AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.2.5

Cloning (biology only)

Past-paper questions

Tier	**Higher**
Question groups	**36**
Available paper years	**2007–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.6.2.5 Cloning (biology only)

Question 01

January 2007 | BLY1H | Original Q7 | Legacy

7 Read the passage about IVF (in-vitro fertilisation) and embryo-splitting.

> "IVF is not as successful as we would like it," says scientist Michael Tucker. "On average, only one in five or one in six of all the embryos that we generate in the IVF lab will develop as far as full-term delivery as a baby."
>
> "There is a way to perhaps double those odds. A new, identical embryo is split off from the original embryo made in the IVF lab."
>
> "What we are really doing is creating an identical twin," says scientist Dr Hilton Kort.
>
> "And that's what happens in nature every day. Cloning is creating a replica of a person or an animal."

(a) Explain why the two embryos will develop into identical twins.

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(2 marks)

(b) Explain why the embryos are **not** clones of their parents.

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(2 marks)

(c) The scientists want to develop this technique, but are afraid to do so because public opinion might be against the technique.

Suggest an explanation for this.

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(1 mark)

5

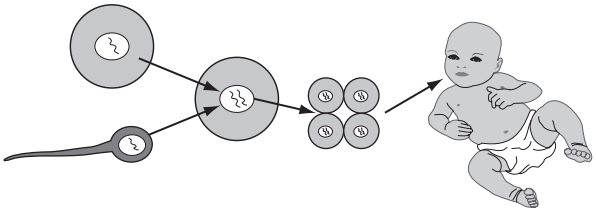
4.6.2.5 Cloning (biology only)

Question 02

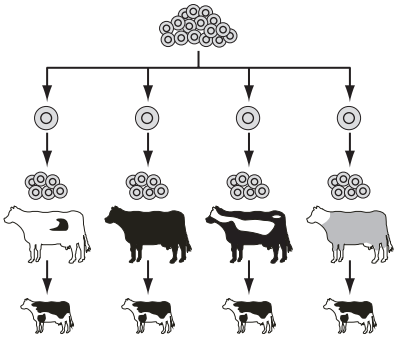
June 2007 | BLY1B | Original Q1 | Legacy

QUESTION ONE

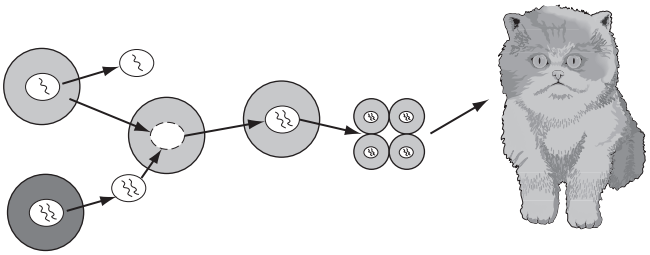
The diagrams show four methods of producing new individuals of animals or plants.



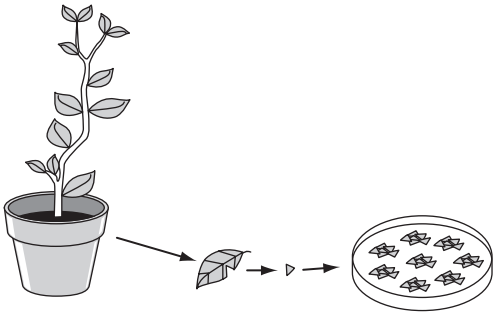
1



2



3



4

Match statements, **A**, **B**, **C** and **D**, with the diagrams **1–4**.

A fusion of two gametes

B fusion cell cloning

C transplanting embryos

D

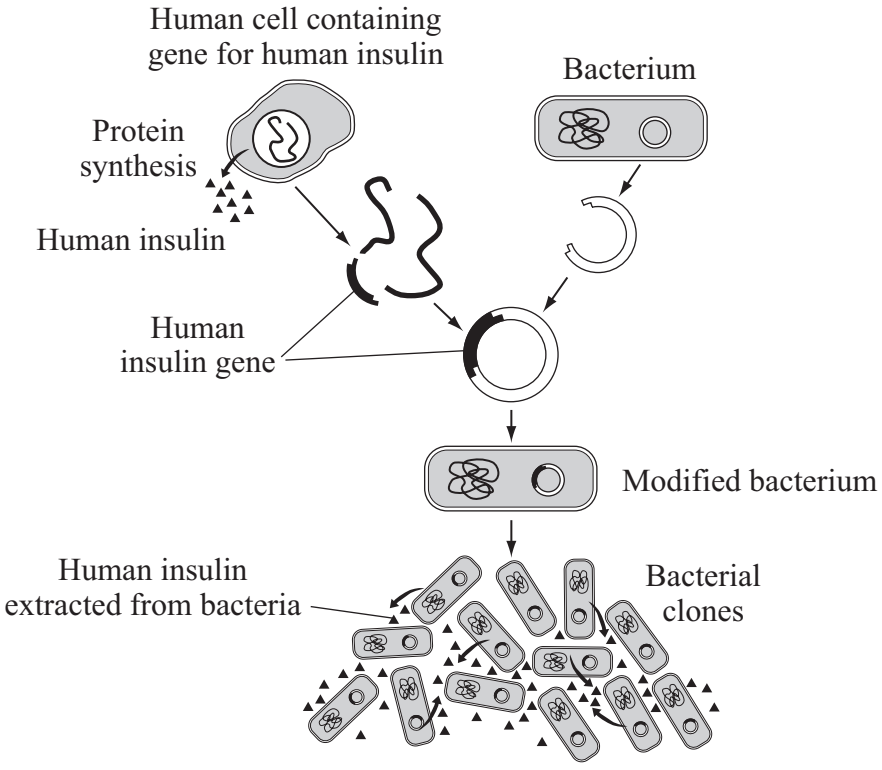
4.6.2.5 Cloning (biology only)

Question 03

June 2007 | BLY1B | Original Q5 | Legacy

QUESTION FIVE

The diagram shows some of the stages involved in the production of the human protein insulin, by a bacterium.



5A The human insulin gene was cut out of a human . . .

1 chromosome.

2 gamete.

3 nucleus.

4 embryo.

5B The removal of the insulin gene from the human cell is carried out by . . .

1 an enzyme.

2 a hormone.

3 a human gene.

4 a bacterium.

4.6.2.5 Cloning (biology only)

5C The advantage of using bacteria rather than mammals to manufacture the insulin is that . . .

1 it needs less research.

2 the bacteria can provide more insulin than a mammal.

3 the bacteria will produce insulin that is less toxic.

4 there are likely to be fewer ethical objections.

5D This method of producing a product using bacteria is an example of . . .

1 sexual reproduction.

2 evolution.

3 genetic engineering.

4 natural selection.

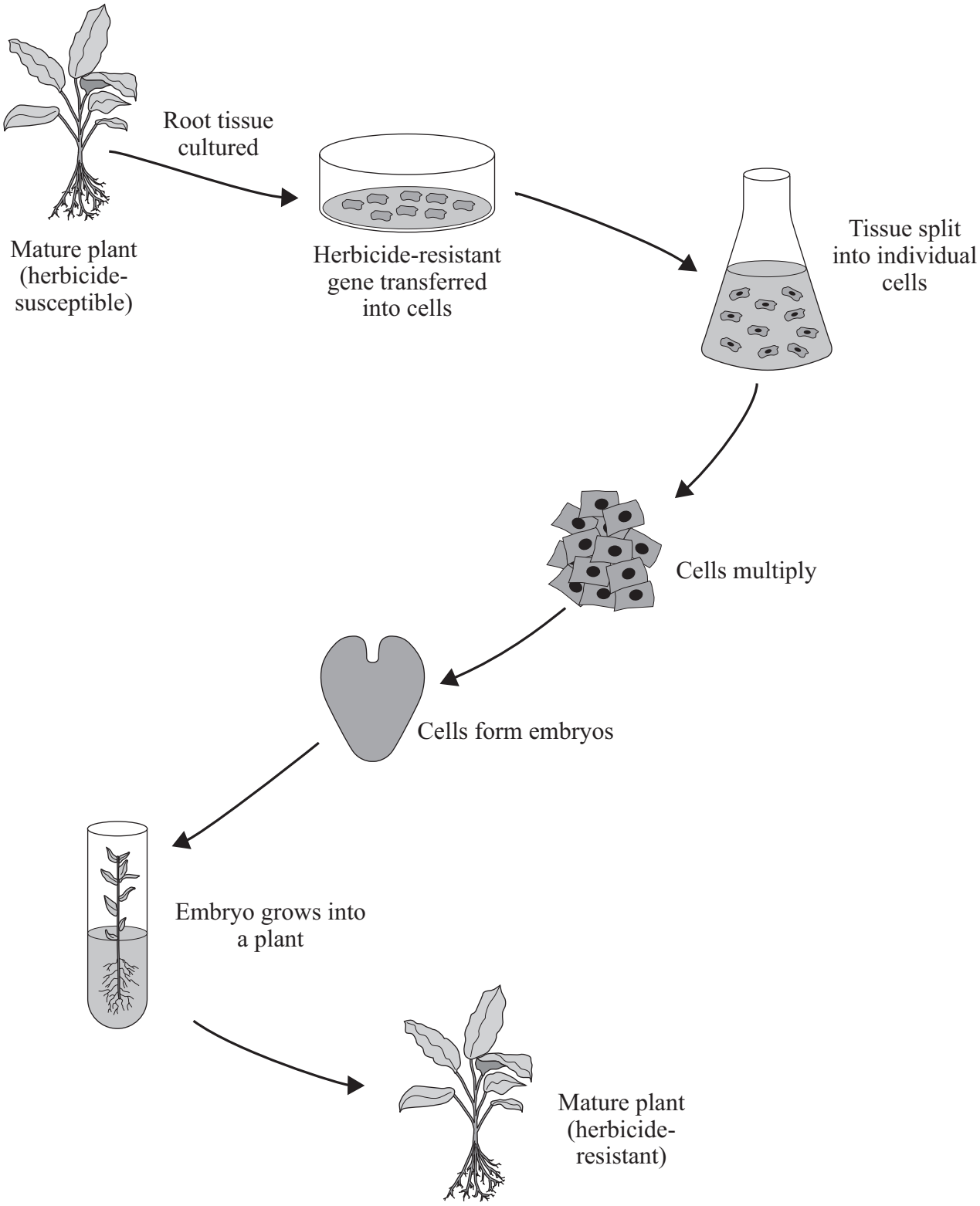
Turn over for the next question

4.6.2.5 Cloning (biology only)

Question 04

January 2008 | BLY1H | Original Q8 | Legacy

8 The diagram shows one method of producing herbicide-resistant crop plants.



4.6.2.5 Cloning (biology only)

Question 04 · continued

BLANK

(a) (i) The herbicide-resistance gene is obtained from a herbicide-resistant plant.

Which structure in a cell carries the genes?

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(1 mark)

(ii) How is the herbicide-resistance gene cut out of this structure?

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.....

(1 mark)

(b) Apart from having the herbicide-resistance gene, the herbicide-resistant plants are identical to the herbicide-susceptible plants.

Explain why.

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.....

(2 marks)

(c) Suggest **one** advantage to a farmer of growing herbicide-resistant crops.

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.....

(1 mark)

(d) Many people are opposed to the growing of herbicide-resistant crops produced in this way.

Suggest **one** reason why.

.....

.....

(1 mark)

6

4.6.2.5 Cloning (biology only)

Question 05

March 2008 | BLY1BP | Original Q4 | Legacy

QUESTION FOUR

Read the passage:

> The *Agrobacterium tumefaciens* bacterium will accept genes from another organism. The bacterium can then transfer those genes from itself into plants. The plant then grows a lump of cells (a gall) that contain the genes from the bacterium. New plants, containing the genes, can be grown from galls. This technique has been used to transfer genes from a firefly into a tobacco plant, which then glows in the dark.

