



## 4 Ecology and the environment

### 4.1 understand the terms population, community, habitat and ecosystem

(d)	(i)	(place/area/environment) where organisms/plants/animals/population/community live / eq;		1	
	(ii)	number / how many / all / amount OF <u>same</u> / <u>a</u> / <u>one</u> / <u>the</u> <u>species</u> ;	allow number of red/grey squirrels ignore number of squirrels ignore number of species	1	
1	(e)	(i)	number of named organism / number of <u>an</u> organism / number of <u>a</u> species / eq;	number of organisms = 0 allow amount as eq to number	1
		(ii)	different types / different species / different organisms;		1
		(iii)	(place) where an organism lives / (place) where organism lives described;		1

### 4.2 practical: investigate the population size of an organism in two different areas using quadrats

1		environment; population; community; quadrat; random / different; average / mean; reliability; anomalous / unusual / odd ;		8
5(a)	(i)	(student B) 1. random / spread out / scattered / eq; 2. used 10 quadrats / repeated use of quadrats / several / eq;		2 max
(b)	(i)	(student) B;		1
	(ii)	(student) D;		1

### 4.3B understand the term biodiversity



**4.4B practical: investigate the distribution of organisms in their habitats and measure biodiversity using quadrats**

(b)	(i)	young heather;		1
	(ii)	<ol style="list-style-type: none"> <li>1. re food / eq;</li> <li>2. re nutritious food / eq;</li> <li>3. sier to digest / softer / less spikes / eq;</li> <li>4. f er other animals / competition from other herbivores;</li> <li>5. mouflage / fewer predators / protection from predators / shelter from predators / hide in long grass;</li> </ol>	<ol style="list-style-type: none"> <li>2. ig re better quality / taste</li> <li>4. ig re competition alone / intraspecific</li> </ol>	3
(c)	(i)	32;;	allow one for $224 \div 700$	
	(ii)	bilberry;		1
(d)		<ol style="list-style-type: none"> <li>1. p ced at random;</li> <li>2. me sized quadrat</li> </ol>	ignore repeat	1

**4.5 understand how abiotic and biotic factors affect the population size and distribution of organisms**

(b)	(i)	<ol style="list-style-type: none"> <li>1. (more) (sun)light;</li> <li>2. water / rainfall;</li> <li>3. photosynthesis; ONCE</li> <li>4. warmer/ higher temperature;</li> <li>5. enzymes;</li> <li>6. (more) mineral ions / named mineral ion / eq;</li> <li>7. <u>use of named</u> mineral ion;</li> </ol>	<p>Ignore carbon dioxide / oxygen / pollution</p> <p>Mp 6 ignore growth</p> <p>nitrate for amino acids = Mp 5 and Mp 6</p> <p>Mp 5 ignore nutrients / fertiliser</p>	4 max
	(ii)	<ol style="list-style-type: none"> <li>1. fewer herbivores / less grazing / fewer plants eaten / fewer consumers / fewer pests / eq;</li> <li>2. fewer weeds / fewer different plants / less competition from other plants;</li> <li>3. less disease / less infection;</li> <li>4. more nitrogen fixing / nitrifying bacteria;</li> </ol>	Mp 1 ignore predator	2 max



4 (a)	1. water / eq; 2. avoid sweating / avoid water loss / avoid dehydration; 3. avoid overheating / respiration produces heat / eq; 4. less food available / less water in plants / eq;		3
(b)	1. avoid the sun / avoid high temperature / avoid heat / to shade / avoid overheating / stay cool / cooler at night;  2. avoid sweating / avoid water loss / avoid dehydration;		2
(c)	1. (eating) plant / plants contain water / grass;  2. respiration;	Ignore food / other animals	1 max

4.6 understand the names given to different trophic levels, including producers, primary, secondary and tertiary consumers and decomposers

3 (a)	<table border="1"> <thead> <tr> <th></th> <th>Number</th> </tr> </thead> <tbody> <tr> <td>the number of different tertiary consumers</td> <td>(1)</td> </tr> <tr> <td>the number of trophic levels</td> <td>4;</td> </tr> <tr> <td>the number of food chains</td> <td>4;</td> </tr> <tr> <td>the number of different predators</td> <td>3;</td> </tr> <tr> <td>the number of different consumers</td> <td>7;</td> </tr> </tbody> </table>		Number	the number of different tertiary consumers	(1)	the number of trophic levels	4;	the number of food chains	4;	the number of different predators	3;	the number of different consumers	7;		4
	Number														
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4.7 understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer

2 (a) (i)	pigeons/birds in middle; arrows correct;	ignore sun	2
1 (a) (i)	1. (food web) order correct; 2. arrows correct;	plant, hare, fox, cats and eagles need to be in correct order allow order only if in pyramid	2
(ii)	herbivore / primary consumer;		1



4.8 understand the transfer of substances and energy along a food chain			
1 (a)	1. eat (more) plants / eats grass / eq; 2. food difficult to digest / less food digested / break down less food / food egested / eq; 3. cellulose;	allow converse for fish	2
(b)	1. re cells / bigger; 2. at loss; 3. u more energy in movement;	3. igno move more	1
(c)	1. keep indoors; 2. less heat loss / maintain body temperature / less energy loss / keep warm; OR 3. restrict movement / eq; 4. less <u>respiration</u> / less <u>energy</u> used; OR 5. more digestible food / food with more energy / food with more fat; 6. more energy absorbed;		4
4.9 understand why only about 10% of energy is transferred from one trophic level to the next			
1 (a) (i)	11.1;; give two marks if 11.1 in working but 11 on dotted line	Allow one mark for 11, 900 or 100 in working	2
(ii)	not eaten / eq; (plant) respiration; active transport;	Ignore loss by heat / movement / excretion / egestion / growth	2



2(a) (i)	0.52 / 0.5 / 0.521;;	Allow one mark for correct use of 8863 as numerator (ie not if in list)  Ignore 0.52135	2  1												
(ii)	<u>light</u> misses plant / <u>light</u> misses chloroplast / <u>light</u> not absorbed / <u>light</u> reflected / eq;	Ignore reference to heat / energy / respiration / rays													
(b)	1. respiration; 2. not digested / cellulose / egested / faeces; 3. not eaten / eq;	Ignore growth / active transport / heat loss / movement / heat loss by consumer / excretion	2 max												
(c)	1. less movement; 2. less respiration; 3. less heat loss / less energy used; 4. energy for egg production;	Ignore ref to lack of sunlight and vit D and calcium metabolism for egg shell	3 max												
<b>4.10 describe the stages in the carbon cycle, including respiration, photosynthesis, decomposition and combustion</b>															
4(a)	1. <u>bacteria / fungi / saprotrophs / saprophytes</u> ; 2. use enzymes; 3. break down / digest;	Mp 1 ignore microorganisms / microbes / decomposers / animals / woodlice / detritivores / maggots / slugs / nitrifying bacteria / denitrifying bacteria / nitrogen fixing bacteria / Mp 3 ignore eat / feed	2 max												
2(a) (i)	A combustion / burning / eq; B respiration; C photosynthesis; D death / decay / decomposition / rotting / eq; E respiration;		5												
(ii)	C;		1												
2(a)	1. broken down / digested; 2. bacteria / fungi / microorganisms / saphrophytes / eq;	Ignore eaten	2												
<b>4.11B describe the stages in the nitrogen cycle, including the roles of nitrogen fixing bacteria, decomposers, nitrifying bacteria and denitrifying bacteria (specific names of bacteria are not required)</b>															
5 (a)	<table border="1" data-bbox="252 1771 943 1948"> <thead> <tr> <th>Stage</th> <th>Number</th> </tr> </thead> <tbody> <tr> <td>absorption</td> <td>8</td> </tr> <tr> <td>denitrification</td> <td>6 / 7;</td> </tr> <tr> <td>nitrogen fixation</td> <td>1;</td> </tr> <tr> <td>excretion</td> <td>3;</td> </tr> <tr> <td>decomposition</td> <td>2;</td> </tr> </tbody> </table>	Stage	Number	absorption	8	denitrification	6 / 7;	nitrogen fixation	1;	excretion	3;	decomposition	2;		4
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(d)	<b>denitrifying</b> (bacteria); (nitrates) to ammonia; (nitrate) to nitrite; (nitrates) to nitrogen (gas);		Max 2
(ii)	nitrogen-fixing;	Allow <i>Rhizobium</i>	1
(b)	1. nitrifying (bacteria) / nitrification; 2. nitrite (to nitrate);		2
<b>QWC</b>	<b>5b*</b>	A description to include some of the following points  <b>Decomposition</b> <ul style="list-style-type: none"> <li>decomposers break down dead animals or plants or animal waste</li> <li>bacteria convert the proteins and urea into ammonia</li> <li>ammonia released into the soil</li> </ul> <b>Nitrification</b> <ul style="list-style-type: none"> <li>nitrifying bacteria (<i>Nitrosomonas/Nitrobacter</i>)</li> <li>convert ammonia to nitrites</li> <li>nitrites are then converted into nitrates</li> <li>available for the plant root to absorb</li> </ul> <b>Fixation</b> <ul style="list-style-type: none"> <li>nitrogen fixing bacteria (<i>Rhizobium</i>)</li> <li>in soil can fix nitrogen gas from the atmosphere</li> <li>mutualistic root nodule bacteria</li> <li>can fix nitrogen gas to nitrogen compounds / ammonia / nitrates</li> <li>found in leguminous plants</li> </ul> <b>Denitrification</b> <ul style="list-style-type: none"> <li>denitrifying bacteria</li> <li>can convert nitrates back into nitrogen gas</li> <li>this happens when the soil becomes waterlogged</li> <li>and occurs under anaerobic conditions</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 description of <b>at least</b> one stage of the nitrogen cycle</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 description of <b>at least</b> two stages of the nitrogen cycle</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 description of <b>at least</b> three stages of the nitrogen cycle including denitrification which removes nitrates from the soil</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>	
4.12 understand the biological consequences of pollution of air by sulfur dioxide and carbon monoxide			
5 (b)	An explanation including: <ul style="list-style-type: none"> <li>(carbon monoxide) binds to haemoglobin (1)</li> <li>less oxygen carried (1)</li> <li>less oxygen to the muscles /less energy provided (for exercise) (1)</li> </ul>	accept red blood cells   accept less aerobic respiration	(3)





4.13 understand that water vapour, carbon dioxide, nitrous oxide, methane and CFCs are greenhouse gases

(b)	Gas	Source	Effect on the environment		5 max
	methane	(cattle farming)	greenhouse effect / global warming / eq;	Allow increase in temperature  Ignore rain  Ignore carbon dioxide	
	(water vapour)	(combustion)	se effect / global warming / eq;		
	sulphur dioxide / nitrogen oxides;	(burning fossil fuels)	(causes acid rain)		
	carbon monoxide;	(incomplete combustion)	(affects transport of oxygen in blood)		
	(CFC)	(refrigerators and air conditioning units)	affect ozone layer / greenhouse effect / global warming / eq;		

4.14 understand how human activities contribute to greenhouse gases

4 (a) (i)	burning fossil fuels / biomass / plants / wood or factories / industry / power stations or exhaust fumes / car/petrol/diesel engines or fertiliser / denitrification / decomposition of manure / sewage treatment;			Max 1
(ii)	water vapour / CFCs / Ozone ;			1

(c)	1. burn less fossil fuels / drive less cars / use hybrid cars / use public transport / cycling / low energy light bulbs / eq; 2. plant more trees / reduce deforestation; 3. use renewable energy / wind / solar / wave / nuclear / eq; 4. reduce cattle farming / fewer paddy fields / less aerosols / eq;	Ignore catalytic converters	2 max
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(b)(i)	$94.3 \div 590.3 = 16.0 / 15.97;;$ ignore negative sign	allow one mark for 15.975 / 15.9749 / 15.97493 / 15.974928  allow one mark for 94.3 or $\div 590.3$ in working (15.9 Not correct but look for working mark)	2
(ii)	1. planting of trees / less deforestation / eq; 2. less burning of fossil fuels / eq; 3. fewer cars / public transport / more efficient cars / hybrid cars / electric cars / cycling / walk more / eq; 4. legislation; 5. renewable energy / wind farms / wave energy / solar energy / low power lighting / nuclear fuels / eq;	3. ignore catalytic converters / carbon neutral 4. eg congestion charge 5. ignore ess electricity / less energy	Max 3
(iii)	1. decreased by 2.5 (million tonnes) / decrease is more than half / 2.1 is less than half / decreased from 4.6 to 2.1 / eq; 2. large decrease between 1990 and 2005 / eq; 3. small decrease between 2005 and 2010 / eq;		Max 2
4.15 understand how an increase in greenhouse gases results in an enhanced greenhouse effect and that this may lead to global warming and its consequences			



