1 The figure below shows the amount of forest cover on an island in Asia, in 1973 and in 2010.

Forest cover in 1973   **Forest cover in 2010**

Key

☐ Forest

0 _____ 250 km
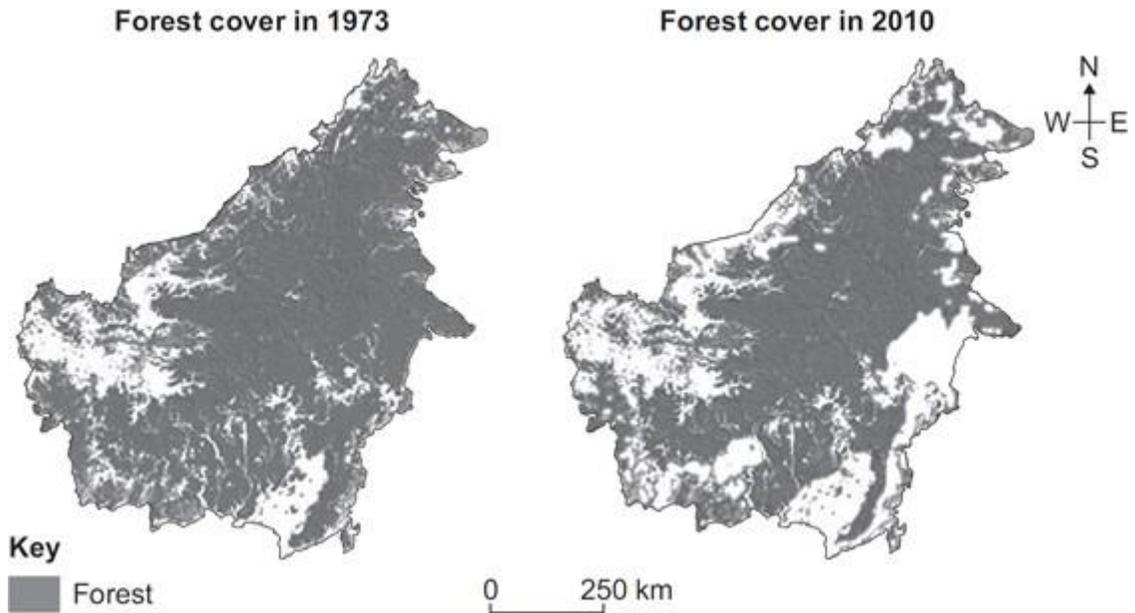
(a) (i) Deforestation has decreased the amount of forest cover on the island.

Describe the change in the pattern of forest cover on the island.

_____

_____

_____

_____

(2)

(ii) Give **two** possible reasons why the amount of forest has decreased between 1973 and 2010.

1. _____

_____

2. _____

_____

(2)

(b)   Scientists are concerned about the effects of a decrease in forest cover on ecosystems.

Give **two** possible negative effects of the decrease in forest cover on ecosystems.

1. _____

_____

2. _____

_____

(2)

(Total 6 marks)