4A The transfer of genes from the firefly into the bacterium is an example of . . .

1 asexual reproduction.

2 cloning.

3 genetic engineering.

4 transplantation.

4B From which structure in the firefly would scientists cut out the gene that causes glowing?

1 gamete

2 chromosome

3 enzyme

4 cell

4C Cells from the tobacco plants containing the new genes would have to be cloned. This cloning would be carried out using . . .

1 embryo transplantation.

2 adult cell cloning.

3 genetic engineering.

4 tissue culture.

4.6.2.5 Cloning (biology only)

4D What was the most likely reason for carrying out this experiment?

1 to make tobacco plants grow taller

2 to remove genes from fireflies

3 to see whether genes could be transferred from animals to plants

4 to grow plants from galls

Turn over for the next question

4.6.2.5 Cloning (biology only)

Question 06

June 2008 | BLY1BP | Original Q1 | Legacy

QUESTION ONE

This question is about adult cell cloning.

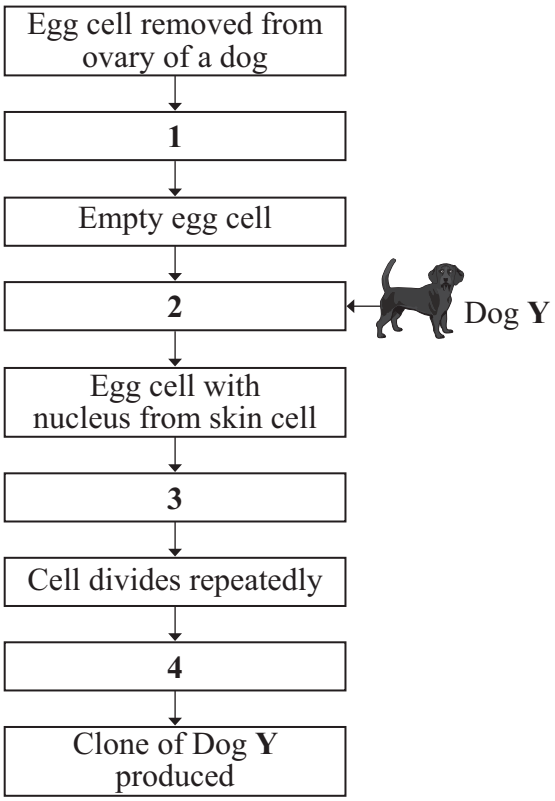
Match stages, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram to explain how clones of dogs can be produced.

A nucleus transferred from skin cell of Dog **Y**

B electric shock applied

C ball of cells inserted into womb of female

D nucleus removed from egg cell



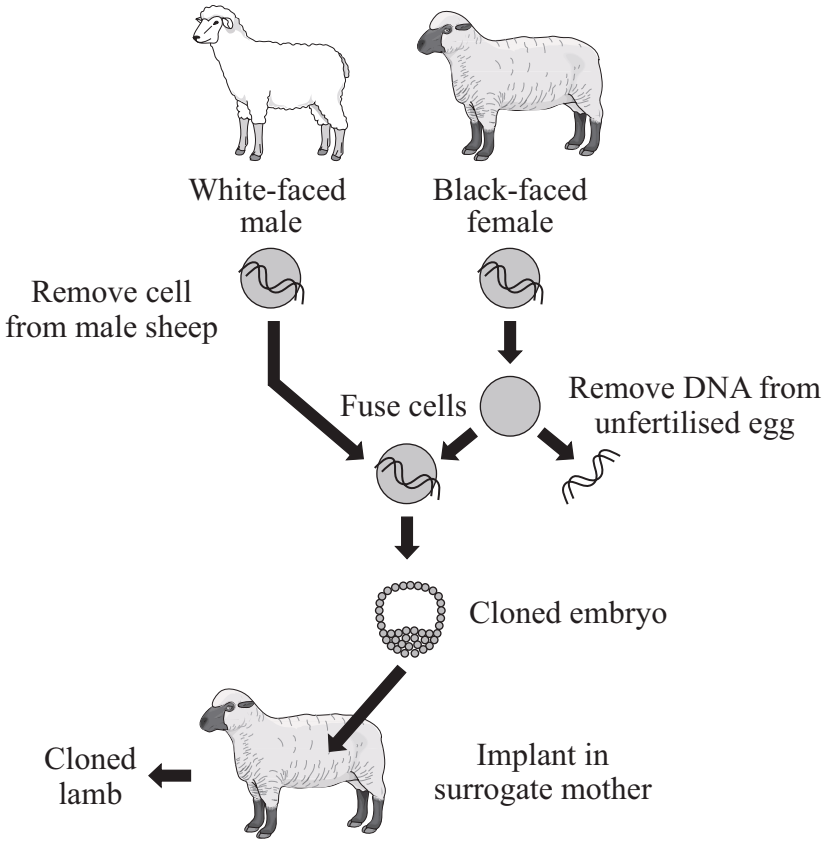
4.6.2.5 Cloning (biology only)

Question 07

November 2008 | BLY1BP | Original Q8 | Legacy

QUESTION EIGHT

The diagram shows the method used to clone sheep.



8A This method of cloning sheep involves . . .

1 fertilisation of an egg by a sperm.

2 sexual reproduction.

3 asexual reproduction.

4 fusion of male and female gametes.

8B The clone produced would be . . .

1 a black-faced male.

2 a white-faced female.

3 a black-faced female.

4 a white-faced male.

4.6.2.5 Cloning (biology only)

Question 07 · continued

8C Proposals have been made to clone human embryos.

Which of the following is a reason why cloning human embryos might be allowed?

1 The cloned embryos could be used to create a 'super-race'.

2 The embryos could be stored for long periods.

3 Cloning will produce surplus embryos.

4 Cells from the embryos could be used to cure human diseases.

8D Clones are produced naturally when . . .

1 two eggs are fertilised.

2 two eggs are fertilised by two separate sperm.

3 one egg is fertilised by one sperm and the embryo splits into two.

4 two eggs are fertilised by one sperm and the embryo splits into two.

4.6.2.5 Cloning (biology only)

Question 08

January 2009 | BLY1H | Original Q6 | Legacy

6 The use of cloned animals in food production is controversial.

It is now possible to clone 'champion' cows.
Champion cows produce large quantities of milk.

6 (a) Describe how adult cell cloning could be used to produce a clone of a 'champion' cow.

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(4 marks)

4.6.2.5 Cloning (biology only)

Question 08 · continued

for mark

6 (b) Read the passage about cloning cattle.

> The Government has been accused of 'inexcusable behaviour' because a calf of a cloned American 'champion' cow has been born on a British farm. Campaigners say it will undermine trust in British food because the cloned cow's milk could enter the human food chain.
>
> But supporters of cloning say that milk from clones and their offspring is as safe as the milk we drink every day.
>
> Those in favour of cloning say that an animal clone is a genetic copy. It is not the same as a genetically engineered animal. Opponents of cloning say that consumers will be uneasy about drinking milk from cloned animals.

Use the information in the passage and your own knowledge and understanding to evaluate whether the government should allow the production of milk from cloned 'champion' cows.

Remember to give a conclusion to your evaluation.

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(5 marks)

9

4.6.2.5 Cloning (biology only)

Question 09

June 2009 | BLY1BP | Original Q1 | Legacy

QUESTION ONE

There are several different methods of cloning animals and plants.

Match methods, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A adult cell cloning

B embryo transplants

C taking cuttings

D tissue culture

	Description of method of cloning
1	splitting apart cells from a developing animal and transplanting them into a host mother
2	placing a nucleus from a skin cell into an egg cell with no nucleus
3	using small groups of cells from part of a plant
4	producing many new plants from old plants quickly and cheaply

4.6.2.5 Cloning (biology only)

Question 10

November 2009 | BLY1BP | Original Q6 | Legacy

QUESTION SIX

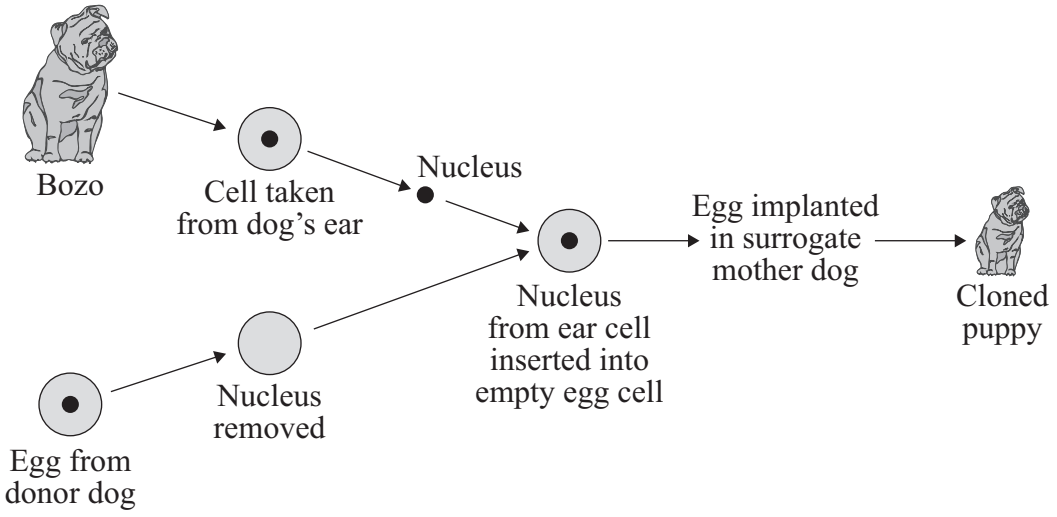
Woman gets 5 cloned puppies of her pet dog

A woman sold her house to raise £25 000 to have her pet dog Bozo cloned before he died of cancer.

The company that cloned the dog said that it could clone 300 dogs a year for pet owners whose dogs have died.

Animal charities condemned the practice as unacceptable.

The diagram shows the cloning process used by the company.



6A The cloned puppy is . . .

1 genetically identical to the surrogate mother dog.

2 genetically identical to the egg donor dog.

3 genetically identical to Bozo.

4 genetically identical to Bozo's parents.

4.6.2.5 Cloning (biology only)

Question 10 · continued

6B The method used to produce the cloned puppies involves . . .

1 asexual reproduction.

2 fertilisation.

3 genetic engineering.

4 sexual reproduction.

6C Some humans are natural clones.

Which method would produce **natural** human clones?

1 two eggs being fertilised by two sperm at the same time

2 a developing embryo splitting to produce two separate embryos

3 an early embryo being split apart and transplanted into two host mothers

4 replacing the nucleus of an egg with the nucleus of an adult cell

6D Cloning puppies is allowed, but the cloning of humans is banned.

This is because . . .

1 no two humans should ever have the same genetic information.

2 there are ethical objections to cloning humans.

3 it would put too big a strain on NHS resources.

4 cloned children are much more likely to have inherited diseases.

