

Question	Marking Guidance	Mark	Comments
2(a)(i)	<ol style="list-style-type: none"> Moves out of the way when calcium ions bind; Allowing myosin to bind (to actin)/crossbridge formation; 	2	<ol style="list-style-type: none"> Accept shape change with Ca^{2+} Don't accept just "calcium" Accept presence of calcium ions leads to movement instead of binds <p>Accept references to troponin</p>
2(a)(ii)	<ol style="list-style-type: none"> Head (of myosin) binds to actin and moves/pulls/slides actin past; (Myosin) detaches from actin and re-sets/moves further along (actin) This uses ATP; 	2 max	<p>Q</p> <ol style="list-style-type: none"> Accept myosin power stroke (to move actin) Accept push Accept crossbridges form instead of myosin head binds to actin Must refer to myosin head or crossbridges
2(b)(i)	<ol style="list-style-type: none"> (Glycogen broken down) gives (lots of) glucose for glycolysis/anaerobic respiration; Glycolysis/anaerobic respiration not very efficient/only yields 2 ATP per glucose; 	2	<ol style="list-style-type: none"> Give if context of anaerobic respiration clear Accept anaerobic respiration is a quick source of ATP for exercise Accept very little ATP
2(b)(ii)	<ol style="list-style-type: none"> (Many capillaries) give high concentration/lots of oxygen/shorter diffusion pathway for oxygen/large surface area for oxygen exchange/diffusion; Good glucose supply with little glycogen present; Allows high rate of/more aerobic respiration OR prevents build-up of lactic acid/(muscle) fatigue; 	2 max	<ol style="list-style-type: none"> Accept idea of aerobic respiration during endurance events/long periods of exercise

Question	Marking Guidance	Mark	Comments
3(a)	<p>Three changes described;;;</p> <p>Eg</p> <ol style="list-style-type: none"> 1. Formation/growth of vacuole; 2. Formation of starch grains/amyloplasts; 3. Movement of grains/amyloplasts towards bottom of cell; 4. Cells get longer/wider/larger; 	3 max	<p>Neutral nucleus shrinks, since it doesn't</p> <p>2. Accept starch grains get bigger</p> <p>Note – list rule applies</p>
3(b)	<ol style="list-style-type: none"> 1. Grows sideways before starch grains form; 2. Bending starts when/as grains form; 3. More bending as grains increase in number; 4. More elongation (of cells)/growth (of roots) downwards as starch grains increase/move; 5. Bending starts before grains move down; 6. Could be related to vacuole; 	3 max	<p>Q</p> <p>3. Ignore starch grain growth references</p> <p>6. Ignore references to nucleus</p>
3(c)	<ol style="list-style-type: none"> 1. Greater (elongation) growth on top of root/less growth on bottom of root; 2. (IAA) at bottom of root/where IAA concentration high inhibits expansion/elongation (of cells); 3. (IAA) at top of root/where IAA concentration low leads to expansion/elongation (of cells); 	2 max	<p>Ignore references to effects of IAA on cell division</p> <p>Reject references to cell shrinkage</p> <p>2 and 3 need reference to expansion/elongation, not just growth</p> <p>3. Accept less inhibition</p>

Question	Marking Guidance	Mark	Comments
4(a)	<ol style="list-style-type: none"> 1. Positive correlation between sucrose and dopamine concentrations/higher concentration of sucrose, more dopamine; 2. So (dopamine) makes them want to drink/eat more (sucrose); 3. Positive feedback because drinking/eating leads to wanting to drink/eat (even) more; 	3	<p>Q NB question is 'How <u>do</u> these ...', not 'Do these'</p> <ol style="list-style-type: none"> 1. Ignore simple statements of numbers from graph without description of trend 3. It must be a clear statement of why this example is positive feedback, not inferred from points 1 and 2
4(b)	<ol style="list-style-type: none"> 1. (Refractory period) leads to discrete/separate nerve impulses/time when another nerve impulse can't happen; <p style="text-align: center;">OR</p> <p>(Refractory period) limits number of impulses per second/frequency of nerve impulses;</p> <ol style="list-style-type: none"> 2. When maximum frequency reached/exceeded, no further increase in information/all (higher) concentrations of sucrose seem the same; 	2	
4(c)	<ol style="list-style-type: none"> 1. (Negative feedback) stops desire/wish to eat/appetite; 2. (This) limits amount eaten/stops eating; 3. Prevents/reduces risk of obesity/too much energy intake; 	3	<ol style="list-style-type: none"> 1. Accept stops dopamine release (in this context) 1. Accept makes them feel full 2. Accept prevents constant eating 3. Accept prevents vomiting <p>Accept descriptions based on what would happen in absence of the feedback mechanism – or if stomach empty for points 1 and 2</p>

Question	Marking Guidance	Mark	Comments
5(a)	4.9/4.89;; $\frac{38.62 - 36.82}{36.82}$	2 max	Correct answer = 2 marks
5(b)	Suitable reason with explanation;; Eg Suit prevents loss of sweat; So heat of evaporation not lost; OR Water (initially) at higher temperature than skin/body/blood; (So) heat gained/less lost (by conduction/convection);	2 max	Accept idea of no heat gradient Ignore references to 'by radiation'
5(c)	1. Yes for temperature <u>and</u> oxygen consumption/no for carbon dioxide; 2. Because P value (equal to, or) less than 0.05 (other than carbon dioxide)/ P value greater than 0.05 (for carbon dioxide);	2	2. Here assume understanding that 0.001 is less than 0.05 2. Accept correct use of < and > for less than and more than 2. Accept valid responses based on greater or less than 95%
5(d)	1. Increased temperature leads to faster enzyme activity; 2. Faster rate of respiration (and oxygen consumption);	2	1. Accept faster metabolism 2. Accept more oxygen for respiration to mean more respiration

QUESTION 6: N/A

Question	Marking Guidance	Mark	Comments
7(a)	<ol style="list-style-type: none"> Causes sodium ion channels to open; Sodium ions enter (cell and cause depolarisation); 	2	<ol style="list-style-type: none"> Reject if wrong sequence of events Reject sodium on its own only once
7(b)	<ol style="list-style-type: none"> (If not removed) keeps binding (to receptors); Keeps causing action potentials/depolarisation (in post-synaptic membrane); Prevents information being carried across synapse/described consequence; 	2 max	Accept answers based on what happens if it is transported out – ie what should happen <ol style="list-style-type: none"> Accept keeps Na⁺ channels open(ing)
7(c)	<ol style="list-style-type: none"> Movement in all groups (about) same before MDMA; MDMA increases movement in Group L; Group K shows MDMA causes movement; No/little increase in mice without receptor/Group M; 	3 max	Q <ol style="list-style-type: none"> Accept normal mice for L Accept K is a control

Question	Marking Guidelines	Mark	Comments
8(a)	Ribulose biphosphate/RuBP;	1	Accept Ribulose biphosphate or Ribulose diphosphate Accept phonetic spellings Accept any variation in upper or lower case for RuBP
(b)	ATP and reduced NADP are produced in grana/thylakoids/ present in A/both tubes;	1	Must be reduced NADP but accept any alternative which show hydrogen attached to NADP Must be reduced NADP not reduced NAD
(c)	1. 4 000; 2. Light-dependent reaction does not occur /ATP and reduced NADP are not produced;	2	Accept 'same as in (tube) C', but not 'same' on its own Accept converse for mark point 2
(d)	1. (Less) GP converted to TP; 2. (Less) TP converted to RuBP;	2	GP = glycerate 3-phosphate TP = triose phosphate but abbreviations are sufficient Accept GALP as TP
(e)	1. No/less ATP / ATP produced (during electron transport); 2. No/less reduced NADP / reduced NADP produced (during electron transport);	2	Must be reduced NADP but accept any alternative which shows hydrogen attached to NADP

Question	Marking Guidelines	Mark	Comments
9(a)	1. Affects <u>enzymes</u> ; 2. Affects respiration; <u>Or</u> 3. Affects volume/pressure of gases; 4. Affects readings;	2 max	'respiration involves enzymes' = two marks Ignore reference to controlling a variable Mark point 4 can only be awarded if mark point 3 has been credited
9(b)(i)	1. <u>Oxygen</u> taken up/used (by seeds); 2. <u>Carbon dioxide</u> (given out) is absorbed by solution/potassium hydroxide; 3. Decrease in volume / pressure (inside flask);	3	Reject air is taken up for mark point 1 Reference to vacuum negates mark point 3
9(b)(ii)	4;	1	
9(c)	1. Remains the same; 2. No oxygen uptake/used;	2	Any reference to 'carbon dioxide not being produced' disqualifies mark point 2

Question	Marking Guidelines	Mark	Comments
10(a)	<ol style="list-style-type: none"> 1. Fertilisers/minerals/named ion (added to soil); 2. Role of named nutrient or element e.g. nitrate/nitrogen for proteins / phosphate/phosphorus for ATP/DNA; 3. Pesticides/biological control prevents damage/consumption of crop; 4. Pesticides/weed killers /herbicides/weeding remove competition; 5. Selective breeding / genetic modification (of crops); 6. Glass/greenhouses enhance temp/CO₂/ light; 7. Ploughing aerates soil/improves drainage; 8. Ploughing/aeration allows nitrification/decreases denitrification; 9. Benefit of crop rotation in terms of soil nutrients/fertility/pest reduction; 10. Irrigation/watering to remove limiting factor; 11. Protection of crops from birds/pests/frost by covers/netting etc.; 	5 max	<p>Accept any named examples of natural fertilisers for mark point 1 e.g. manure, bone meal etc. Ignore named elements</p> <p>Accept fertilisers/minerals/named nutrient/element removes limiting factor for mark point 2</p> <p>Accept any type of pesticide e.g. fungicides for mark point 3</p> <p>Accept seeding method reduces competition for mark point 4</p> <p>Accept idea of choosing particular variety of crop for mark point 5</p> <p>Allow rotivation, harrowing, hoeing as alternatives terms for ploughing in mark points 7 and 8</p> <p>Accept addition of organic material (mark point 1) improves soil structure/drainage or effect of lime on pH for mark point 7</p> <p>Accept activity/number of nitrifying bacteria increased / denitrifying bacteria decreased in mark point 8. Ignore nitrogen fixation</p>

<p>10(b)</p>	<ol style="list-style-type: none"> 1. Protein/amino acids/DNA into ammonium compounds / ammonia; 2. By saprobionts; 3. Ammonium/ammonia into nitrite; 4. Nitrite into nitrate; 5. By nitrifying bacteria/microorganisms; 6. Nitrogen to ammonia/ammonium; 7. By nitrogen-fixing bacteria/microorganisms in soil; 	<p>5 max</p>	<p>Accept any named nitrogen containing compound e.g. urea for mark point 1</p> <p>Accept saprophytes for mark point 2</p> <p>Accept marks for conversion i.e. mark points 1, 3, 4 and 6 even if incorrect type of bacteria named as being involved</p> <p>However, reject marks for type of bacteria i.e. mark points 2, 5 and 7 if linked to incorrect process e.g. nitrite converted to nitrate by saprobionts</p> <p>Award one mark for ammonia/ammonium into nitrate if neither mark point 3 or 4 awarded</p> <p>Ignore reference to nitrogen-fixing bacteria in root nodules. If not specified, assume nitrogen-fixing bacteria are in the soil</p>
<p>(c)</p>	<ol style="list-style-type: none"> 1. <u>Variation/variety</u> in pest population; 2. Due to mutation; 3. <u>Allele</u> for resistance; 4. Reference to selection; 5. Pests with resistance (survive and) breed / differential reproductive success; 6. Increase in frequency of allele; 	<p>5 max</p>	<p>Reference to 'immune' negates mark point 3 or 5 but not both</p> <p>Ignore 'vertical gene transmission'</p> <p>Must be increase in frequency of allele for mark point 6 do not credit answers which only refer to 'change'</p>