

OCR GCSE GATEWAY BIOLOGY A • J247

BIOLOGY



EXAM QUESTION PACK

WS1.3 ANALYSIS AND EVALUATION

SCORE

/159

PERCENTAGE

%

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Gateway Biology A (9-1)

Analysis and evaluation

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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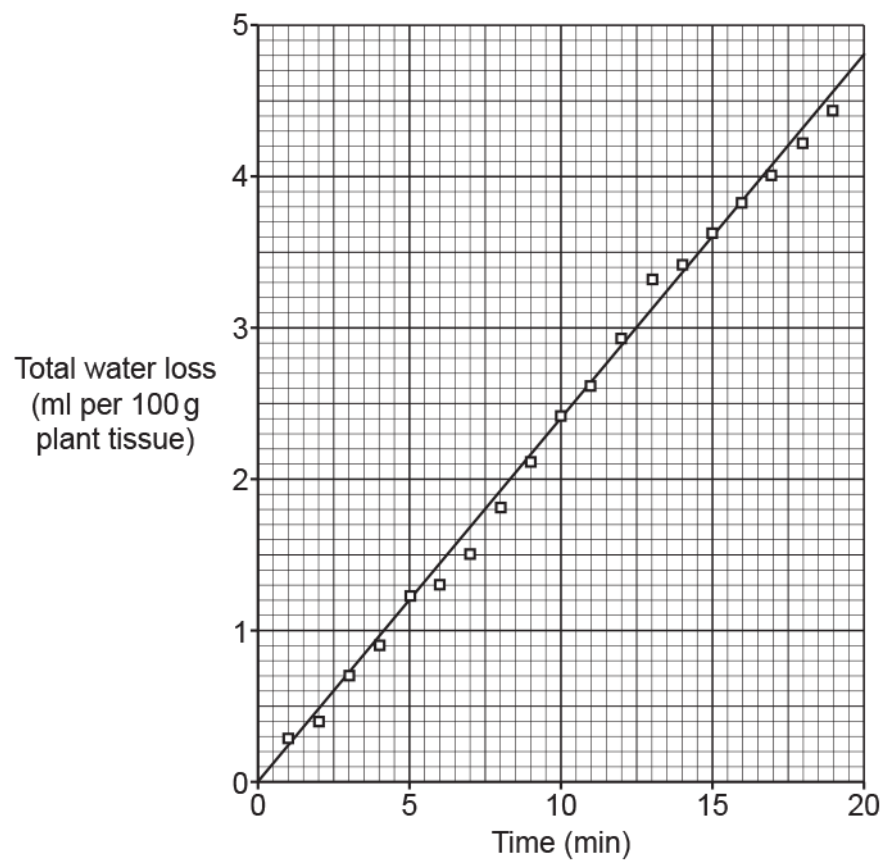
INSTRUCTIONS TO CANDIDATES

- 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 **159**.
- The total number of marks may take into account some 'either/or' question choices.

1 The graph shows total water loss from a plant.



Calculate the water lost between 5 and 15 minutes using the line of best fit.

- A 2.2 ml per 100 g
- B 2.4 ml per 100 g
- C 2.6 ml per 100 g
- D 2.8 ml per 100 g

Your answer

[1]

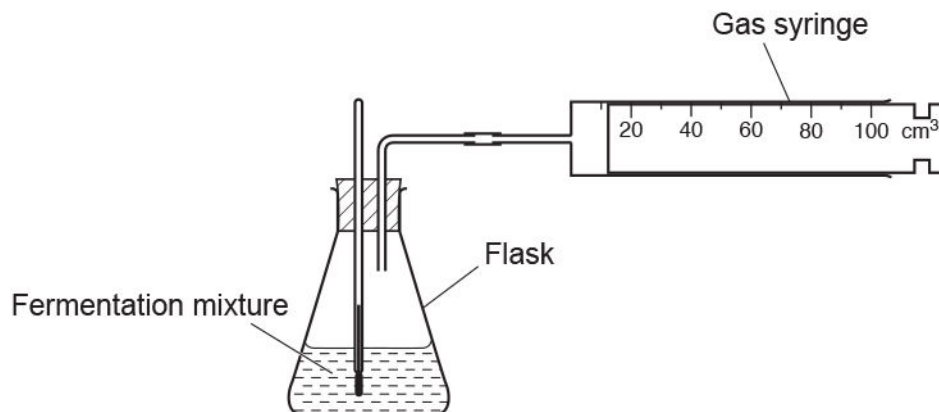
2(a) Fermentation involves enzymes breaking down sugar and releasing carbon dioxide gas.

The volume of carbon dioxide released can be used to measure how fast these enzymes are working.

A student investigates if fermentation works faster at 25 °C or 30 °C.

She measures the volume of carbon dioxide released in 10 minutes.

The diagram shows the apparatus she uses.



Using a Bunsen burner to heat a water bath is **one** way the student could keep the flask at a constant temperature.

(i) What other way could be used to keep the flask at a constant temperature?

[1]

(ii) She chooses to use a Bunsen burner and water bath.

Give **one** safety precaution she should take.

[1]

(iii) Explain why using a Bunsen burner and water bath may introduce errors into her results.

[2]

(b) The table shows the student's results.

Temperature (°C)	Volume of carbon dioxide gas released in 10 minutes (cm ³)				
	Trial 1	Trial 2	Trial 3	Mean	Range
25	23	25	22	23	22–25
30	34	29	33		29–34

(i) Calculate the mean for the results at 30 °C and complete the table.

[2]

(ii) The student repeated the experiment at two more temperatures, 20 °C and 35 °C, to get enough readings to plot a line graph.

Which measurement should the student plot on the x-axis?

[1]

(iii) Describe one way that the range would improve any conclusions made from the graph.

[1]

(iv) The mean volume at a temperature of 20 °C was 15 cm³ and for a temperature of 35 °C it was 27 cm³.

Describe what the student's results show about the effect of temperature on enzyme activity.

[2]

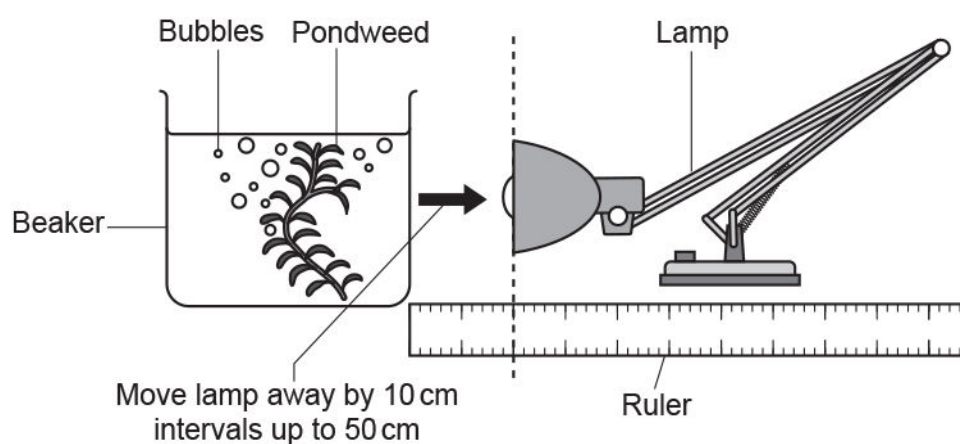
3(a) Two students investigate photosynthesis. Look at the notes from their investigation.

Aim of the experiment

To use pondweed to see how light intensity affects the rate of photosynthesis.

Method

1. Set up the apparatus as in the diagram.
2. Leave the pondweed for five minutes so it can adjust to the new light intensity.
3. Count the number of bubbles given off by the pondweed in one minute.
4. Move the lamp 10 cm further away from the beaker.
5. Leave the pondweed for five minutes so it can adjust again.
6. Count the number of bubbles given off by the pondweed in one minute.
7. Repeat by moving the lamp further away from the beaker by 10 cm intervals until 50 cm is reached.



What is the **independent** variable in their investigation?

[1]

(b)

- (i) Explain why counting the number of bubbles will not give an **accurate** measure of the rate of photosynthesis.

----- [2]

- (ii) Describe how the students could develop their investigation to improve the **accuracy** of their results.

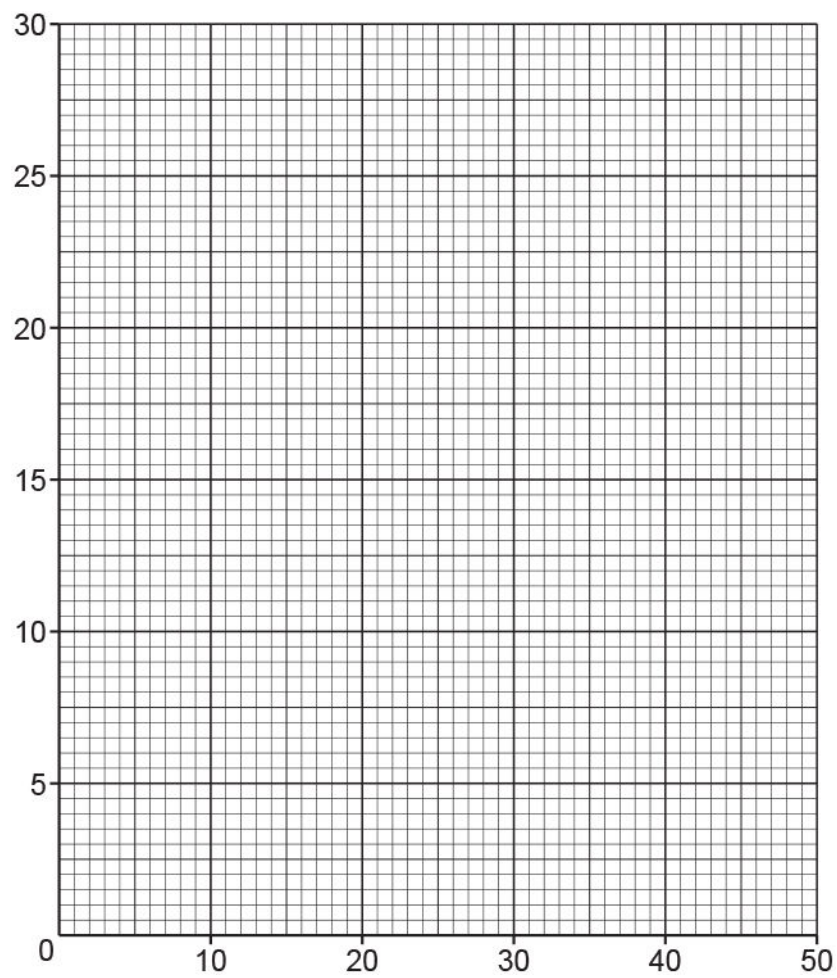
----- [2]

- (c) The table shows the results.

Distance from lamp to beaker (cm)	Number of bubbles given off (per minute)
10	30
20	14
30	6
40	2
50	0

- (i) One student started to draw a graph but did not finish.

Complete the graph using the results in the table and draw a curve of best fit.



[4]

(ii) Write down what the students could conclude from their investigation.

Include data from the results table in your answer.

[2]

4 Some students investigate the effect of the surface area : volume ratio on the rate of diffusion in animal cells.

They use hydrochloric acid and gelatine cubes that have been stained blue using a pH indicator solution. The indicator will turn red in acidic conditions.

They put different sized cubes into 3 different test tubes of hydrochloric acid and time how long it takes for the cubes to completely change to red.

Fig. 21.1 shows the apparatus they use.

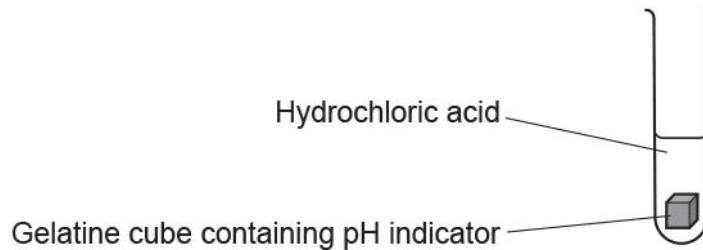


Fig. 21.1

The table shows the students' results.