(b)	1. global warming / earth warms / atmosphere heats up / temperature rises / traps heat / eq; 2. ice caps melt / eq; 3. flooding / rise in sea level; 4. climate change / extreme weather / hurricanes / drought / eq; 5. <u>habitat</u> destruction / desertification / eq; 6. extinction / disruption of food chains / loss of species; 7. migration / distribution of organisms / distribution of pests / spread of disease / affects plant growth;	Mp6 ignore death of organisms	4 max
(c)	1. reduce <u>greenhouse effect</u> / less heat reflected / less heat re-radiated / less heat trapped; 2. less global warming / less temperature rise; 3. less ice caps melt / rise in sea level / flooding; 4. less habitat destruction / less coral destruction / eq; 5. less death / extinction / affect food chain; 6. less migration / change in distribution; 7. less climate change / less extreme weather / less desertification / drought / soil erosion / eq;	4. ignore loss of home	Max 5

4.16 understand the biological consequences of pollution of water by sewage



1(a)	1. (waste) milk; 2. re bacteria (growth) / more microorganism (growth); 3. use of more oxygen / eq;	Reference to the word more must be present ONCE in 2 or 3	2
(b)	1. concentration / strength / dilution / volume / mass released; 2. temperature / light; 3. eed of river flow; 4. nitrate content of <u>pollutant</u> / bacterial content of <u>pollutant</u> ;	Ignore quantity / amount	1
(c)	protein / amino acids / lipid / fat / carbohydrate / lactose;	Allow casein  Ignore minerals / vitamins / sugar	1
(d)	1. raw has higher B.O.D. / less oxygen available / more oxygen used; 2. m e bacteria/microorganisms (in raw sewage) / eq; 3. re respiration; 4. raw sewage has more nutrients / organic material / eq;	Allow converse  2. Ig re organisms	2
2	1. microorganisms / bacteria / viruses / fungi / eq; 2. faeces / urine / urea / named nitrogenous waste; 3. spiration; 4. oxyg ; 5. leachin 6. nitrat / phosphate / potassium / ammonium; 7. al e / plants / producers / eq;	Ignore nitrogen / ammonia	7
4.17 understand the biological consequences of eutrophication caused by leached minerals from fertiliser			



(c)	(nitrates) soluble / dissolve; rain / water / run off; <u>leaching</u> / <u>leached</u> ; algal growth / plant growth / algal bloom / eq; block light / sun / eq; plants die / less photosynthesis / eq; less oxygen / anoxic / eq; bacteria / fungi; decomposers / decomposition / rot / decay / eq; respiration; fish / animals die; <u>eutrophication</u> ;	Max 6
(c)	1. plant / algae growth / algal bloom / eq; 2. algae block light; 3. less photosynthesis; 4. decomposers / decomposition / bacteria / microbes / <u>microorganisms</u> / fungi; 5. respiration; ONCE 6. oxygen depletion / anoxic; ONCE 7. death of plants / fish / organisms;	Max 5



4.18B understand the effects of deforestation, including leaching, soil erosion, disturbance of evapotranspiration and the carbon cycle, and the balance of atmospheric gases

3	(a)	(i)	removal/loss/cutting down of trees/ forest / eq;		1
		(ii)	<ol style="list-style-type: none"> <li>1. (less) photosynthesis;</li> <li>2. re <u>carbon dioxide</u> in air / less <u>carbon dioxide</u> absorbed;</li> <li>3. less consumption of plants / eq;</li> <li>4. less <u>decomposition</u> / <u>decay</u>;</li> <li>5. burning of trees produces <u>carbon dioxide</u>;</li> </ol>		Max 4
1	(a)		<ol style="list-style-type: none"> <li>1. housing / building / construction / eq;</li> <li>2. agriculture / farming / farming cattle / palm oil plantations / eq;</li> <li>3. transport / roads / railways / eq;</li> <li>4. making furniture / making paper;</li> <li>5. fire fuel / cooking / charcoal / to burn / eq;</li> </ol>	ignore for logs / wood / employment	2
	(b)	(i)	<ol style="list-style-type: none"> <li>1. less oxygen / more carbon dioxide / eq;</li> <li>2. (less) photosynthesis;</li> <li>3. re burning;</li> </ol>		2
		(ii)	<ol style="list-style-type: none"> <li>1. soil erosion / less roots to hold soil in place / loose soil;</li> <li>2. leaching / loss of minerals / loss of nutrients / loss of fertility / eq;</li> </ol>		2
	(c)		<ol style="list-style-type: none"> <li>1. laws to protect / prevent / limit deforestation / make deforestation illegal / eq;</li> <li>2. replant / replace each tree felled / plant more trees / use sustainable wood sources / eq;</li> </ol>		2