

# Ecology 4

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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Time: **84 minutes**

Marks: **82 marks**

Comments:

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1.

In 2017, the city of Manchester began a 'City of Trees' project.

The project plans to plant 3 million trees over the next 25 years.

The trees will be used to:

- make existing woodlands larger
- link existing woodlands
- create new woodlands
- plant in parks, public gardens and along streets
- give to people to plant in private gardens.

(a) It was suggested that the council plant  $3.6 \times 10^5$  trees in the first year.

The rest of the trees would be planted in equal numbers over the remaining years.

Calculate how many trees would need to be planted in each of the remaining years.

Give your answer in standard form.

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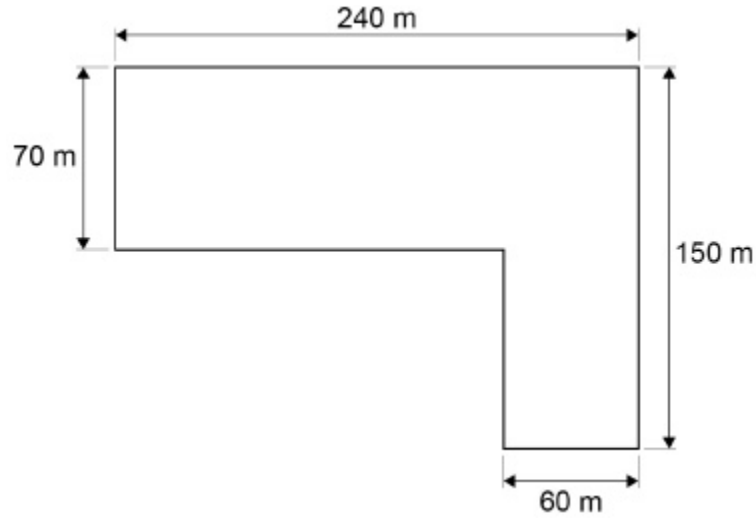
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Number of trees = \_\_\_\_\_ per year

(3)

(b) Students investigated the number of bluebells in one of the existing woodlands.

The diagram shows the dimensions of the woodland.



The students used a  $0.25 \text{ m}^2$  quadrat to sample the bluebell population.

The mean number of bluebells per quadrat was 6

Estimate the population of bluebells in the woodland.

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Population = \_\_\_\_\_ bluebells

(2)



**2.**

Global warming may reduce biodiversity in some areas.

(a) What is biodiversity?

Tick **one** box.

The different habitats in an ecosystem

The interaction of living and non-living factors in a habitat

The interdependence of organisms on Earth

The total number of organisms in an ecosystem

The variety of different species on Earth

**(1)**

(b) What gases cause global warming?

Tick **two** boxes.

Carbon dioxide

Methane

Nitrogen

Oxygen

Water vapour

**(2)**

(c) Give **two** effects of global warming that could reduce biodiversity in an area.

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_

**(2)**  
**(Total 5 marks)**

3.

Peat can be burnt as a fuel.

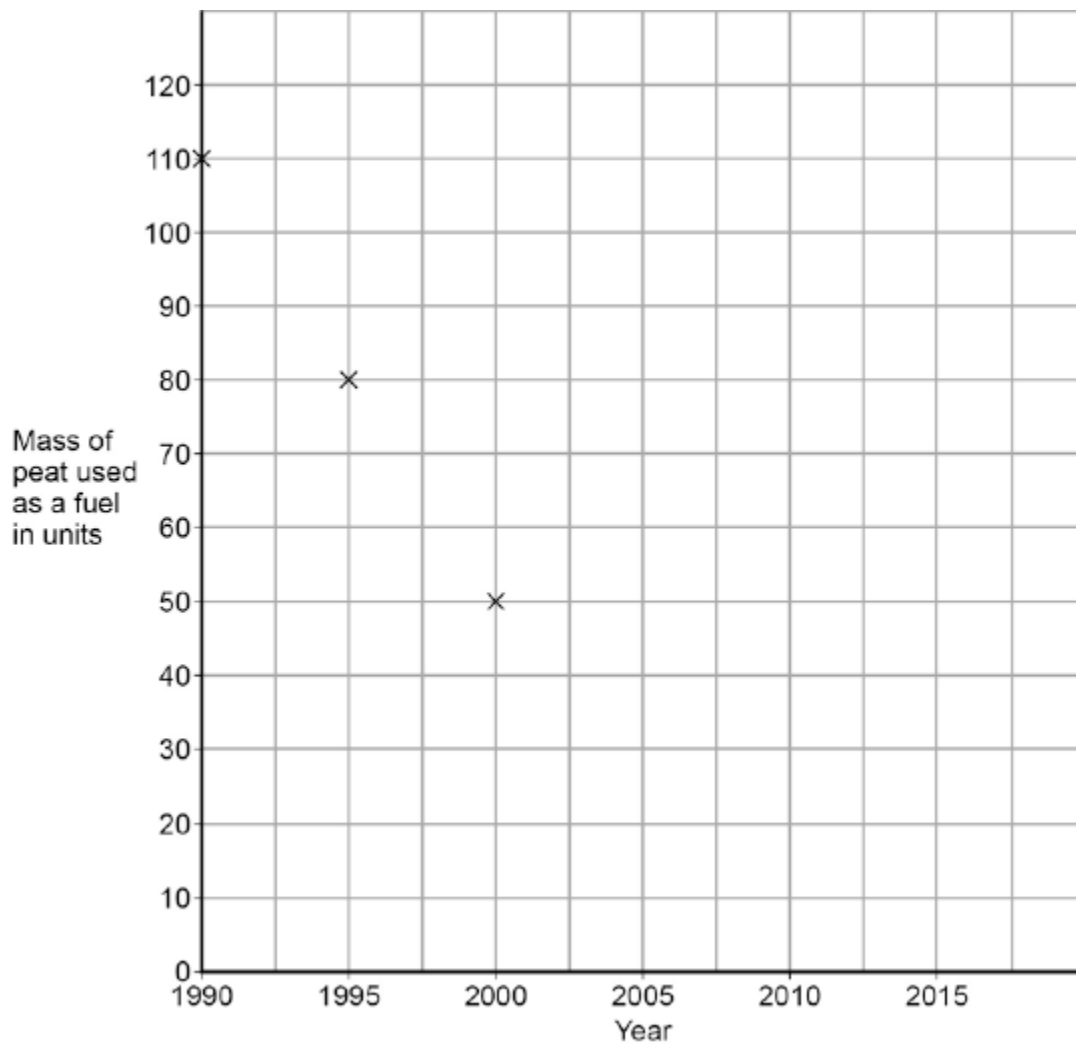
Table 1 shows the amount of peat used as a fuel in the UK over 20 years.

