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: • 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)	A description including **three** of the following: • 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)	Credit: operant behaviour in context of squirrels or other animals Trial and error behaviour Accept operant condition in terms of negative reinforcement / punishment	**(3)**

(Total for question 1 = 10 marks)

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

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	Any **two** from the following points • 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: • 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: • 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)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • 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)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • 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)	An answer that combines the following points of application of knowledge and understanding to provide a logical description: • 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)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (3 marks): • 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** ☒ autotrophically		**(1)**

Question Number	Answer	Acceptable answers	Mark
4a(ii)	7 760 / 97 000 = 0.08 (1) 0.08 x 100 = 8.00 (1) 100 – 8.00 = 92.00 (%) OR 97000 - 7760 = 89240 (1) 89240/97000 = 0.92 (1) X 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)**	An explanation to include some of the following points • mutualism involves organisms living closely with each other • both organisms benefit oxpeckers • 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 cleaner fish • 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 nitrogen fixing bacteria • 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 chemosynthetic bacteria • 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**	• 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**	• 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**	• 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