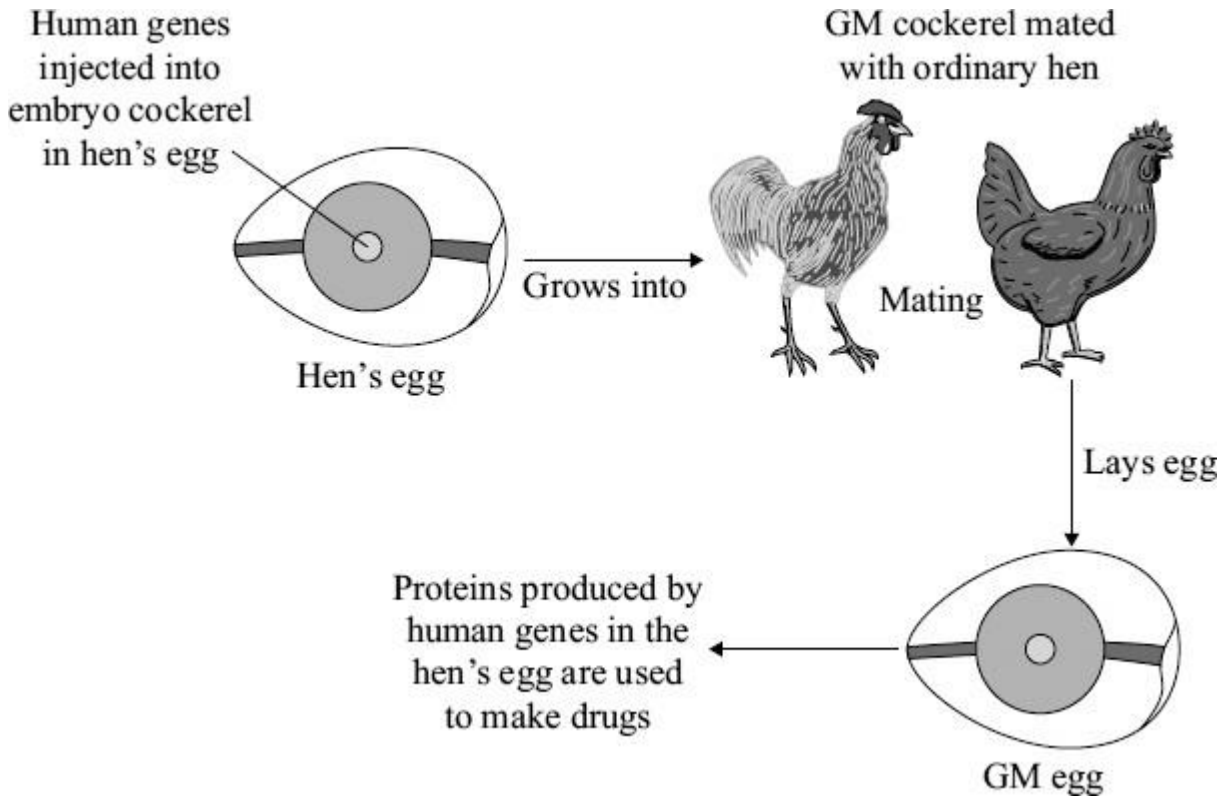
1 Scientists have discovered how to produce genetically modified (GM) hens' eggs.

Some proteins produced in GM eggs can be used as drugs to treat humans.

The diagram shows how this is done.



(a) Which type of reproduction is involved when the cockerel mates with the hen?

Tick (✓) **one** box.

Asexual ☐

Cloning ☐

Sexual ☐

(1)

(b) From which part of a human are the genes cut?

Tick (✓) **one** box.

Chromosome ☐

Embryo ☐

Glands ☐

(1)

(c) Read the information about genetically modified animals.

- GM animals might escape and breed with wild animals.
- Genetic modification can produce fast-growing animals for food.
- Genetic modification can be used to clone animals in danger of extinction.
- Using GM animals can reduce the number of animals used in medical research.
- Animals have the right to be free from genetic modification.