Table 1

Year	Mass of peat used as a fuel in units
1990	110
1995	80
2000	50
2005	20
2010	10

Figure 1 shows some of the information from Table 1.

Figure 1



(a) Complete **Figure 1** by plotting the points for 2005 and 2010.

(2)

(b) Predict the amount of peat used as a fuel in the UK in 2015.

Use information from **Figure 1**.

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(1)

(c) Plants in the UK are often grown in compost.

Compost usually contains peat.

The coconut fibre shown in **Figure 2** is a waste product of coconut farming.

Coconut fibre can be used to produce peat-free compost.

**Figure 2**



© afe207/Thinkstock

**Table 2** shows features of peat-free compost made using coconut fibre.

Complete **Table 2** to show if each feature is an advantage **or** disadvantage.

Put a tick in each row.

**Table 2**

Feature compared to peat compost	Advantage	Disadvantage
Coconut fibre is transported longer distances		
Coconut fibre is a waste product		
Coconut fibre traps less air in the soil, so roots absorb fewer mineral ions		

(2)

(Total 5 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



(a) What word describes the grass in Figure 2?

Tick **one** box.

Consumer

Predator

Prey

Producer

(1)

(b) What word describes the wolves in **Figure 2**?

Tick **one** box.

Communities

Predators

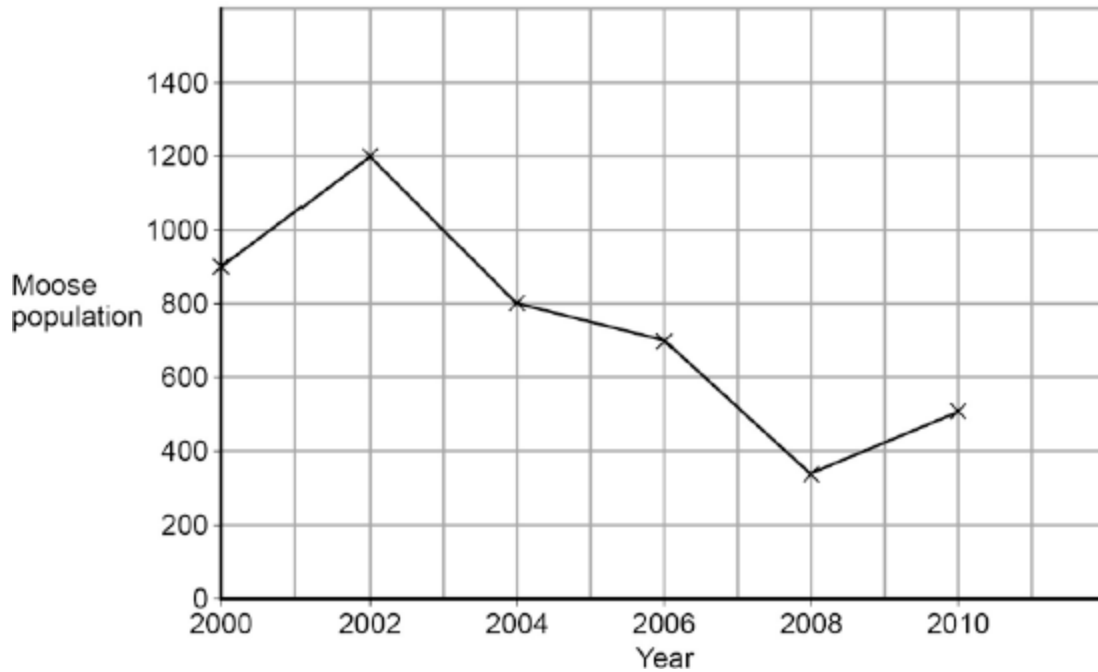
Prey

Producers

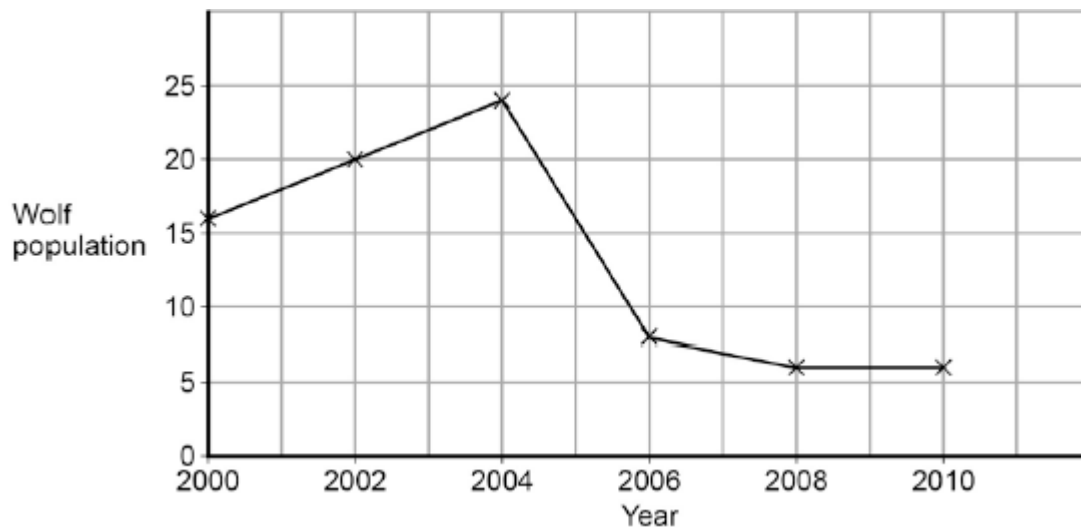
**(1)**

(c) **Figure 3** and **Figure 4** show how the moose population and the wolf population changed in one area.

**Figure 3**



**Figure 4**



Look at **Figure 3**.

In this area the moose population reached its peak in 2002.

What was the size of the moose population in 2002?

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(1)

(d) Look at **Figure 4**.

How long after the moose population peak did the wolf population peak occur?

\_\_\_\_\_ years

(1)

(e) When the moose population increases, the wolf population increases soon after.

Why does the wolf population increase?

Tick **one** box.

There is more competition for moose

There is more food for wolves

Other animals prey on moose

There are more predators of wolves

(1)

(f) Abiotic factors and biotic factors can affect the size of the wolf population.

Which of these are **biotic** factors?

Tick **two** boxes.

Carbon dioxide levels

Humans hunting

Light intensity

Soil type

Viruses

(2)

(Total 7 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.

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**(4)**

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

The students used 0.25 m<sup>2</sup> quadrats.

The students found a mean of 0.42 dandelions per quadrat.

Estimate the population of dandelions on the field.

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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.

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(4)

(Total 10 marks)

6.

The UK contains large areas of peat bogs that have been present for thousands of years.