Length of each side of the cube (mm)	surface area : volume ratio	Time to completely change colour (seconds)
2		32
4	3 : 2	61
6	1 : 1	170

(i) Calculate the surface area : volume ratio for the cube with sides of 2 mm.

surface area : volume ratio = ... [2]

(ii) What conclusion can be made about the effect of surface area : volume ratio on the rate of diffusion?

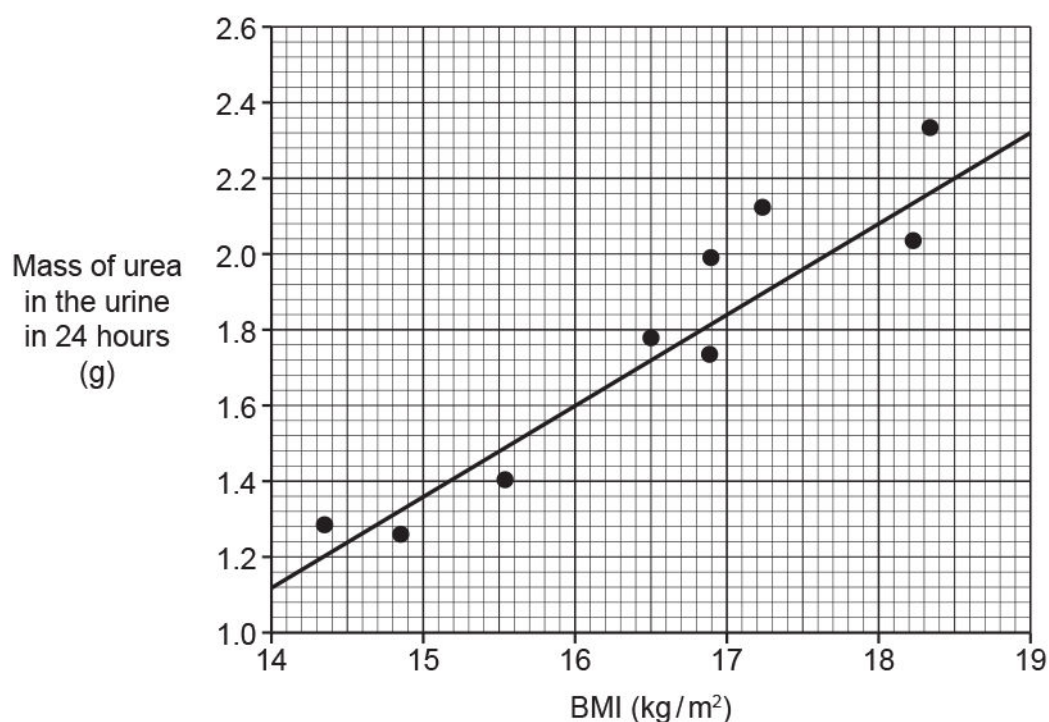
[1]

(iii) Emphysema causes some of the walls of alveoli in the lungs to break down. This produces a smaller number of larger air sacs.

Use the results to explain the effect of emphysema on oxygen diffusing into the blood.

[2]

- 5 Fig. 22.1 shows the mass of urea in the urine plotted against the BMI (Body Mass Index) for nine boys. BMI is a value often used to see if a person is a healthy mass for their height.



- (i) What does the graph show about the relationship between BMI and the mass of urea in the urine?

----- [1]

- (ii) A boy has a BMI of 16. He produces 1000 cm^3 of urine in 24 hours.

Calculate the concentration of urea in the boy's urine.

Concentration = ...g / cm^3
[2]

- (iii) Fig. 22.2 shows the mass of urea in the urine against the BMI for nine **different** boys.

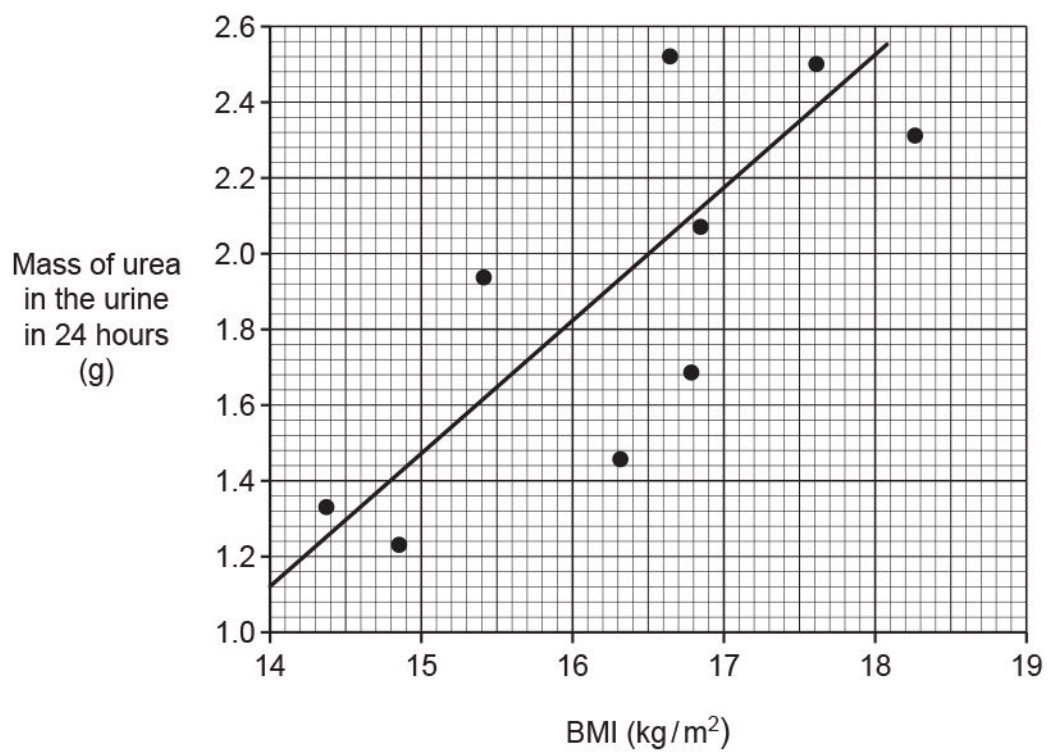


Fig. 22.2

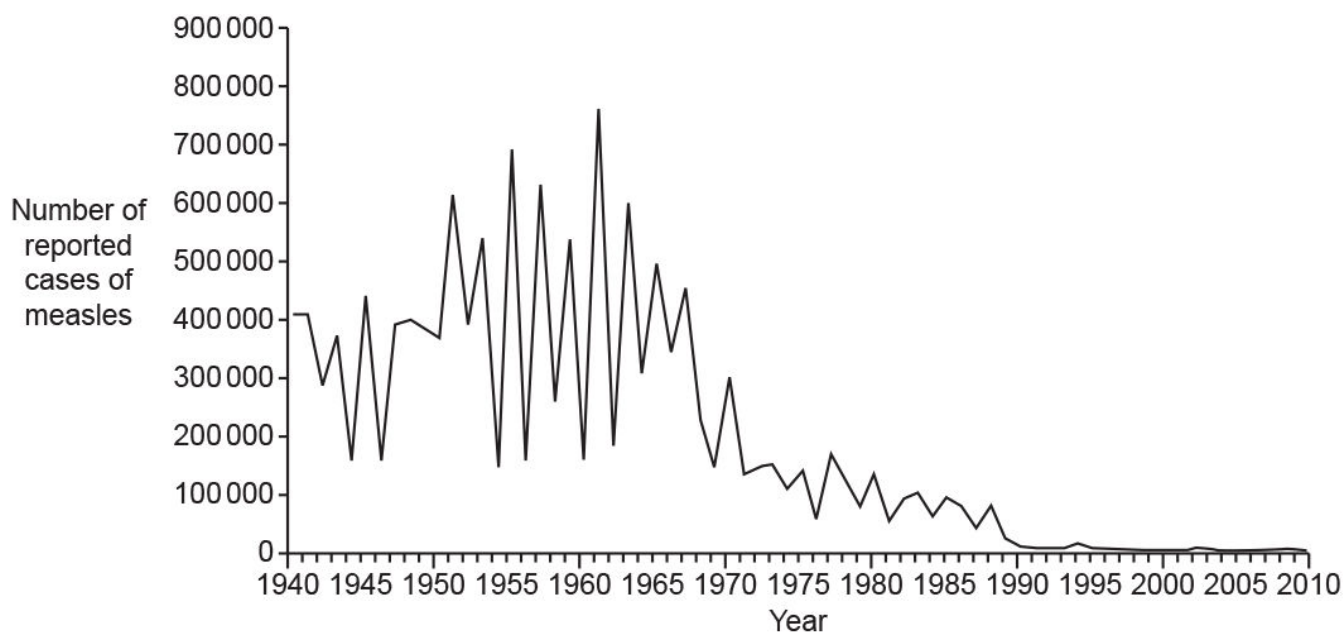
Give **two** differences in the relationship between BMI and the mass of urea in the urine shown in Fig. 22.1 and Fig. 22.2.

1 _____

2 _____

[2]

6 The graph shows the number of reported cases of measles in England and Wales between 1940 and 2010.



In which year was the measles vaccine likely to have been introduced?

- A 1940
- B 1952
- C 1968
- D 1982

Your answer

[1]

7(a) Scientists can estimate the number of insects on a tree using capture-recapture.

First, they collect some insects from the tree.

Fig. 18.2 shows the equipment they use.

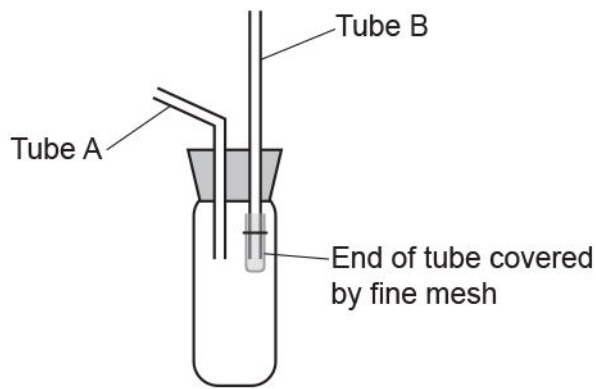


Fig. 18.2

They capture 25 insects from a tree and then mark them. This is their first sample.

They then release the insects and sample the tree again two days later. In this second sample there were 30 insects and 3 had been marked.

- (i) Estimate the population size of insects on the tree.

Use this formula:

$$\text{Estimated population size} = \frac{\text{Number in first sample} \times \text{Number in second sample}}{\text{Number in second sample previously marked}}$$

Estimated population size = ... [2]

- (ii) To mark each insect the scientists put a small spot of paint on the underside of the insect.

Explain why they marked the underside of the insects and not the top.

----- [2]

- (b) Scientists want to see if there is a link between the level of pollution in the air and the number of insects on trees.

They sample trees at different distances from a factory that was releasing sulfur dioxide.

Fig. 18.3 shows their results.

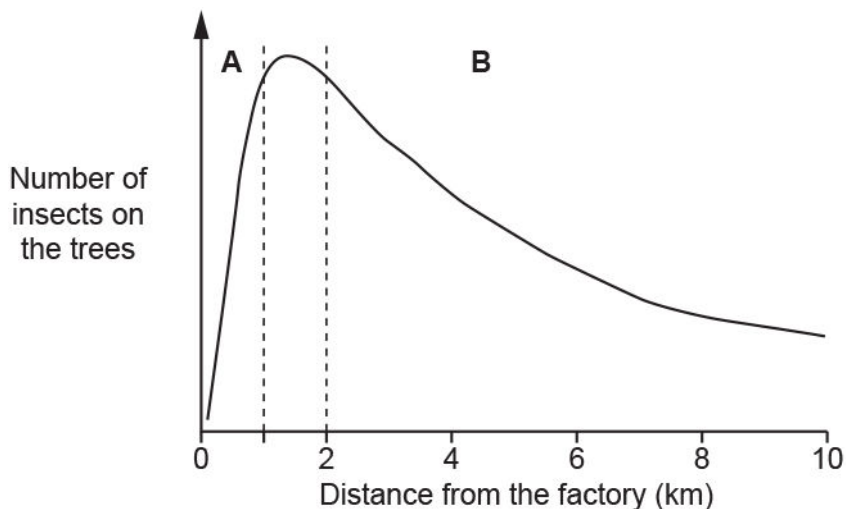


Fig. 18.3

- (i) The scientists found that sulfur dioxide can make the waxy cuticle of leaves thinner.

