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

Tuesday 14 January 2014 – Afternoon
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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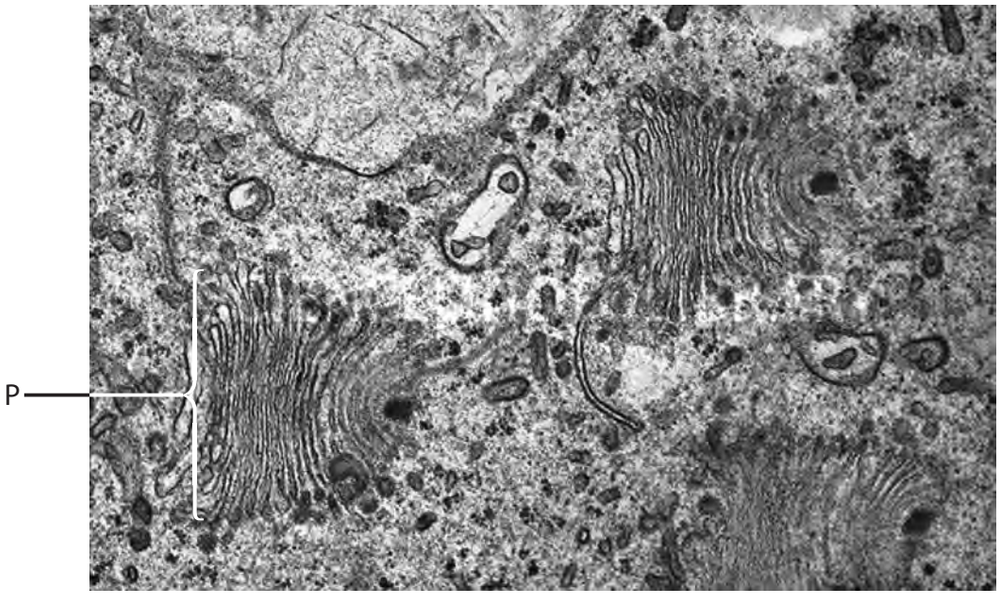
P 4 2 9 1 7 A 0 1 2 4

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 The electron micrograph below is a section through part of a cell showing a group of organelles.



Magnification ×16 000

(a) Place a cross in the box ☒ next to the correct name of the organelle labelled P on the electron micrograph.

(1)

☒ **A** amyloplast

☒ **B** Golgi apparatus

☒ **C** rough endoplasmic reticulum

☒ **D** smooth endoplasmic reticulum

(b) The electron micrograph below is a section through part of a cell showing a mitochondrion.

Magnification ×10000

(i) Using information from these electron micrographs and your own knowledge, compare the structure of the mitochondrion with the structure of the organelle labelled P.

(3)

(ii) Explain why the presence of these two organelles indicates that the cell is eukaryotic.

(1)

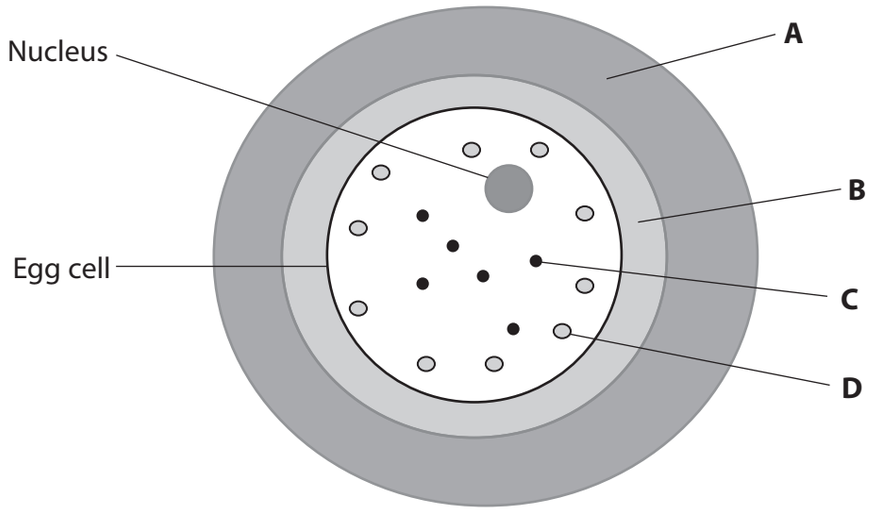
(c) Give the name of a structure found in the cytoplasm of both eukaryotic and prokaryotic cells.

