1 Some animals are adapted to survive in very cold conditions such as the Arctic.

Explain how the adaptations of Arctic animals help them to survive in cold conditions.

(Total 6 marks)

2 Human activity affects ecosystems.

(a) Draw **one** line from each human activity to the effect on ecosystems.

Human activity	Effect on ecosystems
Increase in rice fields	Increases the amount of methane in the atmosphere
Destruction of peat bogs	Increases the amount of carbon dioxide that is released into the atmosphere
	Reduces the rate at which carbon dioxide is locked up as wood

(2)

(b) (i) Deforestation also affects the atmosphere.

Give **two** reasons why deforestation takes place.

1. _____

_____

2. _____

_____

(2)

(ii) Changes in the gases in our atmosphere can cause global warming.

Give **two** possible effects of a rise in the Earth's temperature.

1. _____

_____

2. _____

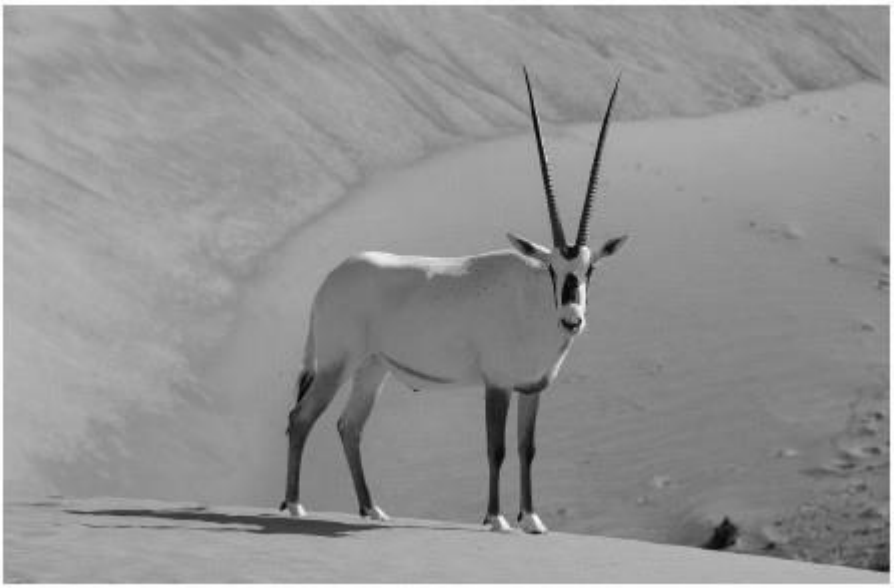
_____

(2)

(Total 6 marks)

3 The Arabian oryx (*Oryx leucoryx*) is a mammal that was once extinct in the wild.

The image shows an Arabian oryx.



(a) What is the genus of the Arabian oryx?

Tick **one** box.

leucoryx ☐ *Oryx* ☐ *Oryx leucoryx* ☐

(1)

(b) Give **two** adaptations of the Arabian oryx to living in hot desert environments.

Use information from the image.

1. _____

_____

2. _____

_____

(2)

(c) The Arabian oryx uses its long horns to fight for territory and mates.

Describe how the long horns could have evolved.

_____

_____

_____

_____

_____

_____

(3)

Arabian oryx from many different zoos were interbred so that they could be reintroduced to the wild.

(d) What is the name of this method of increasing the population of endangered animals?

Tick **one** box.

Breeding programme	☐
Genetic modification	☐
Natural selection	☐
Selective breeding	☐

(1)

(e) Explain why it was important to use Arabian oryx from many different zoos instead of one zoo.

_____

_____

(1)

(Total 8 marks)

4 Moose are animals that eat grass.

Figure 1 shows a moose.

Figure 1

© Wildnerdpix/iStock/Thinkstock

Figure 2 shows a food chain.

Figure 2

Grass ⟶ Moose ⟶ Wolves

(a) Name the secondary consumer shown in **Figure 2**.

