

- 1 The photograph below shows the shiny nematolepis plant (*Nematolepis wilsonii*), which became extinct in the wild. This plant was thought to be extinct as a result of bush fires in South East Australia during 2009.

It had been found in only one site in the wild and this site was burnt to a depth of over one metre. This destroyed seeds that were in the soil.



Magnification  $\times 1$

- (a) (i) State what is meant by the term **species richness**.

(1)

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- (ii) Suggest what effect the extinction of the shiny nematolepis plant would have on species richness in South East Australia.

(1)

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- (b) Suggest why the shiny nematolepis plant was considered to be an endemic species before the bush fires of 2009.

(1)

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(c) Shiny nematolepis seeds had already been stored at the Millennium Seed Bank at Kew. These seeds were used to restore this plant species and to ensure its survival.

(i) Explain how these seeds were selected for storage in the seed bank.

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(ii) Describe the conditions used for the storage of seeds in seed banks.

Explain why seeds are stored in these conditions.

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**(Total for Question 1 = 9 marks)**

- 2 The black-footed ferret, shown in the photograph below, is one of North America's most endangered species. In 1986, only 18 individuals were living in the wild. These were used to start a captive breeding programme. Six zoos are now involved in this programme.



Black-footed ferret

Magnification  $\times 0.1$

- \*(a) Suggest how this captive breeding programme in the six zoos ensures that genetic diversity is maintained in this species.

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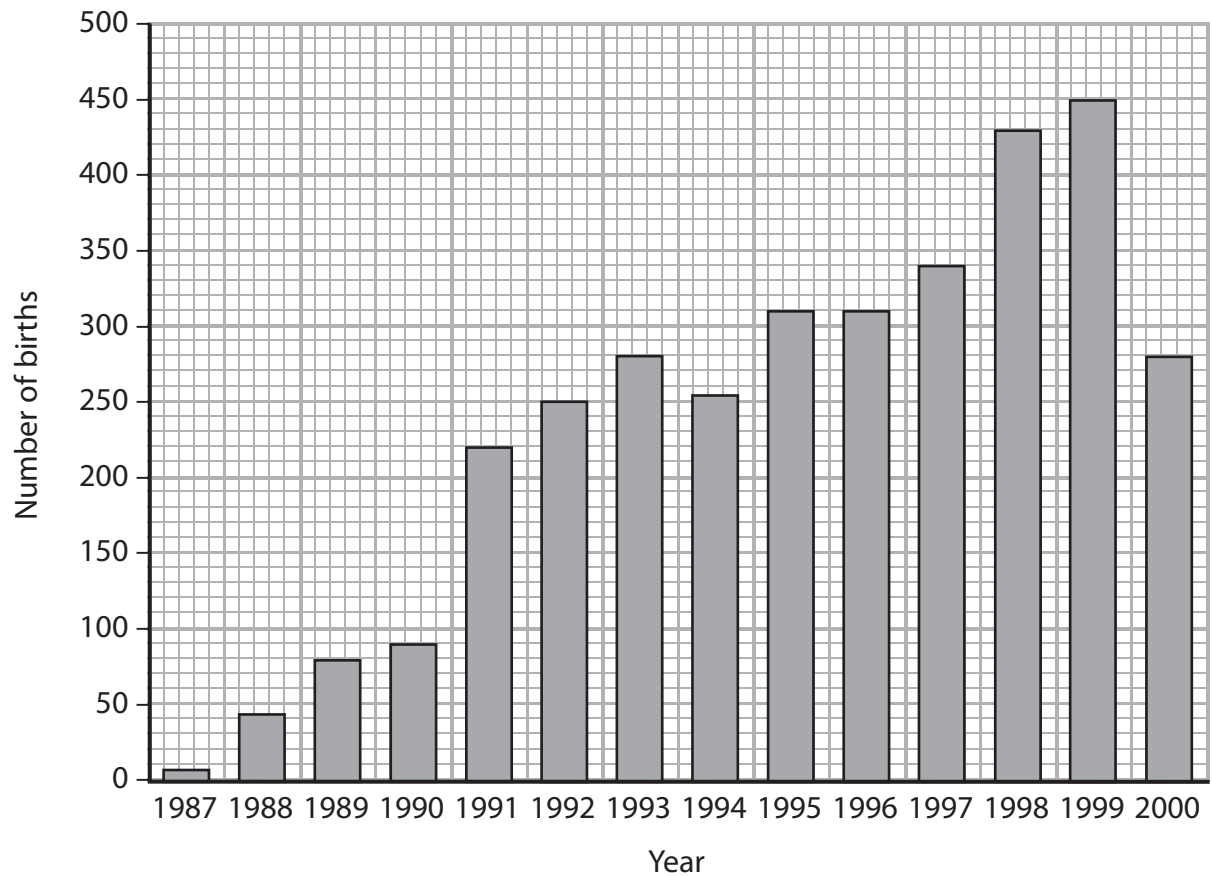
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(b) The graph below shows the number of black-footed ferrets in captivity born each year from 1987 to 2000.



