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Please check the examination details below before entering your candidate infor on

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Tuesday 16 May 2023

Morning (Time: 2 hours)

Paper reference 4BI1/1BR 4SD0/1BR

Biology

Unit: 4BI1
Science (Double Award) 4SD0
Paper: 1BR

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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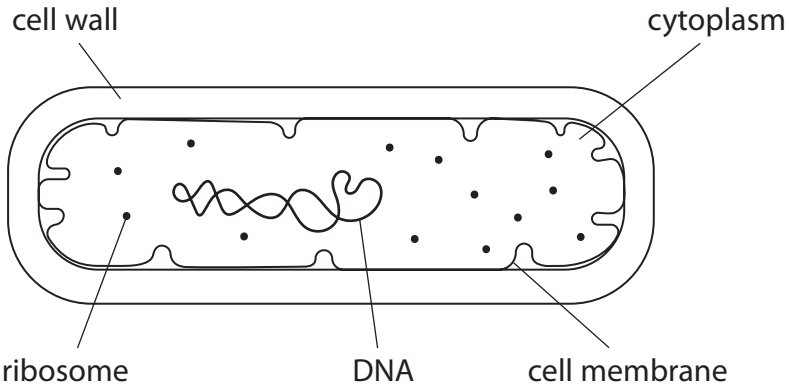
Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind a an answer, put a line through the box ☒ and then mark your new answer with a cross ☒

1 *Lactobacillus* is a type of bacterium used to make yoghurt.

The diagram shows a single *Lactobacillus* bacterium.



(a) (i) What is the function of ribosomes?

(1)

☒ **A** photosynthesis

☒ **B** protein synthesis

☒ **C** respiration

☒ **D** storage of cell sap

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(ii) Which row of the table gives the components that are found in all bacteria and in all eukaryotic cells?

(

	Cytoplasm	Cell surface membrane	Cell wall
☒ **A**	✓	✓	✓
☒ **B**	✓	✓	×
☒ **C**	×	✓	×
☒ **D**	×	✓	✓

(iii) *Lactobacillus* cells do not burst when placed in distilled water.

Red blood cells burst when placed in distilled water.

Explain why the *Lactobacillus* cells do not burst but the red blood cells do burst.

(3)

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(b) Describe how *Lactobacillus* bacteria produce yoghurt from milk.

(Total for Question 1 = 8 marks)

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2 The photograph shows some seeds called lentils.



© Diana Taliun/Shutterstock

Lentils are a good source of protein and are often eaten as part of a balanced diet.

(a) Describe how lentils are transported from the mouth to the stomach after being eaten.

(2)

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.....

(b) The recommended daily amount (RDA) of a nutrient is the mass of that nutrient required by an individual each day.

The table shows some nutrients found in lentils.

It also shows the percentage of each RDA for 16-year-old humans provided by 50 g of lentils.

Nutrient	Percentage of RDA (%) provided by 50 g of lentils
fat	1
carbohydrate	11
protein	22
vitamin C	2
calcium	4

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(i) Give one component of a balanced diet that is not shown in the table.

.....

(ii) Lentils do not contain large amounts of vitamin C and calcium.

State the long-term effect of a dietary shortage of vitamin C and of calcium.

(2)

vitamin C

.....

.....

calcium

.....

.....

(iii) Calculate the mass, in grams, of lentils that a 16-year-old needs to eat, each day, to provide their RDA of protein.

Give your answer to two significant figures.

(2)

mass of lentils needed each day = ... g

(iv) Describe how protein is digested in the human alimentary canal.

(3)

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(Total for Question 2 = 10 marks)

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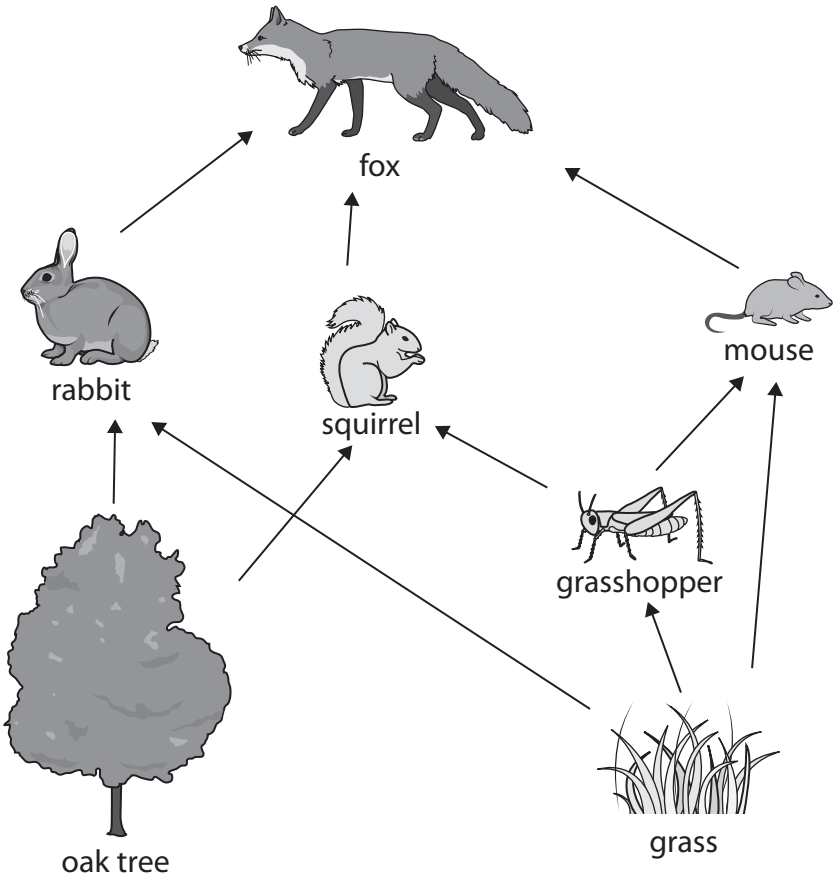
3 The diagram shows a forest food web.



(a) (i) How many secondary consumers are there in this food web?

(1)

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

(ii) Which term describes all the organisms in the food web together with their environment?

(1)

- ☒ **A** community
- ☒ **B** ecosystem
- ☒ **C** habitat
- ☒ **D** population

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(iii) The fox receives 1% of the energy present in the oak tree.

The fox receives 0.04% of the energy present in the grass.

Explain why a higher proportion of the energy reaches the fox from the oak tree than reaches the fox from the grass.

(3)

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(b) A student uses this method to estimate the total area of the woodland floor th is covered by grass.

- randomly place a 0.25 m^2 quadrat in one location of the woodland
- estimate the percentage of the quadrat that is covered by grass
- repeat at one other location
- calculate the mean percentage covered by grass for both quadrats
- measure the total area of the woodland floor
- calculate the total area of the woodland covered by grass.

(i) State why the student placed the quadrats randomly at each location.

(1)

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(ii) Explain how the student could improve their method, to obtain a more reliable estimate of the total area of woodland covered by grass.

(2)

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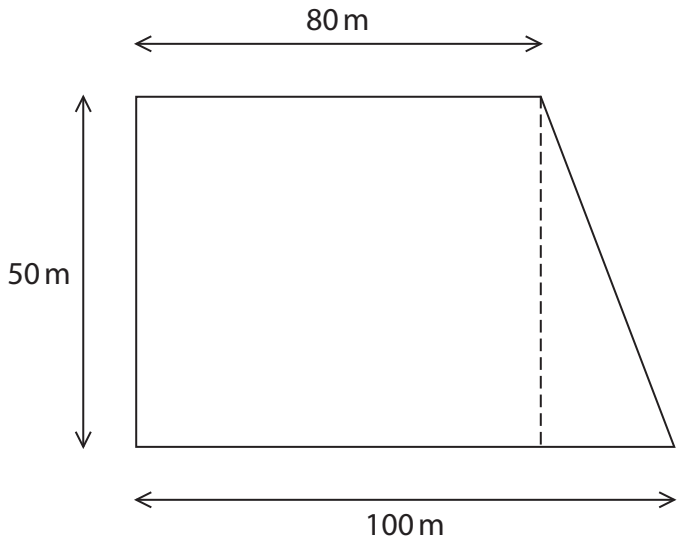
(iii) The diagram shows the dimensions of the woodland.



The student finds the mean percentage of the two quadrats covered by grass is 65%.

Use this value to calculate the total area of the woodland floor covered by grass.

(3)

total area covered by grass = ... m^2

(Total for Question 3 = 11 marks)

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4 Yeast is a fungus that can respire anaerobically.

(a) (i) What substance is the cell wall of a yeast cell made of?

(1)

☒ **A** cellulose

☒ **B** chitin

☒ **C** glycogen

☒ **D** starch

(ii) Which row of the table shows the substances produced by yeast during anaerobic respiration?