(1)

(Total for Question 1 = 6 marks)

2 A human egg cell contains a nucleus, lipid droplets and cortical granules. Cortical granules are lysosomes containing enzymes.

The diagram below shows a human egg cell and the structures surrounding it.



(a) Labels **A**, **B**, **C** and **D** indicate the positions of structures either inside or associated with the human egg cell.

Place a cross in the box ☒ which corresponds to the correct name of each structure.

(i) Cortical granule ☒ **A** ☒ **B** ☒ **C** ☒ **D**

(1)

(ii) Layer of follicle cells ☒ **A** ☒ **B** ☒ **C** ☒ **D**

(1)

(iii) Zona pellucida ☒ **A** ☒ **B** ☒ **C** ☒ **D**

(1)

(b) Describe the function of each of the following structures that are found in a human egg cell.

(i) Lipid droplets

(1)

(ii) Cortical granules

(3)

(c) Give **two** similarities of the nucleus of a human egg cell and the nucleus of a human sperm cell.

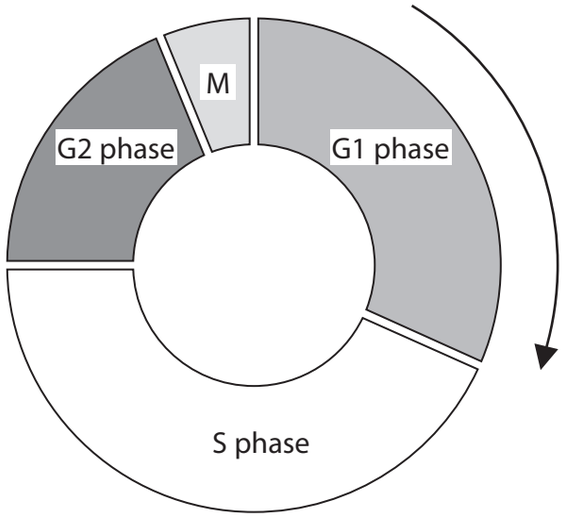
(2)

1

2

(Total for Question 2 = 9 marks)

3 A zygote forms after the fertilisation of a human egg cell. It divides several times to produce a ball of cells. This involves the cell cycle, shown in the diagram below.



(a) (i) Describe the function of the cell cycle.

(3)

(ii) Place a cross ☒ in the box next to the stage of the cell cycle during which DNA is replicated.

(1)

☒ **A** G1 phase

☒ **B** G2 phase

☒ **C** M phase

☒ **D** S phase

(iii) Name the stage indicated by the letter M on the diagram of the cell cycle.

(1)

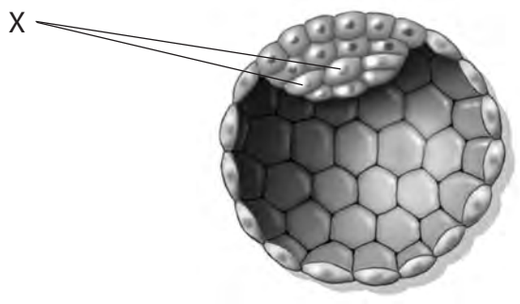
(b) During the G1 phase of the cell cycle, some cells of the embryo become specialised.

Describe the processes which cause a cell to become specialised.

(4)

(c) Several days after fertilisation the ball of cells becomes a blastocyst. The diagram below shows a section through a blastocyst.

The cells labelled X in the diagram are pluripotent. These cells give rise to tissues and then organs.



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

(2)

(ii) Suggest how organs develop from pluripotent cells.

(2)

(Total for Question 3 = 13 marks)

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4 Cellulosic ethanol is a biofuel. It is produced from parts of crop plants that cannot be eaten, such as wood and wheat straw.

This ethanol is made by fermenting the monosaccharide sugar produced when cellulose is broken down.

(a) For each of the following statements place a cross ☒ in the box next to the correct answer.

(i) The monosaccharide sugar produced when cellulose is broken down is

(1)

☒ **A** α glucose

☒ **B** β glucose

☒ **C** fructose

☒ **D** maltose

(ii) The types of bond that would have to be broken down in the cellulose are

(1)

☒ **A** 1-4 glycosidic bonds only

☒ **B** 1-6 glycosidic bonds only

☒ **C** hydrogen bonds and 1-4 glycosidic bonds

☒ **D** hydrogen bonds and 1-6 glycosidic bonds

(b) Explain why the use of this biofuel is more sustainable than using fossil fuels.

