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.
- **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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Q:1/1/1/1/1/

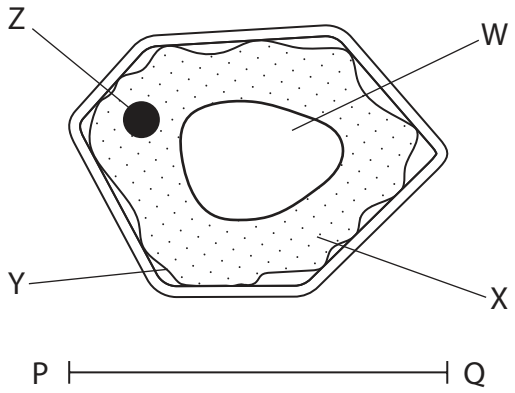
P 6 9 4 6 9 A 0 1 3 2

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 The diagram shows a root cell from a plant with structures labelled W, X, Y and Z.



(a) (i) Which structure is the nucleus?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(ii) Which structure is **not** found in human white blood cells?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(iii) Which molecule is the storage carbohydrate in the root cell?

(1)

- ☒ **A** glucose
- ☒ **B** glycerol
- ☒ **C** glycogen
- ☒ **D** starch

(b) The actual width of the cell from P to Q is 125 μm.

Determine the magnification of the diagram.

[1 mm = 1000 μm]

(3)

magnification = ...

(Total for Question 1 = 6 marks)

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2 Yeast cells can be genetically modified to produce the proteins found on the outside of viruses.

(a) (i) Yeast is a single-celled organism.

A yeast cell has a nucleus, and the cell wall is made of chitin.

Which group of organisms does yeast belong to?

(1)

- ☒ **A** animals
- ☒ **B** fungi
- ☒ **C** plants
- ☒ **D** protoctists

(ii) Give a reason why viruses are not considered to be living organisms.

(1)

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(b) A species of yeast is genetically modified to produce a protein found on the outside of a hepatitis B virus.

This protein is used to make vaccines to prevent people being infected with hepatitis B.

The gene for this protein is inserted into a plasmid.

This plasmid is then used to modify the yeast cells.

Give the roles of two named enzymes used to produce plasmids containing the gene for the hepatitis B protein.

(2)

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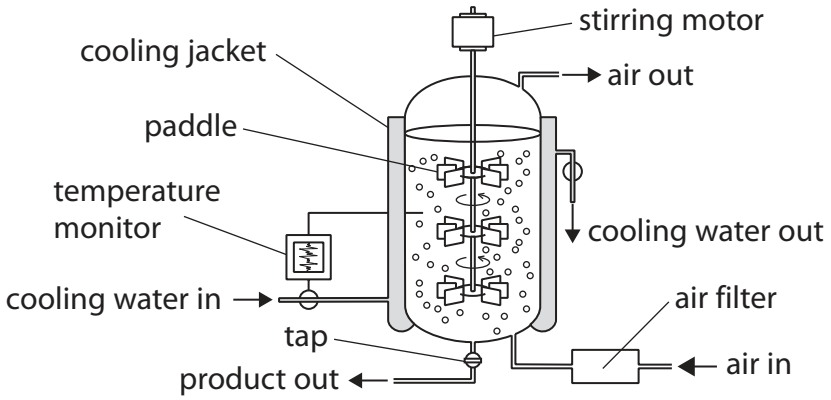
(c) The diagram shows an industrial fermenter that can be used to grow large quantities of genetically modified yeast.



(i) Explain the function of the temperature monitor and cooling jacket.

(3)

(ii) Explain why air is needed in the fermenter.

