Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced Subsidiary
Unit 2: Development, Plants and the Environment

Monday 16 January 2017 – Morning
Time: 1 hour 30 minutes

Paper Reference
WBI02/01

You must have:
Calculator, HB pencil, 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.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

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

Turn over ▶

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2/2/2/1/

P 4 8 3 5 5 A 0 1 2 4

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 Some scientists believe that mitochondria evolved from prokaryotic organisms.

They think that a prokaryotic organism entered a single-celled eukaryotic organism and lived inside it. The two organisms evolved to become dependent on each other.

(a) In the space below, draw and label a diagram to show the structure of a mitochondrion.

(4)

(b) Give **two** similarities between the structure of a mitochondrion and the structure of a prokaryotic organism.

(2)

1 .....

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2 .....

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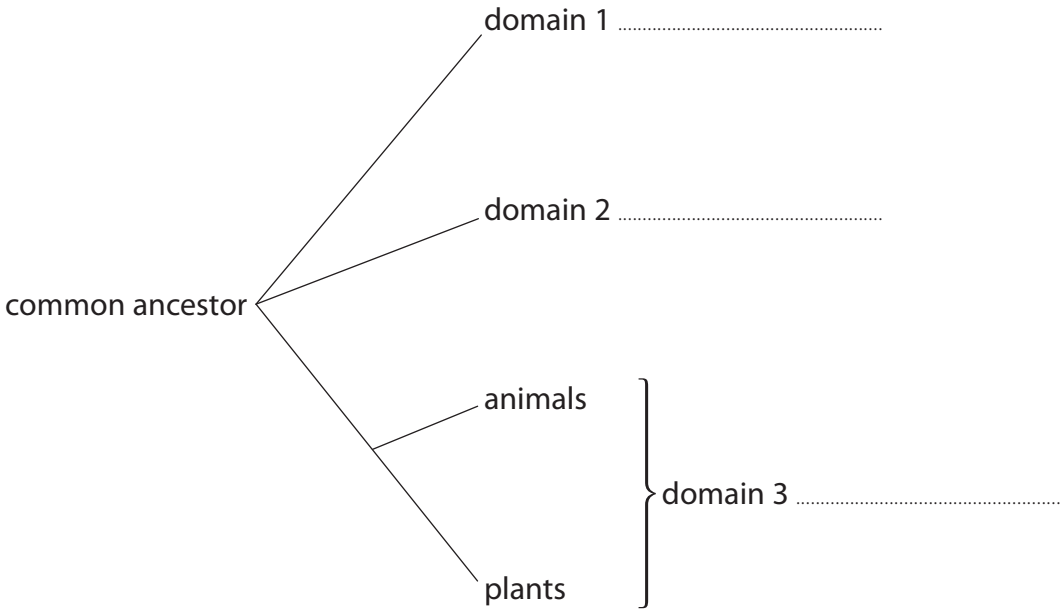
(c) The diagram below shows the three domains and some of the organisms in them.

Complete the diagram by writing the name of each domain on the dotted lines.

(3)



(d) Name **one** organelle found in plants cells but not in animal cells.

(1)

.....

(Total for Question 1 = 10 marks)

2 The use of plant fibres to replace oil-based products is increasing.

The tensile strength of plant fibres can be changed by treating the fibres with chemicals.

A student investigated the effect of treating banana fibres with a solution of sodium hydroxide (NaOH).

The student used some of the banana fibres as a control group.

(a) The diagram below shows some of the steps in this investigation.

Step 1: Banana plants taken from the same banana plantation

↓

Step 2: Stems soaked in water for three weeks

↓

Step 3: Fibres extracted and soaked in NaOH solution

↓

Step 4: Fibres washed thoroughly and dried

↓

Step 5: Fibres selected randomly and their diameters measured in several places along their length

↓

Step 6: Tensile strength of fibres measured

(i) Give **two** reasons why the banana plants were taken from the same plantation in **step 1**.

(2)

1 .....

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2 .....

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(ii) Explain why the stems were soaked in water in **step 2**.

(2)

(iii) Suggest how fibres from the control group should be treated in **step 3**.

(1)

(iv) Suggest why the fibres were washed thoroughly in **step 4**.

(1)

(v) Explain why the diameter of each fibre was measured in several places along its length in **step 5**.

