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 7 June 2016 – 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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1/3/3/2/1/

P 4 6 6 4 3 A 0 1 2 4

PEARSON

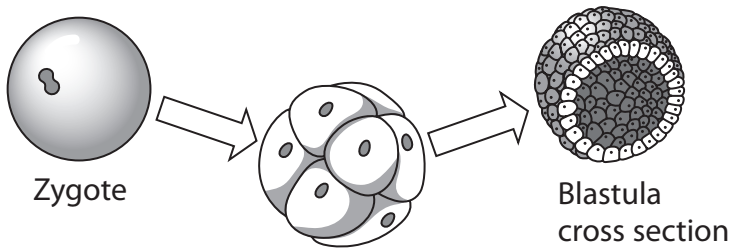
Answer ALL questions.

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 ☒.

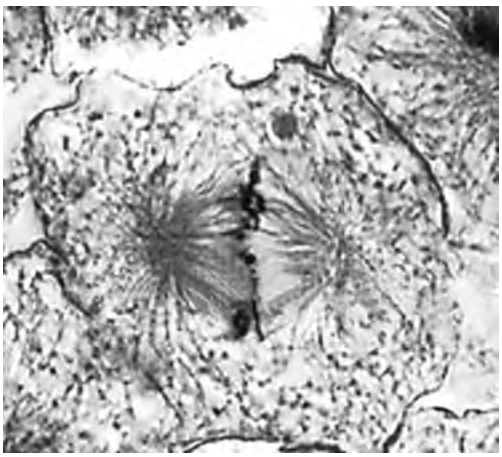
1 After fertilisation in animals, the zygote divides by mitosis.

After several divisions, a hollow ball of cells is produced. In vertebrate animals this is called a blastula.

This process in shown in the diagram below.



(a) The photograph below shows a cell of a blastula of the whitefish, *Coregonus*, at one stage of mitosis.



Magnification ×1000

Put a cross ☒ in the box next to the correct word to complete the following statement.

The stage of mitosis shown in the photograph is

(1)

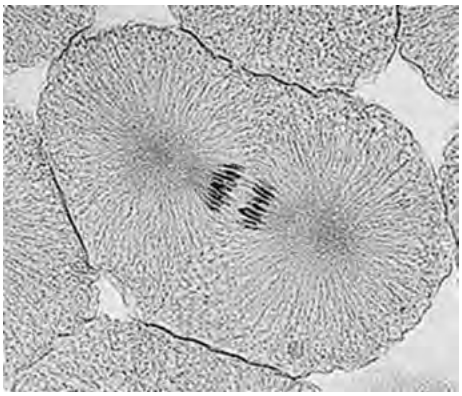
☒ **A** anaphase

☒ **B** metaphase

☒ **C** prophase

☒ **D** telophase

(b) The photograph below shows a cell of a blastula at a different stage of mitosis.



Magnification ×1000

Describe what is happening inside the cell during this stage of mitosis.

(4)

(c) The cells of a blastula are totipotent. Suggest why it is important that these cells are totipotent.

(2)

(Total for Question 1 = 7 marks)

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2 Some organelles in plant and animal cells are surrounded by a membrane.

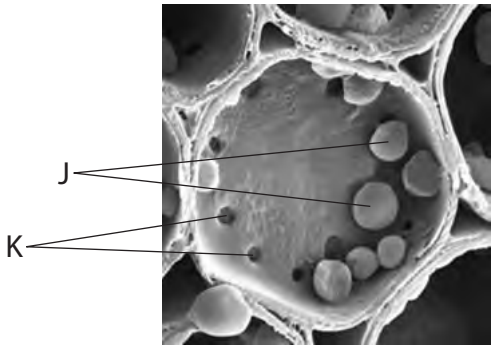
(a) Name **two** organelles that have a single membrane.

(2)

1 .....

2 .....

(b) The photograph below shows a section through a cell from the stem of a clematis plant.



Magnification ×1600

Put a cross ☒ in the box next to the correct word or words to complete each of the following statements.

(i) The structures labelled J contain starch and are

(1)

☒ **A** amyloplasts

☒ **B** mitochondria

☒ **C** nuclei

☒ **D** vesicles

(ii) The structures labelled K, in the cellulose cell wall, are

(1)

☒ **A** middle lamellae

☒ **B** mitochondria

☒ **C** pits

☒ **D** vesicles

*(iii) Compare the structure of starch with the structure of a cellulose molecule.

