Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Friday 24 May 2019

Morning (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 your working in any calculation questions and include units in your answer 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 ▶

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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 Many characteristics within a population show a pattern of variation, similar to the one shown in the graph.



(a) (i) The peak of the curve in the graph is the

(1)

☒ **A** mean

☒ **B** median

☒ **C** mode

☒ **D** standard deviation

(ii) Which one of these phenotypes shows a pattern of continuous variation?

(1)

☒ **A** blood group

☒ **B** body mass

☒ **C** eye colour

☒ **D** gender

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(b) Explain why an individual may have a greater adult height than their biological parents.

(4)

(c) Cell division during the production of gametes produces genetic variation.

This type of cell division involves

(1)

☒ **A** one division to produce diploid cells

☒ **B** one division to produce haploid cells

☒ **C** two divisions to produce diploid cells

☒ **D** two divisions to produce haploid cells

(Total for Question 1 = 7 marks)

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2 Red squirrels, *Sciurus vulgaris*, are native to the UK. The grey squirrel, *Sciurus carolinensis*, has been introduced to the UK.



Sciurus vulgaris



Sciurus carolinensis

(a) The two squirrels are classified as different species because they

(1)

☒ **A** are geographically isolated

☒ **B** cannot produce fertile offspring

☒ **C** have different coloured fur

☒ **D** occupy a different niche

(b) The population of red squirrels on Brownsea Island is one of several protected populations in the UK.

(i) These red squirrels are not classed as endemic to Brownsea Island because they

(1)

☒ **A** are also found in other locations

☒ **B** are not at risk of extinction

☒ **C** are not in competition with grey squirrels

☒ **D** have a large population size

(ii) The red squirrels on Brownsea Island are geographically isolated from other red squirrel populations on the UK mainland.

Over time, the Brownsea Island population of squirrels might develop into a new species.

Name the process that could lead to the Brownsea Island population of squirrels becoming a new species.

(1)

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(c) The red squirrel population on Brownsea Island has been affected by a disease caused by a prokaryotic organism.

(i) Woese classified organisms into domains.

Which of the following contain prokaryotic organisms?

(1)

☒ **A** Archaea, Bacteria and Eukaryota

☒ **B** only Archaea

☒ **C** only Archaea and Bacteria

☒ **D** only Bacteria

(ii) Scientists took blood samples from infected red squirrels and analysed them using an electron microscope.

Describe the features that could be used to identify the prokaryotic cells in the blood sample.

(4)

(Total for Question 2 = 8 marks)

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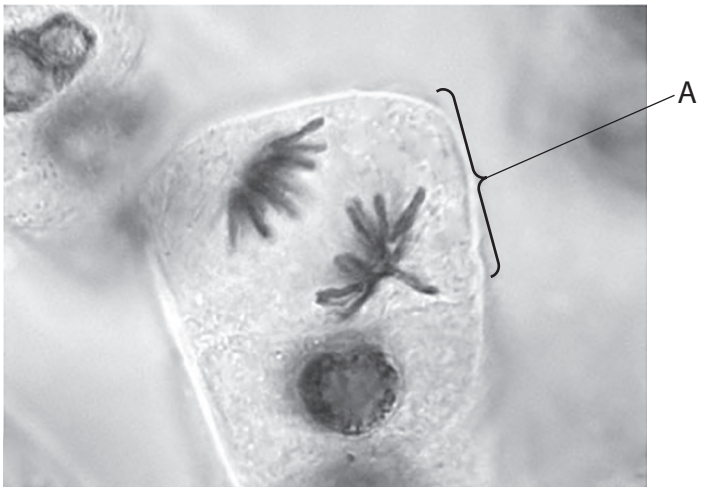
3 Plants have areas of undifferentiated cells called meristems. Cells in these areas divide rapidly during plant growth.

(a) Name this type of division.

(1)

.....

(b) The photograph shows a cell undergoing nuclear division, as seen using a light microscope.



Magnification ×800

(i) Which stage of nuclear division is shown in cell A?

(1)

☒ **A** anaphase

☒ **B** metaphase

☒ **C** prophase

☒ **D** telophase

(ii) The mean distance between the two sets of chromatids in the photograph of cell A is 1.5 cm.

Calculate the actual distance in μm.

(2)

..... μm

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(iii) Devise an investigation to study the effect of temperature on the rate of nuclear division in a plant meristem.

(5)

(Total for Question 3 = 9 marks)

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4 Seed banks are used to conserve plant species for future generations.

A study has shown that 28 187 species of plant have medical uses. Of these species only 4478 have been cited in medical journals.

(a) What percentage of the species with medical uses has been cited in medical journals, and is shown to three significant figures?

(1)

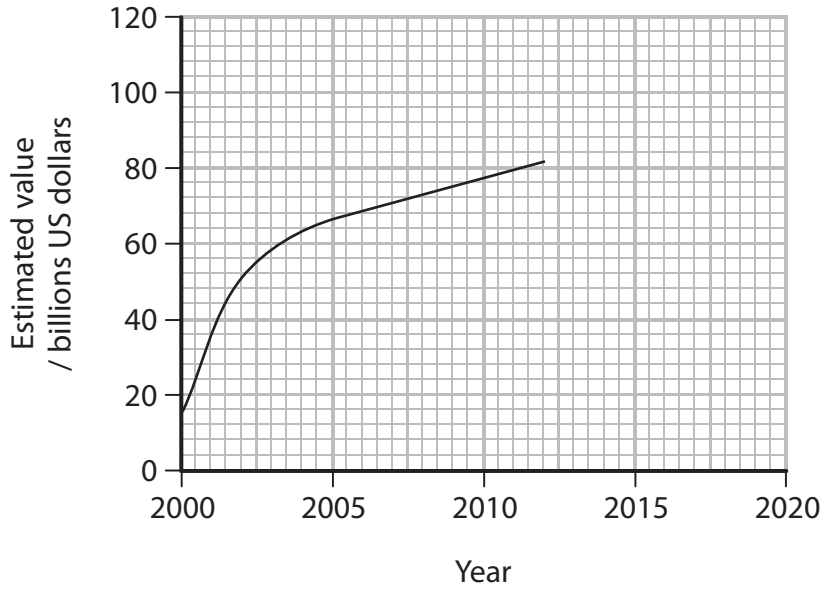
☒ **A** 15.9%

☒ **B** 16.0%

☒ **C** 0.159%

☒ **D** 0.160%

(b) The global value of plant species used in herbal medicine has increased as shown in the graph.



Predict the value of global trade in herbal medicines by 2020.

(1)

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(c) Plant biodiversity in the Boyacá region of Colombia is amongst the highest in the world. Many of these plants have potential medical uses.

Natural vegetation is being cleared to enable the rearing of cattle.

The Royal Botanic Gardens at Kew has begun a project to conserve plant species from Boyacá, Colombia.

Seed banks preserve seeds by drying them. Predictions from initial research suggest that seeds from 80% of flora in Boyacá will survive the drying process.

(i) Explain the advantages of drying seeds before storage.

(2)

(ii) Justify the benefits of conserving seeds from Boyacá.

(3)

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(d) Scientists measure biodiversity using both species richness and the heterozygosity index.

State what is meant by the following terms:

(2)

species richness

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heterozygosity index

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(Total for Question 4 = 9 marks)

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5 Bamboo plants produce fibres that have a high tensile strength.

The photograph shows part of a bamboo plant.



(a) Plant fibres contain cellulose in their cell walls.

Explain how tensile strength is related to the arrangement of cellulose in plant fibres.

(4)

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(b) The photograph shows a coffee cup made from bamboo fibres.



Explain why the use of bamboo fibres to make coffee cups is sustainable.

