

OCR GCSE GATEWAY BIOLOGY A • J247

BIOLOGY



EXAM QUESTION PACK

B1.3 RESPIRATION

SCORE

/137

PERCENTAGE

%

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Gateway Biology A (9-1)

Respiration

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:

Additional resources may be supplied with this paper.

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **137**.
- The total number of marks may take into account some 'either/or' question choices.

1 What are proteins made of?

- A amino acids
- B fatty acids
- C nucleotides
- D sugars

Your answer

[1]

2 What is the word equation for aerobic respiration?

- A carbon dioxide + water → glucose + oxygen
- B glucose + carbon dioxide → oxygen + water
- C glucose + oxygen → carbon dioxide + water
- D oxygen + water → glucose + carbon dioxide

Your answer

[1]

3 What type of reactions are photosynthesis and respiration?

	photosynthesis	respiration
A	endothermic	endothermic
B	endothermic	exothermic
C	exothermic	endothermic
D	exothermic	exothermic

Your answer

[1]

4 What substance does Benedict's reagent test for?

- A lipid
- B protein
- C starch
- D sugar

Your answer

[1]

5 Which molecule is **not** a polymer?

- A DNA
- B lipid
- C protein
- D starch

Your answer

[1]

6(a) What is the gas given off in photosynthesis?

-----[1]

(b) Explain why the amount of this gas given off is **not** a true measure of the rate of photosynthesis.

-----[2]

7 A group of students investigate the effect of temperature on the breakdown of the fat in milk by the enzyme lipase.

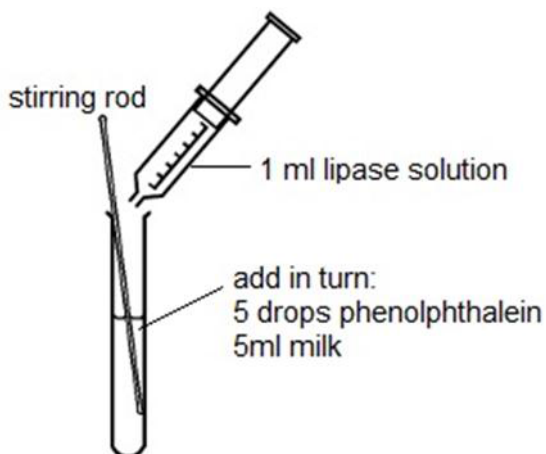
In their investigation they use an indicator called phenolphthalein.

Phenolphthalein is pink in alkali conditions but becomes colourless when the pH falls below pH8.

A student puts 5 drops of phenolphthalein and 5 ml of full fat milk into a test tube.

She adds 1 ml of lipase, stirs the mixture and times how long it takes to lose the pink colour.

Other students repeat this but at different temperatures.



The table shows the group's results.

Temperature (°C)	Time for pink colour to disappear (s)
20	480
40	240
60	270
80	960

Explain why the pH falls when lipase breaks down the fat in milk.

[2]

8 Compost decomposes more slowly above 60 °C or below 30 °C.

Use ideas about enzymes and decomposition to explain why this is.

----- [2]

9 A group of students investigate the effect of temperature on the breakdown of the fat in milk by the enzyme lipase.

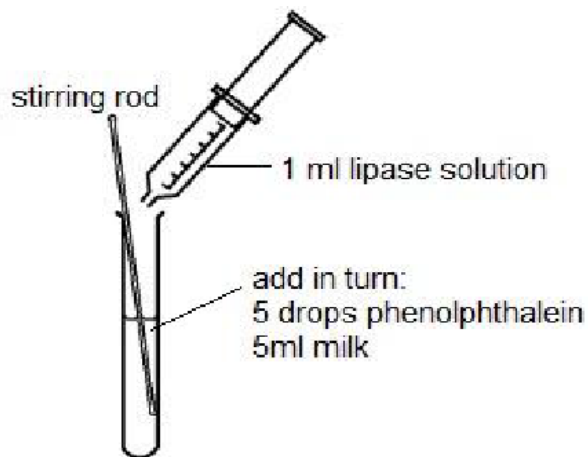
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Other students repeat this but at different temperatures.



The table shows the group's results.

Temperature (°C)	Time for pink colour to disappear (s)
20	480
40	240

60	270
80	960

Explain why the pH falls when lipase breaks down the fat in milk.

----- [2]

- 10 Compost decomposes more slowly above 60°C or below 30°C.

Use ideas about enzymes and decomposition to explain why this is.

----- [2]

- 11 Two athletes run in a long race.

During the race both athletes made more carbon dioxide than normal.

Why is more carbon dioxide made and why must it be removed from the body?

----- [2]

12(a) The table shows some information about three types of mammal.

Mammal	Metabolic rate	Surface area of one red blood cell in arbitrary units	Volume of one red blood cell in arbitrary units	Surface area to volume ratio of red blood cells
Mouse	1.0	91	52	1.75
Rabbit	1.5	114	70	1.63
Shrew	7.5	60	24	

The units for the metabolic rate are cm^3 of oxygen consumed in one hour per gram of animal.

- (i) Suggest why the oxygen consumed is given as **per gram of animal**?

----- [1]

- (ii) Explain why oxygen consumption can be used as a measure of metabolic rate.

----- [2]

(b)

- (i) Calculate the surface area to volume ratio of red blood cells for the shrew.

answer = _____

[1]

- (ii) Explain how the shrew manages to maintain its metabolic rate.

Use your calculation in part (b)(i) and information from the table in your answer.

----- [3]

- 13 Sam investigates the rate of alcohol production by fermentation.
She mixes yeast with sugar and water and leaves the mixture to ferment for 4 days.

She does this for two different strains of yeast, A and B.

Sam monitors the fermentation process by recording the specific gravity of the mixture.

The lower the specific gravity the more alcohol the mixture contains.

Look at Sam's results.

Time in hours	Specific gravity in g/cm ³	
	Yeast strain A	Yeast strain B
0	1.090	1.090
24	1.065	1.057
48	1.054	1.038
72	1.044	1.023
96	1.037	1.010
120	1.037	1.001

Explain the patterns seen in the two sets of data.

----- [2]

14 Which two substances are products of **anaerobic** respiration in **yeast**?

- A Carbon dioxide and ethanol
- B Carbon dioxide and water
- C Oxygen and ethano
- D Oxygen and water

Your answer

[1]

15 A student wants to test for **protein**.

What would they use to test for protein?

- A Benedict's reagent
- B Biuret reagent
- C Iodine solution
- D Ethanol

Your answer

[1]

16 Yeast cells are used in the production of alcohol.

During this process conditions are controlled so that the yeast grows at an optimum rate.

One condition that is controlled is temperature.

Write down two **other** ways to optimise the growth rate of yeast.

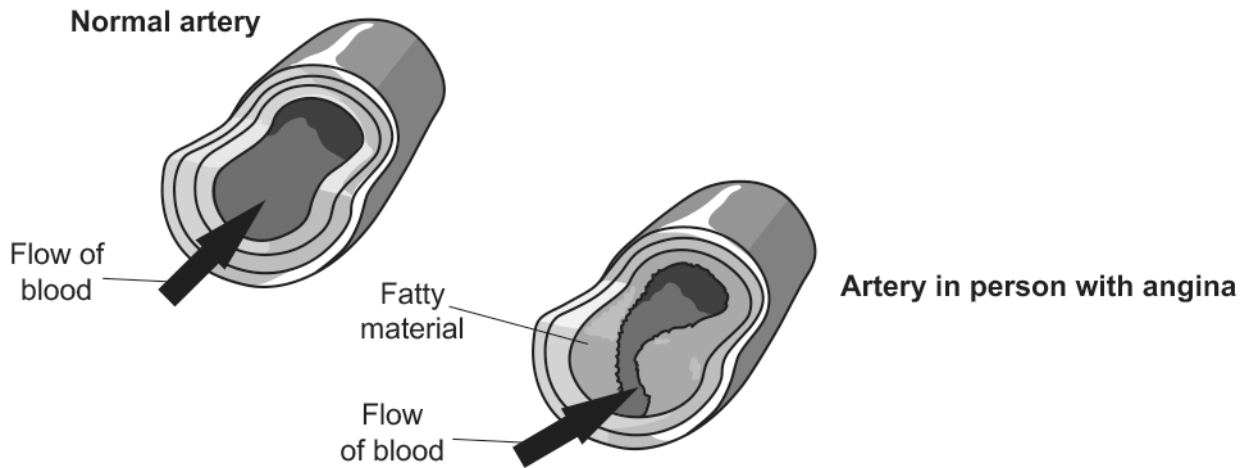
1

2

[2]

17 Angina is caused by a problem in the arteries that supply the heart muscle.

Fatty material (cholesterol) builds up in these arteries.



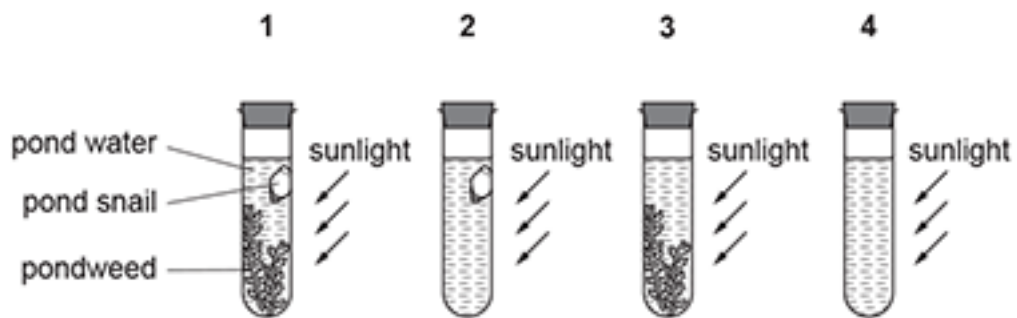
In angina the heart muscle starts to carry out anaerobic respiration.

Explain why this happens.

Use the information in the diagram and your biological knowledge.

[3]

18 Pond snails and pondweed are living in water in sealed test tubes.



Carbon dioxide dissolves in water and forms an acid.

In which test tube would the water become most acidic?

- A 1
- B 2
- C 3
- D 4

Your answer

[1]

19(a) Yeast cells can respire anaerobically.

Complete the word equation for **anaerobic** respiration in yeast.

glucose → + ...

[1]

- (b) Write down **two** ways in which anaerobic respiration in yeast cells is different from anaerobic respiration in human muscle cells.

1 _____

2 _____

[2]

- (c) Date fruits contain three different sugars, fructose, glucose and sucrose.

Different strains of yeast can ferment different sugars to produce a fermented product.

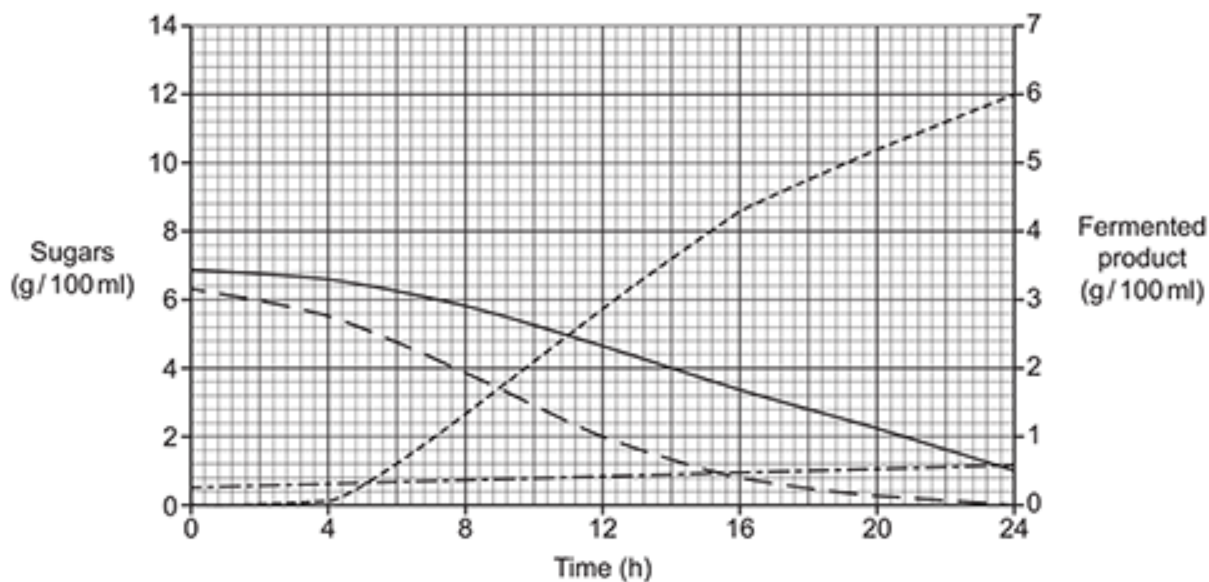
Scientists investigate how two different strains of yeast, **A** and **B**, ferment sugars inside date fruits.

Look at their results.

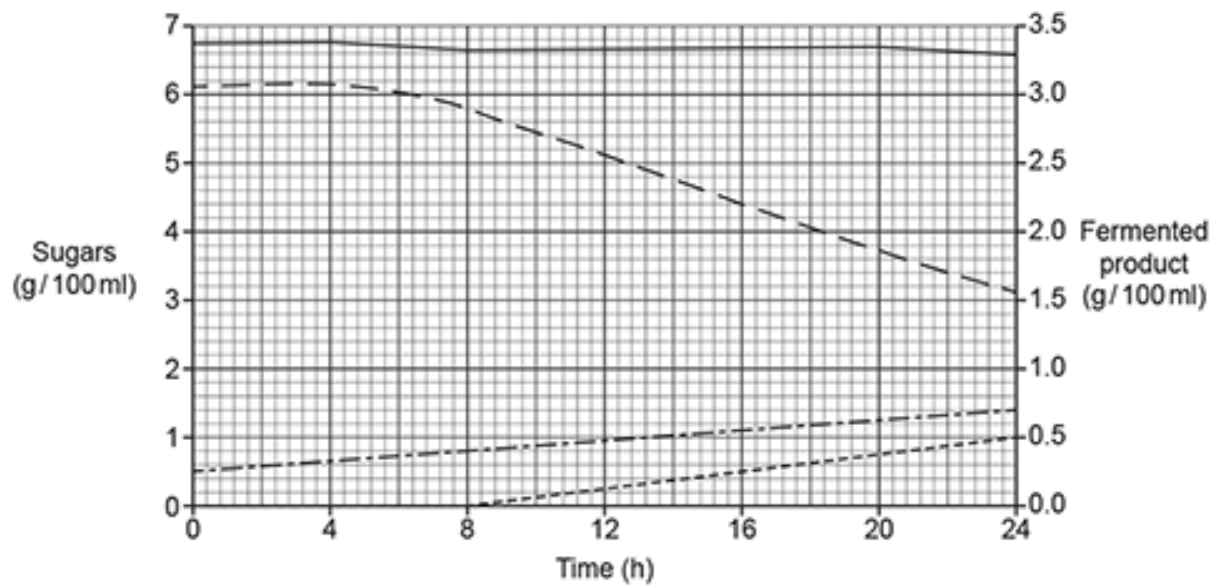
Key

———— fructose ——— glucose - - - - sucrose ----- fermented product

Yeast A



Yeast B



(i) Which sugar is **not** fermented by either strain of yeast?

Tick (✓) **one** box.

Fructose

☐

Glucose

☐

Sucrose

☐

[1]

(ii) After 24 hours, how many times higher is the fermented product yield of yeast **A** compared to yeast **B**?

Number of times higher = ... [2]

(iii) Which sugar would increase fermentation the **most** if added to either yeast **A** or yeast **B**?

Tick (✓) **one** box.

Fructose

☐

Glucose

☐

Sucrose

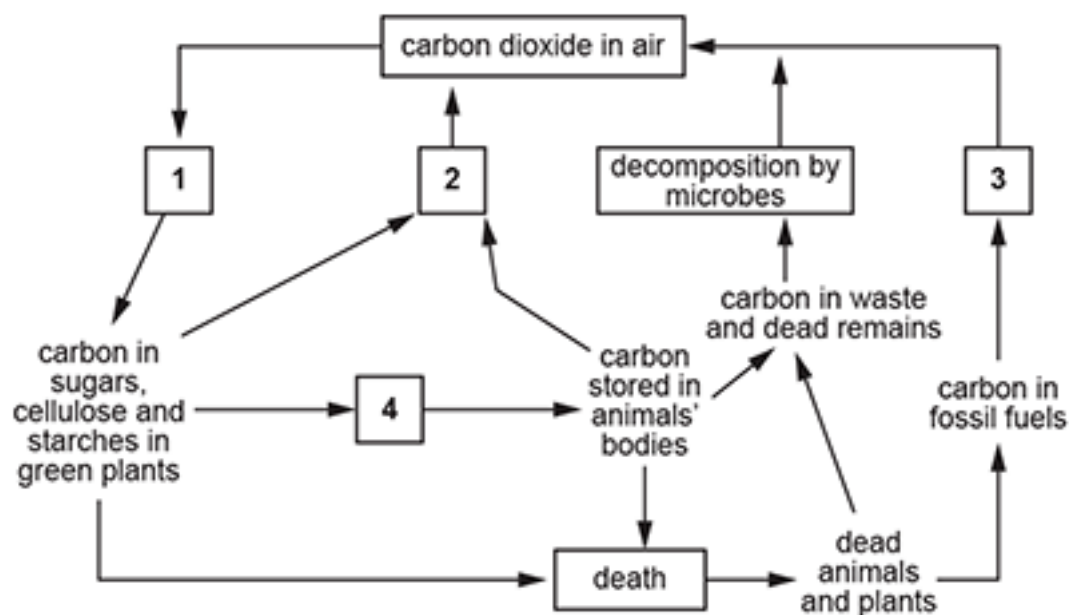
☐

[1]

(iv) Fermented dates are used to supply both fructose and fermented product.

Explain why it would be best to use yeast **B** to ferment dates to supply both fructose and fermented product.

[2]



Scientists investigated if crops can be grown on the planet Mars.

They used a soil that was similar to the soil found on Mars. The soil contained some minerals but no living organisms.

- (i) The scientists managed to grow crops in the soil. However on Mars, the minerals in the soil would soon run out.

Explain why.

----- [2]

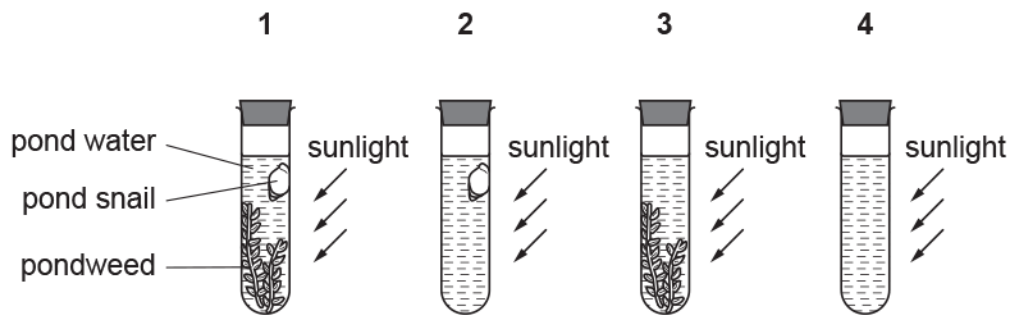
- (ii) Living organisms could be added to the soil but there is no air on Mars. The plants would need to be grown in an enclosed structure.

At first, air would need to be added, but after a while the organisms in the soil and the plants would supply each other with the gases they need.

Explain how this would happen.

[2]

21 Pond snails and pondweed are living in water in sealed test tubes.



Carbon dioxide dissolves in water and forms an acid.

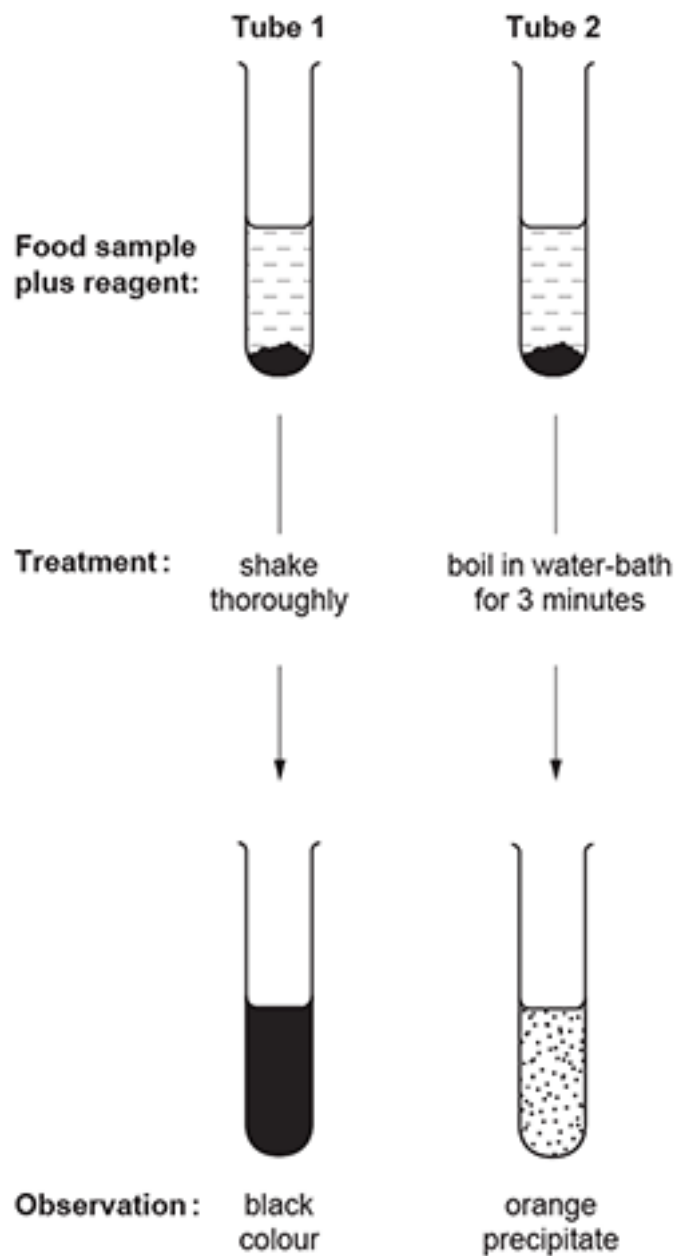
In which test tube would the water become most acidic?

- A 1
- B 2
- C 3
- D 4

Your answer

[1]

22 The diagram shows positive results in two different food tests.



What do the results show in each tube?

	Tube 1	Tube 2
A	sugar	lipid
B	starch	sugar
C	protein	sugar
D	starch	protein

Your answer

[1]

23 Aerobic respiration occurs all the time in plant cells but photosynthesis only occurs in daylight.

Why is more energy released by a plant cell during the night?

- A Photosynthesis is endothermic taking in energy and aerobic respiration is exothermic.
- B Photosynthesis is exothermic taking in energy and aerobic respiration is endothermic.
- C Aerobic respiration is exothermic taking in energy and photosynthesis is endothermic.
- D Aerobic respiration is endothermic taking in energy and photosynthesis is exothermic.

Your answer

[1]

24(a) Complete the word equation for **anaerobic** respiration in yeast.

glucose → ----- + -----

[1]

- (b) Write down **two** ways in which anaerobic respiration in yeast cells is different from anaerobic respiration in human muscle cells.

1 -----

2 -----

[2]

- (c) Date fruits contain three different sugars, fructose, glucose and sucrose.

Different strains of yeast can ferment different sugars to produce a fermented product.

Scientists investigate how two different strains of yeast, **A** and **B**, ferment sugars inside date fruits.

Look at their results.

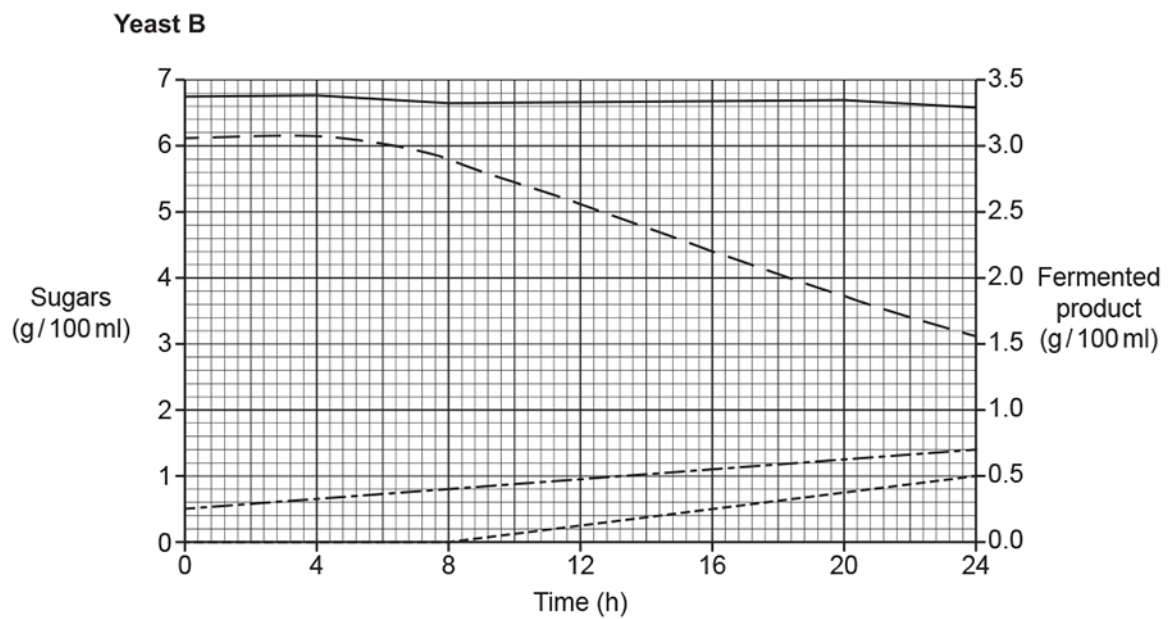
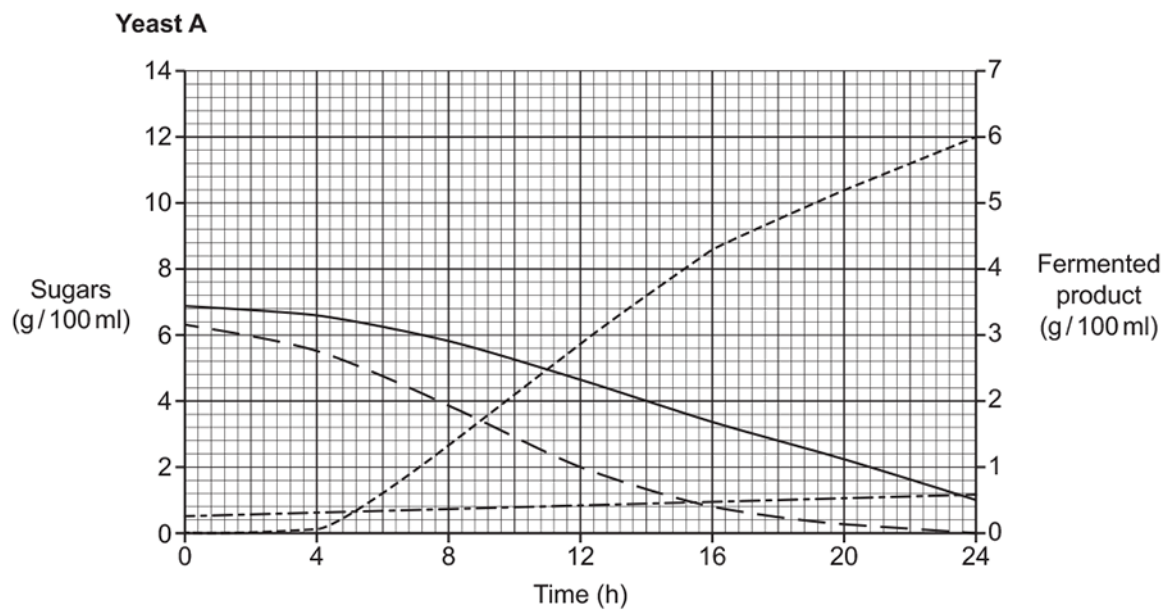
Key

—— fructose

— — glucose

----- sucrose

----- fermented
product



(i) Which sugar is **not** fermented by either strain of yeast?

Tick (✓) one box.

Fructose

☐

Glucose

☐
☐

[1]

- (ii) After 24 hours, how many times higher is the fermented product yield of yeast **A** compared to yeast **B**?

Number of times higher = ... [2]

- (iii) Which sugar would increase fermentation the **most** if added to either yeast **A** or yeast **B**?

Tick (✓) **one** box.

Fructose

☐

Glucose

☐

Sucrose

☐

[1]

- (iv) Fermented dates are used to supply both fructose and fermented product.

Explain why it would be best to use yeast **B** to ferment dates to supply both fructose and fermented product.

----- [2]

25(a) Rats are a major pest in many areas of the world. They can reduce food security and spread diseases.



Warfarin is a chemical that is used as a rat poison. It stops platelets working in the blood.

Describe the function of platelets in the blood.

----- [2]

(b) Some rats are resistant to warfarin. When fed with large amounts of warfarin the rats do not die.

Scientists found that the resistance is due to the dominant allele **R**.

Two resistant rats (**Rr**) mate.

Complete this genetic diagram to find the ratio of resistant rats to non-resistant rats that would be expected to be produced.

		Rr	
Rr	R		
	r		

Ratio = ... [3]

(c) After several years, the percentage of resistant rats in the population had increased.

Use Darwin's theory of natural selection to explain this observation.

[3]

(d) Scientists are now trying to find another poison to use on rats.

They have introduced a chemical called phosphine. This blocks the action of mitochondria in rat cells.

Explain why this might kill rats.

[3]

26 Respiration is a reaction that happens in all cells.

(i) Why do cells need respiration?

----- [1]

(ii) Cells use aerobic respiration when oxygen is available.

What are the **two** products of aerobic respiration?

1 -----

2 -----

[2]

(iii) Aerobic respiration releases heat energy.

What term describes a reaction that releases heat energy?

----- [1]

27 Which monomer is used to make proteins?

- A Amino acid
- B Fatty acid
- C Glucose
- D Glycerol

Your answer

[1]

28 Modern hair shampoos contain cleaning agents. One cleaning agent is made from fatty acids.

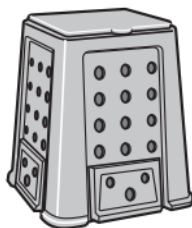
Explain how a **polymer** found in plants and animals can be treated to obtain these fatty acids.

[2]

29(a) Gardeners use dead plant material to make compost. They add this compost to soil where they are growing plants.

Compost can be made in a composting bin. In the bin **aerobic** bacteria turn dead plant material into compost.

The drawing shows a composting bin.



Explain why the composting bin needs holes in it.

[2]

- (b) A new way of making compost is called bokashi. In this process the compost is made **anaerobically** in a different type of composter.

Scientists compare the normal methods of making compost with bokashi.

This is their method:

- Take one large pile of dead plant material
- Divide the material into two samples of equal mass
- Place one sample into the normal composter and place one sample into the bokashi composter
- Measure the temperature in each composter every 10 days
- After 40 days, measure the mass of the compost.

Why did the scientists put the same mass of compost in each composter?

Tick (✓) **one** box.

To allow valid comparisons of the results.

☐

To decrease the temperature.

☐

To make the measurements more accurate.

☐

To make the results repeatable.

☐

[1]

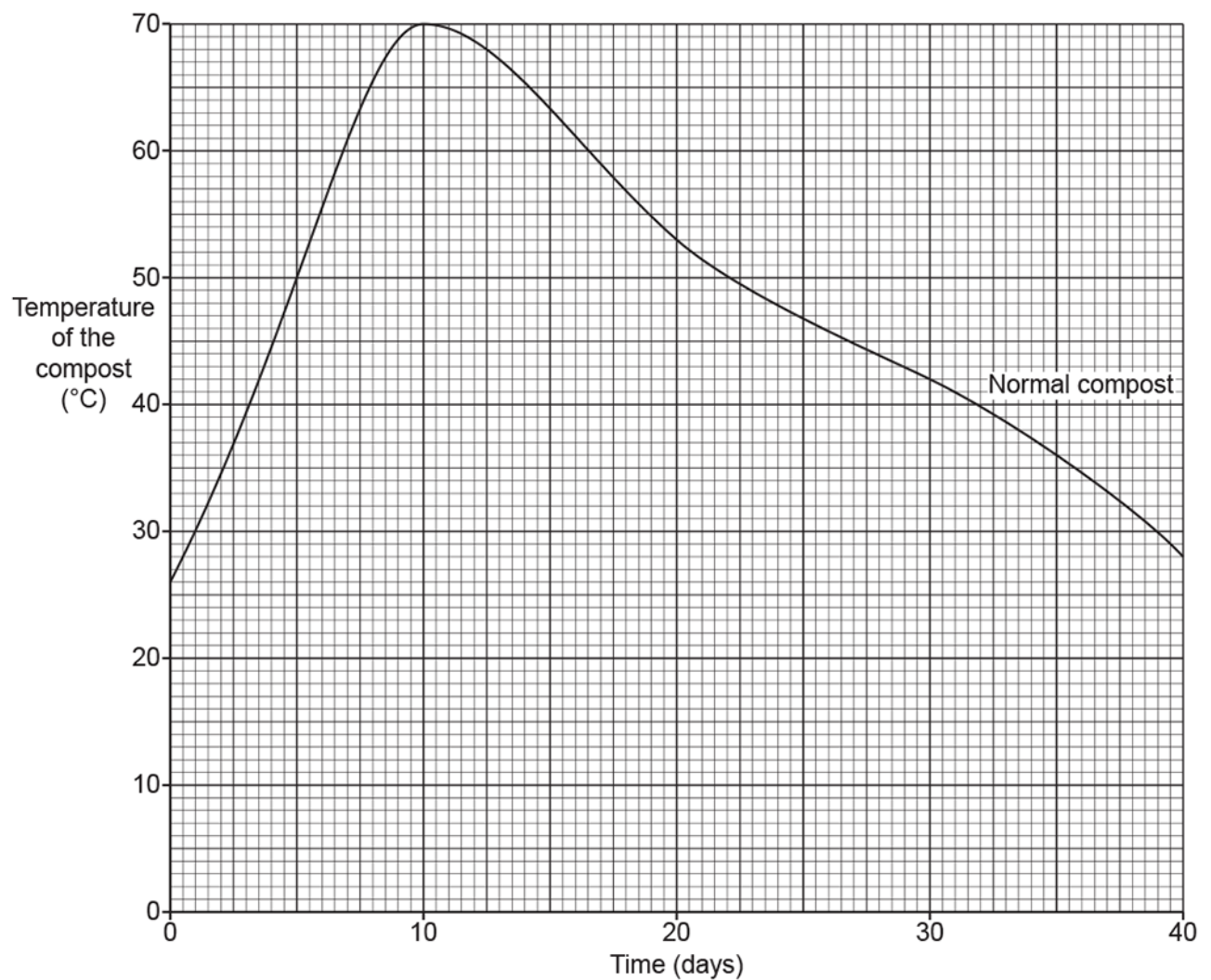
- (c) **Table 20.1** shows the scientists' temperature measurements.

Time (days)	Temperature of the compost (°C)	
	Normal compost	Bokashi compost
0	26	26
10	70	27
20	53	29
30	42	31
40	28	28

Table 20.1

- (i) The scientists' results for the normal compost are plotted on the grid.

Complete the graph by plotting the results for the **bokashi** compost and draw a curve of best fit.



[3]

- (ii) Describe the change in the temperature of the **normal** compost during the investigation.

[2]

- (iii) Use data from **Table 20.1** to calculate the difference between the maximum temperature of the normal compost and the maximum temperature of the bokashi compost.

Difference = ... °C [2]

- (iv) Which **two** statements explain this difference in temperature between the two types of compost?

Tick (✓) **two** boxes.

Both types of compost are made by aerobic respiration.

☐

Normal compost is made by aerobic respiration.

☐

Normal compost is made by anaerobic respiration.

☐

Aerobic respiration and anaerobic respiration release the same amount of energy.

☐

Aerobic respiration releases more energy than anaerobic respiration.

☐

Aerobic respiration releases less energy than anaerobic respiration.

☐

[2]

(d) Table 20.2 shows the scientists' results for the mass of the compost.

	Normal compost	Bokashi compost
Mass at start (kg)	1500	1500
Mass after 40 days (kg)	760	1200

Table 20.2

(i) The mass of the normal compost has decreased by 19 kg per day.

Calculate the decrease in mass of the bokashi compost per day.

Give your answer to the nearest **whole** number.

Decrease = ...kg per day [3]

(ii) Carbon dioxide is given off in the making of the compost. This causes most of the decrease in mass.

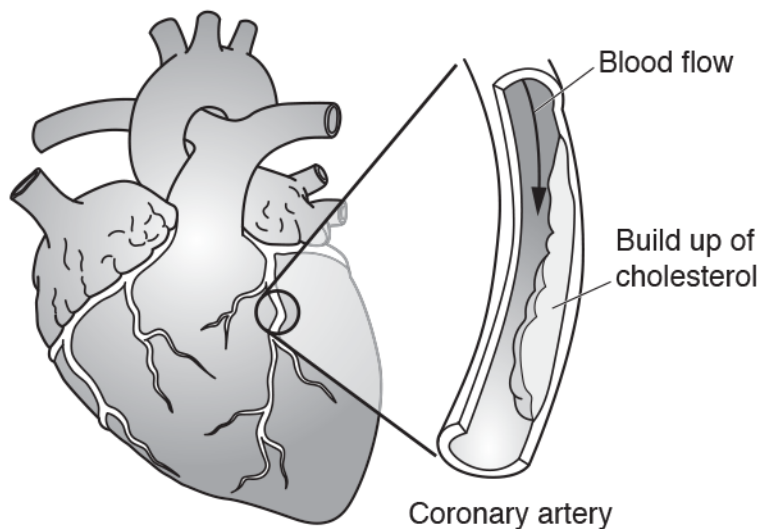
Scientists think that the bokashi method of composting might be better for the environment.

Use your answer from part (i) to justify the scientists' conclusion.

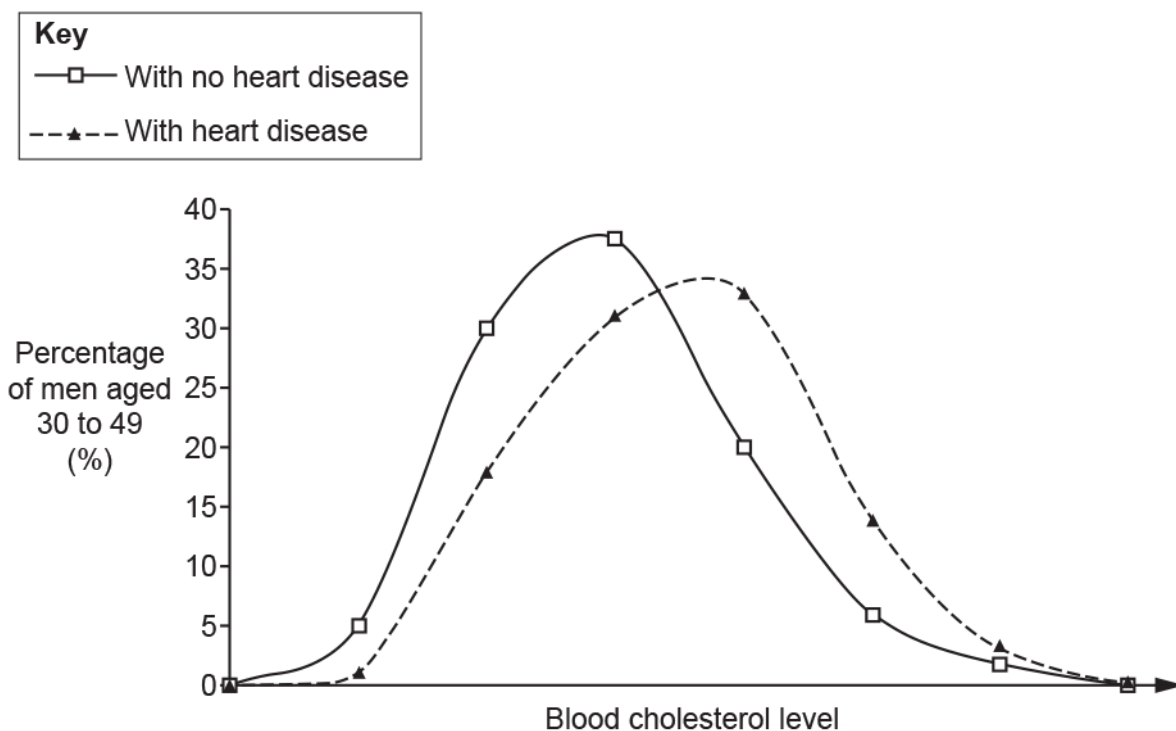
-----[1]

30 Hypercholesterolemia (HC) is caused by a dominant allele on chromosome 19. This allele has mutations which cause a change in the order of DNA nucleotides.

* People with HC are more likely to get heart disease. The diagram shows the heart of a person who has heart disease.



The graph shows the results of a study of men aged 30 to 49. The study measured the cholesterol levels in the blood of the men. It also recorded if the men developed signs of heart disease.



Explain the possible link between cholesterol and heart disease and if this link is supported by the graph.

[6]

31 In a sample of DNA, 23% of the bases are cytosine.

A	23%
B	27%
C	46%
D	54%

[1]

- 32 A process in cells is involved in producing a chemical that causes ripening of fruit.
Look at Fig. 20.2.

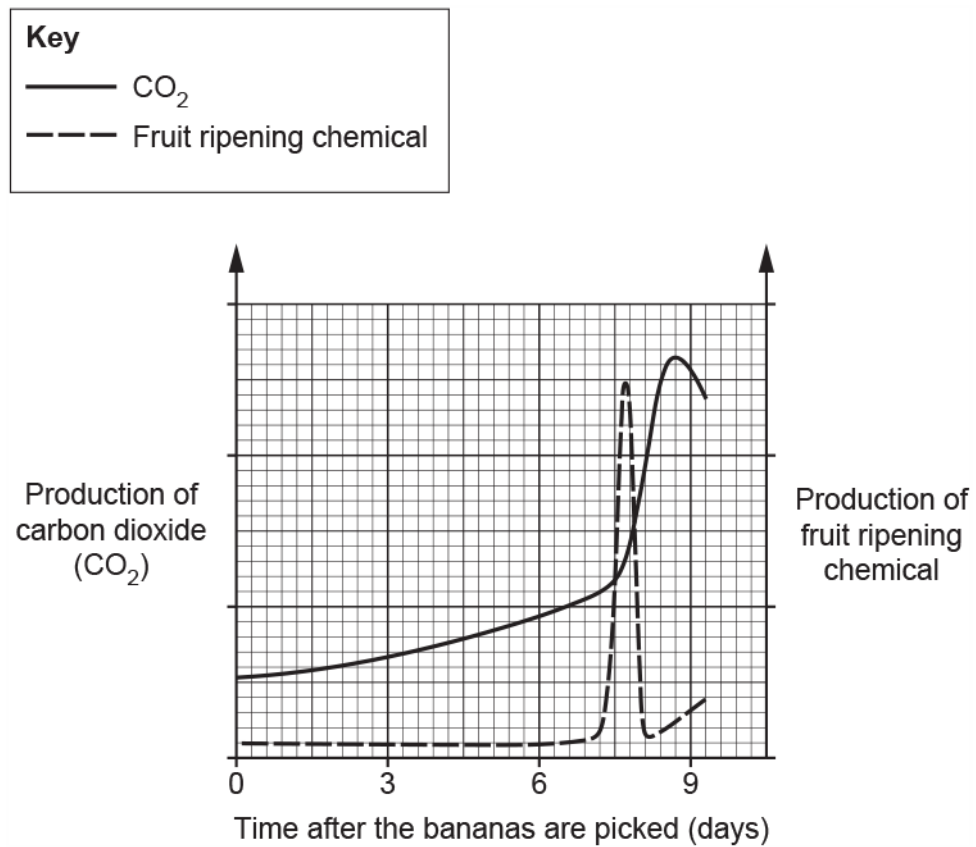


Fig. 20.2

Use evidence from Fig. 20.2 to suggest what this process might be.

[2]

ADH is a protein hormone made up of amino acids.

(i) Complete the sentences to explain the link between amino acids and proteins.

Large molecules, like proteins, made of smaller molecules are called

The smaller molecules, or amino acids, are called

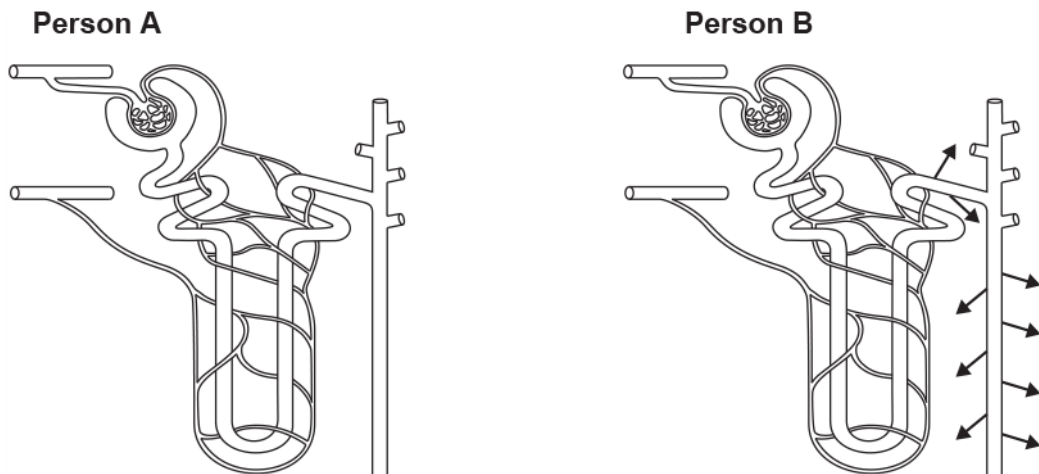
[2]

(ii) Alcohol inhibits ADH production.

Person A and B both drank one small 100 ml drink.

Only one of the drinks was high in alcohol.

Look at the diagram of a kidney tubule in person A and B after the drink.



→ Movement of water

Explain how you can tell from the diagram that person A's drink contained alcohol.

[2]

(iii) After the alcohol has been removed from person A's body, control mechanisms will correct the excess loss of water caused by the alcohol.

Describe these control mechanisms.

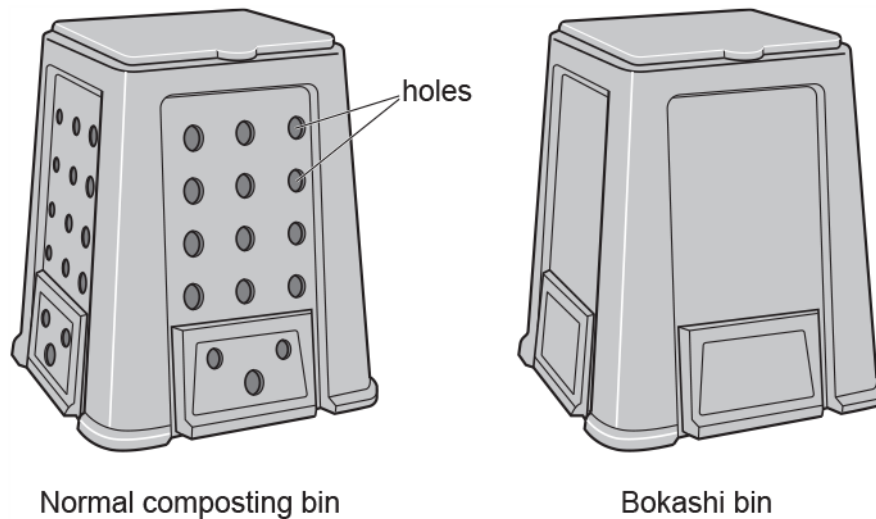
[2]

34(a) Gardeners often turn dead plant material from their garden into compost. They then add this compost to the soil where they are growing plants.

Compost can be made in a composting bin. In the bin **aerobic bacteria** turn dead plant material into compost.

Some people use a different way of making compost, called bokashi. In this process the compost is made **anaerobically**.

The drawings show a normal composting bin and a bokashi bin.



Explain the difference in the design of the two composting bins.

[2]

(b) Scientists investigate the two methods of making compost.

This is their method:

- Take one large pile of dead plant material
- Divide the material into two samples of equal mass
- Place one sample into the normal composter and place one sample into the bokashi composter
- Measure the temperature in each composter every 10 days
- After 40 days, measure the mass of the compost.

Write down **one** way that the scientists make sure that they can draw valid conclusions.

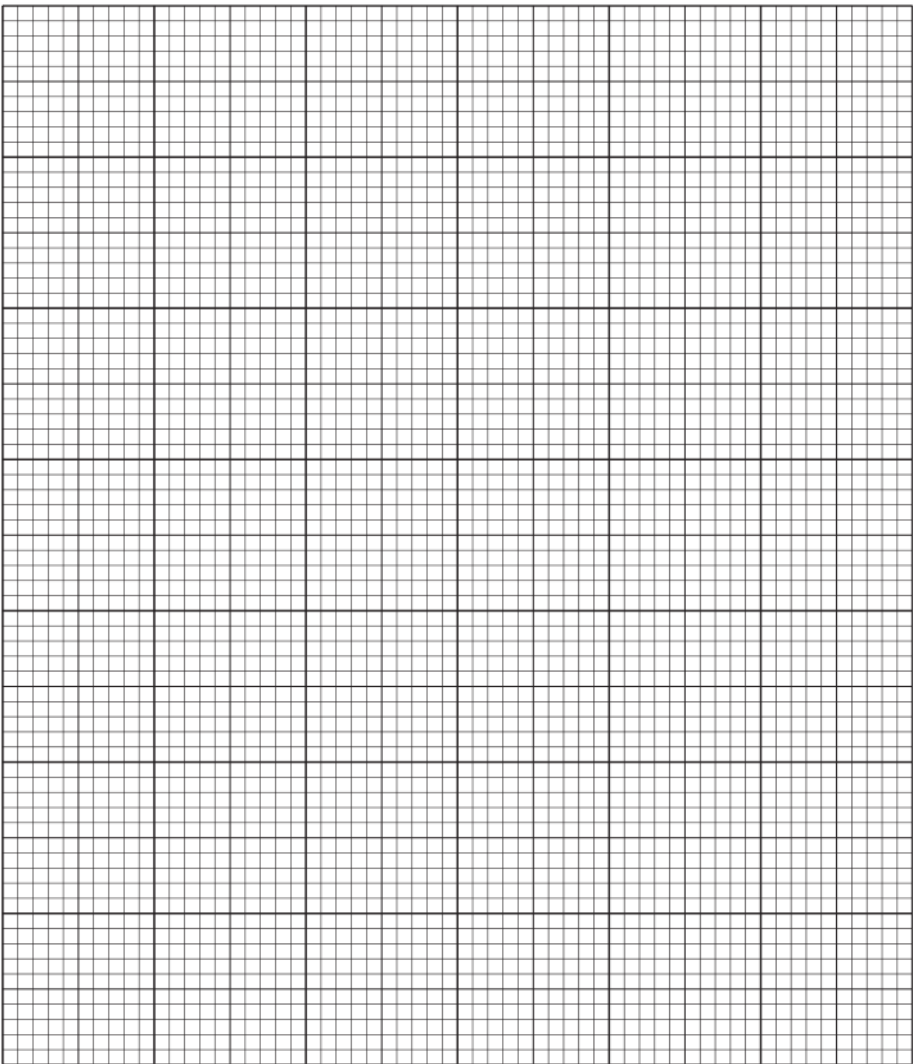
----- [1]

(c) Table 18.1 shows the scientists' temperature readings.

Time (days)	Temperature of the compost (°C)	
	normal compost	bokashi compost
0	26	26
10	70	27
20	53	29
30	42	31
40	28	28

Table 18.1

(i) Plot the scientists' results on the grid for normal and bokashi compost, and draw **two** curves of best fit.



[5]

(ii) Explain why the temperature of the compost in the **normal** bin changed as shown in the graph.

[2]

(iii) Explain the difference in the temperature changes between the aerobic normal compost and the anaerobic bokashi compost.

[2]

(d) **Table 18.2** shows the scientists' results for the mass of the compost.

	Normal compost	Bokashi compost
Mass at start (kg)	1500	1500
Mass after 40 days (kg)	750	1100

Table 18.2

A gas is given off in the formation of the compost. This causes most of the decrease in mass.

- (i) The percentage decrease in the mass of the normal compost is 50%.

Calculate the percentage decrease in the mass of the bokashi compost.

Give your answer to 2 significant figures.

Percentage decrease = ... % **[3]**

- (ii) The scientists concluded that the bokashi method of composting might be better for the environment.

Use your answer from part (i) to justify the scientists' conclusion.

[2]

35 Hypercholesterolemia (HC) is the result of a mutation in the genome. It is caused by a dominant allele on chromosome 19. The mutation involved causes a change in the DNA nucleotides.

People with HC are more likely to develop heart disease. Fig. 21.1 shows the heart of a person who has heart disease.

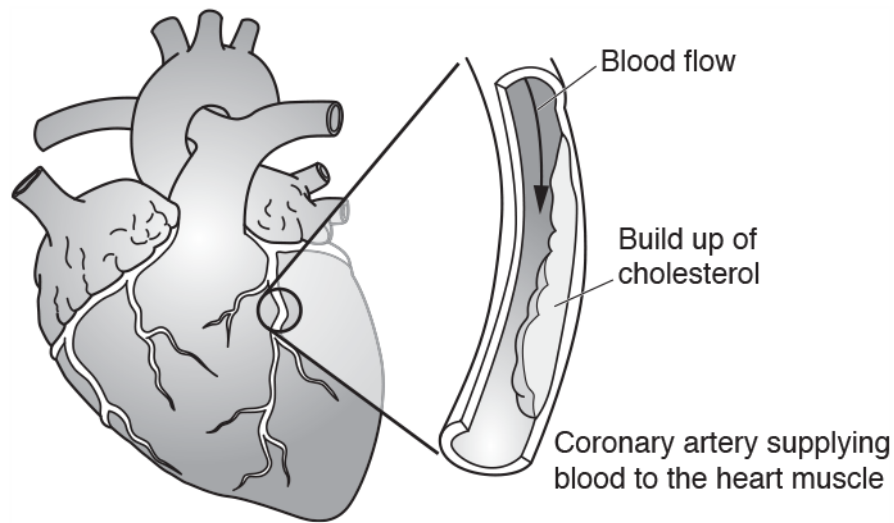


Fig. 21.1

The LDL receptor protein is found on the cell membrane of liver cells. The receptor picks up cholesterol from the blood and transports it into the liver cell. Inside the liver cell the cholesterol is broken down or used.

Explain why people who have the mutation in the allele for the LDL receptor are much more likely to develop heart disease.

[6]

36 A chemical in stevia leaves makes them taste sweet. This chemical is **not** a sugar.
People with diabetes need to know if the food they eat contains sugar.

(i) Describe how you could test some stevia leaves to prove that they do **not** contain sugar.

Reagent used -----

Method -----

Expected result -----

[3]

(ii) Will using stevia in foods help people with type 2 diabetes?

Explain your answer.

[2]

END OF QUESTION PAPER

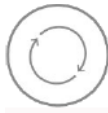
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			A	1	
			Total	1	
2			C	1	
			Total	1	
3			B	1	
			Total	1	
4			D	1	
			Total	1	
5			B	1	
			Total	1	
6	a		oxygen (1)	1	
	b		respiration (is also occurring) (1)	1	allow idea that oxygen given out is the net production
			some oxygen is used up (in respiration) / AW (1)	1	
			Total	3	
7			produces acids (1) but produces fatty acids (2)	2	
			Total	2	
8			above 60 °C the enzymes in the decomposers had denatured (1)	1	
			below 30 °C the enzymes in the decomposers were working too slowly (1)	1	
			Total	2	
9			produces acids = (1) but produces fatty acids = (2)	2	
			Total	2	
10			above 60 °C the enzymes in the decomposers had denatured (1)	1	
			below 30 °C the enzymes in the decomposers were working too slowly (1)	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			Total	2	
11			more respiration occurs (1) carbon dioxide is toxic (1)	2	allow poisonous / changes pH ignore harmful Examiner's Comments Many candidates referred to breathing, anaerobic respiration, lactic acid production etc. but few simply said that the respiration rate will increase.
			Total	2	
12	a	i	allows the animals to be compared (1)	1	
		ii	the metabolic rate is an indication of the rate of respiration (1) oxygen is needed for (aerobic) respiration (1)	2	BUT the more oxygen consumption the more respiration for a higher metabolic rate (2)
	b	i	2.5 (1)	1	
		ii	the shrew needs / uses lots of oxygen (1) shrew red blood cell has a large surface area to volume ratio (1) this means that it can pick up / release oxygen quickly (1)	3	ignore references to shrew's body surface area to volume ratio ignore pick up more oxygen
			Total	7	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
13			Any two from strain B produces alcohol faster / strain B produces more alcohol / ora (1) strain A is less tolerant (to alcohol) /ora (1) increases in alcohol levels result in a slowdown of production / fermentation rate slows as alcohol levels increase (1)	2	allow faster fermentation for strain B/ora (1) ignore references to specific gravity allow strain A is less resistant (to alcohol) /ora (1) allow yeast is killed in higher levels of alcohol (1)
			Total	2	
14			A ✓	1 (AO 1.1)	
			Total	1	
15			B ✓	1 (AO 2.2)	<u>Examiner's Comments</u> The assessment was designed to assess candidates' practical knowledge, AO2.2. By far the most common response was 'A' Benedict's reagent. Clearly candidates are used to using this reagent, but it is evident that few had any recognition of using Biuret reagent.  Candidates had a lack of knowledge of how to test for protein and this needs to be developed.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
16			Any two from: make sure there is plenty of food available (1) (control) pH (1) remove (waste) products (1)	2	ignore temperature allow control food availability (1) ignore water / moisture allow remove alcohol / toxins (that is produced)/(1) ignore control levels of alcohol extra marking points allow remove oxygen / maintain anaerobic conditions (1) allow maintain aseptic conditions / prevent contamination (1)
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
17			blood vessels / arteries are blocked/narrowed ✓ (heart muscle) gets less blood ✓ (heart muscle) gets less oxygen ✓	3 (AO 2.1)	ALLOW atheroma / plaque formed IGNORE no blood IGNORE no oxygen IGNORE references to blood circulation to body cells Examiner's Comments Over half of candidates scored at least one mark here mainly for less blood flow (to the heart muscle). A lot of candidates got confused with the blood flow to the heart muscle with blood flow to the body cells, therefore not gaining credit. Exemplar 8 demonstrates this confusion and is not credited any marks. Exemplar 8 Use the information in the diagram and your biological knowledge. The lack of consistent ^{through} ~~patent~~ flow of blood ~~to~~ the body causes the body to have to adapt as less blood flow means and causes a for less oxygen flow. The body induces around this by using anaerobic respiration to ensure enough respiration occurs in the body.
			Total	3	
18			B	1 (AO 2.1)	Examiner's Comments  AFL Very few candidates answered this challenging AO2.1 question correctly. Again, several did so by writing the number in the answer box rather than the letter. Candidates who wrote 2 were credited but it is something they should be encouraged to avoid and to only use letters A, B, C or D.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
19	a		alcohol / ethanol and carbon dioxide ✓	1 (AO 1.1)	ALLOW either order ALLOW correct formulae <u>Examiner's Comments</u> In this AO1.1 recall question, candidates seemed to either know this or got both products incorrect.
	b		Any two from: alcohol produced in yeast (not humans) / ORA✓ lactic acid produced by humans (not yeast) / ORA✓ carbon dioxide produced by yeast (not humans) / ORA✓	2 (AO 1.1)	If any incorrect product is stated, then max 1 mark. If yeast or humans are not stated assume answer refers to yeast IGNORE reference to oxygen debt / ATP production <u>Examiner's Comments</u> In general, if candidates had scored a mark on (a), they often scored marks for this AO1.1 question as well. Some candidates managed to write enough to score 1 mark, as they knew humans produced lactic acid. However, quite a few thought yeast was a plant, or that oxygen was produced.
	c	i	sucrose ✓	1 (AO 3.2a)	<u>Examiner's Comments</u> Candidates in the main were able to interpret the graph in this AO3.2 question.
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 12 award 2 marks $6.0 \div 0.5$ ✓ = 12 ✓	2 (AO 2.2)	<u>Examiner's Comments</u>  AfL This AO2.2 question was reasonably well answered. However, because candidates often did not include working out they often scored 2 marks or nothing. Several candidates did a subtraction, $6 - 0.5$ rather than dividing. This is another example of where a candidate who is encouraged to show their working out may well obtain at least 1 mark rather than none.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	glucose ✓	1 (AO 3.2a)	<u>Examiner's Comments</u> Candidates in the main were able to interpret the graph in this AO3.2 question.
		iv	(Yeast B) doesn't ferment fructose ✓ (Yeast B) produces some fermented products ✓	2 (AO 3.1a)	ALLOW (Yeast B) does not use up fructose / fructose levels decrease slightly / fructose levels remain high / higher yield of fructose / fructose levels remain constant ALLOW reverse arguments for Yeast A DO NOT ALLOW fructose is produced ALLOW fermented products increased DO NOT ALLOW fermented products produced from fructose DO NOT ALLOW produces high levels of fermented products IGNORE fermented product level stays the same / less fermented product than A <u>Examiner's Comments</u> Some candidates did not answer this AO3.1 question. This may be due to it being the last question but could be that they were unsure how to respond. Many candidates who did respond had the right ideas but did not articulate clearly enough, saying that there was more fermented product in yeast B or similar.
			Total	9	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
20		i	(no) microorganisms (in the soil) ✓ no decay (takes place) ✓	2 (AO 1.1) (AO 2.1)	AW microbes, decomposers, saprophytes, detritivores, bacteria, fungi AW decomposition, rotting, break down ALLOW not enough nitrifying bacteria to replace nitrates / no nitrates released by nitrifying bacteria = 2 IGNORE no organisms to recycle the minerals <u>Examiner's Comments</u> Very few candidates were able to apply their knowledge of microbes and decay to this question, and found it challenging to answer. Many candidates misinterpreted the question and talked about lack of oxygen for life or that Mars is too dry for life. This is demonstrated with Exemplar 4 which was given 0 marks. Exemplar 4 The conditions are different. ~~It~~ it is really hot on mars so the soil would dry out. [2]

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	plants release oxygen by photosynthesis ✓ organisms in the soil / microbes / animals release carbon dioxide by respiration ✓	2 (AO 2.2)	ALLOW correct word (or symbol) equations for photosynthesis linked to plants and respiration linked to organisms in the soil / microbes / animals AW microbes, decomposers, saprophytes IGNORE breathe out carbon dioxide IGNORE plants will respire and give out carbon dioxide ALLOW 1 mark for plants release oxygen/photosynthesis and microbes give out carbon dioxide/respire if no other marks are awarded. <u>Examiner's Comments</u> Candidates had to apply their knowledge and understanding of gases given off by plants in photosynthesis and organisms in carrying out respiration to explain why air would no longer needed to be added after a while. Most non-scoring responses were too vague and just stated gases as in the stem of the question.
			Total	4	
21			B	1 (AO 2.1)	
			Total	1	
22			B	1 (AO 1.2)	
			Total	1	
23			A	1 (AO 1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
24	a		alcohol / ethanol and carbon dioxide ✓	1 (AO 1.1)	ALLOW either order ALLOW correct formulae Examiner's Comments This question was well answered by the majority of candidates.
	b		Any two from: alcohol produced in yeast (not humans) / ORA✓ lactic acid produced by humans (not yeast) / ORA✓ carbon dioxide produced by yeast (not humans) / ORA✓	2 (AO 1.1)	If any incorrect product is stated, then max 1 mark. If yeast or humans are not stated assume answer refers to yeast IGNORE reference to oxygen debt / ATP production Examiner's Comments Although most candidates identified differences in the products formed, there were a number of incorrect references to the energy released by the two processes. One of these is seen in exemplar 2, which only scored one mark. Exemplar 2 1. Anaerobic respiration in humans produces lactic acid. 2. Yeast cells produce more energy anaerobically than human muscle cells do. [2]
	c	i	sucrose ✓	1 (AO 3.2a)	Examiner's Comments Most candidates correctly identified the sugar as sucrose.
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 12 award 2 marks $6.0 \div 0.5$ ✓ = 12 ✓	2 (AO 2.2)	Examiner's Comments Most candidates could extract the correct data from the graph and complete the calculation.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	glucose ✓	1 (AO 3.2a)	Examiner's Comments This question proved to be more challenging with both sucrose and fructose being chosen equally as incorrect answers.
		iv	(Yeast B) doesn't ferment fructose ✓ (Yeast B) produces some fermented products ✓	2 (AO 3.1a)	ALLOW (Yeast B) does not use up fructose / fructose levels decrease slightly / fructose levels remain high / higher yield of fructose / fructose levels remain constant ALLOW reverse arguments for Yeast A DO NOT ALLOW fructose is produced ALLOW fermented products increased DO NOT ALLOW fermented products produced from fructose DO NOT ALLOW produces high levels of fermented products IGNORE fermented product level stays the same / less fermented product than A Examiner's Comments The examiners were looking for an understanding that yeast B does not use up as much fructose but still produces some fermented product. A number of candidates stated that fructose is actually produced by yeast B and others claimed that it also produces high concentrations of fermented product. Exemplar 3 makes both of these errors and so does not score. Exemplar 3 <i>Yeast B produced 3.25g/100ml of fructose in 24 hours which was more than Yeast A did at only 0.4g/100ml. Yeast B also produced 0.5g/100ml of fermented product which is still high.</i>
			Total	9	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
25	a		clots the blood ✓ prevents bleeding / allows wounds to heal / forms a scab ✓	2 (AO 1.1)	IGNORE clump blood ALLOW prevents pathogens getting into the body <u>Examiner's Comments</u> There was some confusion in the responses describing the role of platelets whereby candidates thought platelets had a role in the specific immune response. Only higher ability candidates gained a mark here.
	b		R Rr R RR Rr r Rr rr ratio 3 : 1 ✓ ✓ ✓	3 (AO 2.1) 	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c		Any three from: variation with some rats resistant and some who are not ✓ (resistant rats) more likely to survive/less likely to be killed ORA ✓ (resistant rats more likely) reproduce ORA ✓ pass on the allele / gene for resistance ORA ✓	3 (AO 2.1)	IGNORE selective breeding ALLOW mutation for resistance ALLOW offspring produced / breed together ALLOW pass on advantageous gene IGNORE trait is passed on / genes are passed on <u>Examiner's Comments</u> Candidates had to apply their knowledge of natural selection to explain why the percentage of resistant rats was increasing. There were a range of marks given for this question. Most none scoring responses were too vague and not using key terms. Most candidates did not appreciate that there was variation for resistance within the population.
	d		Any two from: (stops/less) respiration ✓ (no/less) energy/ATP ✓ key process interrupted e.g. cell metabolism/protein synthesis/chemical reactions/active transport ✓	3 (AO 2.1)	<u>Examiner's Comments</u> This question was one of the most challenging application of knowledge and understanding questions. The most common awarded mark was appreciation that energy release would be affected. A lot of responses were very general and would say the rat can't breathe or can't get any oxygen.
			Total	11	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
26		i	provide energy / release energy / produce ATP ✓	1 (AO1.1)	
		ii	carbon dioxide ✓ water ✓	2 (AO1.1)	ALLOW correct answers in either order ALLOW correct formulae in either order IGNORE oxygen and glucose when shown as reactants IGNORE energy
		iii	exothermic ✓	1 (AO1.1)	
			Total	4	
27			A ✓	1 (AO1.1)	
			Total	1	
28			fatty acids are obtained by breaking down/digesting larger molecules ✓ idea (originates) from lipids ✓	2 (AO2.1)	ALLOW using lipase / enzyme ALLOW triglycerides ALLOW lipids/fats/oils
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
29	a		to let air / oxygen in ✓ for (aerobic) respiration ✓	2 (AO1 x 2.1) (AO1 x 1.1)	DO NOT ALLOW carbon dioxide DO NOT ALLOW anaerobic respiration
	b		to allow a valid comparison of the results ✓	1 (AO3.1b)	
	c	i	correct plots ✓✓ smooth curved line between points ✓	3 (AO3 x 2.2)	ALLOW +/- half a square All correct = 2 marks 3 or 4 plots correct = 1 mark DO NOT ALLOW sketchy line / line thicker than half a square
		ii	increases up to 10 days/70°C ✓ then decreases ✓	2 (AO3.1a)	ALLOW increases up to 9-11 days ALLOW increases by 44°C
		iii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 39 (°C) award 2 marks 70-31 ✓ = 39 (°C) ✓	2 (AO2.2) (AO1.2)	
		iv	normal compost is made by aerobic respiration ✓ aerobic respiration releases more energy than anaerobic respiration ✓	2 (AO2 x 2.1)	2 correct ticks = 2 marks 1 correct ticks = 1 mark 3 ticks two correct = 1 mark 3 ticks one correct = 0 marks 4 or more ticks = 0 marks
	d	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 8 (kg) award 3 marks 1500-1200 OR 300 ✓ 300/40 OR 7.5 ✓ = 8 (kg) ✓	3 (AO3 x 2.2)	 ALLOW one mark for clear evidence of rounding incorrect answer correctly to the nearest whole number
		ii	less carbon dioxide is produced ✓	1 (AO3.1b)	ALLOW less contribution to global warming / greenhouse effect / climate change
			Total	16	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
30	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Provides a detailed explanation linking cholesterol to heart disease. AND Provides a detailed analysis to explain if this link is supported by the graph. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Provides a detailed explanation linking cholesterol to heart disease. OR Provides a detailed analysis to explain if this link is supported by the graph. OR Provides a basic explanation linking cholesterol to heart disease. AND Provides a basic analysis of the information to explain if this link is supported by the graph. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Provides a basic explanation linking cholesterol to heart disease. OR Provides a basic analysis of the information to explain if this link is supported by the graph. OR Demonstrates knowledge of the importance of the blood supply to the heart muscle. <i>There is an attempt at a logical structure with a line of reasoning. The information is</i>	6 (AO2 x 1.1) (AO2 x 2.1) (AO2 x 3.1b)	AO1.1 Demonstrate knowledge and understanding of the importance of the blood supply to the heart muscle. - coronary artery carries blood to heart/muscle - blood takes oxygen/glucose to the heart/muscle - heart/muscle carries out aerobic respiration/needs energy - energy is needed for the heart/muscle to contract AO2.1 Apply knowledge and understanding of the requirements of the heart muscle - cholesterol build up (partially) blocks the blood flow in the artery - this reduces blood/oxygen/glucose carried to the heart/muscle - heart/muscle carries out less aerobic respiration/less energy released - heart/muscle can't contract as forcefully AO3.1b Analyse information and ideas to interpret the results on the study Support the link: - men with heart disease had (on average) a higher blood cholesterol level. - Men without heart disease had (on average) a lower blood cholesterol level. - build-up of cholesterol can lead to heart disease Doesn't support the link: - considerable overlap between the two groups - men can still have heart disease with low blood cholesterol levels - Men without heart disease can still have high blood cholesterol levels

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			<i>in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit</i>		
			Total	6	
31			B ✓	1 (AO2.1)	
			Total	1	
32			peak CO ₂ level is close to the peak of ripening chemical level / CO ₂ levels increasing as production of chemical increases ✓ process is respiration ✓	2 (AO2 x 3.2b)	DO NOT ALLOW there is a spike/peak in CO ₂ as the chemical increases ALLOW fermentation
			Total	2	
33		i	polymers ✓ monomers ✓	2 (AO2 x 1.1)	
		ii	(A has) less ADH released/present OR ✓ so less/no reabsorption of water / permeability of collecting duct is lower/has not changed ✓	2 (AO2 x 2.1)	ALLOW ADH release is inhibited in A / lack of ADH production in A IGNORE less movement of water out of the tubule (must state reabsorption)
		iii	Any two from: (low) water potential/(decreased) water levels are detected by hypothalamus ✓ will cause the release of ADH/ increased ADH levels ✓ increased permeability of collecting duct/kidney tubules / increased reabsorption of water (into blood) / decreased urine production / urine will become more concentrated ✓	2 (AO2 x 2.1)	IGNORE brain
			Total	6	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
34	a		normal bin has holes to allow in air / oxygen ✓ (making normal compost) so aerobic respiration occurs ✓	2 (AO2.1) (AO1.1)	ALLOW converse arguments for bokashi bin ALLOW aerobic bacteria carry out respiration IGNORE bacteria work aerobically
	b		used the same pile of dead plant material for both composters / used same plant type / used equal mass in both composters ✓	1 (AO2.2)	ALLOW used the same time interval for both composters ALLOW used the same water/moisture content for both composters ALLOW idea of same external conditions e.g. put both in same place / external temperature kept the same / kept in the same environment IGNORE references to fair testing
	c	i	Axes – both correctly labelled, including units ✓ Axes - even scales occupying more than half of the grid ✓ Plotting - all points correctly plotted ✓ Line - lines labelled or a key ✓ Line - points with curve of best-fit lines ✓	5 (AO5 x 2.2)	Must have time on x-axis and temperature on y-axis ALLOW +/- half a square at least 8 points correctly plotted IGNORE extrapolated lines
		ii	temperature increased as compost decomposed / bacteria released heat by respiration ✓ temperature starts to drop as decomposition slows down/complete / bacterial respiration slows ✓	2 (AO2 x 2.1)	ALLOW rise in temperature due to energy released by respiration ✓ ALLOW bacterial activity slows (if respiration already mentioned) ALLOW temperature starts to drop as enzymes in respiration denature at high temperatures
		iii	idea that decomposition in bokashi (method) bin much slower ✓ anaerobic respiration releases less heat/energy than aerobic respiration ✓	2 (AO2 x 2.1)	Enter text here.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	d	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 27 (%) award 3 marks 400 / 1500 x 100 ✓ 26.6 (%) ✓ = 27 (%) ✓	3 (AO2.2) (AO2.2) (AO1.2)	If answer = 26.6 (%) award 2 marks ALLOW ECF for correct rounding
		ii	idea that the gas given off is carbon dioxide ✓ less greenhouse gas produced / less likely to result in global warming / less contribution to greenhouse effect ✓	2 (AO2.2) (AO3.1b)	ALLOW for 2 marks less carbon dioxide produced which is a greenhouse gas ALLOW correct formula ALLOW explanations of the greenhouse effect IGNORE references to environmental damage/not environmentally friendly/pollution/not good for the environment
			Total	17	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
35	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Demonstrates a knowledge of the importance of the blood supply to the heart. AND Applies knowledge to explain why a failure of this blood supply can lead to heart disease. AND Analyses the information to explain the link between a lack of LDL protein and heart disease. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Demonstrates a knowledge of the importance of the blood supply to the heart. AND Applies knowledge to explain why a failure of this blood supply can lead to heart disease. OR Demonstrates a knowledge of the importance of the blood supply to the heart. AND Analyses the information to explain the link between a lack of LDL protein and heart disease. OR Applies knowledge to explain why a failure of this blood supply can lead to heart disease. AND Analyses the information to explain the link between a lack of LDL protein and heart	6 (AO2 x 1.1) (AO2 x 2.1) (AO2 x 3.1a)	AO1.1 Demonstrate knowledge and understanding of the importance of the blood supply to the heart muscle. • blood in the coronary artery supplies heart muscle • oxygen / glucose is supplied to the muscle • this is needed for the muscle to contract/for respiration AO2.1 Apply knowledge and understanding of the requirements of the heart muscle • without oxygen / glucose the heart muscle cannot <u>respire</u> • <u>energy</u> from respiration is needed for the muscle to contract AO3.1a Analyse information and ideas to interpret the effects of lack of LDL receptor protein. • without LDL receptor protein there will be more cholesterol in the blood / cholesterol levels will be too high to be removed/broken down • increased build up of cholesterol in the coronary artery will increase the risk of heart disease / decrease blood flow to the heart muscle

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			disease. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Demonstrates a knowledge of the importance of the blood supply to the heart. OR Applies knowledge to explain why a failure of this blood supply can lead to heart disease. OR Analyses the information to explain the link between a lack of LDL protein and heart disease. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit</i>		
			Total	6	
36		i	use Benedicts (reagent) ✓ heat / boil ✓ no change in colour / stays blue / does not go red ✓	3 (AO3 x 1.2)	
		ii	Yes (no mark) blood sugar levels will be controlled/not rise ✓ idea of a sugar replacement ✓	2 (AO1 x 3.2a) (AO1 x 2.1)	If No chosen = 0 marks IGNORE blood sugar levels will decrease ALLOW less sugar eaten
			Total	5	