(4)

(c) In plant cells, some of the organelles are plastids.

Most flowering plants gain their plastids from the female parent and not the male parent. This is due to the double fertilisation that occurs in flowering plants.

(i) Describe the process of **double fertilisation** in flowering plants.

(3)

(ii) During the growth of the plant, the cells divide. Before cell division takes place, the plastids divide.

Name the stage of the cell cycle in which plastids would divide.

(1)

.....

(Total for Question 2 = 12 marks)

3 Mammals reproduce sexually. This involves fertilisation to produce a zygote.

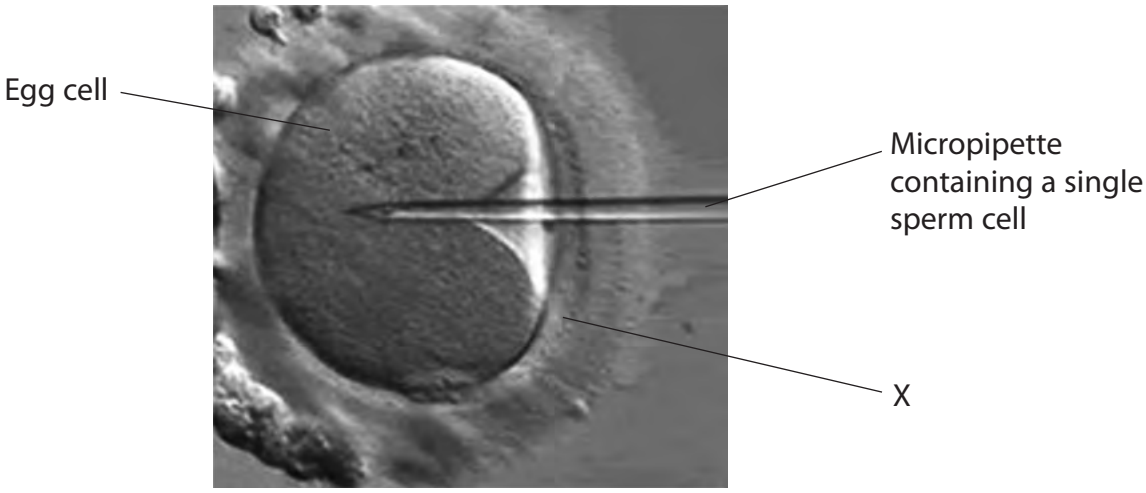
(a) Explain the importance of fertilisation in sexual reproduction.

(2)

(b) Damaged or faulty sperm cells can reduce the chance of fertilisation occurring.

To increase the chance of fertilisation, a technique called intracytoplasmic sperm injection (ICSI) can be used.

This technique involves injecting a single sperm cell into the cytoplasm of an egg cell, as shown in the photograph below.



Magnification ×400

(i) Name the structure labelled X that surrounds the egg cell.

(1)

(ii) Suggest why a sperm cell with a damaged acrosome would **not** be able to fertilise an egg cell.

(3)

(c) In fertilisation, the fusion of the sperm cell membrane with the egg cell membrane is followed by changes in the egg cell.

Describe a process that would **not** occur with the ICSI technique.

(3)

(Total for Question 3 = 9 marks)

4 It has been suggested that all living organisms evolved from simple prokaryotic cells.

(a) Describe how a prokaryotic cell can be distinguished from a eukaryotic cell.

(3)

(b) Woese suggested that all living organisms could be placed into three taxonomic groupings.

(i) Place a cross ☒ in the box next to the correct word to complete the following statement.

Woese called these taxonomic groupings

(1)

☒ **A** classes

☒ **B** domains

☒ **C** kingdoms

☒ **D** phyla

(ii) Woese suggested that Bacteria and Archaea were two separate groups of prokaryotic organisms.

Describe the evidence Woese used to make this suggestion.

(2)

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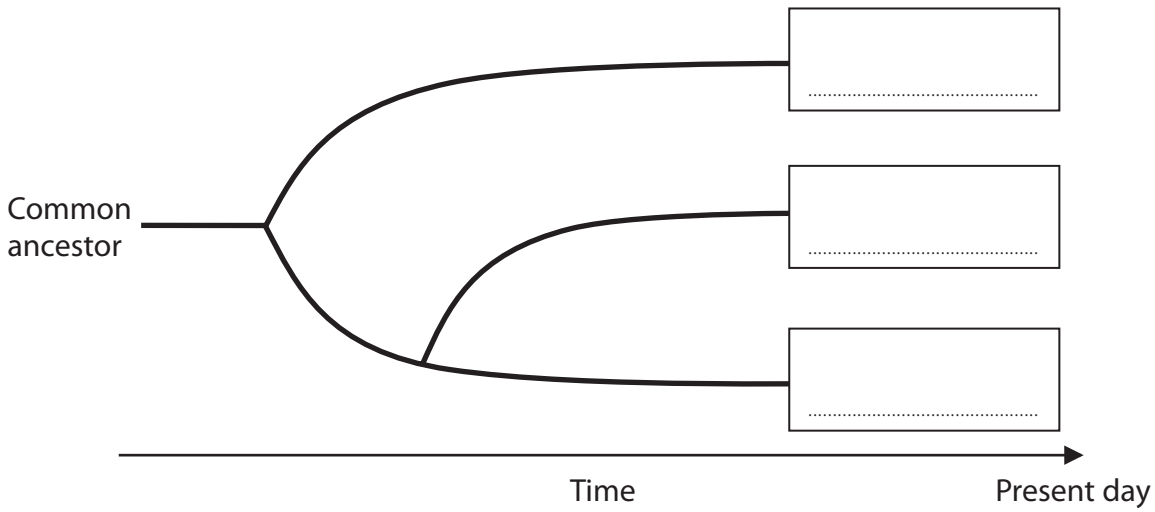
(iii) The diagram below shows the evolutionary relationship between the three groups proposed by Woese.

Complete the diagram to show the positions of these three groups.

(2)



(Total for Question 4 = 8 marks)

5 The photograph below shows a section through the cell walls of two adjacent xylem vessels in the stem of a plant, as seen using an electron microscope.

Magnification ×63 000

(a) Put a cross ☒ in the box next to the correct answer.

(i) The middle lamella is labelled

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) The layer that contains secondary thickening is labelled

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(iii) Explain how secondary thickening in the cell wall contributes to the physical properties of xylem vessels.

(3)

(b) Fibres containing xylem vessels can be used to make textiles.

Fibres from jute plants are used to make rope.

These fibres are extracted in water. The fibres are then hung out to dry, as shown in the photograph below.

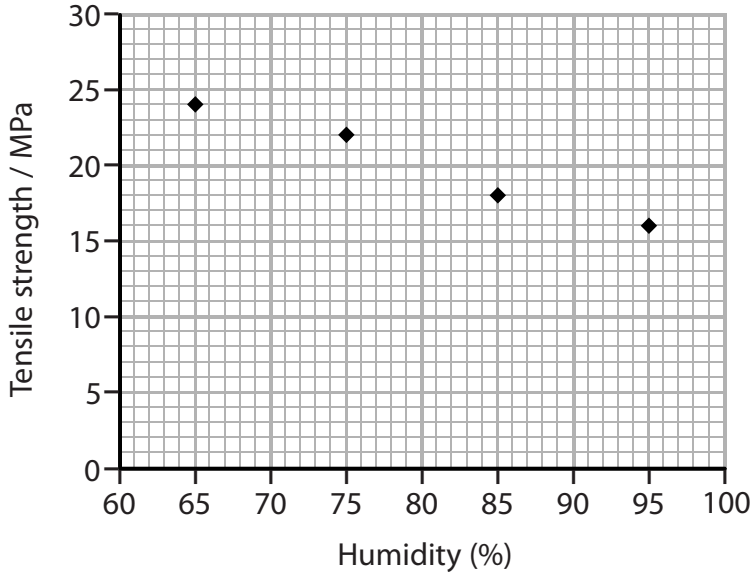
Magnification ×0.2

(i) Explain why jute fibres are an example of a sustainable resource.

(2)

(ii) The tensile strength of jute fibres is affected by humidity, the amount of moisture in the air.

The effect of humidity on the tensile strength of jute fibres is shown in the graph below.