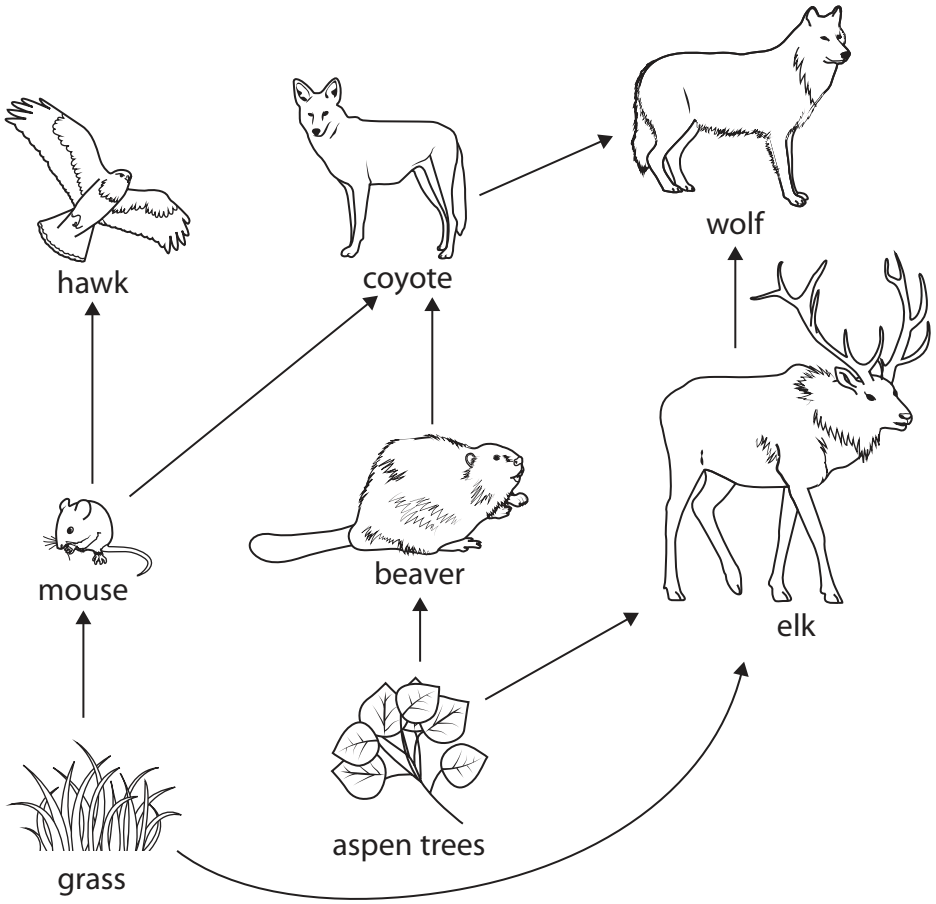
(2)

(iii) Explain why the air is filtered before going into the fermenter.

(2)

(Total for Question 2 = 11 marks)

3 The diagram shows part of a food web from an ecosystem in a region of North America.



(a) (i) Which of these organisms in the food web is a primary consumer?

(1)

- ☒ **A** beaver
- ☒ **B** coyote
- ☒ **C** grass
- ☒ **D** wolf

(ii) State what is meant by the term **ecosystem**.

(1)

.....

.....

(b) Wolves were hunted in this region of North America until they became extinct in 1926.

The extinction of wolves damaged the ecosystem in these ways.

- the population of mice, hawks and beavers decreased
- the population of producer species decreased

Beavers are important in this ecosystem because they cut down old trees and create shelters that other organisms nest in.

Discuss why the extinction of wolves damaged the ecosystem.

(4)