(2)

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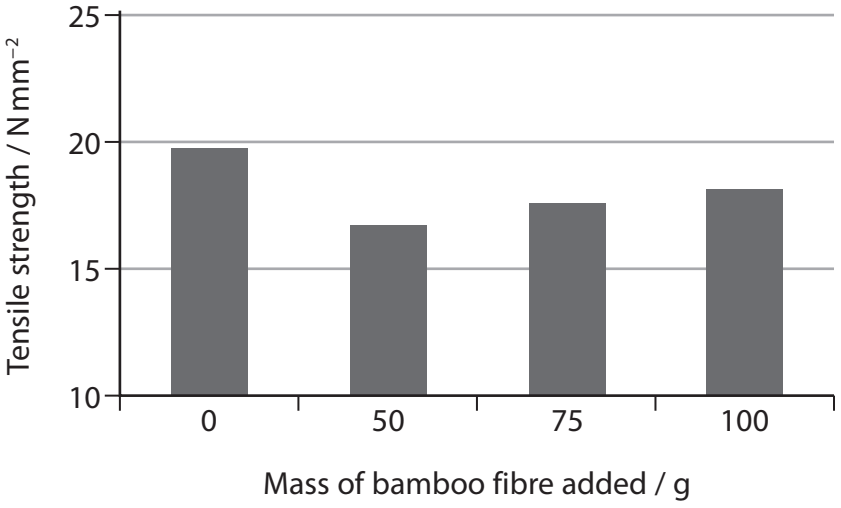
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(c) The effect of mixing bamboo fibre with resin was investigated.

The tensile strength of fibres made from a mixture of resin and different masses of bamboo fibre was measured.

The results are shown in the graph.



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Describe how the tensile strength of these fibres could have been measured.

(3)

(Total for Question 5 = 9 marks)

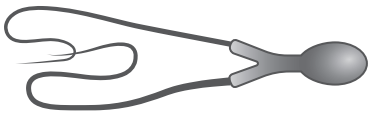
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6 Teratozoospermia is a condition that causes sperm cells to have an abnormal structure. This condition reduces fertility.

The diagram shows an abnormal sperm cell with two flagella.



(a) Explain why the production of these abnormal sperm cells may reduce fertility.

(3)

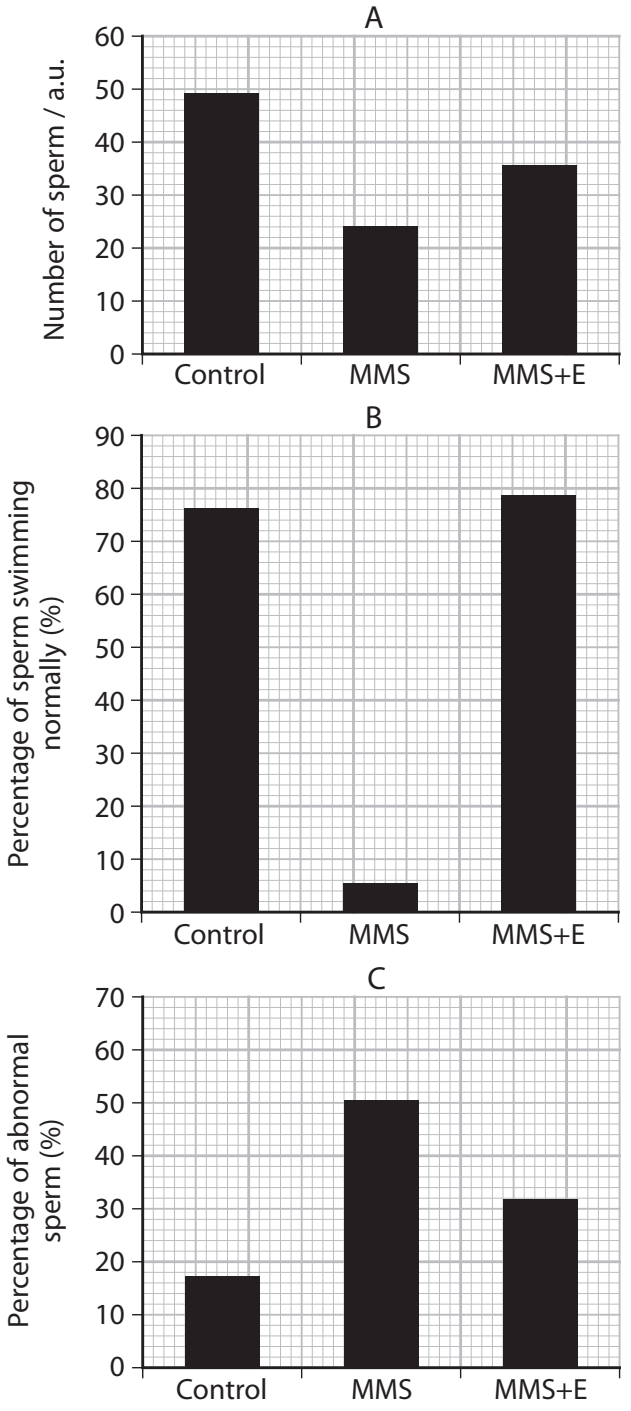
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(b) Methyl methanesulfonate (MMS) can be used as a cancer treatment. One side effect associated with MMS is teratozoospermia.

Three groups of rats were exposed to the following additives to their diet as shown in the table.

Group	Additive to diet
Control	distilled water
MMS	methyl methanesulfonate
MMS+E	methyl methanesulfonate followed by vitamin E

The graphs show the results of the study of the sperm cells produced by these three groups of rats.



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Deduce the effects of MMS on the production of sperm cells in rats.

(3)

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*(c) Discuss the potential use of vitamin E as a fertility treatment for people with teratozoospermia.

(6)

(Total for Question 6 = 12 marks)

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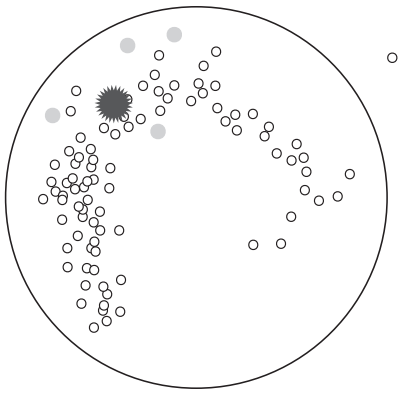
7 Sterile nutrient agar is a medium used for growing microbes.

(a) Describe how aseptic techniques are used when handling bacterial cultures.

(3)

(b) The diagram shows an agar plate after inoculation with a single bacterial culture. This plate was incubated at 25 °C.

The aseptic technique was not successful.



○ = colony from original bacterial culture

(i) Explain how the appearance of the plate shows that the aseptic technique was not successful.

(2)

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(ii) Explain why the agar plate was incubated at 25 °C.

(2)

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(c) Extracts from four different plants were added on separate small paper discs to agar plates containing *E. coli* bacteria.

After 48 hours, the zone of inhibition around each extract was measured.

Extract	Mean diameter of zone of inhibition / mm	Range
P	18.5	± 1.07
Q	23.5	± 0.97
R	22.2	± 0.58
S	22.9	± 1.28

(i) Calculate the area of the largest zone of inhibition for extract S.

(3)

..... mm^2

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(ii) Comment on the antimicrobial properties of these four plant extracts.

(3)

(Total for Question 7 = 13 marks)

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8 Muscular dystrophy is a group of disorders that gradually cause muscles to weaken.

One type of muscular dystrophy, caused by a recessive allele, affects 10 people in 100 000 of the population.

(a) Calculate the number of carriers in a population of 17.02 million.

Use the Hardy-Weinberg equation, $p^2 + 2pq + q^2 = 1$

(3)

Answer .....

(b) Duchenne muscular dystrophy (DMD) is a sex-linked disorder.

(i) Explain what is meant by the term sex-linked disorder.

(2)

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(ii) Explain why the genotype frequency for males with DMD cannot be calculated using this Hardy-Weinberg equation.

(2)

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(iii) Dystrophin is a protein needed to maintain the structure of muscle cells. In DMD the affected allele prevents the production of this protein, leading to symptoms that include a progressive effect on muscle tissue.

Stem cells are a potential treatment for DMD.

Explain why stem cells from a healthy donor may provide a treatment for this disorder.

(3)

(c) As pluripotent stem cells divide, epigenetic changes are passed on.

Explain how epigenetic changes affect the activation of genes in daughter cells.

(3)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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