(1)

	Ethanol	Carbon dioxide	Lactic acid
☒ **A**	✓	✓	×
☒ **B**	✓	×	×
☒ **C**	×	✓	✓
☒ **D**	×	×	✓

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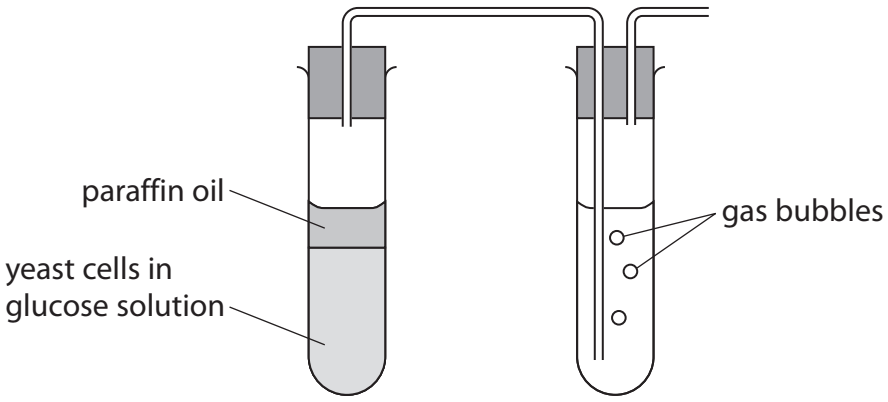
(b) A student uses this apparatus to investigate the effect of temperature on anaerobic respiration by yeast.

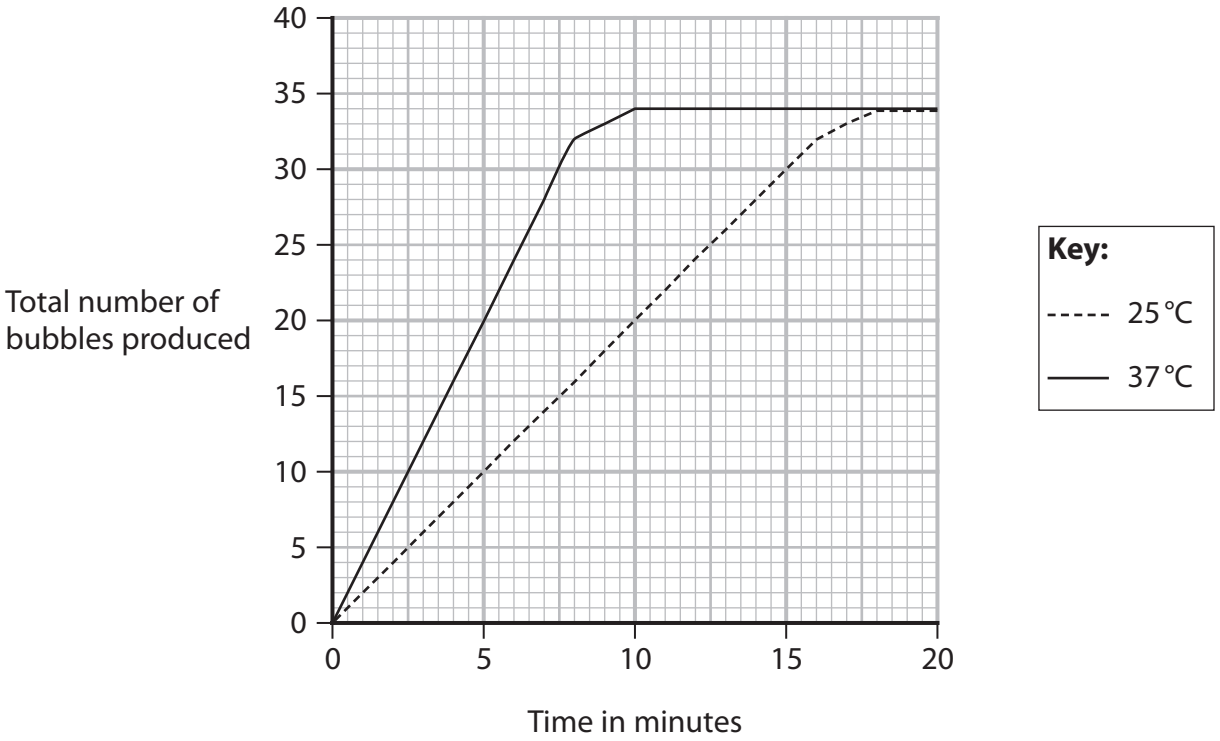


This is the student's method.

- place yeast cells and glucose solution into a test tube
- keep the test tube at a temperature of 25 °C
- cover the yeast and glucose solution with paraffin oil
- count the number of bubbles produced each minute for 20 minutes
- repeat at a temperature of 37 °C

The student draws a graph to show the total number of bubbles that have been produced by the end of each minute for the 20-minute period.

The graph shows the student's results.



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(i) State the function of the paraffin oil.

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(ii) Describe a method the student could use to keep the temperature of the yeast and glucose mixture constant.

(2)

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(iii) Calculate the rate of bubble production from 0 minutes to 8 minutes when the yeast is at 37 °C.

(2)

rate of bubble production = ... bubbles per minute

(iv) Explain the change in the total number of bubbles produced from 0 minutes to 20 minutes at 25 °C.

