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# Biology/Additional Science

## Unit B2: The Components of Life

**Higher Tier**

Friday 5 June 2015 – Afternoon

**Time: 1 hour**

Paper Reference

**5BI2H/01**

**You must have:**

Calculator, 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 60.
- 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.*

### 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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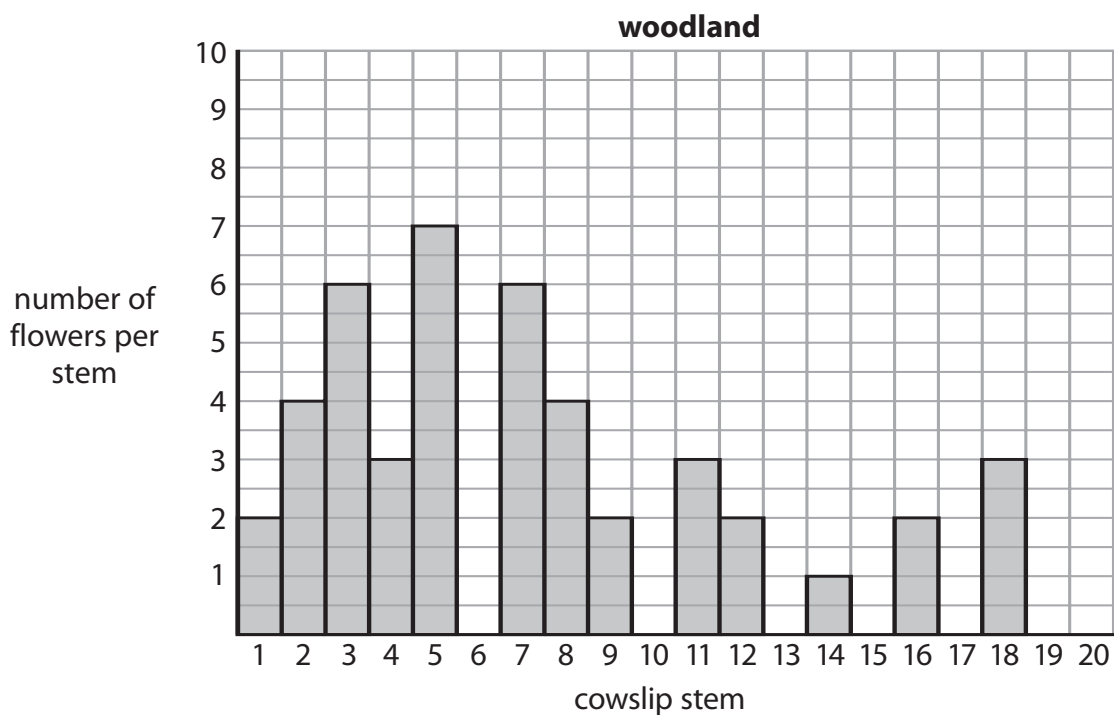
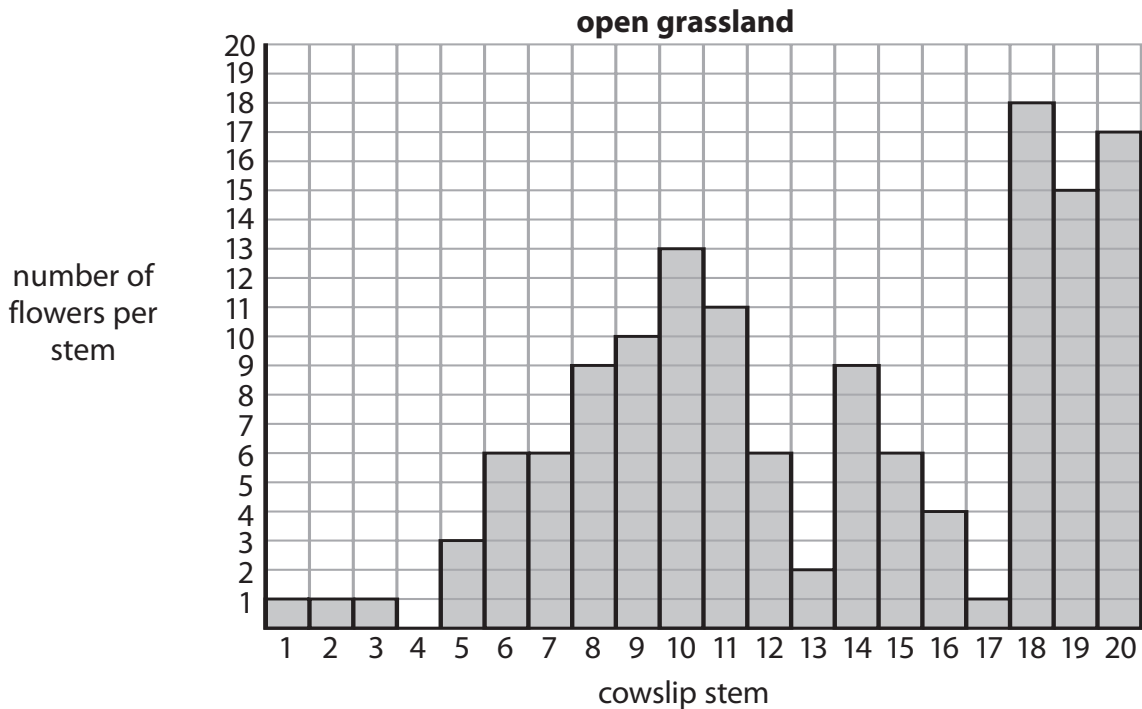
**PEARSON**