(a) Peat is removed from peat bogs.

The peat can be mixed with air and added to garden compost.

The release of carbon dioxide from peat is a problem.

Give **two other** reasons why gardeners should use less peat-based compost in the future.

1. \_\_\_\_\_  
\_\_\_\_\_

2. \_\_\_\_\_  
\_\_\_\_\_

(2)

(b) Explain why mixing peat with air leads to the release of carbon dioxide.

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(4)

(Total 6 marks)

**7.** Ragwort is a plant that often grows as a weed in grassland.

The image below shows a ragwort plant.



© Difydave/iStock

Some students estimated the number of ragwort plants growing in a field on a farm.

The students:

- placed a quadrat at 10 random positions in the field
- counted the number of ragwort plants in each quadrat.

The quadrat measured 1 metre  $\times$  1 metre. The area of the field was 80 000 m<sup>2</sup>.

The table below shows the students' results.

Quadrat number	Number of ragwort plants
1	1
2	0
3	3
4	0
5	0
6	0
7	5
8	0
9	0
10	2

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

Use information from the table above.

Total number of ragwort plants in 10 quadrats = \_\_\_\_\_

Mean number of ragwort plants in 1 m<sup>2</sup> = \_\_\_\_\_

Therefore estimated number of ragwort plants in field = \_\_\_\_\_

(2)

- (b) What could the students do to get a more accurate estimate?

Tick (✓) **one** box.

Place the quadrat in 100 random positions.

Place the quadrat only in areas where they could see ragwort plants.

Place the quadrat in positions at the edge of the field.

(1)

(c) The farmer who owned the field kept horses.

If horses eat ragwort, the ragwort can poison them.

The farmer considered two methods of controlling ragwort in his field.

**Method 1:** Spraying with a selective weed killer

**Method 2:** Pulling out the ragwort plants by hand

In **Method 1:**

- the cost of the weed killer was £420
- the weed killer would not harm the grass but would kill all other plants
- the farmer could apply the weed killer from a sprayer towed by a tractor.

**Method 2** could be done by local volunteers.

What are the advantages and disadvantages of using **Method 2** instead of **Method 1** for controlling ragwort?

Advantages of **Method 2** \_\_\_\_\_

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Disadvantages of **Method 2** \_\_\_\_\_

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(3)  
(Total 6 marks)

8.

In January 2011 more than 600 000 people collected results for the UK national bird survey.

People recorded the number of each species of bird they saw in 1 hour on 1 day in their garden.

Some of the results are shown in the table below.

Species	Mean number of birds seen per garden	Percentage of gardens in which the bird was seen
House sparrow	4.1	64.5
Starling	3.9	51.3
Blackbird	3.2	95.2
Goldfinch	1.5	33.5

(a) A student looked at the table and said:

“In the UK, house sparrows are more common than blackbirds.”

Suggest **three** reasons why the student’s statement may **not** be true.

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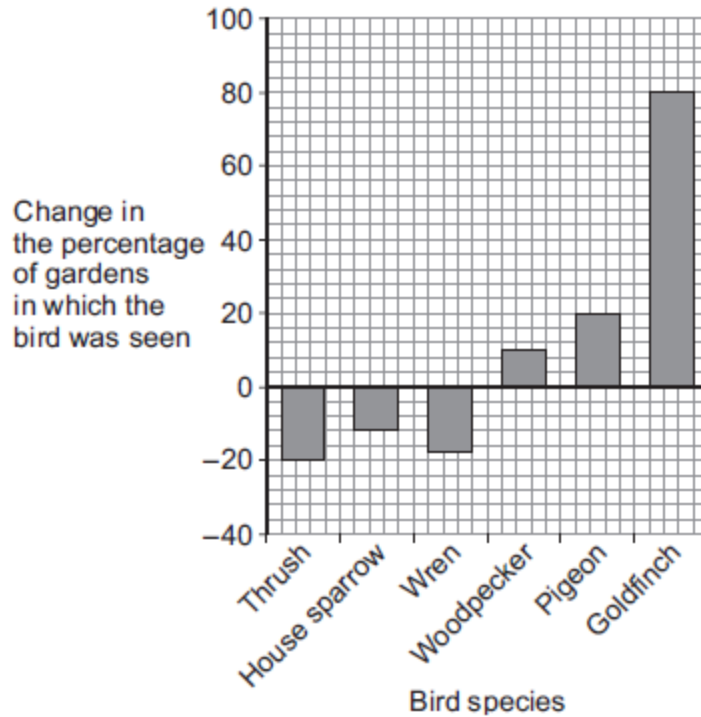
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(3)

(b) A survey in 2012 was done in the same way as the 2011 survey.

The graph below shows changes in the percentages of gardens in which some birds were seen from 2011 to 2012.



(i) Calculate the percentage of gardens in which goldfinches were seen in 2012.

Use information from the graph and the table.

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Answer = \_\_\_\_\_ %

(2)

(ii) Suggest **two** reasons why goldfinches were seen in more gardens in 2012 than in 2011.

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(2)

(Total 7 marks)

**9.** Organisms compete with each other.

(a) **Figure 1** shows two types of seaweed which live in similar seashore habitats.

**Figure 1**

**Saw wrack**



© Nigel Downer/Science Photo Library

**Bladder wrack**



© Colin13362/iStock/Thinkstock

Most of the time the two seaweeds are covered with water.

Bladder wrack has bladders filled with air.

Bladder wrack grows more quickly than saw wrack.  
Suggest an explanation why.

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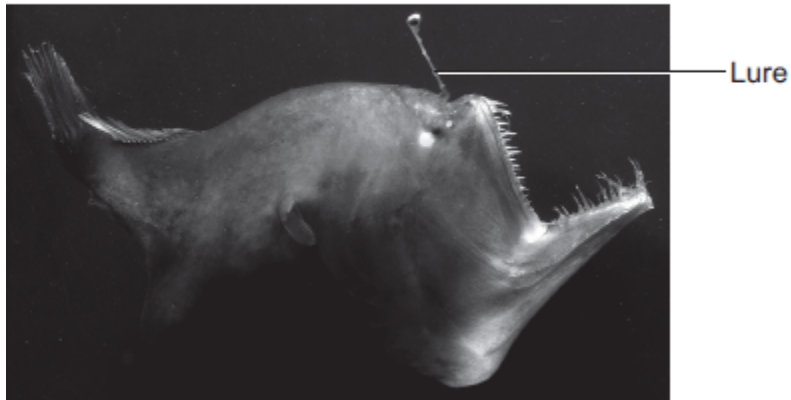
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**(3)**

(b) **Figure 2** shows an angler fish.

**Figure 2**



© Dante Fenolio/Science Photo Library

Angler fish live at depths of over 1000 m.

In clear water, sunlight does not usually reach more than 100 m deep.  
Many angler fish have a transparent 'lure' containing a high concentration of bioluminescent bacteria.

Bioluminescent bacteria produce light.

Suggest an advantage to the angler fish of having a lure containing bioluminescent bacteria.

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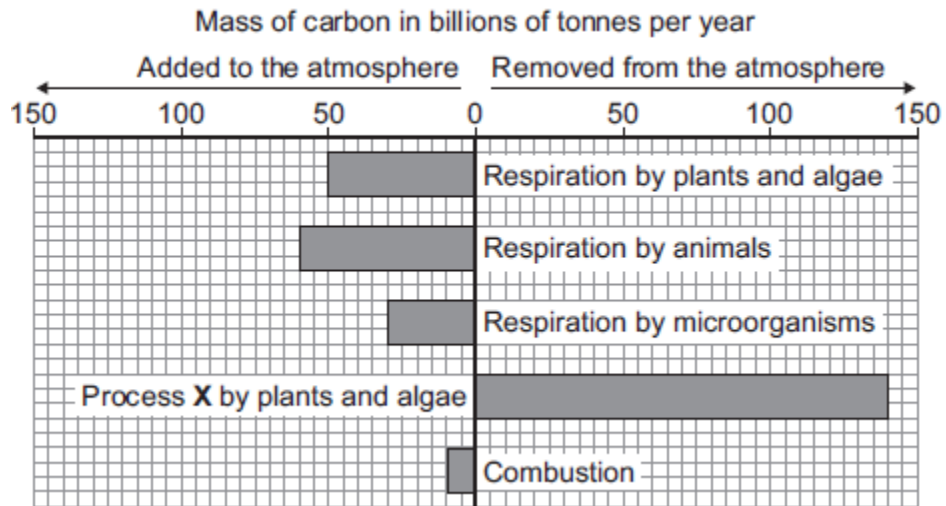
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(2)  
(Total 5 marks)

10.

