Note simplistic answer involving a quantitative statement gains 1 mark. More specific answer involving quantitative information gains 2 marks.

9(c)(ii)	(No) for same body length, antenna are longer/antenna are shorter/some with longer body have short antennae/some with longer body length have longer antennae; ***OR*** (Yes) positive correlation in open/in cave;	1	Habitat not critical as a term. Must refer to idea of same habitat Accept description
9(d)	More alleles of each gene/shrimps in open have all the alleles;	1	Candidates are required to use the information from the table. Must therefore refer to alleles.
9(e)	1. A small number of shrimps were /went into the cave; 2. All/high proportion of shrimps had allele L; 3. Cave population descended from these/these reproduce;	3	
9(f)(i)	1. Cross shrimps from two sites/watch courtship; 2. Breed young together/observe mating; 3. Allow 1 mark for any method of improving quality of results e.g. carry out reciprocal crosses/large number of crosses/isolate beforehand;		Other valid equivalent suggestions should be accepted.
9(f)(ii)	1. If same species the shrimps would breed, producing fertile young/courtship species specific;	3	Accept any form of evidence – mating/laying eggs/giving birth to young.