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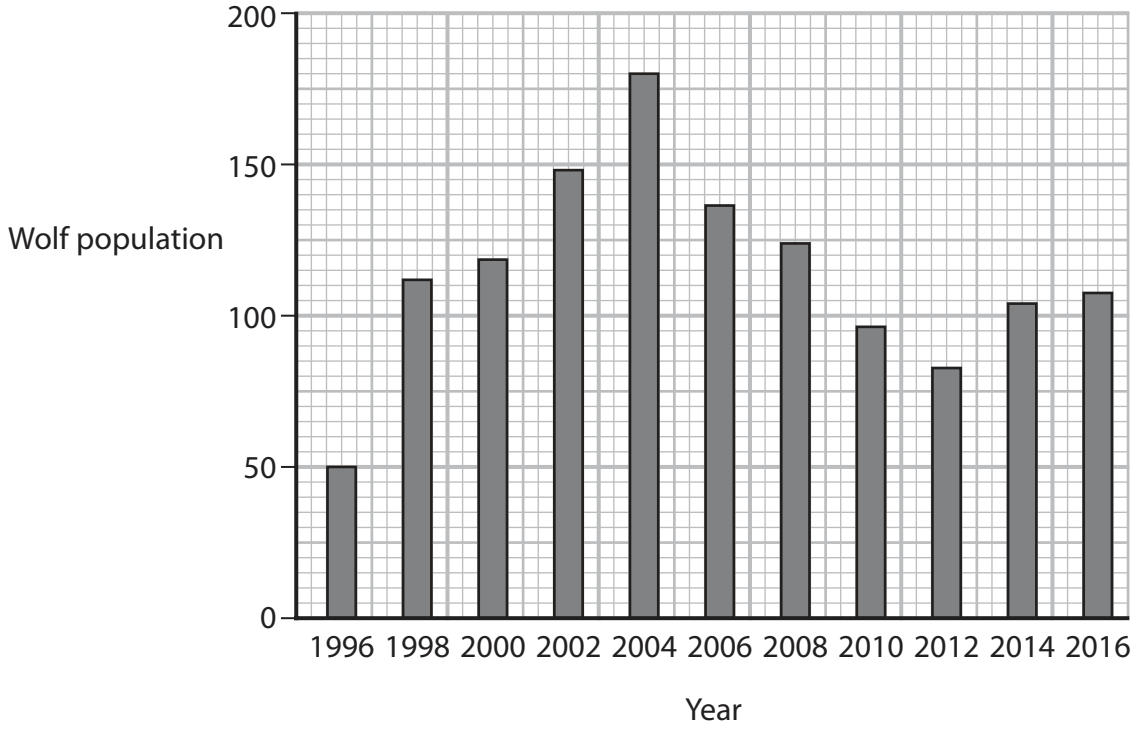
(c) In 1995, 14 wolves were reintroduced to this region.

The diagram shows the change in wolf population from 1996 to 2016.



(i) Calculate the percentage change in the wolf population between 1996 and 2004.

(2)

percentage change = ... %

(ii) Suggest why the wolf population changed between 2004 and 2012.

(2)

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(iii) The reintroduction of wolves caused changes in the populations of some plant species.

Describe how the population size of a plant species in the region could be determined.

(3)

(Total for Question 3 = 13 marks)

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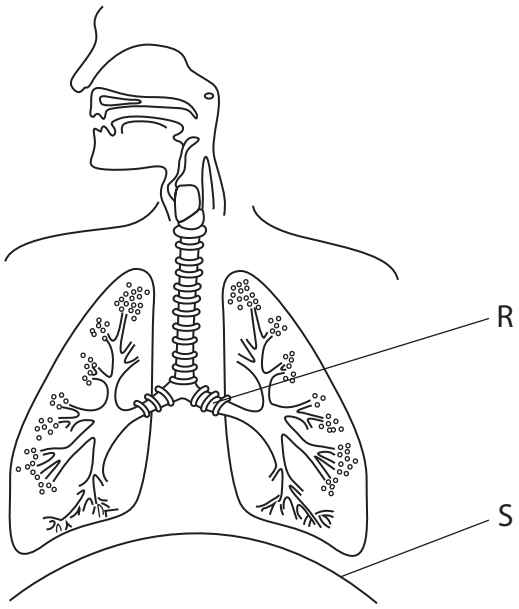
4 (a) The diagram shows part of a human thorax with structures labelled R and S.



(i) What is the name of structure R?

(1)

- ☒ **A** bronchiole
- ☒ **B** bronchus
- ☒ **C** oesophagus
- ☒ **D** trachea

(ii) Explain how changes in structure S enable a person to breathe in.

(3)

(b) A scientist uses this method to investigate the effect of exercise on the ventilation rate of a person.

Step 1: rest for 10 minutes

Step 2: measure the volume of air in each breath

Step 3: measure the breathing rate

Step 4: ride a bicycle at 15 kilometres per hour for 10 minutes

Step 5: measure the volume of air in each breath

Step 6: measure the breathing rate

The scientist repeats Step 4, Step 5 and Step 6 at increasing cycling speeds.

