Question			Expected Answers	Mark	Additional Guidance
1	(a)		spread over wider area / more widespread / bigger range / AW **;**	1	**ACCEPT** geographical description, e.g. **'**they now live in the South / Wales also' but answer must imply that they still live in previously occupied areas **IGNORE** *idea of* higher numbers **IGNORE** bigger / more without further qualification
1	(b)	(i)	impossible / difficult , to count every individual **;** sample provides an estimate **;** sample representative (of whole area) **;**	2 max	**ACCEPT** *idea that* counting every individual is too time consuming
1	(b)	(ii)	to compare (the two areas) ; (presence or absence of) roe deer is independent variable **;** *idea of* controlling variables other than roe deer **;**	1 max	**ACCEPT** one area acts as a control **ACCEPT** to see the effect of the roe deer
1	(b)	(iii)	**1** (species) richness is number of species (in a habitat) **;** **2** (species) evenness is , abundance / number of individuals of , each / every / all , species (in a habitat) **;** **3** *idea that* both (richness and evenness) are needed to reveal dominance **;** **4** *idea that* high biodiversity associated with high species richness **and** high species evenness **;**	3 max	**IGNORE** amount **ACCEPT** 'how many' as AW for 'number' **ACCEPT** evenness is relative , numbers / abundance , of (each) species **IGNORE** number of individuals of , a / the / one , species

Question			Expected Answers	Mark	Additional Guidance
1	(b)	(iv)	plants are , the basis / AW , of (all) food chains **;** shrubs / plants , are food for , insects / animals , that birds eat **;** *idea that* shrubs might provide , nesting sites / cover / protection / habitat **;**	**1 max**	**IGNORE** birds eat , shrubs / seeds / fruit **IGNORE** 'fewer insects' without reason for fewer insects **AWARD** in the context of birds, or animals that birds eat **IGNORE** home
	(b)	**(v)**	(habitat) dominated by, one / few / AW, species **;** ecosystem / habitat , is , unstable / less likely to cope with change **;**	**2**	**ACCEPT** high number of one species **IGNORE** area / environment **ACCEPT** in the context of an example of environmental change **ACCEPT** a change in one species with have a large effect on the , ecosystem / habitat / food chain
1	**(c)**	**(i)**	*idea of* danger to , humans / local wildlife / domestic animals / deer **;** environment may no longer be suitable for lynx / AW **;**	**1**	**ACCEPT** *idea of* danger to existing food chains **IGNORE** could become a pest **IGNORE** dangerous without further qualification **IGNORE** competition

Question			Expected Answers	Mark	Additional Guidance
1	(c)	(ii)	**1** (phylogeny is) the evolutionary , relationship between / history of , organisms / species **;** **2** phylogeny is the basis of classification ; **3** example of molecular evidence used to classify **;** **4** species / organisms , within the same group have shared , phylogeny / evolutionary history / common ancestor **; ora** **5** *idea that* phylogeny of *L. lynx* and *L. pardinus* are sufficiently , different to have been placed in separate species / similar to have been placed in same genus **;**	**4 max**	**1 ACCEPT** reasonable description of evolutionary , history / relationship, e.g. changes in ancestral organisms **2** Must be a clear statement **3 ACCEPT** base sequence / amino acid sequence / DNA / cytochrome C / haemoglobin / ATPase (used to classify)
1	(c)	(iii)	modern / new / better , technology (to distinguish between closely related species) **;** more , molecular / biochemical / DNA / genetic , evidence **;**	**1**	**ACCEPT** named example, e.g. DNA sequencing

Question			Expected Answers	Mark	Additional Guidance
1	(c)	(iv)	**1** *idea of* impact on food chain(s) **;**		**1 ACCEPT** controlling deer population **1 ACCEPT** top carnivore / top predator / keystone species / it might compete with existing species **1 IGNORE** other species might die
			2 *idea of* right to exist / duty of humans to care for other species / ethical reason / preserving species for future generations **;**		**2 IGNORE** 'playing God' **2 IGNORE** refs to poaching / hunting
			3 *idea of* aesthetic reason **;**		**3 ACCEPT** beautiful creatures / nice to look at / AW
			4 economic reason / tourism / might provide useful resource **;**	**3max**	
			Total	**[19]**	

Question			Answer	Mark	Guidance
2	(a)		Nymphaea **;**	1	**NOTE**: the first letter must clearly be in upper case and the others in lower case and the spelling correct
2	(b)		**1** (natural) habitat / ecosystem , lost due to / destroyed by **/** under threat from , climate change / (named) human activity **;** **2** number / population , (in natural habitat) is very low **;** **3** *idea that* in the wild, (sexual) reproduction is difficult (if numbers are low) **; ora** **4** (breeding *ex situ* can) maintain , the gene pool / genetic / allelic , diversity**; ora** **5** *idea that* allows protection from **,** grazers / herbivores / plant collectors / competing species **; ora** **6** *idea of* protection from **,** pathogen / parasites / disease **; ora**	3 max	**IGNORE** can be in optimum conditions throughout **1** The essence of this marking point is habitat loss plus reason. Award tick when both these ideas have been seen. **1 ACCEPT** natural disaster / deforestation , as reason for habitat loss **2 IGNORE** reference to , extinct / endangered **3 ACCEPT** e.g. fertilization can be carried out using a paintbrush **5 ACCEPT** habitat contains organisms that are a threat **5 ACCEPT** protection from , predators / poachers / hunters **6 ACCEPT** pests