(3)

(c) This biofuel is produced from lignocellulose, a structural material containing cellulose and lignin.

Suggest **one** type of plant tissue that would be a source of the lignocellulose.

Give an explanation for your answer.

(3)

Type of plant tissue .....

Explanation .....

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(Total for Question 4 = 8 marks)

5 Industrial melanism is a term used to describe the adaptation of a species in response to air pollution.

The peppered moth, *Biston betularia*, has more than one phenotype. These phenotypes include a light-coloured phenotype (A) and a melanic (dark-coloured) phenotype (B).

The photograph below shows these moths on the bark of a tree from an unpolluted region.

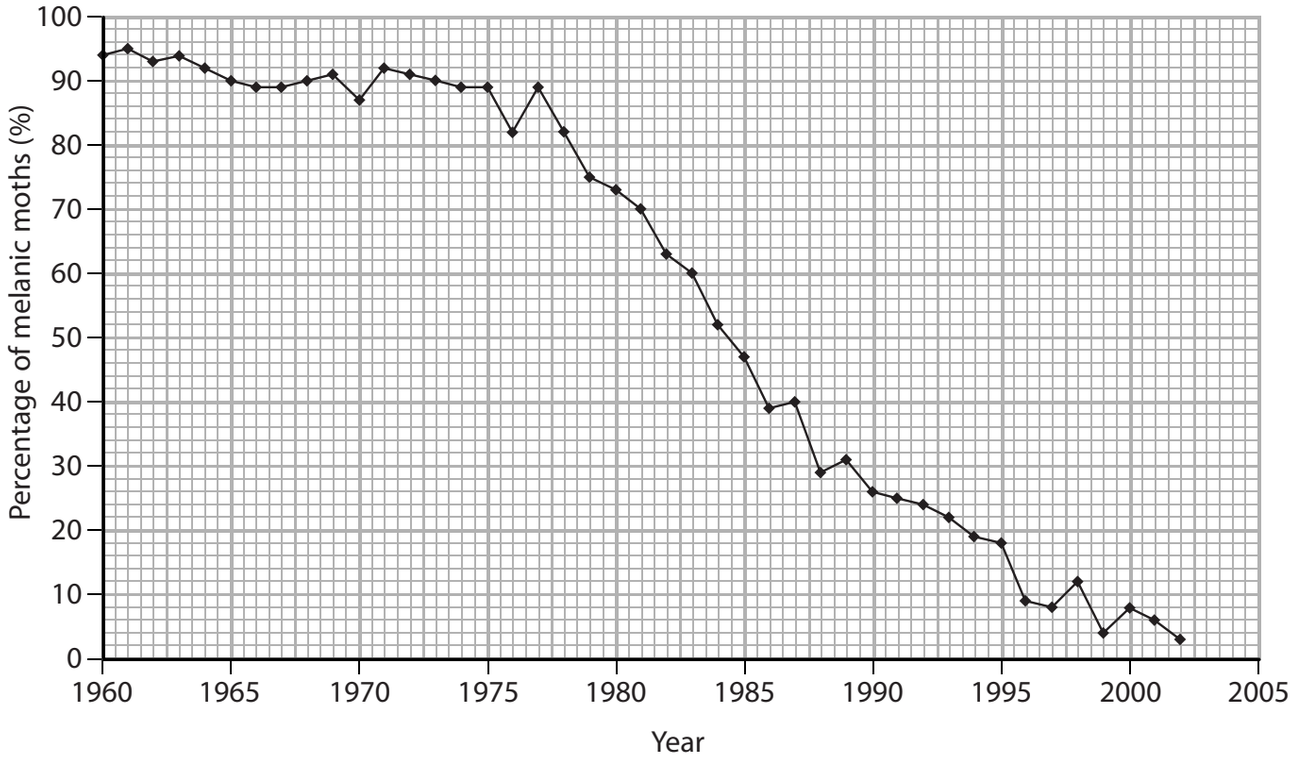
Magnification ×0.5

In polluted regions in northern England, the melanic moths (B) were the dominant phenotype. This is a result of natural selection.

*(a) Suggest how natural selection caused an increase in the proportion of melanic phenotypes in the population of moths in northern England.