2 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

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

(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**.
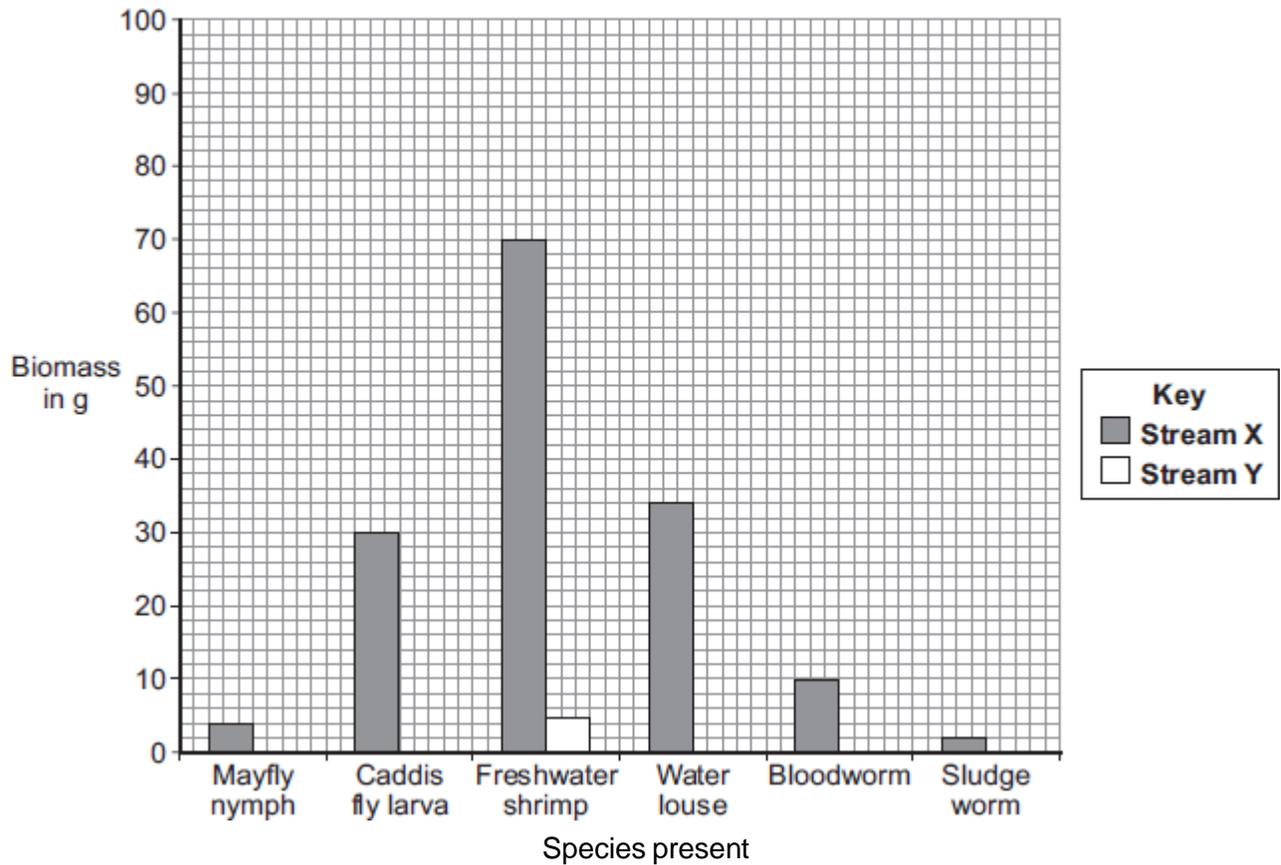
(2)

(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.

_____

_____

_____

_____

(2)

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

Sewage works

Stream Z
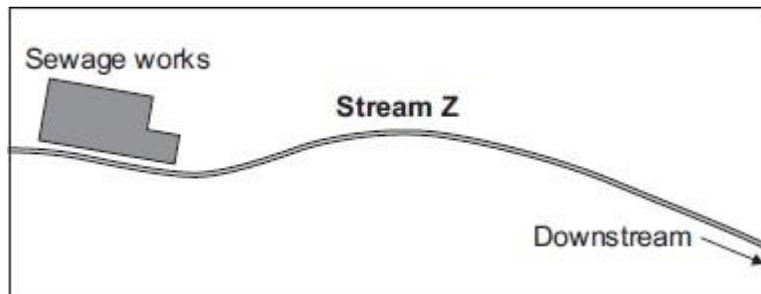
Downstream

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

High

Concentration of
dissolved oxygen

Amount of
suspended solids

Low

Distance downstream
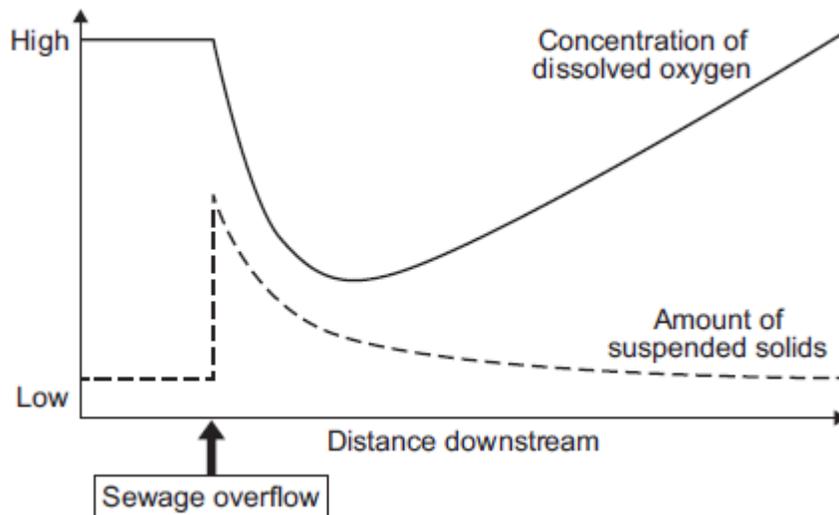
Sewage overflow

Graph Q: change in invertebrates found downstream of sewage overflow
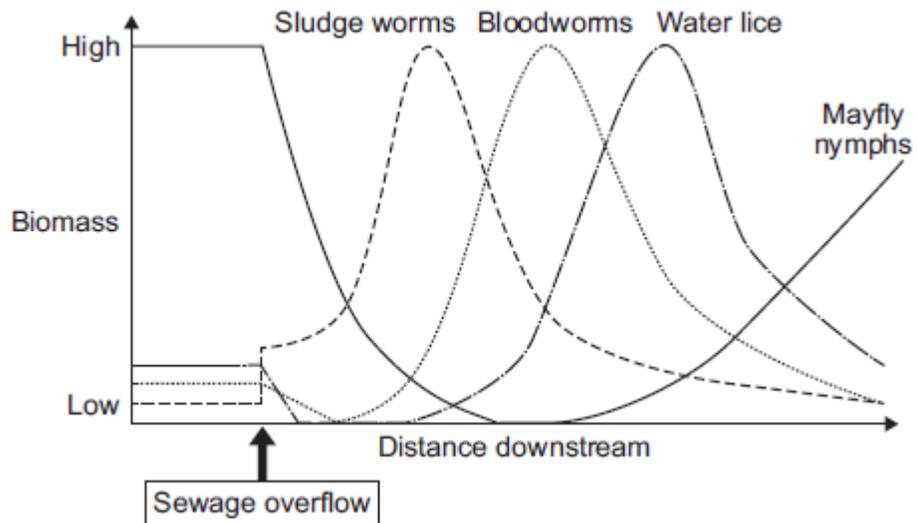
(i)   Describe the patterns shown in **Graph P**.

_____

_____

_____

_____

_____

_____

_____

_____

(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.

_____

_____

_____

_____

_____

_____

(3)

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

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

_____

_____

_____

_____

(2)

(Total 13 marks)

3   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.
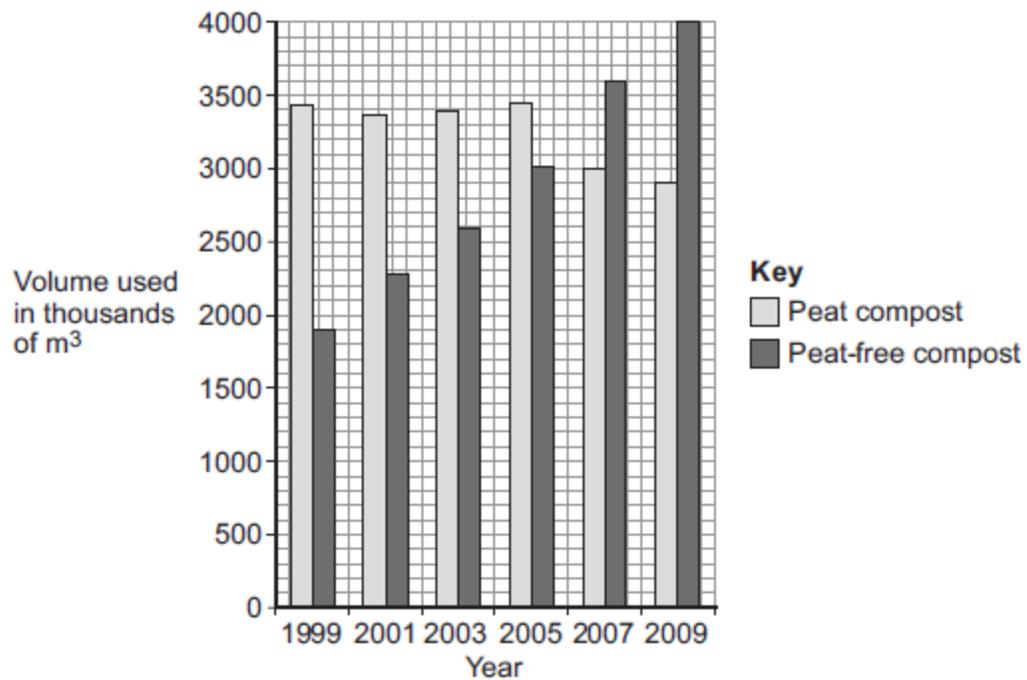
(a)   Describe the trends shown in the graph.

_____

_____

_____

_____

_____

(2)

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

_____

_____

(1)

(c)   Deforestation is also damaging ecosystems.

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

_____

_____

(1)
(Total 4 marks)

4   The photograph shows a fossil of a prehistoric bird called *Archaeopteryx*.
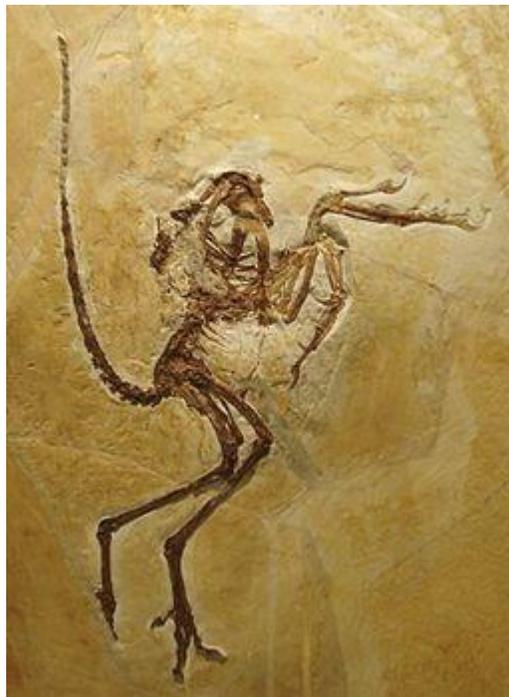
(a)   Describe **three** ways fossils can be made.

_____

_____

_____

_____

_____

_____

(3)

(b)   The drawing shows what an *Archaeopteryx* might have looked like when it was alive.

Scientists think that *Archaeopteryx* was a predator.
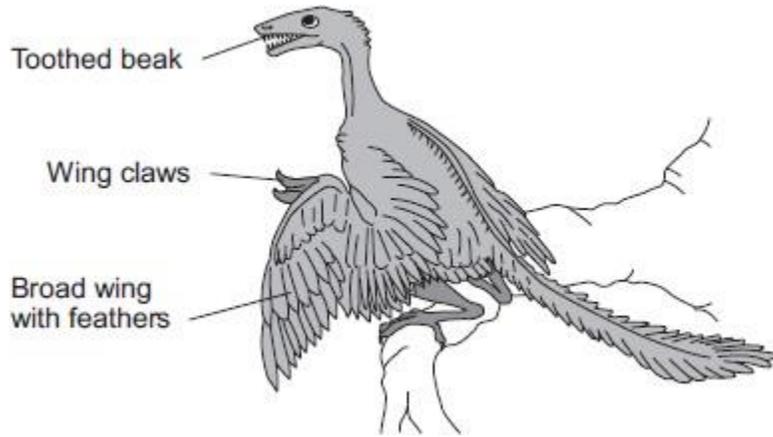
(i) Look at the drawing.

Write down **three** adaptations that might have helped *Archaeopteryx* to catch prey.

How would **each** adaptation have helped *Archaeopteryx* to catch prey?

Adaptation 1 _____

How it helps _____

_____

Adaptation 2 _____

How it helps _____

_____

Adaptation 3 _____

How it helps _____

_____

(3)

(ii) *Archaeopteryx* is now extinct.

Give **two** reasons why animals may become extinct.

1. _____

_____

2. _____

_____

(2)
(Total 8 marks)

5 This question is about carbon.

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

Mass of carbon in billions of tonnes per year

Added to the atmosphere   Removed from the atmosphere

150   100   50   0   50   100   150

Respiration by plants and algae

Respiration by animals

Respiration by microorganisms

Process **X** by plants and algae

Combustion
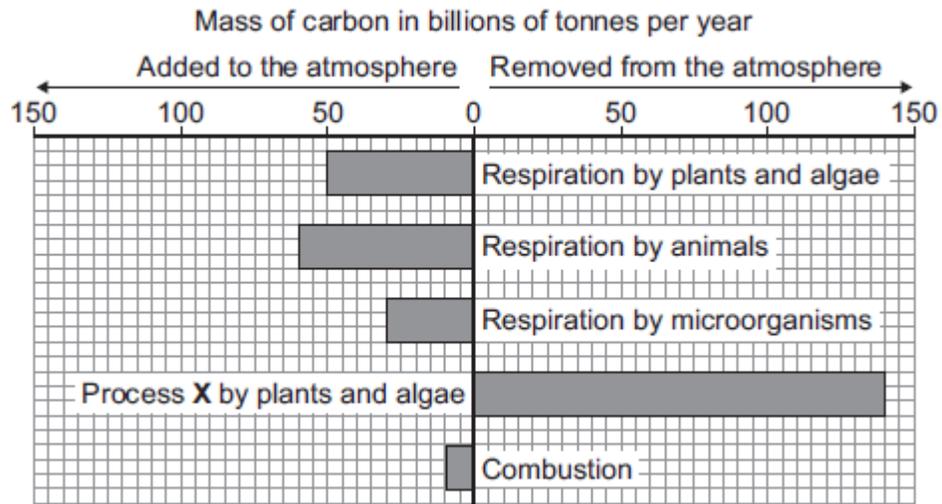
(a)   Name process **X**.

_____

(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)

6 Organisms compete with each other.

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

Figure 1

Saw wrack   Bladder wrack

© Nigel Downer/Science Photo Library   © Colin13362/iStock/Thinkstock

Bladders filled with air

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.

_____

_____

_____

_____

_____

_____

_____

(3)

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

Figure 2
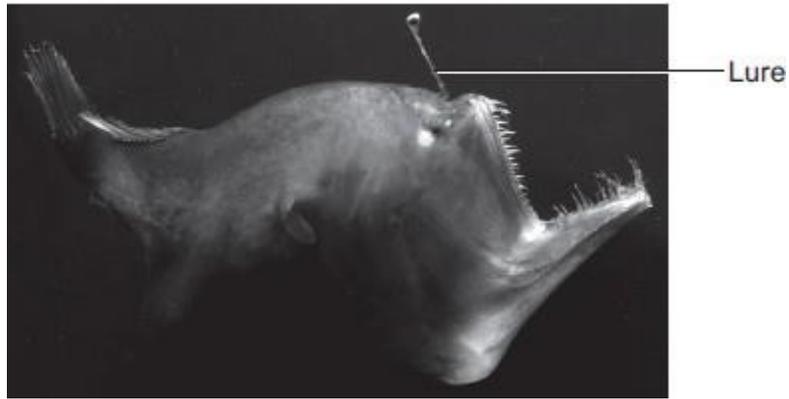
© Dante Fenolio/Science Photo Library

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.

_____

_____

_____

_____

_____

(2)
(Total 5 marks)

7   A grassy field on a farm measured 120 metres by 80 metres.

A student wanted to estimate the number of buttercup plants growing in the field.

The student found an area where buttercup plants were growing and placed a 1 m × 1 m quadrat in one position in that area.

Figure 1 shows the buttercup plants in the quadrat.

Figure 1

Quadrat frame

Key
⊛ Buttercup plant
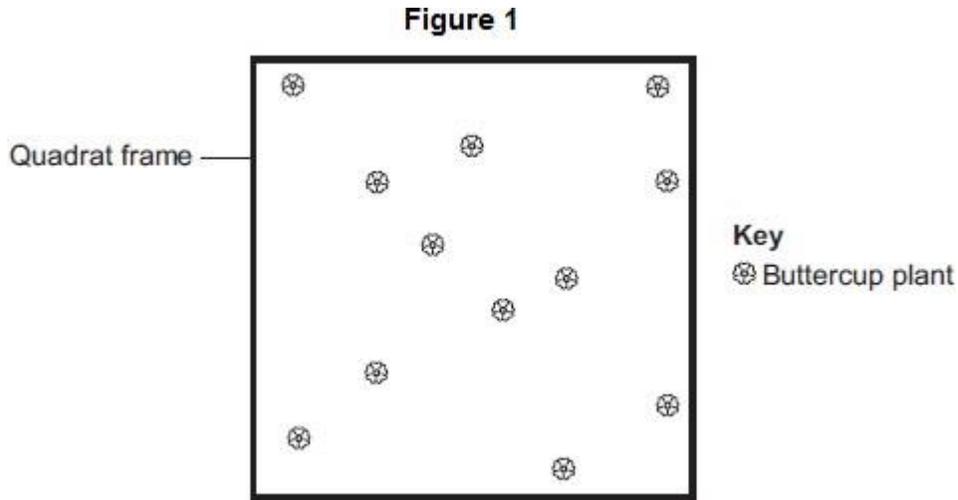
The student said, 'This result shows that there are 115 200 buttercup plants in the field.'

(a)   (i)   How did the student calculate that there were 115 200 buttercup plants in the field?

_____

_____

_____

_____

(2)

(ii)   The student's estimate of the number of buttercup plants in the field is probably not accurate. This is because the buttercup plants are not distributed evenly.

How would you improve the student's method to give a more accurate estimate?

_____

_____

_____

_____

(2)

(b) Sunlight is one environmental factor that might affect the distribution of the buttercup plants.

   (i) Give **three other** environmental factors that might affect the distribution of the buttercup plants.

   1. _____

   2. _____

   3. _____

   (3)

   (ii) Explain how the amount of sunlight could affect the distribution of the buttercup plants.

   (3)

(c) **Figure 2** is a map showing the position of the farm and a river which flows through it.

Figure 2

Direction of water flow

Key

Forest
Farm
City
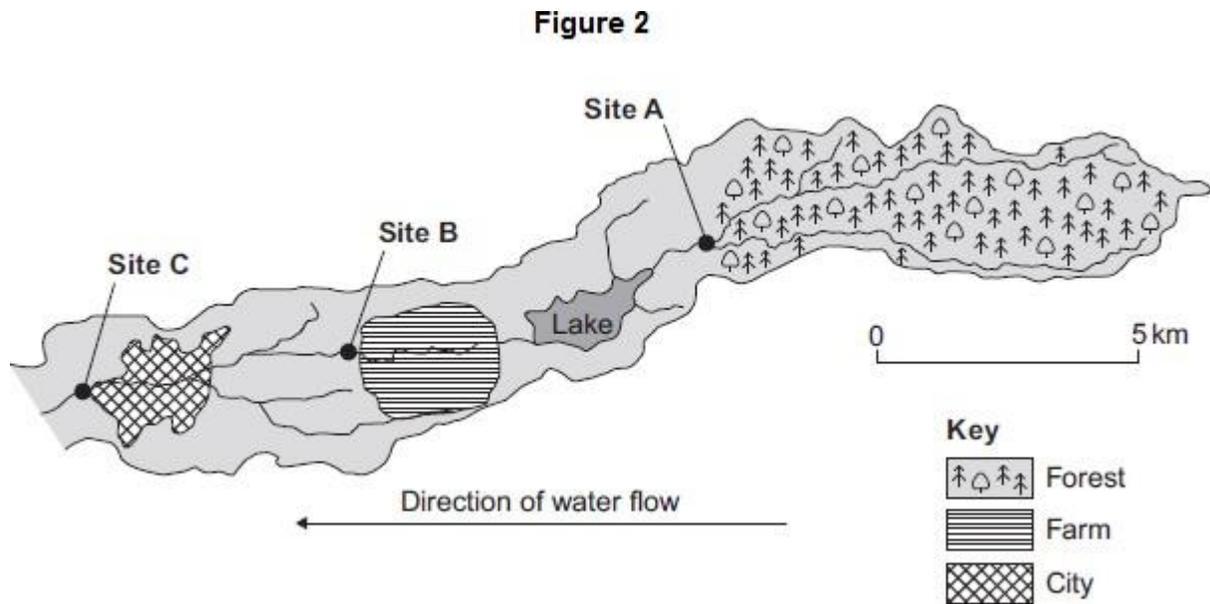
Every year, the farmer puts fertiliser containing mineral ions on some of his fields.When there is a lot of rain, some of the fertiliser is washed into the river.

(i) When fertiliser goes into the river, the concentration of oxygen dissolved in the water decreases.

Explain why the concentration of oxygen decreases.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)

(ii) There is a city 4 km downstream from the farm.

Apart from fertiliser, give **one** other form of pollution that might go into the river as it flows through the city.

_____

(d)   Three sites, **A**, **B** and **C**, are shown in **Figure 2**.

Scientists took many samples of river water from these sites.

The scientists found larvae of three types of insect in the water: mayfly, stonefly and caddisfly. For each type of insect the scientists found several different species.

The scientists counted the number of different species of the larvae of each of the three types of insect.

Figure 3 shows the scientists' results.

Figure 3
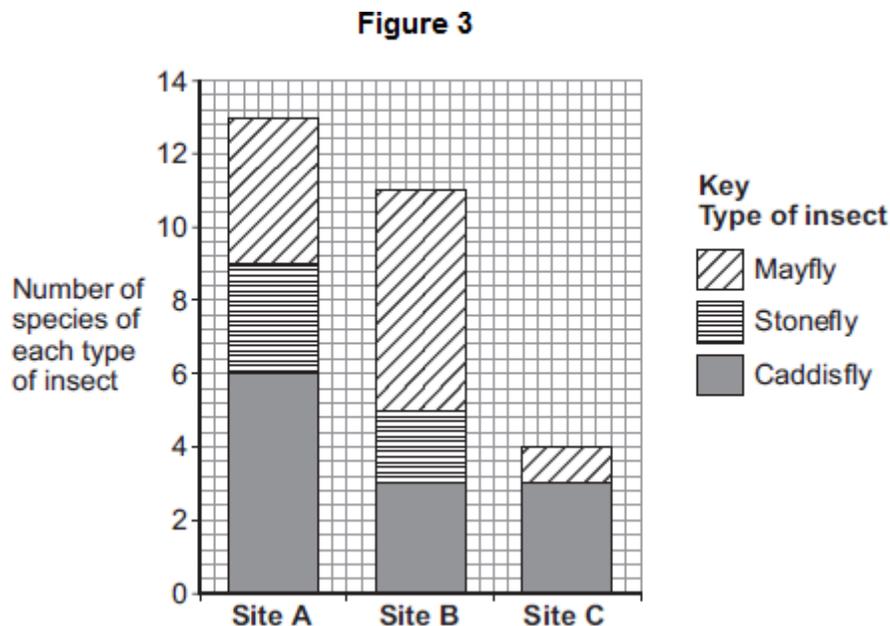
(i)   How many more species of mayfly were there at Site **B** than at Site **A**?

_____

(1)

(ii)   Suggest what caused this increase in the number of species of mayfly.

_____

_____

(1)

(iii) The scientists stated that the number of species of stonefly was the best indicator of the amount of oxygen dissolved in the water.

Use information from **Figure 3** to suggest why.

(1)
(Total 19 marks)

Mark schemes

1 (a) (i) forest at the edges (of the island) has been removed
> *allow centrally the forest remains*

1

an appropriate area on the island is identified eg south east **or** bottom right

1

(ii) any **two** from:
- (to provide land) for farming / agriculture
- (to provide land) for quarrying
- (to provide land / wood) for building
  > *allow to provide timber*
- to provide fuel
- to produce paper
  > *allow forest fires*

2

(b) any **two** from:
- decreased biodiversity
- loss of habitats
- increased carbon dioxide (concentration)
- global warming
  > *allow effects of global warming eg flooding / rise in sea level*
  > *allow soil erosion*

2

[6]

2 (a) (i) correct bar heights
> *three correct **2** marks*
> *two correct **1** mark*
> *one or none correct **0** marks*
> *ignore width*

2

(ii) (Stream Y)

has many sludge worms / bloodworms

or

has no mayflies / caddis or few shrimp
> *allow **1** mark if invertebrate not named but correct association given*

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 **three** from:

- mayflies decrease (to zero) near overflow
  accept 'have died out'
- because oxygen is low **or** mayflies have high oxygen demand
- mayflies repopulate / increase as oxygen increases again
- can't be sure if dissolved oxygen or suspended solids is the cause

3

(c) they respire / respiration

aerobic respiration gains 2 marks

1

this requires / uses up the oxygen

1

[13]

3 (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]

4 (a) any **three** from:

- parts of organisms have not decayed
  - *accept in amber / resin*
  - *allow bones are preserved*
- conditions needed for decay are absent
  - *accept appropriate examples, eg acidic in bogs / lack of oxygen*
- parts of the organism are replaced by other materials as they decay
  - *accept mineralised*
- or other preserved traces of organisms, eg footprints, burrows and rootlet traces
  - *allow imprint or marking of organism*

3

(b) (i) teeth for biting (prey)
  - *must give structure + explanation*

1

claws to grip (prey)
  - *accept sensible uses*

1

wing / tail for flight to find (prey)

1

(ii) any **two** from:

- new predators
- new diseases
- better competitors
- catastrophe eg volcanic eruption, meteor
- changes to environment over geological time
  - *accept climate change*
  - *allow change in weather*
- prey dies out **or** lack of food
  - *allow hunted to extinction*

2

[8]

5 (a) photosynthesis

1

(b) (i) 140

1

(ii) (10 billion tonnes) more added (to atmosphere) than removed
  - *allow ecf from part (b)(i)*

1

[3]

6 (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]

7 (a) (i) counts / 12

1

× 120 × 80 / × 9600
or
× area of field

1

(ii) (more) quadrats / repeats

1

placed randomly

ignore method of achieving randomness

1

(b) (i) any **three** from:
- temperature / warmth / heat
- water / rain
- minerals / ions / salts (in soil)

  allow nutrients / fertiliser / soil fertility

  ignore food
- pH (of soil)
- trampling
- herbivores

  ignore predators
- competition (with other species)
- pollution qualified e.g. SO_2 / herbicide
- wind (related to seed dispersal).

  ignore space / oxygen / CO_2 / soil unqualified

3

(ii) light needed for photosynthesis

1

for making food / sugar / etc.

1

effect on buttercup distribution eg more plants in sunny areas / fewer plants in shady areas

1

(c) (i) fertiliser / ions / salts cause growth of algae / plants

1

(algae / plants) block light

1

(low light) causes algae / plants to die

1

microorganisms / bacteria feed on / break down / cause decay of organic matter / of dead plants

*do **not** allow germs / viruses*

1

(aerobic) respiration (by microbes) uses O_2

*do **not** allow anaerobic*

1

(ii) sewage / toxic chemicals / correct named example eg metals / bleach / disinfectant / detergent etc

allow suitable named examples eg metals such as Pb / Zn / Cr / oil / SO_2 / acid rain / pesticides / litter

ignore chemicals unqualified

ignore waste unqualified

ignore human waste / domestic waste / industrial waste unqualified

1

(d) (i) 2

1

(ii) more food

*allow other sensible suggestion eg more species colonise from
tributary streams after forest*

1

(iii) number of stonefly species decreases (from **A** to **B** / **B** to **C** / **A** to **C**) as more
pollution enters river / less oxygen

allow fewer species in more polluted water

ignore none are found at site C

1

[19]