### 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 .

### Investigating plants

- 1 Cowslips are flowering plants.  
Each cowslip stem can produce different numbers of flowers.  
The graphs show the number of flowers on 20 stems of cowslip growing in open grassland and 20 stems of cowslip growing in woodland.



(a) (i) In the open grassland, 60% of cowslips have stems with five or more flowers.

Use the information from the graph to calculate the percentage of cowslips in the woodland that have stems with five or more flowers.

(2)

..... %

(ii) Suggest reasons why there are more stems with five or more flowers in the open grassland.

(2)

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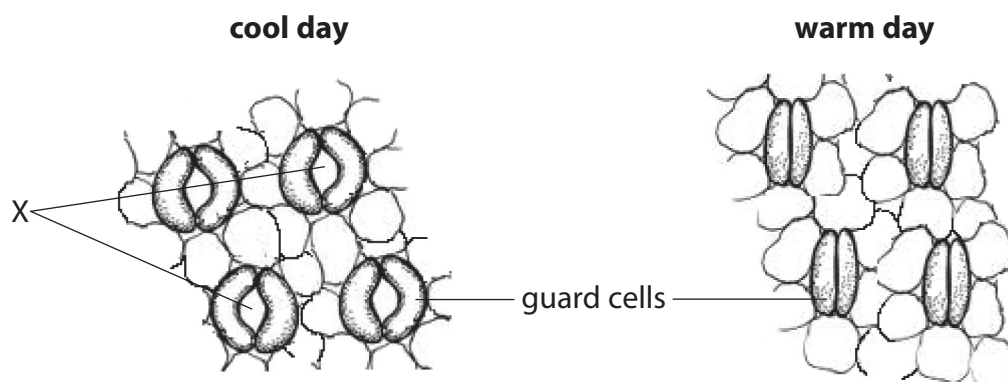
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(b) The diagrams show the underside of a leaf of a cowslip plant on a cool day and on a warm day.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The parts of the leaf labelled **X** are

(1)

- A** stomata
- B** phloem vessels
- C** xylem vessels
- D** chloroplasts

(ii) Complete the following sentence.

(1)

Carbon dioxide moves into the leaves through the parts labelled **X** by the process of .....

(iii) Explain how changes to the guard cells on the warm day help the plant to survive.

(2)

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**(Total for Question 1 = 8 marks)**

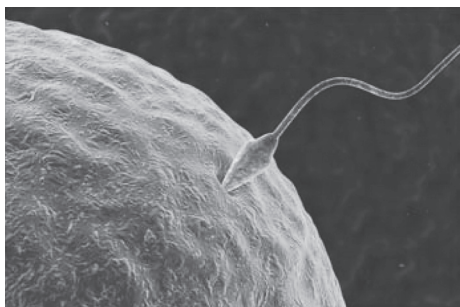


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## DNA and sperm cells

2 The photograph shows a sperm cell and an egg cell just before fertilisation.



© Education Portal

(a) Which row describes the sperm cell and the egg cell before fertilisation?

Place a cross (☒) in the box next to your answer.

(1)

|                            | sperm cell | egg cell |
|----------------------------|------------|----------|
| <input type="checkbox"/> A | diploid    | diploid  |
| <input type="checkbox"/> B | diploid    | haploid  |
| <input type="checkbox"/> C | haploid    | diploid  |
| <input type="checkbox"/> D | haploid    | haploid  |

(b) The sperm cell contains DNA.

Describe the structure of DNA.

(3)

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(c) Information in a DNA strand can be transcribed to make a strand of mRNA.

Describe how this mRNA strand is then used to make proteins.

(4)

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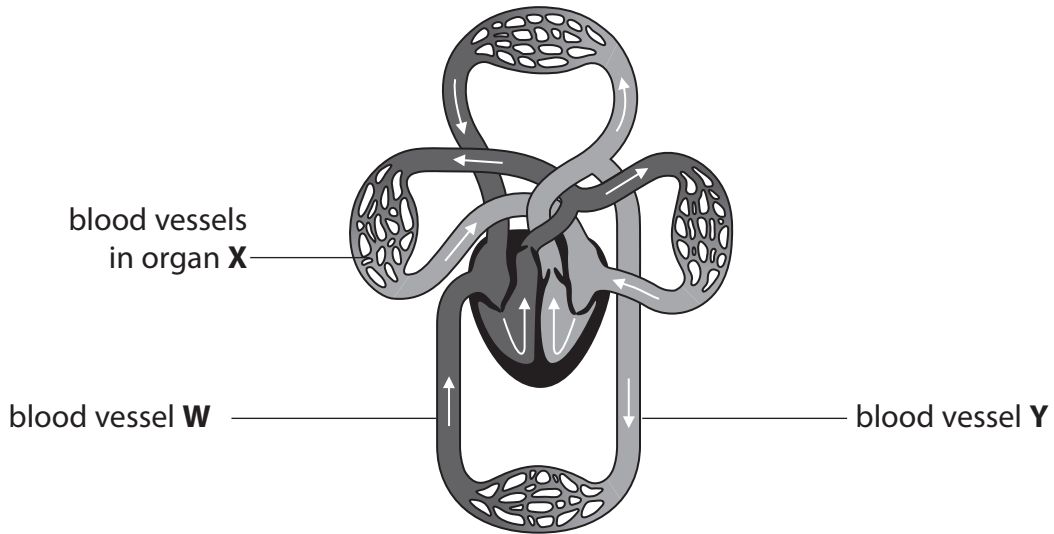
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**(Total for Question 2 = 8 marks)**



### The circulatory system

3 The diagram shows the human circulatory system.



(a) (i) Name organ **X**.

(1)

(ii) Explain how the heart causes blood to move to organ **X**.

(2)

(iii) Which row shows the names of blood vessels **W** and **Y**?

Place a cross (☒) in the box next to your answer.

(1)

|  | blood vessel <b>W</b> | blood vessel <b>Y</b> |
|--|-----------------------|-----------------------|
| <input checked="" type="checkbox"/> <b>A</b> | pulmonary vein        | aorta                 |
| <input checked="" type="checkbox"/> <b>B</b> | vena cava             | pulmonary artery      |
| <input checked="" type="checkbox"/> <b>C</b> | pulmonary artery      | vena cava             |
| <input checked="" type="checkbox"/> <b>D</b> | vena cava             | aorta                 |





(iv) Describe how the blood in vessel **W** is different from the blood in vessel **Y**. (2)

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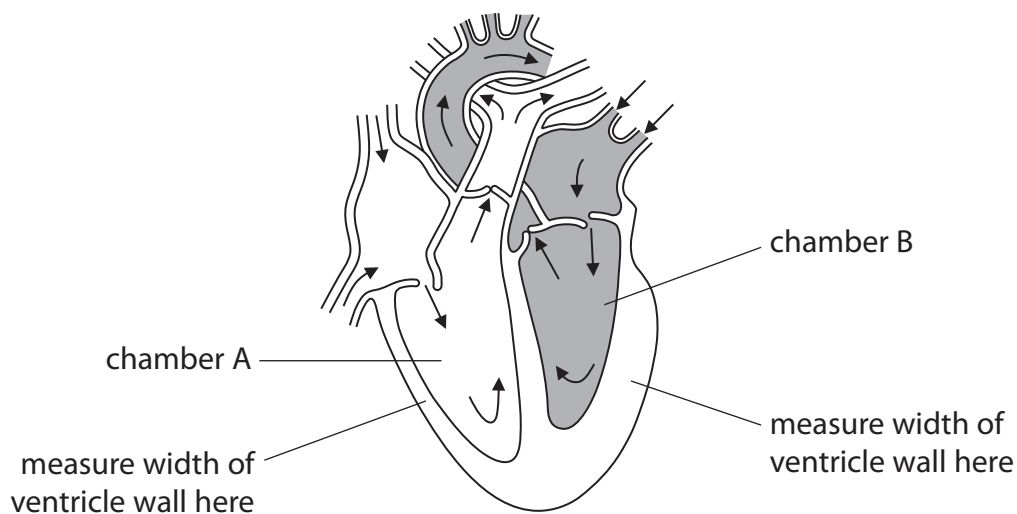
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(b) The diagram shows the chambers of the heart.



(i) Calculate how many times thicker the wall of chamber B is compared with the wall of chamber A. (1)

..... times thicker

(ii) Explain why the wall of chamber B is thicker than the wall of chamber A. (2)

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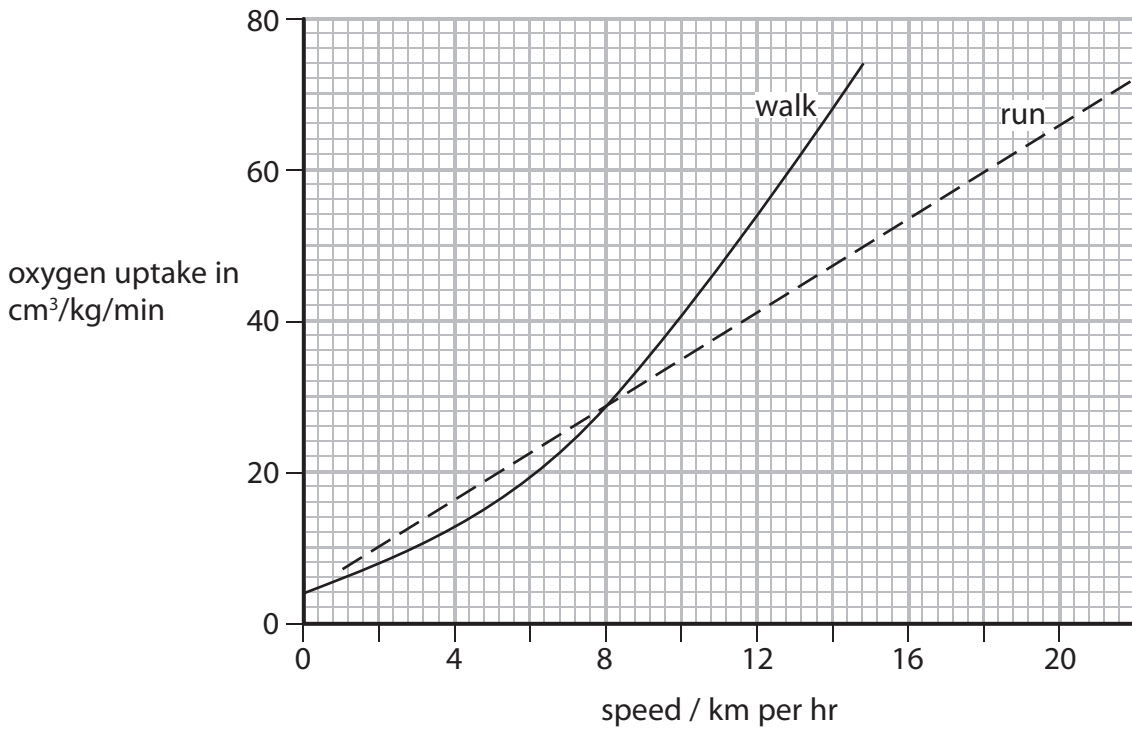
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**(Total for Question 3 = 9 marks)**



### Walking and running

4 The graph shows the oxygen uptake for an athlete when walking and running.



(a) Compare the oxygen uptake when the athlete is walking and running at speeds from 6 to 10 km per hour.

(3)

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(b) (i) Complete the word equation for aerobic respiration. (1)

oxygen + glucose  $\longrightarrow$  ..... + .....

(ii) Explain why oxygen uptake increases as an athlete runs at faster speeds. (2)

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(iii) When athletes train hard they can respire anaerobically.

Which of the following statements about anaerobic respiration are true?

- 1. Lactic acid and carbon dioxide are produced.
- 2. Lactic acid can build up causing cramp.

Put a cross (X) in the box next to your answer.

(1)

- A statement 1 only
- B statement 2 only
- C both statement 1 and 2
- D neither statement 1 nor 2.



(c) The heart rate and stroke volume of an athlete training at a high intensity were measured and their cardiac output was calculated.

The table shows the measurements before, after 2 weeks and after 4 weeks of training.

|                        | heart rate /<br>beats per minute | stroke volume / $\text{dm}^3$ | cardiac output /<br>$\text{dm}^3$ per minute |
|------------------------|----------------------------------|-------------------------------|--|
| Before training        | 142                              | 0.08                          | 11.4   |
| After 2 weeks training | 164                              | 0.10                          | 16.4   |
| After 4 weeks training |                                  | 0.12                          | 24.0   |

(i) Calculate the heart rate after 4 weeks of training.

(2)

..... beats per minute

(ii) Explain how the higher cardiac output after 4 weeks of training increased the rate of aerobic respiration.

(2)

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**(Total for Question 4 = 11 marks)**



## Fossilised bones

- 5 In 2005, a scientist claimed to have found red blood cells in the fossilised bones of a *Tyrannosaurus rex* that lived 68 million years ago.



© history.com

- (a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

A group of the same type of cells, such as red blood cells, is known as

(1)

- A an organ
- B an organ system
- C an organism
- D a tissue

- (ii) The scientist said that each red blood cell found contained a nucleus.

In humans, each mature red blood cell does not have a nucleus.

Suggest why not having a nucleus in a red blood cell is an advantage.

(2)

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(b) Explain why fossils of dinosaurs are often incomplete.

(3)

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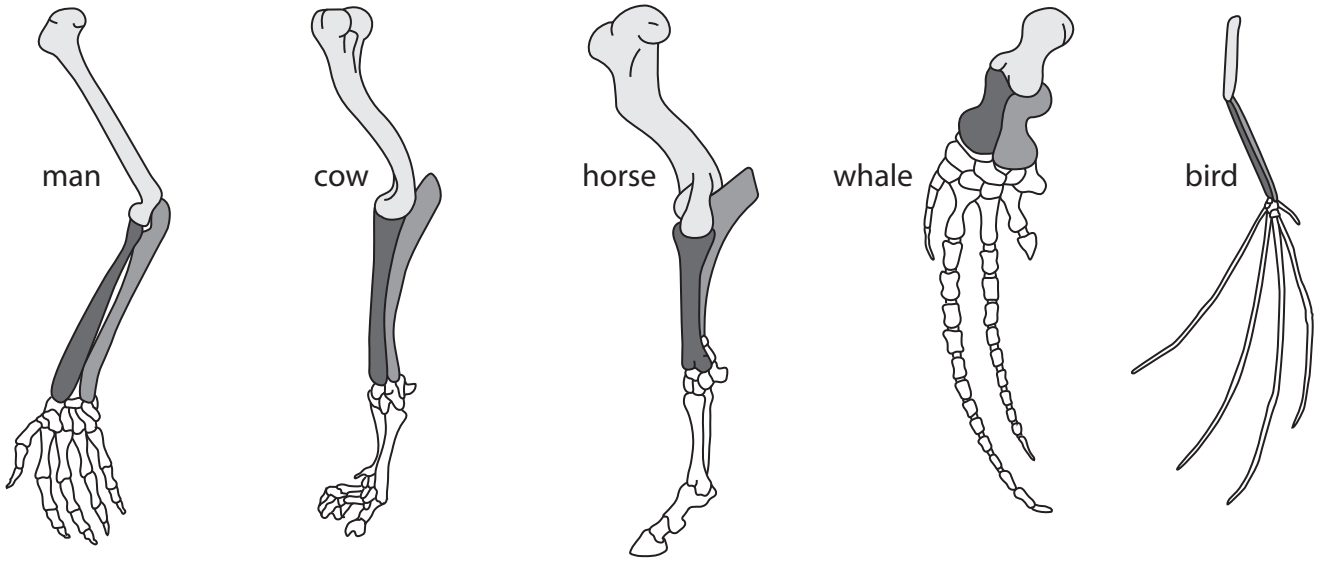
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\*(c) The diagram shows some limbs of modern-day animals.



Explain how the study of the limbs of different species of vertebrates provides evidence for evolution.

(6)

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(Total for Question 5 = 12 marks)



### Tegon, the glowing beagle

6 In 2011, South Korean scientists genetically engineered a cell from a beagle.

They then cloned this cell to create a beagle.

They called this beagle Tegon.

Tegon glows in the dark when UV light is shone on him.

beagle puppy



© Dentistry Today

Cloning involves cells that divide by mitosis.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

When a cell divides by mitosis it produces

(1)

- A two cells that are genetically different
- B two cells that are genetically identical
- C four cells that are genetically different
- D four cells that are genetically identical





(b) To genetically engineer the original cell so that it would glow, the scientists had to obtain a suitable gene.

(i) Describe the stages that a scientist would complete to obtain this gene.

(2)

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\*(ii) Describe the stages used in the laboratory to clone and produce Tegen from the genetically engineered cell.

(6)

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(c) Suggest the advantages of cloning mammals, such as dogs, for use in medical research into human diseases.

(3)

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**(Total for Question 6 = 12 marks)**

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**TOTAL FOR PAPER = 60 MARKS**



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