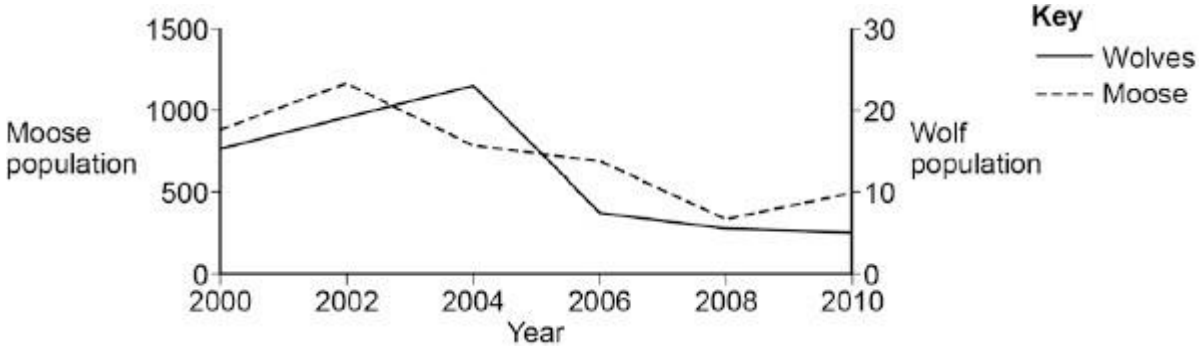
_____

(1)

(b) **Figure 3** shows how the moose population and wolf population have changed in one area.

This is a predator-prey cycle.

Figure 3



In 2004 the line on **Figure 3** for wolves is above the line for moose.

How does **Figure 3** show that there are more moose than wolves in 2004?

_____

_____

(1)

(c) Suggest why the moose population decreased between 2002 and 2004.

Use information from **Figure 3**.

_____

_____

(1)

(d) The number of wolves is one biotic factor that could affect the size of the moose population.

Give **two** other biotic factors that could affect the size of the moose population.

1. _____

_____

2. _____

_____

(2)

(e) Moose have distinct characteristics such as antlers.

Describe how moose may have evolved to have large antlers.

(5)

(Total 10 marks)

5 Students used quadrats to estimate the population of dandelion plants on a field.

(a) Describe how quadrats should be used to estimate the number of dandelion plants in a field.

(4)

(b) The field measured 40 m by 145 m.

The students used 0.25 m^2 quadrats.

The students found a mean of 0.42 dandelions per quadrat.

Estimate the population of dandelions on the field.

Estimated population of dandelions = _____

(2)

(c) In one area of the field there is a lot of grass growing in the same area as dandelions.

Suggest why the dandelions may **not** grow well in this area.

(4)

(Total 10 marks)

6 Some students wanted to estimate the number of plantain plants in a grassy field.

The field measured 100 metres × 50 metres.

The students:

- chose areas where plantains were growing
- placed 10 quadrats in these areas
- counted the number of plantains in each of the 10 quadrats.

Each quadrat measured 25 cm × 25 cm.

The table below shows the students' results.

Quadrat number	Number of plantain plants
1	2
2	1
3	4
4	1
5	3
6	2
7	4
8	1
9	1
10	1

(a) Complete the following calculation to estimate the number of plantain plants in the field.

Use the students' results from the table above.

Total number of plantains in 10 quadrats = _____

Total area of 10 quadrats =_____ m^2

Mean number of plantains per m^2 = _____

_____

Area of field =_____ m^2

Therefore estimated number of plantains in field = _____

_____

(3)

(b) The students' method would **not** give a valid estimate of the number of plantain plants in the field.

Describe **three** improvements you could make to the students' method.

For each improvement, give the reason why your method would produce more valid results than the students' method.

Improvement 1 _____

Reason _____

_____

Improvement 2 _____

Reason _____

_____

Improvement 3 _____

Reason _____

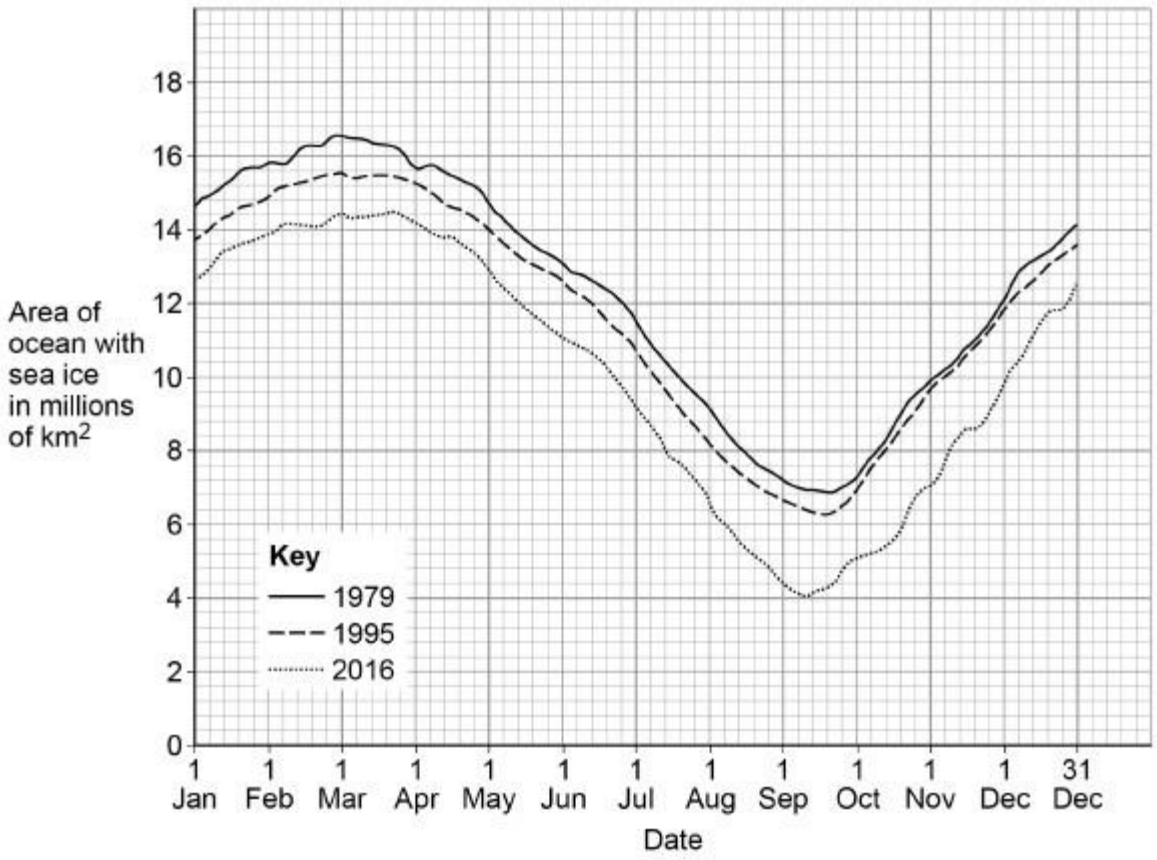
_____

(3)

(Total 6 marks)

7 Human activities can affect our ecosystem.

The graph shows information about how the area of ocean with sea ice in the arctic has changed between 1979 and 2016.



(a) Give **two** conclusions you can make from the data shown in the graph.

1. _____

_____

2. _____

_____

(2)

(b) The area of ocean with sea ice in the arctic has changed.

Most scientists believe this is due to the activities of humans.

Explain the activities of humans that have led to the changes in sea ice from 1979 to 2016.

(6)

(Total 8 marks)

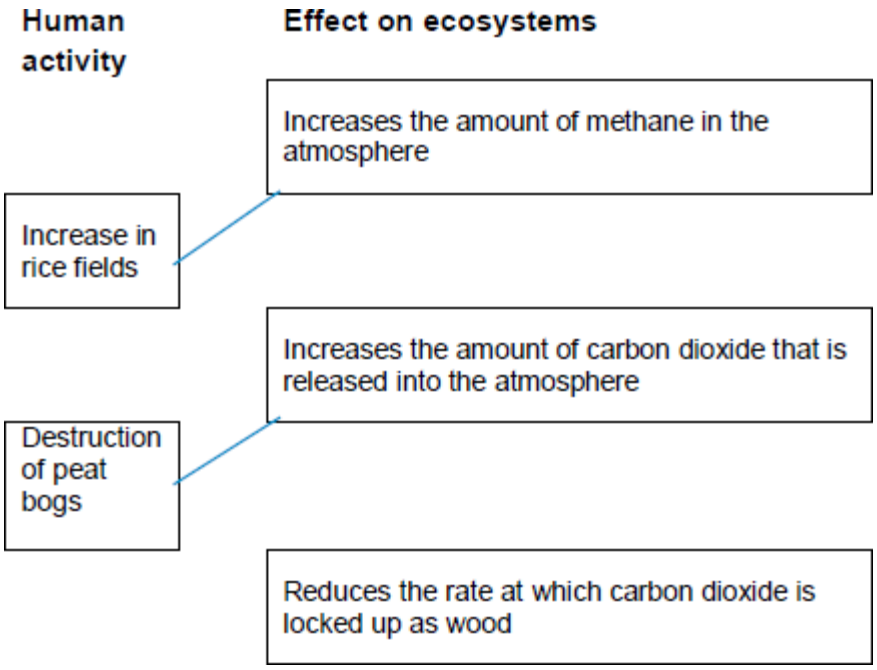
1

Level 3: Relevant adaptations are identified, given in detail and logically linked to form a clear account.	5-6
Level 2: Relevant adaptations are identified, and there are attempts at logical linking. The resulting account is not fully clear	3-4
Level 1: Adaptations are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2
No relevant content	0
Indicative content • a small SA:V ratio • means less thermal energy transferred to surroundings • thick fur **or** hollow hair shafts • traps a layer of air which acts as an insulating layer stopping transfer of thermal energy • a layer of fat or blubber under the skin • acts as an insulating layer **or** as a food store for respiration when food is in short supply • small ears • reduces surface area for thermal energy transfer • white colour • camouflage in the snow so prey do not see them coming and they get more to eat **or** so predators do not see them and they can escape • large feet • to spread weight over snow so they can run faster • hibernate in winter • to conserve energy stores allow 'heat loss' for transfer of thermal energy	

6

[6]

2 (a)



extra lines from left cancels mark

2

(b) (i) any **two** from:

- (to provide land) for farming / agriculture
- (to provide land) for quarrying
- (to provide land) for building
- to provide wood for building materials
- to provide fuel
- to provide paper

2

(ii) any **two** from:

- changes in earth's climate, ie droughts, flooding, hurricanes
  ignore temperature rise
  allow ice caps melt
- rise in sea levels
- reduce biodiversity
- change in migration patterns
- may change distribution of species

  *ignore acid rain **and** the ozone layer **and** forest fires*

2

[6]

3 (a) *Oryx*

1

(b) any **two** from:

- white / light colour (to reduce thermal gain)
- short fur (to reduce thermal insulation)
- little body fat
- large hooves (to walk in sand)
- camouflaged (against sand by light colour)

2

(c) any **three** from:

- variation in population
- animals with longest horns more likely to survive / reproduce
- passing on alleles for long horns
- repeated over many generations

3

(d) breeding programme

1

(e) any **one** from:

- to increase genetic diversity

  *do **not** accept to increase biodiversity*
- species may be unable to cope if environment changes
- all susceptible to same diseases / inbreeding problems

  allow otherwise all offspring would have similar genes or a decreased gene pool
- prevents inbreeding

1

[8]

4 (a) wolves

1

(b) moose and wolves are on different scales

1

(c) wolf population has increased so more moose are eaten

*do **not** accept there are more wolves than moose*

1

(d) any **two** from:

- (other) predators

  allow correct examples

  allow 'humans hunting moose'
- (new) pathogens

  allow diseases
- competition

2

(e) any **four** from:

- variation (within species) of antler size

  allow description relating to antlers
- (caused by) different genes
- as a result of sexual reproduction / process of meiosis / mutation
- (phenotype) most suited to environment most likely to survive and breed

  ignore natural selection unqualified
- genes for large antlers (more likely to be) passed on to next generation

4

reference to mate selection
or
fighting
or
gaining territory
or
competition for mates
or
avoiding predation

1

[10]

5 (a) (placed) randomly

allow description of placement

1

sufficient number (of quadrats) used

1

count (dandelions) in each quadrat

1

use mean number of dandelions, area of quadrat and area of field to estimate population

accept (area of field / area quadrat) × mean number of dandelions per quadrat

1

(b) (40 × 145) / 0.25 = 23 200

1

(0.42 × 23 200 =) 9744

*allow 9744 with no working shown for **2** marks*

*allow ecf from correct attempt at the previous step) × 0.42 for **1** mark*

1

(c) **Level 2 (3–4 marks):**
A detailed and coherent explanation is given. Logical links between clearly identified relevant points are made to explain why dandelion growth may be limited.

Level 1 (1–2 marks):
Discrete relevant points are made. The logic may be unclear.

0 marks:
No relevant content

Indicative content

factors that may be considered:
competition for resources including:
- light
- water
- space
- mineral ions (allow nutrients / salts / ions from the soil)

reference to why growth may be limited:
- (light) energy for photosynthesis
- water as a raw material for photosynthesis / support
- surface area exposed to light
- sugar / glucose produced in photosynthesis
- (space) to grow bigger
- (space) for growth of root system
- (mineral ions) for growth
- (mineral ions / sugar) for production of larger molecules **or** named example

4

[10]

6 (a) 160 000

if incorrect answer / no answer:

allow max. 2 for method:

1 mark for mean = total number ÷ area of ten quadrats

eg $\frac{20}{0.625}$ *or* $\frac{20 \times 8}{5}$ *or* $\frac{160}{5}$ *or 32*

1 mark for final answer = mean × field area

eg mean × 5000

3

(b) Improvement: place quadrats randomly

and

Reason: avoid bias / (more) representative / (more) reliable

allow 1 mark if 2 correct improvements but no reasons / only incorrect reasons

1

Improvement: more quadrats

and

Reason: overcome random variation / (more) typical / (more) representative / (more) reliable / repeatable

1

Improvement: larger quadrats **or** repeat when plants are bigger

and

Reason: less likely to miss plants

ignore accurate, valid, precise and fair

ignore anomalies

1

[6]

7 (a) any **two** from:

- the area of ocean with sea ice has reduced since 1979
- the amount of ice follows the same pattern during a year

allow ice reduces in the summer and increases in the winter

- most ocean with sea ice in February / March
- least ocean with sea ice in September / October
- area of ocean with sea ice decreases from March to September each year
- area of ocean with sea ice increases from September to February / March each year
- decrease is greater between 1995 and 2016 compared with 1979 to 1995

allow other correct conclusions derived from the graph

2

(b)

Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5-6
Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.	3-4
Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2
No relevant content	0
Indicative content • deforestation has reduced the number of trees on the planet • which has reduced the amount of carbon dioxide that can be removed from the atmosphere • increased combustion releases more carbon dioxide into the atmosphere • therefore there is a build-up of carbon dioxide in the atmosphere • (build up) allows short-wavelength radiation to pass into the Earth's atmosphere • and absorbs long-wavelength • causing an increase in global temperature • the increase in temperature causes ice to melt	

6

[8]