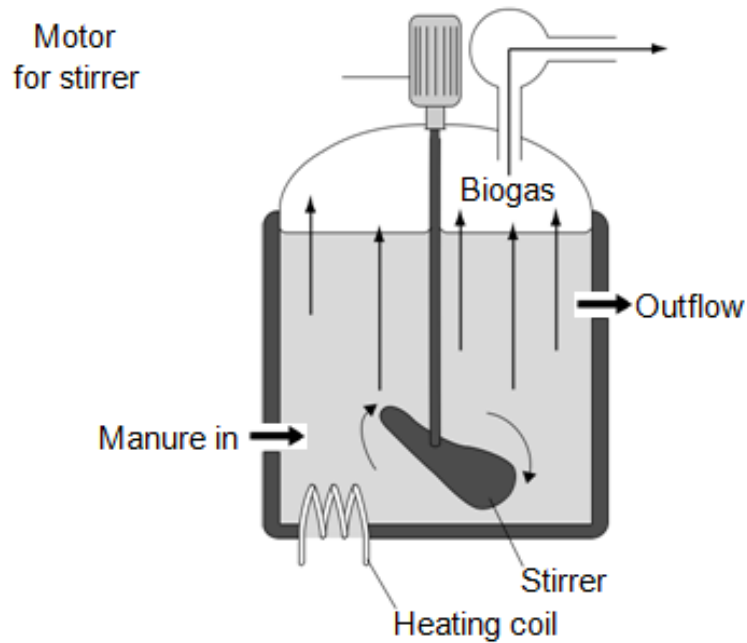


Decay 2 QP

Q:1 The diagram shows one type of anaerobic digester. This is used to produce biogas.



(a) (i) What does anaerobic mean?

(1 mark)

(a) (ii) The concentration of solids fed into this digester must be kept very low. Suggest one reason why.

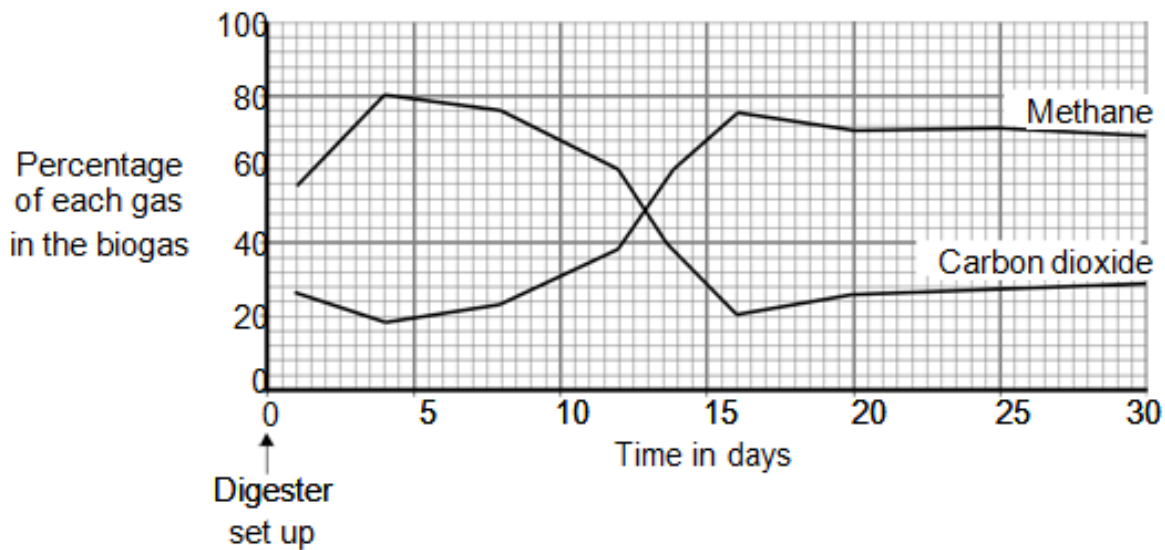
(1 mark)

(a) (iii) This digester is more expensive to run than some other simpler designs of biogas generator.

Suggest one reason why.

(1 mark)

(b) The graph shows how the composition of the biogas produced by the digester changed over the first 30 days after the digester was set up.



Use information from the graph to answer the following questions.

(b) (i) Describe how the percentage of carbon dioxide changed over the 30 days.

(3 marks)

(b)(ii) On which day was the best quality biogas produced? _____

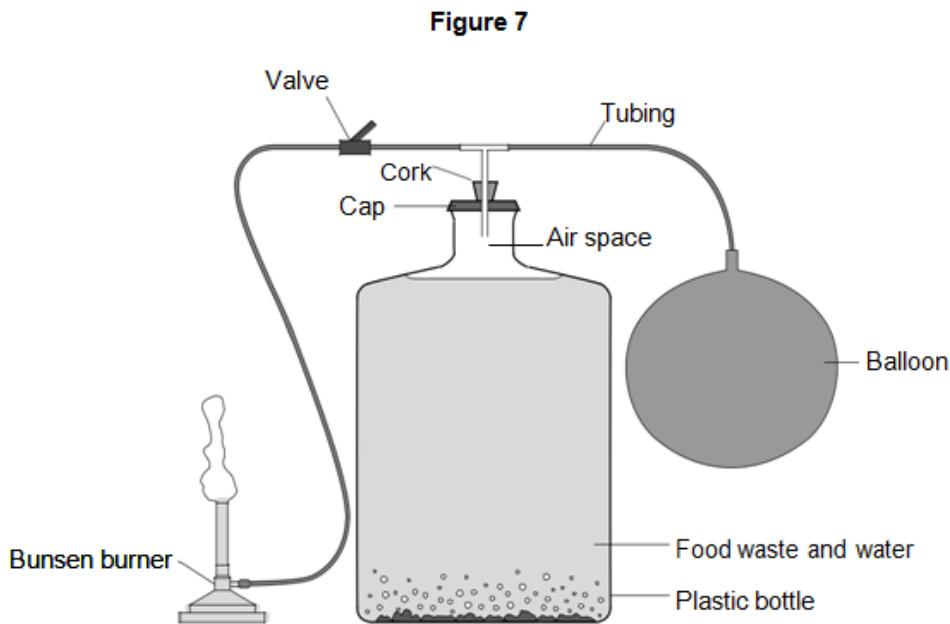
(1 mark)

(c) Four days after the digester was first set up, the biogas contained a high percentage of carbon dioxide.

Suggest an explanation for this.

(2marks)

Q:2 Figure 7 shows a model biogas generator.



Students used the model biogas generator to investigate which type of food waste produces the greatest yield of biogas.

Gas collects in the balloon. The gas is then released through the valve and is burned at the Bunsen burner.

The students:

- ☒ put 500 g of potato peelings in the plastic bottle with some water and sealed the apparatus
- ☒ released the gas from the balloon after day two and timed how long the gas burned for
- ☒ released the gas that had collected in the balloon from day two to day four and timed how long the gas burned for
- ☒ repeated the investigation using 500 g of cooked rice, then 500 g of cabbage leaves and then 500 g of cooked pasta.

(a) Table 3 shows the students' results.

Table 3

Type of food waste	Length of time the gas burned in seconds	
	After day two	From day two to day four
Potato peelings	0	175
Cooked rice	0	100
Cabbage leaves	0	150
Cooked pasta	0	160

(a) (i) Suggest why the gas collected in the balloon and released after day two did not burn.

[3 marks]

(a) (ii) Suggest why potato peelings produced the most biogas.

[1 mark]

(b) Scientists investigated the production of biogas from different types of animal manure.

Table 4 shows the scientists' results.

Table 4

Type of manure	Volume of biogas produced in m ³ per kg of manure	Methane in the biogas as % of total volume
Cow	0.34	65
Pig	0.58	68
Hen	0.62	60
Horse	0.30	66
Sheep	0.61	67

(b) (i) Calculate the volume of methane produced from 1 kg of cow manure.

Volume of methane = _____ m³

[2 marks]

(b) (ii) One scientist concluded that it would be better to use sheep manure in a biogas generator than to use cow manure.

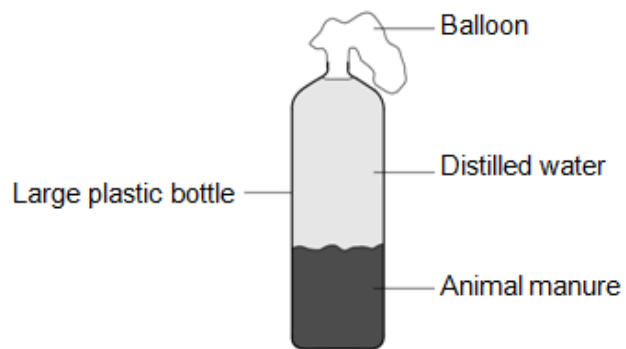
What is the evidence for this conclusion?

Use information from Table 4 in your answer.

[2 marks]

Q:3 Some students set up biogas generators to find out which type of animal manure produced the most biogas.

Figure 3 shows the apparatus they used.



The students:

Step 1: Put some cow manure into the plastic bottle

Step 2: Filled the bottle with distilled water

Step 3: Attached a balloon over the top of the bottle

Step 4: Put the bottle in a warm room for 10 days

Step 5: Measured the diameter of the balloon on day 10

Step 6: Repeated steps 1 to 5 using each type of animal manure.

The students' results are shown in Table 2.

Table 2

Type of animal manure	Diameter of balloon on day 10 in cm
Cow	29
Horse	26
Sheep	34
Pig	32

(a) What is the main gas found in biogas?

[1 mark]

(b) The students concluded that sheep manure is the best type of manure to use in a biogas generator. A teacher told the students that the design of their investigation meant that their conclusion might not be correct.

Suggest two reasons why.

1 _____

2 _____

[2 marks]

(c) Another student suggested that adding potato to the manure would increase the amount of biogas produced.

Why would adding potato increase the amount of biogas produced?

Tick (☑) one box.

The potato contains a lot of carbohydrate.

The potato contains a lot of protein.

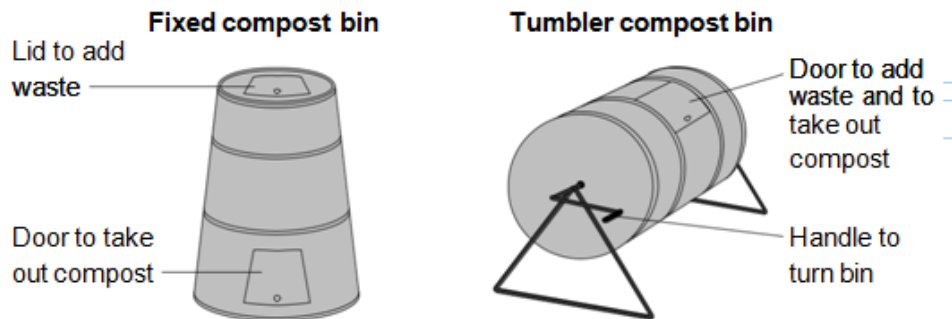
The potato contains a lot of water.

[1 mark]

Q:4 Garden waste can be recycled.

One way of recycling garden waste is to use a compost bin.

The diagram shows two types of compost bin. Each bin can contain the same amount of waste.



Information about the compost bins is given below.

Fixed compost bin

- Compost can be taken out after two years.
- The bin costs about £40.
- The bin takes up an area of 1 m².

Tumbler compost bin

- The bin is turned twice a day using the handle.
- Six weeks later compost can be taken out.
- The bin costs about £80.
- The bin takes up an area of 2 m².