Using the information in the graph, describe the effect of humidity on the tensile strength of jute fibres.

(2)

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(iii) Name **two** variables that need to be controlled when investigating the effect of humidity on the tensile strength of jute fibres.

(2)

1 .....

2 .....

(Total for Question 5 = 11 marks)

6 Carnivorous plants live in soil lacking mineral ions such as nitrates.

Carnivorous plants obtain nitrogen-containing compounds by digesting animal tissue.

(a) Explain the importance of nitrate ions to plants.

(2)

(b) The pitcher plant is a type of carnivorous plant.

The photograph below shows a species of pitcher plant, *Nepenthes attenboroughii.*

Magnification ×0.1

(i) Explain what is meant by the term **niche,** with reference to the pitcher plant.

(2)

(ii) Pitcher plants have leaves that trap insects or small mammals.

These leaves are shaped like deep cups filled with liquid. This liquid contains enzymes that digest protein.

Put a cross ☒ in the box next to the correct words to complete the following statement.

The adaptations shown by the pitcher plants are

(1)

☒ **A** anatomical and behavioural

☒ **B** anatomical and physiological

☒ **C** anatomical, behavioural and physiological

☒ **D** behavioural and physiological

(iii) Suggest how natural selection has given rise to carnivorous plants.

(4)

(c) *Nepenthes attenboroughii* is critically endangered and appeared on the 2012 list of the world's 100 most threatened species.

Scientists have found that it is difficult to grow pitcher plants from seed. Pitcher plants can be grown using tissue culture techniques, as shown in the photograph below.

Suggest how a tissue culture technique could be used to grow pitcher plants.

(4)

(Total for Question 6 = 13 marks)

7 In 1986, an explosion and fire at the Chernobyl nuclear power plant released large quantities of radioactive particles into the atmosphere.

Approximately 100 000 km^2 were contaminated with radioactive fallout, with the worst hit regions being in Belarus.

The table below shows the incidence of thyroid cancer in people from Belarus who were less than four years old at the time of the accident at Chernobyl.

Year	Incidence of thyroid cancer per 100 000 people
1986	0.4
1991	4.1
1996	8.9
2001	17.6

(a) (i) The rate of change in the incidence of thyroid cancer from 1986 to 1991 is 0.74 per 100 000 people per year.

Calculate the rate of change in the incidence of thyroid cancer from 1996 to 2001.

Show your working.

(2)

..... per 100 000 people per year

(ii) Suggest an explanation for the difference in these rates of change in the incidence of thyroid cancer.

(3)

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(b) The town of Pripyat, shown in the photograph below, was evacuated after the disaster at the Chernobyl nuclear power plant. People have not been allowed back to live in the area.

The following two claims have been made about the effect of this disaster on biodiversity:

"Nature has filled the void left by humans to create a sanctuary of biodiversity"

"Radiation has led to a decline in wildlife".

(i) State what is meant by the term **biodiversity**.

(1)

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(ii) Suggest how scientists could find out if biodiversity within the town of Pripyat has increased or decreased since the Chernobyl disaster in 1986.

(2)

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(Total for Question 7 = 8 marks)

8 The photograph below shows a koala, *Phascolarctos cinereus*. Koalas live in Australia.

Magnification ×0.1

(a) Koalas have a low genetic diversity.

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

(1)

(ii) A low genetic diversity in a species can be due to a decrease in population size.

Explain how a decrease in population size can result in a reduced genetic diversity.

(2)

(b) Koalas in the south of Australia have fur that is brown in colour and those in the north have grey fur.

The fur colour of koalas is not affected by their environment.

Koalas that live in habitats between the north and south of Australia have a range of fur colouration from grey to brown.

Suggest **one** reason for this range of fur colour.

(1)

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(c) The table below shows the mean body length and mean body mass of koalas from habitats in the north and south of Australia.

Habitat	Mean body length / cm	Mean body mass / kg
North Australia	69.6	5.8
South Australia	74.9	10.3

(i) Using the information in the table, describe the differences in body length and body mass for koalas living in these two habitats.

(2)

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(ii) Suggest an explanation for the difference in size of koalas from these two habitats.

(1)

*(d) Suggest how a captive breeding programme could maintain the genetic diversity of the koalas in Australia.

(5)

(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS