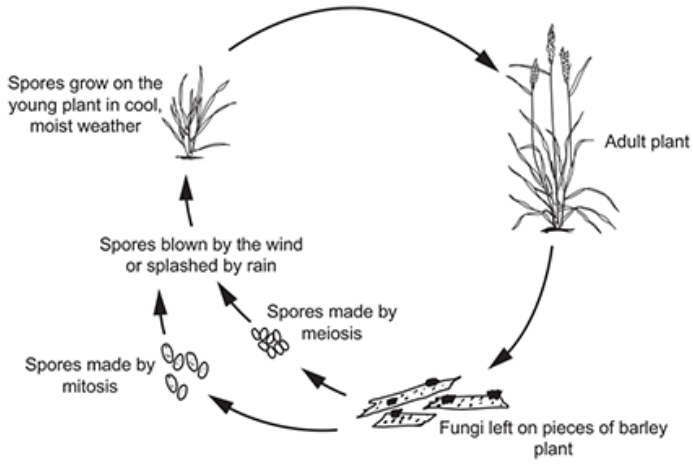
1. Diseases in plants are caused by different types of pathogens.

Barley plants are infected by a fungus that causes powdery mildew.

The diagram shows the life cycle of the fungus.



i. Rainy weather in the spring causes **more** barley plants to be infected with powdery mildew.

Suggest **two** reasons why. Use the diagram.

1 _____

_____

2 _____

[2]

ii. The fungus reproduces using spores.

Which type of reproduction uses meiosis to make spores?

[1]

iii. Farmers make sure that they clear all the dead barley plants from their fields in the autumn.

Explain why.

_____

_____

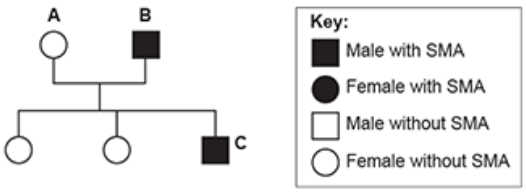
_____

[2]

2. Spinal muscular atrophy (SMA) is a genetic disease.

The diagram shows a family tree which contains some people with SMA.

SMA is caused by a recessive allele.



i. Use the key to give the phenotype of person **A**.

[1]

ii. Which term describes the genotype of person **B**?

Tick (✓) **one** box.

Heterozygous ☐

Homozygous dominant ☐

Homozygous recessive ☐

[1]

iii. People that have SMA cannot produce a protein that is needed for their motor neurones to function.

Explain why person **C** has difficulty moving their legs.

[3]

3. Which sex chromosomes are found in human egg cells?

A All egg cells have one **X** chromosome.
B All egg cells have one **Y** chromosome.
C All egg cells have two **X** chromosomes.
D Egg cells have either an **X** chromosome or a **Y** chromosome.

Your answer ☐ **[1]**

4. Mendel discovered some of the principles of genetics.

He crossed tall pea plants with short pea plants.

All the offspring were **tall**.

How did Mendel explain this result?

A Offspring are always taller than the parent plant.
B Several genes control the height of the pea plants.
C The height of the pea plants is a mixture of tall and short.
D The instructions for short pea plants are recessive so do not show.

Your answer ☐ **[1]**

5. Many plants can reproduce either asexually or sexually.

What is a feature of **sexual** reproduction?

A All the offspring are better adapted to the environment.
B More offspring are produced.
C Reproduction is faster.
D The offspring show variation.

Your answer ☐ **[1]**

6. Cystic fibrosis is caused by a recessive allele (f).

The diagram shows a genetic cross.

		Parent 1	
		F	f
Parent 2	f	Ff	ff
	f	Ff	ff

Which percentage of the offspring have cystic fibrosis?

A 25%
B 50%
C 75%
D 100%

Your answer ☐ **[1]**

7. Duckweed is a small plant that floats on the surface of ponds.

Each plant has one leaf and it usually reproduces by dividing into two.

Only occasionally does it reproduce sexually by growing flowers.

In the box next to each statement, put **A** if it applies to asexual reproduction or **S** if it applies to sexual reproduction.

It is a quicker process. ☐

It introduces variation into the population. ☐

[1]

8(a). Sorghum is a crop plant grown in Africa for its seeds as shown in **Fig. 16.1**.

Fig. 16.1

Sorghum produces a bitter chemical in its seeds.
This makes the seeds less likely to be eaten by birds.

Complete each sentence about how the bitter chemical was first made by sorghum.
Use the words from the list.

gene	**meiosis**	**mutation**	**pathogen**	**sugar**

The bitter chemical was first made due to a change in a ..... .

This type of change is called a ..... .

[2]

(b). Farmers have developed varieties of sorghum with lower levels of the bitter chemical.

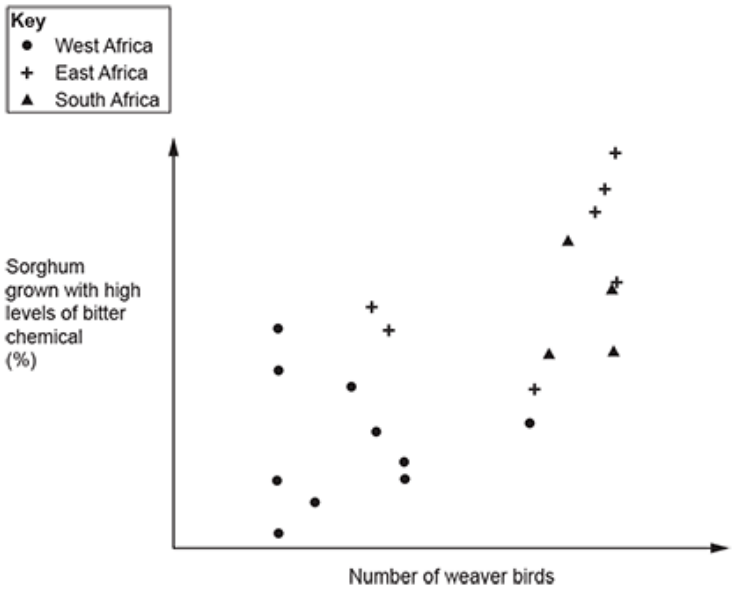
To do this they:
- chose two plants with less bitter chemical than other plants
- bred these plants together
- repeated the same steps with the offspring.

What is the name of this process?

[1]

(c). Scientists recorded the percentage of sorghum grown with high levels of bitter chemical in different areas of Africa. They also recorded the number of weaver birds living in the same areas.

The graph shows the data they collected.



In some areas, there are low numbers of weaver birds.

i. Which area of Africa, west, east or south, has the least number of weaver birds that eat sorghum?

[1]

ii. Complete the sentence about the graph.
Put a (ring) around the correct option.

In the areas with low numbers of weaver birds, farmers choose to grow

a lower / a higher / the same percentage of sorghum with high levels of bitter chemicals.

[1]

iii. Give a reason why the farmers make this choice.

[1]

9. There are 28 chromosomes in each elephant sperm cell.

What is the diploid number of chromosomes in elephants?

A 14
B 28
C 56
D 112

Your answer ☐ **[1]**

10. Charles Darwin and Gregor Mendel did important work in the development of science.

Which row gives the areas of their work?

	Charles Darwin	**Gregor Mendel**
A	evolution	medicine
B	medicine	genetics
C	evolution	genetics
D	genetics	evolution

Your answer ☐ **[1]**

11. Using the data in the table, how many people living in the UK have a Y chromosome in their cells?

Number of individuals of each sex in the UK, rounded to 2 significant figures	
males	females
33 000 000	34 000 000

A 33 000 000
B 34 000 000
C 66 000 000
D 67 000 000

Your answer ☐ **[1]**

12. A genetic disorder is caused by a dominant allele (D). The recessive allele is (d).

Which row shows all the possible genotypes for heterozygous and homozygous individuals?

	Heterozygous	Homozygous
A	Dd	dd
B	DD or dd	Dd
C	Dd	DD or dd
D	Dd	DD

Your answer ☐ **[1]**

13. Which sentence is a correct description of a chromosome?

A A length of protein that contains the genetic material.
B A long molecule of DNA that contains genes.
C A part of a gene that codes for a particular protein.
D A strand of DNA that can leave the nucleus.

