Question			Answer	Marks	Guidance
1	(a)	(i)	**1** peak in , 1988 / 1994 ; **2** trend decrease after 1994 ; **3** ref. decrease and then increase , 1988 to 1994 ; **4** fluctuations (within pattern) ; **5** overall increase from 1965 to 2002 ;	3 max	**IGNORE** ref to population figures **1 ACCEPT** increases until / highest number in, 1988/1994 **4 ACCEPT** 'goes up and down' / oscillates

1	(a)	(ii)	*accurate because*
			
			idea that actual number of elk shot is recorded ;
			
			method not valid because
			idea that number of elk shot / hunting success ,
			           varies independently of population size ;
				2	**ACCEPT** elks shot are counted / reported
					
					CREDIT suitable reason
					e.g. numbers of licences issued / number of hunters
					       set quotas to hunt
					       illegal hunting
					       if weather suitable for hunting
					      only younger / older / diseased / larger**,** elk killed
					
					IGNORE length of time spent hunting

Question			Answer	Marks	Guidance
1	(b)	(i)	**1** *idea that population size is determined by* <u>limiting</u> <u>factor</u>(s) **;**		**IGNORE ref to abiotic / biotic factors throughout**
			Before 1995, population increases due to **2** example of factor that is not limiting population **;**		**2** e.g. plenty of, enough, food Less **/** no predation Less / no overcrowding/ enough space less hunting
			Before 1995, population levels off because **3** reaches <u>carrying capacity</u> **;**		**2 IGNORE** water / nutrients/ availability of food
			Before 1995, population becomes limited by **4** intraspecific competition for named resource;		**4 CREDIT** description of intraspecific
			5 interspecific competition for named resource;		**5 CREDIT** description of interspecific
			Population can decline at any time/ dips, due to		**4 & 5 CREDIT** any suitable limiting factor eg competition for, food / space / mates/ overcrowding
			6 severe weather / natural disaster **;** **7** decrease before 1995 not due to wolves (as none present) **;**		**6 CREDIT** ref to parasites/disease/ drought/floods/fires
			8 decrease after 1995 (probably) due to wolves**;**		
			9 *idea that* effect of wolves on population may be debatable **;**	**6 max**	**9** e.g. lack of data in 1996 and 1997 makes it difficult to form conclusions
			QWC **;**	**1**	**Award if** **1 mark** awarded from **mps 1 to 6 (limiting factors)** <u>and</u> **1 mark** awarded from **mps 7 to 9 (effect of wolves)**

Question			Answer	Marks	Guidance

1	**(b)**	**(ii)**	*re-introduction of wolves is conservation because*
			
			1 restoring the <u>ecosystem</u> (to its original form)
			     or
			  maintains <u>biodiversity</u> **;**
			
			2 helps the (global) wolf population **;**
			
			3 active / dynamic / sustainable,
			                management / maintenance **;**
			
			4 prevents over-population by the elk **;**
			
			5 prevents over-grazing
			      or
			  damage to, habitat / ecosystem **;**
				
				2 max
					ACCEPT controls/ increases, <u>biodiversity</u>
					
					ACCEPT wolves do not become extinct / increase in
					                                 number
					
					'Actively maintains biodiversity' = **MP1 and 3**
					
					ACCEPT wolves, limit / control, elk population or
					         lack of wolves causes elk population to grow
					
					ACCEPT if wolves absent, elk would damage habitat /
					            other species may become extinct

			Total	**14**	

Question			Expected Answer	Mark	Additional Guidance
2	(a)		(belong to the) same <u>genus</u> ;	1	

2	(b)	(i)	1 not much / little / some , competition / niche overlap ;
			
			reasons for little competition
			2 use / feed on ,
			        different sized flowers / different depth of flowers ;
			
			3 vary in proportions of pollen **<u>and</u>** nectar they collect ;
			
			4 fly / live / active / feed / visit flowers , at different times ;
			
			reason for competition
			5 *idea that* fly / live / active / feed / visit flowers ,
			               overlaps there must be competition ;
			
			6 AVP ;
				4 max	This mark is for a stand alone statement
					DO NOT CREDIT no competition
					IGNORE competition unqualified / inter / intra
					
					2 **CREDIT** correct comparative description
					           or use of data
					    e.g. *B. pratorum feed* on ,
					        bigger / longer / deeper , flowers
					    or
					    B. pratorum 7.4(mm) **<u>and</u>** *B. terrestris* 6.3(mm)
					
					3 **CREDIT** correct description
					    e.g. *B. pratorum* mostly pollen and nectar
					        <u>and</u> *B. terrestris* mostly nectar only
					    or comparison of 2 species using table data
					    IGNORE 'different amounts' of pollen and nectar
					
					4 **CREDIT** correct description of difference
					    e.g. *B. pratorum* peak in June **<u>and</u>**
					               B. terrestris in July
					    or
					    B. pratorum appear in earli<u>er</u> in the year
					    or comparison of 2 species using graph data
					
					5 **CREDIT** correct description from data
					    e.g. both compete for food between May and
					    September / both collect pollen only from same
					    % flowers
					
					6 e.g. use / feed on , different <u>species</u> of flowers

Question			Expected Answer	Mark	Additional Guidance
2	(b)	(ii)	1 *idea of* isolation / isolating mechanism / barrier **;**		
			2 seasonal (difference) / temporal (difference) / males and queens (in different populations) produced in different months / breeding (in different populations) in different months **;**		2 **CREDIT** example of seasonal / temporal (e.g. *B. pratorum* has its peak number of workers in June and *B. terrestris* in July)
			3 behavioural (difference) / visit different (types of) flowers / feed at different times / feed on different food types **;**		3 **CREDIT** 'different mating rituals'
			4 different flower locations / different (micro)habitats **;**		
			5 *idea that* gene flow restricted / no gene flow (between populations) **;**		5 **must refer to gene /allele**
			6 different adaptations / specialisation / niche partitioning **;**		6 **IGNORE** speciation (as implied in Q) - can be mistaken for specialisation
				3 max	

	Question		Expected Answer	Mark	Additional Guidance
2	(c)	(i)	<table><thead><tr><th>Observation</th><th>Type of behaviour</th></tr></thead><tbody><tr><td>The time taken for a worker bee to collect food from a flower decreases with practice.</td><td>learned (behaviour) / learning **/** operant conditioning / trial and error **;**</td></tr><tr><td>All bumble bees start at the bottom of a vertical spike of flowers and work upwards.</td><td>innate / instinctive **;**</td></tr></tbody></table>	**2**	**Mark the first answer in each box.** If an additional answer is given that is incorrect or contradicts the correct answer, then **= 0 marks** **ACCEPT** taxis / example of taxis eg chemotaxis **IGNORE** inherited / genetically determined **DO NOT CREDIT** kinesis
2	(c)	(ii)	*Idea that* better / more efficient **,** at **,** finding / getting **,** food **;** AVP **;**	**1 max**	**ACCEPT** more food can be collected less **,** time / energy **,** spent looking for food easier to find food e.g. ref to reduces competition from other colonies
2	(d)	(i)	 reverse transcriptase **;**	**1**	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** DNA (reverse) transcriptase

Question			Expected Answer	Mark	Additional Guidance
2	(d)	(ii)	**1** <u>mRNA</u> binds to , (gene) probes / cDNA / ssDNA , by complementary base pairing **;** **2** *idea that* the **more** active the gene the **more** mRNA produced **;** **3** during transcription **;** **4** *more* fluorescence indicates *more* mRNA (bound) **;**	3 max	**1** **DO NOT CREDIT** in the context of the gene probe binding to DNA **3** **IGNORE** translation
2	(d)	(iii)	**1** dopamine linked to , ADHD / addiction / risk-taking / adventurous behaviour / hyperactivity / erratic behaviour (in humans) **;** **2** *idea of* common mechanism in bees and humans (for adventurous behaviour) **;** **3** *idea that* as they are different organisms the mechanisms may not be comparable (even though apparently similar) **;** **4** AVP **;**	3 max	**1** **IGNORE** ref to schizophrenia / Parkinson's **This mark is for the effect of the *chemical* dopamine, not the dopamine receptors alone.** **2** e.g. **both** have , DRD4 / dopamine receptors e.g. dopamine has the same effect in **both** **4** e.g. other genes also involved in , bee / human , behaviour **Note:** 'both have dopamine receptors which are linked to adventurous behaviour' **= 1 mark** (mp 2 only) 'both have dopamine receptors and dopamine is linked to adventurous behaviour' **= 2 marks** (mps 2 & 1)
			Total	18	

Question			Expected Answer	Mark	Additional Guidance
3	(a)				**Note: All mark points are comparative**
		1	pioneers arrive , *before* climax / *earlier* ; **ora**		**1** **CREDIT** pioneers arrive first / climax arrive last
		2	pioneer communities subject to , *greater* / *more* , change / succession / replacement ; **ora**		
		3	pioneer community (usually) has , *less* / *lower* , biodiversity ; **ora**		
		4	*idea that* pioneer community is (often) *less* , stable / self-sustaining ; **ora**		
		5	pioneer community has *lower* biomass ; **ora**		
		6	AVP ;		**6** e.g. species in pioneer community better adapted to (named) abiotic factor(s) **and** those in climax community better adapted to (named) biotic factor(s)
				2 max	

	Question			Expected Answer	Mark	Additional Guidance
3	(b)		**1**	decomposition is break down , dead matter / waste **or** decomposition is conversion of organic matter to inorganic ;		**1** **IGNORE** putrefication **1** **CREDIT** for **inorganic:** carbon dioxide / CO_2 / water / H_2O / ammonium compounds / ammonium ions / NH_4^+ **IGNORE** ammonia / NH_3
			2	denitrification is conversion of <u>nitrates</u> to nitrogen (gas) ;		**2** **CREDIT** correct formulae (NO_3^- and N_2) **DO NOT CREDIT** nitrogen oxides
			3	decomposition increases , mineral / <u>nitrate</u> , supply **and** denitrification reduces , mineral / <u>nitrate</u> , supply ;	**2 max**	**3** **CREDIT** decomposition returns , mineral / <u>nitrate</u>, to soil **and** denitrification removes mineral / <u>nitrate</u>, to soil
3	(c)		**1**	conservation maintains , ecosystem / biodiversity / species / habitats **or** conservation involves , active / sustainable , management of , ecosystem / resource / habitat ;		**IGNORE environment for MP1 and 2** **ACCEPT** named resource
			2	preservation leaves , ecosystems / habitats , undisturbed ;	**2**	**ACCEPT** unchanged/ not disrupted / no physical intervention **IGNORE** ref to preservation in any context other than that of conservation/preservation