Suggest how this could explain the number of insects on the trees, further from the factory, in section B of the graph in Fig. 18.3.

[2]

- (ii) Look at section A of the graph in Fig. 18.3. Which is a possible explanation for the shape of the graph nearest the factory, in section A?

Tick (✓) one box.

Low concentrations of sulfur dioxide kill the insects.

☐

Low concentrations of sulfur dioxide make the insects reproduce faster.

☐

Very high concentrations of sulfur dioxide kill the insects.

☐

Very high concentrations of sulfur dioxide make the insects reproduce faster.

☐

[1]

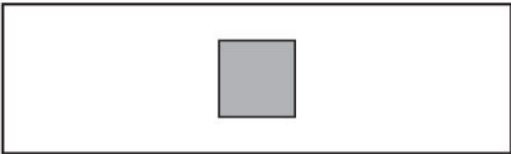
8 Fanconi anaemia is a genetic disorder. The disorder causes a decrease in the number of platelets in the blood.

Fanconi anaemia also causes a decrease in white blood cells and red blood cells.

The table shows ranges for blood components in people **without** Fanconi anaemia.

Blood component	Number per mm ³
red blood cell	4.5 million – 6.5 million
white blood cell	6.0 thousand – 16.0 thousand
platelet	0.15 million – 0.40 million

(i) The diagram shows a microscope slide containing blood from a patient.



The volume of blood under the slide is 0.1 mm³ and it contains 1000 white blood cells.

Calculate the number of white blood cells per mm³ of blood.

Number = ... per mm³ [2]

(ii) Does the blood sample provide evidence that the patient has Fanconi anaemia?

Use the table and your answer to part (i) to justify your answer.

-----[1]

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

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]

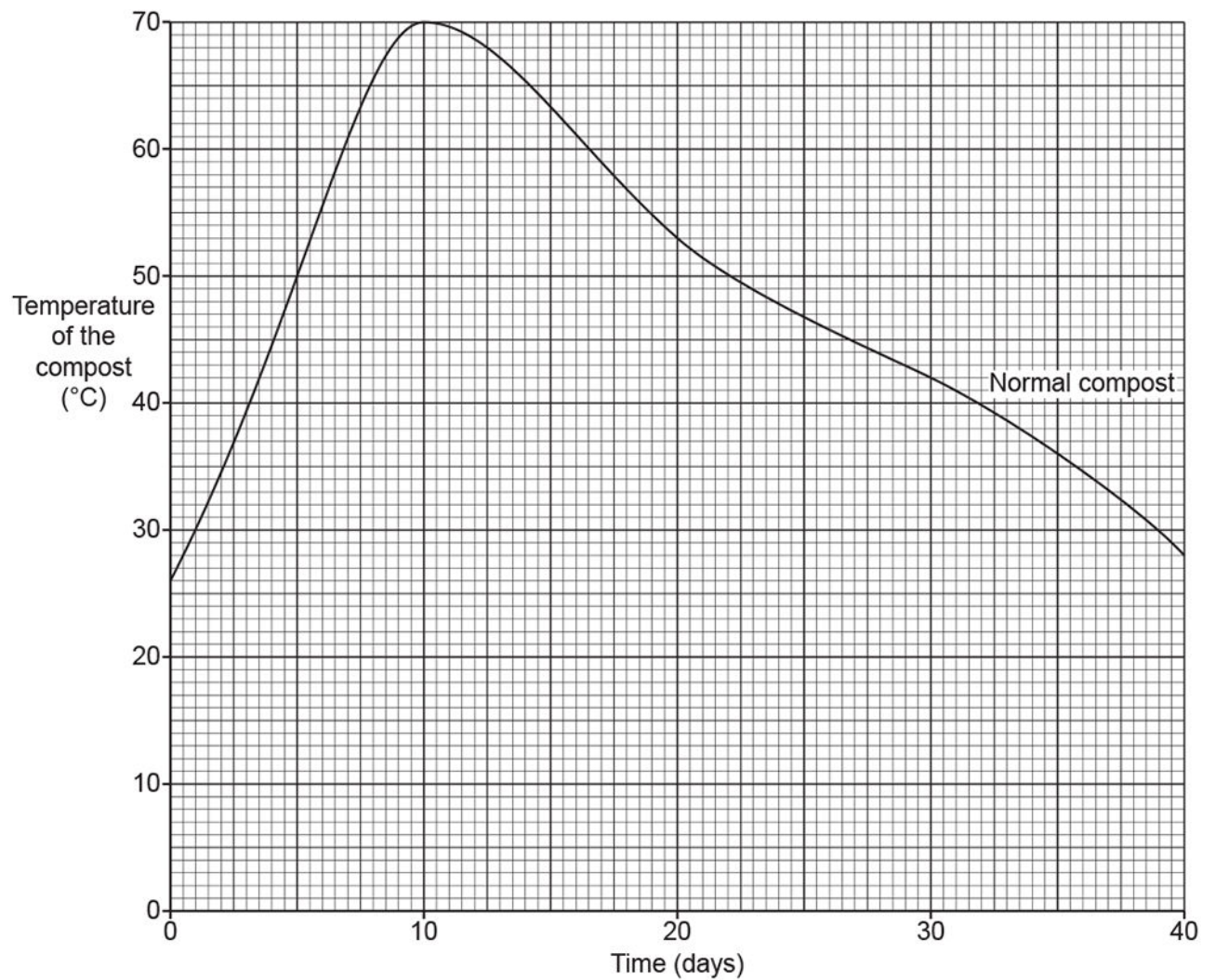
(b) **Table 20.1** shows the scientists' temperature measurements.

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.

- (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.

☐

(c) 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]

10(a) 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.

A woman who does **not** have HC and a man who is heterozygous are expecting a baby.

What is the probability of the baby having HC?

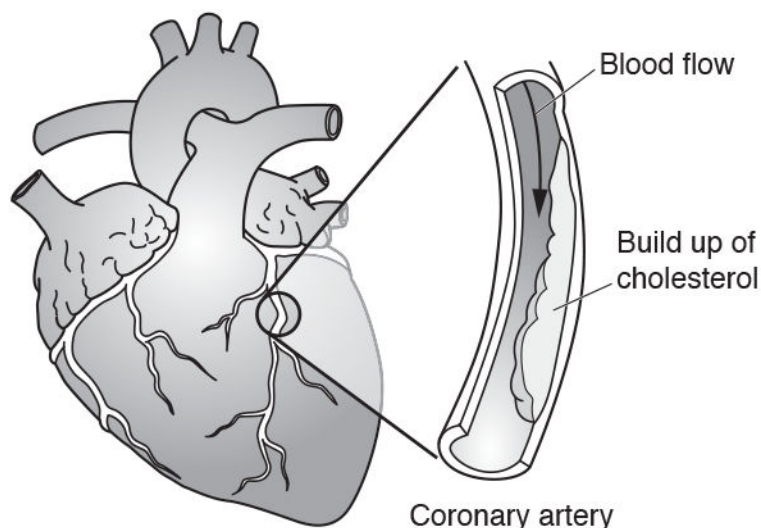
Complete the genetic diagram to explain your answer.

D is the dominant HC allele and d is the recessive allele.

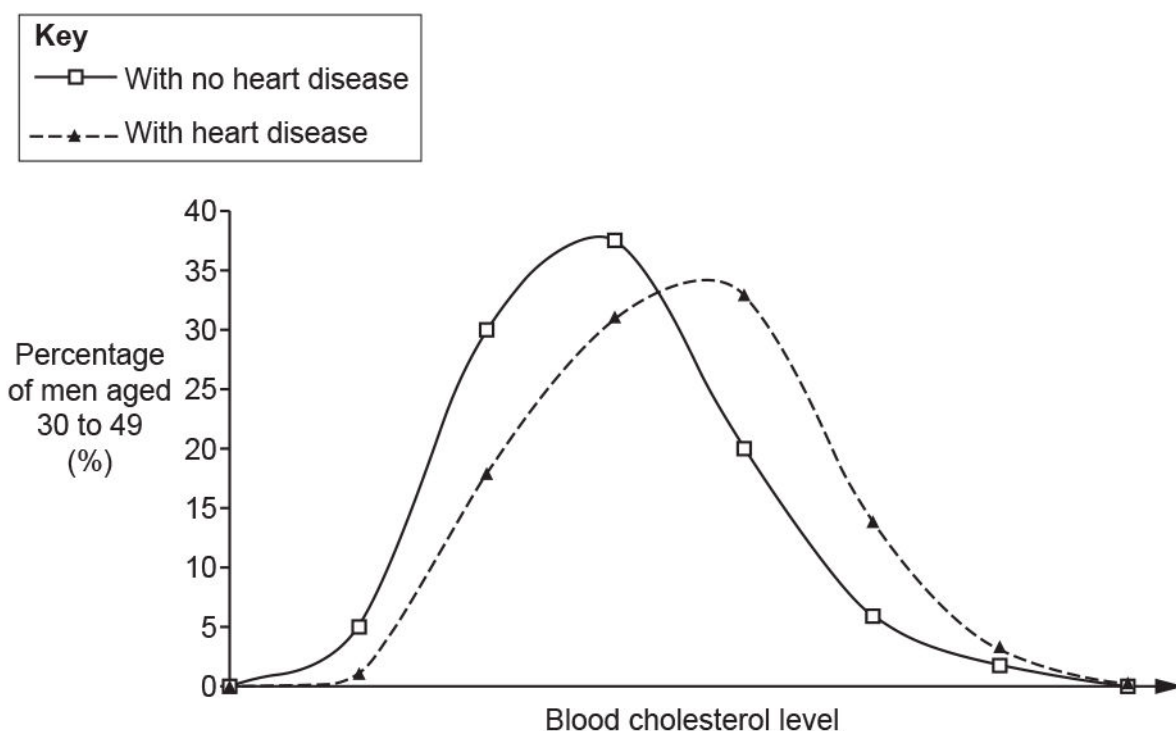
		Man	
		D	d
Woman	d		
	d		

Probability = ... [2]

- (b) * 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.

Use evidence from the diagram and the graph in your answer.

[6]

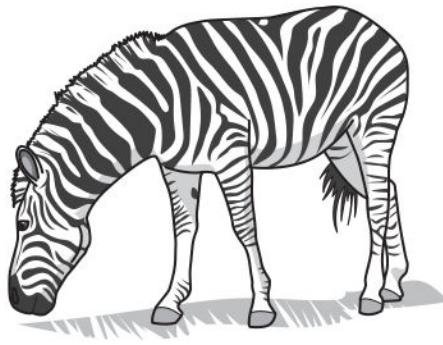


Fig. 23.1

Scientists have tried to find out why zebras have evolved stripes on their body.

One theory is that the stripes help to keep the zebra cooler than other colours. Scientists did an experiment to test this theory. They covered barrels of cold water with the skin of different animals. Then they measured the temperature of the water several hours later.

The results are shown in Fig. 23.2.

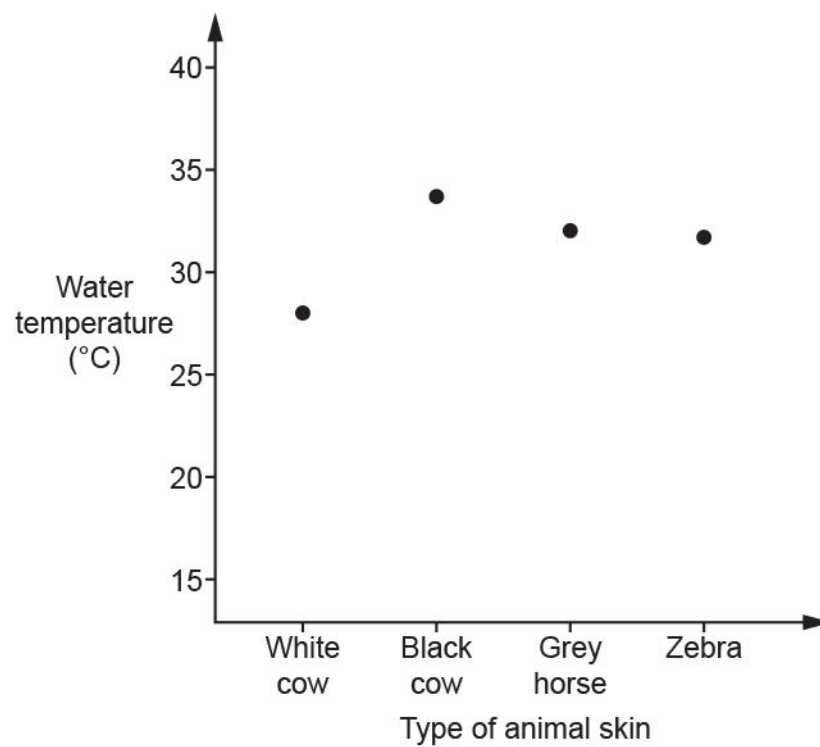


Fig. 23.2

- (i) Do the results in **Fig. 23.2** support the theory that stripes keep zebras cool?
Explain your answer.

----- [1]

- (ii) The scientists were aiming to investigate if it was **only** the colour of the skin that affected temperature regulation.

Suggest **one** improvement the scientists could make to ensure they **only** investigate the **colour** of the skin.
Explain your answer.

----- [1]

12 Some students investigate the effect of the surface area : volume ratio on the rate of diffusion in animal cells.

They use hydrochloric acid and gelatine cubes that have been stained blue using a pH indicator solution. The indicator will turn red in acidic conditions.

They put different sized cubes into 3 different test tubes of hydrochloric acid and time how long it takes for the cubes to completely change to red.

Fig. 16.1 shows the apparatus they use.

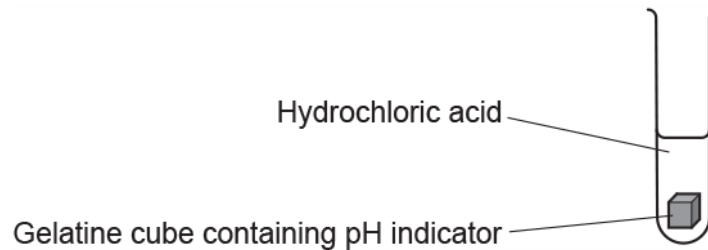


Fig. 16.1

The table shows the students' results.

Length of each side of the cube (mm)	surface area : volume ratio	Time to completely change colour (seconds)
2		32
4	3 : 2	61
6	1 : 1	170

(i) Calculate the surface area : volume ratio for the cube with sides of 2 mm.

surface area : volume ratio = ... [2]

(ii) What conclusion can be made about the effect of surface area : volume ratio on the rate of diffusion?

----- [1]

(iii) Emphysema causes some of the walls of alveoli in the lungs to break down. This produces a smaller number of larger air sacs.

Use the results to explain the effect of emphysema on oxygen diffusing into the blood.

----- [2]

13 Fig. 17.1 shows the mass of urea in the urine plotted against the BMI (Body Mass Index) for nine boys. BMI is a value often used to see if a person is a healthy mass for their height.

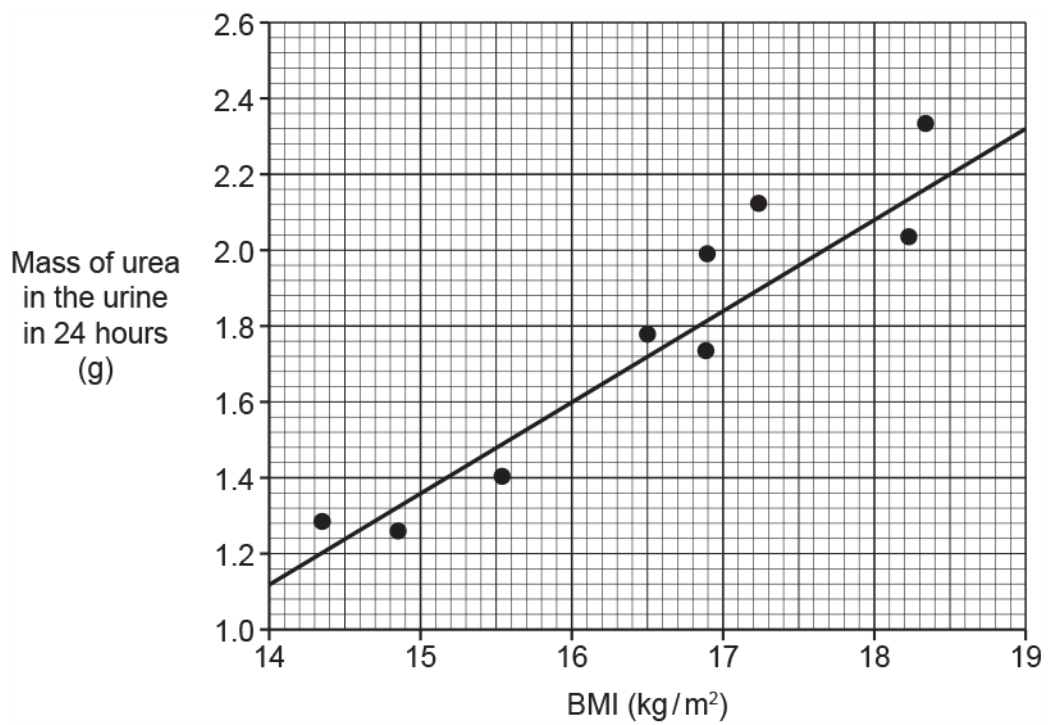


Fig. 17.1

- (i) What does the graph show about the relationship between BMI and the mass of urea in the urine?

----- [1]

- (ii) A boy has a BMI of 16. He produces 1000 cm³ of urine in 24 hours.

Calculate the concentration of urea in the boy's urine.

Concentration = ... g / cm³ [2]

- (iii) Fig. 17.2 shows the mass of urea in the urine against the BMI for nine **different** boys.

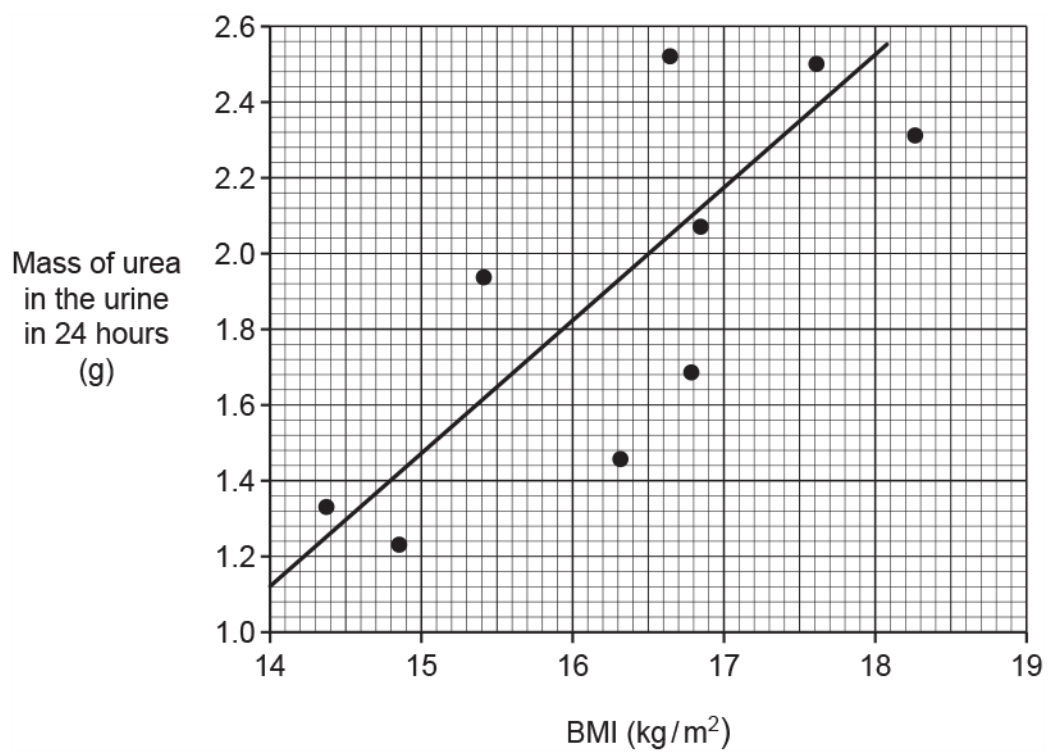


Fig. 17.2

Give **two** differences in the relationship between BMI and the mass of urea in the urine shown in Fig. 17.1 and Fig. 17.2.

1 _____

2 _____

[2]

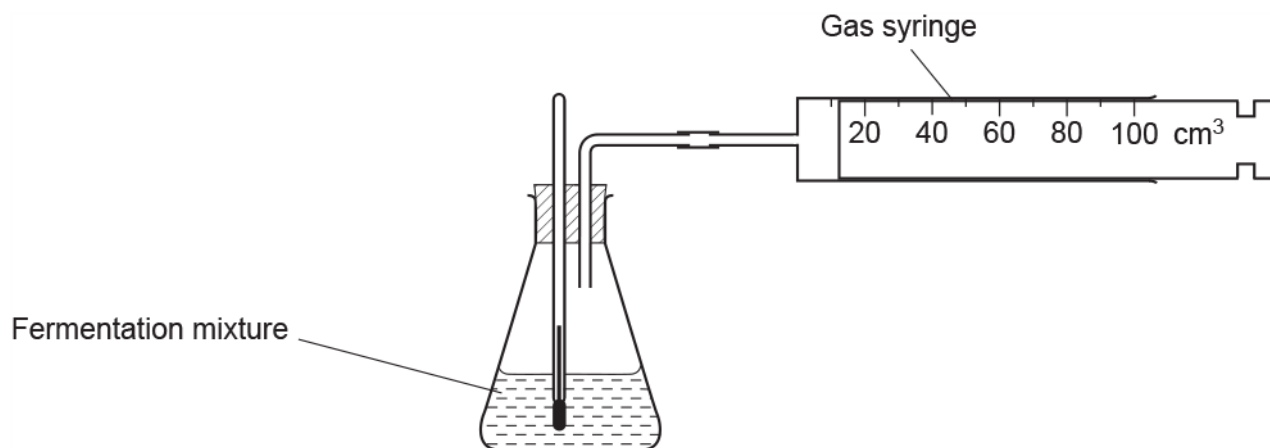
14(a) Fermentation involves enzymes that break down sugar releasing carbon dioxide gas.

The volume of carbon dioxide released can be used to measure how fast these enzymes are working.

A student investigates if fermentation works faster at 25 °C or 30 °C.

She measures the volume of carbon dioxide released in 10 minutes.

The diagram shows the apparatus she uses.



The student could have measured the volume of carbon dioxide by collecting the gas over water in a measuring cylinder.

Why is it better to use a gas syringe?

[1]

(b) The student's results are shown in the table.

Temperature (°C)	Volume of carbon dioxide gas (cm ³) released in 10 minutes		
	Trial 1	Trial 2	Trial 3
25	23	25	22
30	34	27	33

(i) Calculate the **mean** rate of gas produced at **25 °C** in cm³ / minute.

Give your answer to **1** decimal place.

Mean rate of gas produced at 25 °C = ... cm³ / minute [3]

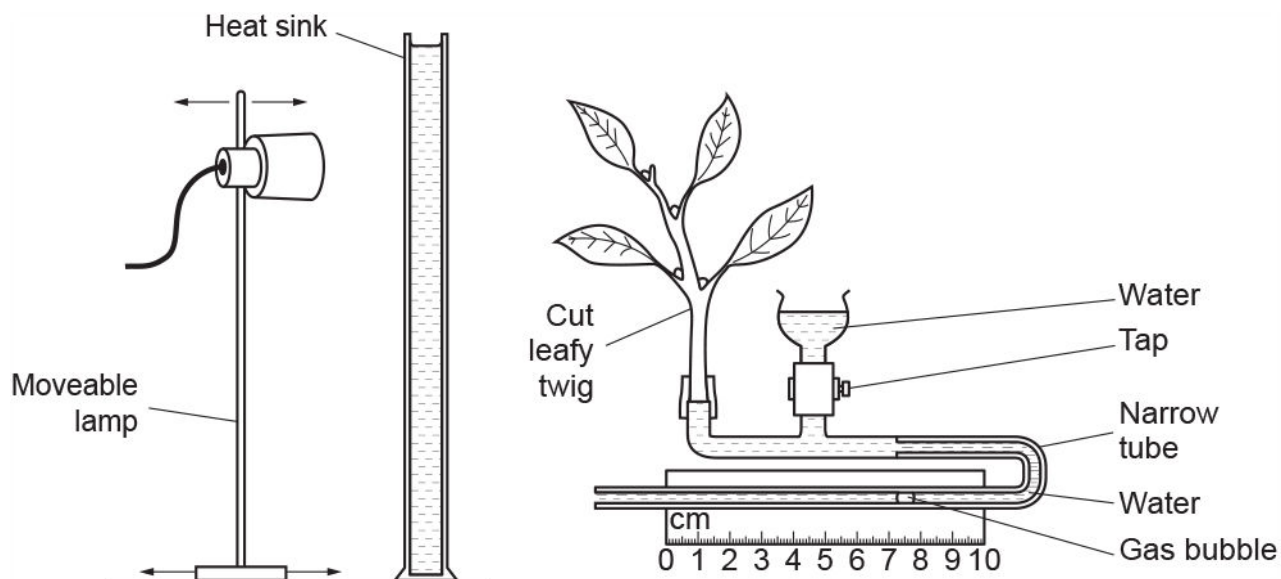
(ii) The rate of gas produced at 30 °C is greater than at 25 °C.

Use ideas about enzymes to explain why.

-----[3]

15(a) The diagram shows a simple potometer.

The apparatus can be used to investigate the effect of light intensity on transpiration rates.



(i) Describe what happens during transpiration.

[2]

(ii) Describe how the apparatus can be used to investigate the effect of light on transpiration rates.

[3]

(iii) The heat sink is a transparent tube of cold water.

Explain why a heat sink is used in this experiment.

[2]

(b) The table shows the results from using the potometer.

Distance of potometer from the light (cm)	Distance gas bubble moved in one minute (mm)		
	Trial 1	Trial 2	Trial 3
10	70	74	72
20	73	75	71
30	52	49	51
40	42	30	31
50	12	14	13

(i) The mean distance the gas bubble moved along the tube at 10 cm from the light was 72 mm.

The diameter of the narrow tube was 1 mm.

Calculate the volume of water taken up by the plant.

Use the equation: $\text{volume} = \pi r^2 l$

where r is the radius of the tube and l is the distance the bubble moves

$\pi = 3.14$

Give your answer to 2 significant figures.

Volume of water = ... mm³ / minute [3]

(ii) Identify the anomalous reading in their recorded results and suggest a possible reason for this.

----- [2]

(iii) How should the scientists deal with this anomalous reading when they process the data?

----- [1]

(iv) The scientists described their results for 20 cm as 73 ± 2 .

Explain why they did this.

----- [2]

16(a) Carolina horsenettle is a weed that grows in crop fields in the USA.

New horsenettle shoots develop from buds on roots in spring. The shoots die in the autumn but the roots remain alive under the ground.

Effective weed control involves stopping seed production and killing the root system.

Selective herbicides are used to control Carolina horsenettle.

The best time to apply selective herbicide is when the horsenettle is actively growing between the bud and flower stage.

(i) Describe how a selective herbicide works.

(ii) Fig. 20.1 and Table 20.1 show information about four different herbicides A, B, C and D.

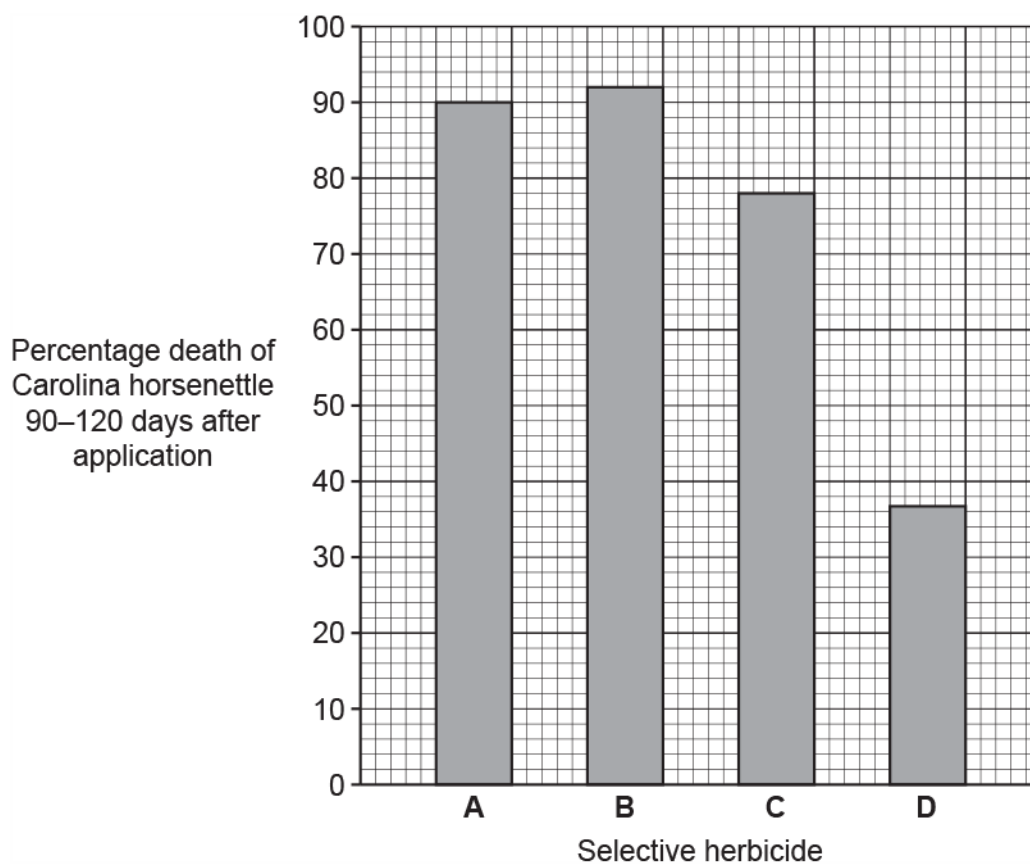


Fig. 20.1

Selective herbicide	A	B	C	D
Effect on Carolina horsenettle	prevents seeds and roots of plants growing	prevents seeds and roots of plants growing	prevents seeds and roots of plants growing	prevents shoot growth and fruiting but minimal damage to roots
What plants herbicide works on	Carolina horsenettle	Carolina horsenettle and several other broad-leaved plant species	Carolina horsenettle	Carolina horsenettle and most other broad-leaved plant species
Cost of herbicide	medium	high	medium	low

Carolina horsenettle is growing in a field with a crop and other broad-leaved weeds.
Evaluate the information on selective herbicides A, B, C and D.

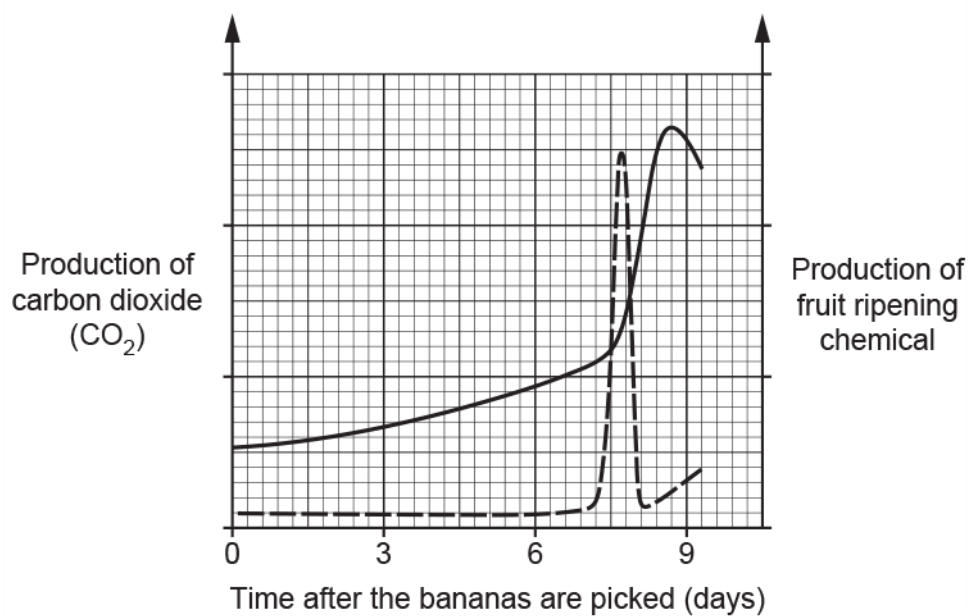
Which selective herbicide would be best to use and when it should be applied?
Explain your decision.

[4]

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

Key— CO_2

--- Fruit ripening chemical

**Fig. 20.2**

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

[2]

17(a) Zebras (Fig. 17.1) have evolved to live in hot grassland in Africa.

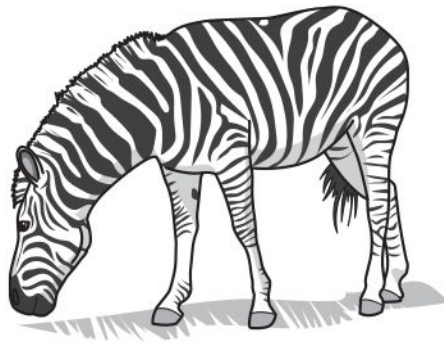


Fig. 17.1

Scientists have tried to find out why zebras have evolved stripes on their body.

One theory is that the stripes help to keep the zebra cooler than other colours. Scientists did an experiment to test this theory. They covered barrels of cold water with the skin of different animals. Then they measured the temperature of the water several hours later.

The results are shown in Fig. 17.2.

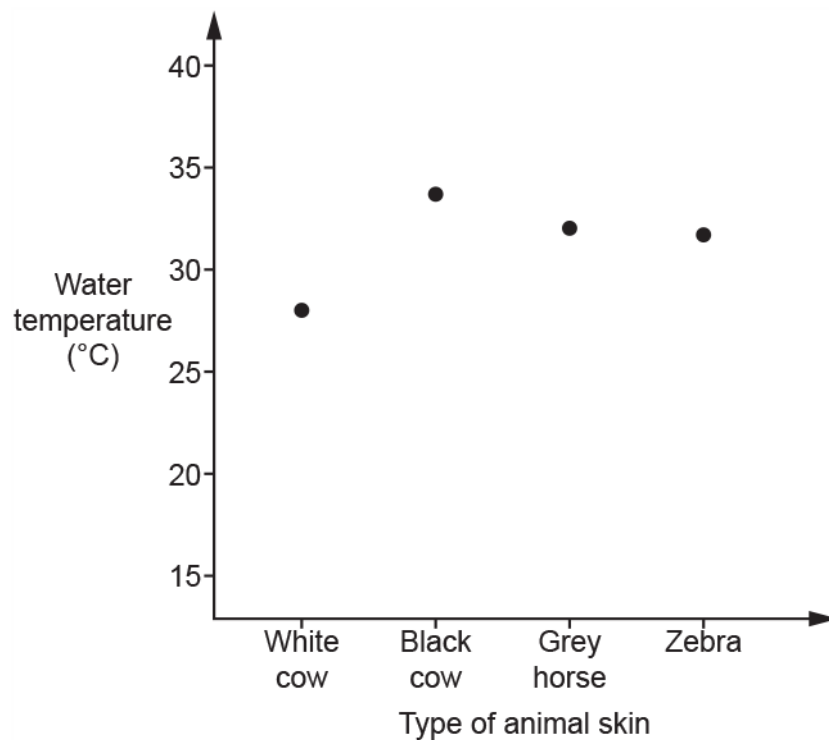


Fig. 17.2

- (i) Do the results in Fig. 17.2 support the theory that stripes keep zebras cool?

Explain your answer.

----- [1]

- (ii) The scientists were aiming to investigate if it was **only** the colour of the skin that affected temperature regulation.

Suggest **one** improvement the scientists could make to ensure they **only** investigate the **colour** of the skin.

Explain your answer.

----- [1]

- (b) Another theory says that the stripes make a zebra less likely to be bitten by insects.

To test this theory scientists made models of zebras and covered them with sticky tape. One model was black. The other models had different widths of stripes.

Fig. 17.3 shows the number of insects that stuck to the tape.

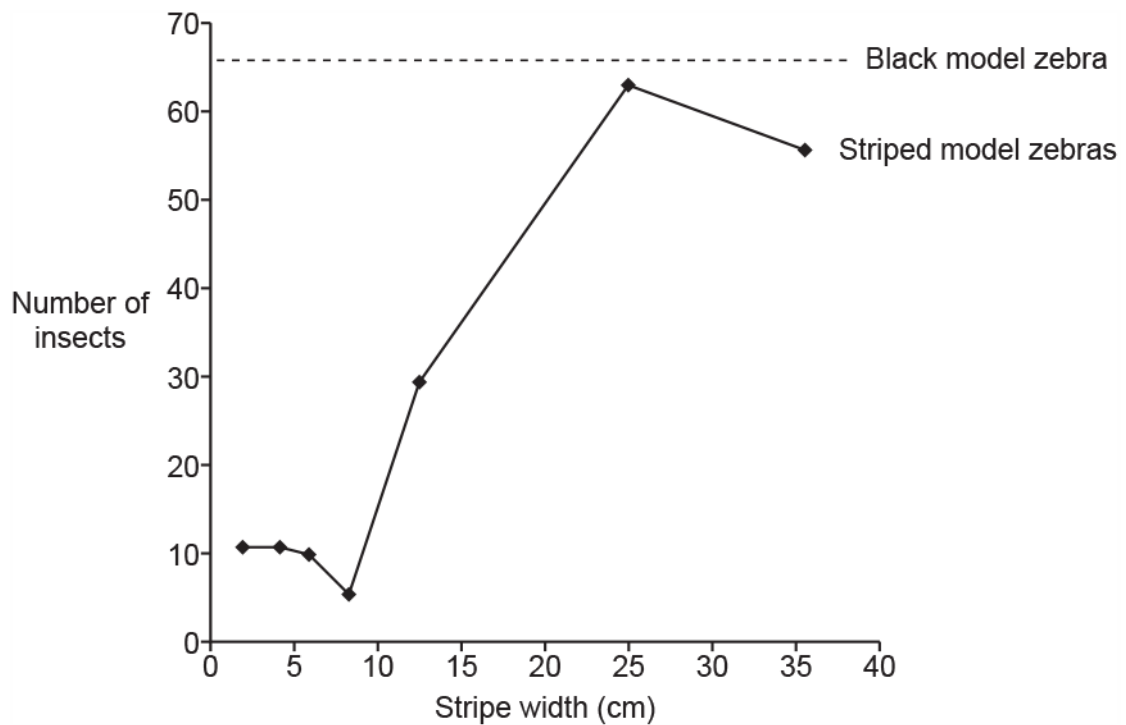


Fig. 17.3

- (i) Describe what Fig. 17.3 shows about the link between zebra stripes and protection from insects.

[2]

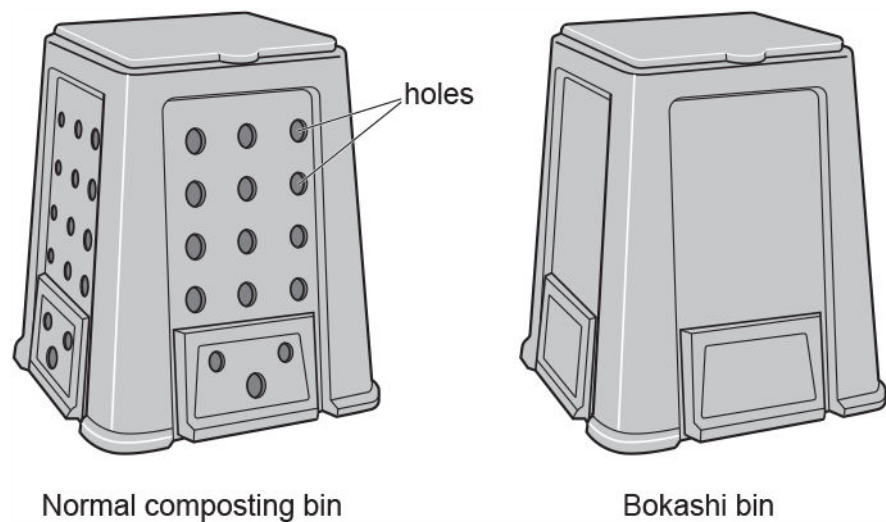
- (ii) Horse blankets are used to cover horses when they are outside. Companies have started to produce horse blankets with zebra stripes.

18(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.

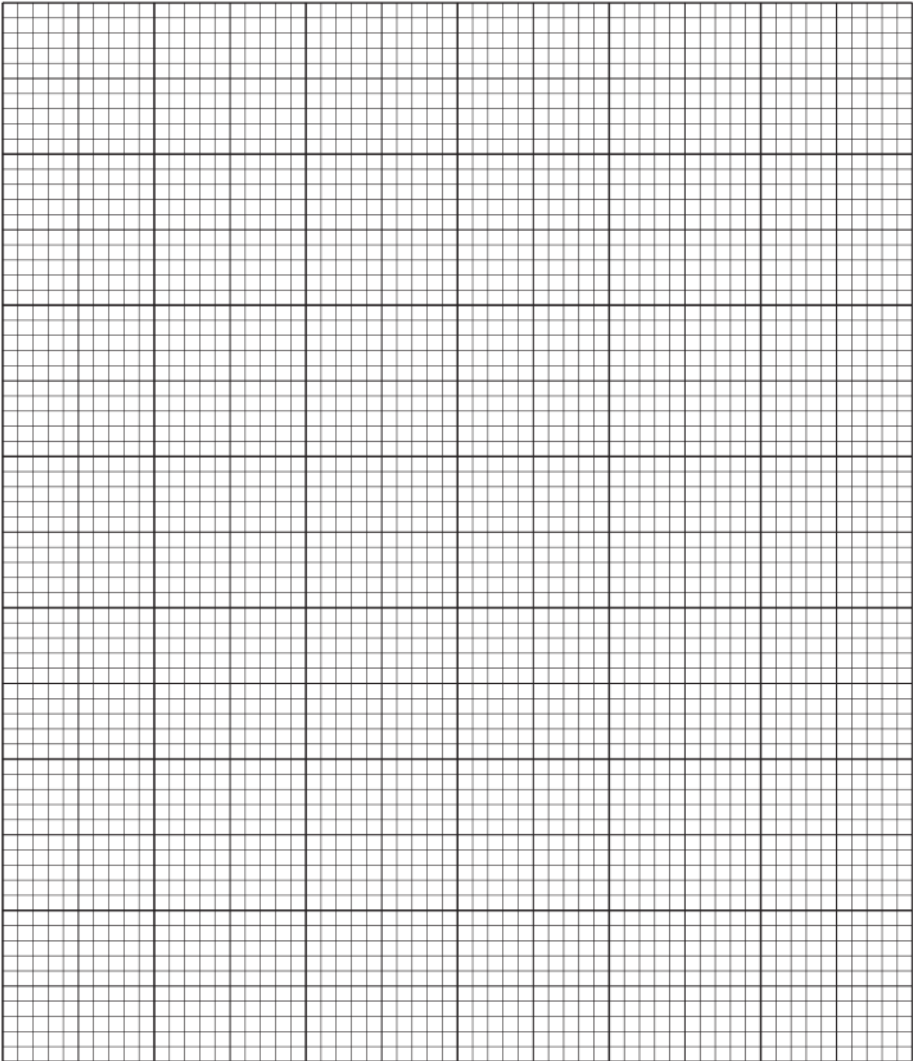
----- [1]

(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]

19(a) Fanconi anaemia is a genetic disorder. It results in the bone marrow being destroyed.
This causes a decrease in the numbers of red blood cells, white blood cells and platelets.

Explain **two** possible symptoms of Fanconi anaemia.

1 _____

2 _____

[2]

(b) Table 19.1 shows normal ranges for blood components in people **without** Fanconi anaemia.

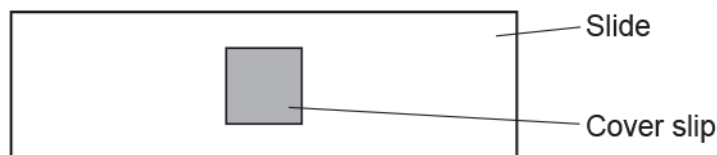
Blood component	Number per mm ³
red blood cell	$4.5 - 6.5 \times 10^6$
white blood cell	$6.0 - 16.0 \times 10^3$
platelet	$1.5 - 4.0 \times 10^5$

Table 19.1

(i) Suggest why there is such a wide range of white blood cell numbers.

[2]

(ii) The diagram shows a microscope slide containing blood from a patient.



The square cover slip is 10 mm wide and the thickness of the blood underneath is 0.001 mm.

Calculate the volume of blood under the cover slip.

Volume of blood = ... mm³ [1]

(iii) Under the cover slip are 1000 white blood cells.

Does the blood sample provide evidence that the patient has Fanconi anaemia?

Use **Table 19.1** and your answer to part (ii) to justify your answer.

----- [3]

(c) There are many different genetic disorders that can affect blood cells. Details of three of these are found in Table 19.2.

Name of disorder	Cause of disorder	Symptom
D-B anaemia	dominant allele	low red blood cell numbers
S-D syndrome	recessive allele	low white blood cell numbers
Fanconi anaemia	recessive allele	small numbers of all blood cells

Table 19.2

A blood smear from another patient shows that he has 3×10^6 red blood cells per mm^3 of blood. Neither of his parents have a blood disorder.

Use Table 19.1 and Table 19.2 to explain which blood disorder the patient could have.

Name of disorder

Explanation

[3]

20(a) 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.

Write the words **allele**, **chromosome**, **genome** and **nucleotide** in the boxes to show their size from smallest feature to largest feature.

Smallest feature

Largest feature

[1]

(b) One in 500 people are heterozygous for HC.

There are 66 000 000 people in the UK.

Calculate how many people in the UK are heterozygous for HC.

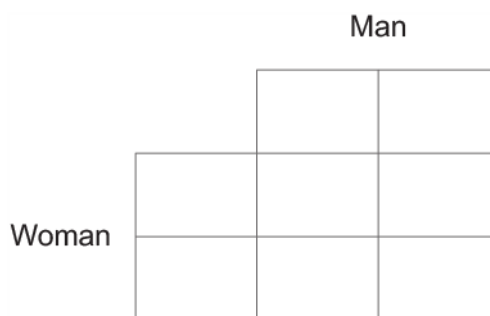
Number of people = ... [1]

(c) A woman who does not have HC and a man who is heterozygous are expecting a baby.

