OCR A-LEVEL BIOLOGY A · H420

BIOLOGY



EXAM QUESTION PACK

6.3.2 POPULATIONS AND SUSTAINABILITY

SCORE	PERCENTAGE
/57	%

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Answer **all** the questions.

1. Peat bogs are ecosystems that contain unique communities of invertebrates, bird species, and wetland plants.

Sphagnum mosses represent a vital part of peat bog ecosystems. These species of moss require a high soil moisture content.

Almost all of the peat bogs in the UK have been affected by human activity.

The following management activities were planned in a peat bog ecosystem:

- the planting of a small area of conifer trees at the edge of the peatland
- a ban on the extraction of peat for use as compost
- reintroduction of natural sphagnum mosses
- the construction of a ditch as a flood prevention measure
- extended grazing by cattle and a large flock of sheep
- managed burning to create new growth for livestock grazing
- the construction of a boardwalk to replace several sets of footpaths

(i) Suggest improvements that could be made to these plans.

Explain why your improvements would help conservation of the peat bog ecosystem.

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[3]

(ii) Explain why the **preservation** of peat bog ecosystems is **not** a strategy that can be used in most cases.

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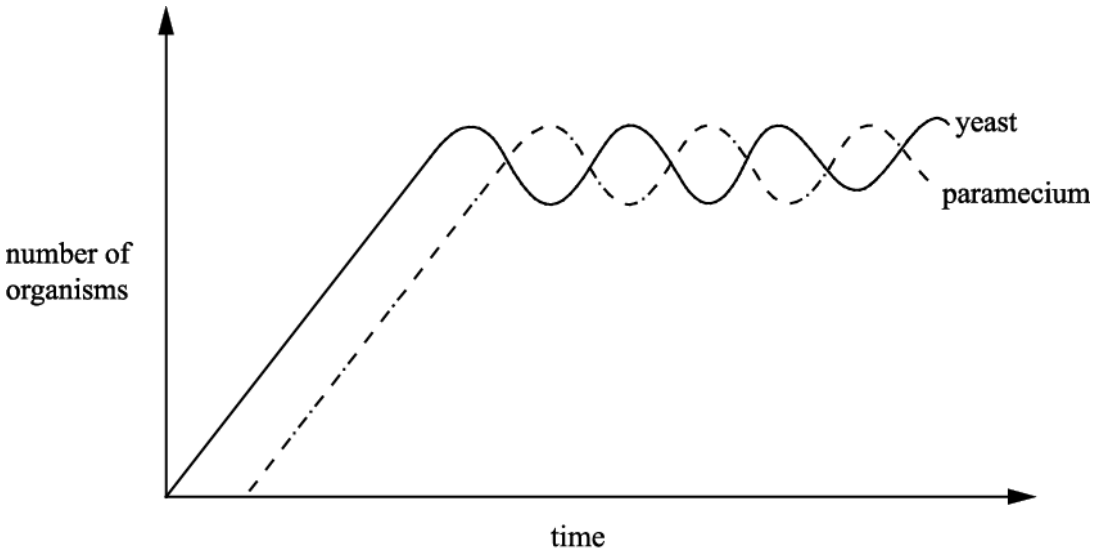
[2]

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2. The graph shows a population of yeast and a unicellular organism, *Paramecium,* grown in a fermentation chamber.



Which **one** of the following statements best describes the relationship between the two organisms?

A The *Paramecium* and yeast populations are complementary to each other.
B The yeast thrives in the relationship at the expense of the *Paramecium* population.
C The *Paramecium* feeds on the yeast and reduces the number in the yeast population.
D The two populations are in equilibrium and stable due to a type of negative feedback.

Your answer ☐

[1]

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3.

(i) The biomass of large fish in the Southern Ocean is a food resource for humans. It is increasingly harvested by powerful, long-distance trawlers. If over-exploited, the Southern Ocean ecosystem may be permanently altered.

- Suggest two measures that an international treaty might impose, to prevent fishing from causing permanent damage to the Southern Ocean.
- Identify the practical difficulties that might prevent your two measures from being effective.

First measure

Difficulty

Second measure

Difficulty

[4]

(ii) Krill can also be harvested as a human food source.
The fishing industry aims to harvest large fish.
Some environmentalists say that krill harvesting should be increased.

Use this information and **Table 21.1** to put forward arguments for and against harvesting krill instead of large fish as a human food source.

