| Centre Number | | | | | | Candidate Number | | | | |
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| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |

| For Examiner's Use | |
|---|---|
| Examiner's Initials | |
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
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| 6 | |
| 7 | |
| TOTAL | |

General Certificate of Secondary Education
Higher Tier
June 2012

# Additional Science BL2HP
**Unit Biology B2**

**H**

# Biology
**Unit Biology B2**

**Monday 21 May 2012 9.00 am to 10.00 am**

**For this paper you must have:**
- a ruler.

You may use a calculator.

**Time allowed**
- 1 hour

**Instructions**
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3(b) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

**Advice**
- In all calculations, show clearly how you work out your answer.

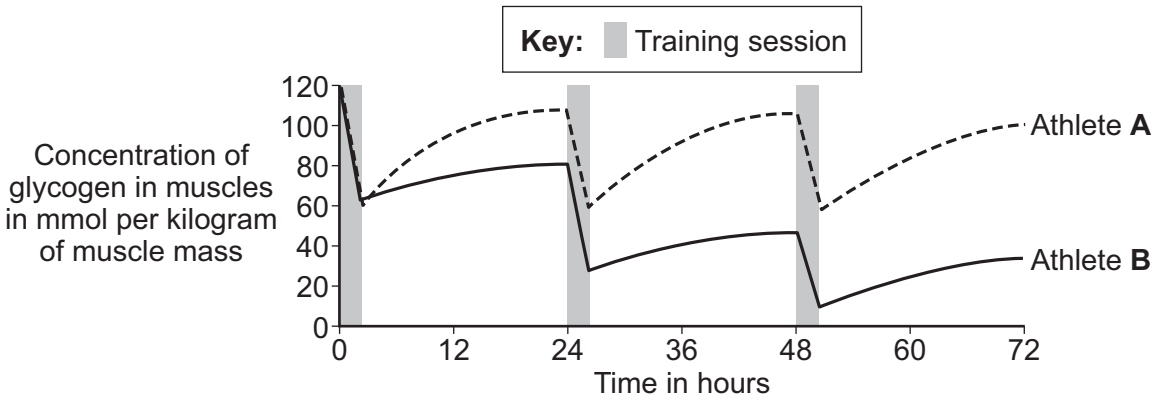
Answer **all** questions in the spaces provided.

**1** Glycogen is stored in the muscles.

Scientists investigated changes in the amount of glycogen stored in the muscles of two 20 year-old male athletes, **A** and **B**.
Athlete **A** ate a high-carbohydrate diet. Athlete **B** ate a low-carbohydrate diet.

Each athlete did one 2-hour training session each day.

The graph shows the results for the first 3 days.




**1 (a) (i)** Give **three** variables that the scientists controlled in this investigation.

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*(3 marks)*

**1 (a) (ii)** Suggest **two** variables that would be difficult to control in this investigation.

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*(2 marks)*

**1 (a) (iii)** Describe **one** way in which the results of Athlete **B** were different from the results of Athlete **A**.

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*(1 mark)*

**1 (b)** Both athletes were training to run a marathon.

Which athlete, **A** or **B**, would be more likely to complete the marathon?

Use information from the graph to explain your answer.