(a) A gardener is buying a compost bin.

(a) (i) Give one advantage to the gardener of buying a tumbler compost bin and not a fixed compost bin.

(1 mark)

(a) (ii) Give two advantages to the gardener of buying a fixed compost bin and not a tumbler compost bin.

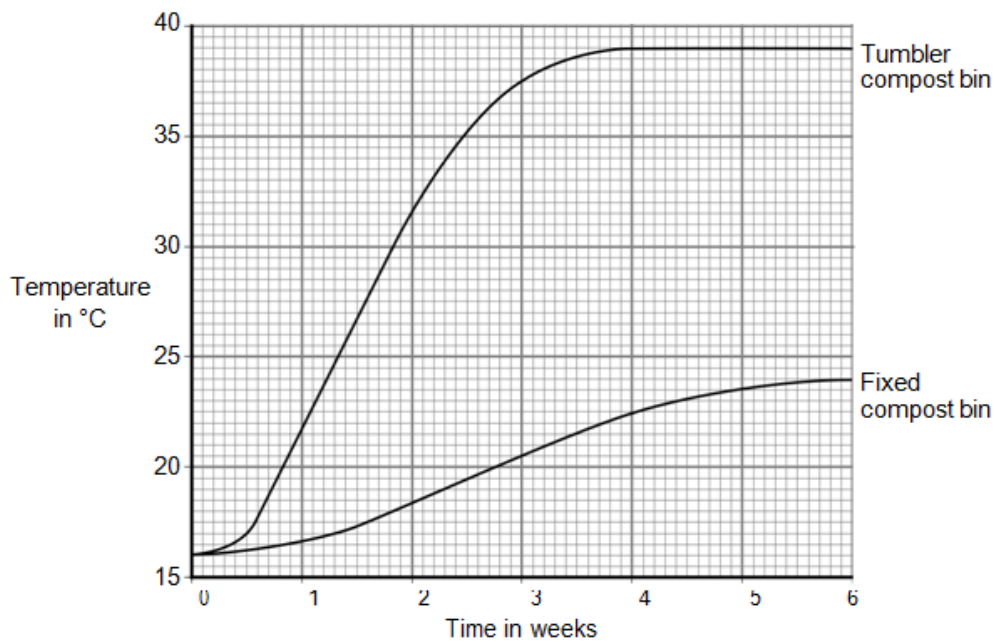
1 _____

2 _____

(2 marks)

(b) The same amounts of waste were added to the two types of bin.

The graph shows the temperature in the bins in the first six weeks after the waste was added.



(b) (i) Give two differences between the results for the tumbler compost bin and the fixed compost bin.

1 _____

2 _____

(2 marks)

(b) (ii) Complete the sentences.

The waste is converted into compost by organisms called _____

The conversion of waste into compost works best in warm, moist
and _____ conditions.

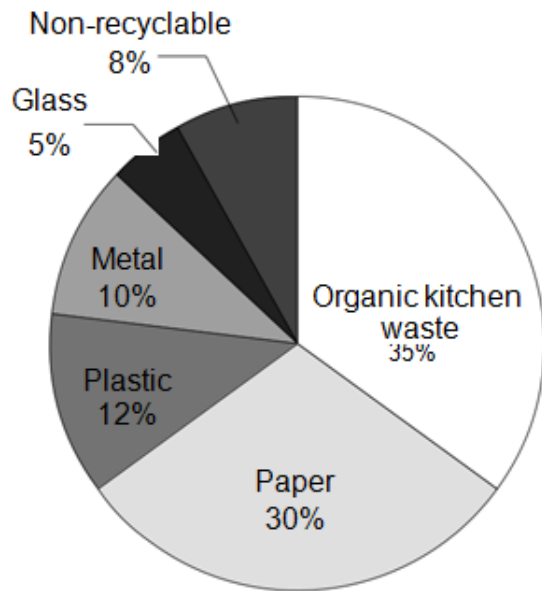
(2 marks)

(b) (iii) There was a big difference in the final temperatures in the two bins. Suggest an explanation for this temperature difference.

(2 marks)

Q:5 This question is about recycling.

The pie chart shows the different types of waste from an average household in England.



(a) In 2010, councils in England collected 23 million tonnes of waste from households.

Most of the waste was put into landfill sites.

Councils pay to use landfill sites.

Organic kitchen waste can be put onto compost heaps.

Calculate the mass of organic kitchen waste from households that could have been put onto compost heaps in 2010.

Answer = _____ million tonnes

(2 marks)

(b) Some householders put organic kitchen waste onto their compost heaps.

(b) (i) Suggest one advantage of this to the council.

(1 mark)

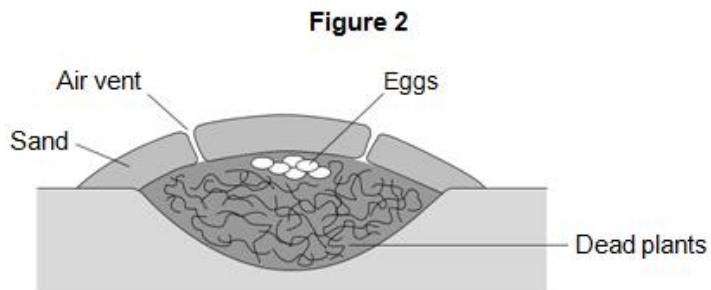
(b) (ii) Suggest one advantage of this to the householder.

(1 mark)

Q:6 Most birds sit on their eggs to keep them warm until they hatch. Megapode birds:

- dig a large hole in sand
- fill the hole with dead plants
- lay their eggs on top of the dead plants
- cover the surface with a thick layer of sand.

Figure 2 shows a megapode bird's nest.



(a) The dead plants in the nest decay. The decaying process helps to keep the eggs warm for many weeks.

Suggest how.

[3 marks]

(b) (i) Megapode birds open and close the air vents of the nest at different times of the day.

Suggest reasons why it is necessary to open and close the air vents.

[3 marks]

(b) (ii) The sex of a megapode bird that hatches from an egg depends on the temperature at which the egg was kept.

Use this information to suggest why it is important for megapode birds to control the temperature of their nests.

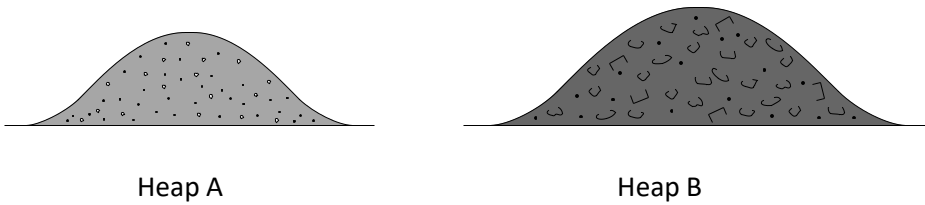
[1 mark]

Q:7 A gardener investigates if turning over the waste in a compost heap makes the waste decay more quickly.

The gardener:

- makes two separate heaps of garden waste, heap A and heap B
- turns over the material in heap A every 2 weeks
- does not turn over the material in heap B
- estimates the amount of decay in the two heaps after 6 months.

Figure 6 shows the two heaps of garden waste at the beginning of the investigation.



(a) Suggest two factors, other than time, the gardener should control to make the investigation fair.

1 _____

2 _____

[2 marks]

(b) Name one type of living thing that causes decay.

[1 mark]

(c) Table 3 shows the gardener's results.

Table 3

Compost heap	Estimated amount of decay
A	A lot
B	Very little

(c) (i) Why does turning over the material in heap A make the material decay more quickly?

[1 mark]

(c) (ii) The gardener puts decayed material around his plants to help them grow.

Suggest why the plants in a woodland grow well each year without material from compost heaps being added.

[2 marks]

TOTAL MARKS=47