

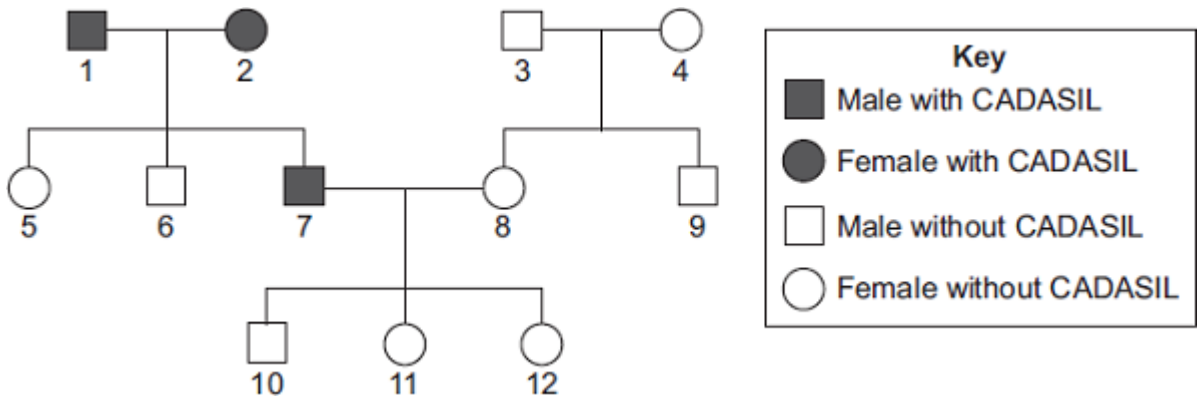
REPRODUCTION PART II

Q1.

CADASIL is an inherited disorder caused by a dominant allele.

CADASIL leads to weakening of blood vessels in the brain.

The diagram shows the inheritance of CADASIL in one family.



(a) CADASIL is caused by a *dominant allele*.

(i) What is a *dominant allele*?

(1)

(ii) What is the evidence in the diagram that CADASIL is caused by a dominant allele?

(1)

(iii) Person 7 has CADASIL.

Is person 7 homozygous or heterozygous for the CADASIL allele?

Give evidence for your answer from the diagram.

(1)

(b) Persons 7 and 8 are planning to have another baby.

Use a genetic diagram to find the probability that the new baby will develop into a person with CADASIL.

Use the following symbols to represent alleles.

D = allele for CADASIL

d = allele for not having CADASIL

Probability = _____

(4)

(c) Scientists are trying to develop a treatment for CADASIL using stem cells.

Specially treated stem cells would be injected into the damaged part of the brain.

(i) Why do the scientists use stem cells?

(2)

