

Write your name here

Surname

Other names

Centre Number

Candidate Number

Edexcel GCE

Biology

Advanced Subsidiary

Unit 2: Development, Plants and the Environment

Tuesday 18 January 2011 – Afternoon

Time: 1 hour 30 minutes

Paper Reference

6BI02/01

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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Answer ALL questions.

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

1 A white blood cell is an example of a typical eukaryotic animal cell.

(a) Place a cross in the box next to the correct word or words to complete each of the following statements.

(i) In eukaryotic cells, two organelles with a double membrane are (1)

- A** the nucleus and smooth endoplasmic reticulum
- B** a nucleus and a mitochondrion
- C** a mitochondrion and a ribosome
- D** a mitochondrion and smooth endoplasmic reticulum

(ii) White blood cells, plant cells and prokaryotic cells all contain (1)

- A** a nucleus
- B** Golgi apparatus
- C** ribosomes
- D** smooth endoplasmic reticulum

(iii) A structure present in prokaryotic cells but not present in a white blood cell is (1)

- A** a cell wall
- B** a centriole
- C** a ribosome
- D** rough endoplasmic reticulum



(b) There are several types of stem cell found in humans.

The table below shows some features of two types of stem cell. If the feature applies to the stem cell place a tick (✓) in the box and if it does not apply, place a cross (✗) in the box.

(2)

Features	Totipotent stem cell	Pluripotent stem cell
Can give rise to totipotent stem cells		
Can give rise to differentiated cells		

*(c) Human bone marrow contains stem cells that can give rise to various types of blood cell including white blood cells. Suggest how a stem cell in the bone marrow can become a differentiated blood cell.

(4)

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(Total for Question 1 = 9 marks)



2 Many drugs used in medicine are developed from plants. These drugs have to be tested before they are used.

(a) In 1775, William Withering published details of testing digitalis soup on patients with dropsy.

Compare this historic drug testing with contemporary drug testing protocols.

Give **one** similarity and **two** differences, other than the use of a **placebo**, between these two protocols.

(3)

Similarity

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Difference 1

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Difference 2

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(b) One of the stages in a drug trial may use a placebo.

In a drug trial, people with schizophrenia were given one of four treatments.

The table below shows the recorded improvement in people with schizophrenia for each of the four treatments.

Treatment	Concentration of drug / mg	Recorded improvement / arbitrary units
1 (placebo)		18.8
2	400	24.8
3	600	30.9
4	800	31.3

(i) Complete the table to give the concentration of the drug in treatment 1 (placebo).

(1)



(ii) Suggest why there was a recorded improvement when the placebo was used. (1)

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(iii) To calculate the actual improvement due to the drug, the effect of the placebo must be considered. This can be done by subtracting the recorded improvement for treatment 1 from each of the other treatments.

Complete the table below by filling in the actual improvements for treatments 2, 3 and 4. (1)

Treatment	Concentration of drug / mg	Actual improvement / arbitrary units
2	400	
3	600	
4	800	

(iv) Use the information in this table to describe the relationship between the concentration of the drug used and the actual improvement in people with schizophrenia. (2)

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(Total for Question 2 = 8 marks)



3 There are now over 1400 seedbanks in the world and they store plant seeds to maintain genetic diversity. Plant seeds are carefully selected and processed so they can be stored for years in a seedbank.

(a) Give **two** differences between genetic diversity and species richness.

(2)

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(b) (i) Suggest **two** reasons why it is better to store seeds rather than to store whole plants.

(2)

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(ii) Suggest why it is better to store seeds from several individual plants of one species rather than seeds from one individual plant.

(2)

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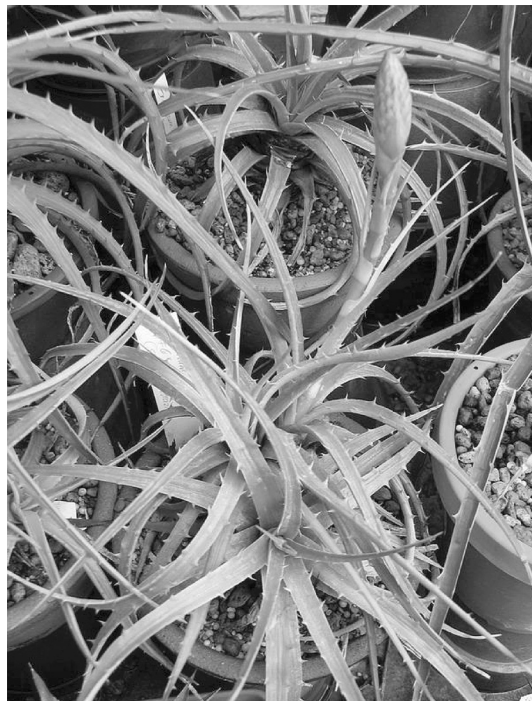
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QUESTION 3 CONTINUES ON THE NEXT PAGE



- (c) Seeds that are selected for storage are usually dried to remove most of the water before they are placed in a seedbank.

