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)

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.*
- Show all the steps in any calculations and state the units.

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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P 7 2 4 7 2 A 0 1 3 2

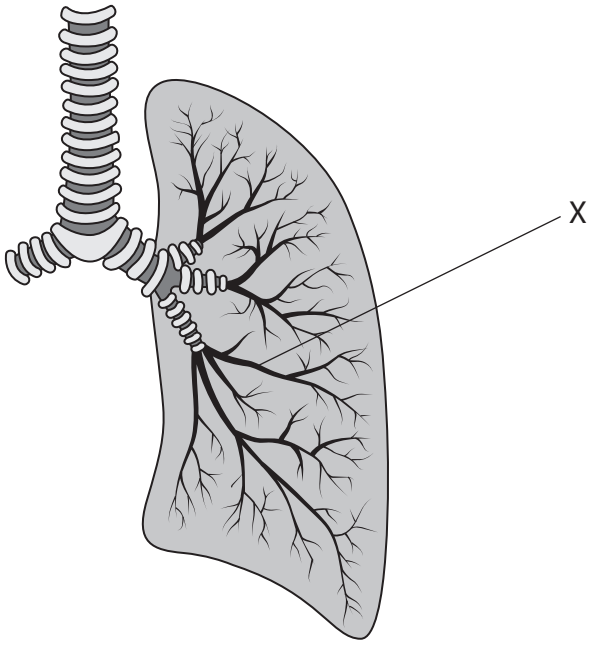
Pearson

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 Gas exchange occurs in the respiratory system. The human respiratory system is located in the thorax.

(a) The diagram shows some of the structures in the human thorax.



(i) What is the name of the structure labelled X?

(1)

☒ **A** alveolus

☒ **B** bronchiole

☒ **C** bronchus

☒ **D** trachea

(ii) Which of these describes what happens when a person breathes in?

(1)

☒ **A** diaphragm contracts and moves downwards

☒ **B** diaphragm contracts and moves upwards

☒ **C** diaphragm relaxes and moves downwards

☒ **D** diaphragm relaxes and moves upwards

(b) The table shows the percentage of some of the gases in inhaled air and exhaled air.

Gas	Percentage of gas (%)	
	inhaled air	exhaled air
oxygen	20	16
carbon dioxide	0.04	4
nitrogen	79	79

(i) Explain the differences between the percentages of gases in inhaled air and in exhaled air.

(3)

(ii) Air in the alveoli has a composition of 14% oxygen and 7% carbon dioxide.

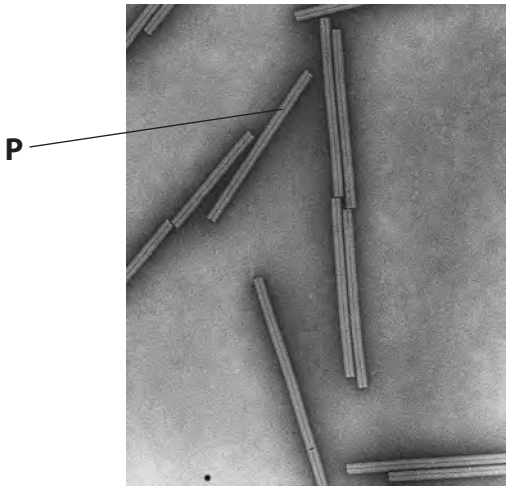
Suggest why the composition of air in the alveoli is different from exhaled air.

(2)

(Total for Question 1 = 7 marks)

2 Tobacco mosaic virus infects plant cells.

The photograph shows some of the virus particles.



(Source: © DR. JOHN FINCH/SCIENCE PHOTO LIBRARY)

(a) (i) Tobacco mosaic virus particles consist of a molecule of RNA surrounded by a coat.

Which substance is the coat made from?

(1)

☒ **A** cellulose

☒ **B** chitin

☒ **C** protein

☒ **D** starch

(ii) The virus particle labelled **P** has an actual length of 0.3 μm.

Calculate the magnification of this virus particle.

[1 mm = 1000 μm]

(3)

magnification = × .....

(b) The photograph shows the leaves of a plant infected by tobacco mosaic virus.

(Source: © PAL)

Plants cells infected with the virus stop making chloroplasts.

Explain why plants that are infected with the virus grow more slowly than uninfected plants.

(3)

(Total for Question 2 = 7 marks)

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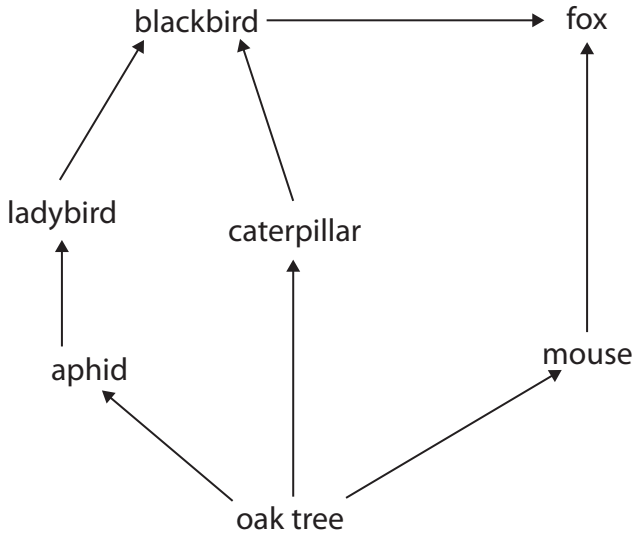
3 The diagram shows part of a woodland food web.



(a) (i) Which organism is a primary consumer in this food web?

(1)

- ☒ **A** aphid
- ☒ **B** blackbird
- ☒ **C** fox
- ☒ **D** oak tree

(ii) Which of these describes the woodland community?

(1)

- ☒ **A** all the abiotic and biotic factors in the area
- ☒ **B** all the blackbirds in the area
- ☒ **C** all the different species and the habitat
- ☒ **D** all the different species in the area

(b) This is one food chain from the food web.

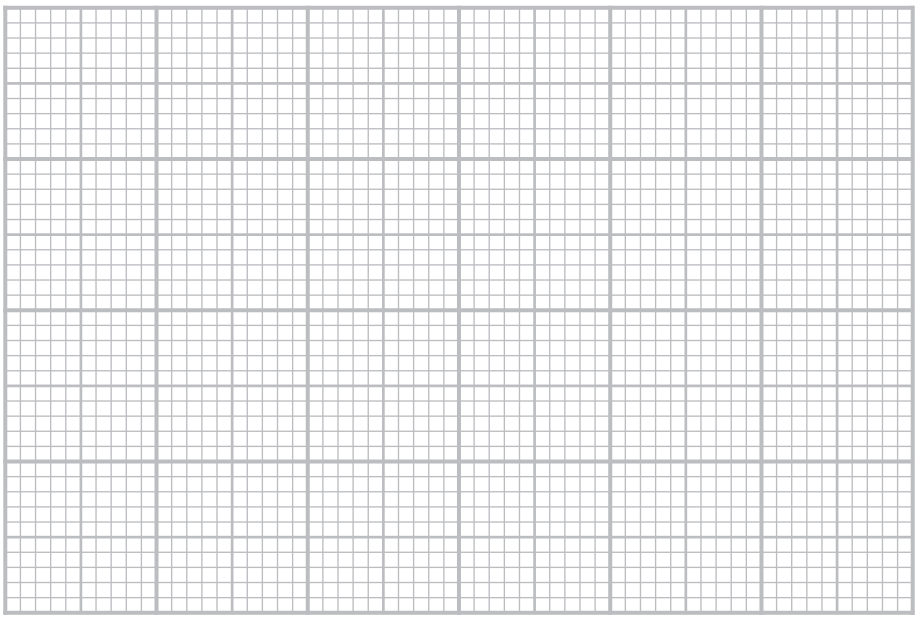
oak tree ⟶ mouse ⟶ fox

(i) A student counted 20 mice living around 4 oak trees. There were also 2 foxes in the area.

Draw a labelled pyramid of numbers for this food chain on the grid.

Your pyramid should be drawn to scale.

(3)



(ii) Photosynthesis results in 25 000 kJ of energy being transferred to the biomass of the oak trees each year.

Only 8% of this energy is transferred to the biomass of the 20 mice each year.

Calculate the mean amount of energy transferred to the biomass of one mouse each year.

(2)

mean amount of energy = ... kJ

(iii) Explain why only 8% of the energy stored in the biomass of the oak trees is used by the mice for growth.

(3)

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(Total for Question 3 = 10 marks)

4 Cow's milk contains a mixture of nutrients, including protein, fat, sugar, vitamins, and minerals.

(a) (i) The main sugar in milk is a carbohydrate called lactose.