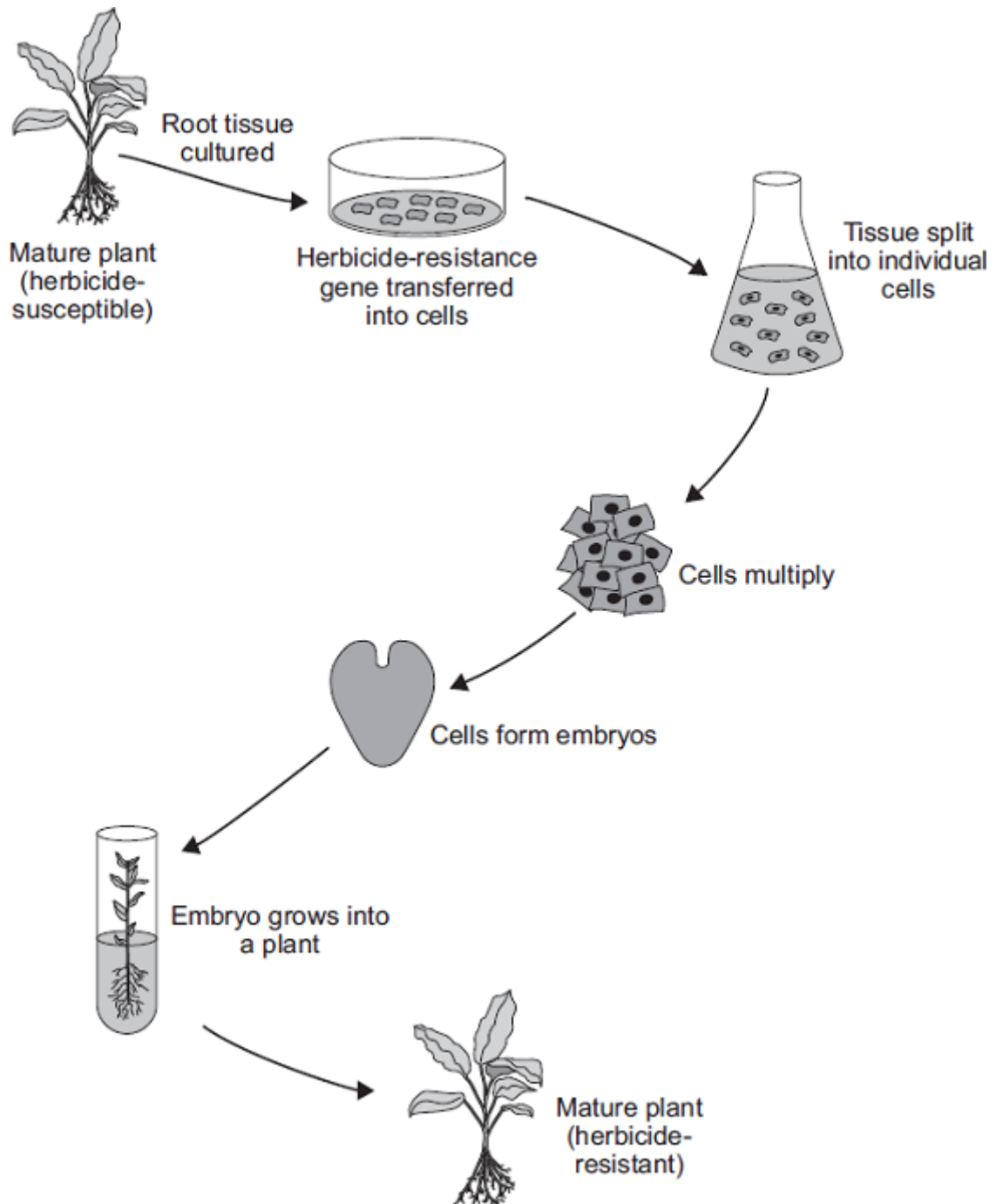
(ii) Embryonic stem cells can be obtained by removing a few cells from a human embryo. In 2006, scientists in Japan discovered how to change adult skin cells into stem cells. Suggest **one** advantage of using stem cells from adult skin cells.

(1)

(Total 10 marks)

Q2.

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



- (a) The herbicide-resistance gene is cut out of a chromosome of a herbicide-resistant plant.

How is the herbicide-resistance gene cut out of the chromosome?

(1)

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

Explain why.

(2)

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

(1)

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

Suggest **one** reason why.

(1)

(Total 5 marks)

Q3.

Humans reproduce sexually.

(a) Draw a ring around the correct answer to complete each sentence.

(i) At fertilisation

chromosomes
genes
gametes

 join together.

(1)

(ii) At fertilisation a single cell forms. The cell has new pairs of

chromosomes.
nuclei.
gametes.

(1)

(b) A child inherits cystic fibrosis. The child's parents do **not** have cystic fibrosis.

(i) What does this information tell us about the cystic fibrosis allele?

Tick (✓) **one** box.

The allele is dominant.

The allele is recessive.

The allele is strong.

(1)

(ii) How many copies of the cystic fibrosis allele does the child have?

Draw a ring around your answer.

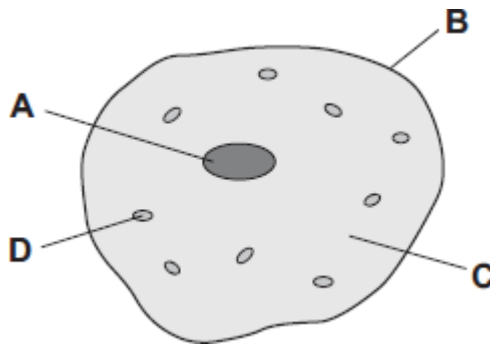
one

two

four

(1)

(c) The diagram shows a human body cell.



Which part of the cell, **A**, **B**, **C** or **D**:

(i) contains the allele for cystic fibrosis

(1)

(ii) is affected by cystic fibrosis?

(1)

(Total 6 marks)

Q4.

- (a) Mr and Mrs Smith both have a history of cystic fibrosis in their families. Neither of them has cystic fibrosis. Mr and Mrs Smith are concerned that they may have a child with cystic fibrosis.

Use a genetic diagram to show how they could have a child with cystic fibrosis.

Use the symbol **A** for the dominant allele and the symbol **a** for the recessive allele.

(3)

- (b) Mr and Mrs Smith decided to visit a genetic counsellor who discussed embryo screening.

Read the information which they received from the genetic counsellor.

- Five eggs will be removed from Mrs Smith's ovary while she is under an anaesthetic.
- The eggs will be fertilised in a dish using Mr Smith's sperm cells.
- The embryos will be grown in the dish until each embryo has about thirty cells.
- One cell will be removed from each embryo and tested for cystic fibrosis.
- A suitable embryo will be placed into Mrs Smith's uterus and she may become pregnant.
- Any unsuitable embryos will be destroyed.

- (i) Suggest why it is helpful to take five eggs from the ovary and not just one egg.

(1)

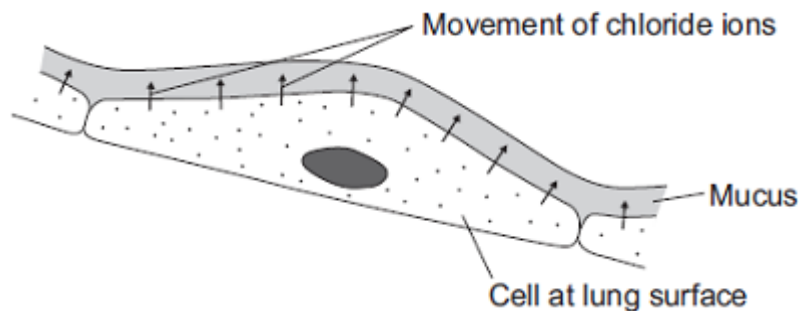
- (ii) Evaluate the use of embryo screening in this case.

Remember to give a conclusion to your evaluation.

(4)

(c) In someone who has cystic fibrosis the person's mucus becomes thick.

The diagram shows how, in a healthy person, cells at the lung surface move chloride ions into the mucus surrounding the air passages.



The movement of chloride ions causes water to pass out of the cells into the mucus.

Explain why.

(3)

(Total 11 marks)

Q5.

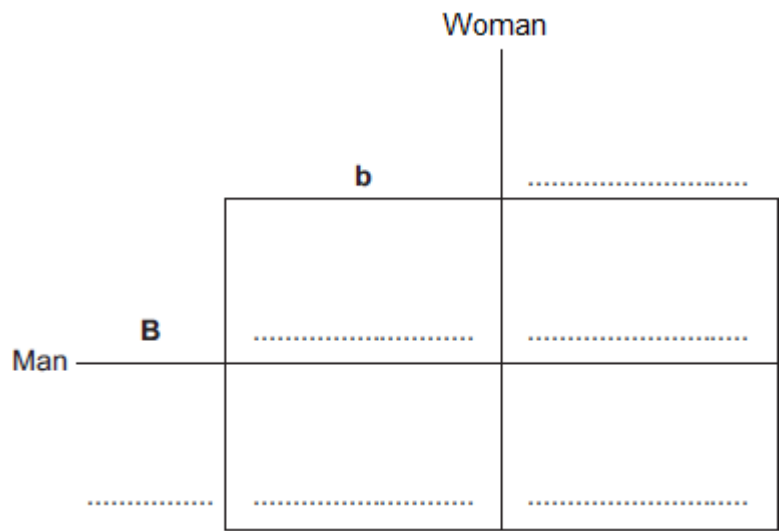
Eye colour is controlled by genes.

The dominant allele of the gene (**b**) produces brown eyes. The recessive allele (**b**) produces blue eyes.

A homozygous blue-eyed woman married a homozygous brown-eyed man.

All of their three children had brown eyes.

(a) (i) Complete the genetic diagram.



(2)

(ii) Give the reason why all of the children had brown eyes.

(1)

(b) The couple's brown-eyed son and his brown-eyed partner had five children. Two of the children had blue eyes and three of the children had brown eyes.

Use a genetic diagram to show how two of their children came to have blue eyes.

(3)

(Total 6 marks)

Q6.

The photographs show two breeds of cow.

Friesian cow



By Keith Weller/USDA (www.ars.usda.gov: Image Number K5176-3) [Public domain], via Wikimedia Commons

Jersey cow



By Jamain (Own work) [CC-BY-SA-3.0-2.5-2.0-1.0], via Wikimedia Commons

In parts (a) and (b) draw a ring around the correct answer to complete each sentence.

(a) Cows produce their young (calves) by

- | |
|-----------------------|
| asexual reproduction. |
| cloning. |
| sexual reproduction. |

(1)

(b) Cows and their calves have many similar characteristics.

(i) The information for characteristics is carried by

- | |
|----------|
| clones. |
| embryos. |
| genes |

(1)

(ii) The information for characteristics is passed to the next generation in cells

called

- | |
|-------------|
| body cells. |
| gametes. |
| neurones. |

(1)

(c) Friesian and Jersey cows can both be used for meat or to produce milk.

The information shows features of Friesian and Jersey cows.

Friesian cows	Jersey cows
Body mass up to 600 kg	Body mass up to 400 kg
Milk contains 3.4% protein	Milk contains 3.8% protein

Can be milked for 325 days after giving birth	Can be milked for 250 days after giving birth
Produce no milk for 55 days before having a calf	Produce no milk for 45 days before having a calf
Produce > 30 litres of milk per day	Produce < 30 litres of milk per day

Use **only** the information above to answer these questions.

In your answers you must make comparisons between the two breeds of cow.

- (i) Give **two** advantages of a farmer keeping Friesian cows and **not** Jersey cows.

1. _____

2. _____

(2)

- (ii) Give **two** advantages of a farmer keeping Jersey cows and **not** Friesian cows.

1. _____

2. _____

(2)

- (d) Cow's milk is different from human milk. Cow's milk should **not** be given to young human babies.

Scientists in China have *genetically engineered* cows to produce human milk. Milk from these cows can be fed to young human babies.

- (i) What is *genetic engineering* ?

Tick (✓) **one** box.

Genes from one organism are transferred to a different organism

Cells are separated from an embryo and are transferred to host mothers

The nucleus from a body cell is transferred to an egg cell

(1)

- (ii) Some people are worried about using milk from genetically engineered cows, to feed human babies.

Give **one** reason why.

(1)

(Total 9 marks)

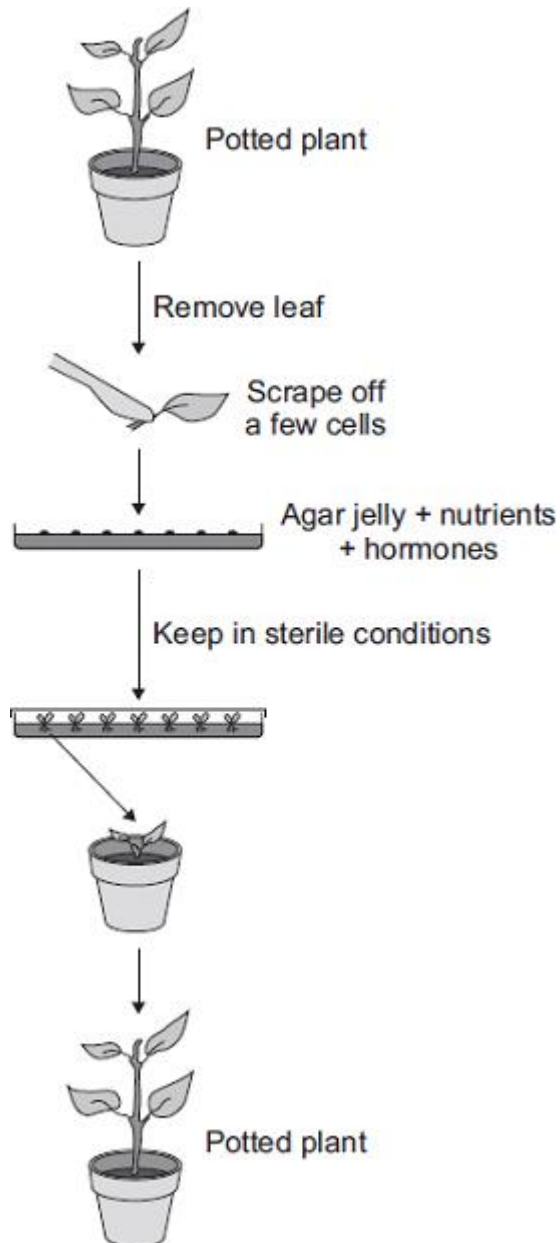
Q7.

Plant hormones are used in horticulture.

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

(1)

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



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

Give the main features of *asexual reproduction* .

(3)

(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)

(Total 5 marks)

Q8.

(a) (i) Mitosis and meiosis are types of cell division.

For each feature in the table, tick (✓) **one** box to show if the feature occurs:

- only in mitosis
- only in meiosis.

Feature	Only in mitosis (✓)	Only in meiosis (✓)
Produces new cells during growth and repair		
Produces gametes (sex cells)		
Produces genetically identical cells		

(2)

(ii) Name the organ that produces gametes (sex cells) in:

a man _____

a woman _____

(2)

(b) **X** and **Y** chromosomes are the sex chromosomes. They determine a person's sex.

What sex chromosomes will be found in the body cells of:

(i) a man _____

(1)

(ii) a woman? _____

(1)

(c) A man and a woman decide to have a child.

What is the chance that the child will be a boy? _____

(1)

(Total 7 marks)

Q9.

Polydactyly is an inherited condition. Polydactyly is controlled by a dominant allele.

The photograph shows the foot of a baby with polydactyly.

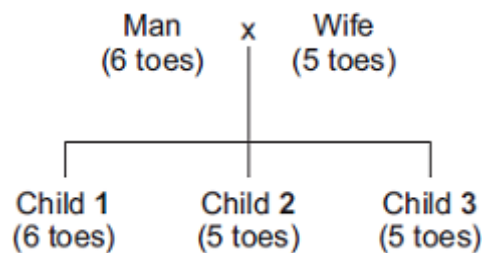


CNRI/Science photo library

A man and his wife have three children. The man has polydactyly.

The diagram shows the inheritance of polydactyly in this family.

The diagram also shows the number of toes each person has on each foot.



In the rest of this question, the following symbols are used to represent alleles.

D = allele for polydactyly (6 toes on each foot)

d = allele for 5 toes on each foot

(a) (i) How many alleles for the number of toes will there be in **one** sperm cell?

(1)

(ii) Complete the sentence.

A sperm cell joins with an egg cell in a process called

(1)

(b) (i) What combination of alleles does the man have?

Tick (✓) **one** box.

DD

Dd

dd

(1)

(ii) What combination of alleles does the man's wife have?

Tick (✓) **one** box.

DD

Dd

dd

(1)

(c) Draw a ring around the correct answer to complete each sentence.

(i) The man and his wife plan to have a fourth child.

The probability that this child will have 6 toes on each foot is

1 in 2.

1 in 3.

1 in 4.

(1)

(ii) When Child **2** grows up, he marries a woman with 5 toes on each foot.

The probability that their first child will have 6 toes on each foot is

1 in 2.

1 in 4.

(1)

(Total 6 marks)

Q10.

A certain gene codes for the production of an enzyme called 'HEXA'.

One human genetic disorder causes damage to nerve cells in the brain.

This disorder is caused by a small change in the DNA of the HEXA gene.

People with this disorder make a changed HEXA enzyme that does not work.

- (a) Explain how a change in the DNA of the HEXA gene can result in the production of a changed HEXA enzyme that does not work.

(3)

- (b) The gene coding for the HEXA enzyme is found on chromosome number 15.

- (i) How many chromosomes are there in the nucleus of a human nerve cell?

(1)

- (ii) A boy had the changed HEXA gene on the chromosome number 15 that he inherited from his father.

The changed HEXA gene coded for a HEXA enzyme that does not work.

The boy did **not** develop the genetic disorder.

Explain why the boy did **not** develop the genetic disorder.

(2)

- (iii) The boy grew up and got married.

A blood test showed that his wife had also inherited the same changed HEXA gene.

There is a 1 in 4 chance that this couple's first child will have the genetic

disorder.

Use a genetic diagram to explain why.

Use the following symbols in your explanation:

H = allele for making the normal HEXA enzyme

h = allele for making a HEXA enzyme that does not work.

(3)

(Total 9 marks)

Q11.

The photographs show the flowers of two closely-related species of plant.

Species A Species B



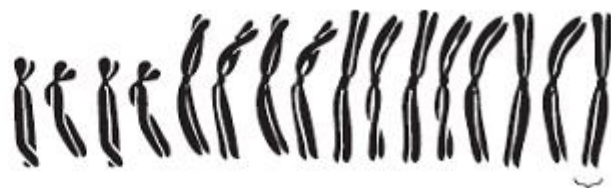
Images: © iStock/Thinkstock

The drawings show chromosomes from one cell in the root of each plant during cell division.

Species A Species B



**One
chromosome**



**One
chromosome**

(a) The drawings show that each chromosome has two strands of genetic material.

(i) How does a chromosome become two strands?

(1)

(ii) Explain why each chromosome must become two strands before the cell divides.

(2)

(b) For sexual reproduction, the plants produce gametes.

(i) Name the type of cell division that produces gametes. _____

(1)

(ii) How many chromosomes would there be in a gamete from each of these two plant species?

Species A **Species B**

(1)

(iii) It is possible for gametes from **Species A** to combine with gametes from **Species B** to produce healthy offspring plants. How many chromosomes would there be in each cell of one of the offspring plants?

(1)

(c) (i) Look back at the information at the start of the question and the information from part (b).

What evidence from these two pieces of information supports the belief that **Species A** and **Species B** evolved from a common ancestor?

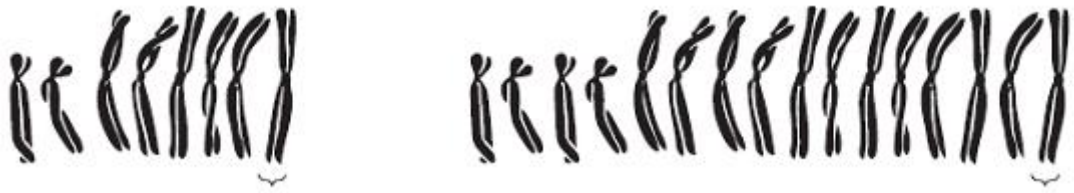
(2)

(ii) For successful gamete production to take place, chromosomes that contain the same genes must pair up.

The drawings showing the chromosomes of **Species A** and of **Species B** are

repeated below.

Species A Species B



The offspring plants cannot reproduce sexually.

Suggest an explanation for this.

(2)

(Total 10 marks)

Q12.

The photograph shows a zorse.



By Kumana @ Wild Equines [CC-BY-2.0], via Wikimedia Commons

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

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

(i) What is *sexual reproduction*?

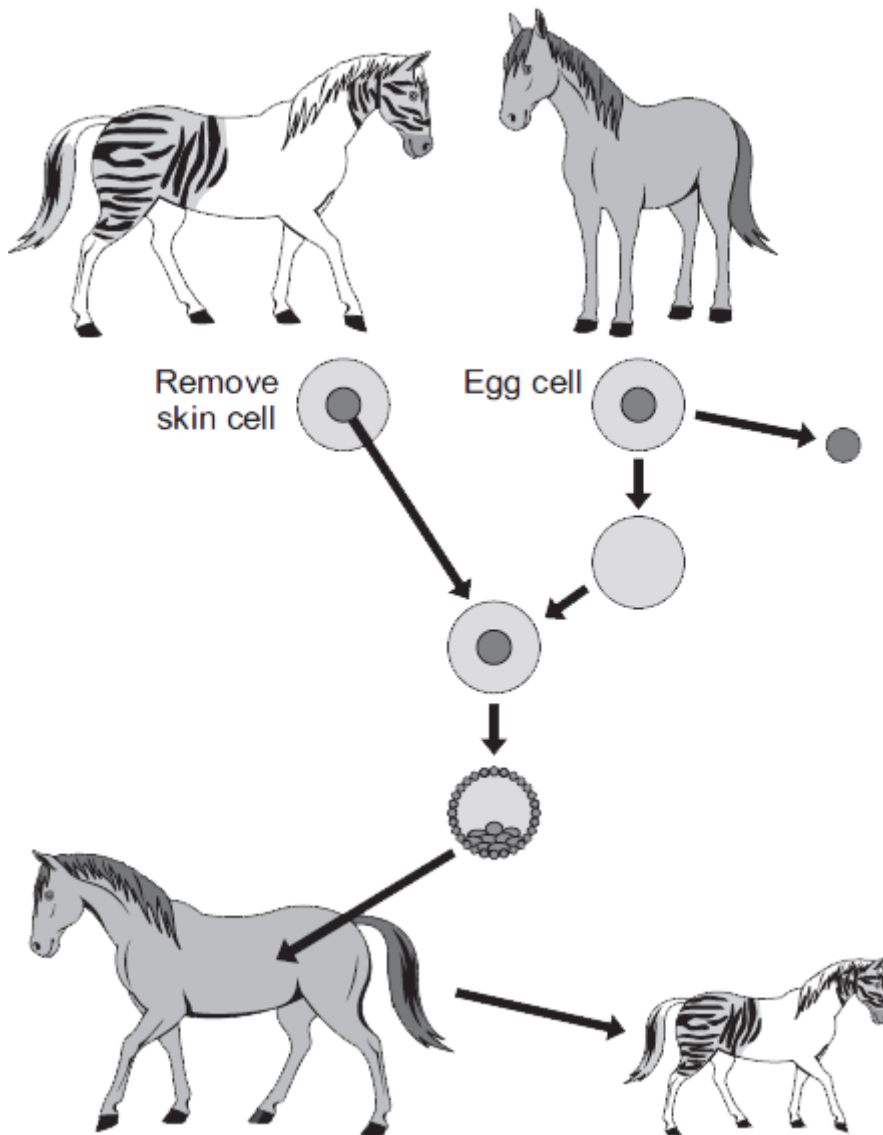
(1)

- (ii) The zorse has characteristics of a zebra and a horse.
Why?

(2)

- (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.



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

- (a) Scientists believe that a change in a gene suddenly occurred to make some males resistant to the bacteria.

What scientific term describes a change in a gene?

(1)

- (b) The numbers of male Blue-moon butterflies in the population increased quickly after the new form of the gene had appeared.

Suggest why.

(4)

(Total 5 marks)

Q14.

Kangaroos have brown coats. The two parent kangaroos in the photograph produced a baby kangaroo with a white coat.



Photographs supplied by iStockphoto/Thinkstock

- (a) Use words from the box to complete the sentences.

asexual	characteristic	chromosome
mutation	nucleus	sexual

The baby kangaroo was produced by _____ reproduction.

The coat colour of the adult kangaroo is a _____

The different coat colour of the baby kangaroo is the result of a

_____ of a gene.

The gene is found on a thread-like structure called a _____

(4)

