Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 3 GCE

Time 1 hour 30 minutes

Paper reference **8BN0/02**

Biology A (Salters Nuffield)

Advanced Subsidiary

PAPER 2: Development, Plants and the Environment

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.
- **Show all your working out** in calculations and **include units** where appropriate.
- 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.*
- You may use a scientific calculator.
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

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 ▶

P69495A

©2022 Pearson Education Ltd.

Q:1/1/1/

P 6 9 4 9 5 A 0 1 2 4

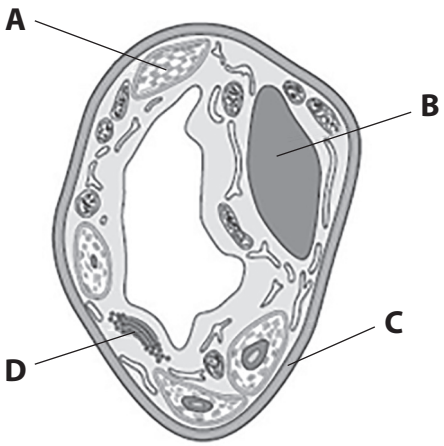
Pearson

Answer ALL questions. Write your answers in the spaces provided.

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 Plant cells are organised into tissues, organs and systems.

(a) The diagram shows a plant cell, as seen using an electron microscope.



(i) Which structure contains pits?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) Which structure could be reinforced with lignin?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(iii) Which structure contains vesicles?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(b) Plants contain xylem tissue.

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

(2)

(ii) It is possible to investigate the location of xylem tissue in a plant stem by using a microscope.

The following method is used:

1. cut the stem of a broad bean plant just above soil level

2. place the cut end of the stem in a beaker of coloured dye for 30 minutes

3. cut thin sections of the stem to view using the microscope.

Explain why the plant is left in the dye for 30 minutes before cutting sections through the stem.

(2)

(Total for Question 1 = 7 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

2 Salmon are fish that produce gametes by meiosis.

Crossing over during meiosis produces new combinations of alleles in the gametes.

(a) A female salmon has the genotype Aa for one gene and Bb for another gene.

Both of these genes are found on the same chromosome and are linked.

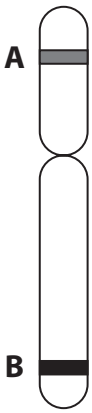
Complete the table to show the percentage of allele combinations seen in the egg cells of this female.

(1)

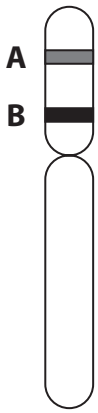
Percentage allele combination in egg cells (%)			
AB	**ab**	**Ab**	**aB**
49.5		0.5	

(b) The diagrams show possible arrangements of these genes on one of the chromosomes of this female salmon.

Arrangement 1



Arrangement 2



DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

State and justify which arrangement is most likely to produce the results shown in the table.

(3)

(c) A female salmon can produce up to 1 600 eggs per year for up to 11 years.

Calculate the maximum number of egg cells that this female salmon could produce containing the allele combination AB in this time.

(2)

Answer .....

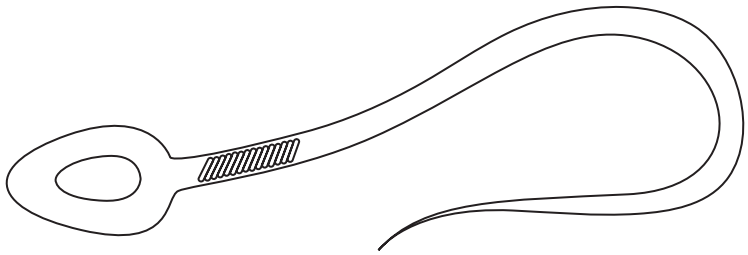
(Total for Question 2 = 6 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

3 The sperm cell is the male gamete in human reproduction.

(a) (i) Complete the diagram of the sperm cell and label the acrosome, nucleus and mitochondria.

(3)



(ii) Which of the following is the role of the acrosome?

(1)

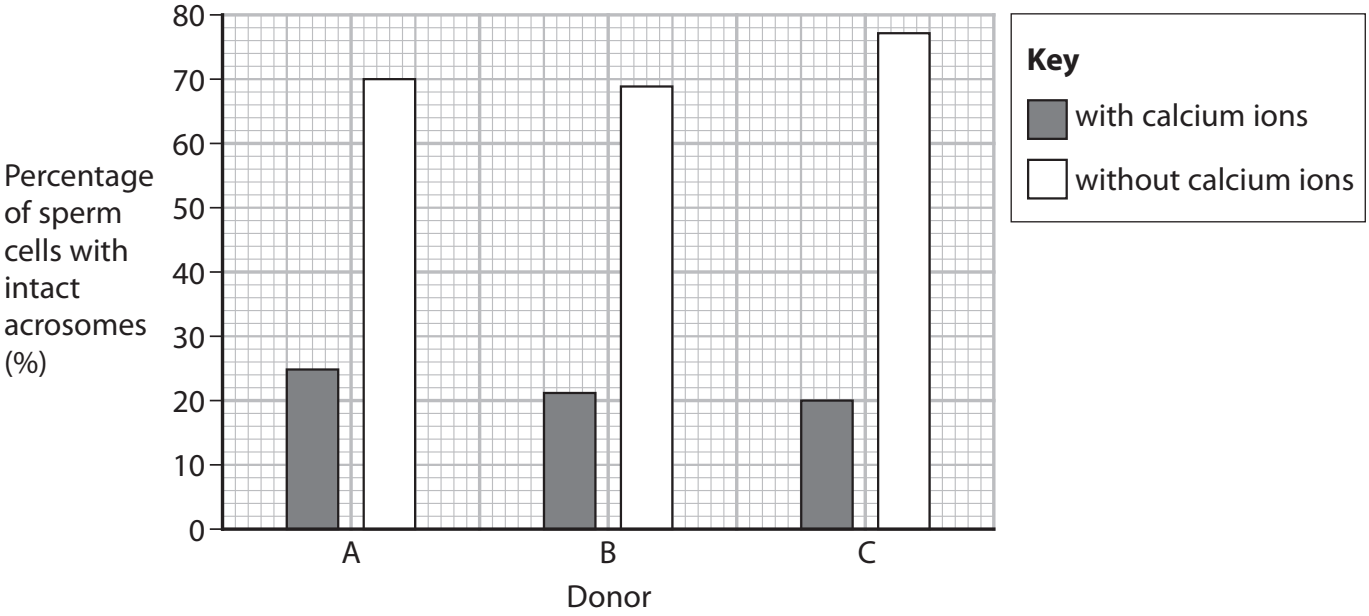
- ☒ **A** to release enzymes to digest the cell membrane of the ovum
- ☒ **B** to release enzymes to digest the zona pellucida
- ☒ **C** to release hormones to digest the cell membrane of the ovum
- ☒ **D** to release hormones to digest the zona pellucida

(b) The effect of calcium ions on sperm cells was investigated.

Sperm cells from three donors, A, B and C, were stored in two different buffer solutions.

One buffer solution contained calcium ions and the other did not contain calcium ions.

The graph shows the percentage of sperm cells that had intact acrosomes after storage.



DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(i) The type of storage solution affects the percentage of sperm cells with intact acrosomes.

Calculate the difference in the mean percentage for the two solutions.

(3)

Answer .....

(ii) Deduce why the percentage of sperm cells with intact acrosomes is greater when stored in the buffer solution without calcium ions.

(2)

.....

.....

.....

.....

.....

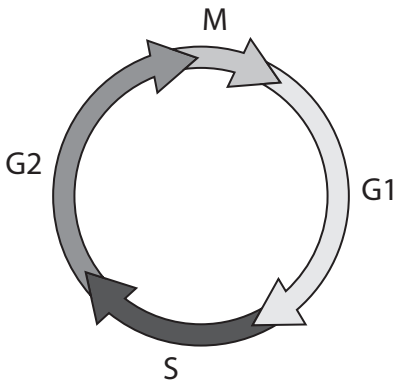
.....

(Total for Question 3 = 9 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

4 Mitosis is a part of the cell cycle and an important part of cell division.

(a) The diagram shows the stages in the cell cycle.



(Source: © PAL)

(i) During which stage of the cell cycle is DNA replicated?

(1)

☒ **A** G1

☒ **B** G2

☒ **C** M

☒ **D** S

(ii) During which stage does the greatest increase in cell size occur?

(1)

☒ **A** G1

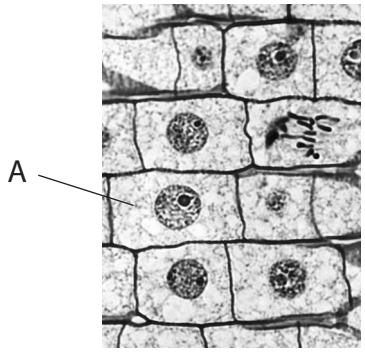
☒ **B** G2

☒ **C** M

☒ **D** S

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(b) The photograph shows cells from a root tip squash.



(Source: © PAL)

(i) The nucleus of cell A is 6 μm in diameter.

The nucleus takes up 9% of the volume of the cell.

The formula for the volume of a sphere is

$$V = \frac{4}{3}\pi r^3$$

Calculate the volume of cell A in μm^3.

Give your answer to two significant figures.

(3)

..... μm^3

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(ii) Devise an investigation to study the relationship between the distance from the tip of a root and the percentage of cells undergoing nuclear division.

(5)

(Total for Question 4 = 10 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

5 Cattle are affected by a condition called mastitis.

Mastitis is caused by *Staphylococcus aureus*, a species of bacteria.

(a) The DNA in *Staphylococcus aureus* is

(1)

- ☒ **A** double-stranded and found in the cytoplasm
- ☒ **B** double-stranded and found in a nucleus
- ☒ **C** single-stranded and found in the cytoplasm
- ☒ **D** single-stranded and found in a nucleus

(b) A different species of bacteria, *Staphylococcus simulans*, produces lysostaphin, an enzyme with antimicrobial properties.

Lysostaphin prevents infection by *S. aureus*.

Scientists have introduced the gene coding for lysostaphin into the genome of cattle.

Messenger RNA coding for lysostaphin is translated at a ribosome in the cells of cattle to produce a polypeptide.

(i) This polypeptide is processed inside the cells to produce the active enzyme. The enzyme is then secreted from the cells.

Describe how the cells process this polypeptide and secrete it as an enzyme.

(4)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(ii) Muscle tissue samples and milk from the cattle were tested for the presence of lysostaphin.

Deduce why lysostaphin was present in the milk but not in muscle tissue.

(4)

(Total for Question 5 = 9 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

6 The snow leopard is an endangered species.

Human activities such as poaching, destruction of habitat, livestock grazing and hunting all pose threats to the future population of the snow leopard.

In May 2014, two snow leopard cubs were born at Lakeland Wildlife Oasis in Cumbria.

(a) (i) Explain why captive breeding programmes are important for maintaining biodiversity.

(3)

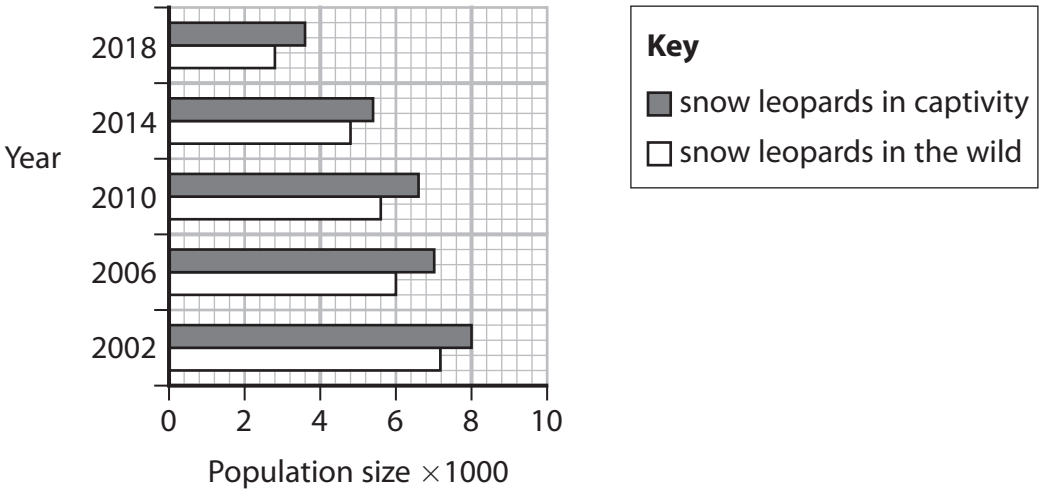
(ii) When these two cubs became adults, they were separated and sent to zoos in Poland and Italy.

Explain why these offspring were not allowed to remain in the same zoo.

(3)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(b) The graph shows the population of snow leopards in captivity and in the wild, over a period of 16 years.



(i) Comment on the populations of snow leopards in captivity and in the wild.

(3)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(ii) Give two reasons why snow leopard cubs born in captivity have not been released into the wild.

(2)

1 .....

.....

.....

2 .....

.....

.....

(Total for Question 6 = 11 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

7 Fibres can be extracted from some species of plants.

There is often variation in the composition of these fibres.

(a) Plant fibres contain cellulose.

Cellulose molecules are arranged in microfibrils in cell walls of plants.

Describe the structure of a cellulose microfibril.

(4)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(b) An investigation was carried out to determine the tensile strength of three types of plant fibre.

The table shows the tensile strength and the composition of these fibres.

Fibre	Tensile strength / MPa	Composition of fibre (%)	
		Cellulose	Lignin
Ramie	91.5	68–76	0.8
Hemp	93.3	70–92	4.0
Coir	141.0	43–46	45.0

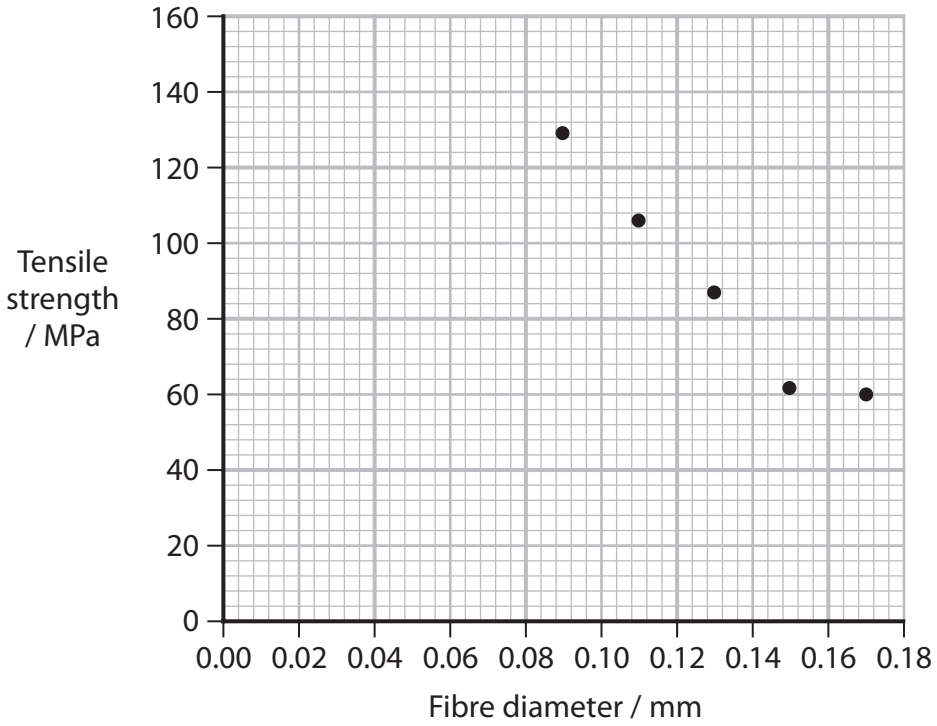
Describe the relationships between the factors shown in the table.

(2)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(c) In another investigation, the effect of fibre diameter on tensile strength was measured.

The graph shows the results of this investigation.



DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Devise an investigation to provide further, valid evidence that there is a significant correlation between fibre diameter and tensile strength.

(6)

(Total for Question 7 = 12 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

8 Quaking aspen trees (*Populus tremuloides*) can produce new growth as shoots from their roots.

These shoots are called ramets. As the ramets grow they appear to be individual trees.

Pando is a colony of these aspen trees all growing from one original plant.

This colony covers 43.6 hectares of Fishlake National Forest in Utah.

All of the trees are male and share an underground root system.

They are considered to be one organism.

(a) (i) State the processes involved in the production of ramets in this Pando colony.

(2)

(ii) Explain why the area covered by Pando shows less biodiversity than a similar area of mixed forest.

(3)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(b) These aspen trees have a range of adaptations including:

- production of phenolic glycosides that taste unpleasant to grazing animals
- production of ramets, shoots that grow upwards from the root system.

(i) Which row of the table shows the correct classification of these adaptations?

(1)

		Phenolic glycosides	Ramets
☒	**A**	anatomical	behavioural
☒	**B**	anatomical	physiological
☒	**C**	physiological	anatomical
☒	**D**	physiological	behavioural

(ii) The Pando colony is decreasing in size.

Scientists have suggested this may be caused by grazing, disease and environmental factors such as reduced rainfall.

Explain why the Pando colony is unable to adapt to changing environmental conditions.

(4)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

*(c) Efforts to maintain the Pando colony have focused on grazing by animals and competition from other plant species.

Table 1 shows the effect of fencing.

Treatment	Number of new ramets per hectare	
	Less than 2 m in height	More than 2 m in height
No fence	299	16
Fence	151	1204

Table 1

Table 2 shows the effect of burning undergrowth in the colony. The undergrowth includes other plants such as juniper bushes.

Treatment	Percentage of the area covered by the colony (%)	Number of new ramets per hectare
Undergrowth burnt	21	639
No burning of undergrowth	18	208

Table 2

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Assess the impact of these treatments on maintaining the Pando colony.

(6)

(Total for Question 8 = 16 marks)

TOTAL FOR PAPER = 80 MARKS

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE