Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number | Candidate Number

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.
- Good luck with your examination.

Turn over

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Answer ALL questions.

Write your answers in the spaces provided.

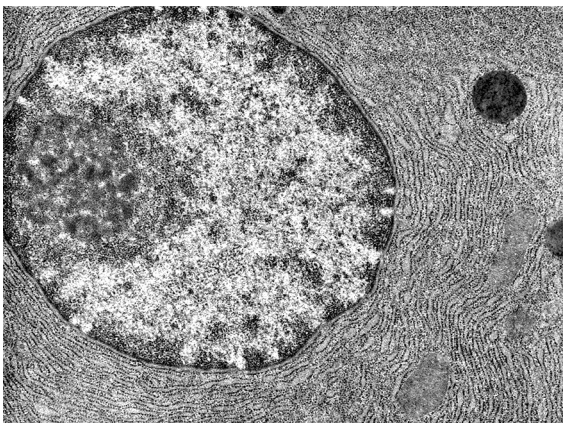
Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 An electron microscope can be used to identify organelles in eukaryotic cells.

(a) The photograph shows part of a eukaryotic cell.

(i) Label the nucleolus on the photograph.

(1)



(Source: AL1379899 – Jose Luis Calvo / Shutterstock / PAL)

(ii) The nucleolus is not found in prokaryotic cells because they

(1)

☒ **A** do not contain DNA

☒ **B** do not have a nucleus

☒ **C** only contain RNA

☒ **D** only contain single-stranded DNA

(iii) Explain why the nucleus cannot be observed at the end of prophase in a eukaryotic cell.

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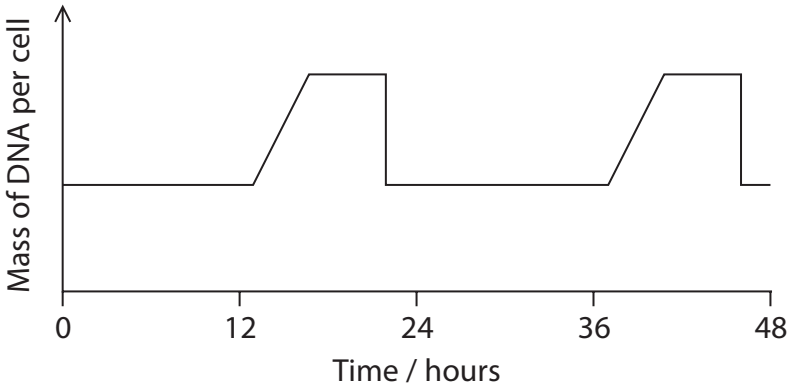
(b) Some plants use asexual reproduction to produce offspring.

The graph shows how the mass of DNA changes in dividing cells.



(i) Mitosis is occurring between

(1)

☒ **A** 0 and 12 hours

☒ **B** 12 and 16 hours

☒ **C** 16 and 20 hours

☒ **D** 24 and 36 hours

(ii) Explain why DNA is replicated before mitosis begins.

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(iii) Explain how large numbers of cells with the same phenotype can be produced in a tissue.

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(Total for Question 1 = 9 marks)

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2 Plant-based products provide a sustainable alternative to oil-based plastics.

In a single year, over 7600 million single-use plastic bags were given to customers by supermarkets in England.

The mean mass of each bag was 5.5 g.

(a) Calculate the total mass in kilograms of plastic bags given out to customers.

Give your answer in standard form.

(2)

Answer ..... kg

(b) A sustainable alternative is a plastic material that contains more than 30% plant-based polymers.

Potato starch is a source of these polymers.

(i) Describe the structure of starch.

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(ii) Explain why this plastic material is only partially sustainable.

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(c) The tensile strength of plant fibres can be tested using different methods.

One method is to attach both ends of a fibre to clamps horizontally and hang increasing numbers of masses until the fibre breaks.

A second method is to attach one end of a fibre to a clamp and the other to a forcemeter, pulling on the forcemeter until the fibre breaks.

Explain which method will give more accurate results.

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3 William Withering tested his digitalis 'soup' by an early form of drug testing.

Withering reported that his first patient found that the digitalis

"made him very sick, the sickness recurring at intervals for several days."

Modern drug testing protocols include four stages.

(a) (i) In modern drug testing protocols, the first stage that patients with an illness are involved is

(1)

☒ **A** preclinical trials

☒ **B** phase 1

☒ **C** phase 2

☒ **D** phase 3

(ii) In modern drug testing protocols, side effects such as nausea will first be identified in healthy volunteers during

(1)

☒ **A** preclinical trials

☒ **B** phase 1

☒ **C** phase 2

☒ **D** phase 3

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(b) Modern drug testing protocols must ensure that new drugs are effective at treating patients.

Explain the role that a placebo and a double blind trial have in producing valid conclusions.

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Placebo

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Double blind trial

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(c) Drug trials may last 15 years before the drug is licensed. The results of each stage are analysed before the drug trial can progress.

The results of a trial of a drug for lowering blood pressure are shown in the table.

Mean reduction in blood pressure / mmHg	
People given the drug	**People given a placebo**
7 ± 12	4 ± 8

Testing of this drug did not proceed beyond this stage.

Deduce why the drug trial was stopped at this stage.

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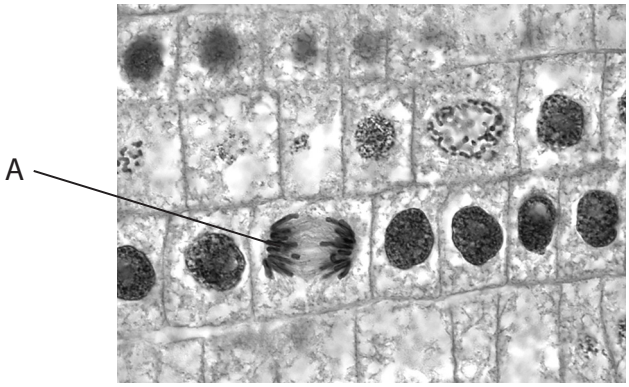
4 Stages of cell division in plant tissue can be observed using a light microscope.

The image shows the result of a root tip squash.



(Source: AL1323910 – Jose Luis Calvo / Shutterstock / PAL)

(a) (i) Which stage of cell division is shown by cell A?

(1)

☒ **A** anaphase

☒ **B** interphase

☒ **C** metaphase

☒ **D** prophase

(ii) The cells shown in the image are dividing by

(1)

☒ **A** meiosis to enable sexual reproduction

☒ **B** meiosis to enable growth

☒ **C** mitosis to enable sexual reproduction

☒ **D** mitosis to enable growth

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(iii) Describe how a slide can be prepared from a root tip sample to produce this image.

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(iv) The mitotic index gives the percentage of cells in a sample undergoing mitosis.

Calculate the mitotic index for the 30 cells in this image.

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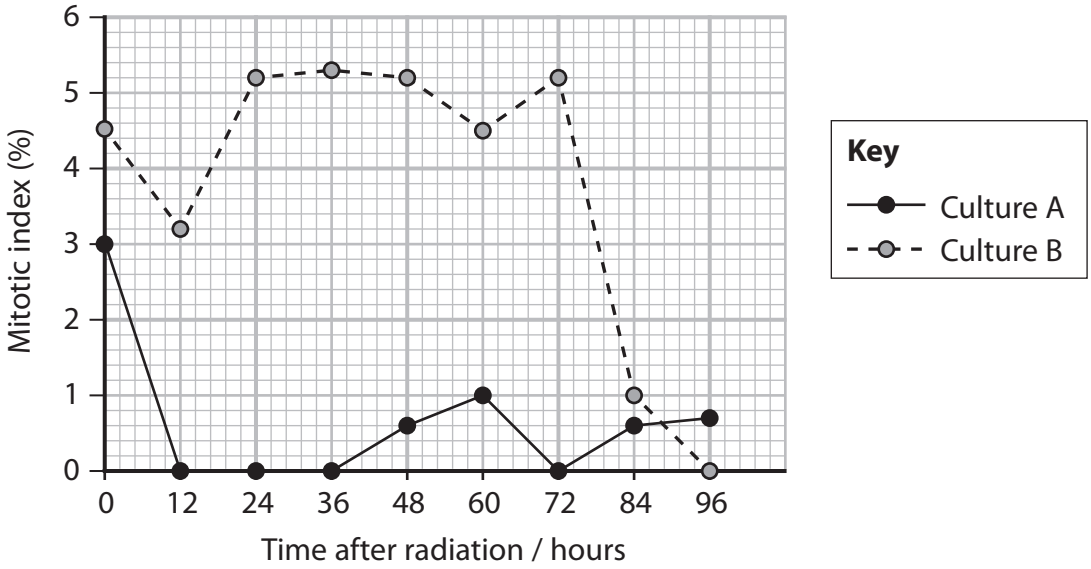
(b) Two cultures of cells were used to investigate the cell cycle.
The cells in culture A have a functioning gene called P21.
The cells in culture B have no functioning P21 gene.

Both cultures were treated with gamma radiation that can cause damage to DNA.
They were then sampled at intervals of 12 hours and the mitotic index calculated.
The results are shown in the graph below.



Deduce the effect of the P21 gene on the cell cycle when cells are treated with gamma radiation.

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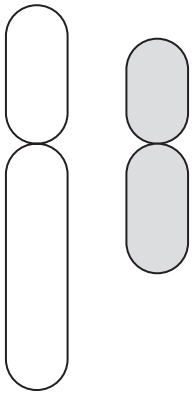
5 Haemophilia is a condition that results in excessive bleeding due to a lack of blood clotting factors such as factor 8.

It is an X-linked recessive condition and one cause is a mutation to the F8 gene.

(a) (i) Complete the diagram, by drawing a line, to show a possible locus for the F8 gene.

(1)



X chromosome Y chromosome

(ii) Explain with the use of a genetic diagram why males with haemophilia cannot pass on this condition to their male offspring.

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(b) There are 2931 mutations to the F8 gene that have been identified.

Haemophilia can also be caused by a mutation to the F9 gene.
There are 1133 mutations to the F9 gene that have been identified.

Haemophilia is not classed as a polygenic disorder.

(i) Give the meaning of the term polygenic.

(2)

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(ii) There are 575 identified mutations to the F9 gene that cause severe symptoms of haemophilia.

The same percentage of these types of mutation is found in the F8 gene.

Calculate the number of mutations to the F8 gene that produce severe symptoms.

(2)

Answer .....

(Total for Question 5 = 9 marks)

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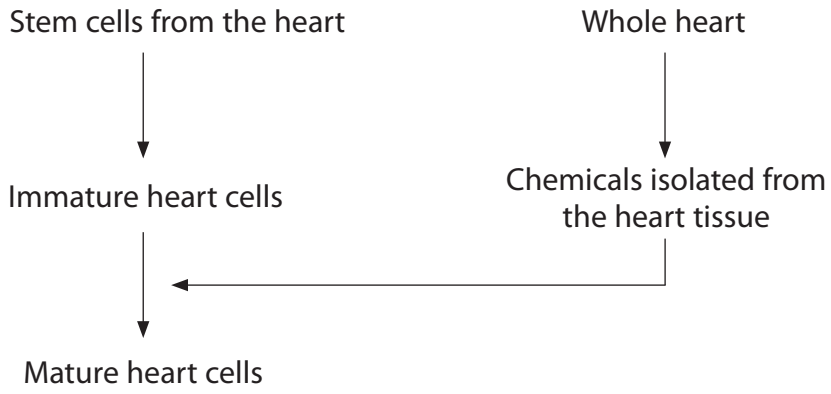
6 Stem cells can be used to repair damaged organs.

Stem cells from the heart can be used to produce mature heart cells.

The diagram below shows one method used to produce mature heart cells.



(a) The whole heart contains cardiac muscle tissue. The whole heart is an organ.

Give one difference between a tissue and an organ.

(1)

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(b) Part of the eye contains stem cells. These cells can be used to repair damaged corneas in the eye.

(i) Explain why stem cells from the heart cannot be used to grow cells to repair the cornea.

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(ii) Explain why chemicals from the eye are needed to produce corneal cells from a suitable source of stem cells.

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(c) Human embryos are another source of stem cells used in medical therapies.

Describe the decisions that society has to make about the use of these embryonic stem cells.

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(Total for Question 6 = 11 marks)

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7 A range of minerals is necessary for the formation of healthy plant tissue.

(a) Which molecule contains magnesium ions?

(1)

☒ **A** amino acid

☒ **B** amylose

☒ **C** chlorophyll

☒ **D** DNA

(b) Seedlings of rice plants were grown for two weeks in a complete solution containing all the mineral ions required.

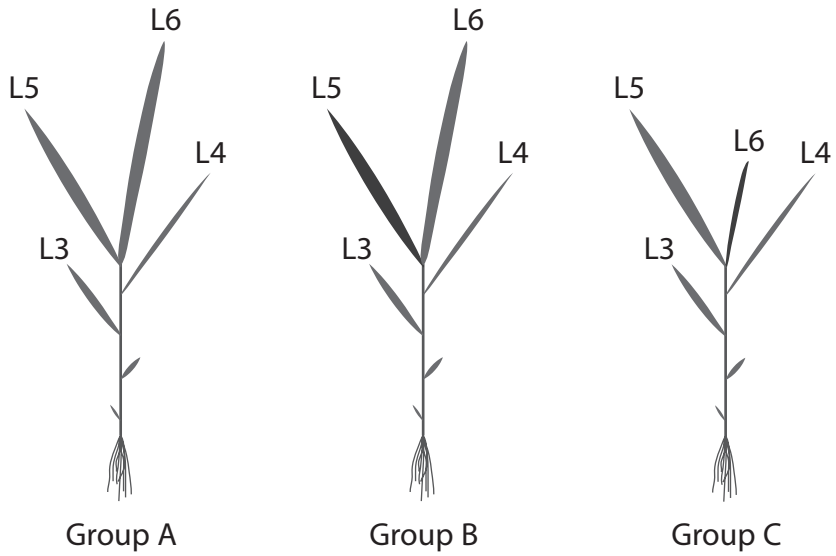
After two weeks, the plants were divided into three groups, A, B and C.