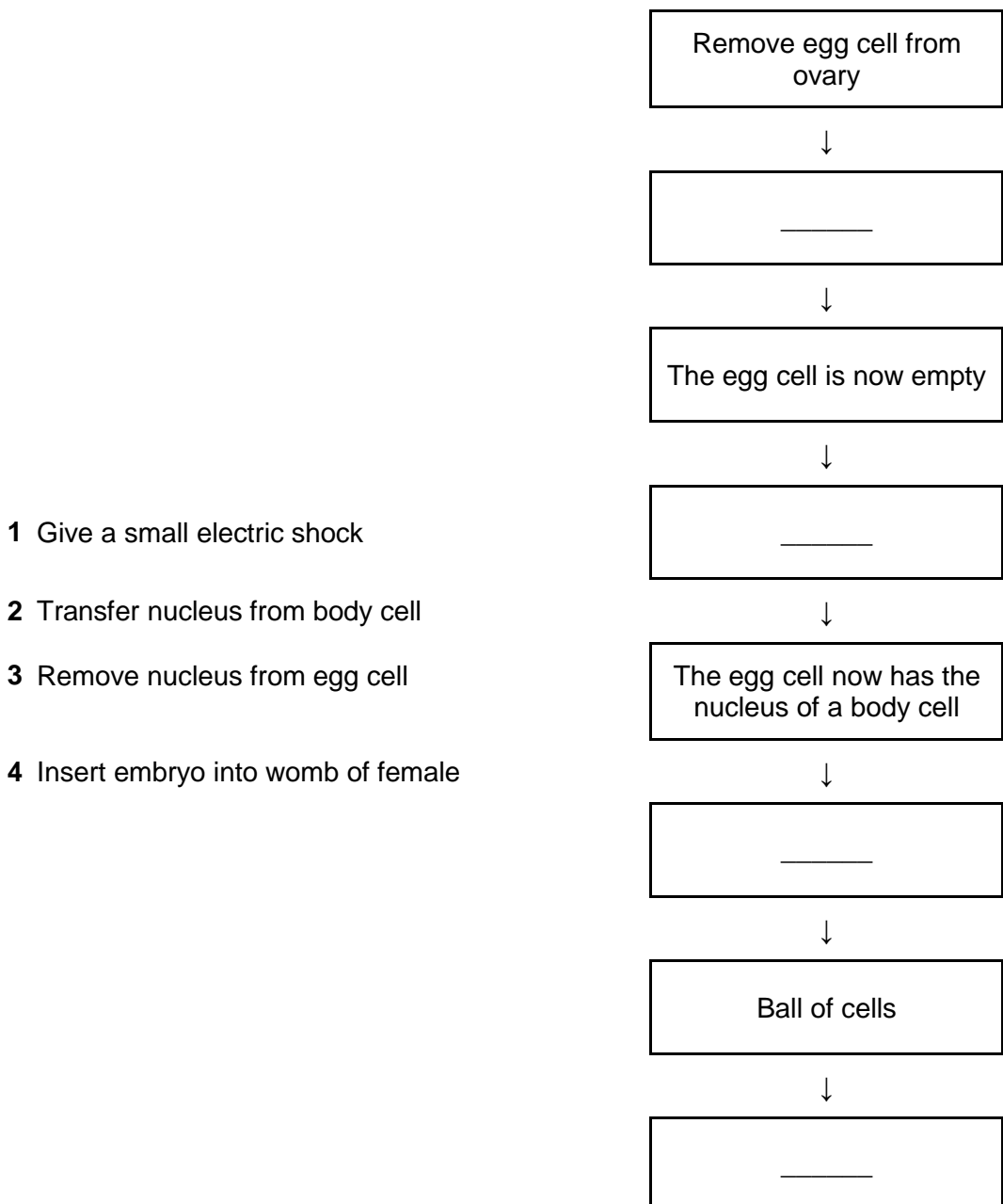
(b) Some animals similar to kangaroos are endangered species.

Cloning is one way of making sure that endangered species do not die out.
The flowchart below shows one way of cloning an animal.

The four statements needed to complete the flowchart are numbered **1**, **2**, **3** and **4**.

Complete the flow chart by writing the **number** of the correct statement in the empty box.

Each number should be used **once** only.





Cloned animal

(3)

(Total 7 marks)

Q15.

- (a) Animal breeders use sexual reproduction to produce new strains of animals.

How does sexual reproduction produce variation?

(2)

- (b) A salmon is a type of fish.

Scientists have created a GM (genetically modified) 'super' salmon.

The scientists transferred a gene from a fish called a pout into a salmon. The gene increases the secretion of growth hormone in the salmon. The GM salmon grows much faster than an ordinary salmon, reaching market size up to one year earlier. Many more GM salmon will be grown in fish farms.

- (i) Describe how a gene can be transferred from a pout into a salmon.

(3)

- (ii) The government might not allow the production of GM salmon.

Suggest **one** reason why.

(1)

(Total 6 marks)

