Q1. A gardener wants to add compost to the soil to increase his yield of strawberries.

The gardener wants to make his own compost.

(a) An airtight compost heap causes anaerobic decay.

Explain why the gardener might be against producing compost using this method.

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(2)

(b) The gardener finds this research on the Internet:

'A carbon to nitrogen ratio of 25:1 will produce fertile compost.'

Look at the table below.

Type of material to compost	Mass of carbon in sample in g	Mass of nitrogen in sample in g	Carbon:nitrogen ratio
Chicken manure	8.75	1.25	7:1
Horse manure	10.00	0.50	20:1
Peat moss	9.80	0.20	**X**

Determine the ratio **X** in the table above.

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Ratio .....

(1)

(c) Which type of material in the table above would be **best** for the gardener to use to make his compost?

Justify your answer.

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(1)

(d) Some of the leaves from the gardener's strawberry plant die.

The dead leaves fall off the strawberry plant onto the ground.

The carbon in the dead leaves is recycled through the carbon cycle.

Explain how the carbon is recycled into the growth of new leaves.

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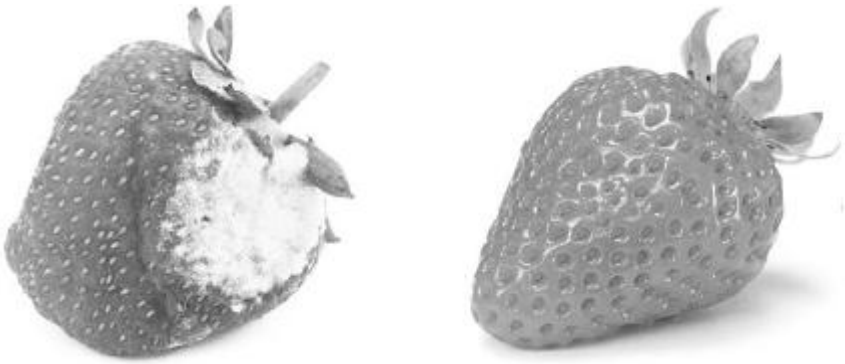
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(6)

(e) The diagram below shows two strawberries.

- Both strawberries were picked from the same strawberry plant.
- Both strawberries were picked 3 days ago.
- The strawberries were stored in different conditions.

Strawberry A **Strawberry B**



A © sarahdoow/iStock/Thinkstock, B © Mariusz Vlack/iStock/Thinkstock

Give **three** possible reasons that may have caused strawberry **A** to decay.

1 .....

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2 .....

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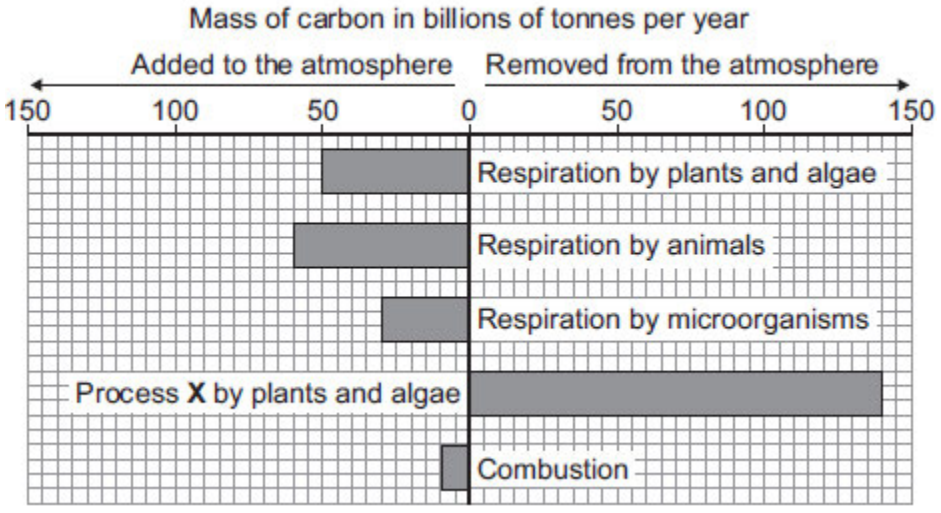
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(3)
(Total 13 marks)

Q2. 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**.

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(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?

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(1)

(Total 3 marks)

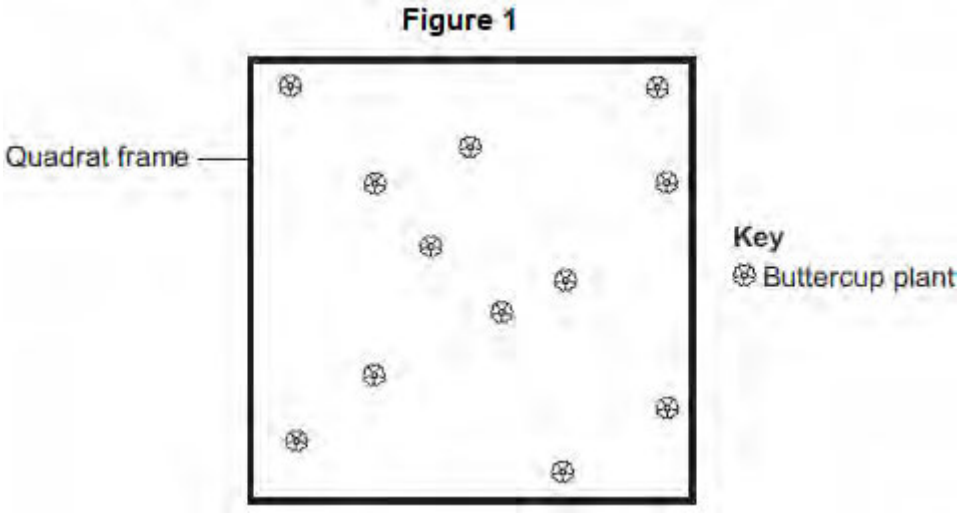
Q3.A grassy field on a farm measured 120 metres by 80 metres.

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.....

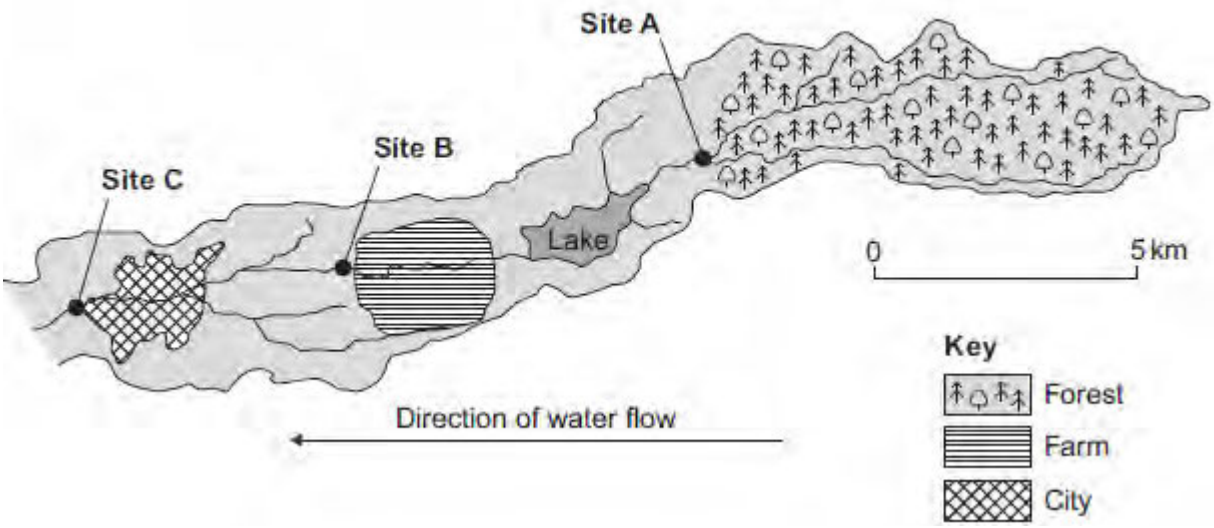
(3)

(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.

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(1)

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

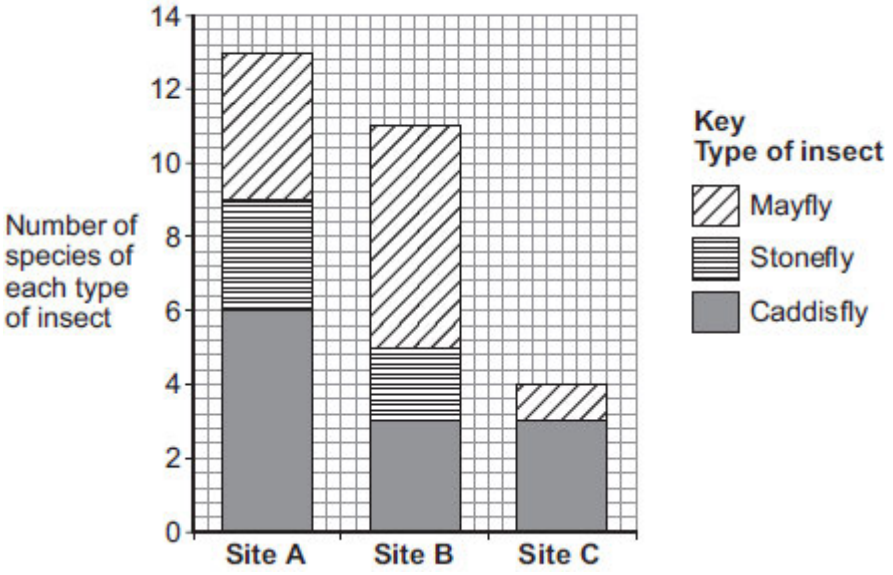
Scientists took many samples of river water from these sites.

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)

Q4.A student plans an investigation using mould.

(a) Mould spores are hazardous.

Give **one** safety precaution the student should take when doing this investigation.

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(1)

(b) A student made the following hypothesis about the growth of mould:

'The higher the temperature, the faster the growth of mould'.

The student planned to measure the amount of mould growing on bread.

The student used the following materials and equipment:

- slices of bread
- sealable plastic bags
- a knife
- a chopping board
- mould spores.

Describe how the materials and equipment could be used to test the hypothesis.

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(4)

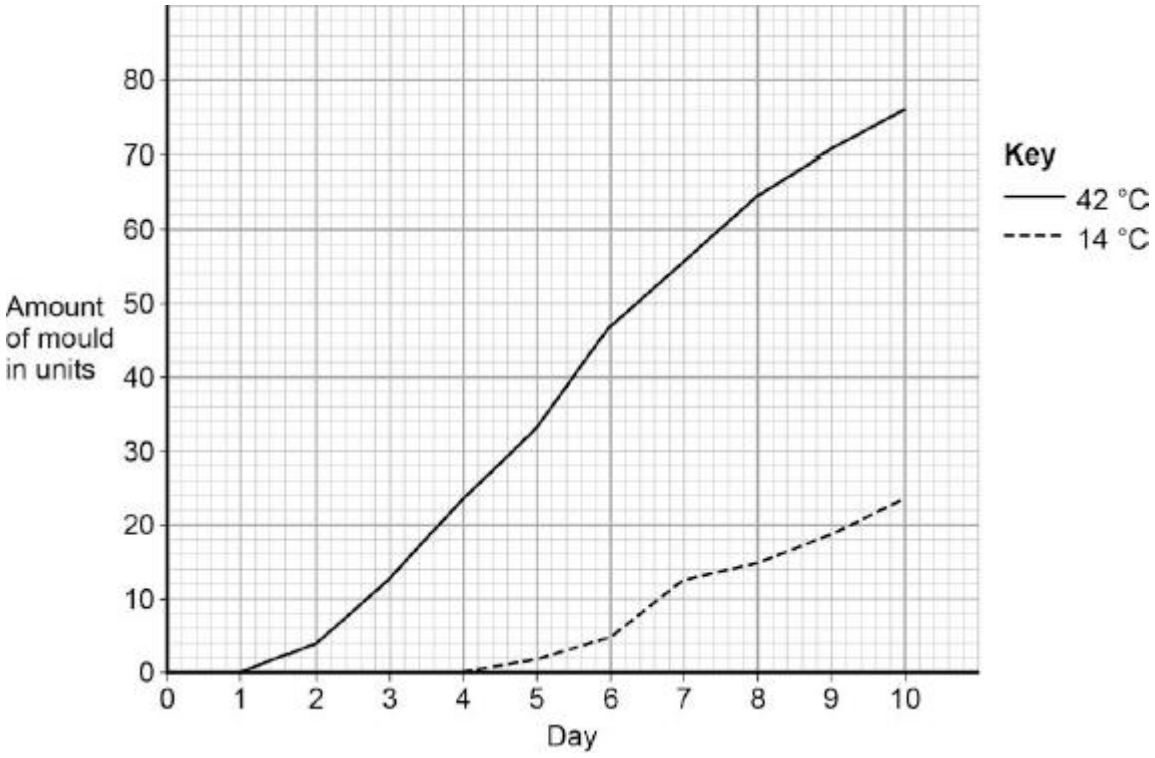
(c) Give **one** variable the student should control in the investigation.

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(1)

(d) Another student did a similar investigation.

The diagram below shows the results.



Determine the rate of mould growth at 42 °C between day 2 and day 7.

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Rate of mould growth = ... units per day

(2)

(e) The growth of mould shows decomposition of the bread.

Give a conclusion about decomposition from the results in the diagram above.

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(1)

(Total 9 marks)

Q5.Figures 1 and **2** show battery chickens and free-range chickens.

Figure 1
Battery chickens



© studiodr/iStock/Thinkstock

Figure 2
Free-range chickens



© xlikovec/iStock/Thinkstock

Battery chickens are kept in cages indoors. Free-range chickens can walk around outside.

(a) Give **one** way in which food production might be more efficient from battery chickens than from free-range chickens. Give a reason for your answer.

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(2)

(b) Some farms use waste from chickens to produce biogas in an anaerobic digester.

Microorganisms in the digester break down the waste by anaerobic respiration.

(i) What does **anaerobic** mean?

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(1)

(ii) One product of anaerobic respiration is methane.

Name **two** other products of anaerobic respiration.

1.....

2.....

(2)

(c) The best temperature for anaerobic digesters is about 35 °C.

Explain why the volume of biogas produced would be **less** at higher temperatures.

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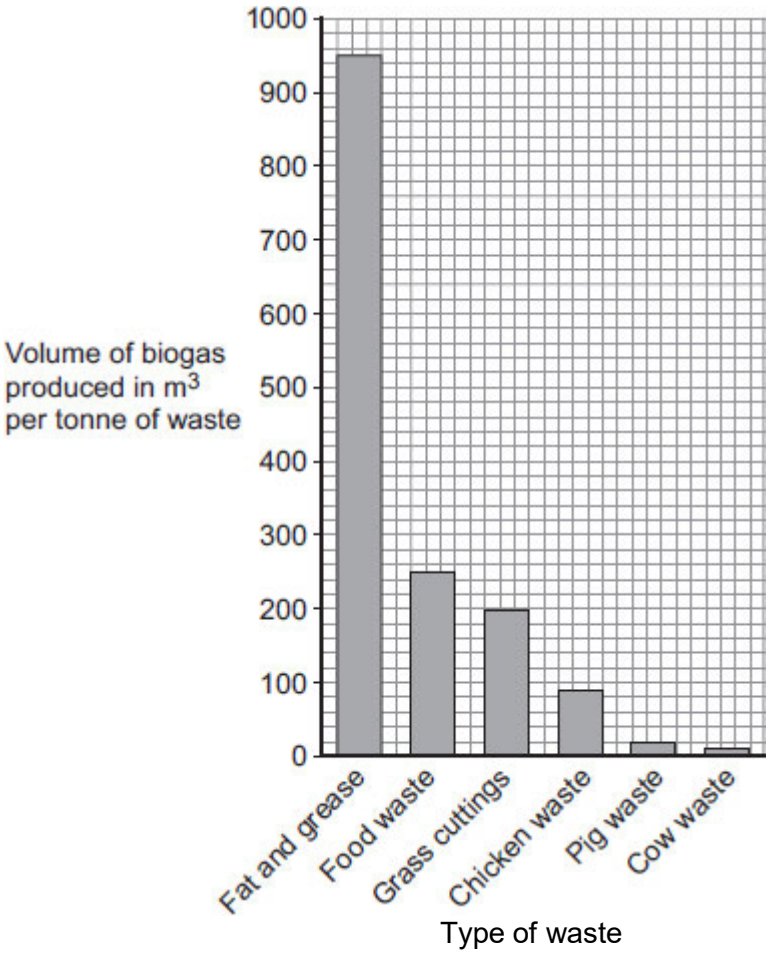
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(2)

(d) **Figure 3** shows other types of waste that can be used in an anaerobic digester to produce biogas.

Figure 3



(i) What is the volume of biogas produced by a tonne of grass cuttings?

..... m^3

(1)

(ii) Biogas is 60% methane.

Calculate the volume of methane gas produced per tonne of grass cuttings.

..... m^3

(1)

(e) Why should biogas **not** be allowed to escape into the atmosphere?

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(2)

(Total 11 marks)