- The plants in Group A were grown in a complete solution.
- The plants in Group B were grown in a complete solution lacking magnesium ions.
- The plants in Group C were grown in a complete solution lacking calcium ions.

The plants were then grown for nine days. The diagrams show the plants at the end of the growing time.

The labels L3 to L6 on the diagrams refer to the leaves in order of growth.

L6 was the last leaf to grow.



At the end of the growing time, L5 was dead and L6 was yellow in the plants in Group B.

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Comment on the effects of deficiencies in magnesium ions and calcium ions on the growth of these rice plants.

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(c) 'The growth of seedlings is affected by the concentration of magnesium ions whereas germination of seeds is not.'

Devise an investigation to obtain valid evidence to support this statement.

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8 Biodiversity can be reduced by management of habitats.

(a) A study of plant species, other than grasses, found in two lawns was completed.

Lawn A was cut every 14 days. Lawn B was cut every 7 days.

The table shows the number of plants of each species identified.

Plant species	Number of plants	
	Lawn A	Lawn B
Daisy	18	5
Bee orchid	1	0
Dandelion	12	0
Clover	4	0
Bird's-foot trefoil	6	0

Biodiversity can be compared in different habitats using a formula to calculate an index of diversity (D).

$$D = \frac{N(N-1)}{\Sigma n(n-1)}$$

n = total number of organisms of a particular species

N = total number of organisms of all species

(i) Calculate the index of diversity for lawn A.

(3)

Answer .....

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(ii) Herbicides are sprayed on lawns to kill unwanted plants.

Explain how the calculated value would change if a herbicide was used on this lawn.

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(b) The bee orchid, *Ophrys apifera*, is pollinated by a species of bee, *Eucera longicornis*, that is found in parts of the UK.

Males of this species of bee mistake the flower for a female bee.

The bee orchid can also self-pollinate.

The niche of *E. longicornis* is that it

(1)

☒ **A** feeds on the orchid

☒ **B** is found in the same location as the orchid

☒ **C** looks like the orchid flower

☒ **D** pollinates the orchid

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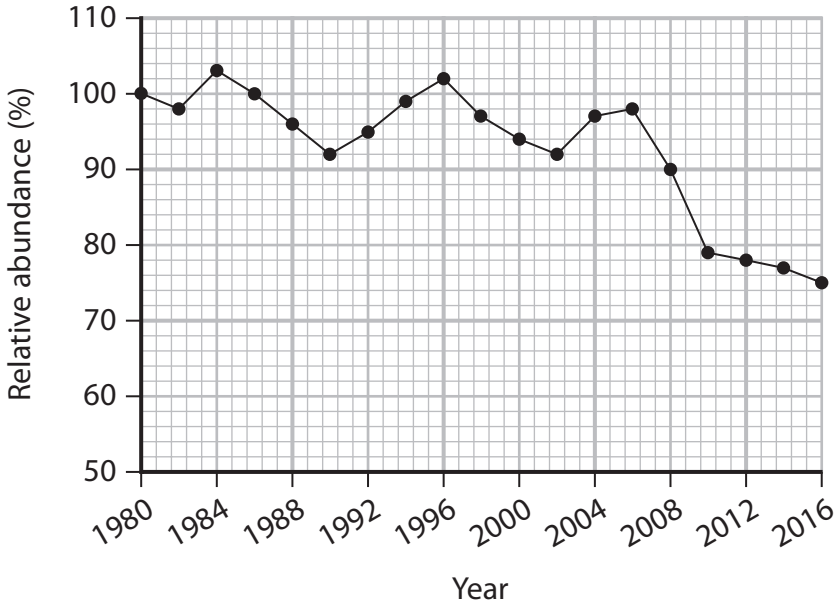
*(c) The graph shows the changes in the relative abundance of pollinating wild bee species in the UK. The original sample in 1980 represents a value of 100%.



Explain how the changes in the relative abundance of bee species in the UK may result in the development of a new species of bee orchid.

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(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS

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