(2)

(vi) Place a cross ☒ in the box next to the units that could be used to measure tensile strength in **step 6**.

(1)

☒ **A** N

☒ **B** $N\ m^{-1}$

☒ **C** $N\ m^{-2}$

☒ **D** $N\ m^{-3}$

(b) The tables below show the results recorded by the student.

Fibres soaked in NaOH

Diameter	Tensile strength
0.080	536
0.129	337
0.153	148

Fibres from the control group

Diameter	Tensile strength
0.080	780
0.132	300
0.156	199
0.193	222

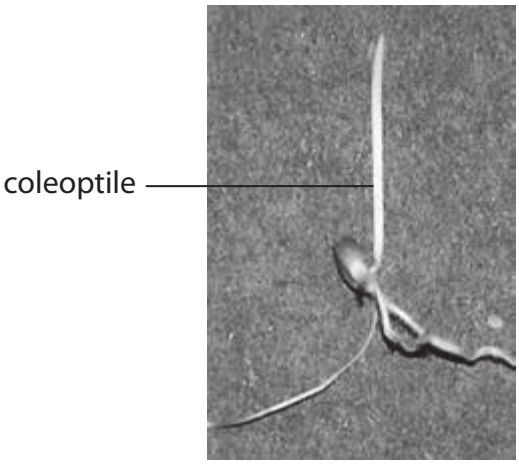
Using the information in the tables, discuss the effect of NaOH on the tensile strength of banana fibres.

(3)

(Total for Question 2 = 12 marks)

3 Coleoptiles are the young shoots of germinating cereals, such as wheat.

The photograph below shows a wheat coleoptile.



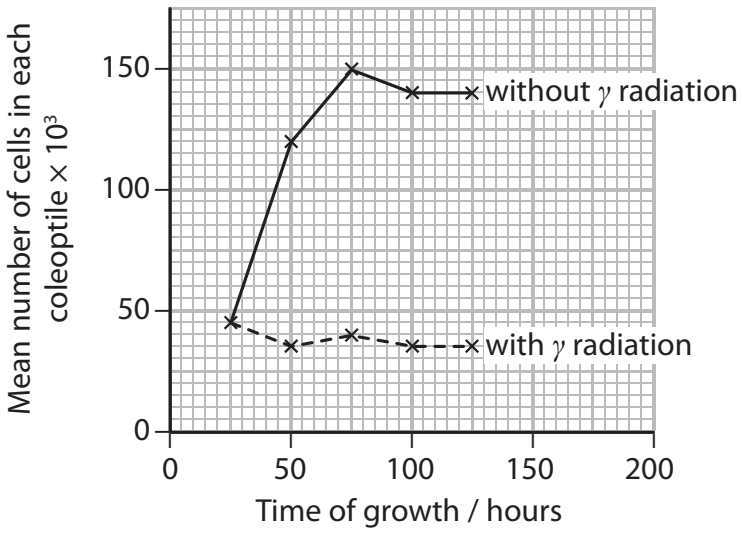
Coleoptiles increase in height due to cell division and cell elongation.

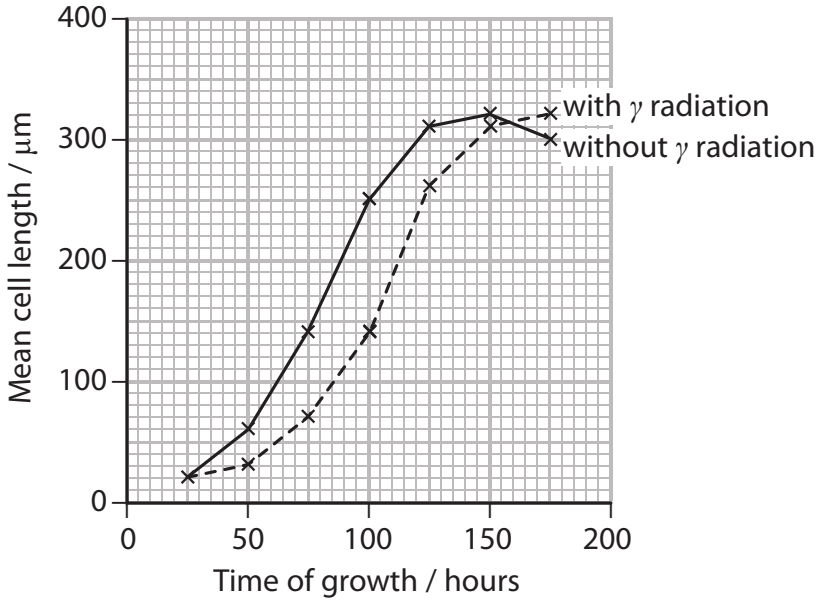
An investigation was carried out into the effects of gamma radiation (γ radiation) on the growth of coleoptiles.

