

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	
Thursday 8 January 2015 – Morning Time: 1 hour 30 minutes	Paper Reference WBI02/01
You do not need any other materials	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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Answer ALL questions.

Some questions must be answered with a cross ☐. 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 photograph below shows an organelle found in some eukaryotic cells.



Magnification $\times 15\,000$

- (a) Place a cross ☐ in the box that completes each of the following statements.

- (i) The organelle shown in the photograph is

(1)

- ☐ **A** an amyloplast
- ☐ **B** a chloroplast
- ☐ **C** a Golgi apparatus
- ☐ **D** a thylakoid

- (ii) The part of the organelle labelled F is

(1)

- ☐ **A** cytoplasm
- ☐ **B** granum
- ☐ **C** matrix
- ☐ **D** stroma



(b) Give **three** structures that this organelle has in common with a mitochondrion.

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(c) Explain why the presence of this organelle indicates that the cell is eukaryotic.

(1)

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(Total for Question 1 = 6 marks)

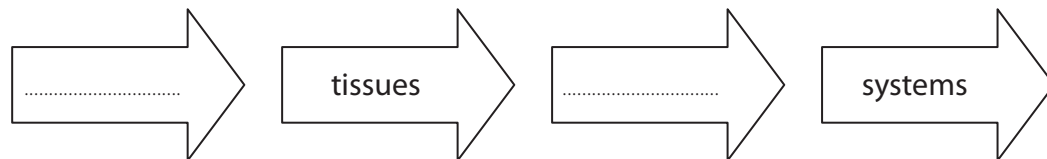


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2 New drugs are being developed. However, before a new drug is approved for general use, it must be tested.

(a) Before drugs are tested on humans, they are tested on tissues and animals.

(i) Complete the flow chart to show levels of organisation in multicellular organisms.



(ii) Suggest why, after testing a drug on tissue samples, the drug is also tested on whole animals.

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- (b) Three-phase testing on humans takes place before a new drug is approved for general use.

The table below shows the test population used in each phase of the test.

	Phase 1	Phase 2	Phase 3
Test population	20–80 healthy volunteers	100–300 volunteer patients	1000–3000 volunteer patients

- (i) Place a cross ☒ in the box that completes the following statement.

The effects of the drug being tested are always compared with the effects of either a placebo or a pre-existing treatment in

(1)

- ☒ **A** animals
- ☒ **B** phase 1
- ☒ **C** phase 2
- ☒ **D** phase 3

- (ii) Suggest **two** variables that need to be taken into account when selecting volunteers for phase 1.

(2)

1

2



P 4 5 0 2 9 A 0 5 2 4

(c) In 1775, William Withering tested foxglove extracts to treat the symptoms of a variety of diseases.

He used extracts of various parts of this plant to treat 163 patients.

Compare the reliability of William Withering's trials with those carried out using contemporary drug testing protocols.

(2)

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(Total for Question 2 = 9 marks)



- 3 The photograph below shows date palm plants in the United Arab Emirates.



Magnification $\times 0.01$

Date palms are either female or male, but only the female plants produce fruit.

It is not possible to determine whether the plants are female or male until they are at least seven years old.

Tissue culture techniques have been used to produce large numbers of female date palms. These techniques also allow for the production of plants that are resistant to pests and disease and produce good quality dates.

- (a) (i) Explain how tissue culture techniques can be used to produce only female date palms.

(2)

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- (ii) Suggest why it would be necessary to grow some male date palms.

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- (b) The table below shows some of the stages in the production of date palm plants by tissue culture, using explants.

Explants are small samples of plant tissue.

Stage	Description of stage
1	Explants removed from leaf buds of mature plants
2	Surfaces of explants sterilised
3	Explants placed in containers of sterile growth medium with growth regulators
4	Sealed containers placed under banks of lights
5	Cells in explants multiply
6	Shoots and roots develop and a whole plant is produced

- (i) Explain how contamination of the explants is prevented.

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- (ii) Explain why contamination of the explants must be prevented.

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The table below shows the effects of 2,4-D on the development of shoots by date palm explants.

Concentration of 2,4-D / mg dm ⁻³	Percentage of explants developing shoots (%)
0.3	47
1.0	53
3.0	53
10.0	53
30.0	67
100.0	13
300.0	6

(3)

[illegible]

(2)

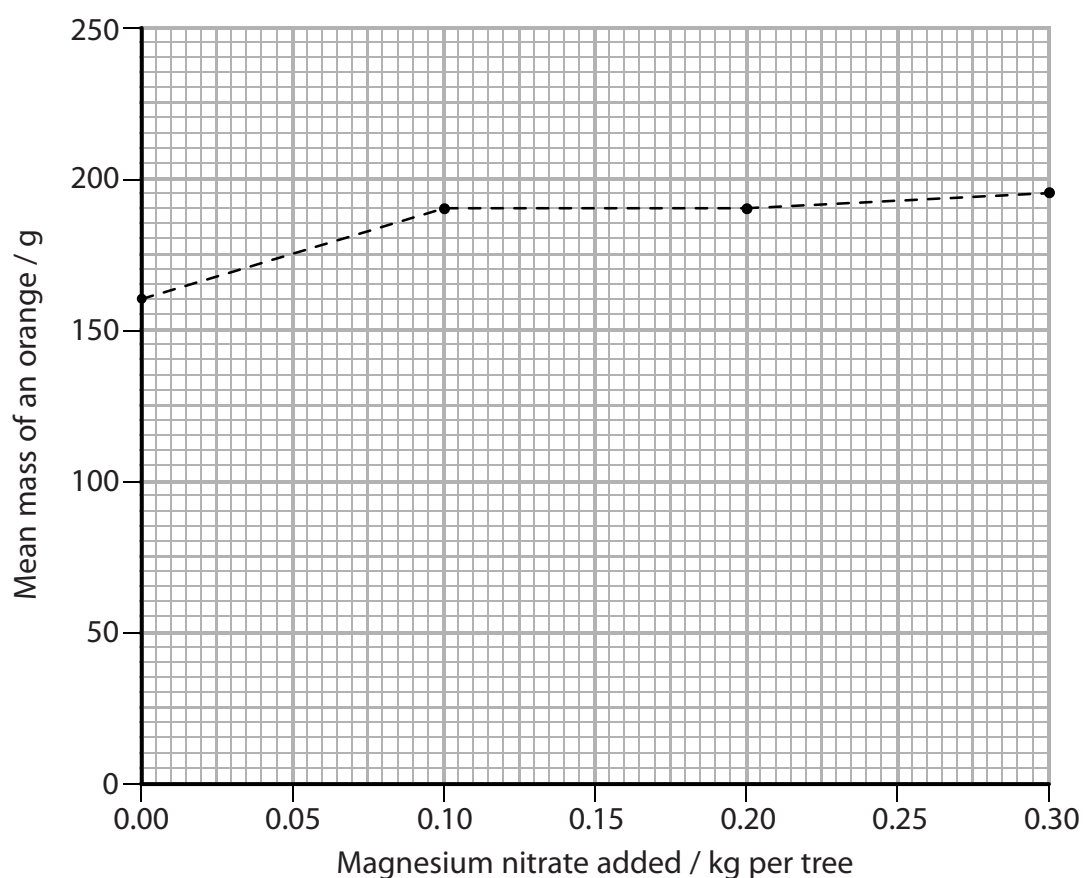
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4 Citrus fruit, such as oranges, are grown in sandy soils in warm climates. Sandy soils are often deficient in mineral ions.

(a) In Egypt, the effect of adding magnesium nitrate to sandy soil was investigated.

(i) The number of oranges produced by each tree and the mass of each orange were recorded. The mean mass of an orange from each tree was calculated.

The results are shown in the graph below.



Using information in the graph, describe the effect of adding magnesium nitrate on the mean mass of oranges.

(2)

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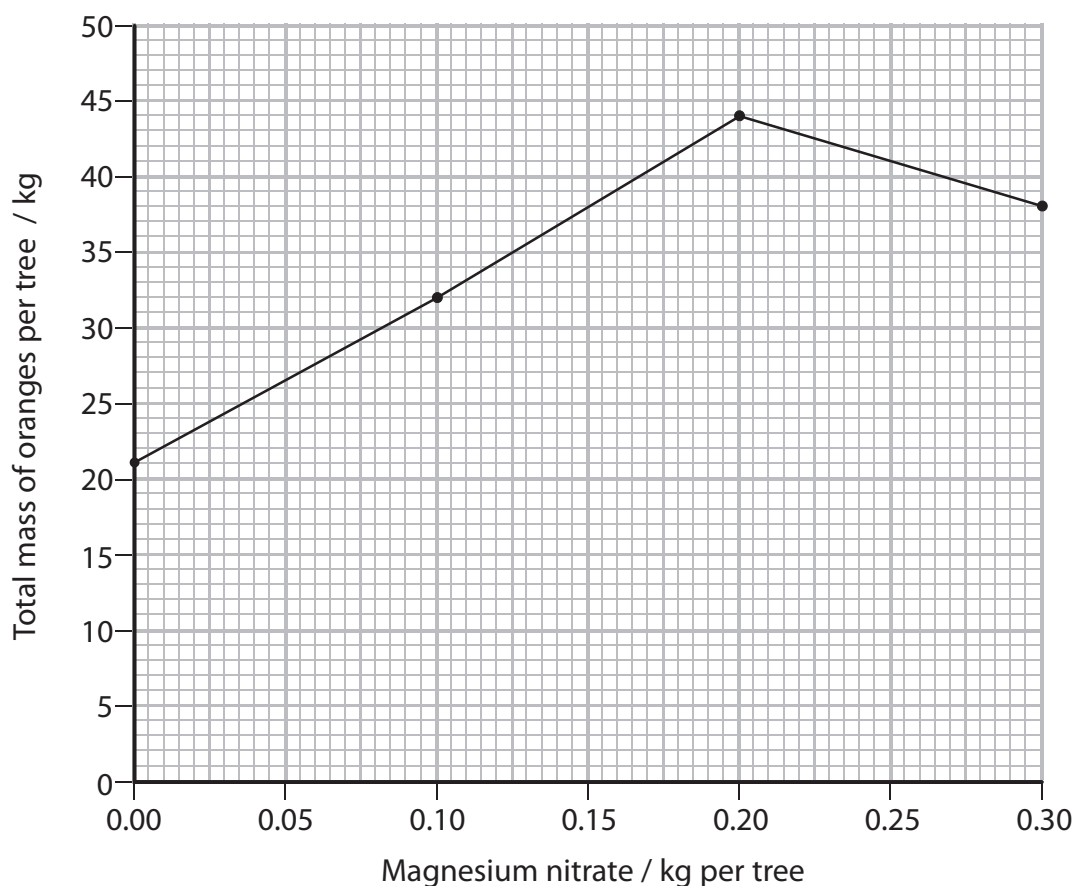
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(ii) The total mass of oranges produced by each tree is shown in the graph below.



Using the information in the graph, calculate the maximum percentage increase in the total mass of oranges produced.

Show your working.

(3)

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(iii) Using the information in both graphs, suggest why the following statement may not be valid.

'The optimum mass of magnesium nitrate for orange trees is 0.2 kg per tree.'

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P 4 5 0 2 9 A 0 1 1 2 4

(b) Suggest why the addition of magnesium nitrate affected the production of oranges.

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(c) When orange trees are grown in sandy soil they may need to be given extra water. Give **two** reasons why plants need water.

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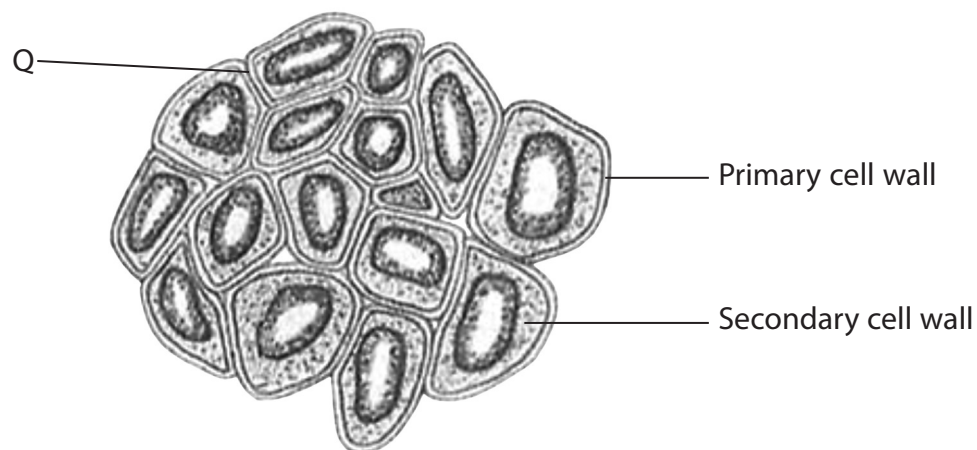
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(Total for Question 4 = 13 marks)



5 The diagram below shows a cross section through part of a plant stem.



(a) (i) Explain what is meant by the term **tissue**.

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(ii) Identify the tissue shown in the diagram.

(1)

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(iii) Place a cross ☒ in the box that completes the following statement.

Letter Q, in the diagram, indicates the

(1)

- ☒ A cell surface membrane
- ☒ B envelope
- ☒ C middle lamella
- ☒ D plasmodesmata



(b) The function of the tissue in the diagram is to provide support.

(i) Name **two** substances found in the secondary cell wall that provide support.

(2)

1

2

(ii) Explain how the structure of the cell walls in this tissue enables it to be strong and flexible.

(2)

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(Total for Question 5 = 8 marks)



6 Information about two species of penguin and their habitats is shown in the table below.

Name of penguin species	Photograph of penguin	Mean adult body mass / kg	Mean adult height / cm	Endemic to	Temperature range of habitat / °C
Emperor penguin (<i>Aptenodytes forsteri</i>)		34.0	115.0	Antarctica	−60 to −28
Galapagos penguin (<i>Spheniscus mendiculus</i>)		2.2	50.0	Galapagos Islands	19 to 31

(a) Explain what is meant by the term **endemic**, with reference to these two species of penguin.

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(b) Place a cross ☒ in the box that completes the following statement.

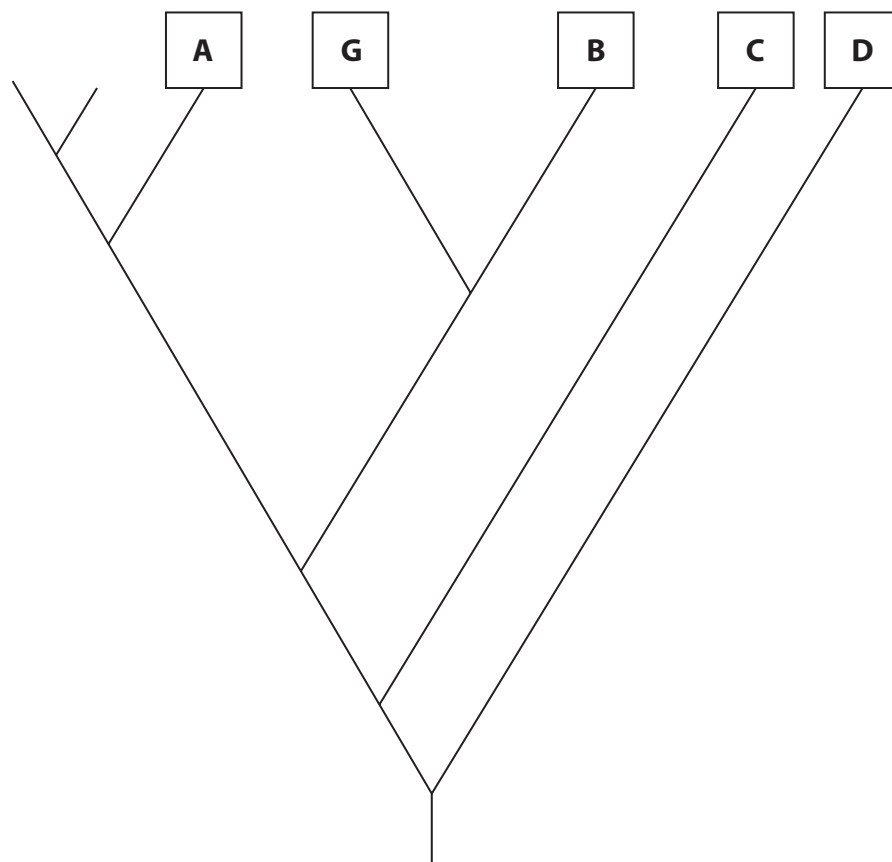
One anatomical adaptation that helps the emperor penguin to survive in its habitat is

(1)

- ☐ **A** having a large surface area to volume ratio to reduce heat loss
- ☐ **B** having a small surface area to volume ratio to reduce heat loss
- ☐ **C** huddling together to maintain body temperature
- ☐ **D** reduced resting metabolic rate while incubating eggs

(c) Molecular phylogeny suggests that the emperor penguin split off from a branch, which led to the evolution of **all** other living penguin species. This split happened 40 million years ago.

The diagram below indicates the evolutionary relationships between the main species of penguin. The letter G indicates the position of the Galapagos penguin.



Place a cross ☒ in the box that completes each of the following statements.

(i) The position of the emperor penguin on the diagram is indicated by the letter (1)

☐ A

☐ B

☐ C

☐ D

(ii) The position on the diagram of the species most closely related to the Galapagos penguin is indicated by the letter (1)

☐ A

☐ B

☐ C

☐ D

(iii) Suggest how molecular phylogeny can be used to determine the evolutionary relationships between the different species of penguin. (3)

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(5)



- 7 The photograph below shows two giant pandas, an adult and a cub. Giant pandas are endangered in the wild. Zoos play a role in the conservation of endangered species.



© Shutterstock/Gang Liu

Magnification $\times 0.05$

- (a) Explain how breeding programmes can help conserve the genetic diversity of the giant panda.

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- (b) Giant pandas are difficult to breed in captivity. The males tend to be aggressive towards the females and there is only a short period of time when the females are fertile.

Artificial insemination can be used to fertilise female pandas. The sperm for this has been stored by freezing.

Freezing for long periods of time can damage the mitochondria in the sperm.

- (i) Explain how damage to the mitochondria could affect the ability of sperm to fertilise an egg.

(3)

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- *(ii) Freezing sperm can also damage the acrosome membrane.

Suggest how damage to the acrosome membrane could affect the fertilisation of an egg.

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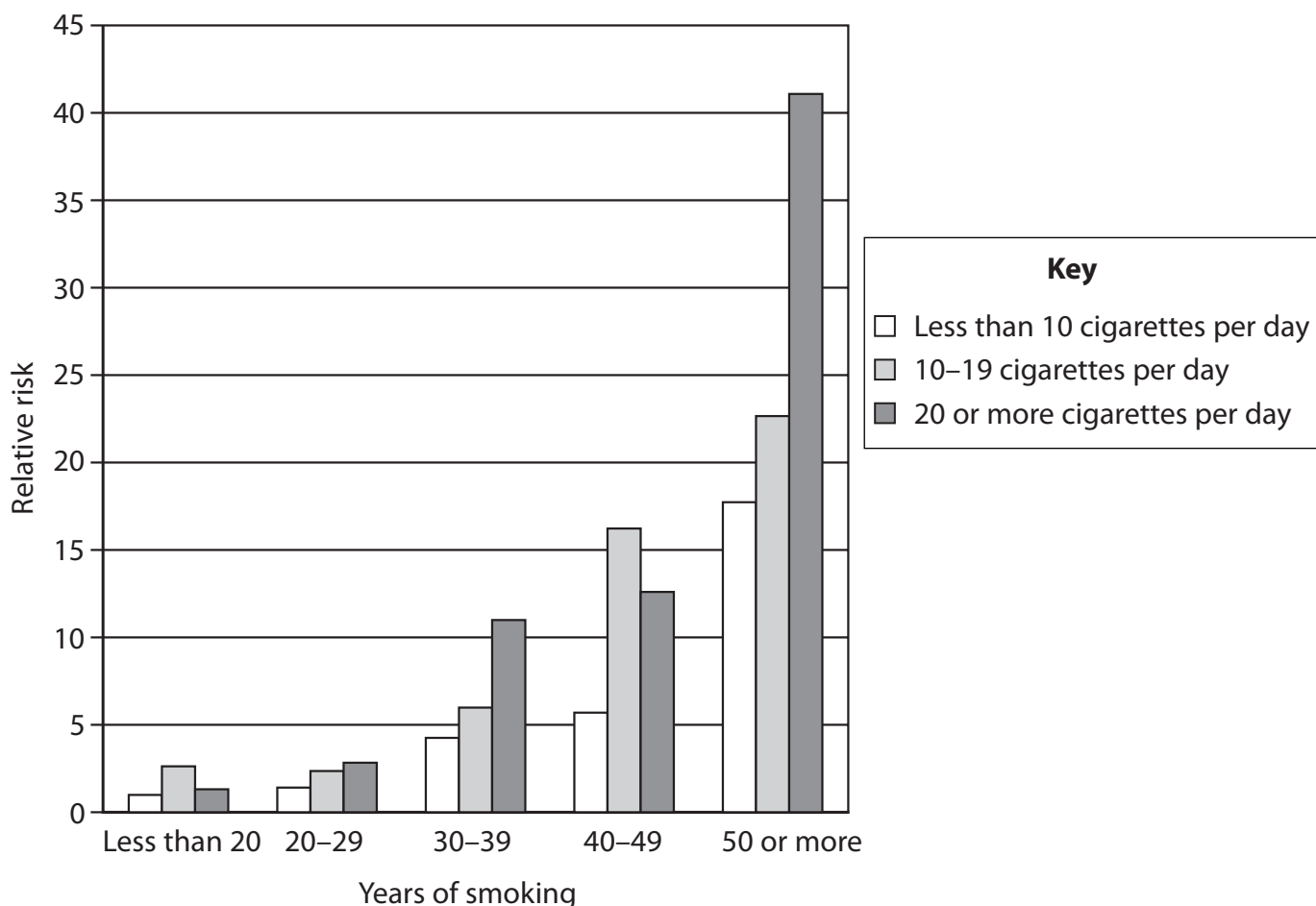
(Total for Question 7 = 11 marks)



8 Smoking cigarettes increases the risk of developing lung cancer.

The graph below shows the relative risk of developing lung cancer in people who have smoked for different numbers of years.

The relative risk is how many times more likely a person is of developing lung cancer than a non-smoker.



(a) Using the information in the graph, describe the effect that smoking has on the relative risk of developing lung cancer.

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P 4 5 0 2 9 A 0 2 1 2 4

- (b) It has been reported that the relative risk of developing lung cancer is doubled if a person has a close family member who has developed lung cancer.

Explain what this suggests about the causes of lung cancer.

(1)

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- (c) Identical twins can provide evidence for the relative effects of the factors that affect a phenotype.

Identical twins develop from one fertilised egg.

- (i) Explain why studies of identical twins can provide evidence for the relative effects of the factors that affect a phenotype.

(2)

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(ii) Non-identical twins are produced from the fertilisation of two eggs.

Concordance is the probability that each twin will have the same characteristic if it is present in one of the twins.

The table below shows the concordance of lung cancer in identical and non-identical twins.

Type of twin	Concordance of lung cancer (%)
Identical	20
Non-identical	11

Using information in the table, comment on the relative contributions of genotype and the environment to the probability of developing lung cancer.

(4)

(Total for Question 8 = 9 marks)

TOTAL FOR PAPER = 80 MARKS

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