(2)

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(v) Explain the difference in the rate of bubble production between 0 and 10 minutes at 37 °C compared with 25 °C.

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(vi) Describe how the student could modify the experiment to give more accurate results.

(2)

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(Total for Question 4 = 14 marks)

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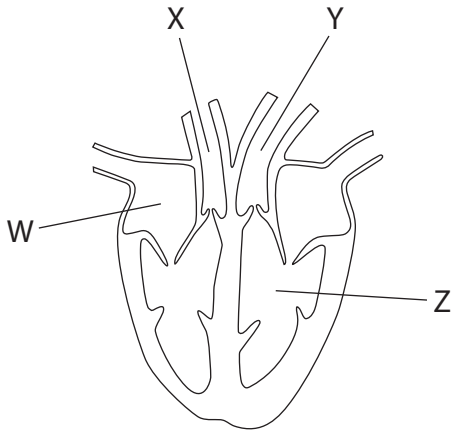
5 The diagram shows the structure of a human heart, with two chambers labelled W and Z and two blood vessels labelled X and Y.



(a) (i) Which row of the table correctly identifies chambers W and Z?

(1)

		W	Z
☒	**A**	left atrium	right ventricle
☒	**B**	left ventricle	right atrium
☒	**C**	right atrium	left ventricle
☒	**D**	right ventricle	left atrium

(ii) Give two differences between the composition of the blood in X and Y.

(2)

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(b) A scientist investigates the effect of exercise on the heart rate of two people.

One person is a trained athlete and the other is an untrained volunteer.

The heart rates of both individuals are measured at rest (0 minutes). Both individuals then exercise for six minutes and then rest for another six minutes.

The table shows the heart rates of the untrained volunteer and the trained athlete at rest, during and after exercise.

Time in minutes	Heart rate in beats per minute (bpm)	
	untrained volunteer	trained athlete
0 (rest)	65	55
2	120	95
4	130	115
6	150	135
10	100	80
12	80	60

(i) The cardiac output is the volume of blood pumped out by the left ventricle in one minute.

The stroke volume is the volume of blood pumped out by the left ventricle in one beat.

The cardiac output of a resting human is 4900 cm^3 per minute.

Calculate the stroke volume of the trained athlete when at rest when their cardiac output is 4900 cm^3 per minute.

Use this formula.

cardiac output = stroke volume × heart rate

(2)

stroke volume = ... cm^3

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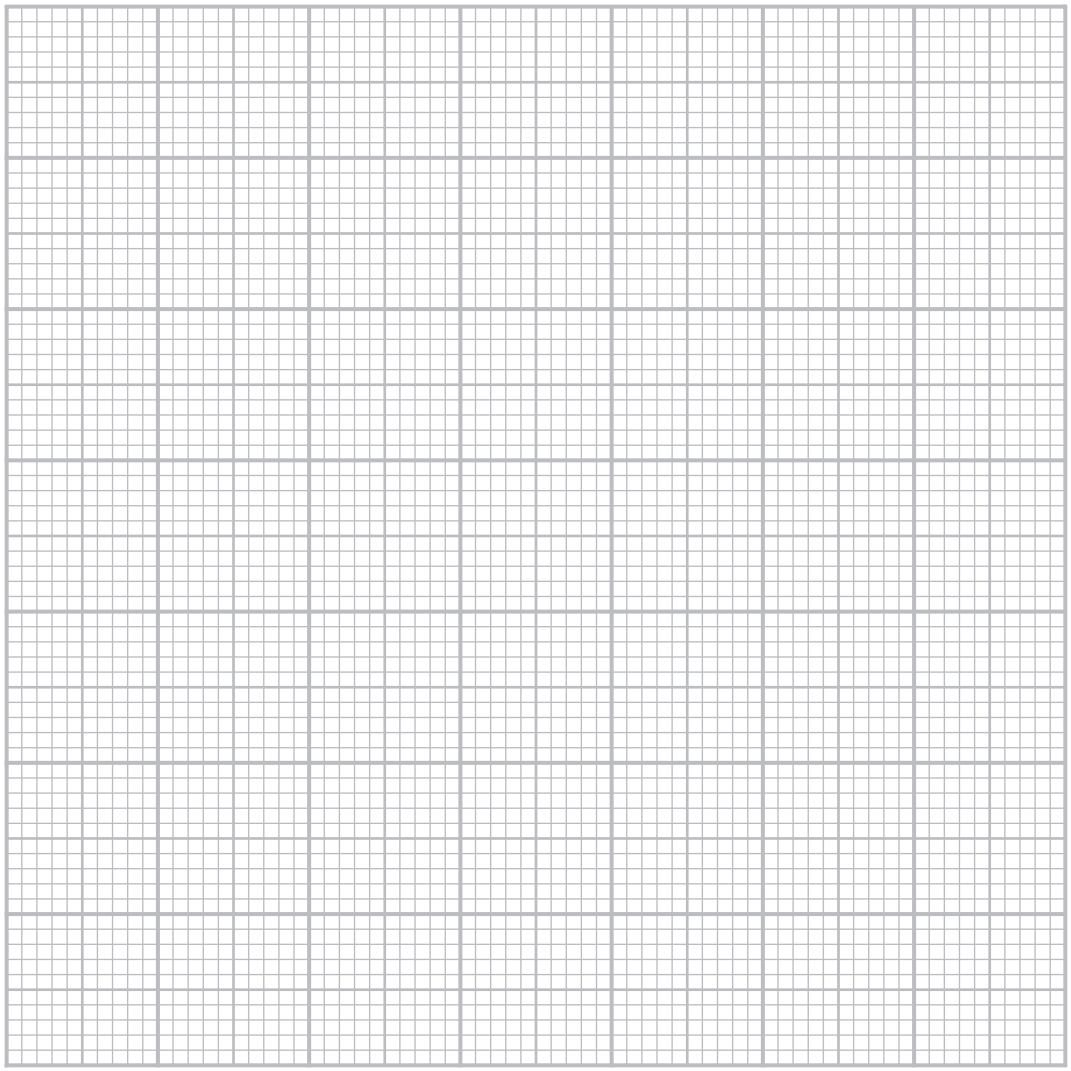
(ii) Plot a graph to show the heart rate of the untrained volunteer and the trai athlete when resting and during exercise from 0 minutes (when at rest) to 12 minutes.

Use a ruler to join the points with straight lines.

(5)



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(iii) Explain why the trained athlete can run faster than the untrained volunteer

Use the information in the table to support your answer.

(4)

(Total for Question 5 = 14 marks)

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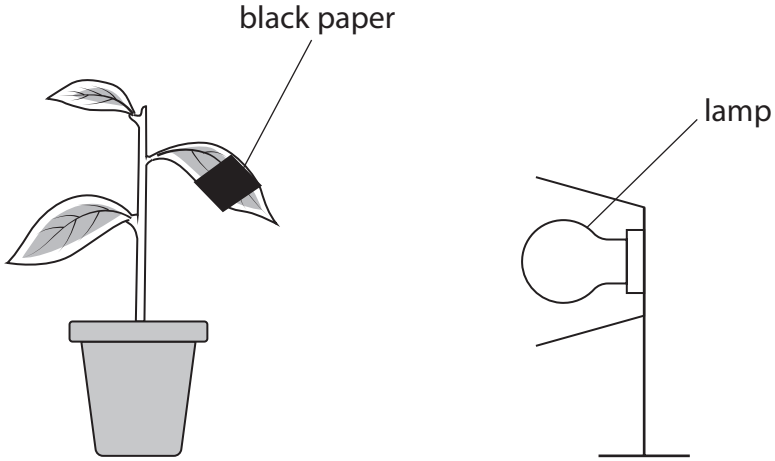
6 Variegated leaves have areas that are green and areas that are white.

A student uses this method to investigate the effect of light on photosynthesis in a variegated leaf.

- place a plant in the dark for 24 hours
- wrap a strip of black paper across a leaf
- shine light on the plant for 24 hours
- remove the black paper
- use iodine solution to test the leaf for starch

The diagram shows the apparatus the student uses.



(a) Complete the balanced chemical symbol equation for photosynthesis.

(2)

..... + $6H_2O$ → ..... + ...

(b) (i) State why the plant was placed in the dark for 24 hours.

(1)

.....

.....

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(ii) Diagram 1 shows the position of the black paper on the leaf.

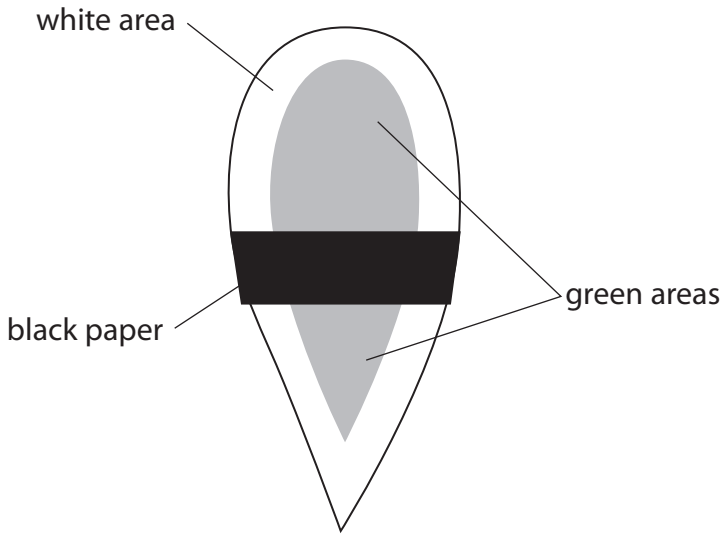

Diagram 1

Complete diagram 2 to show where the variegated leaf would appear black after testing with iodine solution.

(2)

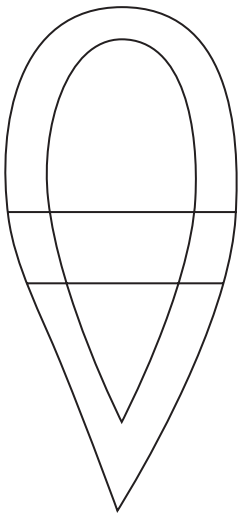

Diagram 2

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(c) The student observes that the leaves on different ivy plants seem to be differe sizes depending on the amount of sunlight the plants receive.

Design an investigation to test whether the amount of sunlight received by ivy plants affects the size of their leaves.

Include experimental details in your answer and write in full sentences.

(6)

(Total for Question 6 = 11 marks)

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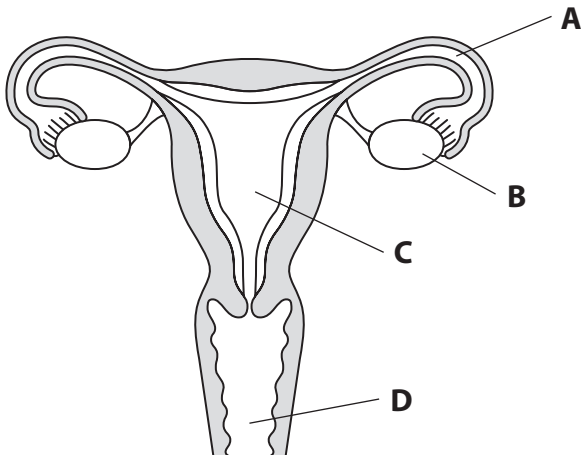
7 The diagram shows the human female reproductive system.



(a) (i) Where does fertilisation normally occur?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(ii) State how oestrogen and progesterone affect structure C during the menstrual cycle.

(2)

oestrogen

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progesterone

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(b) *In vitro* fertilisation (IVF) is used to help some people have children.

Eggs are mixed with sperm in a laboratory.

Embryos are then transferred into a uterus.

(i) Describe how an embryo forms after the eggs and sperm have been mixed together.

(2)

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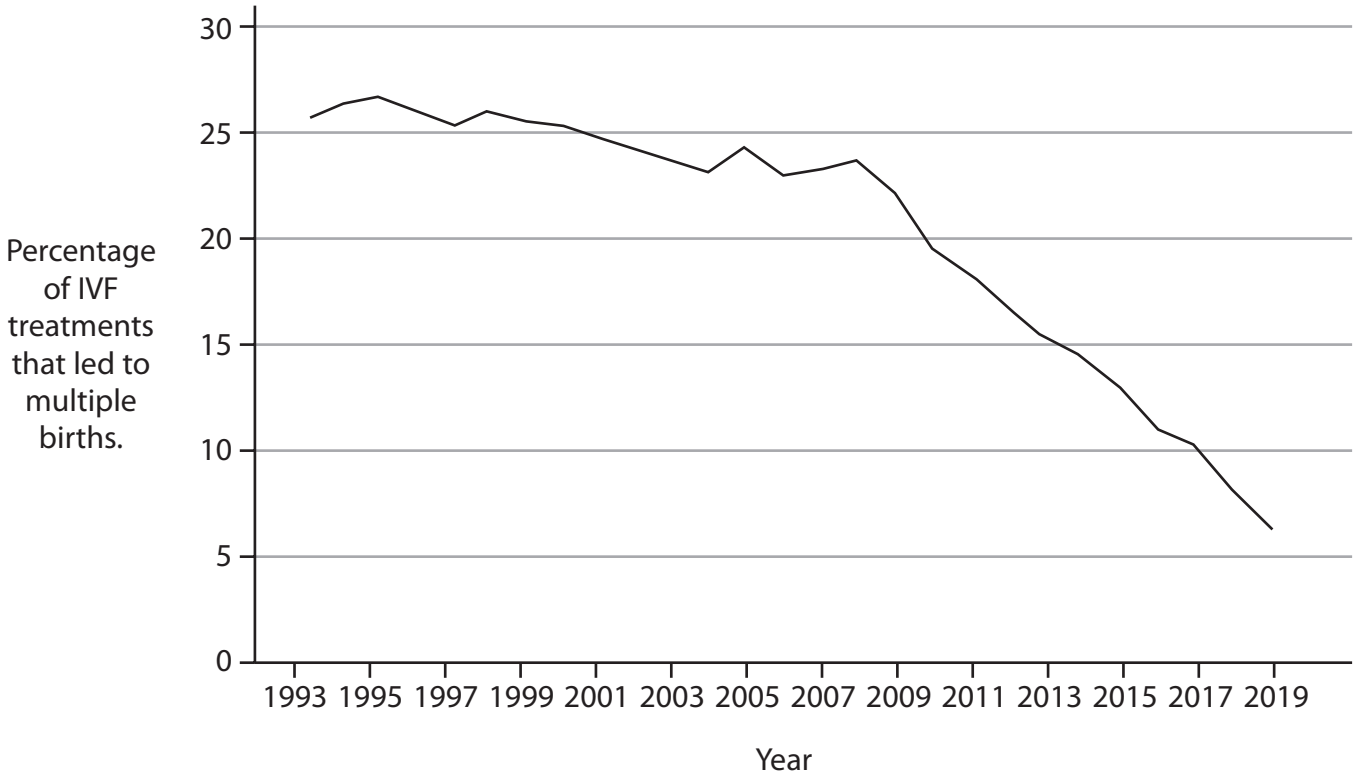
(ii) If more than one embryo is transferred to a uterus, IVF can result in multipl births, such as twins or triplets. Pregnancies that produce more than one bab can be a health risk.

In the United Kingdom, since 2007, the recommendations for the number of embryos transferred are

- a person under 40 should have only one embryo placed into their uterus
- a person over 40 may have two embryos placed into their uterus

The graph shows the percentage of IVF treatments that led to multiple births from 1993 to 2019.



The table shows the success rates for IVF in the United Kingdom in 2019 for people of different age groups.

Age of person receiving embryo in years	Percentage of IVF treatments that produced a baby (%)
under 35	32
35 to 37	28
38 to 39	19
40 to 42	11
43 to 44	5
45 to 50	4

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Discuss the effects of limiting the number of embryos transferred.

Use the information in the table and the graph to support your answer.

(5)

(Total for Question 7 = 10 marks)

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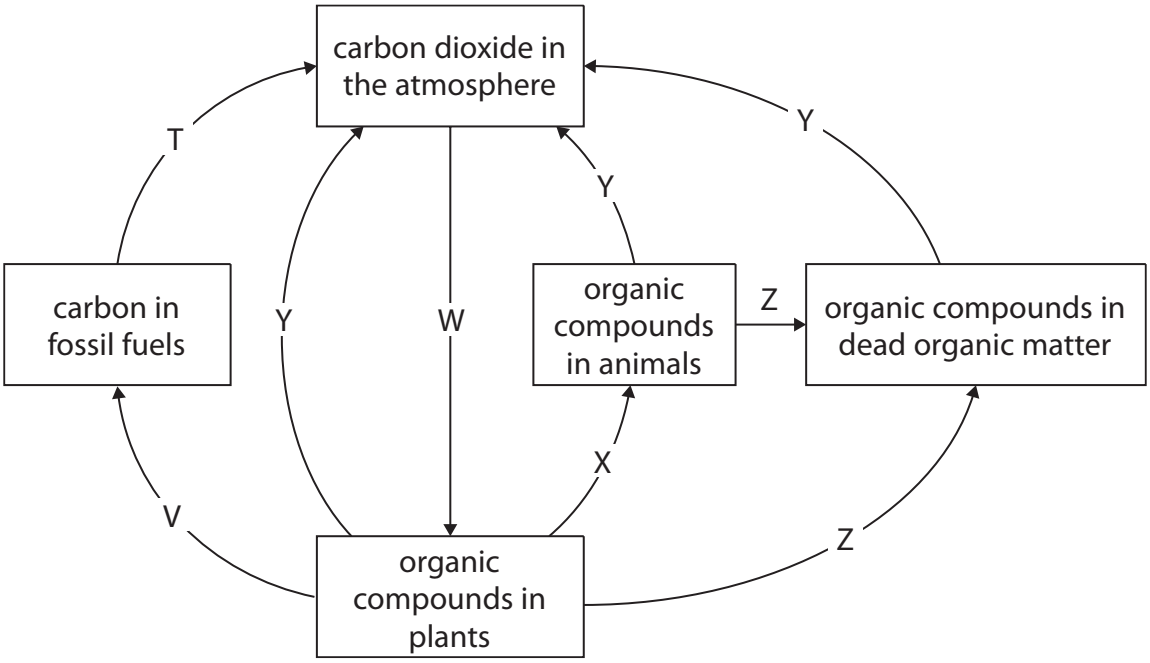
8 The diagram shows the carbon cycle.



(a) (i) Which letter in the diagram represents respiration?

(1)

- ☒ **A** T
- ☒ **B** X
- ☒ **C** Y
- ☒ **D** Z

(ii) Give the name of the process labelled W.

(1)

.....

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(b) Carbon dioxide, methane, and nitrous oxide are three greenhouse gases.

The table shows a comparison of these greenhouse gases.

The Global Warming Potential (GWP) is the ratio of the heat absorbed by a greenhouse gas in the atmosphere relative to the heat absorbed by the same mass of carbon dioxide gas.

Greenhouse gas	Percentage of all greenhouse gas emissions (%)	Global Warming Potential (GWP)	Length of time gas stays in atmosphere in years
carbon dioxide	77.00	1	1000
methane	16.00	30	25
nitrous oxide	0.77	270	298

(i) Name one other greenhouse gas.

(1)

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(ii) Evaluate the information in the table to identify which of these gases is like to contribute most to global warming.

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9 Scientists have developed transgenic crop plants that are resistant to herbicides (weedkillers).

(a) (i) State what is meant by the term **transgenic**.

(1)

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(ii) Suggest why growing herbicide-resistant crop plants is beneficial to farmers.

(2)

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(b) The photograph shows a weed called Palmer amaranth that is often found in fields growing soybeans.



© Jim West/Alamy Stock Photo

Palmer amaranth is a weed that has become resistant to many different herbicides.

In some populations of Palmer amaranth plants, a recessive allele (r) makes the plants resistant to herbicide. A dominant allele (R) makes the plants not resistant to herbicide.

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(i) Give the possible genotypes of Palmer amaranth plants that are not resista to herbicides.

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(ii) A Palmer amaranth plant that is resistant to herbicides is crossed with a Palmer amaranth plant that is heterozygous for herbicide resistance.

Draw a genetic diagram to show the genotypes of the parents, the gametes they produce, and the genotypes and the phenotypes of the offspring.

(3)

(iii) Give the probability of the cross in (b)(ii) producing a plant that is resistant to herbicide.

(1)

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(iv) Explain how Palmer amaranth plants have evolved to become resistant to herbicides in areas where herbicides are used frequently.

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(v) In plants such as Palmer amaranth, where the allele for herbicide resistance is recessive, no non-resistant weeds occur after five years of using herbicides.

In other plants, where the allele for herbicide-resistance is dominant, some non-resistant weeds occur after five years of using herbicides.

Explain this difference in the number of non-resistant weeds after five years of using herbicides.

(2)

(Total for Question 9 = 14 marks)

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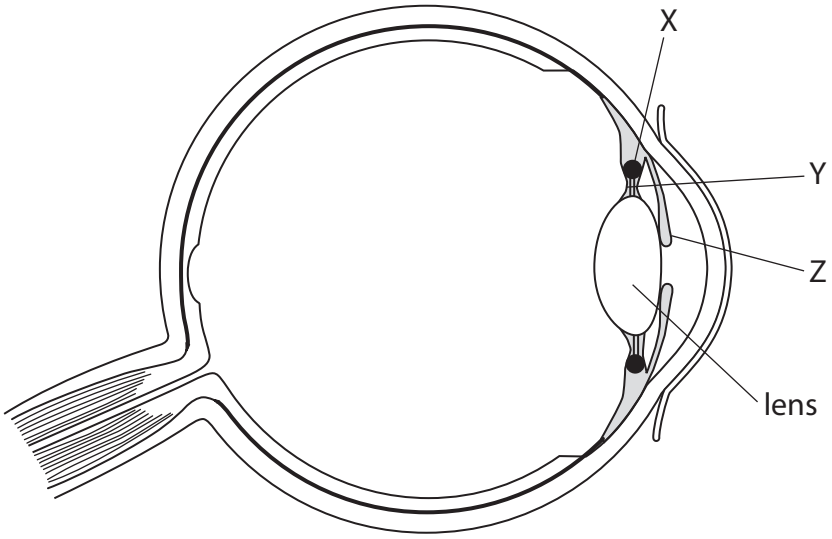
10 The diagram shows the structure of a human eye.



(a) (i) Give the name of structure Z.

(1)

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(ii) Describe how structures X and Y control the shape of a lens when focusing on a near object.

(3)

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(b) A cataract occurs when the lens becomes cloudy.

Severe cataracts are the main cause of blindness around the world.

(i) Explain why people with cataracts are unable to see clearly.

(2)

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(ii) Exposure to ultraviolet light is thought to be a risk factor for the development of cataracts.

The table shows the results of a 25-year investigation into the effect of different mean hours of sunlight on agricultural workers in one south Asian country.

Mean daily hours of exposure to sunlight	Number of people in group	Number of people who develop cataracts
7	100	2
8	270	5
9	350	7
10	580	9
11	440	14
12	540	35

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Comment on the results of the investigation.

(Total for Question 10 = 10 marks)

TOTAL FOR PAPER = 110 MARKS

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