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Surname	Other names
Pearson Edexcel GCE	Centre Number
	Candidate Number
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<h1 style="margin: 0;">Biology</h1> <h2 style="margin: 0;">Advanced Subsidiary</h2> <h3 style="margin: 0;">Unit 2: Development, Plants and the Environment</h3>	
Tuesday 6 June 2017 – Afternoon Time: 1 hour 30 minutes	Paper Reference 6BI02/01
You must have: Calculator, HB pencil, ruler	Total Marks <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div>

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 Plant cell walls contain cellulose. Cellulose molecules are polymers.

(a) Put a cross in the box next to the correct word or words that completes each of the following statements.

(i) The monomers that make up cellulose are

(1)

- A α -glucose
- B amylopectin
- C amylose
- D β -glucose

(ii) The monomers that make up cellulose molecules are joined together by

(1)

- A glycosidic bonds in a branched chain
- B glycosidic bonds in an unbranched chain
- C hydrogen bonds in a branched chain
- D hydrogen bonds in an unbranched chain

(iii) In a plant cell wall, the cellulose molecules are held together in bundles called microfibrils embedded in a matrix containing

(1)

- A calcium carbonate
- B calcium pectate
- C pectin carbonate
- D pectin nitrate

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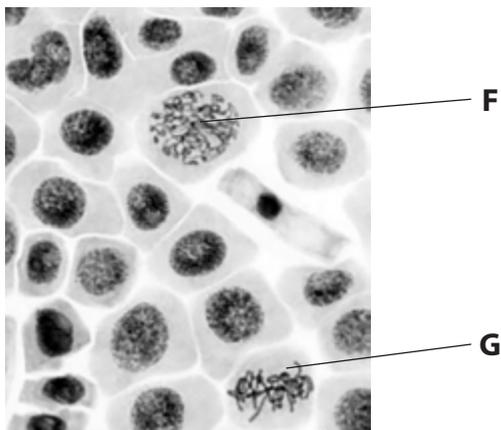
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2 The stages of mitosis can be observed in cells from growing tissues.

(a) The photograph below shows cells from an onion root tip, as seen using a microscope.



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(i) Put a cross in the box next to the row that correctly identifies the stages of mitosis shown in cell F and cell G.

(1)

	Cell F	Cell G
<input checked="" type="checkbox"/> A	Anaphase	Metaphase
<input checked="" type="checkbox"/> B	Metaphase	Prophase
<input checked="" type="checkbox"/> C	Prophase	Metaphase
<input checked="" type="checkbox"/> D	Telophase	Prophase

(ii) The cells in the photograph are stained to make the chromosomes visible.

Name a stain that can be used to make chromosomes visible in a root tip.

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(b) The table shows the number of cells, in a root tip, observed at different stages of the cell cycle.

Stage of the cell cycle	Number of cells
Interphase	693
Prophase	35
Metaphase	37
Anaphase	6
Telophase	24

(i) Put a cross in the box next to the stage of mitosis most likely to be observed in this root tip.

(1)

- A** anaphase
- B** metaphase
- C** prophase
- D** telophase

(ii) The mitotic index is the percentage of cells in a sample undergoing mitosis.

Calculate the mitotic index for the cells in the table.

Show your working.

(2)

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- (c) Herbicides are chemicals used to kill weeds. Some herbicides work by disrupting the cell cycle.

An investigation was carried out to study the effect of different concentrations of the herbicide Agil on mitosis in onion root tips.

Agil concentrations of 0.5 ppm, 1.0 ppm and 1.5 ppm were used. The roots of the onions were exposed to these concentrations for 48 hours. A control was also used with no Agil present.

Root tip squashes were then prepared and the percentage of cells undergoing mitosis was recorded for 150 cells for each slide examined.

The table below shows the results of this investigation.

Concentration of Agil / ppm	Percentage of cells undergoing mitosis (%)
0.0	39.5
0.5	24.7
1.0	22.7
1.5	20.0

- (i) Using the information in the table, describe the effects of Agil concentration on mitosis in onion root tips.

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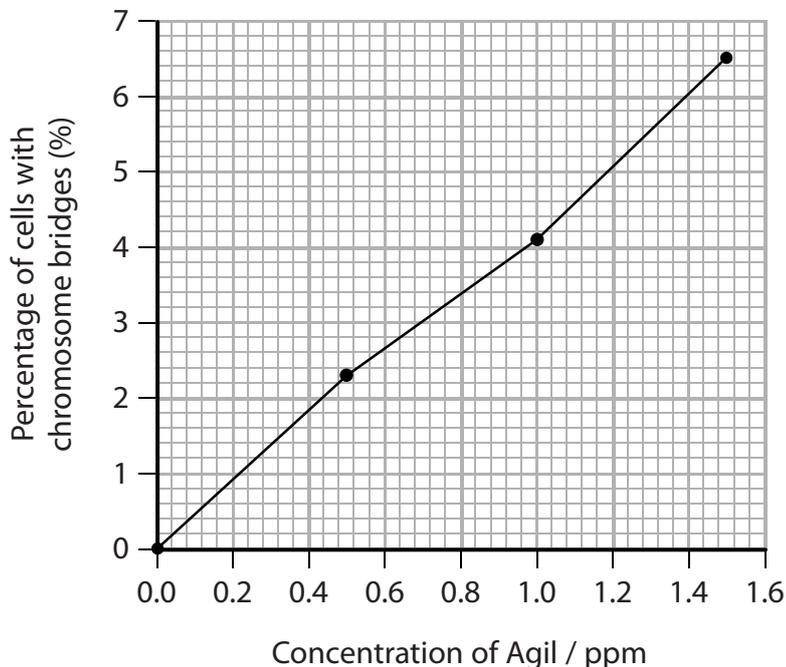
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- (ii) The herbicide Agil also increased the number of chromosome abnormalities. These include chromosome bridges, which prevent anaphase from completing normally.

The graph shows the effect of the concentration of Agil on the percentage of cells with chromosome bridges.



Suggest how chromosome bridge formation could affect the production of gametes.

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(Total for Question 2 = 9 marks)

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(b) The Millennium Seed Bank at Kew collects tree seeds to conserve the genetic diversity of ash trees.

(i) Put a cross ☒ in the box next to the correct definition of the term **genetic diversity**.

(1)

- A the number of different alleles in a gene pool
- B the number of different genes in a species
- C the number of different species in a gene pool
- D the number of different species in a habitat

(ii) Suggest how scientists could increase the probability of collecting seeds that will produce trees resistant to ash dieback disease.

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4 In mammals, reproduction involves the fertilisation of an egg cell by a sperm cell.

(a) (i) Explain how the structure of an egg cell is related to its function.

(4)

Area with horizontal dotted lines for writing the answer.



(ii) Describe how the acrosome reaction allows fertilisation to take place.

(3)

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(i) Describe how the tensile strength of these fibres was measured in this investigation.

(3)

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(ii) Use the information in the graph to describe the relationship between the cross-sectional area of fibres and their tensile strength.

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(Total for Question 5 = 8 marks)

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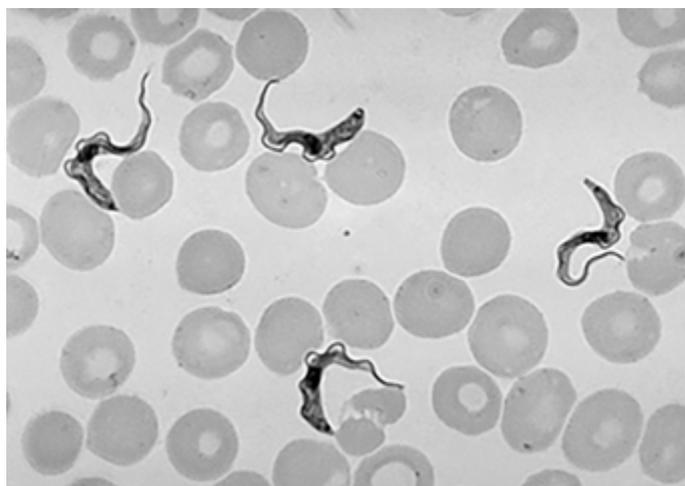
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6 Sleeping sickness is caused by an organism called *Trypanosoma*.

The photograph below shows *Trypanosoma*, a single-celled eukaryotic organism. It has a streamlined shape and a flagellum for movement.



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(a) (i) Explain how scientists identified *Trypanosoma* as a eukaryotic organism and not a prokaryotic organism, such as a bacterium.

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(ii) Name the type of adaptation shown by the flagellum of *Trypanosoma*.

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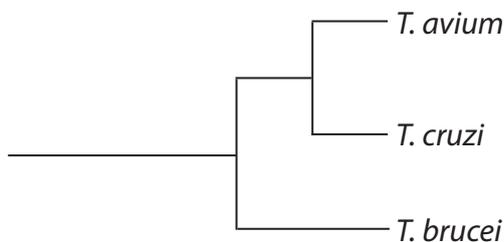


(b) There are many species of *Trypanosoma* and these are responsible for different diseases in different organisms.

The table below gives information about three species of *Trypanosoma*.

Species of <i>Trypanosoma</i>	Organisms infected	Diseases caused
<i>Trypanosoma avium</i>	birds	trypanosomiasis
<i>Trypanosoma brucei</i>	humans	sleeping sickness
	cattle	nagana
<i>Trypanosoma cruzi</i>	humans	Chagas disease

These three species are related as shown in the phylogenetic diagram below.



(i) Using the phylogenetic diagram, explain which two species of *Trypanosoma* are most closely related.

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(ii) Name the process that resulted in different species of *Trypanosoma* developing as parasites in different groups of animals over time.

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(iii) Suggest how molecular phylogeny was used to determine the evolutionary relationships between these different species of *Trypanosoma*.

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(Total for Question 6 = 10 marks)

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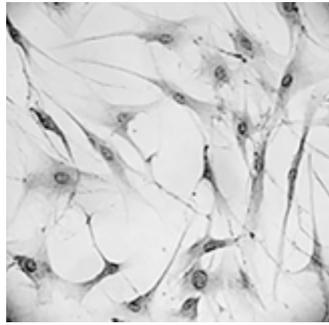
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7 In mammals, different types of stem cell are found in bone marrow.

The photograph below shows mesenchymal stem cells, a type of stem cell found in bone marrow, as seen using a microscope.



Magnification $\times 500$

Mesenchymal stem cells can differentiate into a variety of cell types, including bone cells and muscle cells.

*(a) Suggest how mesenchymal stem cells can give rise to specialised cells in tissues, such as muscle and bone.

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(c) Veterinary medicine is developing techniques to use mesenchymal stem cells from adult animals, such as dogs and cats. These cells will be used to treat damage to tissues, including bone and cartilage.

There are two sources of mesenchymal stem cells:

- allogenic stem cells collected from a genetically different donor within the same species
- autologous cells collected from the patient before being used in their treatment.

Suggest **two** advantages of using autologous stem cells instead of allogenic stem cells.

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(d) Stem cell therapy is also used to treat humans.

State **one** ethical issue concerning the use of embryonic stem cells instead of stem cells collected from adults.

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(Total for Question 7 = 13 marks)