(i) Each year since 1991, 200 black-footed ferrets have been released into the wild.  
Suggest why no black-footed ferrets were released into the wild before 1991.

(2)

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(ii) Using the information in the graph, suggest how effective the captive breeding programme was between 1991 and 2000.

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(c) The map of the USA below shows the original range of the black-footed ferrets and the sites where they have been reintroduced. Their natural habitat is prairie, which is a type of grassland.

Only 1% of the prairie remains undisturbed by human activity.

Black-footed ferrets mainly prey on prairie dogs. Prairie dogs are treated as pests by farmers who may use poison to kill them.



Suggest **three** factors that could affect the survival chances of black-footed ferrets when they are reintroduced to the sites shown on the map.

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**(Total for Question 2 = 12 marks)**

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- 3 The Mount Graham squirrel, *Tamiasciurus hudsonicus grahamensis*, is endemic to Graham Mountain in Arizona, USA.

In 2011 its habitat was threatened by wildfires. Two males and two females were taken from the wild by conservation workers from Phoenix Zoo.



Mount Graham squirrel

Magnification  $\times 0.1$

- (a) Place a cross in the box () that correctly describes what is meant by the term **endemic species**.

(1)

- A a species found in all countries
- B a species found in all habitats
- C a species found in one geographical location
- D a species found in one type of habitat

- (b) Suggest the problems the zoo might have in trying to develop a breeding programme with these Mount Graham squirrels.