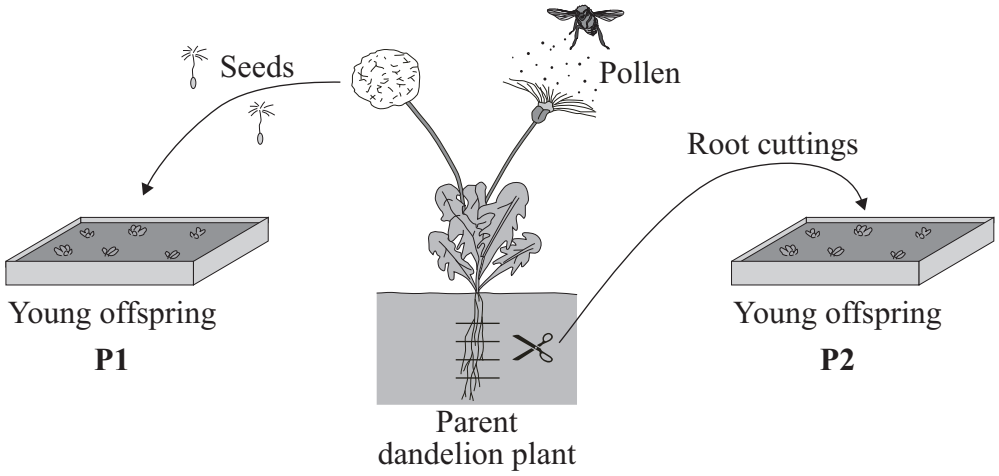
4.6.2.5 Cloning (biology only)

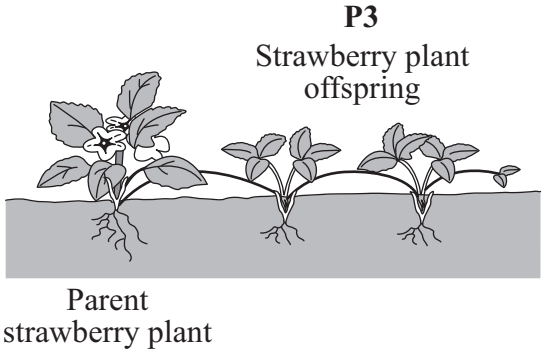
Question 11

November 2009 | BLY1BP | Original Q8 | Legacy

QUESTION EIGHT

The drawings show three ways in which plants can be reproduced.





8A Which new plants would be genetically identical to their parents?

1 **P1** and **P2** only

2 **P1** and **P3** only

3 **P2** and **P3** only

4 **P1**, **P2** and **P3**

4.6.2.5 Cloning (biology only)

Question 11 · continued

8B The seeds from dandelion plants would contain genetic information . . .

1 only from the pollen.

2 from both the parent dandelion plant shown and the pollen.

3 only from the parent dandelion plant shown.

4 identical to that of the parent plant root.

8C Which offspring have been produced naturally?

1 **P2** only

2 **P1** and **P2** only

3 **P1** and **P3** only

4 **P1**, **P2** and **P3**

8D Commercial growers use the method shown to reproduce strawberry plants instead of planting seeds.

This enables growers to . . .

1 eliminate any further use of slug poisons that may have been used previously.

2 create plants that produce progressively bigger and sweeter strawberries.

3 grow more plants in a smaller area.

4 produce strawberries with the same taste, over and over again.

4.6.2.5 Cloning (biology only)

Question 12

March 2010 | BLY1BP | Original Q1 | Legacy

QUESTION ONE

Tasmanian tigers are similar to Tasmanian devils. Tasmanian tigers became extinct in the 20th century.

The picture shows a Tasmanian tiger.



Scientists are trying to create living Tasmanian tigers. They are using cells from the well-preserved remains of a pregnant Tasmanian tiger. They are trying several methods.

4.6.2.5 Cloning (biology only)

Question 12 · continued

Match methods, **A**, **B**, **C** and **D**, with the descriptions **1–4** in the table.

A sexual reproduction

B tissue culture

C embryo transplants

D adult cell cloning

	Description
1	Splitting cells from the Tasmanian tiger embryo and transplanting them into the womb of a Tasmanian devil.
2	Joining female gametes from the Tasmanian tiger with male sperm cells from a Tasmanian devil.
3	Growing small groups of cells in a special nutrient solution.
4	Transferring the nucleus from a Tasmanian tiger skin cell into a Tasmanian devil egg cell. After the cell is given an electric shock, it is transferred to the womb of a female Tasmanian devil.

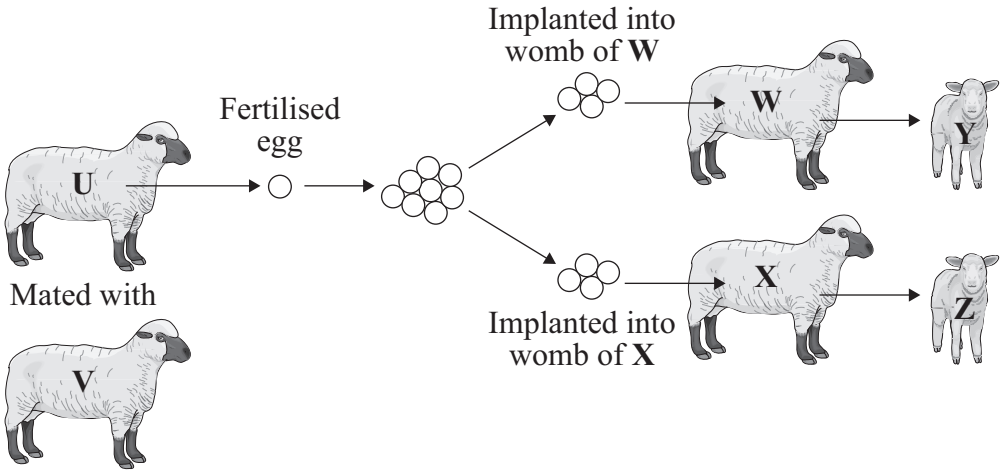
4.6.2.5 Cloning (biology only)

Question 13

March 2010 | BLY1BP | Original Q6 | Legacy

QUESTION SIX

The diagrams illustrate one method of reproducing sheep.



6A The cells of the embryo which develops from the fertilised egg will contain genetic information . . .

1 from both sheep **U** and sheep **V**.

2 from sheep **U** only.

3 from sheep **V** only.

4 from neither sheep **U** nor sheep **V**.

6B The genetic information in the cells of the embryos that develop in sheep **W** and sheep **X** will be . . .

1 from sheep **U** only.

2 from sheep **V** only.

3 from both sheep **U** and sheep **V** but not identical.

4 identical.

4.6.2.5 Cloning (biology only)

Question 13 · continued

6C For **Y** and **Z**, the only thing we can be certain about is that both will be . . .

1 female.

2 male.

3 the same sex.

4 the same sex as sheep **V**.

6D Which sheep are clones?

1 **U** and **V**

2 **W** and **X**

3 **Y** and **Z**

4 **W**, **X**, **Y** and **Z**

Turn over for the next question

4.6.2.5 Cloning (biology only)

Question 14

June 2010 | BLY1BP | Original Q2 | Legacy

QUESTION TWO

There are several methods of cloning animals and plants.

Match organisms, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

A a common garden plant

B a very rare endangered plant

C a well-loved family cat

D a common farm animal

	Best method of cloning
1	small groups of cells are grown on a special jelly
2	unspecialised embryo cells are separated and put into a host
3	cuttings are taken
4	adult cell cloning

4.6.2.5 Cloning (biology only)

Question 15

June 2019 | BLY1H | Original Q6 | Legacy

6 Scientists have recently cloned a mouse that had died and been frozen for 16 years.

6 (a) Explain what is meant by a clone.

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(2 marks)

6 (b) The scientists used an egg cell from a living mouse and the genetic material from a brain cell of the frozen mouse.

Describe how the process of adult cell cloning could be used to clone the frozen mouse.

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(3 marks)

6 (c) People could ask scientists to use this technique to clone long-dead relatives, whose bodies have been deep-frozen.

Most people would be opposed to cloning a human from a deep-frozen, long-dead relative.

Give **one** reason why.

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(1 mark)

6

4.6.2.5 Cloning (biology only)

Question 16

November 2010 | BLY1BP | Original Q2 | Legacy

QUESTION TWO

There are several different techniques used to clone plants and animals.

Match techniques, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A adult cell cloning

B taking cuttings

C embryo transplants

D tissue culture

The type of cloning used by gardeners is usually . . . **1** . . . .

Scientists who want to quickly grow large numbers of plants from one very expensive plant would use . . . **2** . . . .

Scientists who want to produce several identical cows from two parents would use . . . **3** . . . .

Scientists who want to produce a cow identical to the cow that had won a national show would use . . . **4** . . . .

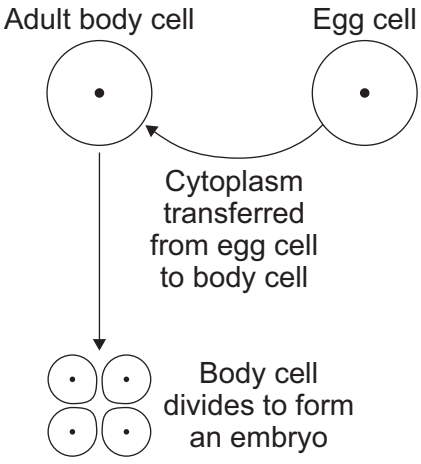
4.6.2.5 Cloning (biology only)

Question 17

November 2010 | BLY1BP | Original Q7 | Legacy

QUESTION SEVEN

The diagram shows one method of cloning animals.



7A This method of cloning is called . . .

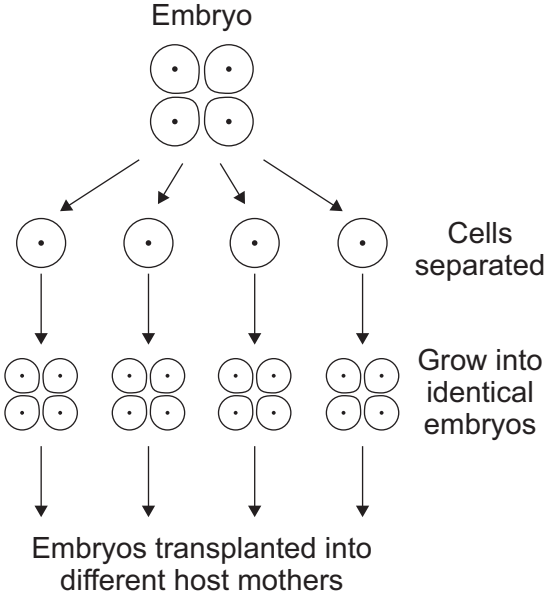
1 sexual reproduction.

2 embryo transplantation.

3 fusion cell cloning.

4 tissue culture.

The cells of the embryo can be separated and allowed to grow into identical embryos.
The embryos are then implanted into different host mothers.



4.6.2.5 Cloning (biology only)

Question 17 · continued

7B The offspring would . . .

1 all look like the animal from which the egg cell was taken.

2 all look like the animal from which the adult body cell was taken.

3 look like the host mother that they developed inside.

4 not look like any of the other animals.

Scientists are carrying out research on human cell cloning to produce unspecialised embryonic cells. Unspecialised embryonic cells could be used to treat incurable diseases. One incurable disease is Parkinson's disease. Parkinson's disease affects the nervous system.

7C Unspecialised embryonic cells are useful in the search for cures for different diseases.

This is because unspecialised embryonic cells . . .

1 are nerve cells.

2 can grow into human beings.

3 are easy to produce.

4 can be made to grow into many different types of cell.

7D An ethical argument **against** this type of research is that . . .

1 this research will probably not be successful for a long time.

2 the research will help only a small number of people.

3 embryos are made, and then some of these embryos are destroyed.

4 God would not like this research.

4.6.2.5 Cloning (biology only)

Question 18

January 2011 | BLY1H | Original Q8 | Legacy

8 Scientists have brought an extinct species of mountain goat, the Pyrenean ibex, 'back to life'. These scientists used skin cells from preserved Pyrenean ibex in cloning experiments.

The Scientists:
- removed the nuclei from domestic goat egg cells
- transferred cell nuclei from the skin cells of the Pyrenean ibex into domestic goat egg cells
- used the domestic goats as surrogate mothers for the embryos that developed.

The scientists made 439 cloned embryos, but only 57 were suitable for transfer into the surrogate goat mothers. Only seven of the goats got pregnant and only one live offspring was born.

Some biologists are very worried about using cloning to preserve endangered animals, because cloned animals often have developmental problems. Some endangered animals are difficult to breed in captivity. For these animals cloning is another way to continue the genetic line.

The biggest threats to endangered animals today are habitat loss, illegal hunting, pollution and climate change. Many scientists say that cloning is not as important as trying to preserve the wild places on Earth. The wild places are being lost very quickly and the animals and plants living in the wild places are dying out.

8 (a) The Pyrenean ibex was 'brought back to life'.

How is this process different from using adult cell cloning to clone a pet animal?

.....

.....

(1 mark)

4.6.2.5 Cloning (biology only)

Question 18 · continued

8 (b) Evaluate the use of adult cell cloning to conserve endangered species.

Use the information given and your own knowledge and understanding.

Remember to give a conclusion to your evaluation.

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(4 marks)

5

4.6.2.5 Cloning (biology only)

Question 19

March 2011 | BLY1BP | Original Q1 | Legacy

QUESTION ONE

We can now produce animals and plants with characteristics we prefer.

Match words, **A**, **B**, **C** and **D**, with the statements **1**–**4** in the table.

A embryo transplants

B sexual reproduction

C taking cuttings

D tissue culture

1	a quick and cheap way of reproducing a plant
2	produces clones of an animal
3	produces offspring using small groups of cells from a plant
4	produces offspring with a variety of different characteristics

4.6.2.5 Cloning (biology only)

Question 20

June 2011 | BLY1H | Original Q7 | Legacy

7 Organisms can be produced by asexual reproduction and by sexual reproduction.

7 (a) Give **two** differences between asexual reproduction and sexual reproduction.

1 .....

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2 .....

.....

(2 marks)

7 (b) Adult cell cloning is a type of asexual reproduction.

Explain why.

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(2 marks)

4

4.6.2.5 Cloning (biology only)

Question 21

November 2011 | BLY1BP | Original Q1 | Legacy

QUESTION ONE

We can now produce animals and plants with the characteristics we want.

Match words, **A**, **B**, **C** and **D**, with the statements **1**–**4** in the table.

A adult cell cloning

B sexual reproduction

C taking cuttings

D tissue culture

	Information
1	used by gardeners to produce clones of a plant
2	the joining of one egg with one sperm
3	enables hundreds of identical individuals to be produced from a few cells from the parent
4	placing a nucleus from a skin cell into an egg cell with no nucleus

4.6.2.5 Cloning (biology only)

Question 22

November 2011 | BLY1BP | Original Q6 | Legacy

QUESTION SIX

In the past, prize bulls used to be transported around the world to mate with cows.
Cattle embryos can now be transported around the world in test tubes.

There are two methods of doing this.

Method 1

- A cow is given drugs that cause her to produce up to 80 eggs at the same time.
- The eggs are fertilised and the resulting embryos removed from the womb.
- The embryos are frozen and sent to other farms around the world.
- Each embryo can then be put into the womb of a different cow.

Method 2

- After fertilisation, one embryo is removed from a cow.
- The embryo is split into several parts.
- The parts are frozen, then sent to other farms around the world.
- Each part can be put into the womb of a cow.

6A Which row in the table describes the calves produced using the two methods?

	Method 1		Method 2	
	Genetically identical	**Genetically different**	**Genetically identical**	**Genetically different**
1	✓		✓	
2		✓		✓
3	✓			✓
4		✓	✓	

6B Which method of reproduction is involved in producing the embryos formed in **Method 1**?

1 embryo splitting

2 genetic modification

3 sexual reproduction

4 tissue culture

4.6.2.5 Cloning (biology only)

Question 22 · continued

6C One advantage of the new methods of producing calves rather than by mating cows with a bull is that . . .

1 the calves will all be male.

2 there is no need for a bull.

3 there is more variation between calves.

4 greater numbers of offspring of the bull are produced.

6D One advantage of adult cell cloning over **Method 2** is that the characteristics of the calves . . .

1 are known before.

2 will all be different.

3 will all be the same.

4 can be changed.

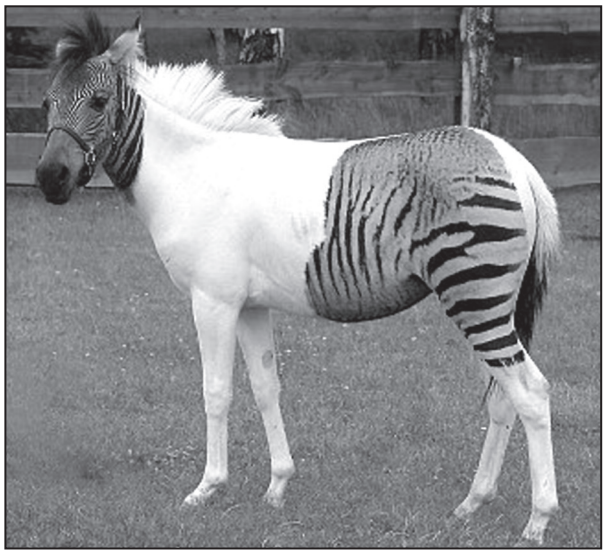
Turn over for the next question

4.6.2.5 Cloning (biology only)

Question 23

January 2012 | BL1HP | Original Q1 | Legacy

1 The photograph shows a zorse.



A zorse is a cross between a male zebra and a female horse.
The zorse has characteristics of both parents.

1 (a) The zorse was produced by *sexual reproduction*.

1 (a) (i) What is *sexual reproduction*?

.....

.....

(1 mark)

1 (a) (ii) The zorse has characteristics of a zebra and a horse.

Why?

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(2 marks)

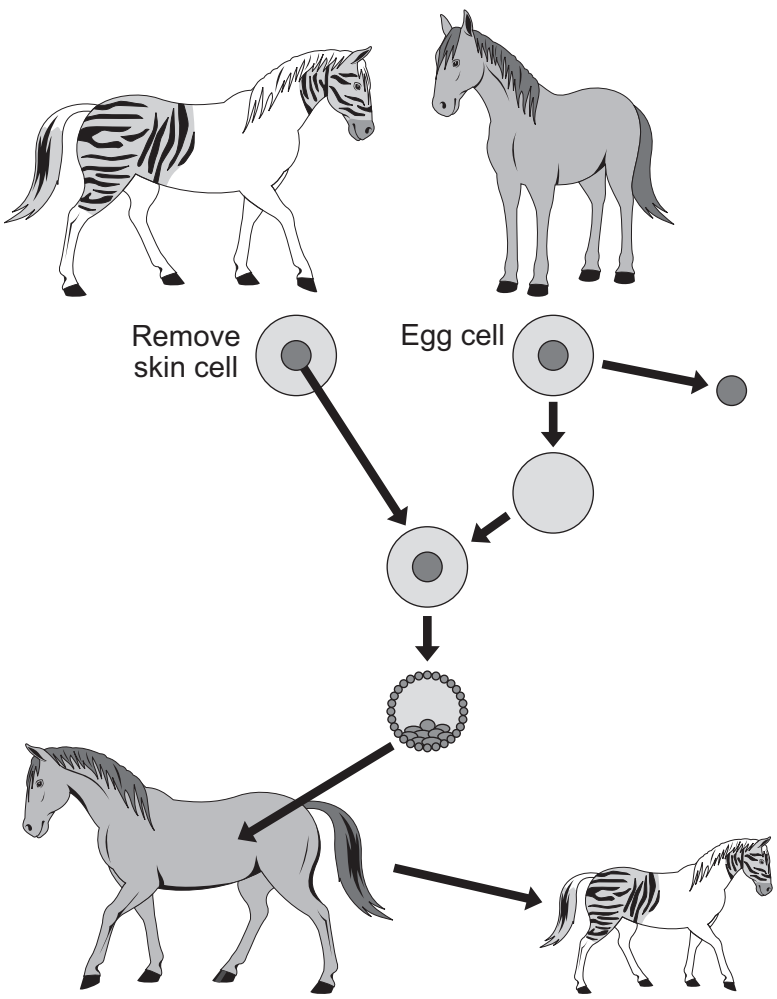
Question 1 continues on the next page

4.6.2.5 Cloning (biology only)

Question 23 · continued

1 (b) Zorses are **not** able to breed.
Scientists could produce more zorses from this zorse by adult cell cloning.

The diagram shows how the scientists might clone a zorse.



4.6.2.5 Cloning (biology only)

Question 23 · continued

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

Use information from the diagram and your own knowledge to describe how adult cell cloning could be used to clone a zorse.

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(6 marks)

9

4.6.2.5 Cloning (biology only)

Question 24

June 2012 | BL2HP | Original Q7 | Legacy

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

.....

.....

(1 mark)

7 (a) (ii) Recessive

.....

.....

(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)

4.6.2.5 Cloning (biology only)

Question 24 · continued

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

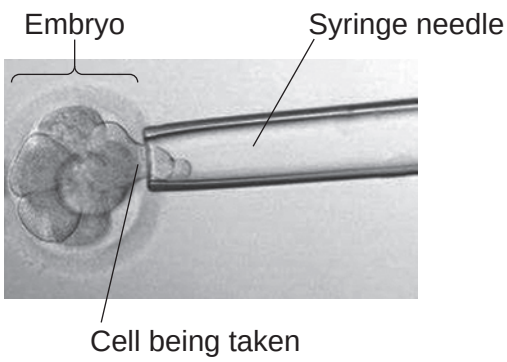
4.6.2.5 Cloning (biology only)

Question 24 · continued

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**).

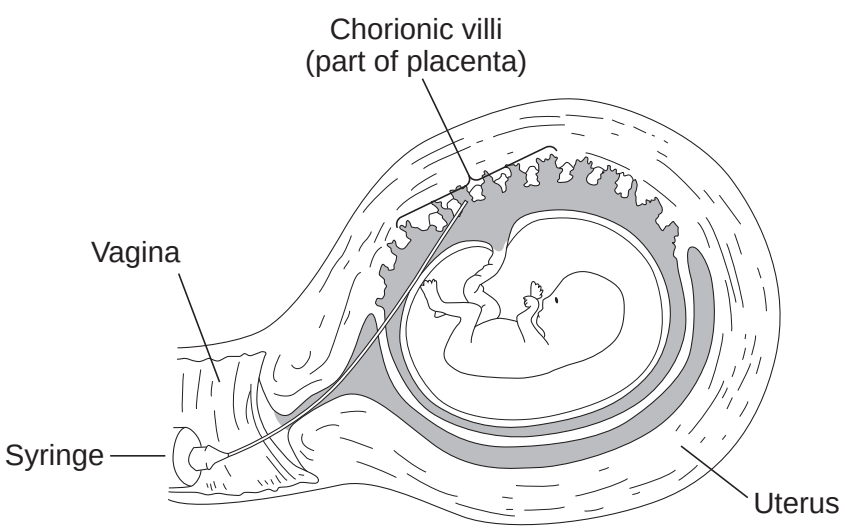
In **PGD**, eggs are fertilised in dishes and allowed to grow into embryos. A cell is taken from each embryo when the embryo is 3 days old. The photograph shows how the cell is taken.



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.