An investigation was carried out to study the effect of drying on the germination success of seeds from *Encholirium* plants, shown in the photograph below.



Magnification $\times 0.2$

One hundred seeds were collected from each of four species of *Encholirium*. The seeds from each species were separated into two groups, each containing 50 seeds.

One group of 50 seeds was planted immediately after collection. The other group of 50 seeds was dried after collection and then planted. Germination success was measured as the number of seeds that germinated out of the 50 seeds planted.

This was repeated several times and the mean germination success was calculated. The results are shown in the table below.

<i>Encholirium</i> species	Mean germination success for 50 seeds	
	Planted immediately	Planted after drying
A	48	45
B	40	23
C	45	45
D	48	37



(i) Use the data in the table to calculate, for *Encholirium* species A, the percentage decrease in mean germination success for dried seeds compared with seeds planted immediately. Show your working.

(2)

Answer %

(ii) Using the data in the table, suggest which of the four species is **least** likely to survive storage in a seedbank. Give reasons for your answer.

(3)

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(iii) Suggest how seeds from these *Encholirium* species may need to be treated to ensure their long term survival in a seedbank.

(2)

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(Total for Question 3 = 13 marks)



4 Meiosis is involved in the formation of human gametes.

(a) Explain the importance of meiosis in the formation of human sperm and egg cells.

(3)

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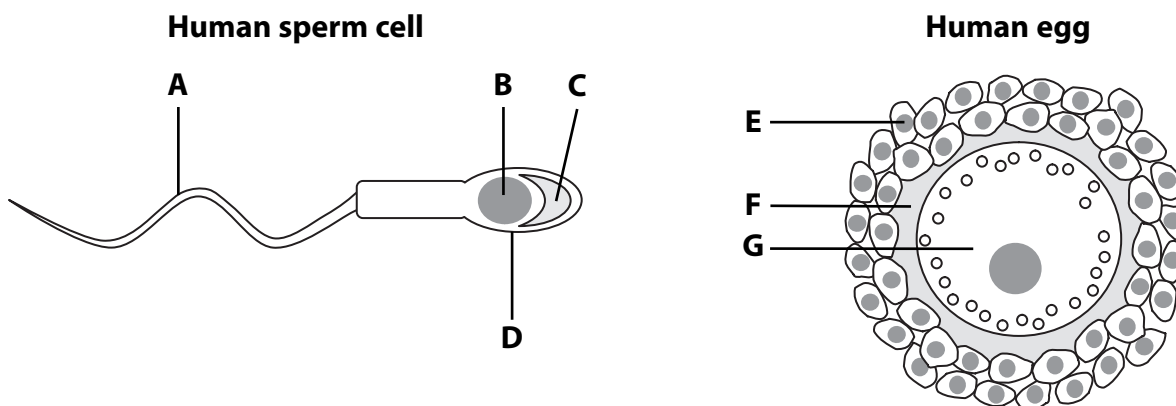
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(b) Sperm cells release acrosin, an enzyme found in the acrosome. This enzyme is involved in digesting the zona pellucida (jelly layer) during fertilisation.

The diagrams below show a human sperm cell and a human egg.



(i) The table below describes four sites.

Place a cross in the box below the letter that correctly links the statement to one of the labels on the diagrams above.

(4)

Statement	A	B	C	D	E	F	G
Site containing acrosin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Site where acrosin works	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Site containing the haploid number of chromosomes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Site containing mitochondria	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



(ii) Describe how the acrosin is released from the acrosome.

(2)

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(c) An investigation was carried out to study the effect of acrosin activity on fertilisation success. Sperm cells with different levels of acrosin activity were mixed with human eggs in a glass container. The number of eggs fertilised was then counted and the percentage of eggs fertilised was calculated.

The results are shown in the table below.

Acrosin activity / arbitrary units	Percentage of eggs fertilised (%)
2.5	33
3.0	66
4.0	85
5.0	100

(i) A student stated that acrosin needs to be active for the eggs to be fertilised and that the higher the acrosin activity, the greater the percentage of eggs fertilised.

Give **one** piece of evidence from the table that supports some of his statement.