Germinating cereal grains were exposed to gamma radiation. The mean number of cells in each coleoptile and the mean cell length in the coleoptiles were deternined at regular intervals.

The investigation was repeated using germinating cereal grains that were not exposed to gamma radiation.

The results of the investigation are shown in the graphs below.





(a) Use the information in the graphs to describe the effect of γ radiation on the mean number of cells in each coleoptile and the mean cell length.

(2)

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(b) The coleoptiles with γ radiation and without γ radiation both increased in height but those with γ radiation were shorter.

Using the results of this investigation, explain the effect of γ radiation on the height of the coleoptiles.

(2)

*(c) Examination of the coleoptiles with γ radiation showed that there were fewer cells in mitosis than there are in the coleoptiles without γ radiation.

Giving practical details, explain how you would compare the number of cells undergoing mitosis in these coleoptiles.

(6)

(Total for Question 3 = 10 marks)

4 In the development of new drugs, three-phased testing will only take place on those drugs that pass the pre-clinical testing stage. Pre-clinical testing involves the use of animals.

*(a) Describe three-phased testing.

(5)

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(b) The table below shows the percentage of drugs that pass through the pre-clinical testing stage and each stage of the three-phased testing.

Percentage of drugs that pass through each stage (%)			
Pre-clinical testing	**Phase I**	**Phase II**	**Phase III**
64	44	22	65

Suggest reasons why some drugs are rejected at each of these stages.

(3)

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(Total for Question 4 = 8 marks)

5 Xylem vessels and sclerenchyma fibres are found in plant stems.

(a) Put a cross ☒ in the box next to the row in the table that correctly describes the level of organisation of xylem vessels and sclerenchyma fibres.

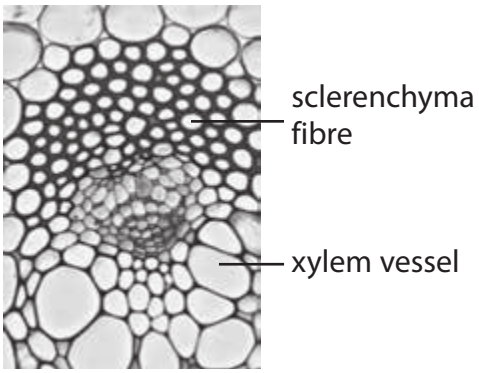
(1)

	Xylem vessels	Sclerenchyma fibres
☒ **A**	organ	organ
☒ **B**	organ	organ system
☒ **C**	organ system	tissue
☒ **D**	tissue	tissue

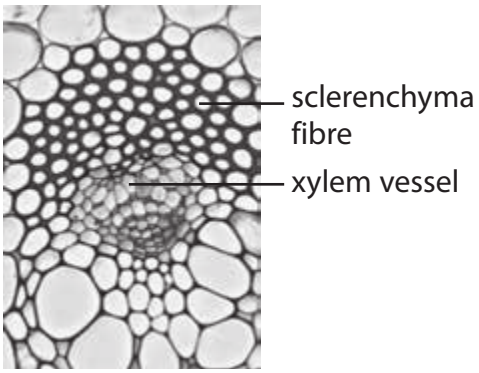
(b) Place a cross ☒ in the box next to the photograph that shows the correct labels for the location of a xylem vessel and a sclerenchyma fibre in a stem.

