Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | | | | | |

Candidate Number | | | | |

Pearson Edexcel International GCSE (9–1)

Sample assessment material for first teaching 2024

Time 1 hour 40 minutes

Paper reference **4WBI2/1B**

Biology (Modular)
UNIT 2

You must have:
Ruler, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **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 unit is 90.
- 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 about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Making Enough Blood for the World

A blood transfusion is the transfer of blood from a donor into a patient. Blood transfusions are routine medical procedures that save the lives of millions of people every year.

(Source: beerkoff/Shutterstock)

The first successful blood transfusions were performed in the early twentieth century after scientists discovered that there are four main blood groups, A, B, AB and O. The blood groups are due to the presence of proteins, called antigens, on the surface of red blood cells. There are two main protein antigens called A and B. If a patient is given blood with antigens different to their own cells, their immune system will make antibodies against that antigen. The antigens present on the surface of red blood cells for each blood group are shown in the table.

Blood group	Antigens present
A	A
B	B
AB	A and B
O	Neither A nor B

Currently, blood transfusions are carried out with blood that has been donated by healthy people. The World Health Organisation calculates that there are 118.5 million blood donations collected globally every year. Of these donations, 40% are collected from a small group of highincome countries. This means that there is a shortage of blood in many countries so the hunt is on to find an alternative.

Scientists have found a way to make artificial red blood cells. They made spheres of cell membranes filled with haemoglobin. These artificial cells are then suspended in sodium chloride solution. These artificial red blood cells have no proteins on their surface. Another way of making red blood cells is being developed in the United Kingdom. A research team has used stem cells to produce red blood cells with blood group O. The red blood cells produced are then suspended in sodium chloride solution.

Both methods produce large quantities of safe red blood cells. There may be other advantages as well, artificial blood would always have the same concentration of solutes and will not clot when stored. Critics have pointed out that the artificial blood will only transport oxygen and that blood has many more functions.

(a) Name the type of cell that produces antibodies. (Lines 8 and 9)

(1)

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(b) Human blood groups are controlled by three alleles, I^A, I^B and I^O.

The I^A and I^B alleles are codominant and the I^O allele is recessive.

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

(1)

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(ii) Two parents have genotypes of I^AI^O and I^BI^O.

Which of these are all the possible blood groups of their children?

(1)

- ☒ **A** A and B
- ☒ **B** A, B and O
- ☒ **C** AB and O
- ☒ **D** A, B, AB and O

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(c) Calculate the number of blood donations collected per year from the high-income countries. (Lines 14 and 15)

Give your answer in standard form.

(2)

number = ...

(d) Some scientists have suggested that spherical artificial red blood cells transport oxygen less efficiently than normal human red blood cells.

Explain why the shape of the artificial red blood cells reduces the efficiency of oxygen transport compared to normal human red blood cells. (Lines 18 and 19)

(3)

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(e) Suggest why artificial blood does not clot when stored. (Lines 26 and 27)

(1)

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(f) Suggest why the scientists made red blood cells with blood group O.
(Lines 22 and 23)

(2)

(g) Blood is filtered in the kidney by the process of ultrafiltration.

Describe the process of ultrafiltration.

(3)

(Total for Question 1 = 14 marks)

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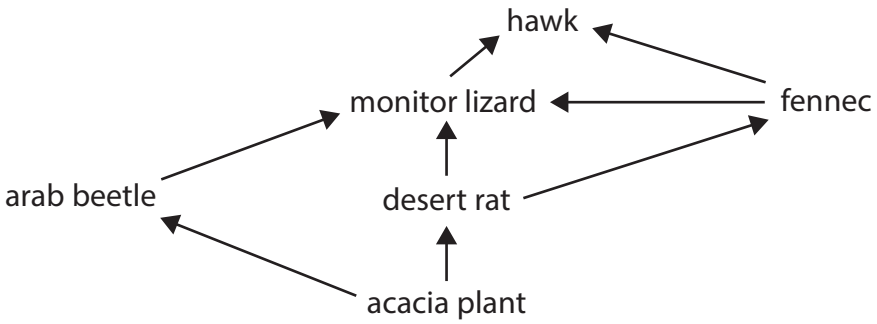
2 The diagram shows part of a food web for a desert community.