Which chemical elements are present in carbohydrates?

(1)

- ☒ **A** carbon and hydrogen only
- ☒ **B** carbon, hydrogen, and oxygen only
- ☒ **C** carbon, hydrogen, and nitrogen only
- ☒ **D** carbon, hydrogen, nitrogen, and oxygen

(ii) Describe how to test a sample of milk for protein.

(2)

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(b) Some people drink a milk alternative produced from plants, such as soy and rice, instead of milk produced by animals.

The table shows nutritional information for different milk products.

Milk product	Nutrient content in 224 g of milk				
	Energy in kJ	Mass of protein in g	Mass of fat in mg	Mass of carbohydrate in g	Mass of calcium in mg
cow	146	8	8.0	11	250
soy	80	8	4.0	4	300
rice	120	1	2.5	14	0

(i) The recommended daily amount of calcium for a child is 1400 mg.

Calculate the mass of cow's milk that would contain 1400 mg of calcium.

(2)

mass = ... g

(ii) Discuss whether soy milk or rice milk is a suitable replacement for cow's milk in the diet of children.

(5)

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(Total for Question 4 = 10 marks)

5 The photograph shows a red fire ant.

(Source: © JAMES H. ROBINSON/SCIENCE PHOTO LIBRARY)

Fire ants are pests that damage crops.

Phorid flies can be used as a biological control of fire ants.

Scientists use this method to investigate the use of pesticides and biological control on populations of fire ants that live on plants in glasshouses.

- in one glasshouse, keep plants with no treatment
- in a second glasshouse, treat plants with pesticide
- in a third glasshouse, treat plants with pesticide and then immediately introduce phorid flies
- count the number of fire ants in each glasshouse at intervals for 24 months

The table shows the scientists' results.

Time after treatment in months	Number of fire ants		
	No treatment	Pesticide only	Pesticide and phorid flies
0	500	500	500
6	700	50	50
12	600	75	25
18	600	125	25
24	700	400	25

(a) Give a reason why the scientists include results from a glasshouse with no treatment in their investigation.

(1)

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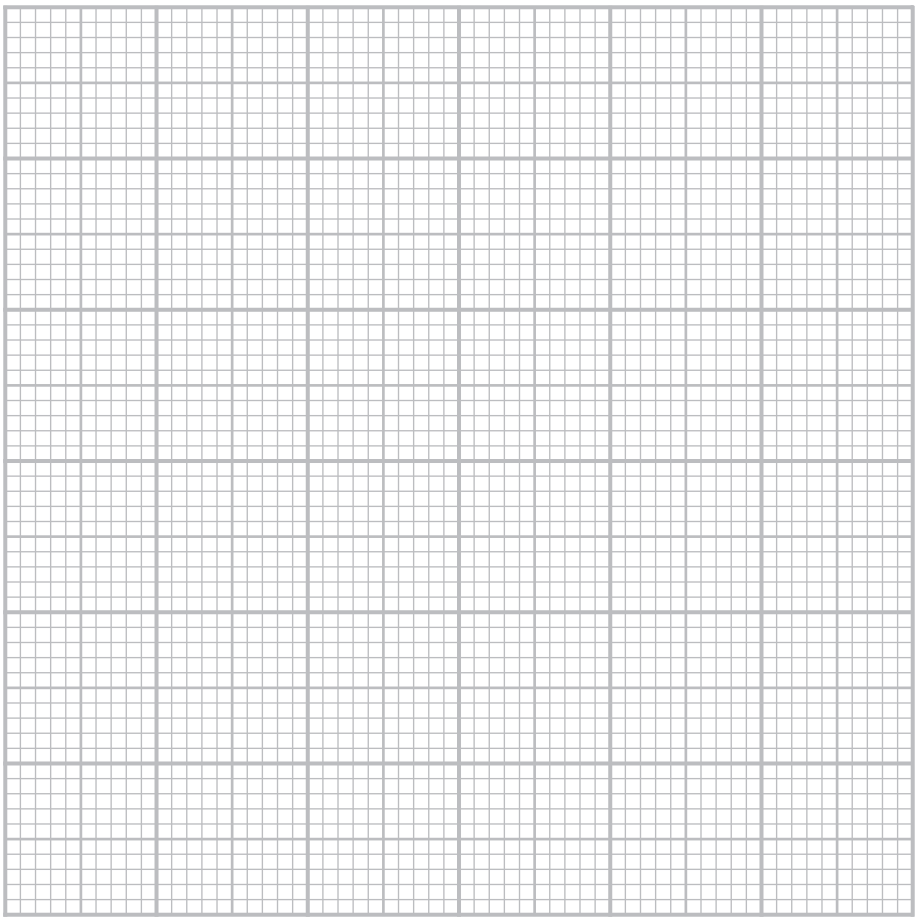
(b) Draw a line graph to show the changes in the number of fire ants with pesticide only and with both pesticide and phorid flies for the 24 months.

Join your points with straight lines.

(5)



(c) Describe the effect of using pesticide only on the number of fire ants for the 24 months.

(2)

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(d) Discuss the effects of using pesticide only and of using both pesticide and phorid flies on the number of fire ants.

Use the data and your own biological knowledge in your answer.

(5)

(Total for Question 5 = 13 marks)

6 The following passage is about chemical coordination in animals and plants.
Complete the passage by writing a suitable word in the blank space.

Animals and plants use chemicals to coordinate responses. In animals, some glands produce hormones which are transported in the ..... of the blood. A high glucose concentration in the blood stimulates the release of a hormone called ..... from the ..... . This causes an organ called the ..... to remove glucose from the blood and store it as a substance called ..... .

Plant shoots grow towards light. This response is called ..... . The movement of a chemical called ..... to the shaded side of the shoot causes the shoot to grow towards the light.

(Total for Question 6 = 7 marks)

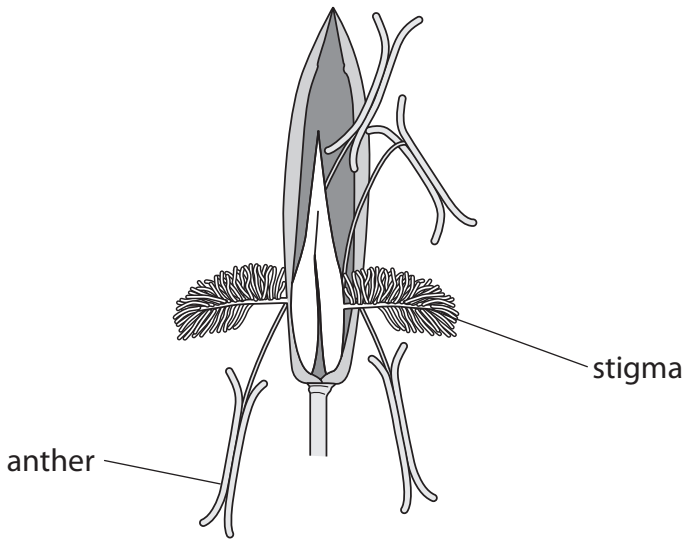
7 A species of grass has a diploid chromosome number of 12.

(a) Which row in the table shows the number of chromosomes in the nucleus of a pollen grain, and in the nucleus of a root cell, of this grass?

(1)

	Number of chromosomes present	
	Pollen grain nucleus	**Root cell nucleus**
☒ **A**	6	6
☒ **B**	6	12
☒ **C**	12	6
☒ **D**	12	12

(b) The diagram shows a flower from the grass plant.



Explain two ways this flower is adapted for wind pollination.

(4)

1 .....

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2 .....

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(c) Scientists use this method to investigate self-pollination and cross-pollination in a species of grass plant.

- take pollen grains from the anther of a flower
- place some of the pollen grains on the stigma of the same flower
- after one day, count how many of the pollen grains grow a pollen tube

Repeat the method but place the pollen grains on the stigma of a flower of a different plant.

The table shows the scientists' results.

Pollen transfer	Percentage of pollen grains that grow a pollen tube
pollen transferred to the stigma of same flower	5
pollen transferred to the stigma of a flower on a different plant	75

(i) State the dependent variable in this investigation.

(1)

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(ii) Explain how the results of the investigation show that this species of grass plant is able to survive in a changing environment.

Use the information in the table to support your answer.

(3)

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(d) Grass plants can also be produced by asexual reproduction.

New plants are produced from the roots of a parent plant.

(i) State the name of the type of cell division used to produce new plants by asexual reproduction.

(1)

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(ii) Describe why it is an advantage for commercial growers to produce plants by asexual reproduction.

(2)

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(Total for Question 7 = 12 marks)

8 Reflexes are responses that protect the body and involve the central nervous system (CNS).

(a) (i) Give the name of one part of the CNS.

(1)

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(ii) If an animal steps on a sharp object, a reflex arc occurs so that it picks up its foot to prevent further damage.

Describe how named neurones bring about a withdrawal reflex to protect the animal from damage.

(4)

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(b) The photograph shows a breed of dog called a border collie.

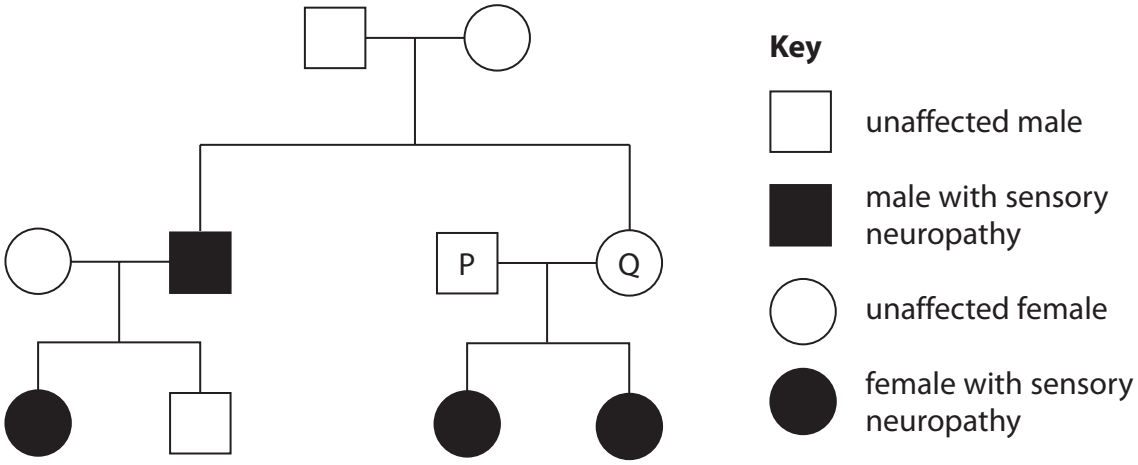
(Source: © PAL)

Some border collies have a genetic condition called sensory neuropathy.

Border collies with sensory neuropathy may be injured as their reflexes do not work well.

Sensory neuropathy is caused by a recessive allele, n. The dominant allele for not having sensory neuropathy is N.

The diagram shows a family pedigree for some border collies.



(i) Sex determination in dogs is controlled in the same way as in humans.

Which combination of sex chromosomes is present in the body cells of a male dog?

(1)

☒ **A** XX

☒ **B** XY

☒ **C** Y

☒ **D** YY

(ii) How many individuals in this family have the genotype Nn?

(1)

- ☒ **A** 2
- ☒ **B** 4
- ☒ **C** 5
- ☒ **D** 6

(iii) Determine the probability that the next offspring produced by individuals P and Q is a male with sensory neuropathy.

Include a genetic diagram in your answer.

(4)

probability = ...

(iv) Dog breeders use selective breeding to try to remove harmful alleles from dog breeds.

Explain how selective breeding could be used to remove the allele for sensory neuropathy from a population of border collies.

(3)

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(Total for Question 8 = 14 marks)

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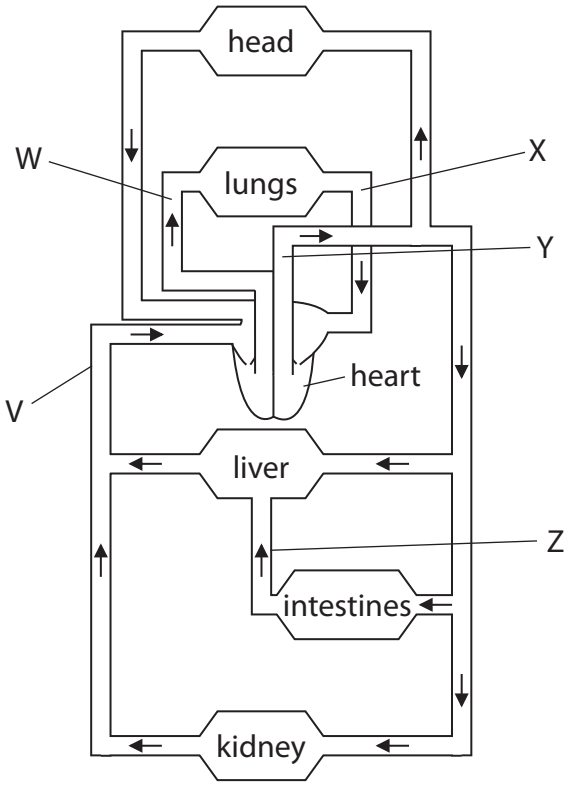
9 The diagram shows the human blood circulation system.



(a) (i) What is the name of the blood vessel labelled Z?

(1)

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(ii) Which labelled blood vessel contains blood with the lowest concentration of carbon dioxide?

(1)

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

(b) Give two differences in the structure of the blood vessel labelled V and the structure of the blood vessel labelled Y.

(2)

1 .....

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2 .....

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(c) High blood pressure and the presence of certain genes are risk factors for coronary heart disease.

(i) Give two **other** risk factors for coronary heart disease.

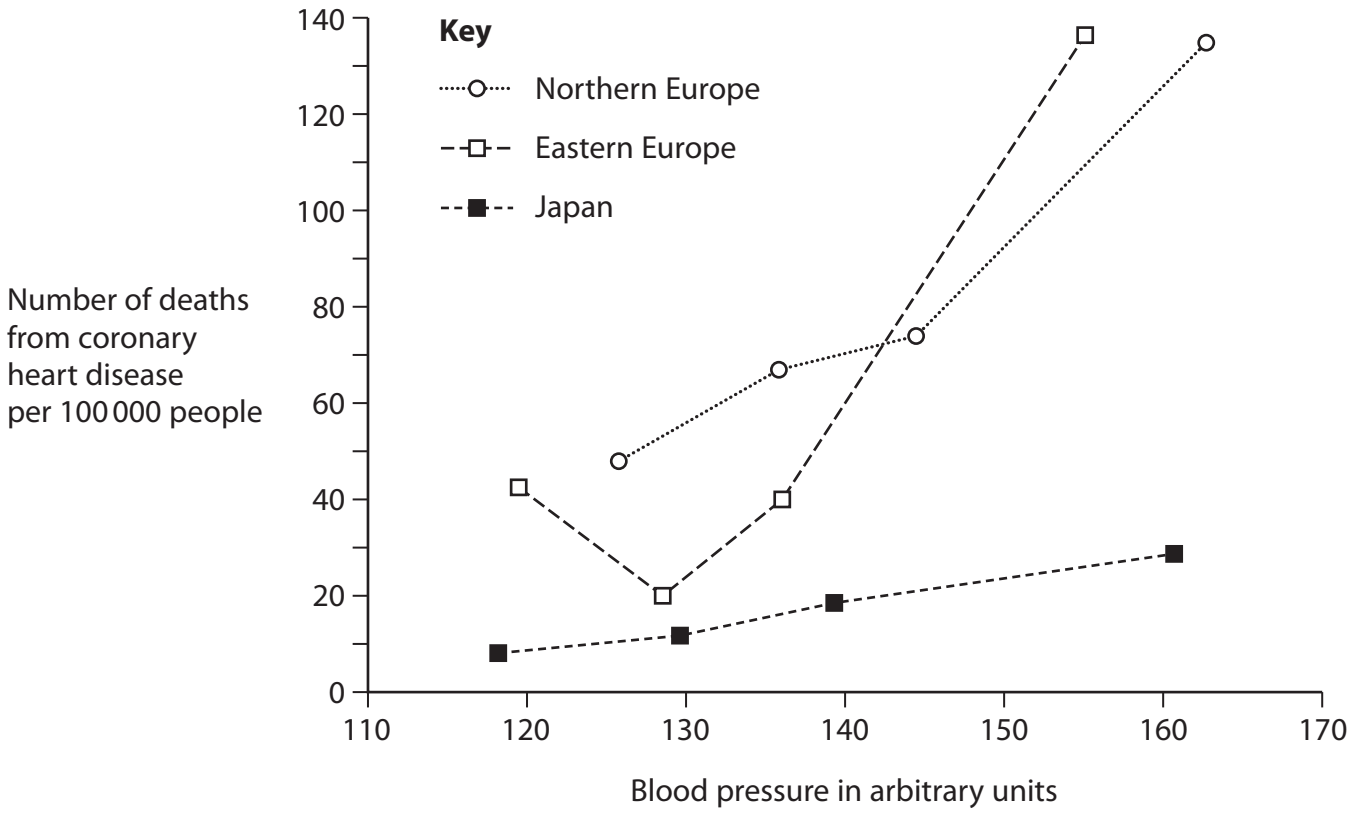
(2)

1 .....

2 .....

(ii) Scientists compared the relationship between blood pressure and the number of deaths from coronary heart disease in Northern Europe, Eastern Europe and Japan.

The graph shows their results.



A high blood pressure is considered to be above 130 arbitrary units.

Use the graph and your own knowledge to comment on the causes of death due to coronary heart disease in each region.

(4)

(Total for Question 9 = 10 marks)

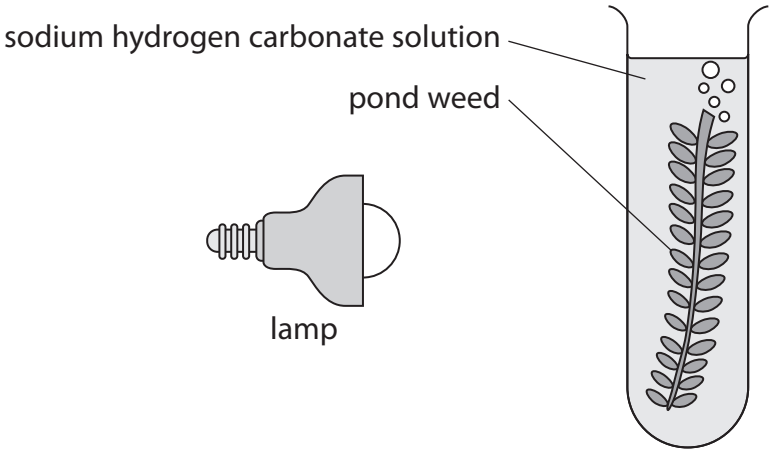
10 A student investigates factors affecting the rate of photosynthesis.

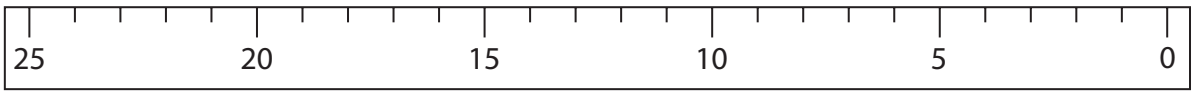
(a) Complete the balanced chemical symbol equation for photosynthesis.

(2)

..... + ... ⟶ ..... + $6O_2$

(b) The diagram shows apparatus that can be used to measure the rate at which a piece of pond weed produces bubbles of oxygen.





The student uses this apparatus to investigate the effect of changing light intensity and carbon dioxide concentration on the rate of photosynthesis in pond weed.

This is the student's method.

Step 1 fill the test tube with 5% sodium hydrogen carbonate solution

Step 2 place a piece of pond weed into the test tube

Step 3 place a lamp 5 cm from the test tube

Step 4 count the number of bubbles produced by the pond weed in two minutes

Step 5 repeat steps 1 to 4 with the lamp at distances of 10 cm, 15 cm, 20 cm, and 25 cm

This method is repeated using 10% sodium hydrogen carbonate solution.

The table shows the results of the investigation.

Distance of lamp from test tube in cm	Number of bubbles of oxygen produced in 2 minutes	
	Concentration of sodium hydrogen carbonate	
	5%	10%
5	30	50
10	30	40
15	30	32
20	26	25
25	14	14

The student used the same colour of light in the investigation.

(i) Describe how the student could control one other relevant, named abiotic factor.

(2)

(ii) Explain the effect of changing the distance of the lamp on the rate of photosynthesis of pond weed in both concentrations of carbon dioxide.

(4)

(iii) Describe one way the student could modify this method to obtain more accurate data.

(2)

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(iv) Describe how the student could ensure that the results of the investigation are reliable.

(2)

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(Total for Question 10 = 12 marks)

11 Biological washing powders contain protease enzymes to digest proteins in clothing stains.

Scientists have produced recombinant plasmids containing a gene for a protease enzyme that works at high temperatures. The plasmids have been inserted into bacteria so that the bacteria produce the protease enzyme.

(a) Describe how named enzymes are used to produce a recombinant plasmid containing a gene for a protease.

(2)

(b) Design an investigation to find the best temperature for removing protein stains by using washing powder that contains protease enzyme.

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

(6)

(Total for Question 11 = 8 marks)

TOTAL FOR PAPER = 110 MARKS

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