Your answer ☐ **[1]**

14(a). The diagram shows a tulip plant. Many gardeners like to grow tulip plants.

Tulips can be grown from seeds produced from sexual reproduction.

They can also be grown from bulbs that are produced by asexual reproduction.

Which statements explain why gardeners usually choose to plant bulbs that were produced asexually?

Tick (✓) **two** boxes.

Bulbs will grow much faster than seeds. ☐
The gardener will know the colour of the flowers from bulbs. ☐
Tulip plants grown from seed will not need to photosynthesise. ☐
Tulips grown from seeds will not require water. ☐
Tulips grown from seeds will all look exactly the same. ☐

[2]

(b). In 1637, tulip growers found that a small number of their tulip plants produced flowers with different coloured stripes.

The growers did not know what was causing the colour changes.

Complete the sentences to show **two** possible explanations for the colour changes.
Use words from the list.

antibody	**gene**	**mutation**
pathogen	**phenotype**	**producer**

The tulips could be diseased because they have been infected by a ..... .

This has altered the production of a chemical that colours the flowers.

Another explanation is that a ..... has occurred in the DNA of the tulip.

This is a change in the ..... that codes for a coloured chemical.

[3]

(c). It was not until 1960 that scientists could show that the tulips were infected with a virus.

Viruses are much smaller than human cells.

Suggest why it took so long to identify the cause of the infection.

---

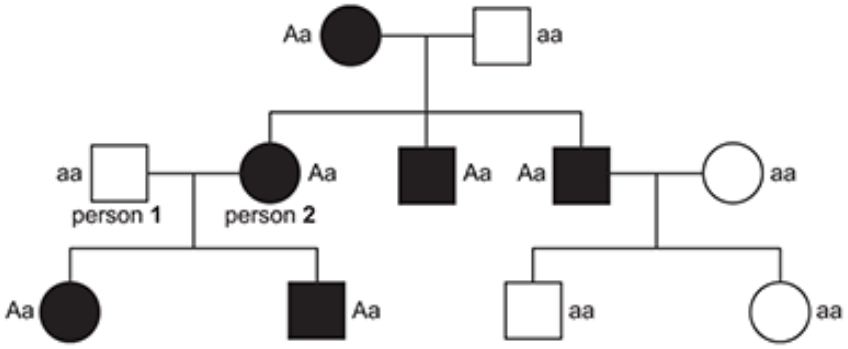
[1]

15(a). Amyloidosis is a group of inherited conditions that affect people's health.

The most common type of amyloidosis is caused by a dominant allele (**A**) of a gene.

The allele **A** codes for a harmful protein called amyloid.

The diagram shows the inheritance of the allele in a family.



i. Complete the table about the family tree.

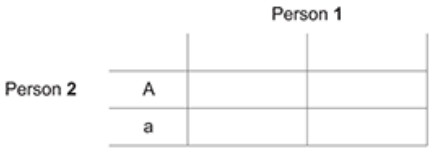
The first row has been done for you.

	Number in the family
Number of males	**6**
Number of people who are homozygous recessive for the gene	
Number of people who have amyloidosis	

[2]

ii. Person **1** and person **2** are expecting another baby.

Complete the genetic diagram to find the probability that the baby will have amyloidosis.



Probability = ...

[2]

(b). Amyloid protein is made by blood cells called plasma cells.
Amyloid can stop the pancreas releasing insulin.
It can also prevent sensory neurones from working.

Explain why person **2** starts to develop symptoms of amyloidosis **and** suggest what these symptoms might be.

[3]

16. Which sperm would fertilise an egg to produce a female baby?

A A sperm with one X chromosome.
B A sperm with one Y chromosome.
C A sperm with two X chromosomes.
D A sperm with X and Y chromosomes.

Your answer ☐ **[1]**

17. Which of these factors affect the phenotype of an organism?

A Only the environment of the organism.
B Only the organism's genes.
C The organism's genes and its environment.
D The organism's habitat and the habitat of its parents.

Your answer ☐ **[1]**

END OF QUESTION PAPER