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

(1)

- ☒ **A** 2
- ☒ **B** 3
- ☒ **C** 4
- ☒ **D** 5

(ii) Draw the longest food chain in this food web.

(1)

(iii) Explain why most of the energy in the producers is not transferred to the hawk.

(3)

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(b) The photograph shows a fennec fox.

(Source: anolis01.123rf.com/PAL)

Fennec foxes live in the Sahara Desert, which is very hot. They have very large ears and a thin body.

Explain how the body shape of the fennec fox has evolved by natural selection.

(4)

(Total for Question 2 = 9 marks)

3 A group of students compares the distribution of plant species in two fields using this method.

- use random sampling
- use a 0.5 m × 0.5 m quadrat
- count the number of each species in a quadrat

Repeat this method for five quadrats in each field.

The tables show the students' results.

	Field A						
	Number of plants in each quadrat						Number of plants per m^2
Species	**first**	**second**	**third**	**fourth**	**fifth**	**mean**	
dandelion	7	0	6	3	4	4	16
buttercup	2	1	0	3	2	2	6
violet	1	0	2	1	2	1	5
heather	2	3	1	2	1	2	7

	Field B						
	Number of plants in each quadrat						Number of plants per m^2
Species	**first**	**second**	**third**	**fourth**	**fifth**	**mean**	
dandelion	7	3	2	1	2		
buttercup	0	0	0	0	0	0	0
violet	0	0	0	1	0	0	0
heather	0	0	0	0	0	0	0

(a) Describe how the students would obtain random samples from each field.

(2)

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(b) (i) Calculate the mean number of dandelions per quadrat in field B.

(1)

mean number = ...

(ii) Calculate the number of dandelions per m^2 in field B.

(1)

number of dandelions per m^2 = ...

(c) Describe the differences in species distribution in field A and field B.

(2)

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(d) A teacher suggests that there are no buttercups in field B because of poor water drainage from the field.

Describe what further experiment the students could do to investigate this suggestion.

(3)

(Total for Question 3 = 9 marks)

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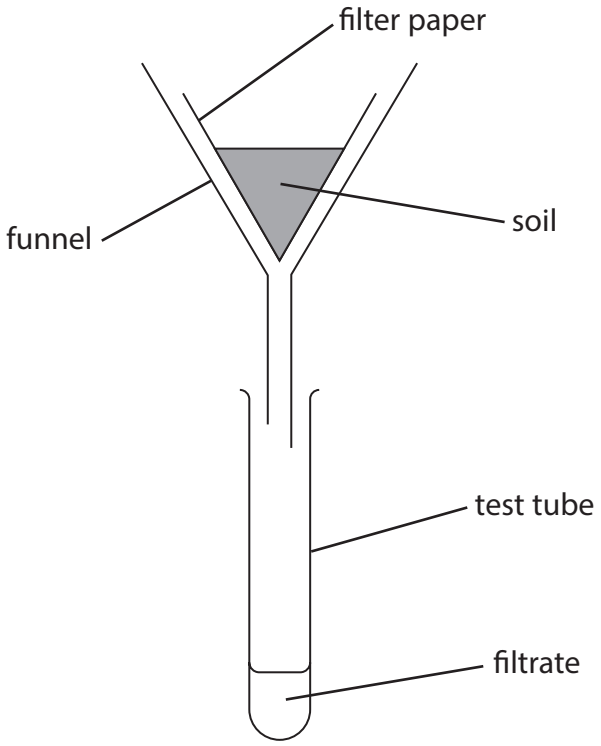
4 A student uses this method to investigate the nitrogen cycle.

- take two samples of soil, each of mass 100 g
- sterilise one sample of soil by heating at 100 °C for one hour
- place the sterilised and unsterilised samples into separate filter funnels
- pour 25 cm^3 of water through each soil sample and collect the filtrate in a test tube
- test each filtrate for nitrates
- pour water through each soil sample for 5 minutes
- pour another 25 cm^3 of water through each soil sample and collect the filtrate in a test tube
- test each filtrate for nitrates
- add 1 cm^3 of a solution of ammonium salts to each soil and leave for three days
- pour 25 cm^3 of water through each soil sample again and collect the filtrate in a test tube
- test each filtrate for nitrates

The diagram shows the student's apparatus.



The table shows the student's results.

Soil sample	Result of test for nitrates		
	At start of investigation	After water has passed through for five minutes	Three days after adding ammonium salts
unsterilised	present	absent	present
sterilised	present	absent	absent

(a) Give the independent variable in the investigation.

(1)

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(b) (i) Suggest why the student poured water through the soil samples for five minutes before adding the ammonium salts.

(2)

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(ii) Comment on the results of the nitrate tests on the two soil samples three days after adding ammonium salts.

(4)

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(Total for Question 4 = 7 marks)

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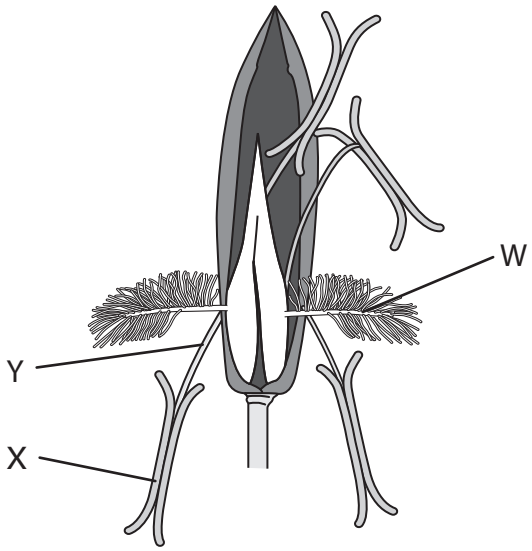
5 The diagram shows a wind-pollinated flower with some structures labelled W, X and Y.



(a) (i) Describe how structures W, X and Y are adapted for wind pollination.

(3)

(ii) Structures W, X and Y are adapted for wind pollination.

Give **two** other differences between wind-pollinated flowers and insect-pollinated flowers.

(2)