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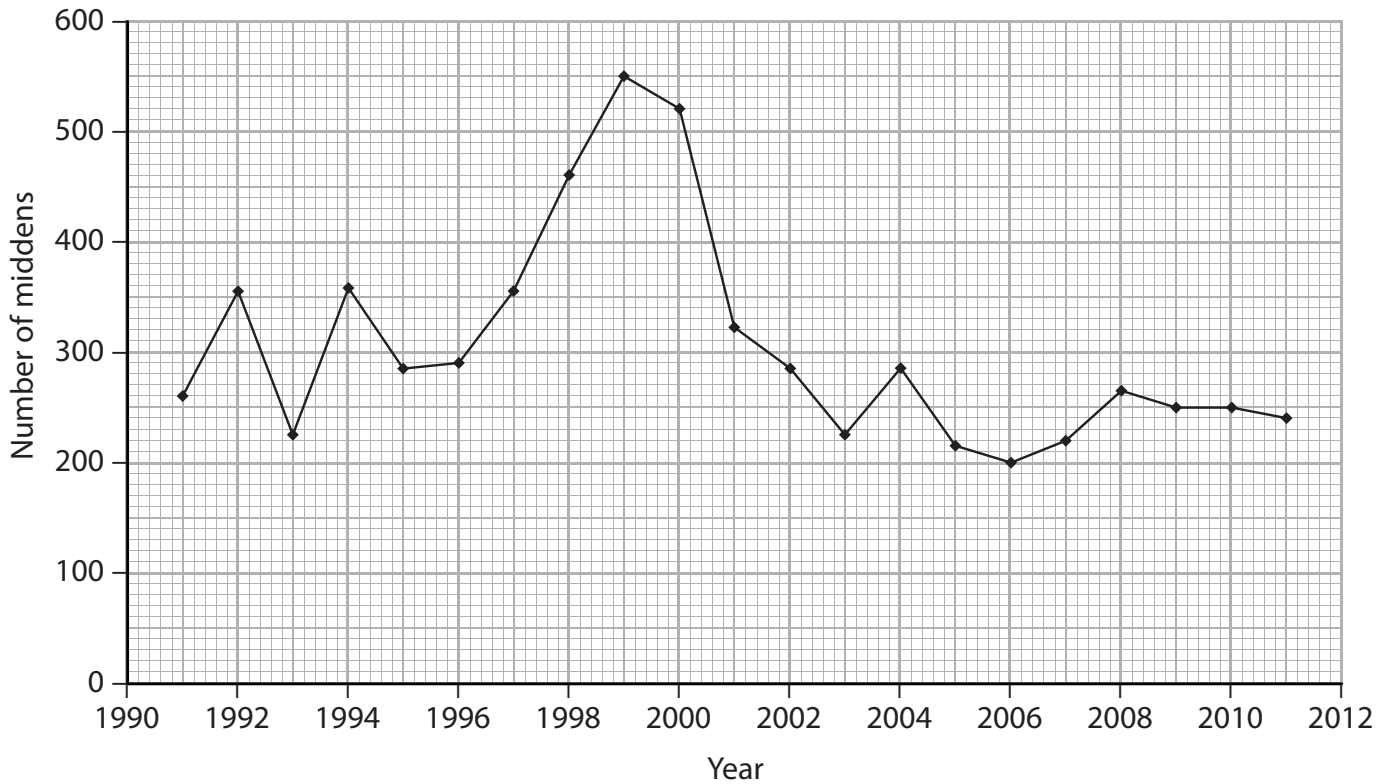
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(c) Squirrels bury food, such as seeds and nuts, in areas called middens.

The population size of Mount Graham squirrels in the wild is estimated by surveying the number of middens.

The graph below shows the results of surveys carried out from 1991 to 2011.



(i) Using the information in the graph, calculate the percentage change in the number of middens from 1999 to 2006. Show your working.

(3)

Answer .....%



(ii) Using information in the graph, suggest what happened to the population size of the Mount Graham squirrel between 1999 and 2006.

(2)

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(d) Suggest and explain why it was decided to develop a captive breeding programme for the Mount Graham squirrel.

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**(Total for Question 3 = 12 marks)**

- 4 As a result of the destruction of many habitats, the numbers of some species of animals are now so low that they may not be able to survive.

The white rhinoceros, *Ceratotherium simum*, is an example of a mammal that is threatened with extinction.



White rhino  
Magnification  $\times 0.02$

In southern Africa, many reserves have been set up to protect habitats and animals. These areas are governed by special legislation and monitored by wardens.

- (a) Suggest why many scientists consider that the use of protected reserves is likely to be more successful for the conservation of some animals than captive breeding programmes in zoos.

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\*(b) The illegal killing of white rhinoceros (poaching), to obtain their horns, is a serious problem in many of the reserves in southern Africa. When the body of a white rhinoceros is discovered, determination of the time of death is an important part of the police investigation to catch the poachers.

After several days, body temperature and rigor mortis cannot be used to determine the time of death.

Suggest how the time of death of a white rhinoceros could be determined if it is discovered several days after being killed.

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**(Total for Question 4 = 8 marks)**