Use **only** this information to answer these questions.

(i) Give **two** reasons why many people are in favour of genetically modified animals.

1. _____

2. _____

(2)

(ii) Give **two** reasons why many people are against genetically modified animals.

1. _____

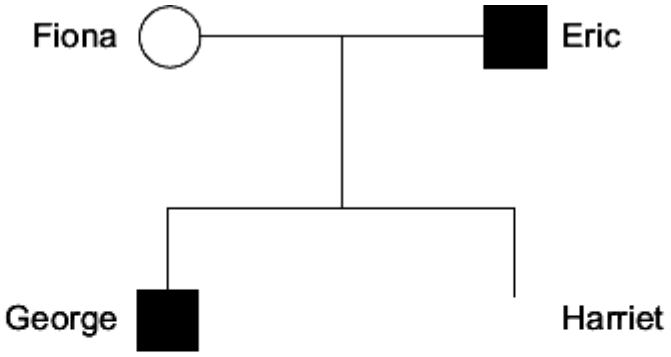
2. _____

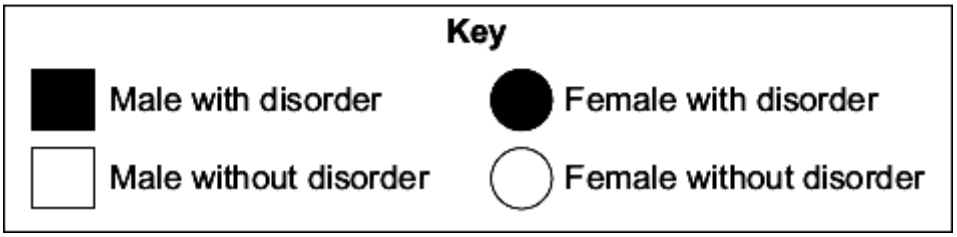
(2)

(Total 6 marks)

2 The family tree shows the inheritance of a disorder caused by a dominant allele.

Fiona and Eric have two children George and Harriet.





(a) The son, George, has the disorder.

The daughter, Harriet, does **not** have the disorder.

(i) Use the key to draw the symbol for Harriet next to her name **on the family tree**.

(2)

(ii) The symbol **D** represents the dominant allele for the disorder.
The symbol **d** represents the recessive allele.

Fiona has the pair of alleles **dd**.

Write the correct pairs of alleles in the boxes.

Harriet has the pair of alleles ☐

A person with the disorder could have

the pair of alleles ☐ or the pair of alleles ☐

(3)

(b) Before Harriet was born, a doctor suggested that Fiona should have the embryo 'screened'.

(i) Give **one** reason why the doctor suggested screening.

Tick (✓) **one** box.

To check for the **D** allele ☐

To check the sex of the embryo ☐

To cure the disorder ☐

(1)

(ii) Why do some people believe that embryos should **not** be screened?

_____

_____

(1)

(Total 7 marks)

3 (a) Human body cells contain 46 chromosomes.

(i) How many chromosomes are there in a human sperm cell? ☐

(1)

(ii) Name the part of the sperm cell that contains the chromosomes.

_____

(1)

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

(i) In human females, the sex chromosomes are

X and **X**.

X and **Y**.

Y and **Y**.

(1)

(ii) In human males, the sex chromosomes are

X and **X**.
X and **Y**.
Y and **Y**.

(1)

(c) A man might release 300 million sperm cells at a time.

How many of these sperm cells would contain an **X** chromosome?

_____

(1)

(Total 5 marks)

4 Humans reproduce sexually.

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

(a) (i) At fertilisation

chromosomes
genes
sex cells

join together.

(1)

(ii) At fertilisation a single cell forms, which has new pairs of

chromosomes.
nuclei.
sex cells.

(1)

(b) Cystic fibrosis can be inherited by children whose parents do not have it.

(i) A person who has cystic fibrosis has

two
three
four

copies of the

cystic fibrosis allele.

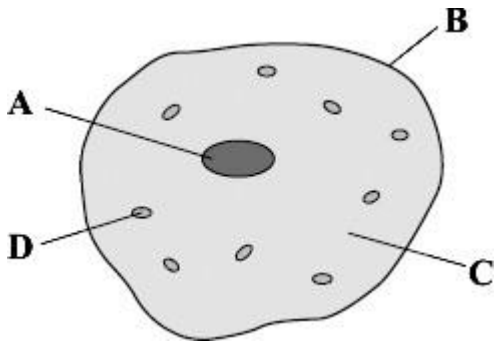
(1)

(ii) The cystic fibrosis allele is

large.
recessive.
strong.

(1)

(c) The diagram shows a human body cell.



Choose the correct answer from the box to complete each sentence.

cell membrane	**cell wall**	**cytoplasm**	**nucleus**

(i) The part of the cell labelled **B** is the _____

(1)

(ii) The part of the cell labelled **C** is the _____

(1)

(d) 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 8 marks)

5 The diagram shows a strawberry plant.

The parent plant grows side shoots.

New plants grow on the side shoots.

The new plants will all have the same inherited characteristics as the original parent plant.

Complete the sentences to explain why.

Use words from the box.

asexual	**differentiation**	**embryos**	**fertilisation**
gametes	**genes**	**mitosis**	**sexual**

(a) The new plant is produced by _____ reproduction.

(1)

(b) In this type of reproduction, body cells divide by _____

(1)

(c) The new plant has the same _____ as the parent plant.

(1)

(Total 3 marks)

6 Soay sheep live wild on an island off the north coast of Scotland. No people live on the island.

By Owen Jones = Jonesor [CC-BY-SA-2.5], via Wikimedia Commons

Over the last 25 years, the average height and mass of the wild Soay sheep have decreased.

The scientists think that climate change might have affected the size of the sheep.

(a) More Soay sheep are now able to survive winter than 25 years ago.

What change in the climate may have helped more Soay sheep to survive winters?

_____

_____

(1)

(b) Complete the sentences.

(i) Soay sheep show variation in size because of differences in their

_____

(1)

(ii) The change in the size of the Soay sheep over 25 years can be explained by Darwin's

theory of _____

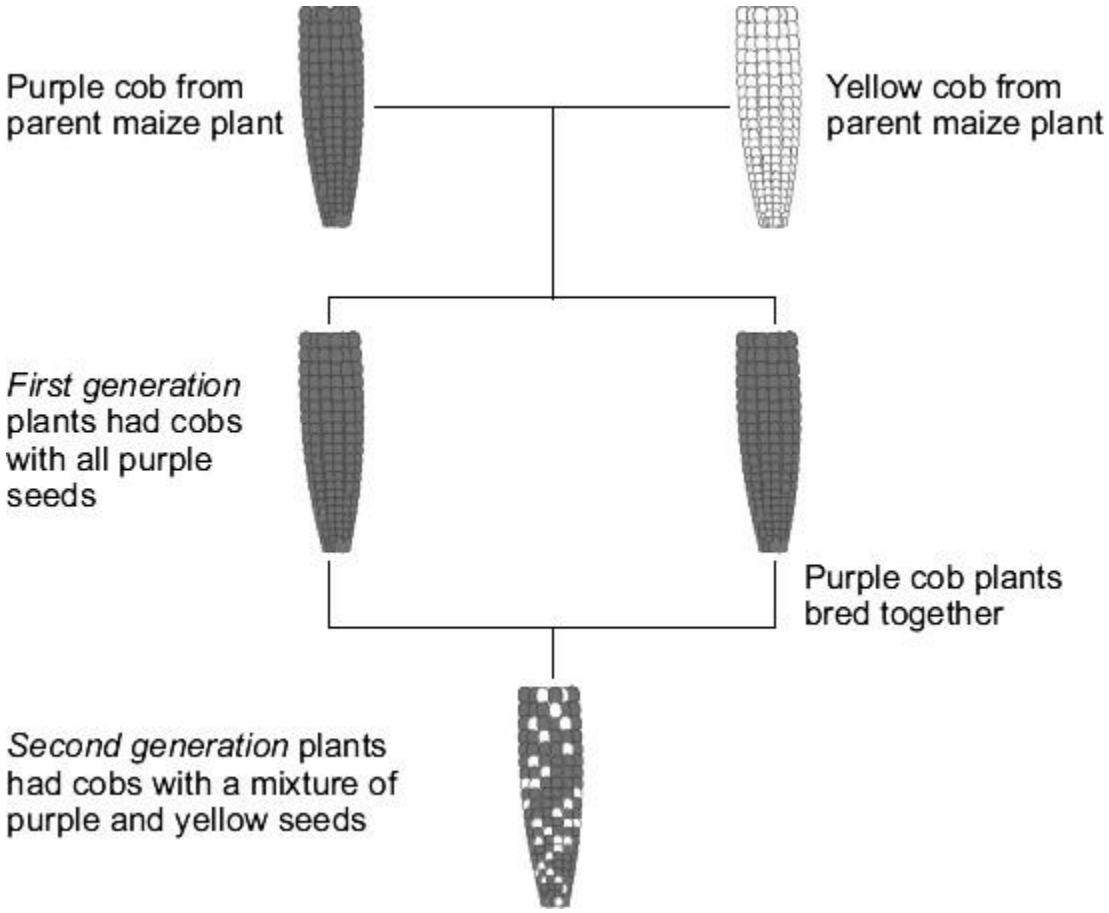
(1)

(Total 3 marks)

7 Maize plants reproduce sexually to form maize cobs.
Each maize cob has many seeds.

The colour of the seeds is controlled by a gene.
The gene has two alleles, purple and yellow.

The diagram shows the cobs produced by breeding maize plants.



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

dominant	**environmental**	**recessive**

(i) The first generation plants show that the purple allele is

_____

(1)

(ii) The second generation plants show that the yellow allele is

_____

(1)

(b) The allele for purple can be represented by the letter **A**.
The allele for yellow can be represented by the letter **a**.

(i) What alleles does a yellow seed have?

Draw a ring around **one** answer.

AA **Aa** **aa**

(1)

(ii) What alleles does a purple seed from a *first* generation plant have?

Draw a ring around **one** answer.

AA **Aa** **aa**

(1)

(c) The drawing shows a cob from one of the *second generation* plants.

A student counted 334 purple seeds and 110 yellow seeds on this maize cob.

What is the approximate ratio of purple seeds to yellow seeds on the cob?

Tick (✓) **one** box.

3 purple : 1 yellow ☐

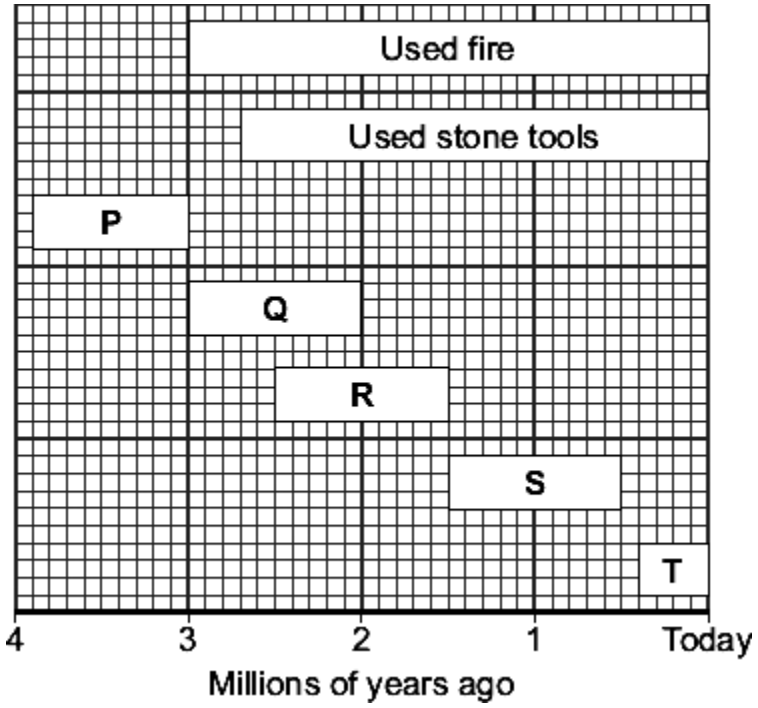
1 purple : 3 yellow ☐

1 purple : 1 yellow ☐

(1)

(Total 5 marks)

8 The diagram shows a time line for the evolution of humans.



The letters **P**, **Q**, **R** and **S** show human ancestors.
The letter **T** shows modern humans.

(a) (i) How many millions of years ago did humans first use fire?

☐ millions of years ago

(1)

(ii) Which human ancestor, **P**, **Q**, **R** or **S**, was the first ancestor to use tools?

(1)

(iii) For how many millions of years did human ancestor **R** live on Earth?

(1)

(b) How do we know that human ancestors **P**, **Q**, **R** and **S** lived on Earth?

_____

_____

(1)

(c) Which scientist suggested that humans have evolved from ape-like ancestors?

Draw a ring around **one** answer.

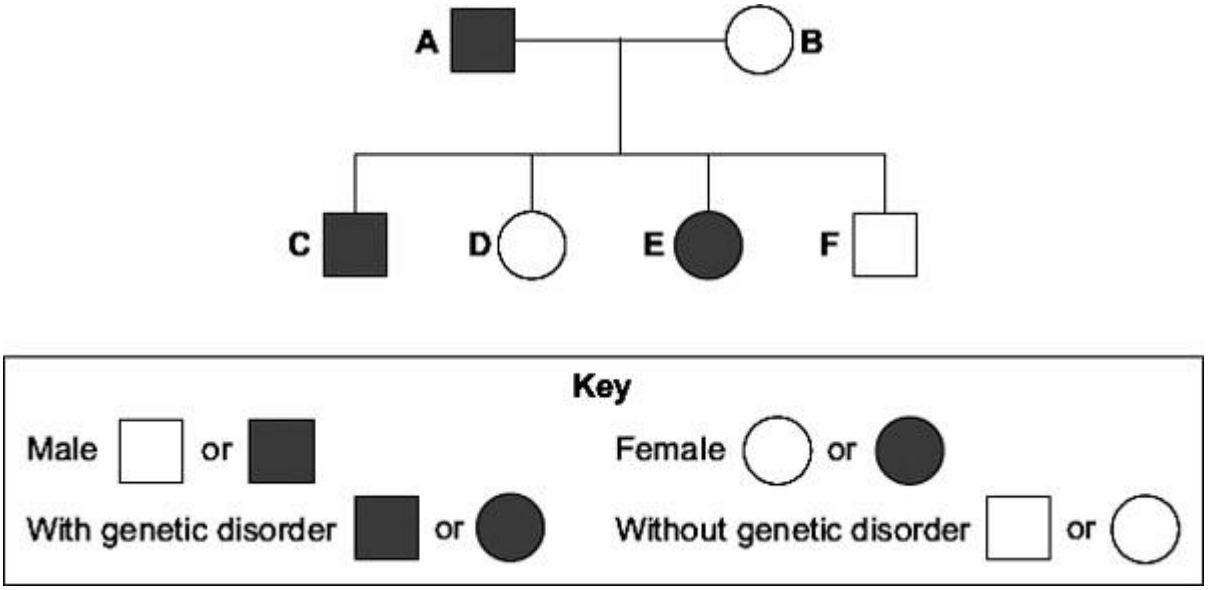
Darwin **Mendel** **Semmelweiss**

(1)

(Total 5 marks)

9 The diagram shows the family tree of a pair of pigs, **A** and **B**.
Pigs **A** and **B** have four offspring, **C**, **D**, **E** and **F**.

Some of the pigs have a genetic disorder.



(a) Which pig, **A**, **B**, **C**, **D**, **E** or **F**, is:

(i) a male pig with the genetic disorder

(1)

(ii) a female pig without the genetic disorder?

(1)

(b) Draw a ring around the correct answer to complete the sentences.

Pig **C** has the genetic disorder.

(i) Pig **C** inherited the genetic disorder from

pig **A**.

pig **B**.

pig **E**.

(1)

(ii) The gene for the genetic disorder was passed on in

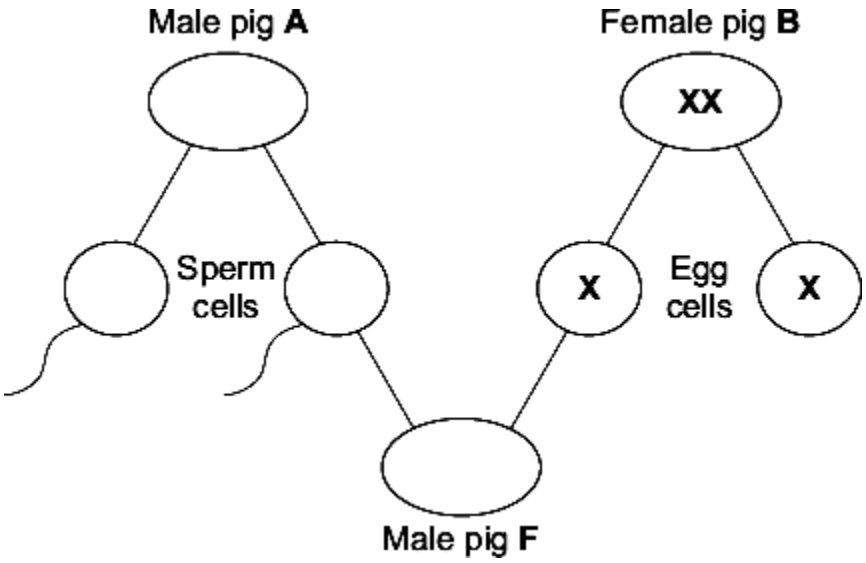
an embryo.
an enzyme.
a gamete.

(1)

(c) Pig **F** is a male.

Complete the diagram to show how the sex of pig **F** depends on the inheritance of the sex chromosomes **X** and **Y**.

The sex chromosomes of pig **B** and the egg cells have been completed for you.



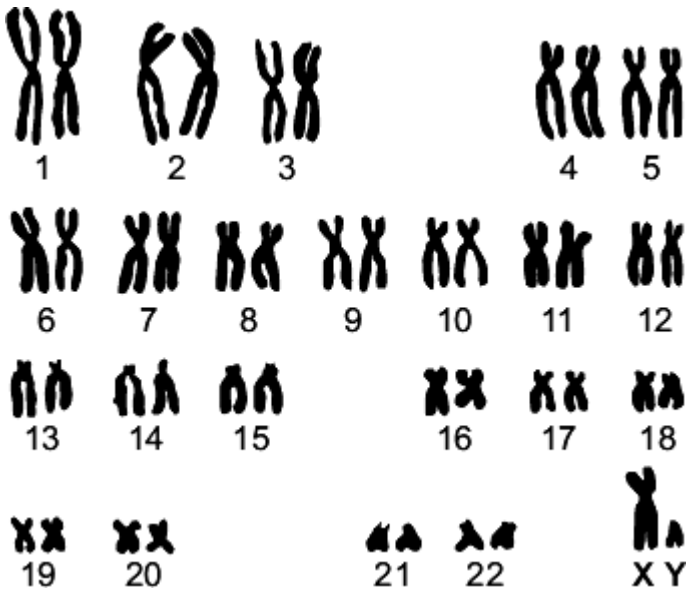
(3)

(Total 7 marks)

10 When scientists look at dividing cells under a microscope, they can see strands that contain a chemical called DNA.

A photograph of these strands can be cut up and re-arranged.

The diagram shows an arrangement of the strands from a human cell.



(a) What name is given to the strands containing DNA shown in the diagram?

Draw a ring around **one** answer.

alleles **chromosomes** **genes**

(1)

(b) Look carefully at the diagram.

(i) The cell was taken from a man and not from a woman.

How can you tell?

_____

(1)

(ii) What evidence is there that the strands are from a body cell, and not from a gamete?

Tick (✓) **one** box.

The strands are arranged in order of size.	☐
The strands are in pairs.	☐
Gametes are made in the testes and ovaries.	☐

(1)

(iii) When a human cell is not dividing the strands containing DNA are **not** clearly visible.

Draw a ring around the correct answer to complete the sentence.

In a human cell, the DNA is normally found in the

cell membrane.
cytoplasm.
nucleus.

(1)
(Total 4 marks)

11 Cystic fibrosis is an inherited disorder.

Mr and Mrs Brown do **not** have cystic fibrosis but they have a child with cystic fibrosis.

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

(i) The allele for cystic fibrosis is a

carrier allele.
dominant allele.
recessive allele.

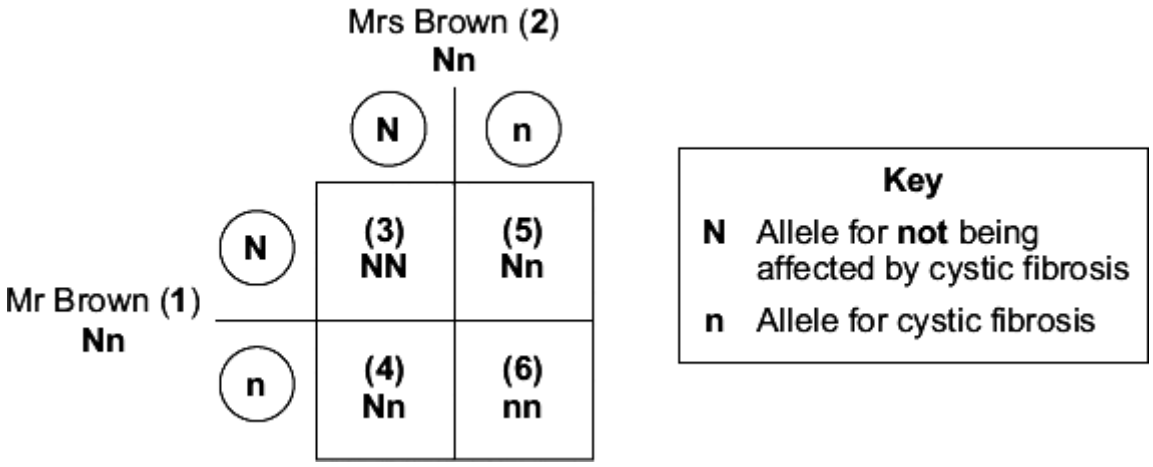
(1)

(ii) Mr and Mrs Brown are both

carriers.
immune.
infected.

(1)

(b) The diagram shows how the allele for cystic fibrosis can be inherited by Mr and Mrs Brown's children.



(i) Give the number of **one** person in the diagram who has cystic fibrosis. ☐

(1)

(ii) The chance that Mr and Mrs Brown's next child will have cystic fibrosis is

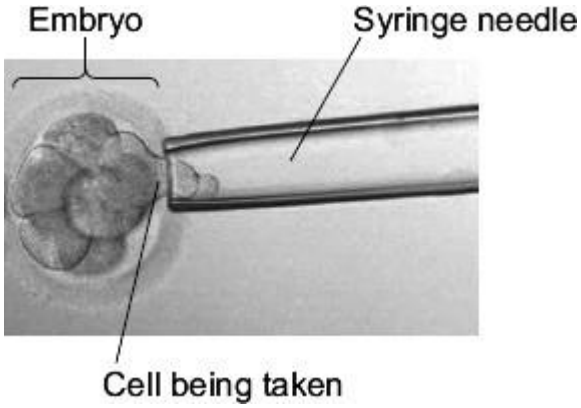
_____

(1)

(c) A genetic counsellor describes to Mr and Mrs Brown one way of screening embryos for cystic fibrosis.

- Some eggs are collected from Mrs Brown.
- The eggs are then fertilised in a dish.
- Several embryos may start to develop.

The photograph shows how doctors take one cell from each embryo when it is only 3 days old.



- The DNA in the cell from each embryo is tested for cystic fibrosis.
- Doctors select one embryo that is unaffected and place it in Mrs Brown's uterus.
- The embryo then develops into a baby.

Use the information to suggest **one** advantage and **one** disadvantage of screening embryos in this way.

Advantage _____

_____

Disadvantage _____

_____

(2)

(Total 6 marks)

Mark schemes

1 (a) sexual

1

(b) chromosome

1

(c) (i) any **two** from:

ignore answers that do not relate to list

- genetic-engineering can produce fast-growing food animals
- genetic engineering can be used to clone animals in danger of extinction
- using GM animals can reduce the number of animals used in medical research

2

(ii) GM animals might escape and breed with wild animals

ignore answers that do not relate to list

1

animals have the right to be free from genetic modification

1

[6]

2 (a) (i) circle

mark independently

1

unshaded

could be in body of script

1

(ii) (Harriet) dd

in first box

1

DD

if another letter is chosen it must be used throughout and upper or lower case must be clear

1

Dd

1

(b) (i) to check for the D allele.

1

(ii) any **one** from:

- may harm / kill foetus / embryo / baby / mother
  allow could affect the baby
- immoral / unethical / religion
  ignore playing God
  ignore references to unnatural
  ignore wrong unqualified
  ignore expense / prejudice unqualified
  ignore lack of permission
  ignore results are unreliable

1

[7]

3 (a) (i) 23

1

(ii) nucleus / 'the head'
allow phonetic spelling

1

(b) (i) **X** and **X**

1

(ii) **X** and **Y**

1

(c) 150 million / 150,000,000 / half (of them) / 50% / 1 in 2

1

[5]

4 (a) (i) sex cells

1

(ii) chromosomes

1

(b) (i) two

1

(ii) recessive

1

(c) (i) cell membrane
allow membrane

1

(ii) cytoplasm

1

(d) (i) A

1

(ii) B

1

[8]

5 (a) asexual

1

(b) mitosis

1

(c) genes

1

[3]

6 (a) warmer / dryer

allow greenhouse effect / global warming

ignore wind

1

(b) (i) genes / alleles / chromosomes / DNA / genetic material / genetics

allow inheritance

allow nutrition / food / metabolism / growth <u>rate</u>

ignore environment

1

(ii) natural selection / evolution

allow survival of the fittest

1

[3]

7 (a) (i) dominant

allow clear indication

1

(ii) recessive

allow clear indication

1

(b) (i) aa

extra ring drawn cancels the mark

1

(ii) Aa

extra ring drawn cancels the mark

1

(c) 3 purple : 1 yellow

extra box ticked cancels the mark

1

[5]

8 (a) (i) 3

1

(ii) Q

1

(iii) 1

1

(b) from fossils / bones

allow artefacts / named artefacts / drawings / evidence of fires

1

(c) Darwin

1

[5]

9 (a) (i) any **one** from:

- A
- C

1

(ii) any **one** from:

- B
- D

1

(b) (i) pig A

1

(ii) a gamete

1

(c) XY **or** YX

1

X Y

1

XY **or** YX

in this order only

1

[7]

10 (a) chromosomes

1

(b) (i) has XY / Y

allow female would be XX / has no Y

1

(ii) The strands are in pairs

1

(iii) nucleus

1

[4]

11 (a) (i) recessive allele

1

(ii) carriers

1

(b) (i) 6

allow nn

1

(ii) 1 in 4 / 0.25 / ¼ / 25 % / 1:3

*do **not** accept '3:1' / 1:4 / 1 in 3 / 25*

1

(c) **advantage:**

detect CF qualified – eg at early stage / before becoming pregnant **or** (only) healthy children produced

allow 'after only 3 days'

allow reduces health care costs

1

disadvantage:

some embryos are destroyed / may damage embryo

allow increased risk of miscarriage
ignore not natural
ignore cost

1

[6]