Question			Answer	Mark	Guidance
2	(c)			3 max	**Mark as prose. Ignore numbered lines**.
			1 can be collected with minimal damage to (wild) , population / habitat / ecosystem ;		
			2 take up little space / larger numbers can be stored **;** **ora**		**2 ACCEPT** easier to store a large amount
			3 can store great(er) , genetic / allelic , diversity **; ora**		
			4 low(er) maintenance / manpower costs / AW **; ora**		**4 CREDIT** 'cheaper' only if supported by an explanation **4 IGNORE** easier to keep unqualified **4 ACCEPT** less labour-intensive **4 DO NOT CREDIT** no maintenance costs
			5 easy / cheaper, to transport / AW **; ora**		
			6 *idea of* remaining viable for long periods **; ora**		**6 CREDIT** description / example – e.g. kept dry so that they do not rot / regular germination and new seed production **6 IGNORE** 'last a long time' unqualified **6 ACCEPT** 'stay , alive / fertile , for a long time'
			7 less , susceptible / vulnerable , to, disease / pests / environmental change **; ora**		**7 ACCEPT** the adult plant might have a disease **7 IGNORE** prevents
			8 *idea that* prevents fertilisation by undesired pollen **;**		

Question			Answer	Mark	Guidance
2	(d)		**1** (use of) quadrat **;**	4 max	**1 ACCEPT** description of a quadrat / point frame **1 IGNORE** quadrant ***AWARD either a or b*** *for both marking points **2** and **3**. Do not mix a and b marks. If both a and b marks are present ignore the lower scoring letter.*
			2a random (sampling) **;**		**2a ACCEPT** bits of paper in a hat / random number generator **2a DO NOT CREDIT** throw
			3a placing measuring tapes (at right angles) / use grid **;** **OR** **2b** (use of) transect **;** **3b** (quadrat / point frame) placed at regular intervals **;**		**3a ACCEPT** e.g. bottom left hand corner of quadrat placed at coordinate / two students walk in a straight line from each tape measure **3b ACCEPT** systematic sampling
			4 (use of identification) key **;**		
			5 example / detail , of method used to determine abundance **;**		**5 ACCEPT** percentage cover / percentage frequency / number of hits with point frame / ACFOR **5 ACCEPT** strategy for dealing with plants half in or out of quadrat **5 IGNORE** 'count' without further clarification
			6 repeat many times / *idea of* considering appropriate number of samples **;**		**6 ACCEPT** calculate running mean **6 IGNORE** several / a few **6** If number state must be at least 5
			7 sample / AW , at different , seasons / times of year **;**		**7 ACCEPT** throughout the year

Question			Answer	Mark	Guidance
2	(e)			3 max	**IGNORE** prompt lines and mark as prose
			1 reason for not having found all species ;		**1 ACCEPT** e.g. some (named) habitats inaccessible / microscopic species missed / low numbers of individuals / habitat unexplored / some habitats rare / species are nocturnal
			2 may have become extinct , recently / since recording **;**		**2 ACCEPT** organisms constantly become extinct
			3 evolution is on-going / new species are being formed / AW **;**		**3 ACCEPT** new species are being created
			4 *idea that* some (species) difficult to distinguish / some species may be reclassified / AW **;**		**4 ACCEPT** e.g. might mistake several species for one **4 ACCEPT** scientists might disagree about whether it is a species or not.
			Total	**14**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th>species</th><th>number of individuals (n)</th><th>n/N</th><th>$(n/N)^2$</th></tr>
<tr><td>Dog's mercury</td><td>40</td><td>0.4</td><td>0.1600</td></tr>
<tr><td>Wild strawberry</td><td>13</td><td>0.13</td><td>0.</td></tr>
<tr><td>Common avens</td><td>43</td><td>0.4</td><td>0.1849</td></tr>
<tr><td>Wood sorrel</td><td>4</td><td>0.04</td><td>0.0016</td></tr>
<tr><td></td><td>N = 100</td><td></td><td>$\Sigma(n/N)^2$ = 0.3634</td></tr>
<tr><td></td><td></td><td></td><td>$1-(\Sigma(n/N)^2)$ = 0.6366</td></tr>
</table>
; ; ;</td><td>3</td><td>Award 3 marks for the correct answer (0.6366)

If answer is incorrect:

IGNORE numbers in first 4 rows

'N = 100' = 1 mark

$\Sigma(n/N)^2$
ALLOW ecf for correct calculation from candidate's incorrect N value

$1-(\Sigma(n/N)^2)$
ALLOW ecf for correct calculation from candidate's $\Sigma(n/N)^2$ value

Answer must be given to 4 dp for ecf</td></tr>
<tr><td>3</td><td>(a)</td><td>(ii)</td><td>species richness
number of species (in an area / habitat) ;

species evenness
number of / how many, individuals there are of, each / every, species (in an area / habitat) ;</td><td>2</td><td>IGNORE organisms / abundance / quantity / variety
DO NOT CREDIT amount

ACCEPT 'organisms' as AW for individuals
CREDIT relative abundance of (each) species / population size of each species
IGNORE relative abundance of, a / one, species
DO NOT CREDIT amount</td></tr>
</table>

Question			Answer		Marks	Guidance
3	(a)	(iii)	(habitat) dominated by, one / few / AW, species **;** change in one species , likely to affect whole habitat / AW **;** community / ecosystem / habitat / area , is unstable / not able to withstand change / easily damaged **;**		2	**ACCEPT** high number of one species **IGNORE** environment / biodiversity as AW for community **IGNORE** the community / AW will be damaged
3	(b)		**1**	*idea of* random sampling **;**	2	**IGNORE** prompt lines and mark as prose **1 ACCEPT** description of randomisation method
			2	standardisation of technique **;**		**2 ACCEPT** description of standardisation method **2 ACCEPT** count the same way each time
			3	use of, key/identification chart **;**		
			4	survey at different , times of year / season **;**		**4 IGNORE** 'repeat' unqualified **4 IGNORE** different times of day / different times
			5	include , trees / species larger than quadrat **;**		
				Total	**9**	

Question			Answer		Marks	Guidance
4	(a)	(i)	range / variety / number **,** of species (in an area) **;** range / variety of, habitats / ecosystems **;** variety of , alleles / genes **;**		2	**IGNORE** amount throughout **ACCEPT** a combination of species richness and species evenness **ACCEPT** abundance **IGNORE** organisms **ACCEPT** number of habitats
4	(a)	(ii)	**1** **2** **3** **4** **5**	part of (local) food , chain / web **;** tourism **;** native species / *idea of* heritage of the area **;** to protect a neighbouring red squirrel population **;** *idea that* Northumberland red squirrel population is nationally significant **;**	2	**IGNORE** prompt lines and any reference to biodiversity **CREDIT** a correct response anywhere in the answer **IGNORE** unspecified refs to ethical, aesthetic or economic **1 ACCEPT** keystone species **3 ACCEPT** native to UK **5** e.g. Northumberland has significant proportion of total population so loss of this population might jeopardise all British squirrels **IGNORE** refs to genetic resource as no suggestion that this population is distinct from red squirrels elsewhere.

Question			Answer		Marks	Guidance
4	(a)	(iii)	*idea that:* it is wrong to interfere with nature **;** it is wrong to kill animals **;** grey has (as much) right to live there (as red) **;** *idea that* might be useful in the future / enjoyed by future generations **;** grey will be part of food chain **;**		1	**ACCEPT** qualified refs to , moral / ethical / religious , reasons **IGNORE** it's wrong to play God **ACCEPT** it is cruel
4	(b)			*idea that*: **1** harder to see **; ora** **2** (harder to see because) more timid / frightened of people / spend less time on ground / smaller **; ora** **3** species may be wrongly identified **;** **4** grey squirrels more likely to visit gardens / parks / public areas **; ora** **5** people are more inclined to report grey sightings **; ora** **6** AVP **: ora**	2	**IGNORE** prompt lines and mark as prose **CREDIT** correct response where seen **1 ACCEPT** 'they remain hidden'. **IGNORE** 'they may be hiding' **2 IGNORE** 'they may be hiding' **6 ACCEPT** grey squirrels might be less camouflaged (so easier to see) **6 ACCEPT** red squirrels might be (more) nocturnal / AW **6 IGNORE** squirrel species hard to distinguish / same individual counted more than once

Question			Answer		Marks	Guidance
4	(c)				3	**IGNORE** prompt lines and mark as prose **IGNORE** refs to benefits of development Answers should be given in terms of assessing aspects of the development.
			1	size (of development) **;**		**1 ACCEPT** 'how big will it be?'
			2	*idea of* environmental sensitivity / which species present / which habitats present , in the area **;**		**2 ACCEPT** e.g. 'what lives there?' / 'whether a rare species live there' 'whether red squirrels live there' / 'the biodiversity of the area' / is it an SSSI? / species richness
			3	potential damage (to area / organisms) **;**		**3 ACCEPT** e.g. 'how much damage will it do?' / effect on ecosystem / how much it would be destroyed / how many organisms will it kill?
			4	*idea of* potential strategies to minimise impact **;**		**4 ACCEPT** e.g. 'what can be done about it?' / possible change to reduce impact **4** Must be a general statement **4 IGNORE** stated example without the general idea
				Total	**10**	