

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

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

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

Question Number	Answer	Acceptable answers	Mark
<b>1(c)(ii)</b>	B habituation		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(c)(iii)</b>	<p>A description including <b>three</b> of the following:</p> <ul style="list-style-type: none"> <li>• random / chance behaviour (1)</li> <li>• (specific / repeated) behaviour rewarded (1)</li> <li>• animal associates (reward with behaviour) (1)</li> <li>• behaviour reinforced (1)</li> <li>• (eventually) behaviour occurs without reward / infrequent reward / learned behaviour(1)</li> </ul>	<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>	<b>(3)</b>

**(Total for question 1 = 10 marks)**

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

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

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

Question Number	Answer	Acceptable answers	Mark
<b>2(c)(i)</b>	C		<b>(1)</b>

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

**(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"> <li>• the bacteria convert the ammonia into nitrites then nitrates maintaining the pH (1)</li> <li>• (this prevents an increase in pH) which would cause enzymes to denature and kill the fish (1)</li> </ul>	(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"> <li>• the aquatic plant will take up nitrates by active transport (1)</li> <li>• against the concentration gradient/from where there is a low concentration to where there is a high concentration of nitrates (1)</li> </ul>	(2)

Question number	Answer	Additional guidance	Marks
<b>3(b)</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"> <li>• a description of the use of a quadrat either by random sampling or using a belt transect (1)</li> <li>• a sample size 10–100 and count the number of clover plants in each quadrat (1)</li> <li>• multiplication factor dependent on the number of quadrats sampled (1)</li> </ul>	to gain maximum marks steps must be in a logical sequence	<b>(3)</b>

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

**(Total for question 3 = 12 marks)**

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

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

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

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

Total for question 4 = 12 marks