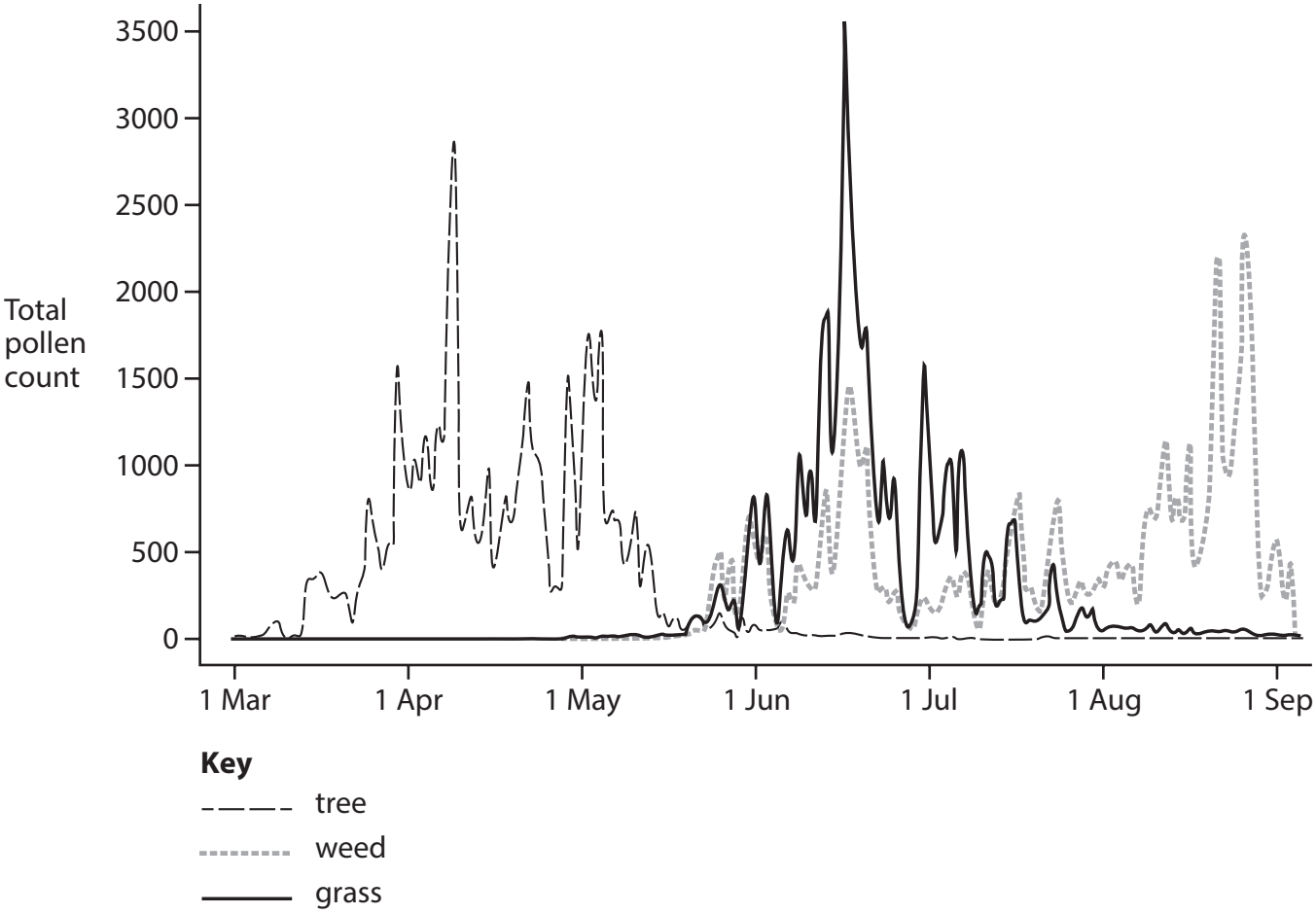
1 .....

2 .....

(b) Wind-pollinated flowers often cause an allergic response in people. This is known as hay fever.

Most people in the United Kingdom who get hay fever have the symptoms from April to September.

The graph shows the changes in total pollen count for three different plant types from March to September during one year in the United Kingdom.



As part of an investigation into pollen allergy, five people keep a diary of their hay fever symptoms. They do this for the same year as the pollen count.

The table gives their results.

Person	Months with severe symptoms	Months with mild symptoms	Months with no symptoms
A	April and May	March and June	July to September
B	June and July	March to May, August	none
C	April to September	March	none
D	none	none	all
E	June to September	March to May	none

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Using the data in the table and the information from the graph, discuss the likely causes of the allergic responses in each person.

(5)

(Total for Question 5 = 10 marks)

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6 The photograph shows a variety of chicken called a silkie chicken.

(Source: © yves lanceau/nature picture library/science photo library)

Silkie chickens have feathers that have a fluffy appearance.

Feather structure is controlled by a single gene.

The allele for producing silkie feathers (f) is recessive to the allele for producing normal feathers (F).

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

(1)

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(ii) Give the possible genotypes of a chicken with normal feathers.

(1)

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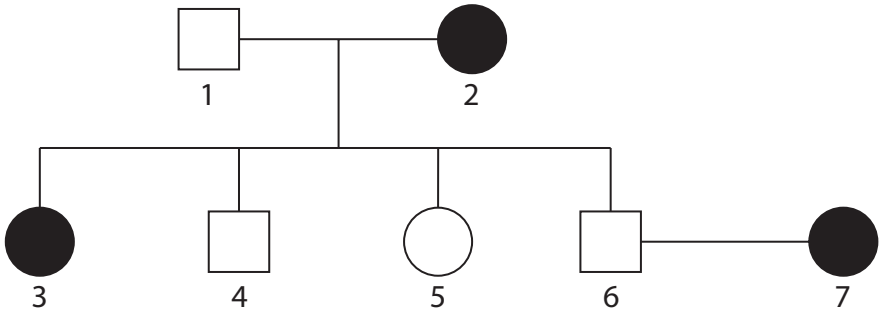
(b) A scientist investigates the inheritance of feather types in chickens.

The diagram shows a family pedigree for some chickens.



Key

- male with normal feathers
- male with silkie feathers
- female with normal feathers
- female with silkie feathers

(i) How many chickens in the family pedigree are heterozygous?

(1)

- ☒ **A** 0
- ☒ **B** 3
- ☒ **C** 4
- ☒ **D** 5

(ii) Use a genetic diagram to determine the probability of one of the offspring of individual 6 and individual 7 being a chicken with silkie feathers.

(4)

probability = ...

(iii) The scientist observes that the chickens have either normal feathers or silkie feathers.

However, the chickens have a wide range of different heights.

Explain why there is a wider range of variation in height than in feather type.

(3)

(Total for Question 6 = 10 marks)

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7 Some people cannot make the proteins needed for blood clotting.

Cloning is used to produce large numbers of transgenic mammals.

These transgenic mammals can make the human blood-clotting proteins. The human blood-clotting proteins can then be removed from the mammals' milk and injected into people who cannot make proteins.

(a) (i) Explain why these mammals are described as transgenic.

(2)

(ii) Which enzyme is used to cut DNA to make a recombinant plasmid?

(1)

- ☒ **A** amylase
- ☒ **B** ligase
- ☒ **C** lipase
- ☒ **D** restriction

(b) Describe how a mammal is cloned.

(6)

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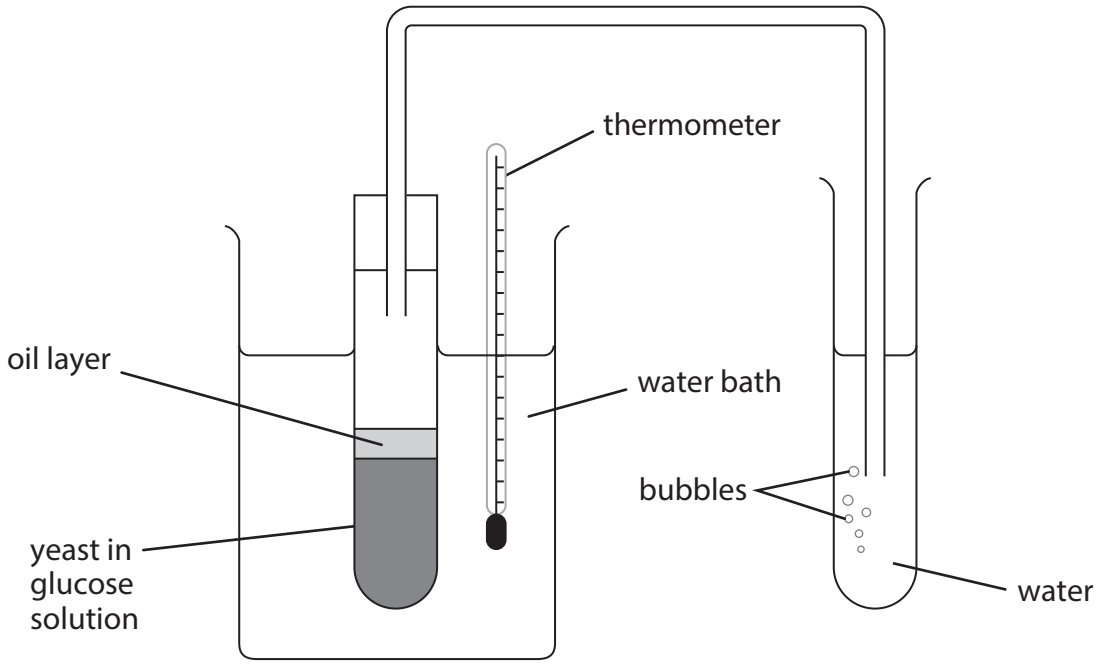
(Total for Question 7 = 9 marks)

8 A student uses this apparatus to investigate the effect of temperature on the rate of anaerobic respiration by yeast.



(a) The oil layer prevents the entry of air into the glucose solution.

Explain why this is necessary.

(2)

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(b) The student varies the temperature of the water bath between 15 °C and 60 °C.

The student leaves the test tube of yeast and glucose in the water baths for five minutes before starting to count the bubbles.

They measure the rate of respiration by counting the number of carbon dioxide bubbles produced per minute.

The table shows the results.

	Number of bubbles produced in one minute				
Temperture / °C	**trial 1**	**trial 2**	**trail 3**	**trial 4**	**trial mean**
15	6	7	5	5	6
20	7	8	7	9	8
35	10	12	11	14	
45	12	15	14	16	14
60	3	2	1	2	2

(i) Explain why the student waits five minutes before they begin counting bubbles.

(2)

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(ii) Calculate the mean number of bubbles produced in one minute at 35 °C.

(2)

mean number of bubbles in one minute = ...

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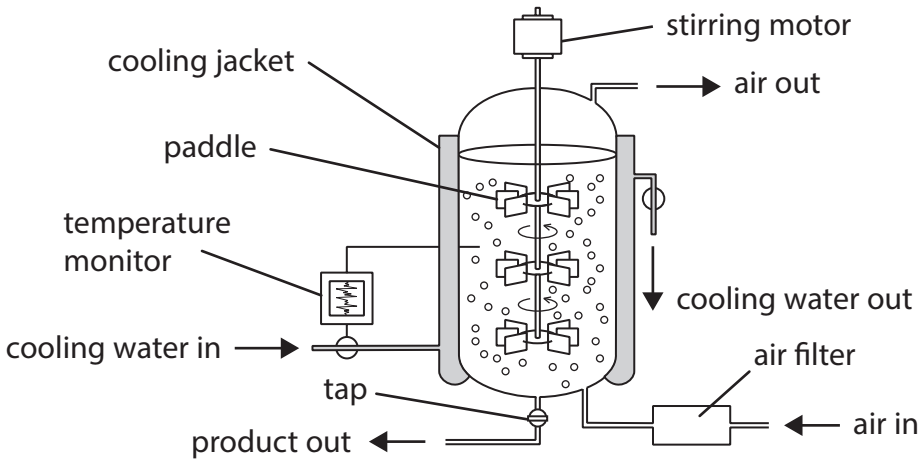
(iii) Explain the change in the rate of bubble production by yeast as the temperature increases from 15 °C to 45 °C.

(3)

(c) Describe **one** way that the student could make the results more accurate.

(2)

(d) The diagram shows an industrial fermenter that can be used to grow large quantities of genetically modified yeast.



Explain the function of the temperature monitor and cooling jacket.

(2)

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(Total for Question 8 = 13 marks)

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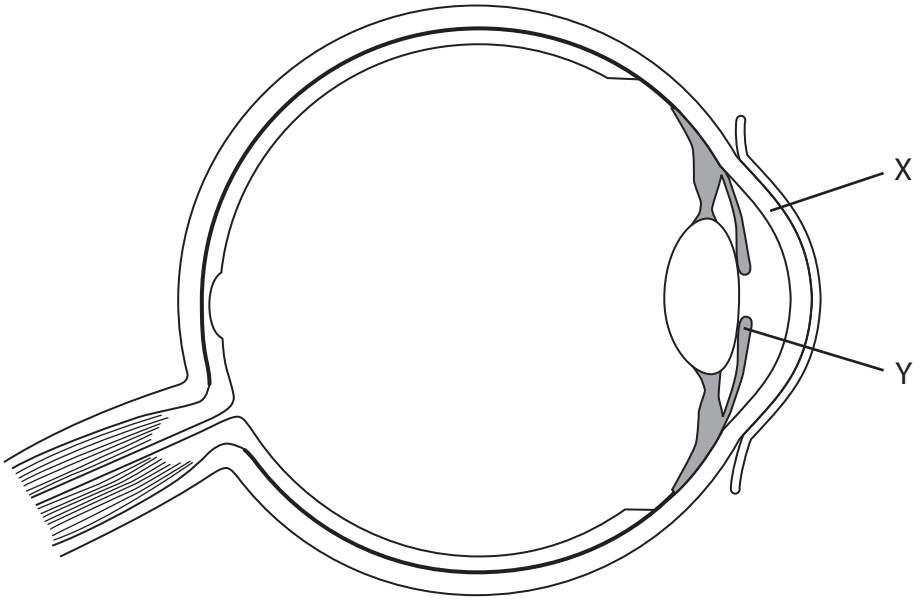
9 (a) The diagram shows the structure of a human eye.



(i) Which of these is the structure labelled X?

(1)

- ☒ **A** conjunctiva
- ☒ **B** cornea
- ☒ **C** lens
- ☒ **D** retina

(ii) When looking at a close object, which row of the table shows the state of the ciliary muscles and suspensory ligaments?

(1)

	Ciliary muscles	Suspensory ligaments
☒ **A**	contracted	loose
☒ **B**	contracted	tight
☒ **C**	relaxed	loose
☒ **D**	relaxed	tight

(iii) Explain how structure Y controls the light entering the eye when someone walks into a dark room.

(2)

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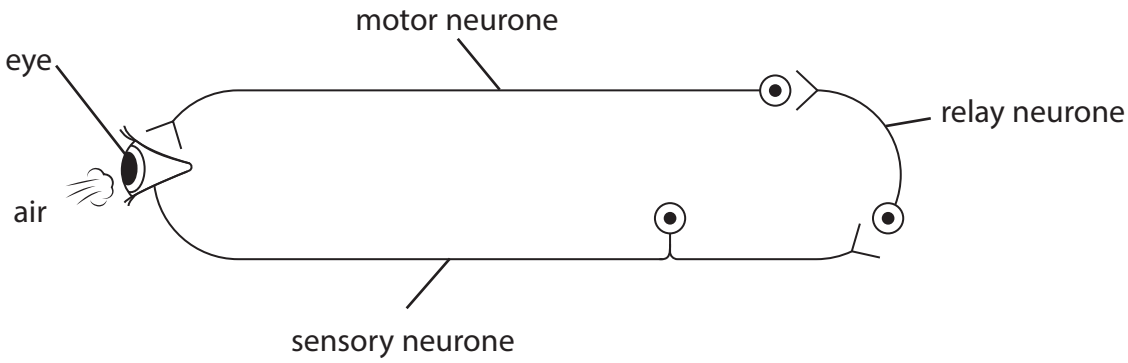
(b) Multiple sclerosis is a condition that can slow down the speed at which electrical impulses travel along neurones.

The time taken for the blink reflex to occur can be used to help diagnose if someone has multiple sclerosis.

The blink reflex causes the eyelid to close.

Air is blown on to the eye and the time taken for the eyelid to close is recorded.

The diagram shows the reflex pathway.



The speed the impulse moves along the reflex arc consisting of all three neurones in a person without multiple sclerosis is 77 metres per second.

The time taken for the blink reflex to occur in a person with multiple sclerosis is 0.0050 s.

The total length of the neurones in the reflex arc for the person with multiple sclerosis is 25 cm.

(i) Calculate the difference between the speed of impulse for the person with multiple sclerosis and for the person without multiple sclerosis, in metres per second.

(3)

difference in speed = ... m/s

(ii) The speed of an impulse along the axon of the motor neurone for someone without multiple sclerosis is 120 metres per second.

Suggest why the speed of the impulse calculated along all three neurones is less than the speed of the impulse along only the motor neurone.

(2)

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(Total for Question 9 = 9 marks)

TOTAL FOR UNIT = 90 MARKS