The table shows some of the results.

Cycling speed in km per hour	Volume of air in each breath in cm^3	Breathing rate in breaths per minute	Ventilation rate in dm^3 per minute
0	500	14	7
15	1500	14	21
20	2000	14	28
25	2500	16	40
30	2600	20	52
35		25	65

(i) State the independent variable in the investigation.

(1)

(ii) At a cycling speed of 35 km per hour the person has a breathing rate of 25 breaths per minute.

They also have a ventilation rate of 65 dm^3 per minute.

Calculate the volume of air, in cm^3, in each breath.

[1 dm^3 = 1000 cm^3]

(2)

volume = ... cm^3

(iii) Comment on the effect of increasing cycling speed on ventilation rate.

Refer to the data in the table in your answer.

(4)

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(iv) State how the scientist could make the investigation more reliable.

(1)

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(Total for Question 4 = 12 marks)

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5 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)

.....

.....

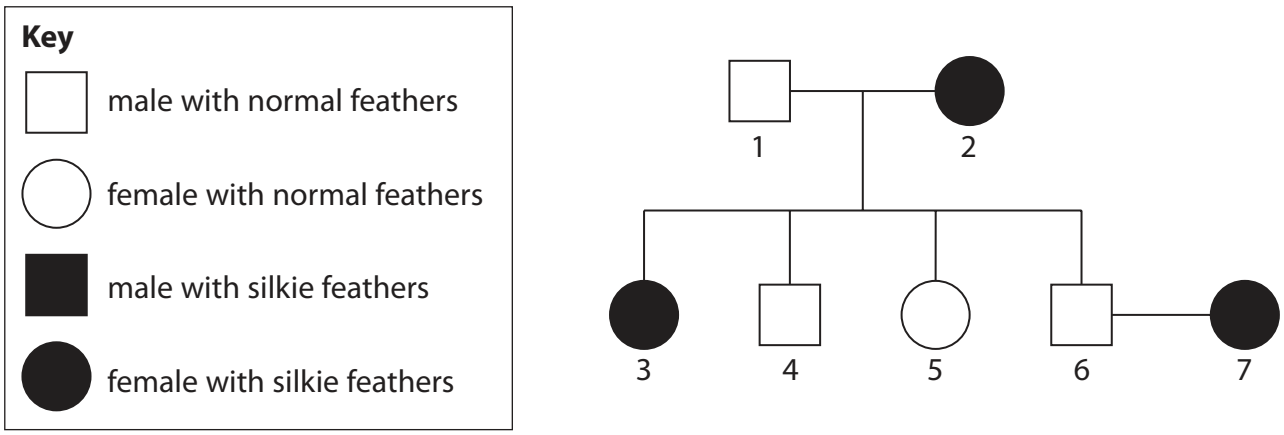
(ii) Give the possible genotypes of a chicken with normal feathers.

(1)

.....

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

The diagram shows a family pedigree for some chickens.



(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.

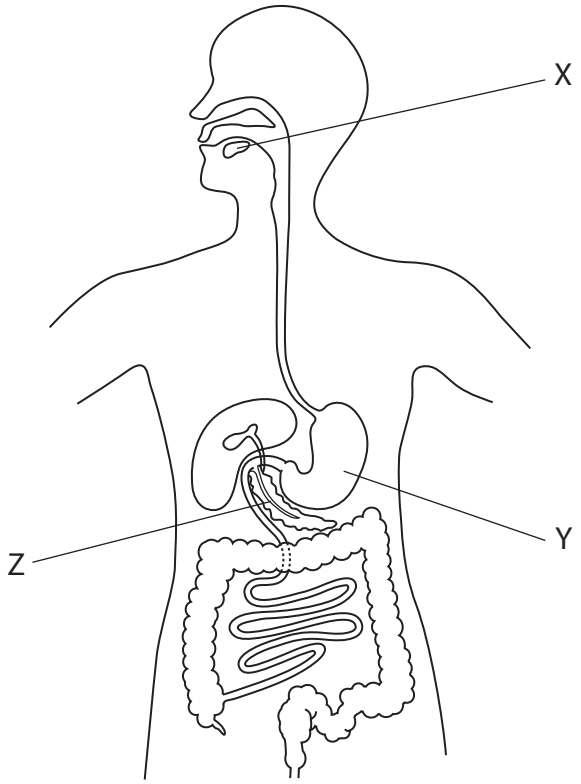
However, the chickens have a wide range of different heights.

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

(3)

(Total for Question 5 = 10 marks)

6 (a) The diagram shows the human alimentary canal with structures labelled X, Y and Z.



(i) Which of these structures produce amylase?

(1)

- ☒ **A** X only
- ☒ **B** X and Y
- ☒ **C** X and Z
- ☒ **D** Y and Z

(ii) Table 1 gives the names of some enzymes, the molecules they digest, and the products formed.

Complete Table 1 by giving the missing information.

(3)

Enzyme	Molecule	Product
		maltose
	lipid	
protease		

Table 1

(b) Table 2 shows the recommended daily amounts (RDA) of some dietary components for a person.

Table 2 also shows the actual amounts of these dietary components in a person's diet in one day.

	Amount of dietary component						
	Energy in kJ	**Protein in g**	**Vitamin A in mg**	**Vitamin C in mg**	**Calcium in mg**	**Iron in mg**	**Fibre in g**
RDA	2200	46	0.70	65	1300	15	26
Diet of person	2700	46	0.72	32	800	16	12

Table 2

(i) One 100 g serving of lentils provides 25 g of protein.

Calculate the mass of lentils that contains 46 g of protein.

(2)

mass of lentils = ... g

(ii) Discuss the possible long-term effects of this person eating the same diet every day.

(5)

(iii) Suggest two reasons why the RDA for energy may not be the actual amount required by this person.

(2)

1 .....

2 .....

(Total for Question 6 = 13 marks)

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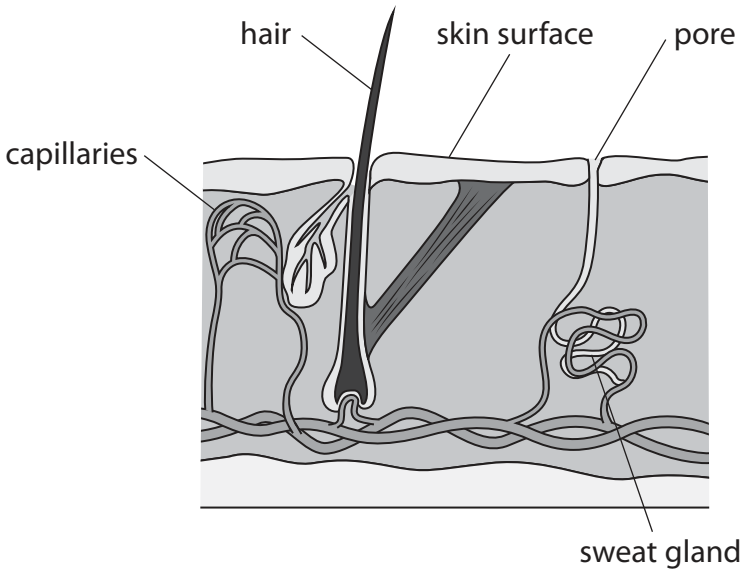
7 The skin is an organ involved in temperature regulation.

(a) State why the skin is described as an organ.

(1)

(b) The diagram shows a section of human skin.



(i) Explain how the skin capillaries regulate body temperature when the body temperature increases.

(3)

(ii) Some people have suggested that drinking warm drinks may cool the body because it increases the rate of sweat production.

Design an investigation to determine whether drinking warm drinks increases the rate of sweat production.

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

(6)

(Total for Question 7 = 10 marks)

8 A student uses this method to investigate the effect of fertiliser on the growth of plant seedlings.

- set up two trays with an equal mass of compost in each tray
- plant 100 seeds, equally spaced, in each tray
- place the trays under the same lamp until the seeds start to germinate
- water each tray every day with the same volume of water
- add fertiliser to one of the trays every day
- remove five seedlings from each tray every four days for a period of 20 days
- dry these seedlings in an oven and find their mass

The table shows the student's results.

Day	Dry mass of seedlings in g	
	Without fertiliser	With fertiliser
4	3.5	3.8
8	4.9	5.8
12	5.8	6.7
16	6.3	7.8
20	6.8	8.5

(a) (i) Give two abiotic variables that the student controls.

(2)

1 .....

2 .....

(ii) The student dries the seedlings in an oven to find their dry mass.

Suggest why it is important to use dry mass in this investigation.

(2)

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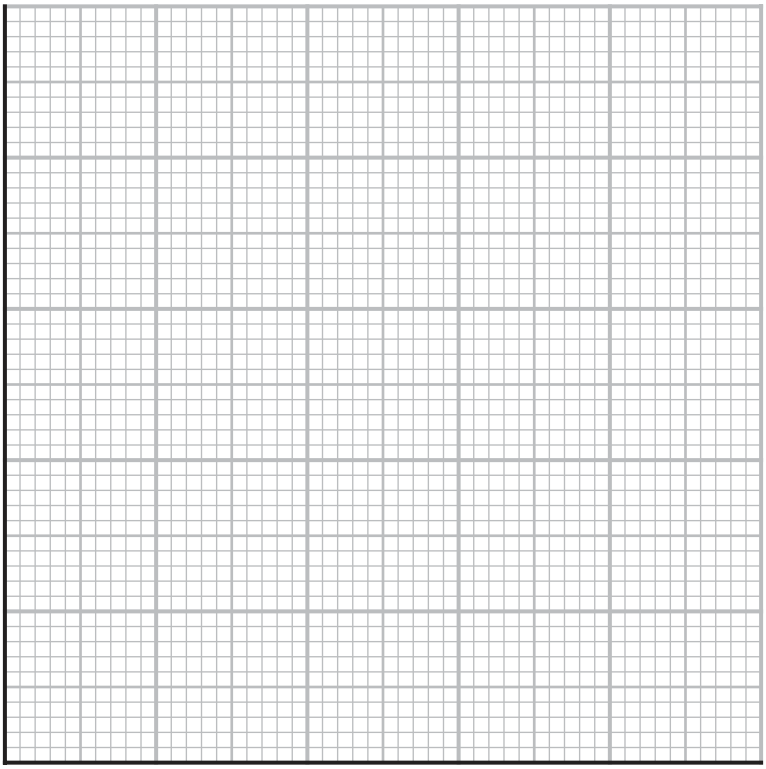
(b) (i) Plot a line graph to show the dry mass of seedlings without fertiliser and the dry mass of seedlings with fertiliser, from day 4 to day 20.

Use a ruler to join your points with straight lines.

(5)



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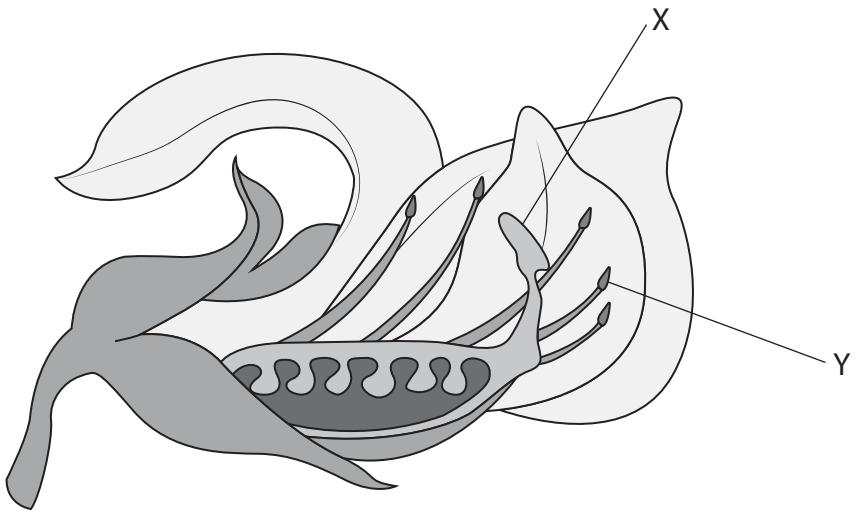
(ii) The fertiliser contains magnesium ions and nitrate ions.