This question is about carbon.

The graph shows the mass of carbon added to and removed from the atmosphere each year.



(a) Name process X.

\_\_\_\_\_

(1)

(b) (i) Calculate the mass of carbon added to the atmosphere by respiration per year.

Answer = \_\_\_\_\_ billion tonnes

(1)

(ii) Some scientists are concerned that the mass of carbon in the atmosphere is changing.

How does the data in the graph support this idea?

\_\_\_\_\_

\_\_\_\_\_

(1)

(Total 3 marks)

**11.**

Freshwater streams may have different levels of pollution. The level of pollution affects which species of invertebrate will live in the water.

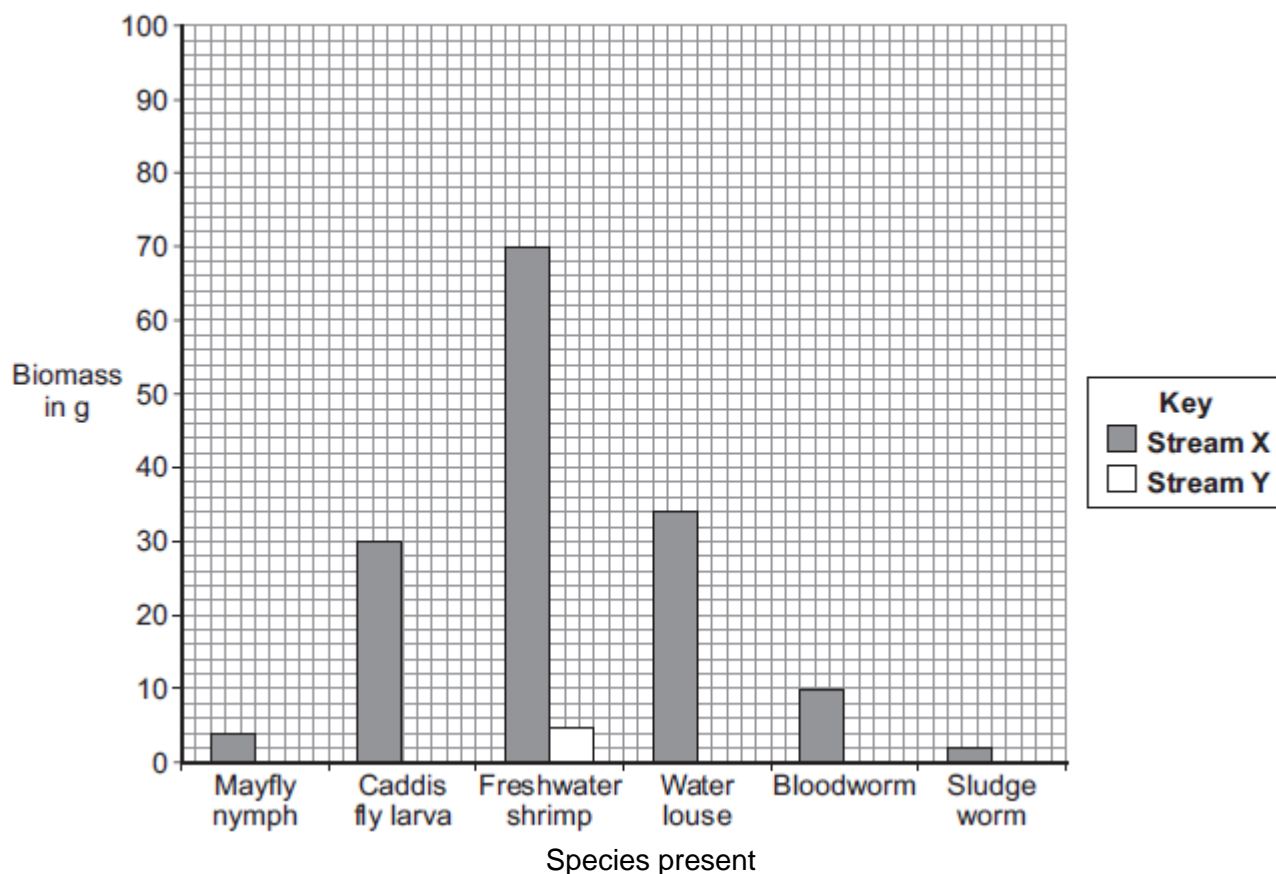
**Table 1** shows the biomass of different invertebrate species found in two different streams, **X** and **Y**.

**Table 1**

<b>Invertebrate species</b>	<b>Biomass in g</b>	
	<b>Stream X</b>	<b>Stream Y</b>
Mayfly nymph	4	0
Caddis fly larva	30	0
Freshwater shrimp	70	5
Water louse	34	10
Bloodworm	10	45
Sludge worm	2	90
<b>Total</b>	<b>150</b>	<b>150</b>

- (a) The bar chart below shows the biomass of invertebrate species found in **Stream X**.
- (i) Complete the bar chart by drawing the bars for water louse, bloodworm and sludge worm in **Stream Y**.

Use the data in **Table 1**.



(2)

- (ii) **Table 2** shows which invertebrates can live in different levels of water pollution.

**Table 2**

Pollution level	Invertebrate species likely to be present
Clean water	Mayfly nymph
Low pollution	Caddis fly larva, Freshwater shrimp
Medium pollution	Water louse, Bloodworm
High pollution	Sludge worm

Which stream, **X** or **Y**, is more polluted?

Use the information from **Table 1** and **Table 2** to justify your answer.

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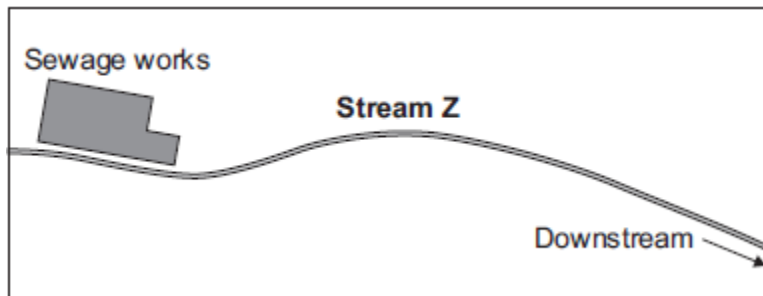
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(2)

(b) There is a sewage works near another stream, **Z**.



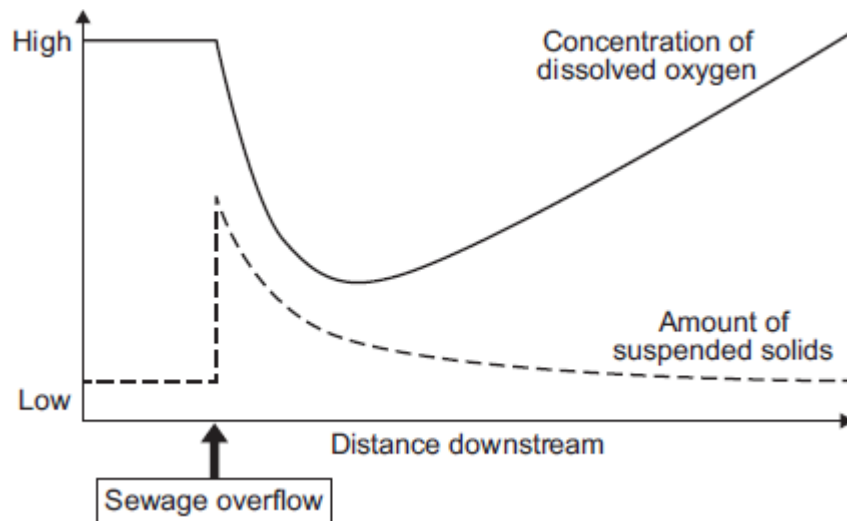
An accident caused sewage to overflow into **Stream Z**.

Two weeks later scientists took samples of water and invertebrates from the stream.

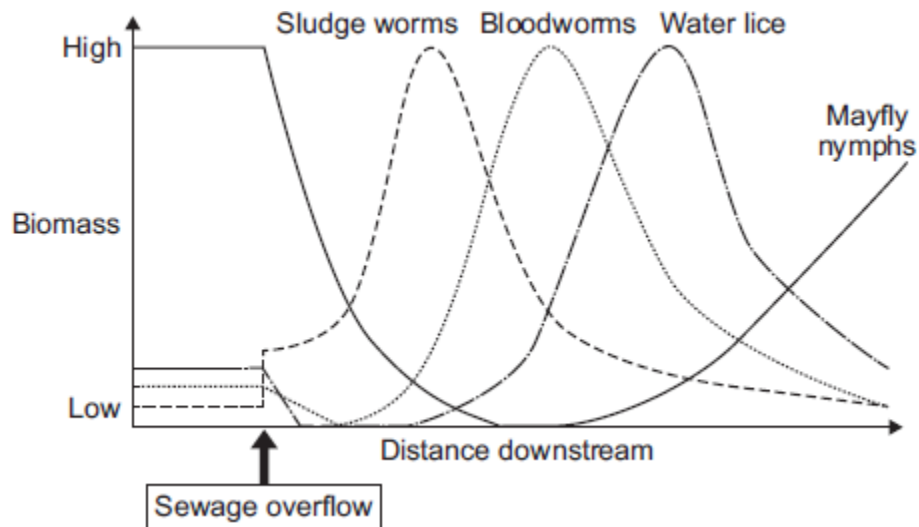
They took samples at different distances downstream from where the sewage overflowed.

The scientists plotted the results shown in **Graphs P** and **Q**.

**Graph P: change in water quality downstream of sewage overflow**



**Graph Q: change in invertebrates found downstream of sewage overflow**



(i) Describe the patterns shown in **Graph P**.

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(4)

(ii) Describe the relationship between dissolved oxygen and the survival of mayfly nymphs in **Stream Z**. Suggest a reason for the pattern you have described.

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(3)

(c) Many microorganisms are present in the sewage overflow.

Explain why microorganisms cause the level of oxygen in the water to decrease.

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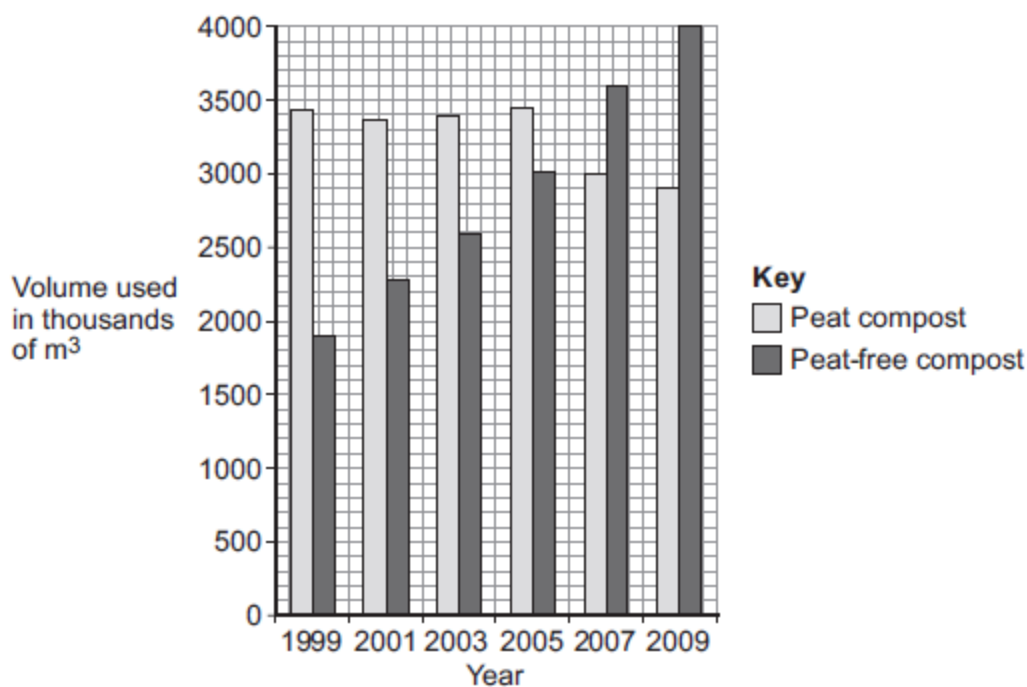
(2)

(Total 13 marks)

12.

Human activities have many effects on our ecosystem.

The graph shows the volume of peat compost and peat-free compost used in gardening from 1999 to 2009.



(a) Describe the trends shown in the graph.

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(2)

(b) What effect does the destruction of peat bogs have on the gases in the atmosphere?

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(1)

(c) Deforestation is also damaging ecosystems.

Describe **one** effect of deforestation on ecosystems.

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(1)

(Total 4 marks)

## Mark schemes

- 1.** (a) 2 640 000 (in remaining 24 years) 1
- 110 000 in each remaining year  
**or**  
 $2.64 \times 10^6$  in remaining 24 years 1
- $1.1 \times 10^5$   
*an answer of  $1.1 \times 10^5$  scores 3 marks* 1
- (b) (area of woodland =) 21 600  
*allow  $16\,800 + 4\,800$*   
*or  $9\,000 + 12\,600$*   
*or  $4\,800 + 4\,200 + 12\,600$*  1
- 518 400 (bluebells)  
*allow their area  $\times 4 \times 6$*   
*an answer 518 400 (bluebells) scores 2 marks* 1

(c)

<b>Level 3:</b> Relevant points are identified, given in detail and logically linked to form a clear account.	5-6
<b>Level 2:</b> Relevant points are identified, and there are attempts at logically linking. The resulting account is not fully clear.	3-4
<b>Level 1:</b> Relevant 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
<b>Indicative content</b> <b>reducing pollution</b> <ul style="list-style-type: none"><li>• trees take in carbon dioxide</li><li>• which will lower atmospheric greenhouse gases and reduce global warming (allow consequences of global warming)</li><li>• trees act as noise absorbers</li><li>• which will reduce noise pollution in the city</li><li>• roots of trees will bind the soil</li><li>• which will reduce local flooding and soil erosion</li><li>• leaves on trees will trap PM2.5 / tiny particulates</li><li>• which will reduce asthma/breathing difficulties of people</li></ul> <b>increasing biodiversity</b> <ul style="list-style-type: none"><li>• new woodlands or new trees in parks / gardens will provide new habitats</li><li>• for new species of plants and animals</li><li>• linking woodlands</li><li>• will allow animals to move into new areas</li><li>• planting many new species of trees</li><li>• will provide food and shelter for new species of insects/birds</li><li>• could extend the scheme</li><li>• to reintroduce species of plants or animals which no longer live in that area</li><li>• could protect wildlife in the area</li><li>• by legislation or community projects</li></ul>	

6

[11]

2.

(a) the variety of different species on Earth

1

- (b) carbon dioxide 1
- methane 1
- (c) any **two** from:
- drought
  - flooding
  - temperature change  
*allow temperature increase or decrease*
  - rainfall change  
*allow rainfall increase or decrease*

2  
[5]

**3.**

- (a) both plots correct 1
- suitable line of best fit 1
- (b) allow range of 3–7 (units)  
*allow ecf from line of best fit given in 03.1* 1

(c)

Advantage	Disadvantage
	✓
✓	
	✓

*allow 1 mark for 2 correct*

*more than one tick in a row negates a mark*

2  
[5]

**4.**

- (a) producer 1
- (b) predators 1
- (c) 1200 1
- (d) 2 (years) 1
- (e) there is more food for wolves 1

- (f) humans hunting 1
- viruses 1
- [7]**

**5.**

- (a) (placed) randomly 1  
*allow description of placement*
- 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)  $(40 \times 145) / 0.25 = 23\ 200$  1
- $(0.42 \times 23\ 200 =) 9744$   
*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) reduces biodiversity

1

peat is being used faster than it forms

*allow peat is non-renewable*

1

(b) decay / decomposition / rotting of peat

1

by microorganisms / bacteria / microbes / fungi / decomposers introduced when peat is mixed with air

1

that respire using substances in peat as reactant

1

and using oxygen that is introduced when peat is mixed with air

1

[6]

7.

(a) 88 000

*correct answer = 2 marks*

*allow 1 mark for 1.1 (in 1 m<sup>2</sup>)*

**or**

*allow 1 mark for answer = [candidate's value in 1m<sup>2</sup>] × 80 000*

2

(b) Place the quadrat in 100 random positions.

1

(c) any **three** from:

*must include at least one advantage and one disadvantage for full marks*

Advantages:

- less cost / free
- less likely to kill other (harmless species of) plants
- weedkiller may be toxic **or** may cause water pollution
- weedkiller may accumulate up food chains

*allow uneven distribution of ragwort so much wastage of weedkiller*

Disadvantages:

- volunteers may mistake other species for ragwort
- volunteers may miss plants  
*allow weeds will grow back*
- some ragwort left to poison horses
- time consuming
- difficulties getting enough volunteers  
*if no other disadvantages; allow ref. to issues with volunteers – eg don't turn up / not careful / don't finish the job*

3

[6]

8.

(a) any **three** from:

- blackbirds seen in higher % of / more gardens
- multiplying mean number by percentage of gardens seen in shows blackbird is higher

*allow 1 additional mark for correct figures showing this, ie 264 sparrows: 305 blackbirds*

- only done on one day / month / hour  
*eg only done in January*
- only done in gardens (one bird may prefer a different habitat)
- problem of (correct) identification
- may re-count same ones

*if neither point 5 or 6 given allow 1 mark for idea of error / miscounted*

- people may quote false numbers / may make it up

3

(b) (i) 60.3

*award 2 marks for correct*

*answer, irrespective of working*

*award 1 mark for  $33.5 + (33.5 \times 80 / 100)$  or equivalent with no answer or incorrect answer **or** award 1 mark for 26.8*

2

(ii) any **two** from:

- change in temperature

*a comparison is required*

*eg cooler / warmer / less frost (in 2012)*

- fewer predators
- more food **or** less competition for food
- more nesting space **or** less competition for nesting space
- less disease (in 2012)

*allow idea that people may be better / worse at identifying birds / goldfinches*

*allow idea of movement to gardens (due to poor food supply elsewhere)*

2

[7]

9.

(a) gets more light (near surface)

*allow warmer (near surface)*

*allow bladders contain (more) carbon dioxide*

1

(so) photosynthesises more

1

(because) bladders aid floating (when tide is in)

**or**

(so) more biomass / glucose / starch produced

*ref to 'more' needed only once, eg gets more light for photosynthesis gains **two** marks*

*if 'more' not given do not award mark on the first occasion*

1

(b) lets angler fish see / attract its prey / mates **or** see predators as it is dark (at 1000m)

**or**

lets angler fish see / attract prey to get food

**or**

lets angler fish see / attract mates to reproduce

**or**

lets angler fish see predators to avoid being eaten

*must be in a correct pair to gain **two** marks*

2

[5]

<b>10.</b>	(a) photosynthesis	1	
	(b) (i) 140	1	
	(ii) (10 billion tonnes) more added (to atmosphere) than removed <i>allow ecf from part (b)(i)</i>	1	
			<b>[3]</b>
<b>11.</b>	(a) (i) correct bar heights <i>three correct 2 marks</i> <i>two correct 1 mark</i> <i>one or none correct 0 marks</i> <i>ignore width</i>	2	
	(ii) (Stream Y)  has many sludge worms / bloodworms  <b>or</b>  has no mayflies / caddis or few shrimp <i>allow 1 mark if invertebrate not named but correct association given</i>	1	
	which indicate medium or high pollution	1	
	(b) (i) suspended solids increase (as a result of sewage overflow)	1	
	then decrease downstream / return to original levels	1	
	oxygen levels decrease (after sewage overflow)	1	
	and then rise again	1	
	(ii) any <b>three</b> from:		
	<ul style="list-style-type: none"> <li>• mayflies decrease (to zero) near overflow <i>accept 'have died out'</i></li> <li>• because oxygen is low <b>or</b> mayflies have high oxygen demand</li> <li>• mayflies repopulate / increase as oxygen increases again</li> <li>• can't be sure if dissolved oxygen or suspended solids is the cause</li> </ul>	3	

- (c) they respire / respiration  
*aerobic respiration gains 2 marks*

1

this requires / uses up the oxygen

1

[13]

12.

- (a) any **two** from:
- (volume of) peat compost has been steady and then declined **or** volume of peat compost has declined since 2005  
*allow 2007 instead of 2005*
  - (volume of) peat-free compost has increased (since 1999)
  - (volume of) peat is higher than peat-free until 2005, then peat-free compost is higher (than peat)  
*allow 2007*
  - total volume of peat and peat-free compost has increased.

2

- (b) increases carbon dioxide (in the atmosphere)  
*ignore methane*

1

- (c) any **one** from:
- reduces biodiversity
  - destruction of habitats
  - disruption of food chains.

1

[4]