(4)

(b) The graph below shows the percentage of melanic moths in the population in an area in northern England from 1960 to 2002.



Compare the changes in the percentage of melanic moths between 1960 and 1970 with the changes between 1980 and 1990.

Suggest **one** reason for your answer.

(3)

(c) There is a range of different phenotypes of *Biston betularia* with intermediates between the light-coloured and melanic forms of moth. This may be a result of polygenic inheritance.

Explain what is meant by the term **polygenic inheritance**.

(2)

(Total for Question 5 = 9 marks)

6 The table below shows the numbers of species of lizard found living in different regions of the world. The table also shows the total land area of each region and the number of lizard species per 10 000 km^2 in each region.

Region of the world	Number of lizard species	Land area / km^2	Number of species per 10 000 km^2
Australia	623	7 741 000	0.80
California	67	424 000	1.58
New Zealand	80	268 700	2.98
Texas	61	696 200	0.88
United Kingdom		244 800	0.12

(a) (i) Using the data in the table, calculate the number of species of lizard in the United Kingdom. Show your working.

(2)

Answer .....

(ii) Using information in the table, compare the biodiversity of lizard species in California with that in Texas.

(2)

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(iii) Explain what is meant by the term **species richness**.

(2)

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(b) Several types of lizards called geckos, live in New Zealand.

Naultinus are green geckos. They are active during the day and live in trees.

Hoplodactylus are brown forest geckos. They are active at night and live on the ground or in trees.

These geckos are shown in the photographs below.

Green gecko Magnification ×1

Brown forest gecko Magnification ×1

(i) These geckos are endemic to New Zealand.

Describe what is meant by the term **endemic**.

(1)

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(ii) Both types of gecko live in the same habitat. However, they occupy different niches.

Explain what is meant by the term **niche**.

(2)

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(iii) Suggest how these two types of gecko can survive in the same habitat.

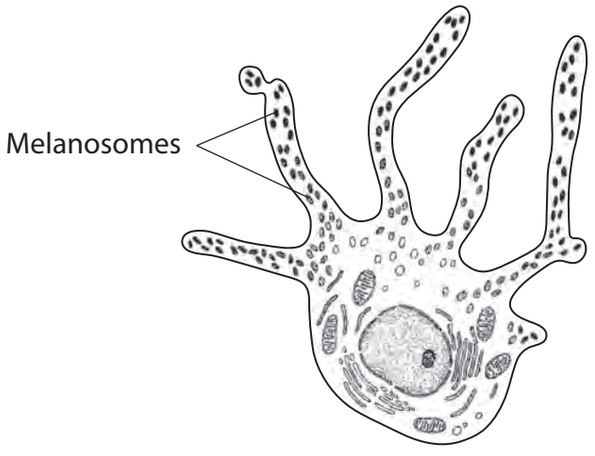
(3)

(Total for Question 6 = 12 marks)

7 Melanocytes are cells, found in the skin, that produce melanosomes. Melanosomes are vesicles containing the dark pigment melanin.

When activated by a hormone called melanocyte-stimulating hormone (MSH) melanocytes produce melanosomes. Bright sunlight increases the production of MSH.

The diagram below shows a melanocyte containing melanosomes.



Magnification $\times 10\,000$

(a) Exposure to bright sunlight increases the pigmentation in the skin.

Describe how the production of melanin shows that the phenotype of an organism can be affected by the environment.

(3)

(b) Tyrosinase is an enzyme involved in the production of melanin in melanocytes.

Tyrosinase is synthesised on ribosomes and is then modified before being transferred to the melanosomes.

*(i) Suggest what happens to the tyrosinase from when it is released from the ribosomes until it enters the melanosomes.

(5)

(ii) In some forms of albinism, melanin is not produced. This can be due to tyrosinase being secreted from the cell instead of entering the melanosomes.

Suggest how tyrosinase is secreted from the cell.

(2)

(Total for Question 7 = 10 marks)

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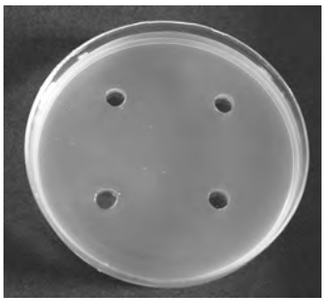
8 The antimicrobial properties of the extracts of four fruits: apple, guava, orange and pomegranate, were investigated.

Cultures of three different bacterial species, A, B and C, were mixed with agar, in separate Petri dishes. Small wells were cut into the agar and a different fruit extract was added to each.

The Petri dishes were then incubated for 24 hours.



Culture plate with wells cut into agar
Magnification ×0.3

(a) (i) Describe how the Petri dishes should be made safe before incubation. Explain your answer.

(2)

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(ii) Suggest a suitable temperature for the incubation of the Petri dishes. Give a reason for your answer.

(2)

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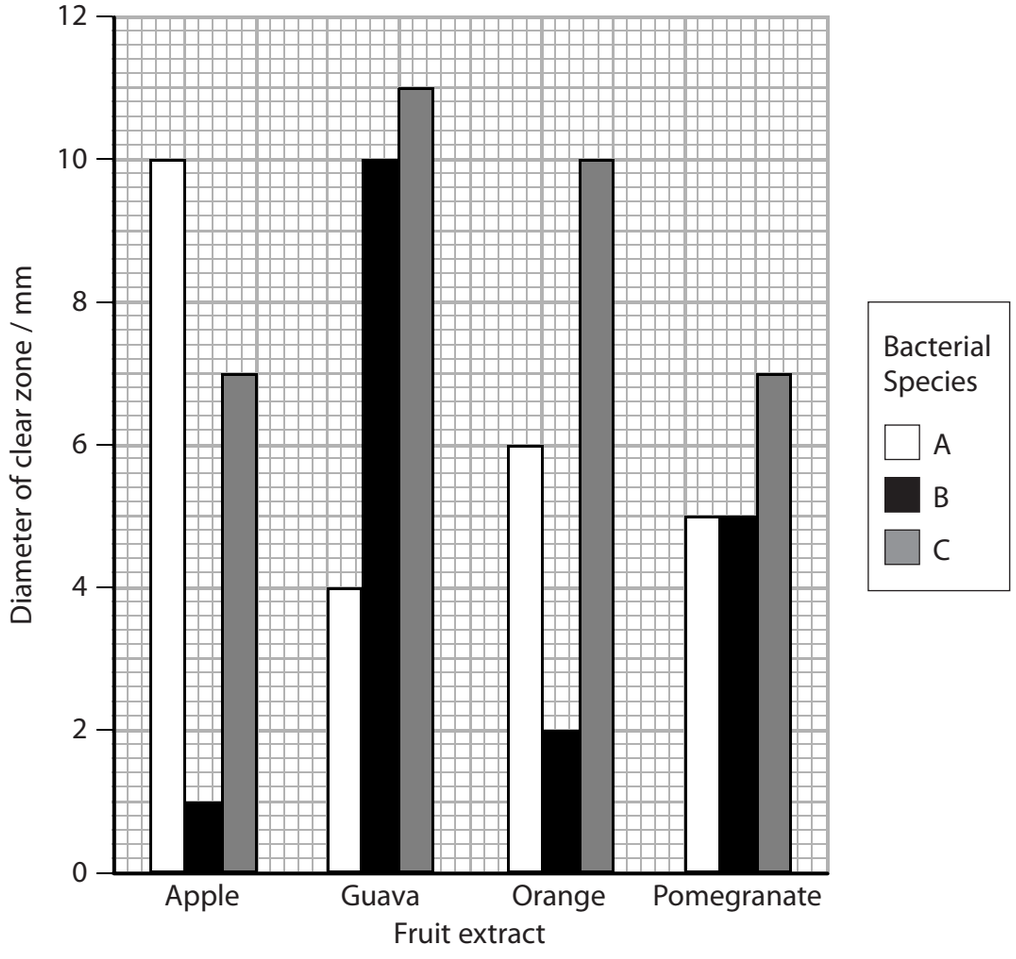
(b) After incubation, there were clear zones around each well. The diameter of each clear zone was measured and the results are shown in the graph below.



(i) Explain why clear zones were observed around the wells.

(2)

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(ii) Compare the effects of the fruit extracts on the different species of bacteria.

(3)

(c) The jambolan is a tropical fruit that has antimicrobial properties.

An investigation was carried out to compare the antimicrobial properties of jambolan with those of guava. This showed that jambolan was effective against more species of bacteria than guava.

Describe how this investigation would have been carried out to produce reliable data.

(4)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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