	Question		Expected Answer	Mark	Additional Guidance
3	(d)		**1** nitrogen fixation is the conversion of (atmospheric) nitrogen into **,** ammonia / ammonium compounds / ammonium ions **;**		**1** **CREDIT** N_2 / NH_3 / NH_4^+
			2 nitrification is the conversion of **,** ammonia / ammonium compounds /ammonium ions **,** into nitrite / nitrate **;**		**2** **CREDIT** NH_3 / NH_4^+ **CREDIT** NO_2^- / NO_3^- **DO NOT CREDIT** nitrate to nitrite
			3 correct ref to microorganisms involvement in both processes **;**		**3** e.g. nitrogen fixation involves **,** *Rhizobium* / *Azotobacter* / *Nostoc* **and** nitrification involves **,** *Nitrosomonas* / *Nitrobacter*
				2 max	
			Total	**8**	

Question			answer	Marks	Guidance
4	(a)		1 <u>geographic</u>al, isolation / separation / barrier **;**	2	**1** **IGNORE** allopatric speciation
			2 *idea of* reproductive isolation **;**		**2** e.g. no / less **,** interbreeding between different **,** populations (early) / species (late)

			3 different **,** <u>selection</u> pressures / adaptations
			                         (on different islands) **;**
					3 **IGNOR** different to mainland
					   ACCEPT in different environments or conditions they
					   evolve or adapt differently

			4 small **,** populations / gene pools **;**		**4** **DO NOT CREDIT** small species

			5 *idea of mp 4* resulting in founder effect **;**		**5** **ACC PT** *idea of mp 4* resulting in greater impact of **,**
					          mutation / input of alleles (migration) /
					          loss of alleles (accidents etc.)

			6 *idea of mp 4* resulting in greater genetic <u>drift</u> **;**		
4	(b)	(i)	681 **; ;**	2	**Correct answer = 2 marks** even if no working shown *Expected working* *125 000 − 16 000 = 109 000* *(109 000 ÷ 16 000) x 100 = 681 (%)* If answer not rounded or rounded incorrectly **ACCEPT** e.g. 682 **or** 681.3 **or** 681.25 for **1 mark** If the final answer is incorrect **and** no mark was awarded for a figure close to correct value, **ACCEPT** the figure 109 000 in the working **or** 125 000 − 16 000 for **1 mark**.

Question			Answer	Marks	Guidance
4	**(b)**	**(ii)**	**1** <u>habitat</u> / <u>ecosystem</u> , disturbance / destruction **;**	6	
			2 (land used for) (named) building / roads **;**		**2** e.g. houses, schools, factories **ACCEPT** urbanisation and development for tourism
			3 (land used for) agriculture / farming **;**		
			4 deforestation **;**		**4** **ACCEPT** description e.g. cutting down trees / logging
			5 effect of (tourist) **,** boats / divers, described **;**		
			6 more / increased **,** <u>pollution</u> **;**		
			7 sewage / eutrophication **,** in sea / water **;**		
			8 oil / fuel **,** spill in sea **;**		
			9 (humans) hunting / collecting / (over-) fishing **;**		**9** **CREDIT** poaching / green sea turtles caught in fish nets
			10 competition from introduced species **;**		**10** **CREDIT** nest / egg **,** trampling by introduced species
			11 predation / overgrazing **,** by introduced species **;**		
			12 **(**new / named) **,** diseases / pathogens, introduced **;**		**12** **CREDIT** West Nile virus / avian malaria / bird flu
			QWC – linking **TWO** ecological pressures above to **TWO** examples of affected species **;**	1	**Two** Galapagos animals or plants named in context. e.g. ● (marine / land) iguana, (lava) lizard, (ground) finch (**mp11** predation by cats) ● rock purslane (**mp11** overgrazing by goats) ● (giant) tortoise (**mp9** hunting, **mp10** competition from goats) ● whale / seal / named fish / sea cucumber (**mp9** hunting) ● *Scalesia* tree (**mp4** deforestation, **mp10** competition from red quinine tree) ● (blue-footed) boobies (**mp11** predation by rats)

Question			answer	Marks	Guidance

4	**(c)**		*economic*
			fewer jobs / smaller profits / business closure /
			       reduced tourism / less income / less revenue **;**
			
			ethical
			question of **,** humane killing / animal suffering
			or
			people suffer through losing their **,**
			       homes / friends / jobs **;**
				2	**IGNORE** economic loss
					
					IGNORE right to life arguments

			Total	**13**	