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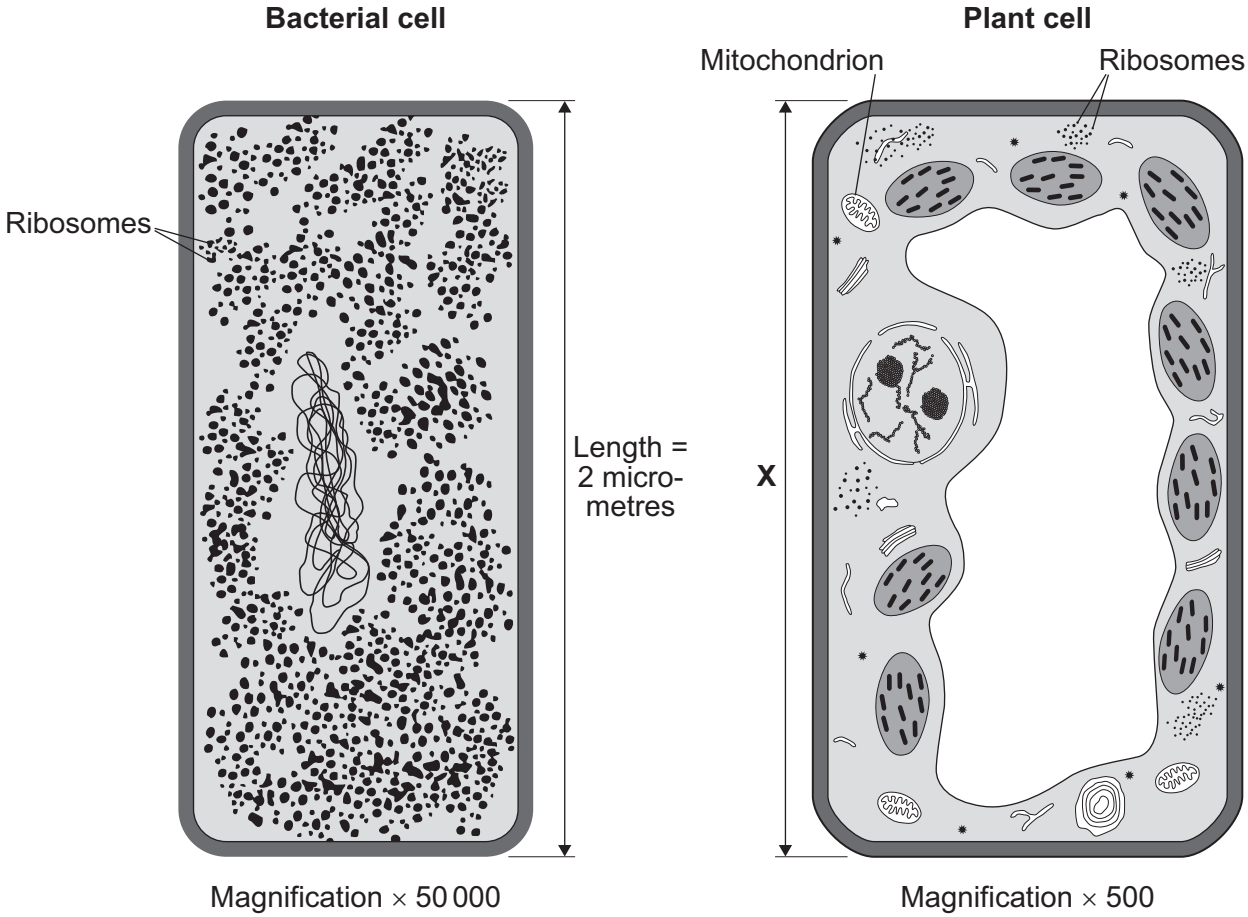
*(4 marks)*

**10**

**Turn over for the next question**

**2** The diagram shows two cells, a bacterial cell and a plant cell.




**2 (a) (i)** Both the bacterial cell and the plant cell contain ribosomes.

What is the function of a ribosome?

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*(1 mark)*

**2 (a) (ii)** The plant cell contains mitochondria but the bacterial cell does **not** contain mitochondria.

Give **one** other way in which the plant cell is different from the bacterial cell.

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*(1 mark)*

**2 (b) (i)** Both cells are drawn the same length, but the magnification of each cell is different.

The real length of the bacterial cell is 2 micrometres.
Calculate the real length, **X**, of the plant cell. Give your answer in micrometres.

Show clearly how you work out your answer.

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**X** = ..... micrometres
*(2 marks)*

**2 (b) (ii)** Most mitochondria are about 3 micrometres in length.

The plant cell contains mitochondria but the bacterial cell does **not** contain mitochondria.

Use your answer to part **(b)(i)** and the information in the diagram to suggest why.

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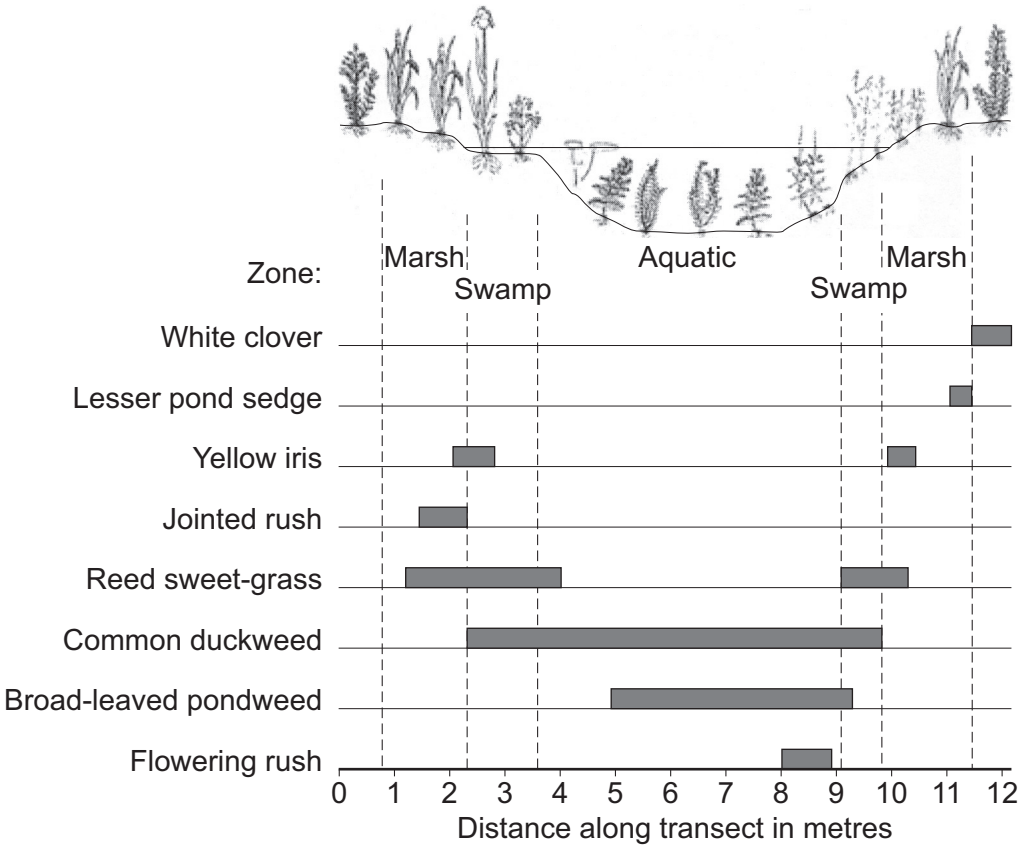
*(1 mark)*

**5**

**Turn over for the next question**

**3** Some students investigated the distribution of some of the plants growing in and around a shallow stream. They sampled along a transect line.

The diagram shows their results.




**3 (a) (i)** Name the **one** species that grew only in the driest conditions.

.....

*(1 mark)*

**3 (a) (ii)** Only **one** species grew in the marsh, the swamp and in the aquatic zones.

Which species?

.....

*(1 mark)*

**3 (a) (iii)** Duckweed grows floating in water. What evidence is there for this in the students' results?

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*(1 mark)*

**3 (b)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Describe how you would use a $\frac{1}{2}$-metre $\times$ $\frac{1}{2}$-metre quadrat frame and a 30-metre tape measure to obtain data similar to the data shown in the diagram.

You should include details of how you would make sure that you would obtain valid results.

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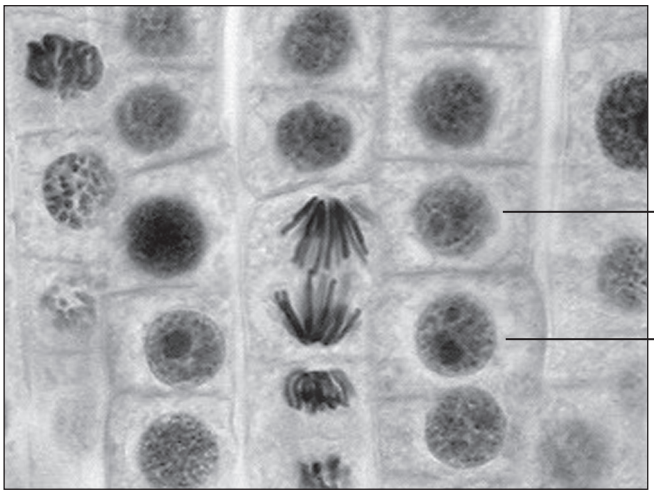
*(6 marks)*

9

**Turn over for the next question**

**4** The photograph shows some cells in the root of an onion plant.




Photograph: © Karen Wynne, Tyler Junior College

**4 (a)** Cells **X** and **Y** have just been produced by cell division.

**4 (a) (i)** Name the type of cell division that produced cells **X** and **Y**.

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*(1 mark)*

**4 (a) (ii)** What happens to the genetic material before the cell divides?

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*(1 mark)*

**4 (b)** A gardener wanted to produce a new variety of onion.

Explain why sexual reproduction could produce a new variety of onion.

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*(3 marks)*

**5**

**5 (a)** Complete the equation for photosynthesis.

..... + ..... $\xrightarrow{\text{light energy}}$ ..... + oxygen

*(2 marks)*

**5 (b)** Scientists investigated how temperature affects the rate of photosynthesis.
The scientists grew some orange trees in a greenhouse.
They used discs cut from the leaves of the young orange trees.

The scientists used the rate of oxygen production by the leaf discs to show the rate of photosynthesis.

**5 (b) (i)** The leaf discs did not produce any oxygen in the dark.

Why?

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*(1 mark)*

**5 (b) (ii)** The leaf discs took in oxygen in the dark.

Explain why.

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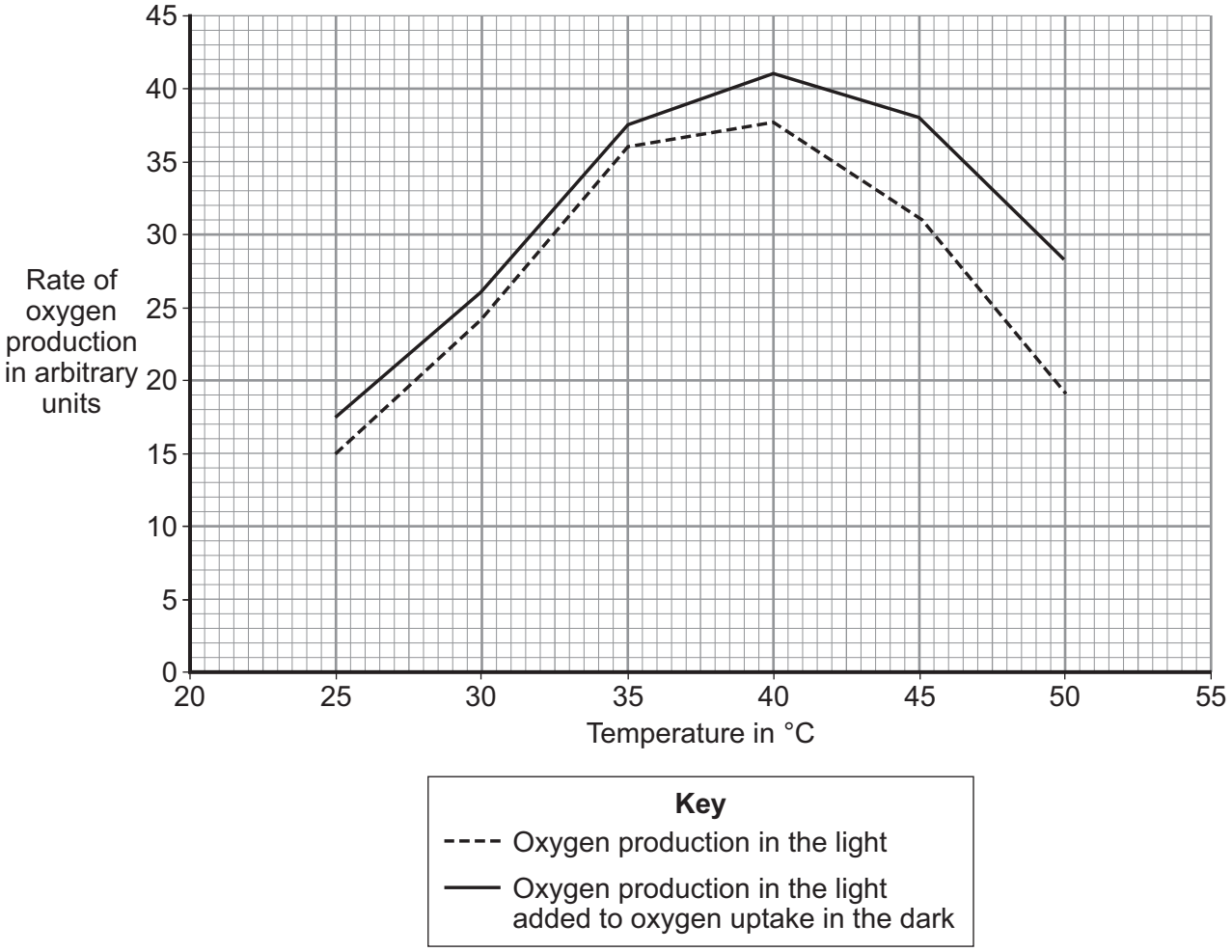
*(2 marks)*

**Question 5 continues on the next page**

**5 (c)** In their investigation, the scientists measured the rate of oxygen release by the leaf discs in the light. The scientists then measured the rate of oxygen uptake by the leaf discs in the dark.

The graph shows the effect of temperature on

- oxygen production in the light
- oxygen production in the light added to oxygen uptake in the dark.




Use the information from the graph to answer each of the following questions.

**5 (c) (i)** Describe the effect of temperature on oxygen production in the light.

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*(2 marks)*

**5 (c) (ii)** Explain the effect of temperature on oxygen production in the light when the temperature is increased:

from 25 °C to 35 °C

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from 40 °C to 50 °C.

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*(2 marks)*

**5 (d)** A farmer in the UK wants to grow orange trees in a greenhouse. He wants to sell the oranges he produces at a local market.
He decides to heat the greenhouse to 35 °C.

Explain why he should **not** heat the greenhouse to a temperature higher than 35 °C.
Use information from the graph in your answer.

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*(3 marks)*

12

**6 (a)** How do fossils provide evidence that species alive today have evolved from simpler organisms?

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*(3 marks)*

**6 (b)** The photographs show two species of gull.

**Herring gull (*Larus argentatus)***

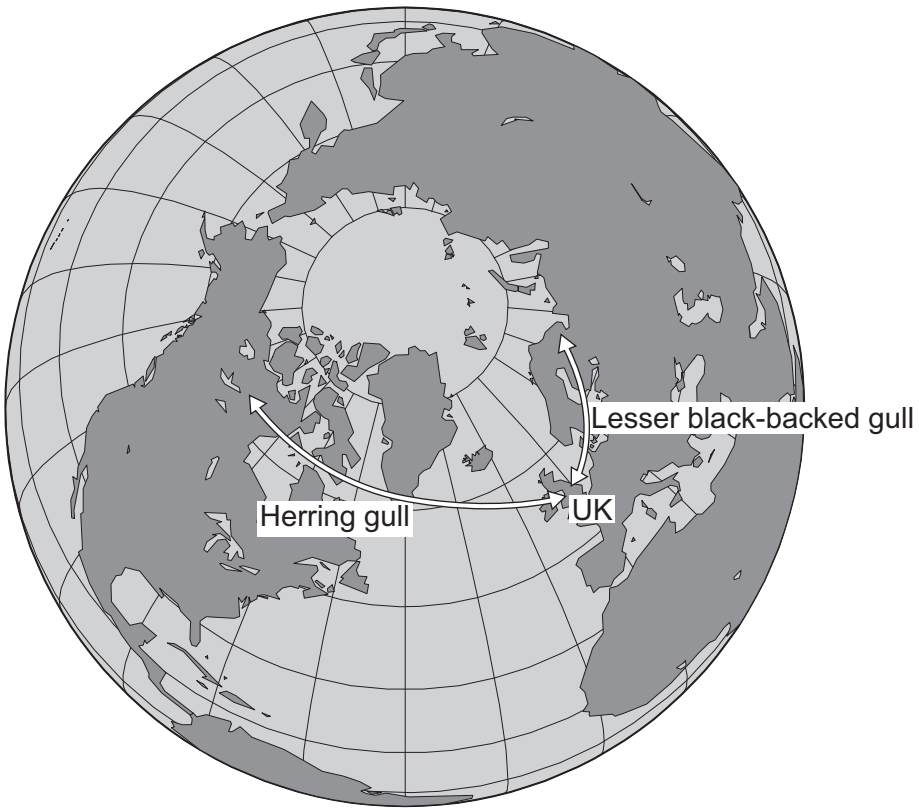
Photograph: © John Howard/Science Photo Library

**Lesser black-backed gull (*Larus fuscus)***

Photograph: © John Devries/Science Photo Library

Both species are now found in the UK but the two species cannot interbreed with each other. Scientists believe that these two species have evolved from a common ancestor.

The map on the next page shows a view of the Earth from above the North Pole.
The map also shows where these two species are found.




**6 (b)** Suggest an explanation for the development of these different species.

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*(6 marks)*

9

**Turn over ▶**

**7** People with cystic fibrosis make large amounts of thick, sticky mucus in their lungs. Cystic fibrosis is caused by the inheritance of recessive alleles.

**7 (a)** What do each of the following mean?

**7 (a) (i)** Alleles

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*(1 mark)*

**7 (a) (ii)** Recessive

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*(1 mark)*

**7 (b)** Mr and Mrs Brown have a child with cystic fibrosis. They hope to have another child. They want to know the probability that their next child will have cystic fibrosis. They visit a genetic counsellor who explains, "You are both heterozygous for cystic fibrosis. There is a 1 in 4 (25%) chance that your next child will have cystic fibrosis."

Use the following symbols in answering the questions.

**N** = allele for being unaffected by cystic fibrosis
**n** = allele for cystic fibrosis

**7 (b) (i)** Mr and Mrs Brown both have the same genotype.

What is their genotype? .....

*(1 mark)*

**7 (b) (ii)** There is a 1 in 4 chance that Mr and Mrs Brown's next child will have cystic fibrosis. Use a genetic diagram to explain why.

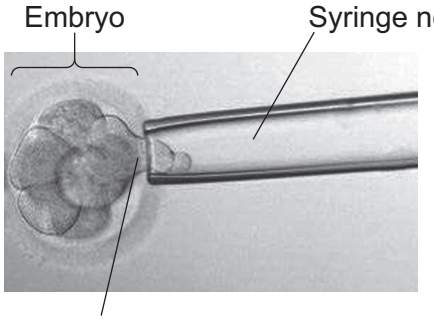
*(3 marks)*

**Question 7 continues on the next page**

**7 (c)** Mr and Mrs Brown do **not** want to have another child with cystic fibrosis. The genetic counsellor explains two different methods for finding out whether an embryo has cystic fibrosis. The methods are:

- pre-implantation genetic diagnosis (**PGD**)
- chorionic villus sampling (**CVS**).

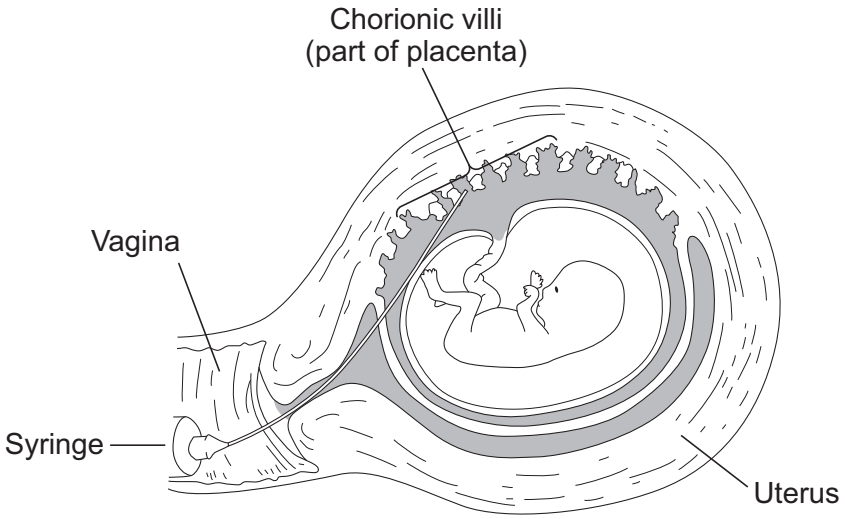
In **PGD**, eggs are fertilised in dishes and allowed to grow into embryos. A cell is taken from each embryo when the embryo is 3 days old. The photograph shows how the cell is taken.




Photograph: © Pascal Goetgheluck/Science Photo Library

The DNA in the cell can then be tested. The possibility of a false positive result is about 1 in 6. An unaffected embryo can then be placed in the woman's uterus. The procedure costs about £6000.

**CVS** can only be done after 9 weeks of pregnancy. A tiny piece of the placenta is taken out using a tube attached to a syringe. This is grown in tissue culture for about 7 days. The diagram below shows how **CVS** is done.



The DNA in the cells can then be tested. About 2 in every 100 women have a miscarriage because of **CVS**. The possibility of a false positive result is about 1%. The procedure costs about £600. Following a positive result, the parents must then decide whether to terminate the pregnancy.

**7 (c)** The genetic counsellor thinks that **PGD** is a better method than **CVS** for detecting cystic fibrosis in an embryo.

Evaluate this opinion.

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*(4 marks)*

10

**END OF QUESTIONS**

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