

Question Number	Answer	Acceptable answers	Mark
1(a)	13 (1) 65 (%)	Two marks for correct bald answer	(2)

Question Number	Answer	Acceptable answers	Mark
1(b)	innate / instinctive / inherited	Kinesis Ignore positive / negative Reject taxis	(1)

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	An explanation linking three of the following: <ul style="list-style-type: none"> • the squirrels are marking their territory (1) • using chemical markers / chemical signals / pheromones / scent (1) • which reduces conflict (1) • reduces competition / results in more food for these squirrels / the offspring (1) 	Accept area for territory Keep other squirrels away / out Ignore comments re scaring predators away / attracting mates / finding way home.	(3)

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	B habituation		(1)

Question Number	Answer	Acceptable answers	Mark
1(c)(iii)	<p>A description including three of the following:</p> <ul style="list-style-type: none"> • random / chance behaviour (1) • (specific / repeated) behaviour rewarded (1) • animal associates (reward with behaviour) (1) • behaviour reinforced (1) • (eventually) behaviour occurs without reward / infrequent reward / learned behaviour(1) 	<p>Credit: operant behaviour in context of squirrels or other animals</p> <p>Trial and error behaviour</p> <p>Accept operant condition in terms of negative reinforcement / punishment</p>	(3)

(Total for question 1 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	$\frac{90}{780} = 0.115 \text{ (1)}$ $\times 100 = 11.5\% \text{ (1)}$	Accept 12%	(2)

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	Any two from the following points <ul style="list-style-type: none"> • respiration (1) • excretion / egestion (1) • temperature regulation (1) • movement / exercise • not all eaten (1) 	energy lost as heat	(2)

Question Number	Answer	Acceptable answers	Mark
2(b)	Any two from the following points: <ul style="list-style-type: none"> • keep them in a warm environment (1) • restrict their movement (1) • provide {high energy / low wastage / easily digestible} food (1) • treat parasites (1) 	Ignore feed more	(2)

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	C		(1)

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	An explanation linking the following points: <ul style="list-style-type: none"> • bacteria provides nitrates for the plants (1) • (by) nitrogen-fixation / converting nitrogen into nitrates (1) • (nitrates) provide protein / for growth (1) 	Accept nitrogen-fixing bacteria	(3)

(Total for question 2 = 10 marks)

Question number	Answer	Mark
3(a)(i)	B	(1)

Question number	Answer		Mark
3(a)(ii)	<p>An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark):</p> <ul style="list-style-type: none"> the bacteria convert the ammonia into nitrites then nitrates maintaining the pH (1) (this prevents an increase in pH) which would cause enzymes to denature and kill the fish (1) 		(2)

Question number	Answer	Mark
3(a)(iii)	<p>An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark):</p> <ul style="list-style-type: none"> the aquatic plant will take up nitrates by active transport (1) against the concentration gradient/from where there is a low concentration to where there is a high concentration of nitrates (1) 	(2)

Question number	Answer	Additional guidance	Marks
3(b)	<p>An answer that combines the following points of application of knowledge and understanding to provide a logical description:</p> <ul style="list-style-type: none"> • a description of the use of a quadrat either by random sampling or using a belt transect (1) • a sample size 10–100 and count the number of clover plants in each quadrat (1) • multiplication factor dependent on the number of quadrats sampled (1) 	to gain maximum marks steps must be in a logical sequence	(3)

Question number	Answer	Mark
3(c)	<p>An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (3 marks):</p> <ul style="list-style-type: none"> • clover/leguminous plants could be used in crop rotation (1) • where at intervals (2–3 years) a field is planted with clover/leguminous plants and left fallow (1) • the clover/leguminous plants will have colonies of nitrogen fixing bacteria which will produce nitrates (1) • the nitrates will increase the fertility of the soil and negate the need for artificial fertilisers (1) 	(4)

(Total for question 3 = 12 marks)

Question Number	Answer	Acceptable answers	Mark
4a(i)	A <input checked="" type="checkbox"/> autotrophically		(1)

Question Number	Answer	Acceptable answers	Mark
4a(ii)	$7\,760 / 97\,000 = 0.08$ (1) $0.08 \times 100 = 8.00$ (1) $100 - 8.00 = 92.00$ (%) OR $97000 - 7760 = 89240$ (1) $89240/97000 = 0.92$ (1) $\times 100 = 92(\%)$	Award 3 marks for correct bald answer Accept alternate method of calculation	(3)

Question Number	Answer	Acceptable answers	Mark
4a(iii)	Any two of the following: not all of the organisms are consumed (1) indigestible / egestion (1) excretion (1) movement (1) heat / respiration (1) reproduction (1)	hunting / flying	(2)

Question Number		Indicative Content	Mark
QWC	*4(b)	<p>An explanation to include some of the following points</p> <ul style="list-style-type: none"> • mutualism involves organisms living closely with each other • both organisms benefit <p>oxpeckers</p> <ul style="list-style-type: none"> • relationship with large herbivores in Africa • oxpecker feeds off of the parasitic insects that live on the herbivore • disease reduced in herbivores from parasitic insect removal <p>cleaner fish</p> <ul style="list-style-type: none"> • relationship with ocean species such as sharks and large fish • cleaner fish eats the dead skin and parasites on the large fish or sharks • large fish / sharks have disease reduced by removal of parasites <p>nitrogen fixing bacteria</p> <ul style="list-style-type: none"> • relationship with leguminous plants such as beans • bacteria live inside root nodules • bacteria fix nitrogen for the plant to use • bacteria obtain nutrition from the plant and are protected from the environment <p>chemosynthetic bacteria</p> <ul style="list-style-type: none"> • relationship tubeworms in deep sea vents • lack of light so no photosynthesis • tubeworm gathers chemical substances needed by the bacteria for chemosynthesis / provide protection from heat • bacteria produce chemicals for the tubeworm 	(6)
Level	0	No rewardable content	
1	1 - 2	<ul style="list-style-type: none"> • a limited explanation of at least one example of mutualism or definition of mutualism • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy 	
2	3 - 4	<ul style="list-style-type: none"> • a simple explanation of at least two examples of mutualism or a detailed explanation of one • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy 	
3	5 - 6	<ul style="list-style-type: none"> • a detailed explanation of at least three examples of mutualism including nitrogen fixing bacteria or chemosynthetic bacteria • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors 	

Total for question 4 = 12 marks