(1)

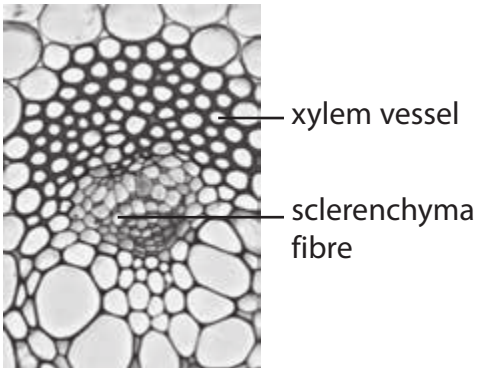
☒ **A**



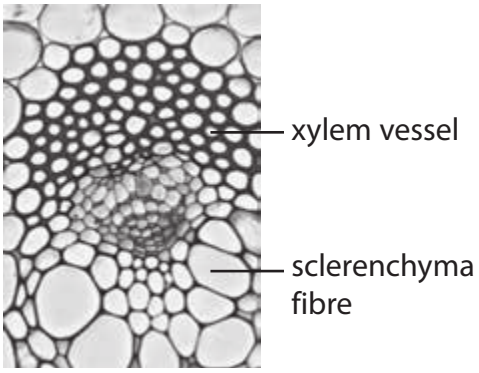
☒ **B**



☒ **C**



☒ **D**



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(c) Place a cross ☒ in the box next to the row in the table that correctly describes features of xylem vessels.

(1)

	Cellulose microfibrils present	Lignin present	Pits present
☒ **A**	No	Yes	Yes
☒ **B**	Yes	No	Yes
☒ **C**	Yes	Yes	Yes
☒ **D**	No	Yes	No

(d) Place a cross ☒ in the box next to the row in the table that correctly describes the functions of xylem vessels and sclerenchyma fibres.

(1)

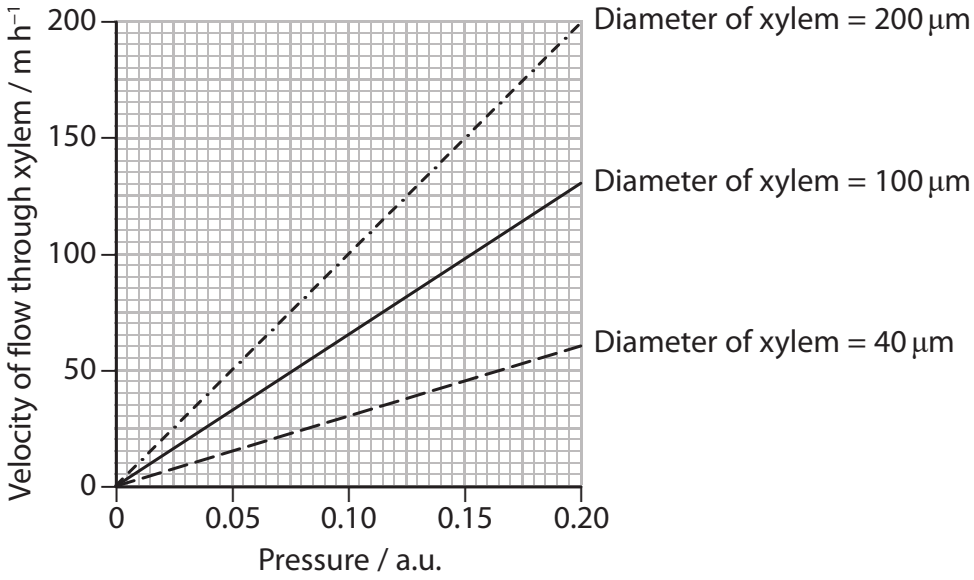
	Xylem vessels	Sclerenchyma fibres
☒ **A**	transport of mineral ions and water only	support only
☒ **B**	support and transport of mineral ions and water	transport of mineral ions and water only
☒ **C**	support and transport of mineral ions and water	support only
☒ **D**	transport of mineral ions and water only	support and transport of mineral ions and water

(e) Name **two** mineral ions carried in xylem vessels.

(1)

..... and .....

(f) The graph below shows the effect of pressure on the velocity of flow in xylem vessels of three different diameters.



Use the information in the graph to describe each of the following.

(i) The effect of pressure on the velocity of flow

(2)

(ii) The effect of the diameter of xylem on the velocity of flow

(2)

(Total for Question 5 = 9 marks)

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6 The photograph below shows a human sperm cell fusing with a human female gamete.

Magnification ×2000

(a) The diameter of a human female gamete is about 30 times bigger than the length of the head of a human sperm cell.

