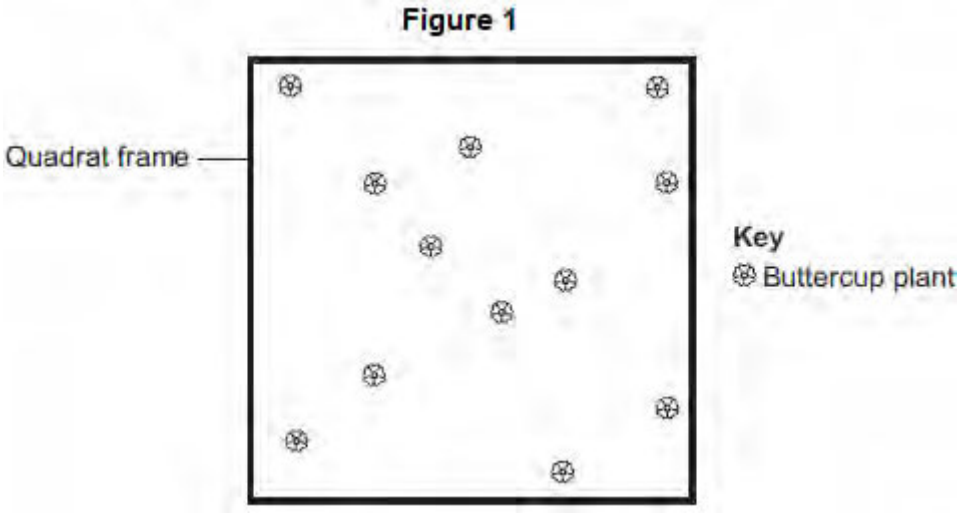
Q1.A grassy field on a farm measured 120 metres by 80 metres.

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



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?

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(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?

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(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.....

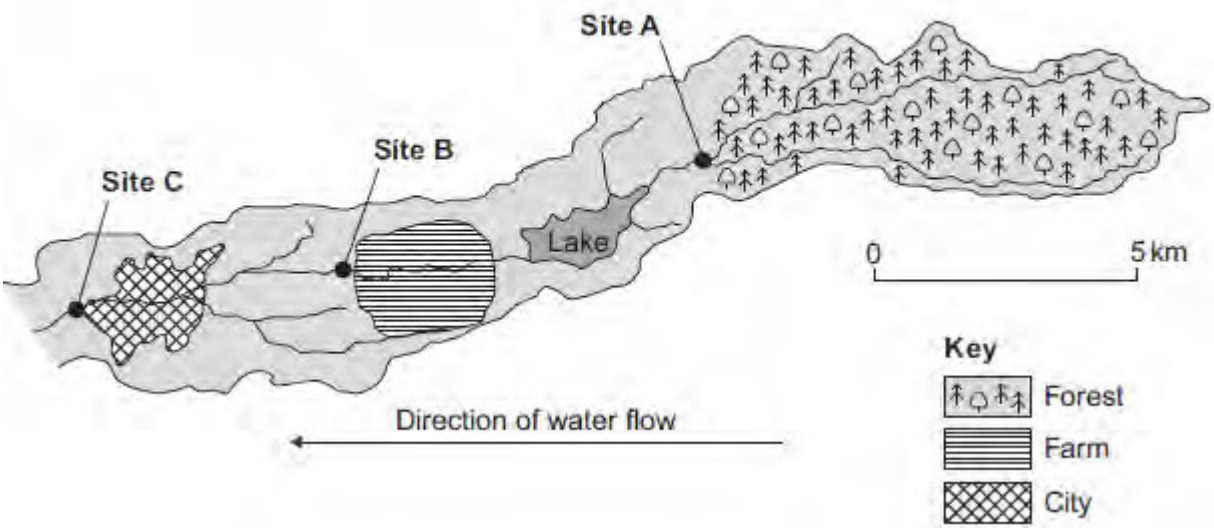
(3)

(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



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.

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(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.

.....

(1)

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

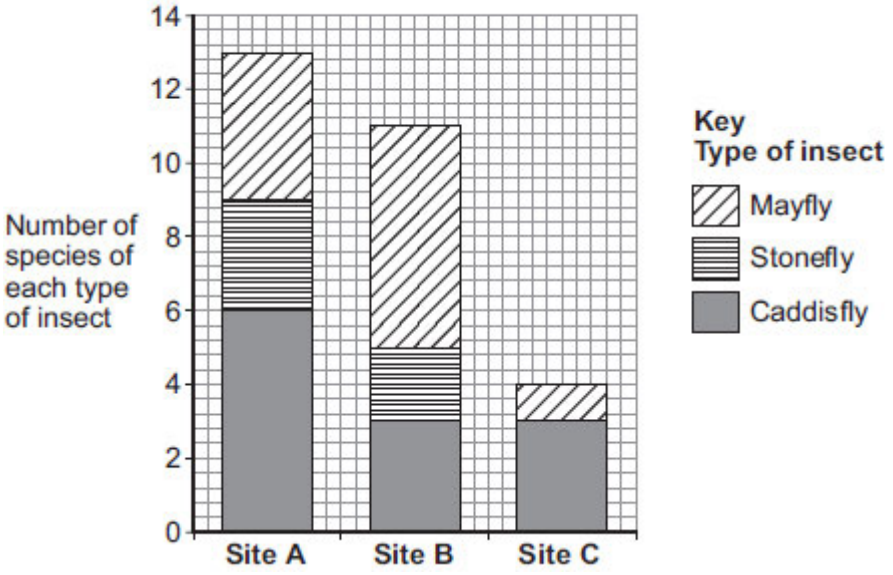
Scientists took many samples of river water from these sites.

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**?

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(1)

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

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(1)

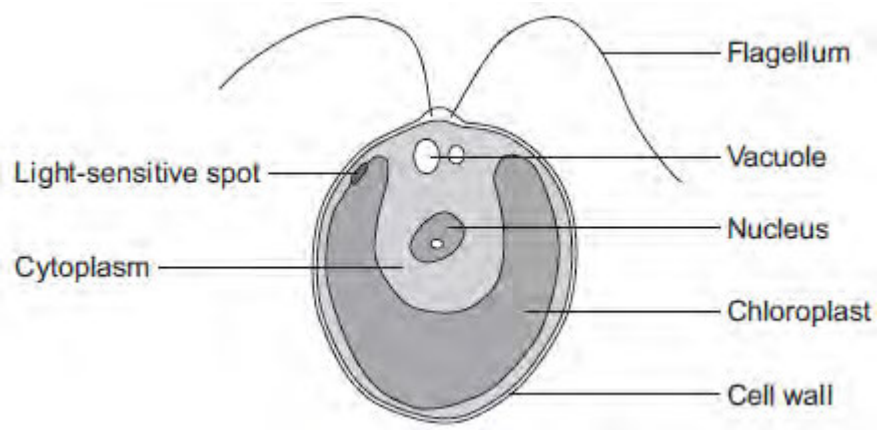
(iii) The scientists stated that the number of species of stonefly was the best indicator of the amount of oxygen dissolved in the water.

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

(1)

(Total 19 marks)

Q2. The diagram below shows a single-celled alga which lives in fresh water.



(a) Which part of the cell labelled above:

(i) traps light for photosynthesis

.....

(1)

(ii) is made of cellulose?

.....

(1)

(b) In the freshwater environment water enters the algal cell.

(i) What is the name of the process by which water moves into cells?

.....

(1)

(ii) Give the reason why the algal cell does not burst.

.....

.....

(1)

(c) (i) The alga can photosynthesise.

Complete the **word** equation for photosynthesis.

water + ... $\xrightarrow{\text{Light energy}}$ ..... + oxygen

(2)

(ii) The flagellum helps the cell to move through water. Scientists think that the flagellum and the light-sensitive spot work together to increase photosynthesis.

Suggest how this might happen.

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(2)

(d) Multicellular organisms often have complex structures, such as lungs, for gas exchange.

Explain why single-celled organisms, like algae, do **not** need complex structures for gas exchange.

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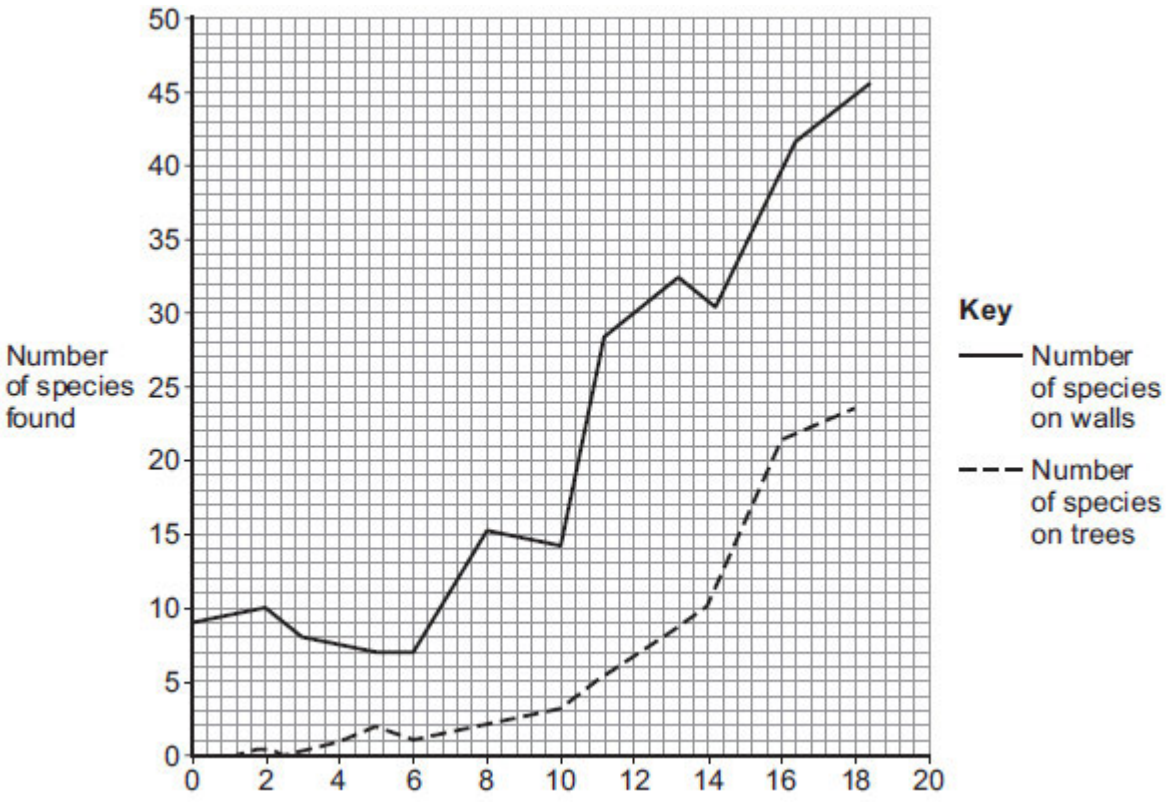
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(3)

(Total 11 marks)

Q3. Lichens can be used as air pollution indicators.

The graph below shows the number of lichen species found growing on walls and trees at increasing distances from a city centre.



(a) (i) How many species of lichen are found on walls 2 km from the city centre?

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(1)

(ii) Describe the patterns in the data.

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(3)

(b) The table below shows the concentration of sulfur dioxide (SO_2) in the air at different distances from the same city centre.

Distance from city centre in km	**SO_2 concentration in g per m^3**
0	200
3	160
8	110
13	85
18	65

Suggest how the data in the table could explain the patterns in the graph above.

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(2)

(c) Nitrogen oxides are also air pollutants.

The main source of nitrogen oxide pollution comes from road vehicles.

Different lichen species vary in their tolerance of the levels of nitrogen oxides in the air.

Some lichens can only grow in very clean air where there are low levels of nitrogen oxides. They are nitrogen-sensitive.

Some lichens grow very well in high levels of nitrogen oxides. They are

nitrogen-loving.

The table below shows one lichen species which is nitrogen-sensitive and one lichen species which is nitrogen-loving.

Nitrogen-sensitive	**Nitrogen-loving**
Usnea 	*Xanthoria* 

Usnea © epantha/iStock/Thinkstock; Xanthoria By Zakwitnij!pl Ejdzej + Iric (CC BY-SA.2.0) via wikicommons

(i) Describe how you would investigate the distribution of the two lichens at different distances into a wood from a main road.

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(3)

(ii) Predict the results from the experiment you described in your answer to part **(c)(i)**. Explain why you made this prediction.

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(3)
(Total 12 marks)

Q4. Organisms compete with each other.

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

Figure 1



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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(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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(2)
(Total 5 marks)

Q5. The photograph shows a fossil of a prehistoric bird called *Archaeopteryx*.



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(a) Describe **three** ways fossils can be made.

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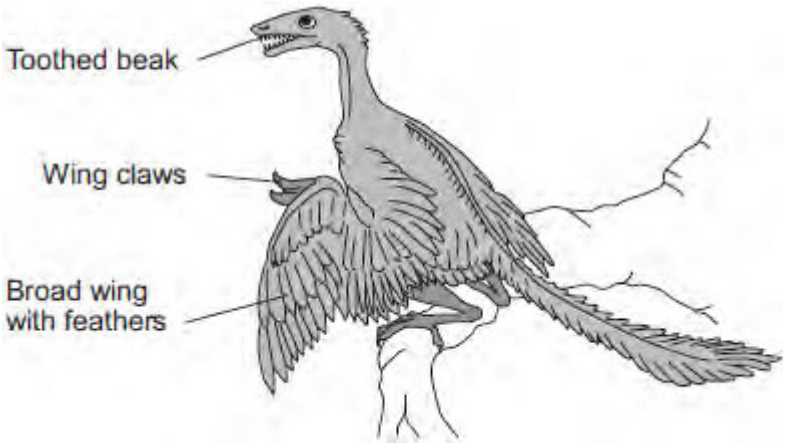
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(3)

(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 .....

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2 .....

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(2)
(Total 8 marks)