[2]

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4(a). The elk, *Cervus canadensis*, is a large herbivore.

Fig. 2.1, shows figures relating to the number of elk in Yellowstone National Park in the USA between 1965 and 2002.

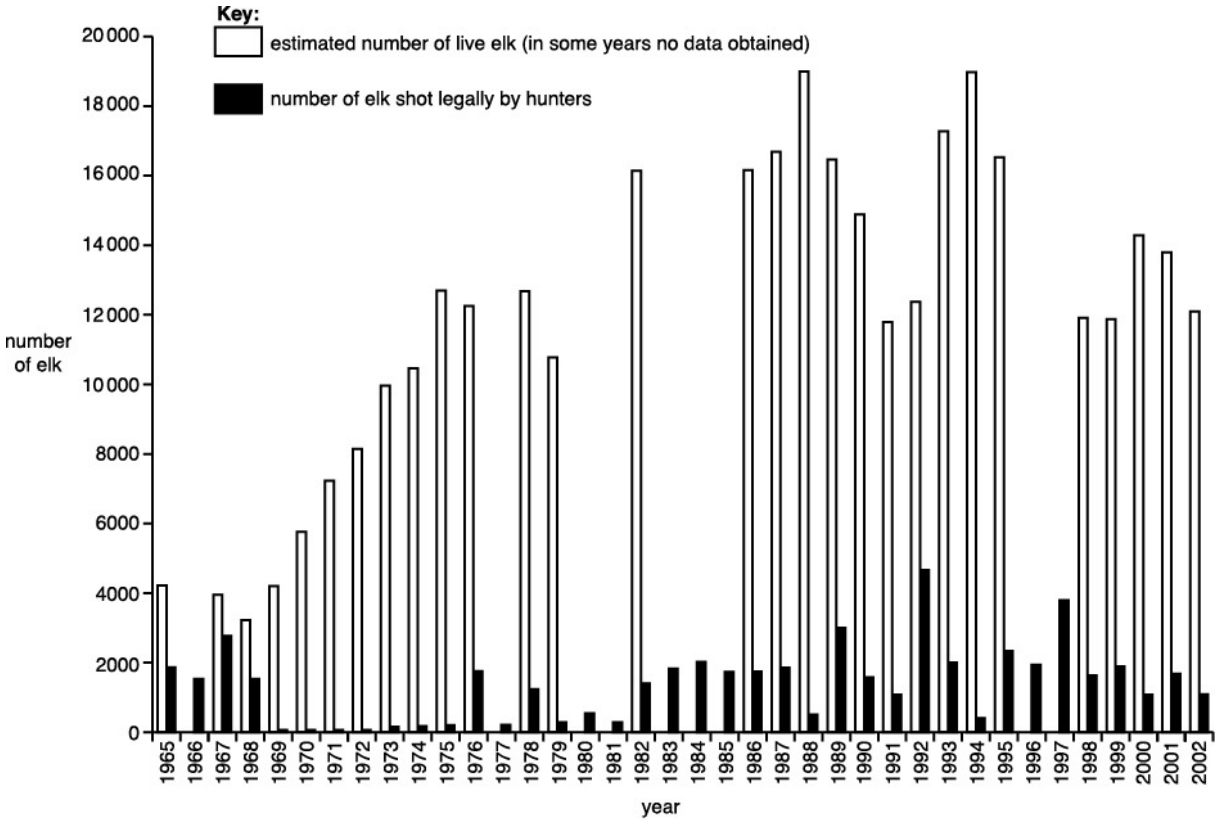


Fig. 2.1

The figures were obtained in two different ways:

- the white bars show estimated numbers of live elk obtained by ecological sampling
- the black bars show numbers of elk that were legally shot by hunters.

In some years no data for live elk were obtained.

(i) Using Fig. 2.1, describe the pattern shown by the data for the estimated number of live elk from 1965 to 2002.

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---**[3]**

(ii) The recorded number of elk legally shot by hunters provides accurate data.

Suggest why these data are accurate, but the method used to obtain these data is not a valid way of estimating the number of elk in the population.

---**[2]**

(b). The grey wolf, *Canis lupus*, is a large predator whose diet includes elk.

By 1926, grey wolves had been hunted to extinction in Yellowstone Park. However, this species could still be found in other parts of the world.

In 1995, a population of grey wolves was introduced to Yellowstone Park and their numbers increased.

(i) With reference to Fig. 2.1, discuss the factors that may have affected the size of the elk population:

- before 1995
- after 1995.

In your answer you should provide a balanced account referring to factors before and after 1995.

---

[7]

(ii) Explain why the introduction of wolves to Yellowstone Park in 1995 is an example of conservation.

[2]

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5. Fig. 2.1 shows the number of worker bees of *B. pratorum* and *B. terrestris* observed at one location over a year.

Table 2.1 shows some differences in the food collecting behaviour of worker bees of these species.

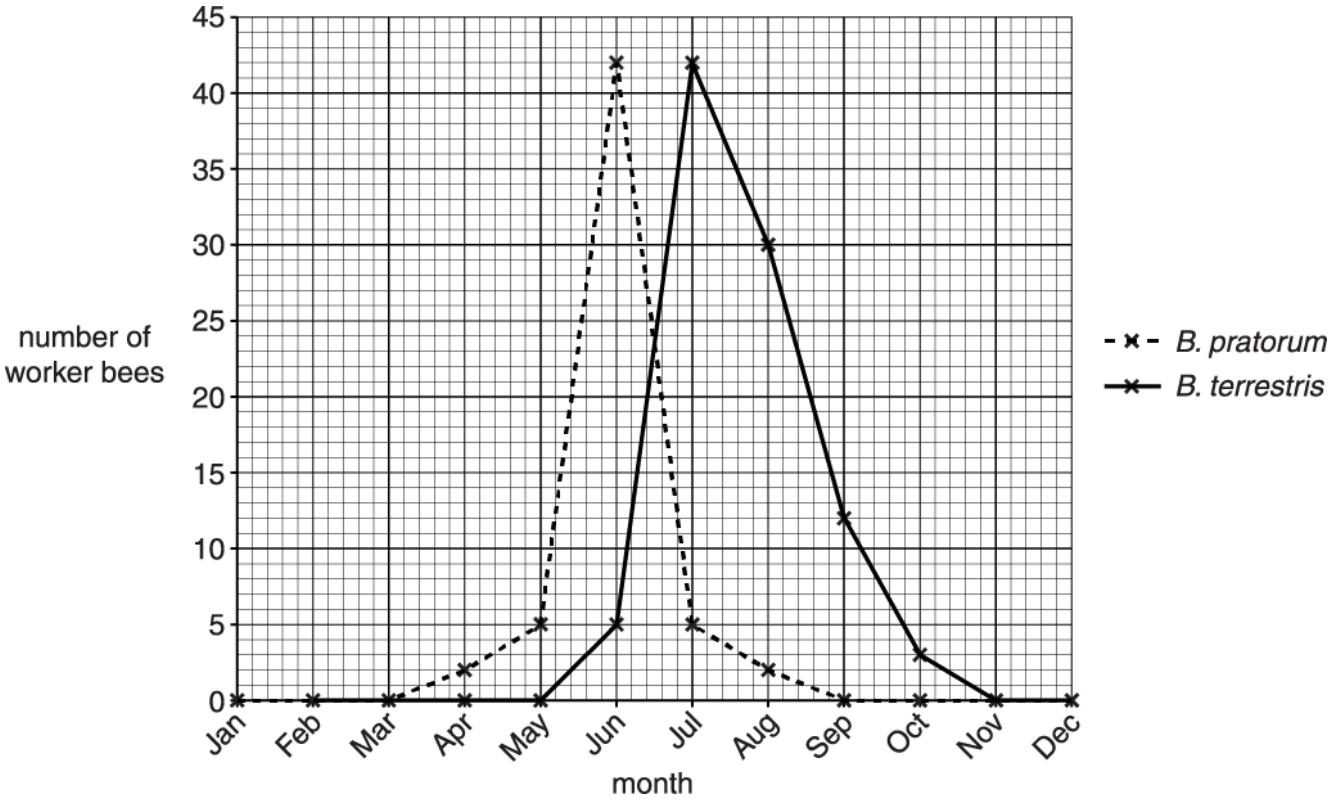


Fig. 2.1

Species of bumble bee	Mean depth of flower visited (mm)	Visits to flowers when nectar only collected (%)	Visits to flowers when pollen only collected (%)	Visits to flowers when both nectar and pollen collected (%)
Bombus pratorum	7.4	23	10	67
Bombus terrestris	6.3	80	11	9

Table 2.1

(i) *B. pratorum* and *B. terrestris* both live in Britain. They can often be found in the same location, as their geographical distributions overlap.

Use Fig. 2.1 and Table 2.1 to evaluate the extent to which the two species may compete.

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[4]

(ii) Use Fig. 2.1 and Table 2.1, and the information given on page 7, to suggest how an ancestral species might have evolved into the two species, *B. pratorum* and *B. terrestris*.

[3]

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6. A batch fermenter is used during the production of beer.

Fig. 5.1(a) and Fig. 5.1(b), show some changes that take place in the fermenter over the first 6 days.

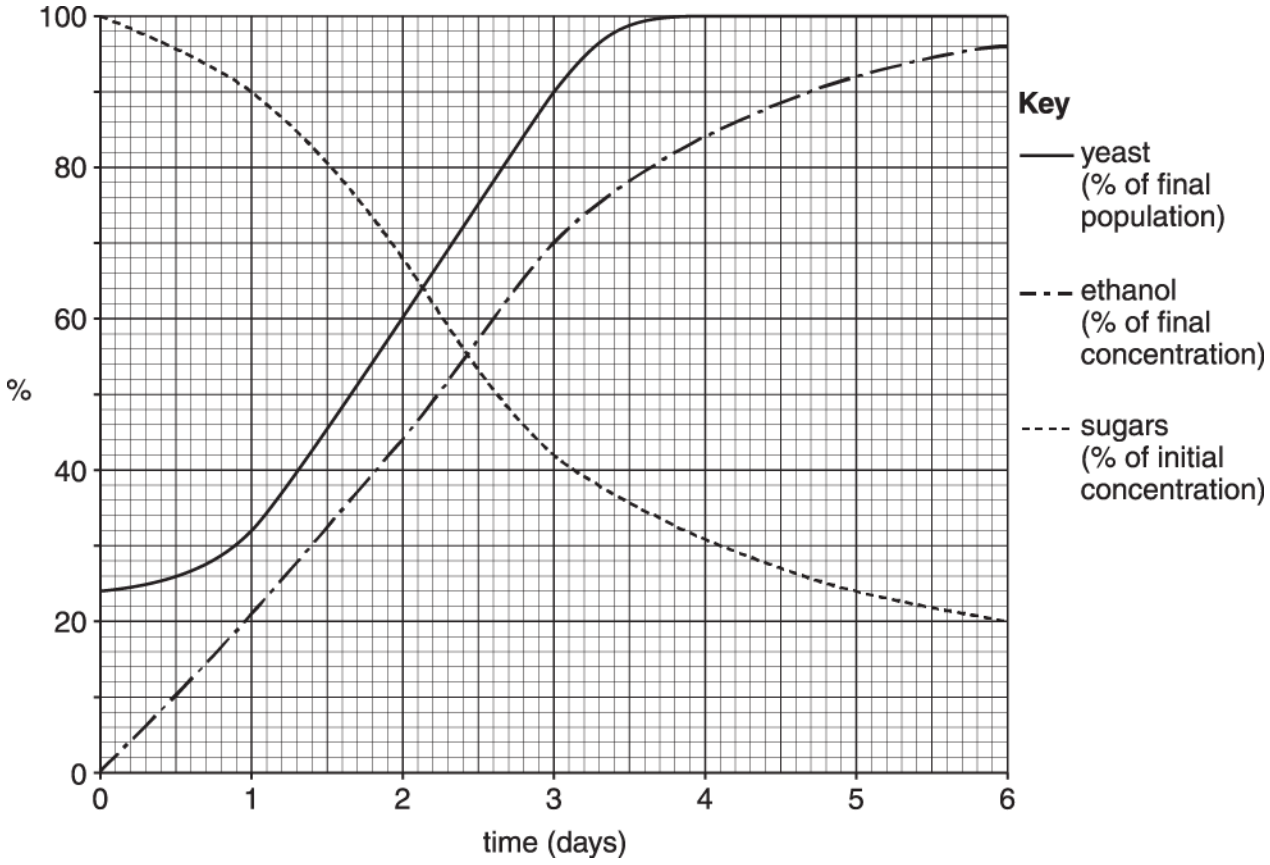


Fig. 5.1(a)

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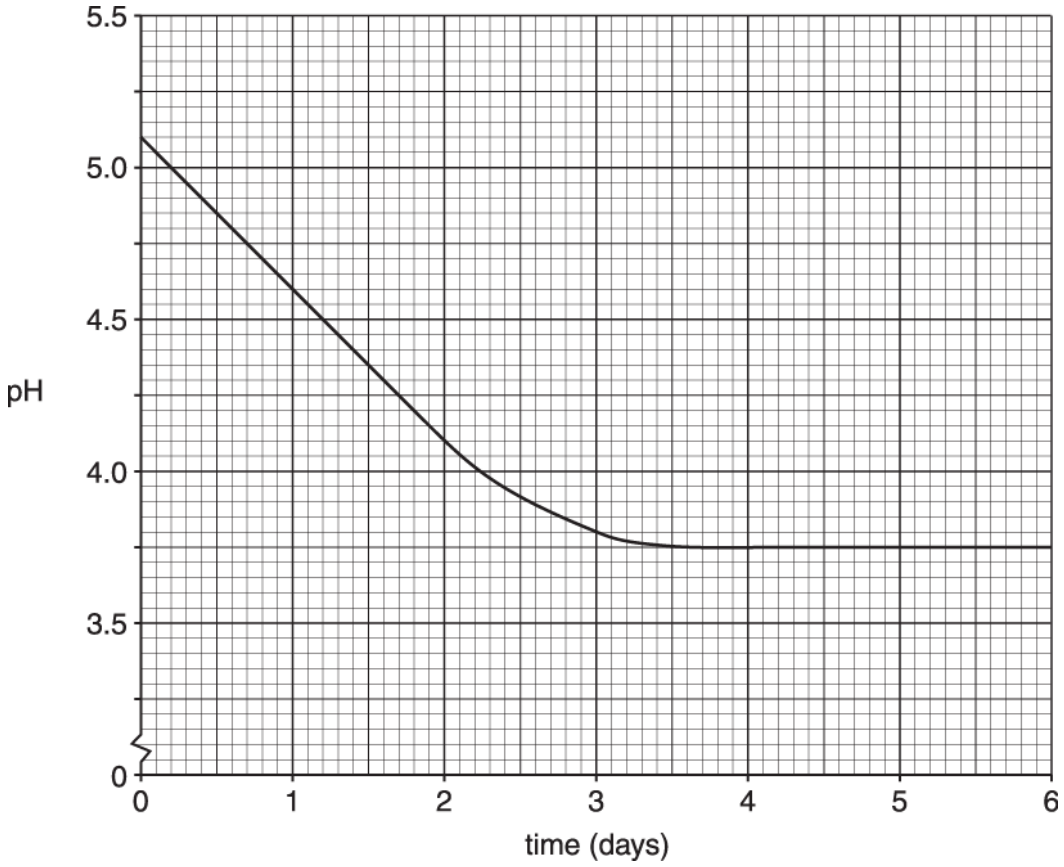


Fig. 5.1(b)

(i) Describe the pattern of growth of the yeast population in this fermenter.

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[4]

(ii) Fig. 5.1(a) shows that as the sugar concentration decreases the ethanol concentration increases.

Explain this relationship.

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[3]

(iii) Using the information from Fig. 5.1(a), explain why ethanol is considered to be a primary metabolite of yeast.

---

[1]

(iv) Using only the information from Fig. 5.1(a) and Fig. 5.1(b), outline how **two** factors may limit the maximum size of the yeast population.

1

2

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[2]

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7. Describe the differences between the following biological terms:

conservation and preservation

---**[2]**

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8(a). Beavers were hunted to extinction in the UK about 500 years ago. Recently a trial reintroduction in Scotland was hailed as a great success after researchers found that the animals had 'transformed the landscape'. After five years the beavers had:

- constructed dams – the largest of which was 18 m long and 1.6 m high
- felled trees
- created canals
- built lodges (large nests)
- successfully reproduced.

(i) Beavers are considered to be a keystone species.

Explain why they are a keystone species in their native Canada.

[2]

(ii) One benefit of the reintroduction of beavers in Scotland was an increase in habitat diversity.

Explain how the following activities could have contributed to increased habitat diversity.

constructed dams

felled trees

built lodges

[3]

(iii) Suggest **one** other benefit of the reintroduction of beavers.

---

[1]

(b). Increasing habitat diversity may lead to an increase in species diversity and genetic diversity.

Explain why species diversity and genetic diversity may be increased as a result of the beavers' activity.

---

[2]

(c). Some land owners have expressed concern about the impact that beavers can have on rural businesses.

Suggest **two** arguments that may be used by local business leaders against the introduction of beavers. State whether these outweigh the arguments presented by the naturalists.

argument 1 _____

---

argument 2 _____

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[4]

END OF QUESTION PAPER

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Question			Answer/Indicative content	Marks	Guidance
1		i	no / less, planting **AND** *idea of* trees remove water from the bog (1) no ditch **AND** *idea of* ditch drains water from the bog (1) no / controlled, grazing **AND** *idea of* overgrazing disrupts the food chain (1) no / less, burning **AND** *idea of* death of organisms from rare species (1)	3	
		ii	*idea that* preservation leaves ecosystems untouched, or without human interference (1) *idea that* most peat bogs have been damaged already and require management and restoration (1)	2	
			Total	**5**	
2			D	1	
			Total	**1**	
3		i	*Measures* fishing quotas (1) mesh size (1) species restriction (1) trawler size / days at sea (1) penalties / sanctions (1) monitoring / surveillance (1) publicity / public education (1) *Difficulties* area too large (1) expense of monitoring (1) monitoring hampered by, weather / seasons (1) false reporting of, catches / trawler size / mesh size / days (1) death of fish caught but not kept (because of restrictions) (1)	4	**The difficulties should relate to the measures proposed.**
		ii	*argument for* comparison of the energy in large fish and krill shows humans would get 100x more kJ / energy from krill than large fish (1) *argument against* would require large change to fishing industry / consumer habits **or** could impact ecosystem at first trophic level (1)	2	**ALLOW** the use of figures to illustrate the data comparison.

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Question			Answer/Indicative content	Marks	Guidance
			Total	**6**	

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Question			Answer/Indicative content	Marks	Guidance
4	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 **Examiner's Comments** This question was generally well answered. The majority of candidates were able to identify either or both of the peaks in 1988 and 1994 and some went onto mention the decrease and increase in population between these dates, finishing with the decrease after 1994. It was encouraging to see general statements about the fluctuations in the data and the overall increase from 1965 to 2002. Common errors were to describe trends from 1965 to 1988 or comment on the numbers of shot elk. Other mistakes made were misreading the data or not mentioning any dates at all.

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Question			Answer/Indicative content	Marks	Guidance
		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 **Examiner's Comments** Most candidates got the first marking point and understood that the number of elk shot would be recorded and was therefore accurate. However, fewer candidates gained the second marking point about why the method was not valid. The candidates who did get it tended to talk about illegal hunting making the data less valid, as opposed to hunting success being independent of overall population size. A common mistake was to talk about hunting scaring off elk from the area or elk dying from factors other than hunting. Some candidates also confused their answers by talking about ecological sampling in general and not relating it to the question asked.

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Question			Answer/Indicative content	Marks	Guidance
	b	i	**1** *idea that population size is determined by* limiting factor(s); *Before 1995, population increases due to* **2** example of factor that is not limiting population; *Before 1995, population levels off because* **3** reaches carrying capacity; *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 from conclusions

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Question			Answer/Indicative content	Marks	Guidance
		i	QWC;	1	**Award if** **1 mark** awarded from **mps 1 to 6 (limiting factors)** **and** **1 mark** awarded from **mps 7 to 9 (effect of wolves)** **Examiner's Comments** Most students used additional sheets for this question but very few gained additional marks for their extra effort. Mostly they continued with lengthy descriptions and explanations of predator-prey relationships and gained no marks for that. Those candidates who recognised the need to explain the population growth curve and did so in a logical sequence, setting out a section for before 1995 and one for after 1995, gained the most marks for this question. Very few candidates recognised that limiting factors were involved. A good number of candidates recognised that the population increase was due to an abundance of food, enough space, enough mates or less predation or less hunting. Some candidates didn't mention the population at all or mentioned the size of the elk, and not the elk population. General references to population being affected wouldn't gain marks here as it was specifically for a reason linking it to an increase in population. A minority of candidates mentioned the carrying capacity being reached before 1995 but sometimes it was not always awarded due to it being referred to after 1995. When candidates used the proper terms of intraspecific and interspecific competition or described them correctly they often missed the marks by not giving a **named** resource or linking it with population size, rather than a named resource. Many candidates gained the mark for

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Question			Answer/Indicative content	Marks	Guidance
					disease affecting population size but sometimes didn't link it with a decrease or dip in population size. The link that any decrease before 1995 was not due to the wolves as none were present was rarely awarded, but the majority of candidates mentioned that after 1995 there was a decrease in elk population and it was likely due to the wolves. This often triggered the QWC mark being awarded. Very occasionally candidates mentioned the idea that the effect of wolves on population may be debatable. There were a number of candidates who wrote about Elm trees or Elk trees and not Elk. In some cases, candidates went into detail of photosynthesis and mineral ions in the soil, showing a complete misunderstanding of the question asked, and relating it to a question asked about Elm trees in a previous paper.

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Question			Answer/Indicative content	Marks	Guidance
		ii	*re-introduction of wolves is conservation because* 1 restoring the ecosystem (to its original form) **or** maintains biodiversity; 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, biodiversity **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 **Examiner's Comments** This was generally a well answered question with references to maintaining or increasing biodiversity and the idea of conserving the wolf as a species, gaining two marks. Only a few answers included reference to biological control of the elk population, which if uncontrolled would result in damage to the ecosystem by overgrazing. A lack of key terms (ecosystem / management / maintenance) stopped some candidates from getting both marks and several candidates used the word 'conservation' in their answer, despite it being in the stem of the question. Common mistakes were to focus the whole answer on just increasing biodiversity or helping the wolf population, without making a second point for the other mark, or to give a general definition of conservation without relating it to the question asked.
			Total	**14**	

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Question			Answer/Indicative content	Marks	Guidance
5		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 **Examiner's Comments** Most candidates got the idea that there was some degree of competition, and successfully gained 1 or 2 marks, but generally answers were poorly constructed with many candidates using the space

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Question			Answer/Indicative content	Marks	Guidance
					available to explain just one or two marking points. For example, many candidates achieved marking point 5, referring to numerous examples of competition in their answer, but only able to achieve one mark. Candidates were good at using data from the graph and table, but often in a vague way - eg. 'peak in the summer months' - and without relating it to the question. Common errors were giving the wrong time scale from x axis, not mentioning both nectar and pollen for mp3 and saying that bees competed as they visited flowers of similar or same depths, or that one species outcompeted the other species of bee.

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Question			Answer/Indicative content	Marks	Guidance
		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; **3** behavioural (difference) / visit different (types of) flowers / feed at different times / feed on different food types; **4** different flower locations / different (micro)habitats; **5** *idea that* gene flow restricted / no gene flow (between populations); **6** different adaptations / specialisation / niche partitioning;	3 max	**2 CREDIT** example of seasonal / temporal (e.g. *B. pratorum* has its peak number of workers in June and *B. terrestris* in July) **3 CREDIT** 'different mating rituals' **5 must refer to gene / allele** **6 IGNORE** speciation (as implied in Q) - can be mistaken for specialisation **Examiner's Comments** The majority of candidates scored well on this question. Most recognised the need for isolation / barriers and mentioned seasonal and / or behavioural differences. However, few mentioned the idea of restricted gene flow and specialisation in the two separate populations leading to the evolution of the new species.
			Total	**7**	

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Question			Answer/Indicative content	Marks	Guidance
6		i	**1** lag phase / slow increase (in, population / number / percentage), at start / initially / day 0 - 1 / during day 1; **2** log phase / exponential increase / rapid increase, day 1 - 3; **3** <u>rate of increase</u>, slows / less steep, days 3 - 4 / during day 3; **4** stationary phase / population levels off / population stays at 100%, at end / finally / remaining days / days 4 - 6; **5** comparative figures quoted with 2 x-y readings;	4 max	**IGNORE** explanations **ACCEPT** 'the population grows' or 'it grows' (rather than increase) **DO NOT CREDIT** 'yeast grow(s)' **1 ACCEPT** days 0 – 0.9 **ACCEPT** lasts 1 day **2 ACCEPT** days 0.9 – 3.5 **3 ACCEPT** days 3.3 – 3.6 **4 ACCEPT** after day 3.5 – 4 **5** Each unit must be quoted at least once **Take care to distinguish between an increase in percentage (by either quoting the figures for the days or by calculating the difference) and a *percentage increase*.** **Examiner's Comments** This question was generally done very well with candidates often gaining 3 out of the 4 available marks. Most candidates knew the terms lag and log phase and could describe the growth occurring there. However many could not accurately quote the days at the beginning and end of each phase. Many also read the values wrongly from the graph or failed to express it correctly i.e. 2 x-y readings, and so failed to gain mp5. Only a very few candidates

Time (days)	Yeast (% final population)
0	24
1	32
3	90
3.5 - 6	100

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Question			Answer/Indicative content	Marks	Guidance
					gave a comment that the rate of increase slowed down during day 3. A significant number also described the pH, sugar and ethanol changes shown by the graphs, or explained reasons why the growth rate was slow or fast, which gained no credit.
		ii	**1** sugar converted to ethanol; **2** in anaerobic respiration; **3** sugar, undergoes glycolysis / converted to pyruvate; **4** pyruvate, loses carbon dioxide / decarboxylated / forms ethanal; **5** reduced NAD giving hydrogen to ethanal; **6** *idea of* NAD being, regenerated / recycled, (so) glycolysis continues; **7** correct ref to, pyruvate decarboxylase / ethanol dehydrogenase;	3 max	**CREDIT** glucose / maltose / maltotriose for 'sugar' **2 IGNORE** fermentation **5 CREDIT** $NADH_2$ / NADH ($+H^+$) / red NAD **Examiner's Comments** It was pleasing to see that the majority of candidates could relate the decrease in sugar concentration to the fact that the yeast is converting it to ethanol in anaerobic respiration. Good responses went on to describe the steps involved in the conversion of sugar to ethanol to gain full marks.
		iii	*ethanol is* produced in, **all** yeast growth phases / **all** of the time **or** production of ethanol increases as yeast population increases **or** *idea that* ethanol is a normal (metabolic waste) product (of yeast);	1	**IGNORE** ref to ethanol not being a secondary product **CREDIT** 'produced during normal growth' **CREDIT** follows growth curve for yeast **IGNORE** waste unqualified **Examiner's Comments** Many candidates successfully gained a mark for stating that ethanol was produced as a normal product of metabolism or that it followed the growth curve of yeast. A common error was to say that ethanol was produced during a specific phase rather than in all growth phases, or that ethanol is needed for growth.

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Question			Answer/Indicative content	Marks	Guidance
		iv	**1** sugar concentration falls **too** low; **2** pH falls **too** low / conditions become **too** acidic / decrease in pH causes enzymes to denature; **3** high ethanol concentration, damages / poisons / inhibits, yeast;	2 max	**1 ACCEPT** very low sugar concentration / sugar concentration decreases as used up **2 ACCEPT** very low pH / very acidic **DO NOT CREDIT** 'falls and rises' **3 ACCEPT** high ethanol concentration kills yeast **Examiner's Comments** It was surprising that more candidates did not score 2 marks on this question. Many referred to pH but did not discuss it being too low or refer to denaturing of enzymes, and some thought it would go too high. A number of candidates incorrectly referred to the presence of ethanol as being responsible for pH changes. Only a few referred to sugar concentration going too low, and many just used the term sugar alone or just said it would decrease. The term 'amount' was often used instead of the required more precise term 'concentration'.
			Total	**10**	

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Question			Answer/Indicative content	Marks	Guidance
7			**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 **Examiner's Comments** It was pleasing to see that the majority of candidates could correctly describe conservation, but the idea of preservation leaving a habitat untouched / undisturbed was not always made clear. Some candidates lost marks for the use of the term environment or area when meaning ecosystem or habitat when talking about both conservation and preservation.
			Total	**2**	

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Question			Answer/Indicative content	Marks	Guidance
8	a	i	have significant effect on ecosystem many other species rely on activity of beavers	2	
		ii	*created dams* flooded areas upstream / reduced flow rate downstream creating still / slow moving water for aquatic species *felled trees* opened up tree canopy allowing light to ground level *built lodges* creates sheltered habitat for insect species / beaver parasites	Max 3	**ALLOW** any other valid point
		iii	ecotourism / education / scientific study water quality improved as silt is held back by dams	Max 1	
	b		species diversity will rise as more species live in the new habitats genetic diversity will increase as species have a wider range of conditions in which to live	2	
	c		loss of farmland due to flooding strength of argument depends on area affected (probably) not a strong argument as relatively small areas affected trees cut down (of concern to foresters) likely to occur only in area near water – so not a strong argument damage to river bank needing costly repairs cost should be shared by all who benefit (including those downstream) so not a strong argument	max 4	
			Total	**12**	

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