(1)

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(ii) Using the data in the table, suggest why the student could **not** support all of his statement.

(1)

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Total for Question 4 = 11 marks



5 Plants are multicellular organisms that contain organic molecules such as starch and cellulose.

(a) Multicellular organisms contain organs and tissues.

Suggest why organs are considered more complex than tissues.

(2)

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

(4)

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- (ii) Cellulose molecules form cellulose microfibrils.
Explain how the arrangement of cellulose microfibrils contributes to the physical properties of plant fibres.

(2)

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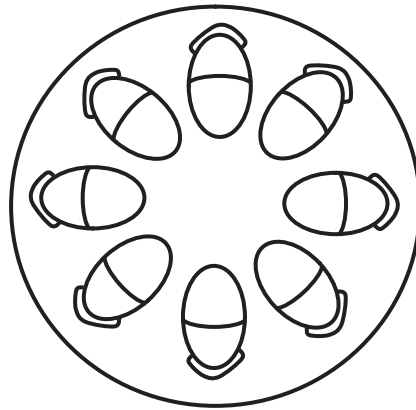
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- (c) (i) The diagram below shows a transverse section through a stem.
On the diagram, put a label **X** to indicate where xylem vessels are present.

(1)



- (ii) Give **two** functions of xylem vessels.

(2)

1

2

(Total for Question 5 = 11 marks)



6 Mitosis is part of the cell cycle.

(a) Give **two** roles of the cell cycle.

(2)

1.....

2.....

(b) For each of the statements about mitosis below, place a cross ☒ in the box that identifies the correct word or words.

(i) The following disappear during prophase in an animal cell

(1)

- A nucleus and centrioles
- B nucleus and nucleolus
- C nucleolus and mitochondria
- D nucleus and ribosomes

(ii) The following are formed during prophase in an animal cell

(1)

- A DNA
- B Golgi apparatus
- C mitochondria
- D spindle fibres



(c) A student prepared a root tip squash to observe the stages in mitosis.
Describe how the student could distinguish between a cell in metaphase and a cell in anaphase.

(3)

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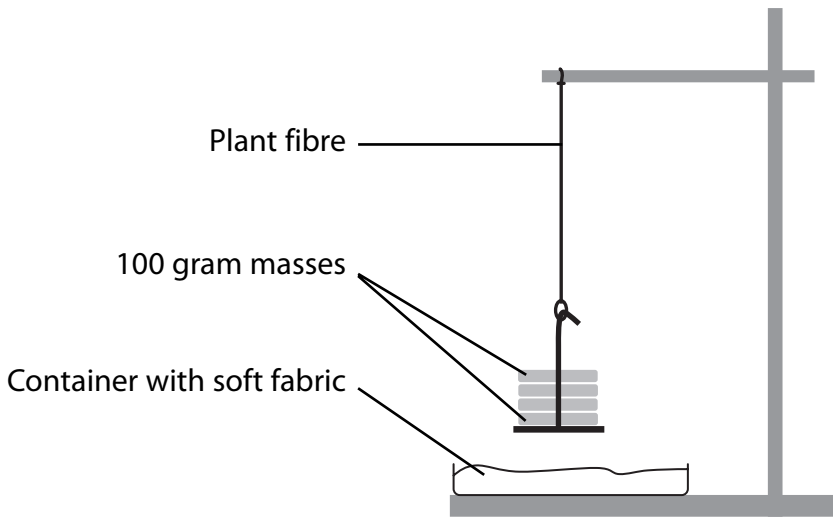
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(Total for Question 6 = 7 marks)



7 The diagram below shows a technique used by a student to investigate the mass needed to break dry plant fibres. In this investigation, 100 gram masses were added until the fibre broke.



(a) The student carried out the investigation four times to achieve reliable results.

(i) Suggest **three** factors that would need to be kept constant in this investigation.

(3)

- 1
- 2
- 3

(ii) Describe how the results obtained would be processed to produce a mean.

(2)

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-
-

(b) Suggest why increasing the mass by 50 grams each time, rather than 100 grams, could increase the accuracy of the student's results.

(1)

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(c) The diagram shows a container with soft fabric in it. Suggest the safety role of this container.

(1)

(d) This student also investigated the mass required to break four samples of an oil-based plastic fibre.

The table below shows the data the student collected for the plastic fibre.

Sample	Mass required to break the plastic fibre / g
1	13 300
2	2 300
3	13 600
4	13 600
Mean	13 500

(i) The student calculated the mean using only three of the results from the table.
Explain why the mean for the plastic fibre was calculated using only these three results.