What is the probability of the baby having HC?

Complete the genetic diagram to explain your answer.

Use D for the dominant HC allele and d for the recessive allele.



Probability = ... [2]

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

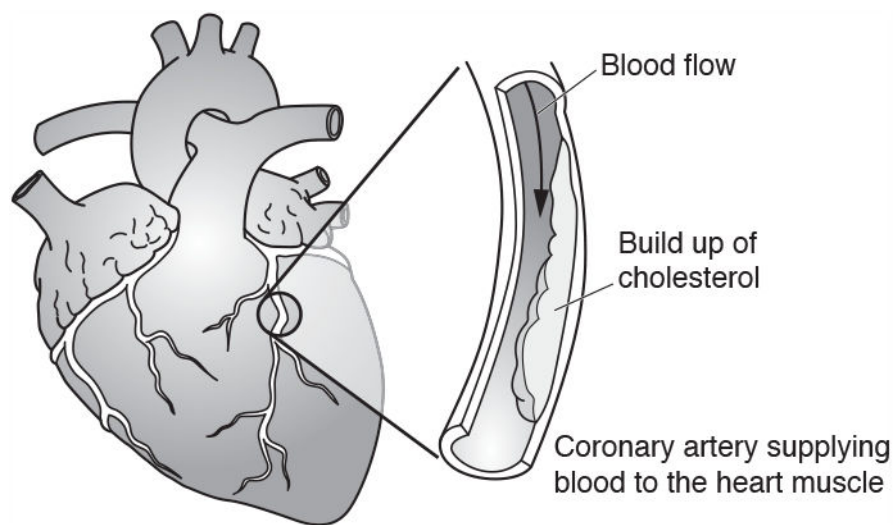


Fig. 21.1

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.

- (e) A drug is being developed that might help protect people from heart disease. To test the drug patients were divided into three groups. Each group was given a different treatment and their blood cholesterol measured.

The results are shown in Fig. 21.2.

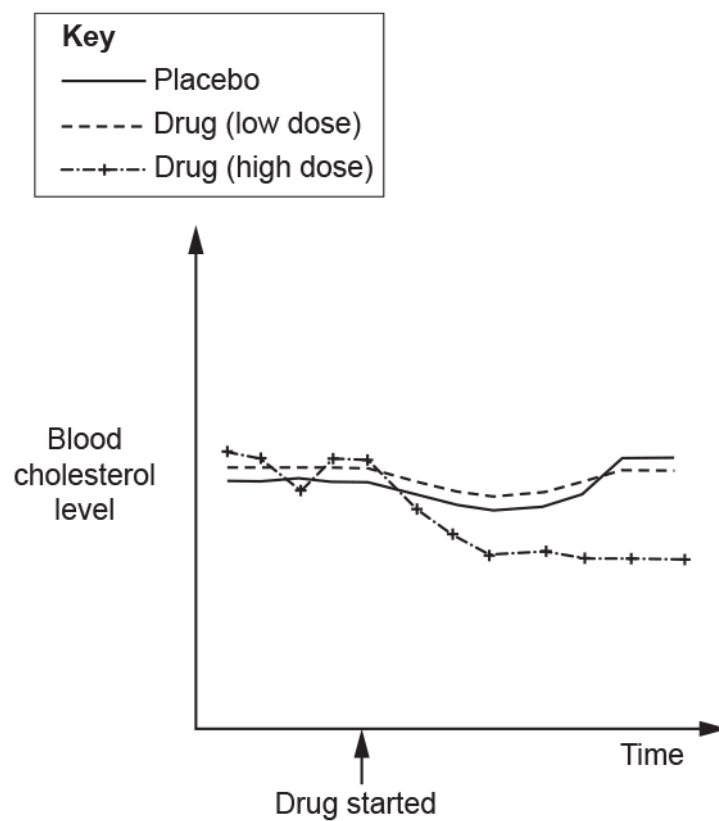


Fig. 21.2

Evaluate the results of the test.

[3]

21 Fig. 16.2 shows a food web containing stevia.

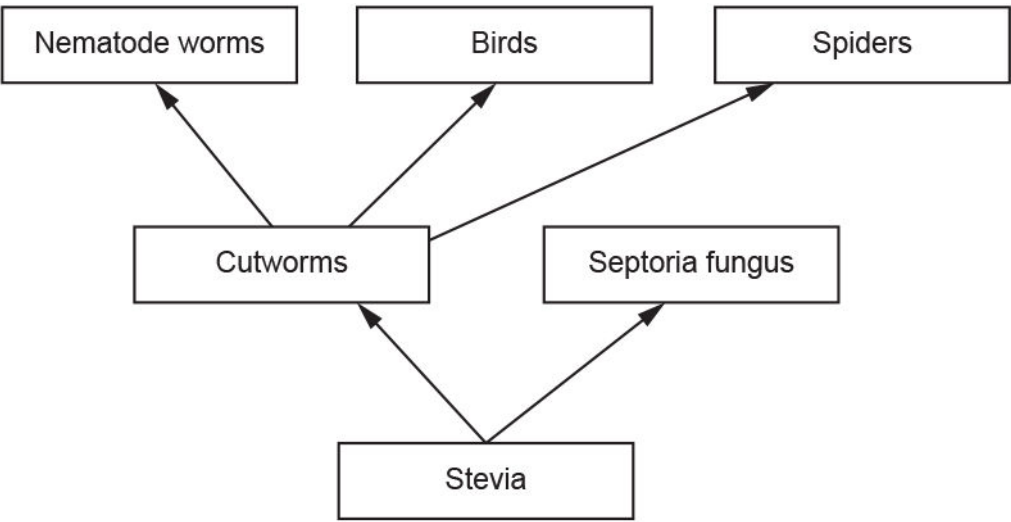


Fig. 16.2

The leaves of stevia taste very sweet. People are now trying to grow stevia as a crop.

Stevia farmers often add nematode worms to their fields.

Explain why farmers do this.

Use Fig. 16.2 in your answer.

[3]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			B ✓	1 (AO2.2)	
			Total	1	
2	a	i	electric heater ✓	1 (AO2.2)	ALLOW electric incubator / <u>electric</u> (water) bath
		ii	wear goggles / tie (long) hair back / secure loose clothing ✓	1 (AO1.2)	ALLOW wear gloves / use gauze under flask / use heatproof mat IGNORE face mask / do not touch hot equipment
		iii	Any two from: difficult to keep constant/regulate temperature ✓ uneven heating of flask creating hot/cold spots ✓ human error in reading thermometer ✓	2 (AO2.2)	ALLOW water may overheat ALLOW may become hot and denature enzyme ALLOW flask may have slightly raised temperature ALLOW temperature in water bath may not reflect temperature in the flask
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 32 award 2 marks $34 + 29 + 33 = 96$ ✓ $96 \div 3 = 32$ ✓	2 (AO2.2)	ALLOW answer in the space under the table but answer on answer line in table takes preference ALLOW ECF for mean calculation
		ii	temperature ✓	1 (AO2.1)	
		iii	identifies variability in each point plot / gives an estimate of level of uncertainty ✓	1 (AO1.2)	ALLOW can plot range/error bars ALLOW large error bars variability is high/ORA ALLOW high variability then reliability is low/ORA ALLOW idea of the spread of data at each point and possibly identify/eliminate outlier/anomaly ALLOW ranges overlap the data at those 2 points isn't significantly different

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iv	Any two from: as temperature increases enzyme activity increases ✓ optimum enzyme activity between 25⁰C and 35⁰C enzyme activity ✓ but somewhere between 30⁰C and 35⁰C enzyme activity starts to decrease ✓ idea decrease in rate (after 35⁰C) due to denaturing ✓	2 (AO3.1a)	ALLOW idea that as temperature increases/gets higher so does rate of (enzyme) reaction / gas release / ORA ALLOW higher temperature the faster the enzyme activity ALLOW enzyme starts to denature above 30⁰C/between 30⁰C and 35⁰C
			Total	10	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
3	a		distance of lamp/light source ✓	1 (AO2.2)	ALLOW light intensity IGNORE the lamp with no mention of distance or intensity
	b	i	Any two from: bubbles are different sizes / has different volume of gas ✓ some bubbles may also be missed/miscounted ✓ so volume at each point may not be representative of rate ✓	2 (AO2.2)	ALLOW amount of oxygen varies / bubbles burst IGNORE the pondweed could be different sizes
		ii	Any two from: measure volume (of gas released) ✓ names a suitable apparatus for measuring for volume ✓ use a heat sink ✓	2 (AO2 x 3.3a)	IGNORE measure amount ALLOW e.g. measuring cylinder / gas syringe / Audus apparatus / graduated pipette
	c	i	axes correctly labelled, including units ✓ all points correctly plotted ✓ ✓ suitable line of best fit drawn ✓	4 (AO4 x 2.2)	ALLOW +/- half a square all points correctly plotted 0 to 1 correct point plotted = 0 mark 2 to 4 correct points plotted = 1 mark All 5 correct points plotted = 2 marks ALLOW line of best fit based on plotted points IGNORE dot to dot line

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	further lamp is from the plant photosynthesis reduced / ORA ✓ example of a decrease from data e.g. at 10cm 30 bubbles given off and at 40cm only 2 bubbles ✓ OR photosynthesis stops in very low light ✓ by 50 cm there are no bubbles ✓ OR idea that rate of photosynthesis decrease is a non-linear relationship ✓ e.g. nearly double the number of bubbles at 10cm compared to 20cm but not double elsewhere ✓	2 (AO3.2b)	IGNORE type of gas mentioned in bubbles ALLOW description of decrease in bubbles e.g. further lamp the less bubbles ALLOW there is a negative correlation
			Total	11	
4		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 3 : 1 award 2 marks 24 : 8 or 3 ✓ 3 : 1 ✓	2 (AO2.2)	ALLOW answer in the table but answer on answer line takes preference
		ii	higher SA:V ratio faster rate of diffusion / ORA ✓	1 (AO3.2b)	ALLOW positive correlation ALLOW reference to less time instead of faster rate IGNORE they are directly proportional
		iii	reduces (total) SA of alveoli/air sacs / reduces SA : Vol ratio of alveoli/air sacs ✓ so diffusion (of oxygen) reduced ✓	2 (AO2 x 3.1a)	ALLOW harder for oxygen to diffuse IGNORE oxygen cannot diffuse into the blood in emphysema
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
5		i	The higher the BMI then the higher the mass of urea (in urine) / ORA ✓	1 (AO2.1)	ALLOW positive correlation IGNORE they are directly proportional IGNORE linear relationship
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.0016 (g/cm ³) award 2 marks 1.6 ÷ 1000 ✓ = 0.0016 (g/cm ³) ✓	2 (AO2.2)	ALLOW 1.6 x 10 ⁻³
		iii	idea that there is a greater increase in mass of urea as BMI increases in Fig 22.2/second graph ✓ idea that first graph/22.1 has stronger correlation / more points closer to line of best fit / less spread of data ✓	2 (AO2 x 3.2b)	ALLOW larger mass of urea per BMI gained ALLOW line is steeper/higher gradient in Fig22.2 IGNORE higher BMI for greater mass of urea ALLOW second graph does not follow the line of best fit so closely
			Total	5	
6			C ✓	1 (AO2.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
7	a	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 250 award 2 marks $25 \times 30 / 3$ OR $750 / 3$ ✓ = 250 ✓	2 (AO2 x 2.2)	
		ii	Idea of less visible ORA ✓ otherwise they are more likely to be eaten ORA ✓	2 (AO2 x 2.2)	ALLOW spot not visible to predators = 2 marks ALLOW small spot is less likely to be toxic / poisonous If no other mark scored, credit less likely to be washed off
	b	i	(further from the factory) there is less sulfur dioxide and so thicker cuticle/leaves ORA✓ insects find it harder to feed on the thicker leaves/cuticle ORA✓ the numbers are lower with thicker leaves/cuticle ORA✓	2 (AO2 x 3.1b)	IGNORE any reference to section A If no other mark scored, credit thicker leaves/cuticle further from the factory ORA
		ii	very high concentrations of sulfur dioxide kill the insects✓	1 (AO3.2b)	
			Total	7	
8		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 10 000(per mm ³) award 2 marks $1000 \div 0.1$ OR 1000×10 ✓ = 10 000 (per mm ³) ✓	2 (AO2 x 2.2)	
		ii	no (no mark) (because 10 000) is in the normal range / levels / range without Fanconi anaemia✓	1 (AO3.2a)	ALLOW ECF from (i) ALLOW 10 000 is between 6000 and 16000
			Total	3	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
9	a		to allow a valid comparison of the results✓	1 (AO3.1b)	
	b	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
	c	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	14	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance									
10	a		man <table><tr><td></td><td>D</td><td>d</td></tr><tr><td>woman</td><td>d</td><td>Dd</td></tr><tr><td></td><td>d</td><td>dd</td></tr></table> ✓ 50% / 0.5 / ½ ✓		D	d	woman	d	Dd		d	dd	2 (AO1 x 2.2) (AO1 x 3.1a)	ALLOW 1 in 2 or 1:1 ALLOW ecf for probability
	D	d												
woman	d	Dd												
	d	dd												

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	b	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	8	
11		i	Yes (no marks) cooler than black/grey skin OR Yes (no marks) lighter skin is cooler OR No (no marks) zebra skin was similar temperature to the other barrels OR No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓	1 (AO3.2a)	argument must support decision
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours OR idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	1 (AO3.3a)	ALLOW use painted towels to cover barrels ALLOW for same type of skin e.g. hair-free skin
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
12		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 3 : 1 award 2 marks 24 : 8 or 3 ✓ 3 : 1 ✓	2 (AO2.2)	ALLOW answer in the table but answer on answer line takes preference
		ii	higher SA:V ratio faster rate of diffusion / ORA ✓	1 (AO3.2b)	ALLOW positive correlation ALLOW reference to less time instead of faster rate IGNORE they are directly proportional
		iii	reduces (total) SA of alveoli/air sacs / reduces SA : Vol ratio of alveoli/air sacs ✓ so diffusion (of oxygen) reduced ✓	2 (AO2 x 3.1a)	ALLOW harder for oxygen to diffuse IGNORE oxygen cannot diffuse into the blood in emphysema
			Total	5	
13		i	The higher the BMI then the higher the mass of urea (in urine) / ORA ✓	1 (AO2.1)	ALLOW positive correlation IGNORE they are directly proportional IGNORE linear relationship
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.0016 (g/cm ³) award 2 marks 1.6 ÷ 1000 ✓ = 0.0016 (g/cm ³) ✓	2 (AO2.2)	ALLOW 1.6 x 10 ⁻³
		iii	idea that there is a greater increase in mass of urea as BMI increases in Fig 17.2/second graph ✓ idea that first graph/17.1 has stronger correlation / more points closer to line of best fit / less spread of data ✓	2 (AO2 x 3.2b)	ALLOW larger mass of urea per BMI gained ALLOW line is steeper/higher gradient in Fig17.2 IGNORE higher BMI for greater mass of urea ALLOW second graph does not follow the line of best fit so closely
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
14	a		more accurate/precise measurement (of volume/amount of gas) ✓	1 (AO3.3b)	ALLOW gas could dissolve in water / less gas can escape IGNORE gives exact measurement of gas release
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 2.3 (cm³ / min) award 3 marks $\frac{25+23+22}{3} = 23.3333333 \quad \checkmark$ $\frac{23.3}{10} = 2.3333333 \quad \checkmark$ = 2.3 (cm³ / min) ✓	3 (AO1 x 1.2) (AO2 x 2.2)	ALLOW one mark for clear evidence of rounding incorrect answer correctly to one dp.
		ii	increased movement of molecules / increased kinetic energy ✓ therefore, more chance of substrate colliding with enzymes/active sites ✓ more chance of substrate entering active site ✓	3 (AO2 x2.1)	increased KE of enzymes and substrates leads to more collisions = 2 marks ALLOW more enzyme-substrate complexes forming
			Total	7	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
15	a	i	water evaporates (on surface of spongy mesophyll) ✓ water (vapour) passes/diffuses through the stomata/pores ✓	2 (AO1.1)	Need evaporate or a description of the process
		ii	measure distance gas bubble moves ✓ over certain time / specified time ✓ vary distance of lamp from potometer ✓	3 (AO1.2)	ALLOW measure position of bubble before and after time taken for bubble to move a certain distance = 2 marks
		iii	absorbs heat/thermal energy (from lamp) / keeps (plants at) constant temperature ✓ heat/temperature would affect transpiration ✓	2 (AO2.2)	IGNORE references to photosynthesis
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 57 (mm ³) award 3 marks $\pi \times 0.5^2 \times 72$ ✓ = 56.52 ✓ = 57 (mm ³) ✓	3 (AO3 x 2.2)	ALLOW one mark for an answer of 226.08 and 2 marks for an answer of 230 (1.0 has been used as r) ALLOW one mark for clear evidence of incorrect answer correctly rounded to two sig figs.
		ii	42 (mm) / Trial 1 at 40cm ✓ reading taken too quickly after moving the lamp / error in measurement (distance bubble moved/time) / heat sink not in the way/radiating heat / change in room temp/air movements / potometer/light not at correct distance ✓	2 (AO2 x 2.2)	
		iii	Idea that they should remove/ignore the anomalous result (before processing) ✓	1 (AO1.2)	ALLOW repeat that reading
		iv	the mean is 73 mm ✓ the range of values is 71 to 75 / range is 4 mm / 2mm is half the range ✓	2 (AO2 x 1.2)	ALLOW adding or subtracting 2 from 73 covers all the readings this is the mean $\pm$ half the range = 2 marks
			Total	15	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
16	a	i	Any two from: contains (plant) hormones ✓ causes excessive/rapid cell elongation/growth ✓ only affects broadleaved plants ✓	2 (AO2 x 1.1)	ALLOW auxins IGNORE just plants grow faster ALLOW effects some plants/weeds and not others/the crop
		ii	B because B causes highest percentage death of horsetail ✓ A/C do not kill other broadleaved plants/weeds / A/C not suitable as field contains other weeds / A/C only kills horsetail ✓ D does not kill roots / much less effective at killing horsetail ✓ Spring treatment because buds just growing and flowering yet to happen ✓	4 (AO3.1b)	No mark for B on its own. NEED a choice of B or D to score any marks Mark first choice Need reference to both buds and flowering ALLOW D for three marks if B is not chosen first: because D kills more species of weeds ✓ D much cheaper than B ✓ spring treatment because buds just growing and flowering yet to happen ✓
	b		peak CO₂ level is close to the peak of ripening chemical level / CO₂ levels increasing as production of chemical increases ✓ process is respiration ✓	2 (AO2 x 3.2b)	DO NOT ALLOW there is a spike/peak in CO₂ as the chemical increases ALLOW fermentation
			Total	8	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
17	a	i	Yes (no marks) cooler than black/grey skin OR Yes (no marks) lighter skin is cooler OR No (no marks) zebra skin was similar temperature to the other barrels OR No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓	1 (AO3.2a)	argument must support decision
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours OR idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	1 (AO3.3a)	ALLOW use painted towels to cover barrels ALLOW for same type of skin e.g. hair-free skin
	b	i	Any two from: zebras with stripes attracts less/fewer insects / ORA✓ narrower stripes attract less insects / ORA ✓ stripe width for least number of insects/optimum protection is about 8cm / stripe width for most number of insects is about 25cm ✓	2 (AO2x3.1 a)	ALLOW insect bites for insects IGNORE length of stripe ALLOW width range between 5-10cm for least number of insects / most number of insects is 22-27cm
		ii	stripe width of 8cm because it is the lowest point on the graph/fewest number of insects ✓	1 (AO3.2a)	ALLOW width tolerance between 7-9cm and least number of insects (on tape)

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	Any three from: stripes developed as a mutation / variation for skin stripes ✓ (animals with stripes) less likely to be bitten by insects / more healthy / spread less pathogens / ORA ✓ (striped animals) more likely to survive ✓ (striped animals) more likely to reproduce ✓ pass on allele/gene for stripes / ORA ✓ process occurs over many generations ✓	3 (AO3 x 2.1)	ALLOW some more striped than others ALLOW offspring produced / breed together IGNORE selective breeding ALLOW pass on advantageous gene IGNORE trait is passed on / genes are passed on IGNORE over time
			Total	8	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
18	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
19	a		Any two from: anaemia / tiredness / lack of energy due to lack of red blood cells ✓ inability to fight off infections / prone to infections due to lack of white blood cells/WBC ✓ slow blood clotting due to lack of platelets ✓	2 (AO2 x 1.1)	DO NOT ALLOW incorrectly matched symptom to blood cell type ALLOW less immunity / reduced immune response / weakened immune system due to lack of white blood cells/WBC ALLOW (recurring) nosebleeds / bruise easily due to lack of platelets
	b	i	people may be ill with infection / have a pathogen / just recovering from infection ✓ therefore have produced more white blood cells to destroy the pathogen/produce antibodies ✓ OR weakened immune system/cancer/cancer treatment reducing white blood cell number so less white blood cells to defend against pathogens/produce antibodies	2 (AO2 x 2.1)	IGNORE fighting(off) pathogens
		ii	Area = $10 \times 10 = 100(\text{mm}^2)$ Volume = $100 \times 0.001 = 0.1 (\text{mm}^3)$ ✓	1 (AO2.2)	
		iii	No (no mark) $1000 \div 0.1$ OR 1000×10 ✓ number of white blood cells/mm^3 is 10×10^3 / 1.0×10^4 / 10000 ✓ within the range of $6.0 - 16.0 \times 10^3$ ✓	3 (AO2 x 2.2) (AO3.2b)	ALLOW ECF from (ii) ALLOW number of white blood cells /mm^3 = 10 000 ALLOW within the normal white blood cell range/ 6000 – 16000

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c		(Fanconi anaemia) (no mark) (3×10^6 is a) low red blood cell count ✓ must be Fanconi anaemia because: caused by recessive allele ✓ obtained from heterozygous/carrier parents who don't have a blood disorder ✓ OR cannot be D-B anaemia because: neither parents have a blood disorder ✓ it is caused by a dominant allele ✓	3 (AO3x3.2 b)	if incorrect disorder then no marks IGNORE low numbers of all cells
			Total	11	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance									
20	a		smallest nucleotide allele chromosome largest genome	1 (AO1.1)										
	b		66000000 ÷ 500 = 132 000 ✓	1 (AO2.2)	ALLOW 0.132 million or 132 thousand									
	c		man <table><tr><td></td><td>D</td><td>d</td></tr><tr><td>d</td><td>Dd</td><td>dd</td></tr><tr><td>d</td><td>Dd</td><td>dd</td></tr></table> woman ✓ 0.5 / 50(%)✓		D	d	d	Dd	dd	d	Dd	dd	2 (AO2.2) (AO3.1a)	ALLOW appropriate use of other lower/upper case letters ALLOW ECF ALLOW 1 in 2 / ½ / 1:1 ✓ DO NOT ALLOW 1:2
	D	d												
d	Dd	dd												
d	Dd	dd												

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	d		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>		
	e		low dose of the drug does not seem to have any effect ✓ because the effect is very similar to the placebo ✓ high dose of the drug lowers blood cholesterol level most and would be the best way to administer the drug ✓	3 (AO3 x 3.1b)	
			Total	13	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
21			Any three from: biological control ✓ nematodes will eat cutworms ✓ less cutworms ✓ less stevia eaten ✓ increase the yield ✓	3 (AO3 x 2.1)	ALLOW predators of the cutworms added ALLOW more crop
			Total	3	