4.6.2.5 Cloning (biology only)

Question 24 · continued

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

4.6.2.5 Cloning (biology only)

Question 25

June 2013 | BL1HP | Original Q5 | Legacy

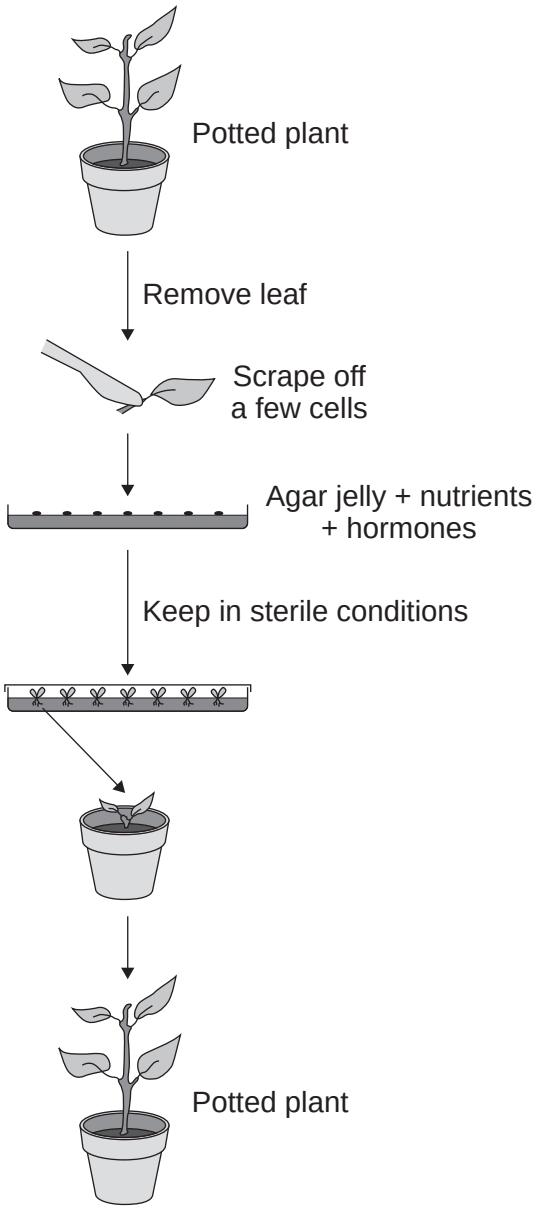
5 Plant hormones are used in horticulture.

5 (a) Name **one** plant hormone.

.....

(1 mark)

5 (b) The diagram shows how new plants are produced using tissue culture.



4.6.2.5 Cloning (biology only)

Question 25 · continued

5 (b) (i) Tissue culture is a type of *asexual reproduction*.

Give the main features of *asexual reproduction*.

.....

.....

.....

.....

.....

.....

(3 marks)

5 (b) (ii) Another method of producing new plants is by taking cuttings.

Suggest **one** advantage of using tissue culture and **not** using cuttings to produce plants.

.....

.....

.....

(1 mark)

5

4.6.2.5 Cloning (biology only)

Question 26

June 2015 | BL1HP | Original Q8 | Legacy

8 As embryos develop, some genes in cells are turned off and some genes are turned on. This allows cells to become specialised for particular functions.

Usually, after cells have become specialised, they cannot change again into different types of cells.

8 (a) What is a gene?

[2 marks]

.....

.....

.....

.....

8 (b) Scientists have developed a way to change specialised cells back into embryo-like cells by a method called iPS.

Read the information in the box.

> Cells made using iPS can be changed into different types of cells.
>
> Scientists plan to take skin cells from an endangered species of monkey called a drill and change these cells into iPS cells. These iPS cells can then be changed into egg cells or sperm cells.
>
> After fertilisation, the embryo can be inserted into the womb of a female of a non-endangered species called a mandrill. The mandrill is closely related to the drill.

Describe similarities and differences between the iPS method and adult cell cloning.

[4 marks]

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4.6.2.5 Cloning (biology only)

Question 26 · continued

.....

.....

.....

.....

8 (c) Suggest **one** advantage of trying to preserve endangered species such as the drill.

[1 mark]

.....

.....

7

Turn over for the next question

4.6.2.5 Cloning (biology only)

Question 27

June 2017 | BL1HP | Original Q7 | Legacy

7 Reproduction may be sexual or asexual.

7 (a) Describe **one** advantage to a species of sexual reproduction rather than asexual reproduction.

[1 mark]

_____

_____

7 (b) Mitochondria contain genes. The genes control some of the reactions in respiration.

In a person with mitochondrial disease, genes in the mitochondria are faulty. The person may have muscle weakness, blindness and heart failure.

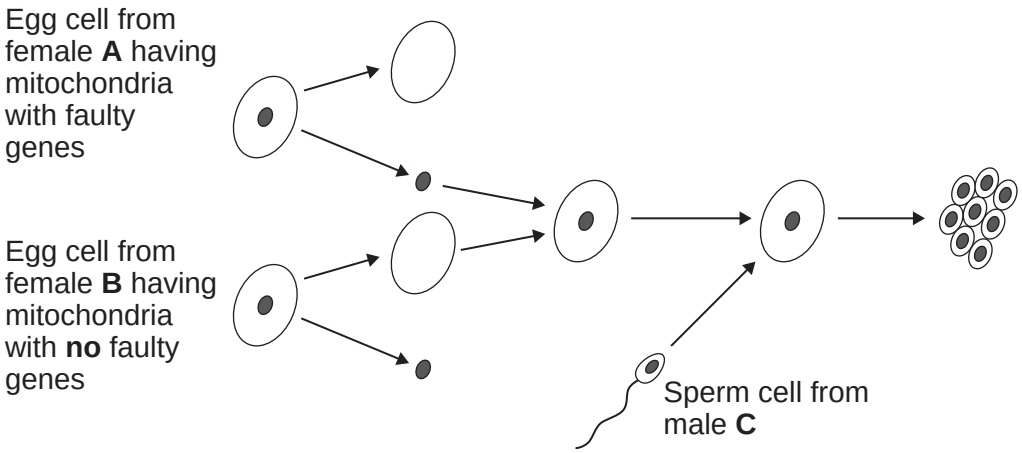
In human reproduction, an embryo will have mitochondria from the cytoplasm of the mother's egg cell.

Scientists have developed a way of solving the problem of a child inheriting mitochondrial disease.

Figure 6 shows the process.

The cells involved come from three different people, **A**, **B** and **C**.

Figure 6



4.6.2.5 Cloning (biology only)

Question 27 · continued

7 (b) (i) Describe the process shown in **Figure 6**.

Use your knowledge of sexual reproduction and adult cell cloning.

[4 marks]

7 (b) (ii) Explain why the embryo formed from the process shown in **Figure 6** will **not** have mitochondrial disease.

[2 marks]

7 (b) (iii) Suggest **one** ethical objection to this process being used for reproduction in humans.

[1 mark]

8

4.6.2.5 Cloning (biology only)

Question 28

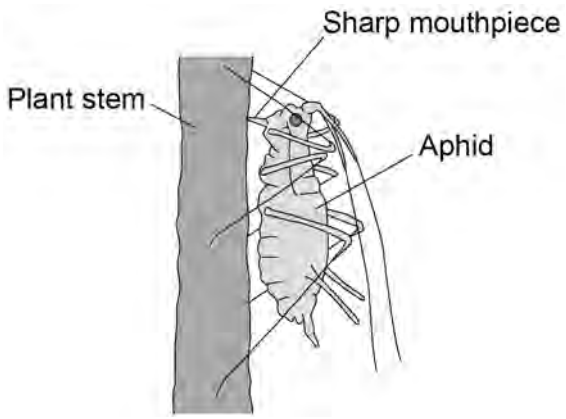
June 2018 | 8461/1H | Original Q5

0 5 Plants can be infected by fungi, viruses and insects.

Aphids are small insects that carry pathogens.

Figure 6 shows an aphid feeding from a plant stem.

Figure 6



0 5 . 1 An aphid feeds by inserting its sharp mouthpiece into the stem of a plant.

Give the reason why the mouthpiece of an aphid contains a high concentration of dissolved sugars after feeding.

[1 mark]

Question 5 continues on the next page

4.6.2.5 Cloning (biology only)

Question 28 · continued

0 5 . 2 Plants infected with aphids may show symptoms of magnesium deficiency.

Magnesium deficiency symptoms include:

- yellow leaves
- stunted growth.

Explain how a deficiency of magnesium could cause these symptoms.

[5 marks]

4.6.2.5 Cloning (biology only)

Question 28 · continued

0 5 . 3 A farmer thinks a potato crop is infected with potato virus Y (PVY).

The farmer obtains a monoclonal antibody test kit for PVY.

To make the monoclonal antibodies a scientist first isolates the PVY protein from the virus.

Describe how the scientist would use the protein to produce the PVY monoclonal antibody.

[4 marks]

10

4.6.2.5 Cloning (biology only)

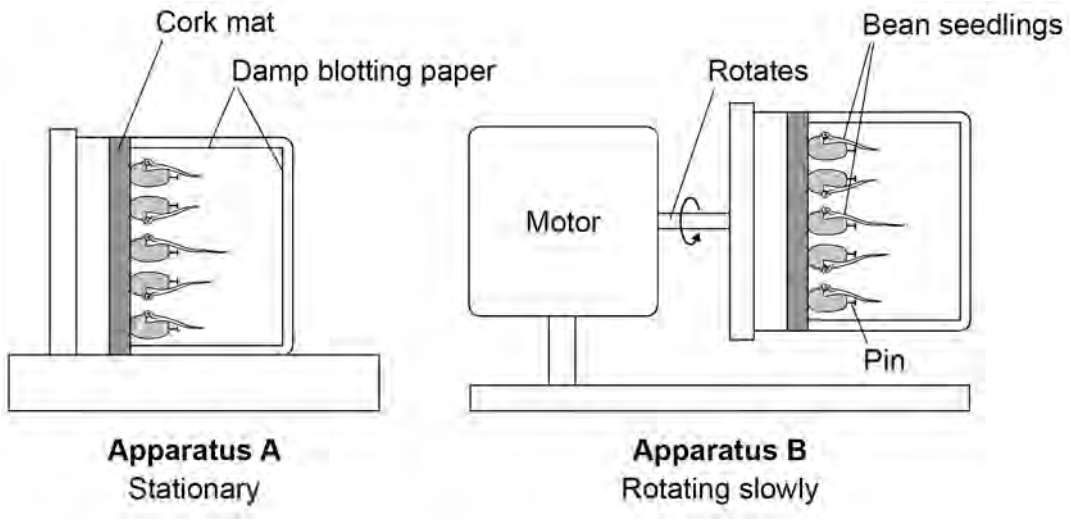
Question 29

June 2018 | 8461/2H | Original Q6

0 6 Some students investigated geotropism in the roots of bean seedlings.

Figure 6 shows the apparatus used.

Figure 6



This is the method used.

1. Measure the length of the root of each of 10 bean seedlings.
2. Pin 5 seedlings to the cork mat in apparatus **A**.
3. Pin 5 seedlings to the cork mat in apparatus **B**.
4. Leave **A** and **B** in a dark cupboard for 2 days.
5. After the 2 days:
   - make a drawing to show the appearance of each seedling
   - measure the length of the root of each seedling.

0 6 . 1 Why did the students surround the seedlings with damp blotting paper?

[1 mark]

Tick **one** box.

To prevent light affecting the direction of root growth ☐

To prevent photosynthesis taking place in the roots ☐

To prevent the growth of mould on the roots ☐

To prevent water affecting the direction of root growth ☐

Apparatus **B** is a control.

Apparatus **B** rotates slowly.

0 6 . 2 How does apparatus **B** act as a control?

[1 mark]

Table 4 shows the students' results.

Table 4

	Apparatus A					Apparatus B				
Seedling number	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Length at start in mm	35	41	32	33	39	30	33	29	28	31
Length after 2 days in mm	49	57	43	45	54	45	45	44	29	44
Length change in mm	14	16	11	12	15	15	12	15	1	13
Mean length change in mm	14					11				

0 6 . 3 One student stated:

'The mean length change for the seedlings in apparatus **B** is **not** valid.'

Suggest the reason for the student's statement.

[1 mark]

0 6 . 4 Suggest **one** improvement the students could make to obtain a more valid mean length change for the seedlings in apparatus **B**.

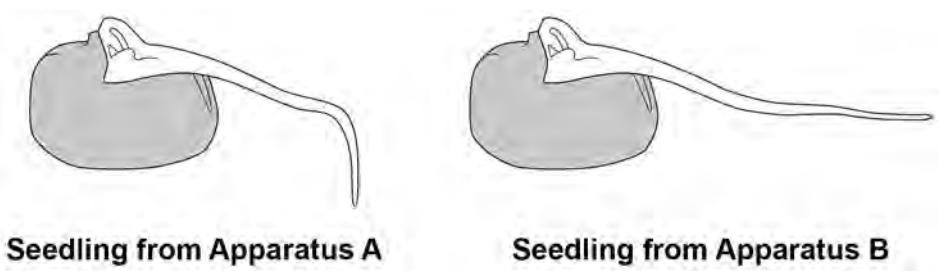
[1 mark]

4.6.2.5 Cloning (biology only)

Question 29 · continued

0 6 . 5 **Figure 7** shows the students' drawings of two seedlings at the end of the 2 days.

Figure 7



A plant hormone is made in the root tip.

The hormone diffuses from the tip into the tissues of the root.

Explain how the hormone causes the appearance of the seedlings in **Figure 7** to be different.

You should refer to **both** seedlings in your answer.

[3 marks]

4.6.2.5 Cloning (biology only)

Question 29 · continued

June 2018 | 8461/2H | Original Q6

0 6 . 6 In horticulture plant hormones are used for controlling plant growth.

Draw **one** line from each plant hormone to the correct use of that hormone.

[3 marks]

Plant hormone	Use of hormone
	To reduce the time taken for tomatoes to ripen
Auxin	To slow down the growth of plant stems
Ethene	To promote seed germination
Gibberellin	To stimulate root growth in plant cuttings

10

4.6.2.5 Cloning (biology only)

Question 30

June 2019 | 8461/1H | Original Q8

0 8 Pancreatic cancer develops when a malignant tumour grows inside the pancreas.

0 8 . 1 The pancreas produces digestive enzymes.

What is an enzyme?

[2 marks]

0 8 . 2 Carbohydrase is an enzyme produced by the pancreas.

Name **two** other organs in the digestive system that produce carbohydrase.

[2 marks]

1 _____

2 _____

0 8 . 3 One symptom of pancreatic cancer is weight loss.

Explain how pancreatic cancer may cause a person to lose weight.

Do **not** refer to hormones in your answer.

[4 marks]

4.6.2.5 Cloning (biology only)

Question 30 · continued

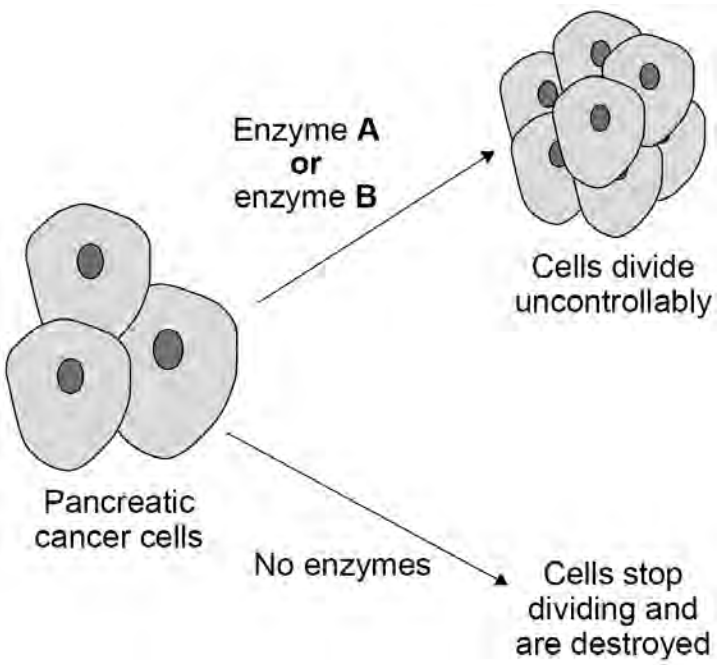
Enzyme **A** and enzyme **B** are involved in controlling cell division in pancreatic cancer cells.

Most cancer cells produce both enzyme **A** and enzyme **B**.

Some people have a gene mutation that stops cancer cells producing enzyme **B**.

Figure 9 shows how cell division is controlled in pancreatic cancer cells.

Figure 9



4.6.2.5 Cloning (biology only)

Question 30 · continued

Scientists have developed a drug that inhibits enzyme **A**.

The drug is given to pancreatic cancer patients who have the gene mutation that stops cancer cells producing enzyme **B**.

The drug only targets cancer cells.

0 8 . 4 Explain why the drug can be used to treat pancreatic cancer in patients with the gene mutation.

Use information from **Figure 9**.

[3 marks]

0 8 . 5 Explain why the drug could **not** be used to treat pancreatic cancer in a patient that produces both enzyme **A** and enzyme **B**.

[2 marks]

Question 8 continues on the next page

4.6.2.5 Cloning (biology only)

Question 30 · continued

0 8 . 6 The drug was trialled before it was licensed for use.

To improve validity of the results in the trial:

- some patients were given a placebo
- a double-blind trial was used.

Give reasons why a placebo and a double-blind trial were used.

[2 marks]

A placebo _____

_____

_____

A double-blind trial _____

_____

_____

0 8 . 7 One stage in a drug trial is to test the drug on healthy volunteers.

What is the next stage in the drug trial?

[1 mark]

Tick (✓) **one** box.

Testing on all patients with the disease ☐

Testing on human tissue ☐

Testing on live animals ☐

Testing on volunteers with the disease ☐

4.6.2.5 Cloning (biology only)

Question 30 · continued

0 8 . 8 A monoclonal antibody has been produced to treat pancreatic cancer.

Explain how the monoclonal antibody works to treat pancreatic cancer.

[3 marks]

19

4.6.2.5 Cloning (biology only)

Question 31

0 5 **Table 2** gives the classification of four plant species.

Table 2

Group	Species 1	Species 2	Species 3	Species 4
Kingdom	*Plantae*	*Plantae*	*Plantae*	*Plantae*
Phylum	*Spermatophyta*	*Spermatophyta*	*Spermatophyta*	*Spermatophyta*
Class	*Monocotyledonae*	*Dicotyledonae*	*Monocotyledonae*	*Dicotyledonae*
Order	*Poales*	*Fabales*	*Poales*	*Scrophulariales*
Family	*Cyperaceae*	*Fabaceae*	*Poaceae*	*Scrophulariaceae*
Genus	*Eriophorum*	*Pisum*	*Poa*	*Antirrhinum*
Species	*angustifolium*	*sativum*	*annua*	*majus*

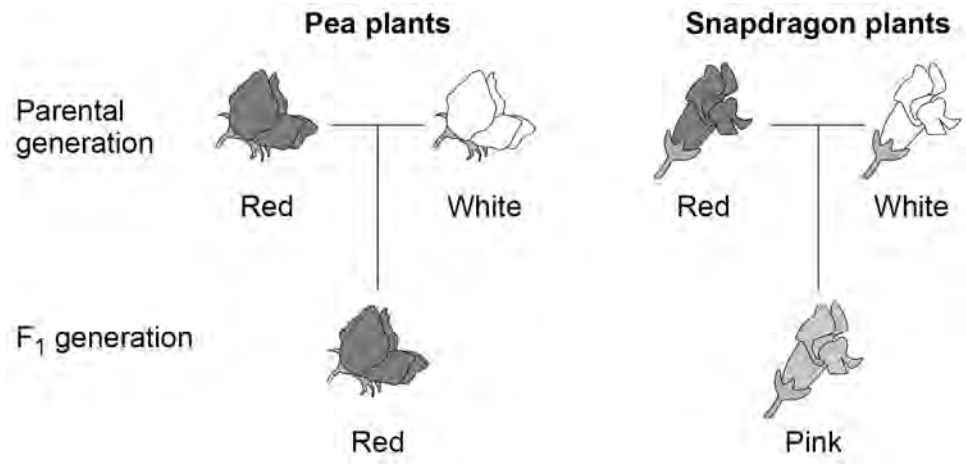
0 5 . 1 Species **1** and **3** are the most closely related.

What information in **Table 2** gives evidence for this?

[1 mark]

Figure 6 shows the inheritance of flower colour in two species of plant.

Figure 6



- In pea plants and in snapdragon plants, flower colour is controlled by one pair of alleles.
- In **Figure 6** the parental generation plants are homozygous for flower colour.
- In heterozygous **pea** plants, the allele for red flower colour is dominant.
- In heterozygous **snapdragon** plants, the alleles for flower colour are both expressed.

4.6.2.5 Cloning (biology only)

Question 31 · continued

Use the following symbols for alleles in your answers to Questions **05.2** to **05.4**:

Pea plants	**Snapdragon plants**
R = allele for red flowers	C^R = allele for red flowers
r = allele for white flowers	C^W = allele for white flowers

0 5 . 2 What is the genotype of the red-flowered pea plants in the F_1 generation?

[1 mark]

_____

0 5 . 3 What is the genotype of a white-flowered snapdragon plant?

[1 mark]

_____

A gardener crossed two pink-flowered snapdragon plants.

0 5 . 4 Draw a Punnett square diagram to show why only some of the next generation plants had pink flowers.

Identify the phenotypes of all the offspring plants.

[3 marks]

0 5 . 5 What percentage of the offspring would you expect to have pink flowers?

[1 mark]

Percentage = _____ %

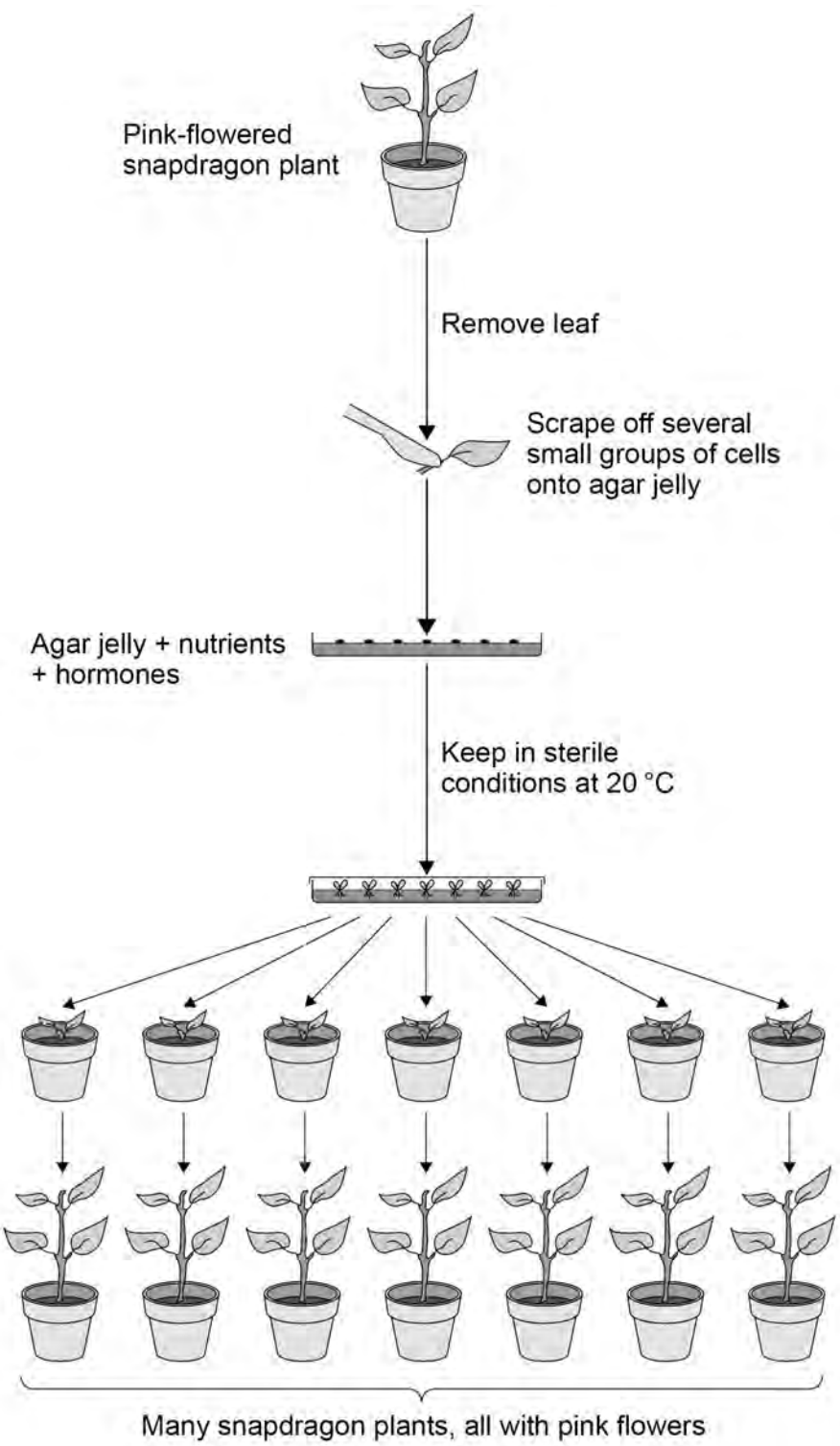
4.6.2.5 Cloning (biology only)

Question 31 · continued

Commercially, hundreds of pink-flowered snapdragon plants can be produced from one pink-flowered plant.

Figure 7 shows a tissue culture technique used for producing many plants from one plant.

Figure 7



4.6.2.5 Cloning (biology only)

Question 31 · continued

0 5 . 6 Give a reason for each of the following steps shown in **Figure 7**.

[5 marks]

Several groups of cells are scraped off the leaf: _____

Nutrients are added to the agar jelly: _____

Hormones are added to the agar jelly: _____

The plant cells are kept in **sterile** conditions: _____

The plant cells are kept at **20 °C**: _____

0 5 . 7 Explain why the method shown in **Figure 7** produces **only** pink-flowered plants.

[2 marks]

14

4.6.2.5 Cloning (biology only)

Question 32

November 2020 | 8461/1H | Original Q7

0 7 Monoclonal antibodies (mAbs) are usually made using mouse lymphocytes.

Candida albicans infection produces serious symptoms in patients with a poor immune system.

Recently scientists have produced mAbs to *Candida albicans* using human lymphocytes produced naturally after an infection.

0 7 . 1 *Candida albicans* lives in the throat of infected patients.

A sample is taken from the throat of a patient with a suspected *Candida albicans* infection.

The sample is transferred onto a microscope slide.

Describe how the mAbs and a fluorescent dye could be used to see any *Candida albicans* pathogens on the slide.

[3 marks]

4.6.2.5 Cloning (biology only)

Question 32 · continued

In a laboratory the human lymphocyte mAbs were injected into animals infected with *Candida albicans*.

The mAbs caused increased phagocytosis of the *Candida albicans* pathogens.

Doctors intend to start a trial to give the mAbs to patients severely ill with *Candida albicans.*

0 7 . 2 Explain how increased phagocytosis of the *Candida albicans* pathogen will help the patient.

[2 marks]

Question 7 continues on the next page

4.6.2.5 Cloning (biology only)

Question 32 · continued

0 7 . 3 It has been shown that this mAbs treatment is effective in the laboratory using both:

- infected tissue culture cells
- infected live animals.

The mAbs treatment for *Candida albicans* is now ready for clinical trials on people.

Describe how the clinical trials should be carried out.

[6 marks]

4.6.2.5 Cloning (biology only)

Question 32 · continued

0 7 . 4 Scientists have also used human lymphocytes to make mAbs to other pathogens and to some types of cancer cells.

Suggest **one** reason why these new mAbs have been more successful in treating diseases in humans than mAbs made using mice.

[1 mark]

12

4.6.2.5 Cloning (biology only)

Question 33

0 7 Human immunodeficiency virus (HIV) is a pathogen.

0 7 . 1 Give **one** way HIV can spread from one person to another person.

[1 mark]

Table 8 shows information about new cases of HIV diagnosed in the UK.

Table 8

Year	Number of new HIV cases in women	Number of new HIV cases in men
2010	376	2266
2012	361	2310
2014	397	2370
2016	298	1886
2018	242	1288

0 7 . 2 Describe the trends shown in **Table 8** between 2010 and 2018.

[2 marks]

0 7 . 3 Suggest **one** reason for the change in the number of new HIV cases between 2014 and 2018.

[1 mark]

4.6.2.5 Cloning (biology only)

Question 33 · continued

0 7 . 4 Calculate the ratio of new cases of HIV in women to new cases of HIV in men in 2018.

Give your answer to 3 significant figures.

[3 marks]

Ratio (3 significant figures) = _____ : 1

0 7 . 5 In the UK population the total number of women is greater than the total number of men.

The data in **Table 8** is used to compare the proportions of new cases of HIV in the population for men and women.

Suggest how the data could be presented differently so that a more valid comparison can be made.

[1 mark]

Question 7 continues on the next page

4.6.2.5 Cloning (biology only)

Question 33 · continued

Scientists have been working to produce a vaccine for HIV for many years.

0 7 . 6 Explain how a vaccine for HIV could work to prevent a person developing HIV infection.

[4 marks]

A person with late stage HIV infection has AIDS.

Scientists have produced monoclonal antibodies for HIV.
The monoclonal antibodies can prevent a person infected with HIV developing AIDS.

0 7 . 7 Describe how the monoclonal antibody for HIV can be produced.

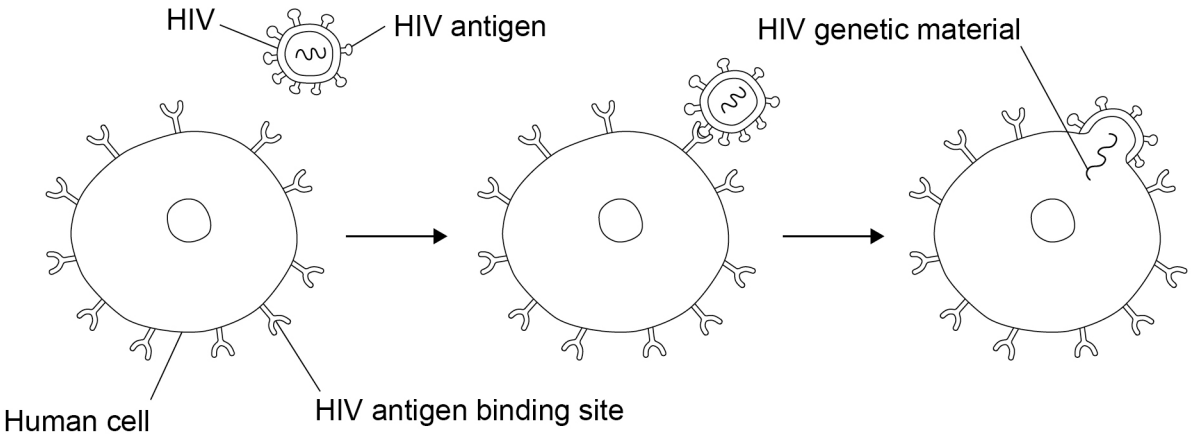
[4 marks]

4.6.2.5 Cloning (biology only)

Question 33 · continued

0 7 . 8 **Figure 9** shows how HIV enters a human cell.

Figure 9



Suggest how the monoclonal antibody for HIV helps to prevent a person infected with HIV developing AIDS.

Use information from **Figure 9**.

[3 marks]

19

4.6.2.5 Cloning (biology only)

Question 34

June 2023 | 8461/1H | Original Q4

0 4 This question is about exercise.

0 4 . 1 During vigorous exercise, anaerobic respiration occurs in a person's body.

Explain **two** effects of anaerobic respiration on the person's body.

[4 marks]

1 _____

2 _____

4.6.2.5 Cloning (biology only)

Question 34 · continued

0 4 . 2 Design an investigation to show the effect of different types of exercise on the heart rate of athletes.

[6 marks]

Question 4 continues on the next page

4.6.2.5 Cloning (biology only)

Question 34 · continued

Anabolic steroids are drugs.

Anabolic steroids:

- increase muscle mass in humans
- are banned in most competitive sports.

Some athletes take anabolic steroids to improve their performance in sport.

0 4 . 3 Explain how taking anabolic steroids could improve an athlete's performance.

[2 marks]

Scientists use monoclonal antibodies to test for the presence of anabolic steroids in an athlete's urine.

To produce monoclonal antibodies, a mouse lymphocyte is combined with a tumour cell.

0 4 . 4 What type of cell is created when a mouse lymphocyte and a tumour cell combine?

[1 mark]

Tick (✓) **one** box.

- Embryo ☐
- Hybridoma ☐
- Phagocyte ☐
- Stem cell ☐

4.6.2.5 Cloning (biology only)

Question 34 · continued

0 4 . 5 Describe how scientists make monoclonal antibodies using the cell created when a mouse lymphocyte and a tumour cell combine.

[3 marks]

0 4 . 6 What property makes a monoclonal antibody useful in detecting the presence of an anabolic steroid in urine?

[1 mark]

Tick (✓) **one** box.

A monoclonal antibody is quick and easy to produce. ☐

A monoclonal antibody is specific to only one person's urine. ☐

A monoclonal antibody only binds to the anabolic steroid. ☐

A monoclonal antibody can identify many different drugs at the same time. ☐

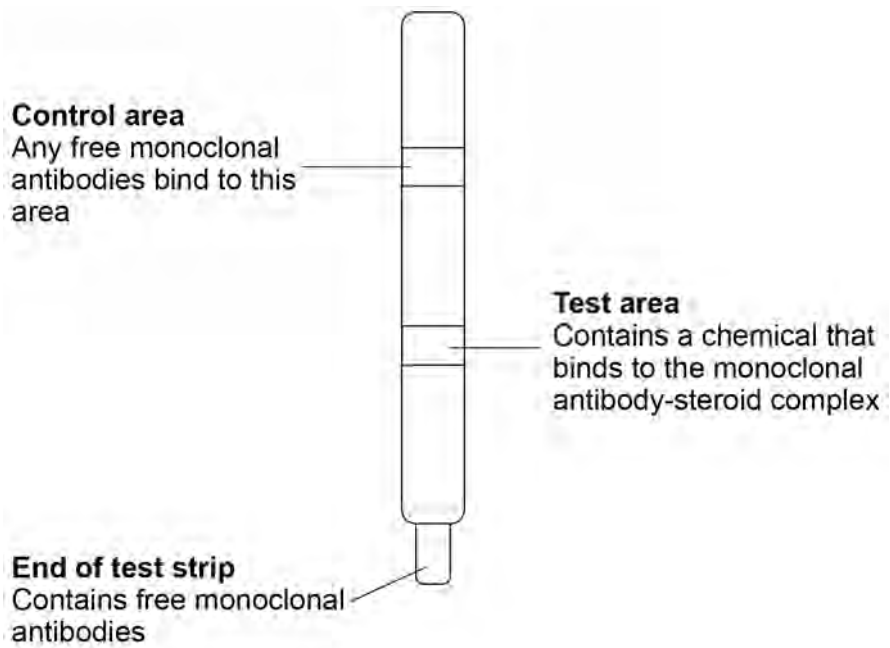
Question 4 continues on the next page

4.6.2.5 Cloning (biology only)

Question 34 · continued

Figure 5 shows a test strip that can detect the presence of an anabolic steroid in an athlete's urine.

Figure 5



The end of the test strip is dipped in urine.

The urine moves up through the test strip.

The test area and the control area contain a dye.
The dye turns blue when monoclonal antibodies bind to it.

0 4 . 7 Suggest the purpose of the control area in the test strip.

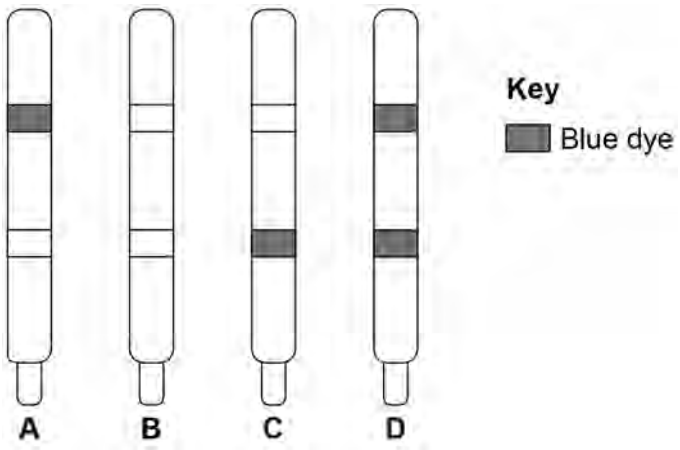
[1 mark]

4.6.2.5 Cloning (biology only)

Question 34 · continued

Figure 6 shows the urine test results of four athletes.

Figure 6



0 4 . 8 Describe the evidence in **Figure 6** that shows the test for athlete **B** has **not** worked.

Suggest **one** reason why the test did **not** work.

[2 marks]

Evidence _____

_____

Reason _____

_____

0 4 . 9 Which athlete has tested positive for anabolic steroids in their urine?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

21

4.6.2.5 Cloning (biology only)

Question 35

June 2023 | 8461/2H | Original Q3

0 3 Reproduction can produce offspring which are:

- genetically different

  or

- genetically identical.

Farmers grow tomato plants in greenhouses.

The tomatoes are sold in supermarkets.

0 3 . 1 Suggest **one** advantage of growing tomato plants that are genetically different.

[1 mark]

0 3 . 2 Suggest **one** advantage of growing tomato plants that are genetically identical.

[1 mark]

0 3 . 3 Scientists can grow genetically identical tomato plants using tissue culture.

What is tissue culture?

[1 mark]

0 3 . 4 Genetically identical tomato plants growing in the same garden do **not** all grow to the same height.

Give **one** reason why.

[1 mark]

4.6.2.5 Cloning (biology only)

Question 35 · continued

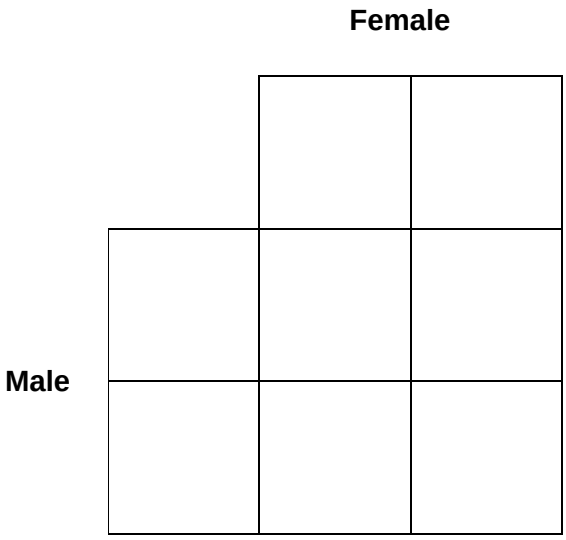
The sex of dogs is determined by **X** and **Y** chromosomes in the same way as in humans.

0 3 . 5 Complete the Punnett square diagram in **Figure 4** to show the inheritance of sex in dogs.

Use the symbols **X** and **Y**.

[3 marks]

Figure 4



0 3 . 6 A female dog gave birth to six offspring.

Why would you expect there to be three male offspring and three female offspring?

Use your answer to Question **03.5**.

[1 mark]

Question 3 continues on the next page

Question 35 · continued

Farmers keep chickens for:

- meat production
- egg production.

Some varieties of chicken grow more quickly and are more suitable for meat production.

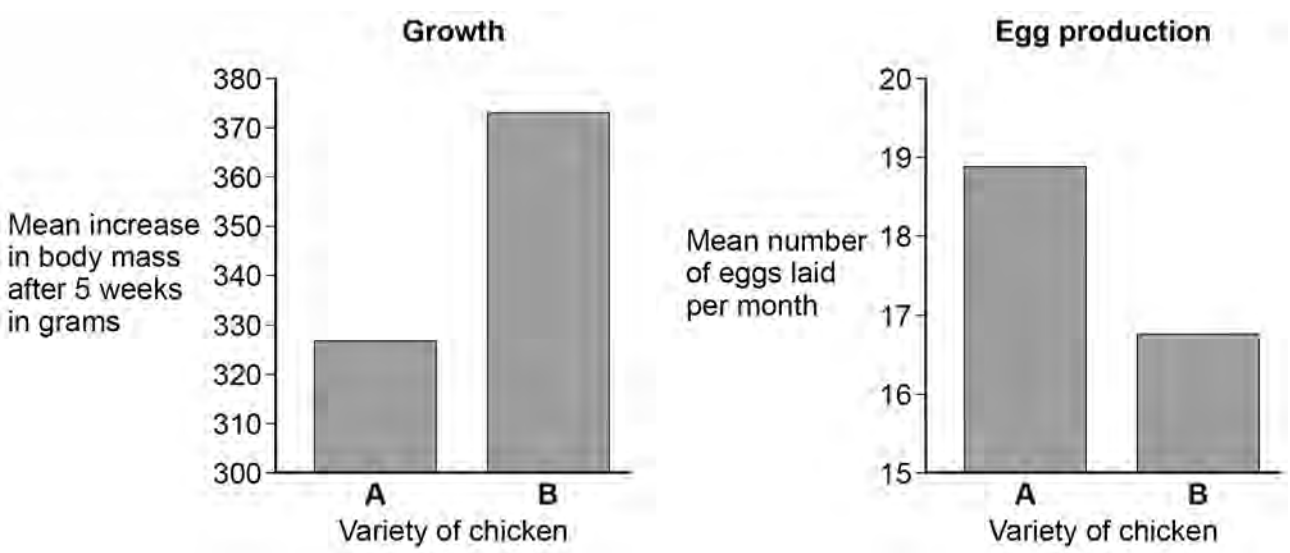
Other varieties of chicken produce more eggs.

A farmer keeps two varieties of chicken, **A** and **B**.

The farmer investigated the growth rates and egg-production rates of both varieties.

Figure 5 shows the results.

Figure 5



0 3 . 7 Suggest **two** control variables the farmer should have used in this investigation.

[2 marks]

1 _____

_____

2 _____

_____

4.6.2.5 Cloning (biology only)

Question 35 · continued

0 3 . 8 **Figure 5** shows mean values from 500 chickens of each variety.

Give the reason the farmer used a large number of chickens.

[1 mark]

0 3 . 9 The farmer wants to produce a new variety of chicken that is good for **both** meat production **and** egg production.

Describe how selective breeding of chicken varieties **A** and **B** can produce the new variety of chicken.

[4 marks]

15

4.6.2.5 Cloning (biology only)

Question 36

June 2025 | 8461/1H | Original Q7

0 7 In people with severe liver disease the liver stops working correctly.

A person with severe liver disease can be treated with:

- an injection of embryonic stem cells
  or
- a liver transplant from a donor.

The person's body can reject embryonic stem cells and can reject a liver transplanted from a donor.

0 7 . 1 What property of embryonic stem cells makes them suitable to treat liver disease?

[1 mark]

0 7 . 2 Suggest **one ethical** reason why a person may **not** want an injection of embryonic stem cells.

[1 mark]

4.6.2.5 Cloning (biology only)

Question 36 · continued

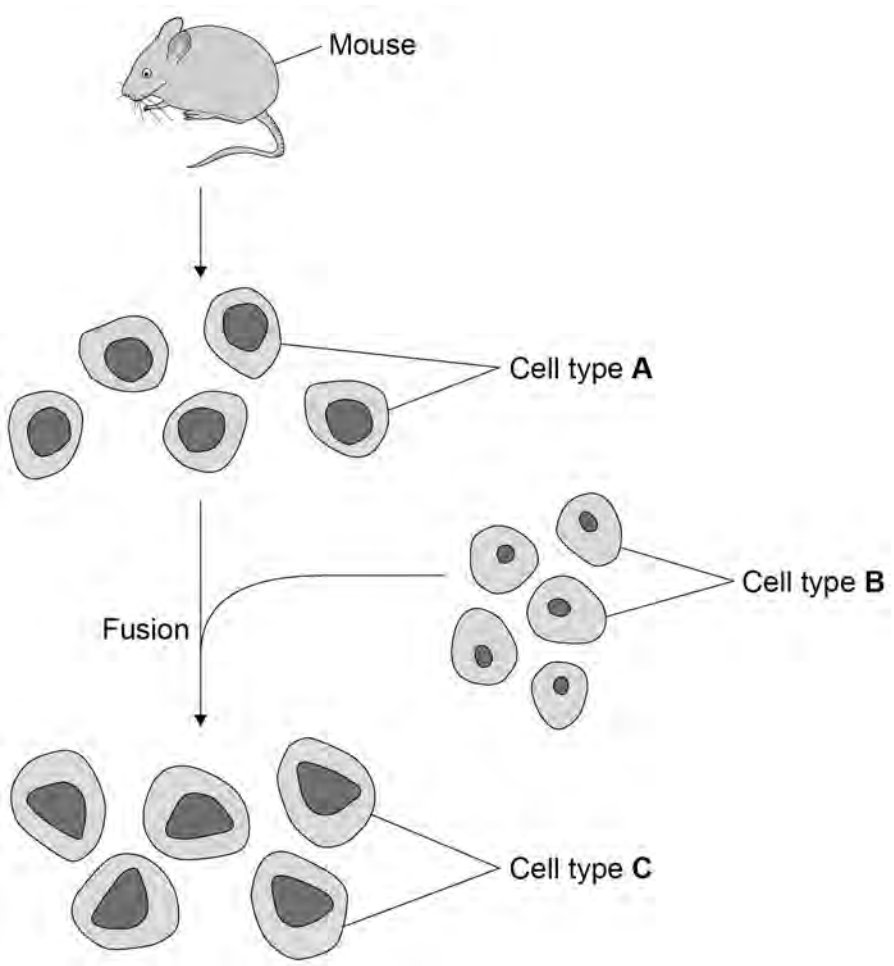
Drugs can be used to reduce the risk of liver rejection after a transplant.

One drug contains monoclonal antibodies.

The monoclonal antibodies are specific to an antigen on the surface of liver cells.

Figure 9 shows part of the process used to create the monoclonal antibodies.

Figure 9



0 7 . 3 Name the **three** types of cell in **Figure 9**.

[3 marks]

A _____

B _____

C _____

4.6.2.5 Cloning (biology only)

Question 36 · continued

0 7 . 4 How is the mouse stimulated to produce cell type **A**?

[1 mark]

0 7 . 5 A patient with severe liver disease was given a liver transplant.

The drug containing the monoclonal antibody is given to the patient.

Explain how the monoclonal antibody stops the patient's white blood cells from attacking the cells of the donor liver.

[3 marks]

0 7 . 6 Give **one** other use of monoclonal antibodies.

Do **not** refer to pregnancy tests.

[1 mark]

Question 7 continues on the next page

The liver produces bile.

Bile is needed for efficient digestion.

0 7 . 7 Where is bile stored in the human body?

[1 mark]

Tick (✓) **one** box.

- Gall bladder ☐
- Kidney ☐
- Pancreas ☐
- Small intestine ☐

0 7 . 8 Explain why a person with severe liver disease has difficulty digesting fats.

[6 marks]

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