(i) Measure the length of the head of the sperm in the photograph.

(1)

Answer .....

(ii) Use your measurement to calculate the actual diameter of the female gamete. Show your working.

(2)

Answer .....

(b) Give **two** differences, other than size, between the structure of a sperm cell and the structure of a female gamete.

(2)

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2 .....

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(c) Female gametes and sperm cells are formed by meiosis.

A zygote is formed when a sperm cell fertilises a female gamete.

The zygote divides by mitosis.

(i) Compare mitosis with meiosis.

(3)

(ii) Describe the process of fertilisation in mammals.

(4)

(Total for Question 6 = 12 marks)

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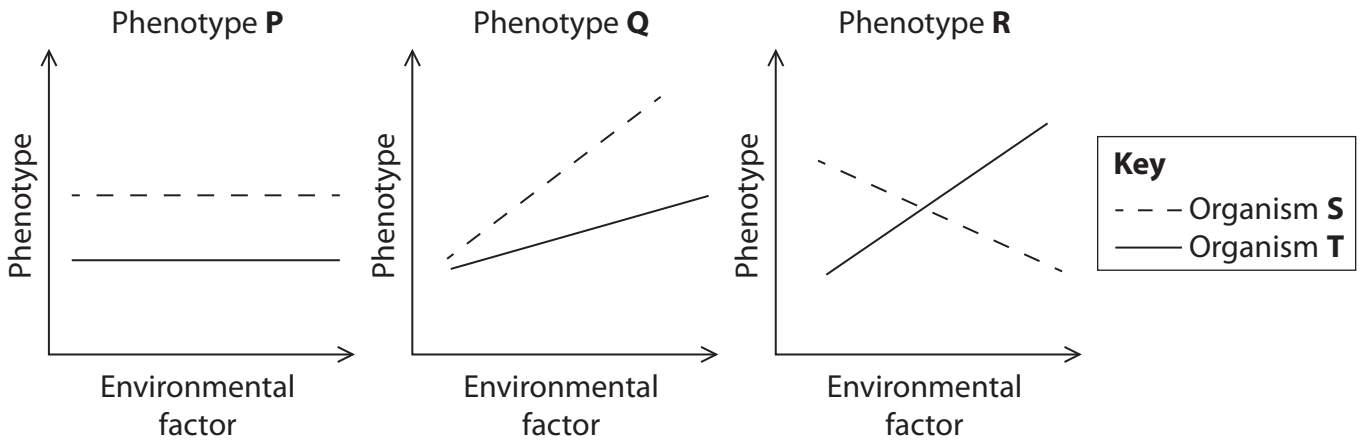
7 The phenotype of an organism can be the result of an interaction between the genotype and the environment.

(a) The graphs below show the effect of an environmental factor on three different phenotypes, **P**, **Q** and **R**.

The graphs show the effect of this factor on the phenotype of two organisms, **S** and **T**. These two organisms belong to the same species. Each organism has a different genotype.



Place a cross ☒ in the box to show which phenotypes result from an interaction between the genotype and the environment.

(1)