Explain the effect of these two ions on the growth of the seedlings.

(4)

(Total for Question 8 = 13 marks)

9 (a) The diagram shows a pea flower with structures labelled X and Y.



(i) Give the names of structures X and Y.

(2)

X .....

Y .....

(ii) Explain how two structures, present in the diagram, show how the flower is pollinated.

(3)

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(b) A scientist uses this method to compare the carbohydrates present in ungerminated and germinating pea seeds.

- carry out an iodine test and a Benedict's test on ungerminated seeds
- soak another set of seeds in water and allow them to germinate in unsealed jars
- after three days, carry out an iodine test and a Benedict's test on the germinating seeds

The table shows the scientist's results.

Seeds	Colour of iodine solution	Colour of Benedict's solution
ungerminated	black	blue
germinating	black	red

(i) State which carbohydrates the scientist identified in the ungerminated seeds and the germinating seeds.

(2)

ungerminated seeds

.....

germinating seeds

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(ii) Explain the difference in the carbohydrate composition of the ungerminated seeds and the germinating seeds.

(3)

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(iii) Explain why the jars used in the investigation are not sealed.

(2)

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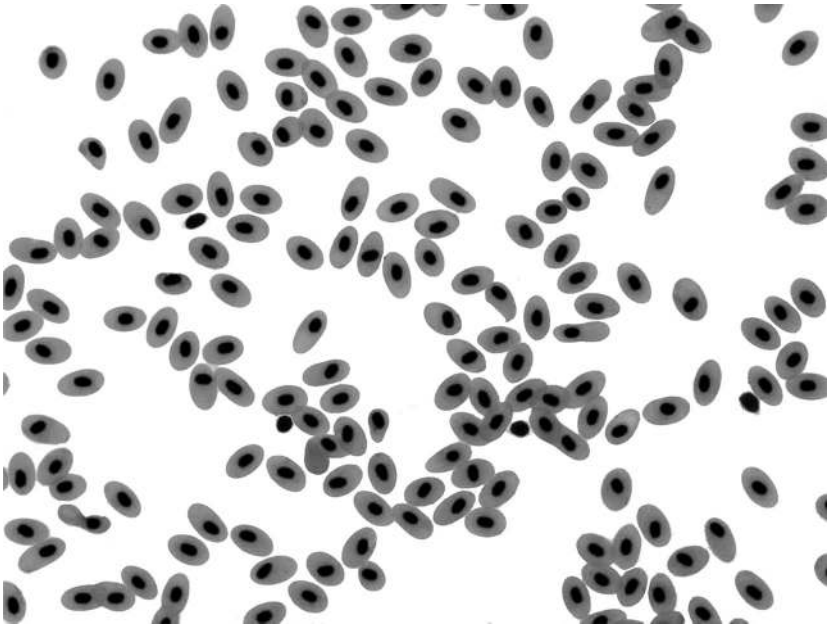
(Total for Question 9 = 12 marks)

10 Red blood cells and white blood cells are two components of blood.

(a) The diagram shows some red blood cells from a fish.

Human red blood cells have a biconcave shape. Fish red blood cells have a more rounded, sphere-like shape.



(Source: © STEVE GSCHMEISSNER/SCIENCE PHOTO LIBRARY)

(i) Give a difference, other than shape, between the structure of fish red blood cells and human red blood cells.

(1)

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(ii) Explain why fish red blood cells transport oxygen less efficiently than human red blood cells.

(2)

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(b) Llamas are large mammals that have evolved to live at high altitude where there is less oxygen in the atmosphere.

The red blood cells of llamas can absorb more oxygen than the red blood cells of animals that live at low altitude.

Explain how llamas have evolved by natural selection to live at high altitude.

(4)

(c) Phagocytes are white blood cells that are transported in the blood.

Describe the role of phagocytes in the body.

(3)

(Total for Question 10 = 10 marks)

TOTAL FOR PAPER = 110 MARKS

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