Write your name here

| Surname | Other names |
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**Pearson Edexcel International Advanced Level**

Centre Number | Candidate Number

# Biology

## Advanced Subsidiary
## Unit 2: Development, Plants and the Environment

Monday 15 January 2018 – Morning
**Time: 1 hour 30 minutes**

Paper Reference
**WBI02/01**

**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.
- 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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P 5 1 8 5 7 A 0 1 2 4

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**Answer ALL questions.**

**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** Decreasing biodiversity is a problem in many countries.

(a) Biodiversity within a habitat can be measured using species richness.

Biodiversity within a species can be measured using genetic diversity.

State the meaning of each of the following terms.

(i) Species richness

**(1)**

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(ii) Genetic diversity

**(2)**

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(b) Complete the table below to give **two** factors that could decrease biodiversity and two factors that could increase biodiversity.

**(2)**

| Factors that could decrease biodiversity | Factors that could increase biodiversity |
|---|---|
| 1 ..... | 1 ..... |
| 2 ..... | 2 ..... |

**(Total for Question 1 = 5 marks)**

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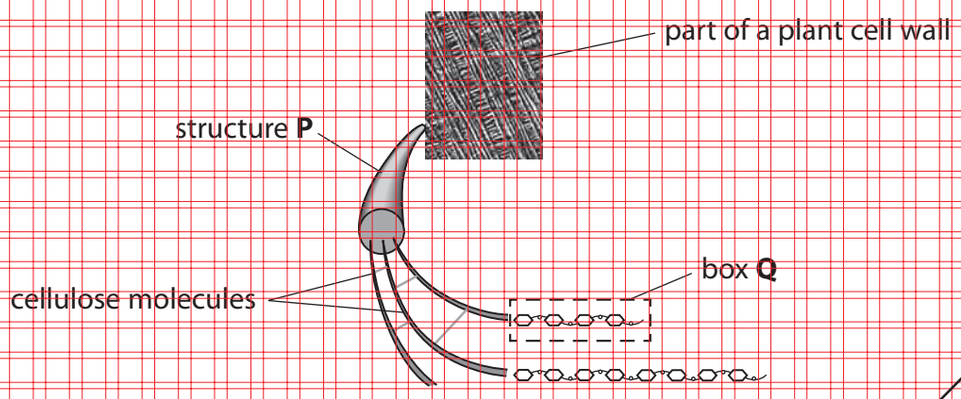
**2** Cellulose and lignin are components of the cell walls in plant stems.

(a) The diagram below shows the arrangement of cellulose in part of a plant cell wall.




(i) Put a cross ☒ in the box next to the name of the part of the plant cell wall shown in this diagram.

**(1)**

☐ **A** middle lamella

☐ **B** pit

☐ **C** plasmodesmata

☐ **D** primary cell wall

(ii) Name structure **P** shown in the diagram.

**(1)**

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(iii) Box **Q** contains part of a cellulose molecule.

Put a cross ☒ in the box to complete the following sentence.

**(1)**

**Q** contains

☐ **A** $\alpha$ glucose molecules joined by 1-4 glycosidic bonds

☐ **B** $\alpha$ glucose molecules joined by 1-6 glycosidic bonds

☐ **C** $\beta$ glucose molecules joined by 1-4 glycosidic bonds

☐ **D** $\beta$ glucose molecules joined by 1-6 glycosidic bonds

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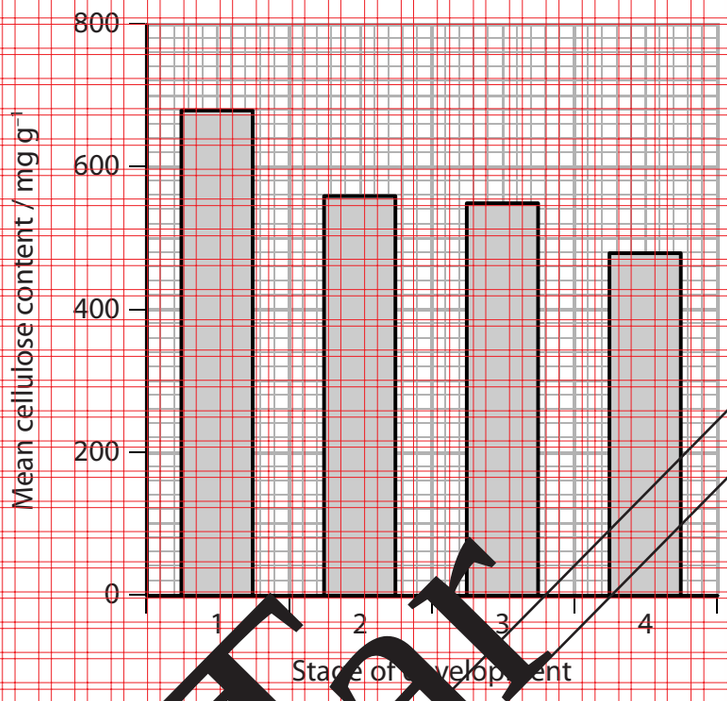
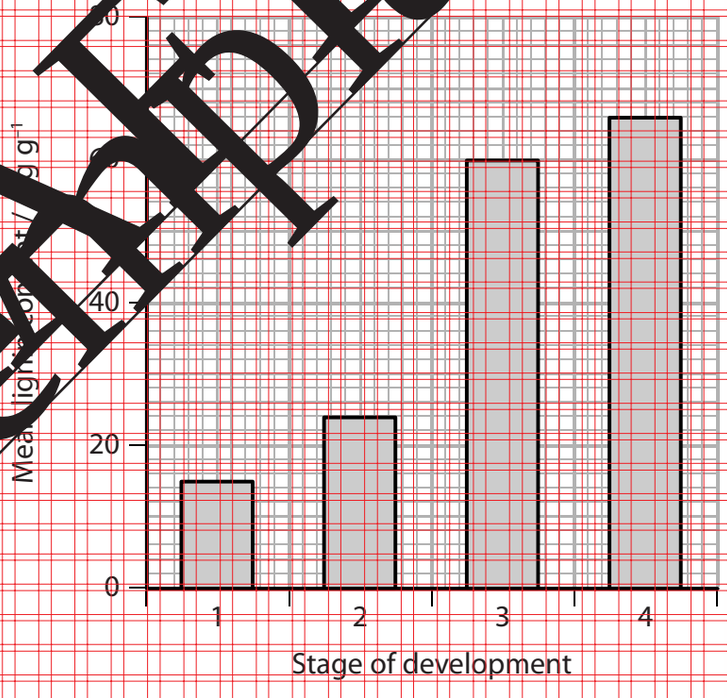
Example

(b) The mean cellulose content and the mean lignin content of stems from one species of plant were determined at four stages in the development of the plant.

The graphs below show the mean cellulose content and the mean lignin content of these stems.

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Exemplar

(i) Using the information in the graphs, compare the changes in the mean cellulose content and the mean lignin content of these stems as this plant develops.

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(ii) Explain the role of lignin in plant stems.

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Exemplar

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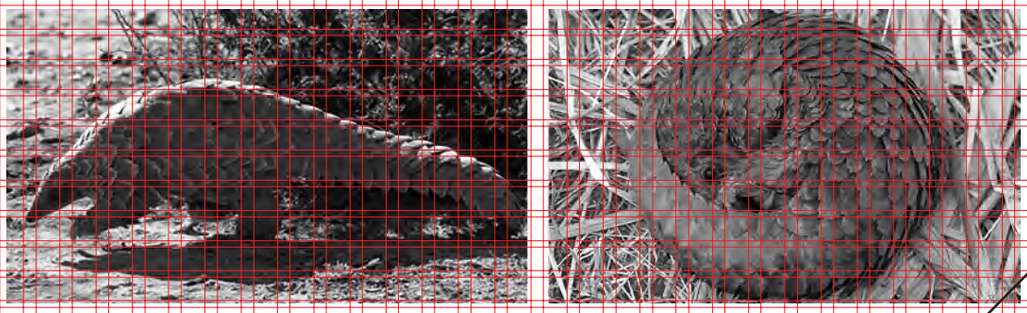
**3** The photographs below show a pangolin.

Pangolins occupy niches in the African plains.



Magnification ×0.1

The information below gives some facts about pangolins.

- They are mammals covered in large, hard protective scales.
- They curl up in a ball when threatened (see right-hand photograph above).
- They live in hollow trees or burrows.
- They eat mainly ants and termites, which they capture with very long tongues after digging for them with long claws.
- Their tongues are sticky with secreted saliva.
- They do not have teeth.
- When feeding, they ingest small stones which build up in their stomachs.

(a) Using the pangolin as an example, explain the meaning of the term **niche**.

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Example

(b) Put a cross ☒ in the box next to the row in the table that correctly identifies the types of adaptation of the pangolin.

**(1)**

| | | Anatomical adaptation | Behavioural adaptation | Physiological adaptation |
|---|---|---|---|---|
| ☒ | **A** | has a long tongue | lives in hollow trees | secretes saliva |
| ☒ | **B** | has long claws | has a long tongue | lives in hollow trees |
| ☒ | **C** | curls up in a ball | ingests small stones | has long claws |
| ☒ | **D** | secretes saliva | curls up in a ball | ingests small stones |

(c) Using the information given, suggest the advantages to the pangolin of ingesting small stones.

**(2)**

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(d) (i) A pangolin may eat 1.0 g of insects each day.

Small ants weigh 0.002 g.

Calculate how many ants a pangolin may eat in one year.

Show your working.

**(2)**

Answer .....

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(ii) One scientist estimated that a pangolin eats 70 million insects each year.

Another scientist estimated that a pangolin needs to eat 20 000 ants each day.

Using this information, explain why there is such variation between your calculated value and these two estimates.

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**(Total for Question 3 = 10 marks)**

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Exemplar

**4** Meiosis results in genetic variation through the recombination of alleles, independent assortment and crossing over.

Meiosis consists of two main stages, I and II.

(a) (i) Put a cross ☒ in the box next to the phase of meiosis when independent assortment takes place.

**(1)**

☐ **A** metaphase I

☐ **B** metaphase II

☐ **C** telophase I

☐ **D** telophase II

(ii) Describe how independent assortment results in genetic variation.

**(2)**

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(b) (i) Put a cross ☒ in the box next to the phase of meiosis when crossing over takes place.

**(1)**

☐ **A** anaphase I

☐ **B** anaphase II

☐ **C** telophase I

☐ **D** telophase II

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(ii) The position of genes on a chromosome can be mapped using the frequency of crossing over.

The frequency of crossing over is proportional to the distance between the genes on the same chromosome.

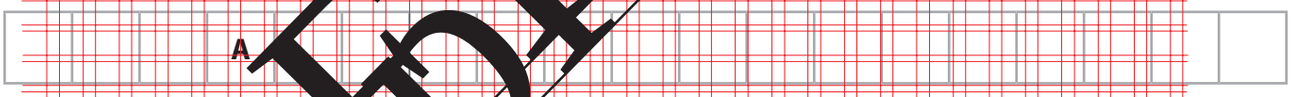
The table below shows the frequency of crossing over between four genes, **A**, **B**, **C** and **D**, that are on the same chromosome.

| Pair of genes | Frequency of crossing over (%) |
|---|---|
| **A** and **B** | 10 |
| **A** and **D** | 3 |
| **B** and **C** | 2 |
| **B** and **D** | 7 |
| **C** and **D** | 9 |

The diagram below shows the position of gene **A** on this chromosome.

Complete the diagram below to show the position of the genes **B**, **C** and **D** on this chromosome.

**(3)**




**(Total for Question 4 = 7 marks)**

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Exemplar

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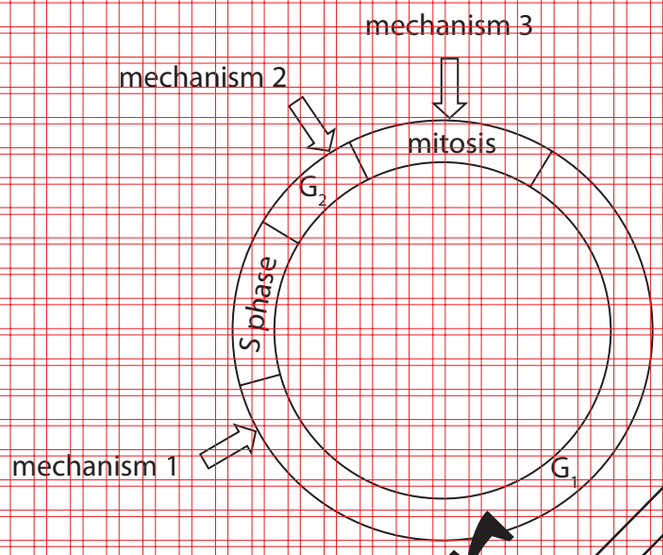
**5** Cancer cells go through the cell cycle continuously.

(a) Healthy cells have mechanisms to control the cell cycle. These mechanisms occur at different points in the cell cycle.

The diagram below shows where these mechanisms occur in the cell cycle.




(i) Mechanism 1 prevents cells continuing through the cell cycle if their DNA is damaged.

Suggest why it is an advantage for cells with damaged DNA to be prevented from continuing through the cell cycle.

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Example

(ii) Mechanism 2 prevents cells from entering mitosis if their chromosomes have not replicated successfully.

In the space below, draw and label a diagram to show the structure of a chromosome during metaphase.

**(2)**

(iii) Mechanism 3 occurs in metaphase.

Describe the appearance of a cell in metaphase.

**(3)**

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Exemplar

(b) In cancer cells, mechanisms 1, 2 and 3 do not occur.

A student suggested that in a sample of cancer cells there will be a greater proportion of cells in mitosis than in a sample of healthy cells.

Describe an investigation that could be carried out to test this suggestion.

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**(Total for Question 5 = 12 marks)**

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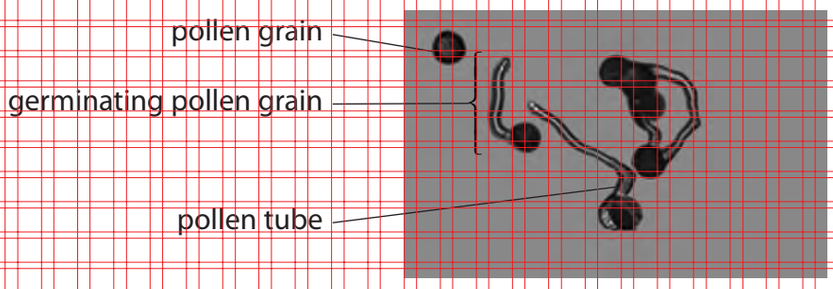
Exemplar

**6** The photograph below shows some germinating pollen grains, as seen using a light microscope.




Magnification ×200

*(a) The cytoplasm of the pollen tube contains organelles, including the pollen tube nucleus, rough endoplasmic reticulum and Golgi apparatus.

Explain the importance of these organelles in the production of extracellular enzymes needed for the growth of the pollen tube.

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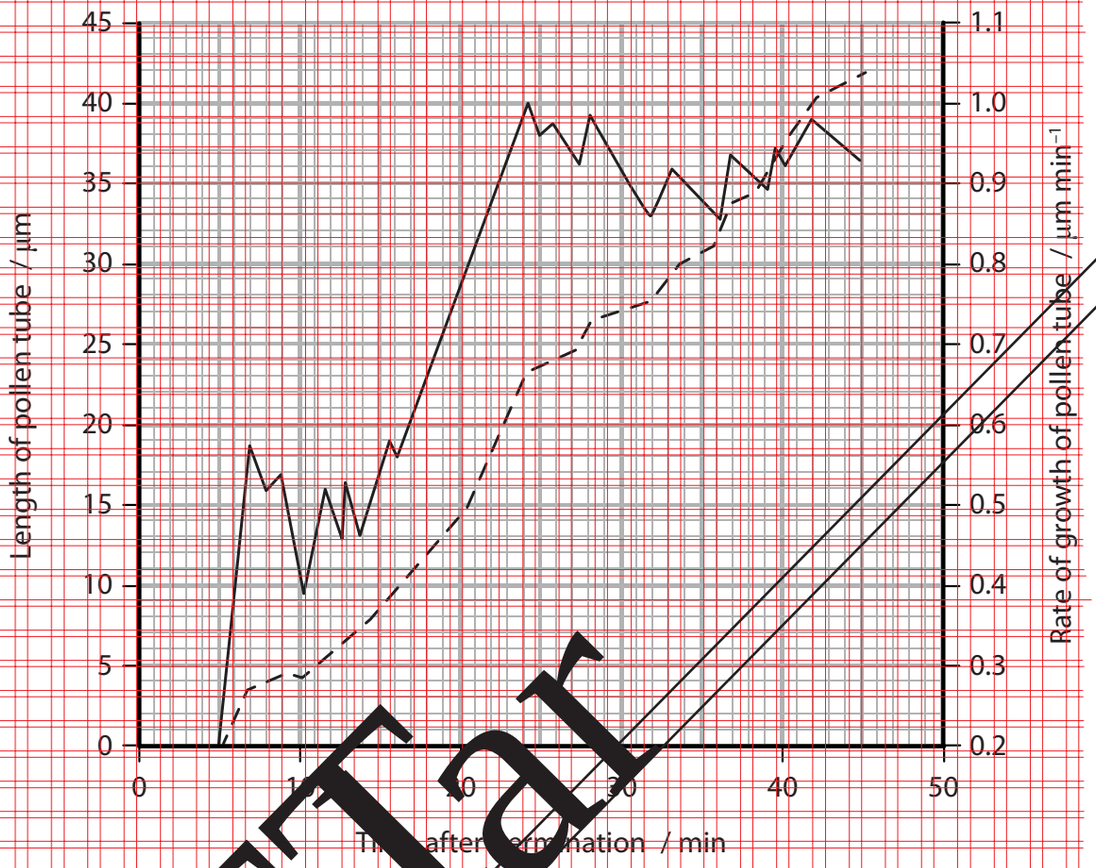
Exemplar

(b) The graph below shows the length of a pollen tube and its rate of growth after germination.




**Key**

—— rate of growth of pollen tube

- - - length of pollen tube

(i) Using the information in the graph, describe the changes in the growth of this pollen tube.

**(3)**

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Example

(ii) The pollen tube has to grow through a number of structures before fertilisation can occur.

Put a cross ☒ in the box next to the correct sequence of structures through which the pollen tube grows.

**(1)**

☐ **A** stigma, ovule, style

☐ **B** stigma, style, ovule

☐ **C** style, ovule, stigma

☐ **D** style, stigma, ovule

(iii) Describe the role of the male nuclei in sexual reproduction in flowering plants.

**(3)**

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**(Total for Question 6 = 13 marks)**

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Exemplar

**7** Water and inorganic ions are important to plants.

(a) (i) Explain the importance of water to plants.

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(ii) Explain the importance of nitrate ions to plants.

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(iii) Describe the appearance of a plant with a magnesium ion deficiency.

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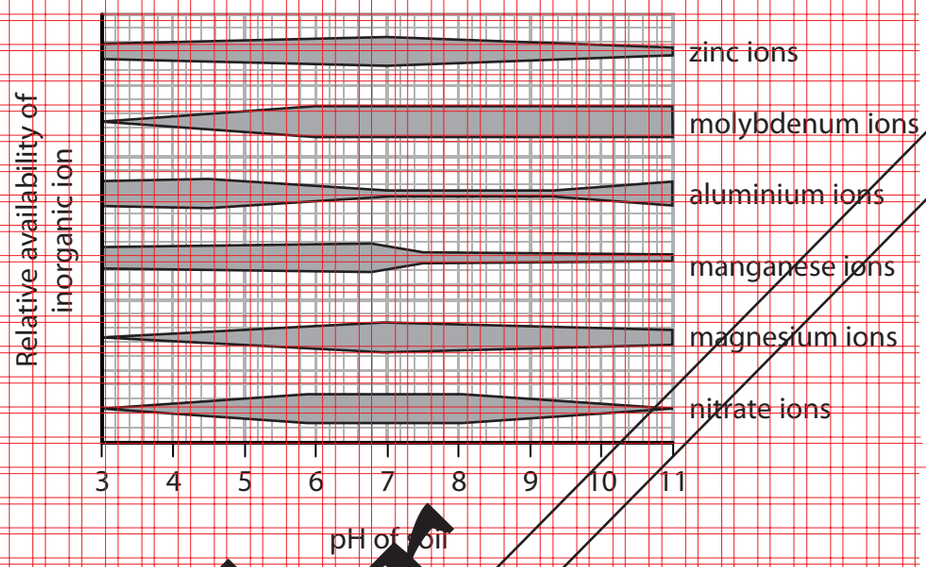
Exemplar

(b) The pH of the soil affects the availability of inorganic ions to plants.

The chart below shows the relative availability of inorganic ions needed by plants, at different soil pH values.

The thickness of each line shows the relative availability of each ion.




(i) Put a cross ☒ in the box next to the pH of soil with the lowest availability of aluminium and manganese.

(1)

☐ **A** 3

☐ **B** 5

☐ **C** 7

☐ **D** 9

(ii) Put a cross ☒ in the box next to the pH range that gives the maximum availability of these six inorganic ions for the growth of plants.

(1)

☐ **A** 3.5 to 4.5

☐ **B** 5.5 to 6.5

☐ **C** 7.5 to 8.5

☐ **D** 9.5 to 10.5

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*(iii) Describe an investigation that could be carried out into the effect of pH on the growth of plants.

**(5)**

**(Total for Question 7 = 13 marks)**

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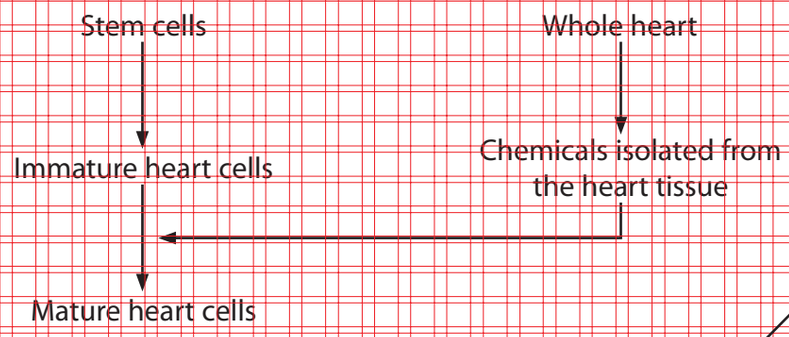
Exemplar

**8** One potential use of stem cells is to treat patients with heart disease.

The stem cells are used to produce mature heart cells.

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




(a) Pluripotent cells from an embryo are one source of stem cells.

(i) Distinguish between the terms **pluripotency** and **totipotency**.

**(1)**

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(ii) Give **two** reasons why there are regulatory authorities relating to human embryo research.

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(b) Explain why chemicals from a whole heart are needed to produce mature heart cells from immature heart cells.

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(ii) Describe contemporary drug testing protocols that could be used to test drugs developed for treating heart disease.

**(3)**

**(Total for Question 8 = 12 marks)**

**TOTAL FOR PAPER = 80 MARKS**

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