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) **;** *Before 1995, population increases due to* **2** example of factor that is not limiting population **;** *Before 1995, population levels off because* **3** reaches <u>carrying capacity</u> **;** *Before 1995, population becomes limited by* **4** intraspecific competition for named resource; **5** interspecific competition for named resource; *Population can decline at any time/ dips, due to* **6** severe weather / natural disaster ; **7** decrease before 1995 not due to wolves (as none present) **;** **8** decrease after 1995 (probably) due to wolves**;** **9** *idea that* effect of wolves on population may be debatable **;**	**6 max**	**IGNORE ref to abiotic / biotic factors throughout** **2** e.g. plenty of, enough, food Less **/** no predation Less / no overcrowding/ enough space less hunting **2 IGNORE** water / nutrients/ availability of food **4 CREDIT** description of intraspecific **5 CREDIT** description of interspecific **4 & 5 CREDIT** any suitable limiting factor eg competition for, food / space / mates/ overcrowding **6 CREDIT** ref to parasites/disease/ drought/floods/fires **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 genus ;	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 **and** 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) **and** *B. terrestris* 6.3(mm) **3** **CREDIT** correct description e.g. *B. pratorum* mostly pollen and nectar **and** *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 **and** *B. terrestris* in July **or** *B. pratorum* appear in earlier 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 species 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 **;**	**3 max**	**6** **IGNORE** speciation (as implied in Q) - can be mistaken for specialisation

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(c)</td><td>(i)</td><td>
<table>
<tr><th>Observation</th><th>Type of behaviour</th></tr>
<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>
</table>
</td><td>2</td><td>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</td></tr>
<tr><td>2</td><td>(c)</td><td>(ii)</td><td>Idea that better / more efficient , at , finding / getting , food ;

AVP ;</td><td>1 max</td><td>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</td></tr>
<tr><td>2</td><td>(d)</td><td>(i)</td><td>reverse transcriptase ;</td><td>1</td><td>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</td></tr>
</table>

Question			Expected Answer	Mark	Additional Guidance
2	(d)	(ii)	1 mRNA 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)		**1** pioneers arrive **,** ***before*** climax / ***earlier*** **;** **ora** **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 **;**	**2 max**	**Note: All mark points are comparative** **1** **CREDIT** pioneers arrive first / climax arrive last **6** e.g. species in pioneer community better adapted to (named) abiotic factor(s) **<u>and</u>** those in climax community better adapted to (named) biotic factor(s)

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 **;** **2** denitrification is conversion of nitrates to nitrogen (gas) **;** **3** decomposition increases **,** mineral / nitrate **,** supply **and** denitrification reduces **,** mineral / nitrate **,** supply **;**	**2 max**	**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 CREDIT** correct formulae (NO_3^- and N_2) **DO NOT CREDIT** nitrogen oxides **3 CREDIT** decomposition returns , mineral / nitrate, to soil **and** denitrification removes mineral / nitrate, to soil
3	(c)		**1** conservation maintains **,** ecosystem / biodiversity / species / habitats **or** conservation involves **,** active / sustainable **,** management of **,** ecosystem / resource / habitat **;** **2** preservation leaves **,** ecosystems / habitats **,** undisturbed **;**	**2**	**IGNORE environment for MP1 and 2** **ACCEPT** named resource **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** geographical, isolation / separation / barrier **;** **2** *idea of* reproductive isolation **;** **3** different **,** selection pressures / adaptations (on different islands) **;** **4** small **,** populations / gene pools **;** **5** *idea of mp 4* resulting in founder effect **;** **6** *idea of mp 4* resulting in greater genetic drift **;**	2	**1** **IGNORE** allopatric speciation **2** e.g. no / less **,** interbreeding between different **,** populations (early) / species (late) **3** **IGNOR** different to mainland **ACCEPT** in different environments or conditions they evolve or adapt differently **4** **DO NOT CREDIT** small species **5** **ACC PT** *idea of mp 4* resulting in greater impact of **,** mutation / input of alleles (migration) / loss of alleles (accidents etc.)
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** habitat / ecosystem , disturbance / destruction ; **2** (land used for) (named) building / roads ; **3** (land used for) agriculture / farming ; **4** deforestation ; **5** effect of (tourist) , boats / divers, described ; **6** more / increased , pollution ; **7** sewage / eutrophication , in sea / water ; **8** oil / fuel , spill in sea ; **9** (humans) hunting / collecting / (over-) fishing ; **10** competition from introduced species ; **11** predation / overgrazing , by introduced species ; **12** (new / named) , diseases / pathogens, introduced ;	6	**2** e.g. houses, schools, factories **ACCEPT** urbanisation and development for tourism **4** **ACCEPT** description e.g. cutting down trees / logging **9** **CREDIT** poaching / green sea turtles caught in fish nets **10** **CREDIT** nest / egg , trampling by introduced species **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**	