(1)

(ii) Suggest why the use of oil-based plastic fibres such as nylon, rather than plant fibres, does not contribute to sustainability.

(2)

(Total for Question 7 = 10 marks)



8 Various internal and external factors can affect the phenotype of humans.

(a) Explain what is meant by the term **phenotype**.

(2)

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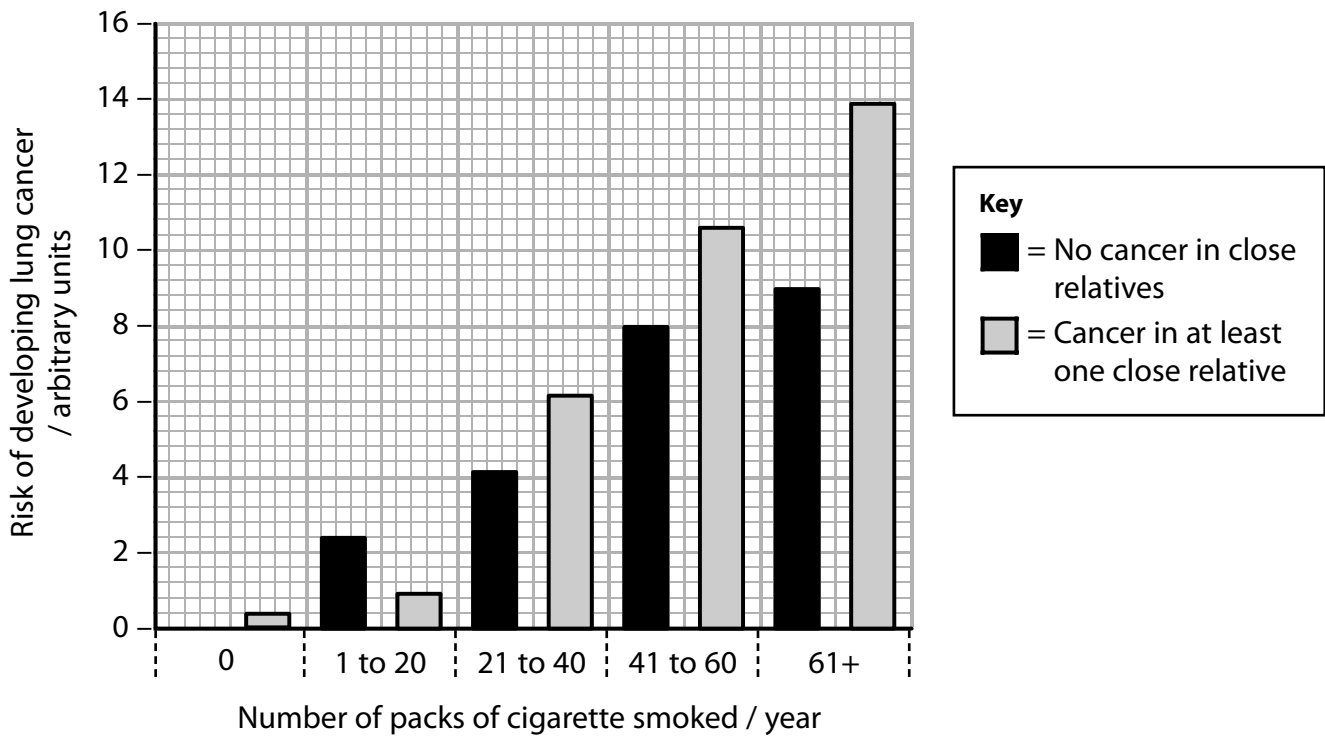
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(b) A survey was carried out to investigate the factors affecting the risk of developing lung cancer. In this survey, people were asked how many packs of cigarettes they smoked per year. They were also asked whether a close relative (a brother, sister or parent) had developed some form of cancer.

The results of the survey are shown in the graph below.

A risk of developing lung cancer of 0 arbitrary units means that there is no increased risk.



(i) Identify the control group in this survey and suggest why they were included. (2)

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(ii) State the phenotype being investigated. (1)

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(iii) Describe the effect of smoking on the increased risk of developing lung cancer, for the people who had close relatives who developed cancer. (2)

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(iv) Use evidence from the graph to support the suggestion that genetic factors may influence the risk of developing lung cancer. (2)

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(v) Give **one** piece of evidence from the graph which suggests that genetic factors may **not** influence the risk of developing lung cancer.

(1)

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(vi) Give **one** piece of evidence from the graph which suggests that external factors may influence the risk of developing lung cancer.

(1)

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(Total for Question 8 = 11 marks)

TOTAL FOR PAPER = 80 MARKS