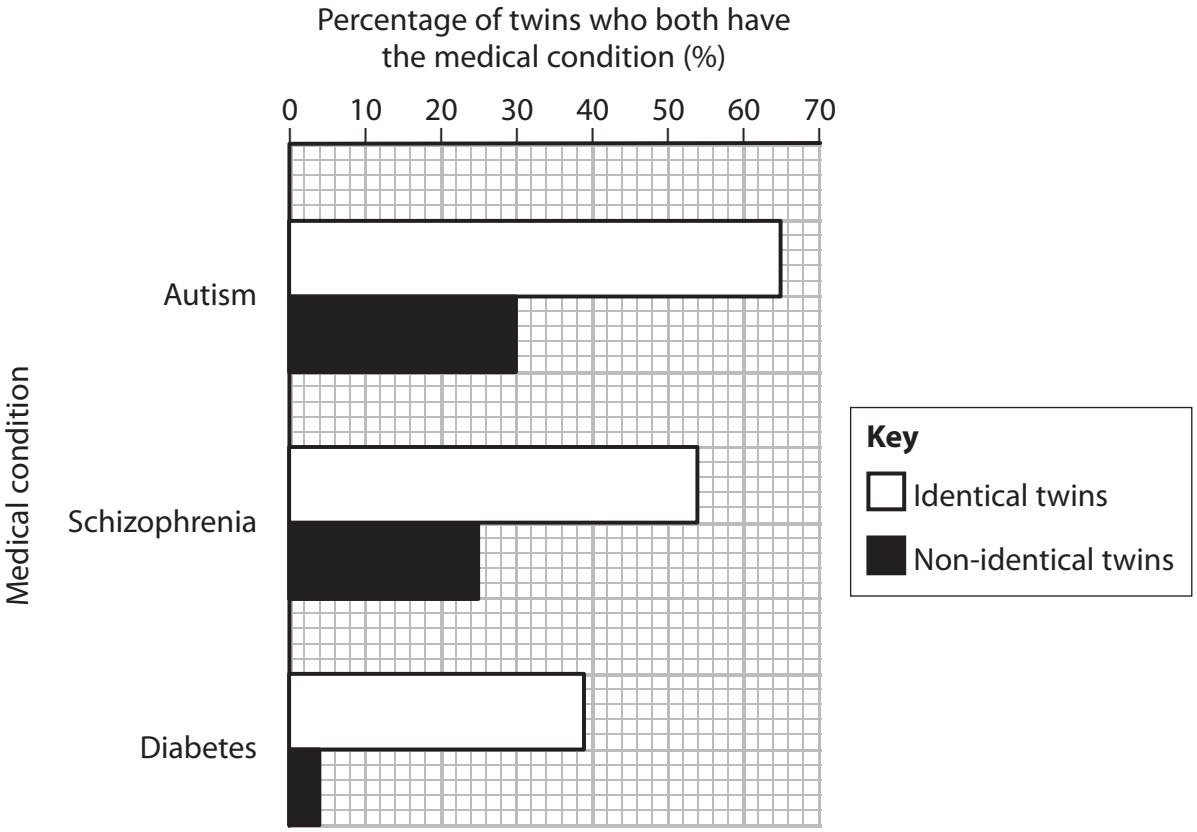
☒ **A** **P** and **Q**

☒ **B** **P** and **R**

☒ **C** **Q** and **R**

☒ **D** **P**, **Q** and **R**

(b) The graph below shows three medical conditions and the percentage of identical and non-identical twins who both have the medical condition.



Place a cross ☒ in the box to complete the following sentence. The graph shows that compared with schizophrenia and diabetes, autism is affected

(1)

☒ **A** least by the genotype and least by the environment

☒ **B** least by the genotype and most by the environment

☒ **C** most by the genotype and least by the environment

☒ **D** most by the genotype and most by the environment

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(c) Investigations have shown that the behaviour of a person can result from interaction between the genotype for monoamine oxidase A (MAOA) and the environment.

(i) Describe how interaction between the genotype for MAOA and the environment can affect behaviour.

(3)

(ii) Explain why the data from these investigations is often difficult to interpret.

(2)

(Total for Question 7 = 7 marks)

8 The photograph below shows an Iberian lynx.

Magnification ×0.1

In 2000, the number of Iberian lynx fell to about 400. In 2008, the number had fallen further to between 99 and 158 and it was listed as 'critically endangered'.

The Iberian lynx is now listed as 'endangered' as numbers have increased to around 1000.

This is partly due to a captive breeding and reintroduction programme.

(a) The table below shows the total number of Iberian lynx in three captive breeding programme centres.

Some of the Iberian lynx were originally from the wild and some have been born in captivity.

Year	Total number of Iberian lynx originally from the wild	Total number of Iberian lynx born in captivity
2000	3	0
2001	4	0
2002	7	0
2003	8	0
2004	14	0
2005	19	2
2006	26	5
2007	26	11

(i) Use the information in the table to describe the changes in the number of Iberian lynx in these three captive breeding programmes.

(3)

(ii) Explain the importance of these changes in the conservation of the Iberian lynx.

(3)

(b) Iberian lynx could not be reintroduced into the wild until there were at least 60 animals in the captive breeding programme.

Suggest why a minimum number of Iberian lynx is required before they can be reintroduced into the wild.

(3)

(c) Describe how these captive breeding centres would need to work together to ensure the success of the captive breeding and reintroduction programme.

(3)

(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS