Genes, Inheritance and selection – 2021/20 GCSE Gateway Biology A

1. Nov 2021/Paper_J247/02/No.5

Which process can result in a new allele being formed?

A Asexual reproduction

B Fertilisation

C Mutation

D Natural selection

Your answer ☐ **[1]**

2. Nov 2021/Paper_J247/02/No.7

Which scientists worked separately but developed a very similar theory?

A Darwin and Wallace

B Mendel and Darwin

C Wallace and Mendel

D Wallace, Darwin and Mendel

Your answer ☐ **[1]**

3. Nov 2021/Paper_J247/02/No.8

Which of these changes would cause an **increase** in biodiversity?

A Draining ponds to build a car park.

B Keeping tigers in a zoo.

C Reintroducing otters into an area where they had died out.

D Replacing a woodland with a field that contains wheat.

Your answer ☐ **[1]**

4. Nov 2021/Paper_J247/02/No.9

A genetic condition is controlled by a dominant allele **P**.

How is the genotype **Pp** described?

A Haploid

B Heterozygous

C Homozygous dominant

D Homozygous recessive

Your answer ☐ **[1]**

5. Nov 2021/Paper_J247/02/No.11

The diploid number of chromosomes in sheep is 54.

How many chromosomes would be found in a sperm cell from a sheep?

A 23

B 27

C 54

D 108

Your answer ☐ **[1]**

6. Nov 2020/Paper_J247/01/No.9

When a woman reaches the age of about 50, eggs are released less often from her ovaries. To try and correct this, her body increases the production of one hormone.

Which hormone is this?

A Adrenaline

B FSH

C Progesterone

D Testosterone

Your answer ☐ **[1]**

7. Nov 2020/Paper_J247/01/No.10

A student models the process of mitosis using cookies and sprinkles.

Mitosis is part of the cell cycle.

Which part of the cell cycle has the student modelled?

A Cell division

B Chromosome movement

C DNA replication

D Growth of cell

Your answer ☐ **[1]**

8. Nov 2020/Paper_J247/02/No.2

Goldfish are a species of fish.

What name is given to all the goldfish living in a pond?

A A community

B An ecosystem

C A habitat

D A population

Your answer ☐ **[1]**

9. Nov 2020/Paper_J247/02/No.3

The table shows features of **meiosis**.

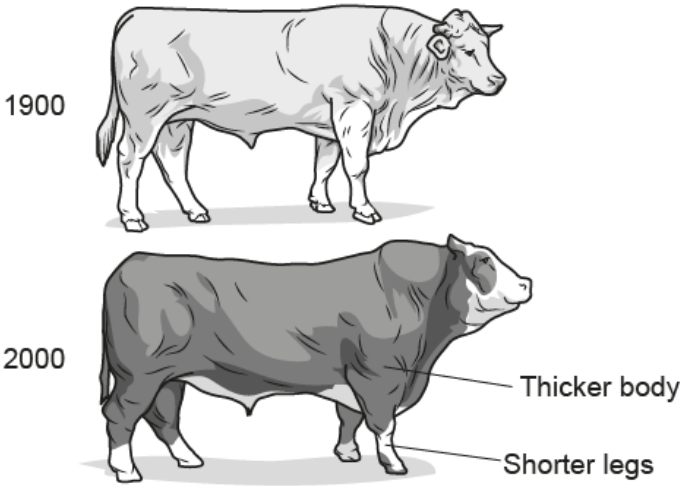
	Type of cells made	Genetic variation introduced
A	body cells	✓
B	body cells	✗
C	gametes	✓
D	gametes	✗

Which row in the table is correct?

Your answer ☐ **[1]**

10. Nov 2020/Paper_J247/02/No.6

The drawings show typical cattle kept by farmers in 1900 and in 2000.



Which process would have been used between 1900 and 2000 to produce these changes in the cattle?

A Artificial classification

B Biological control

C Natural selection

D Selective breeding

Your answer ☐ **[1]**

11. Nov 2020/Paper_J247/02/No.9

Scientists found DNA from a Stone Age woman trapped in gum from a tree. The woman had chewed the tree gum. Using this DNA scientists were able to predict some of her features.

Which feature would scientists have been able to predict from her DNA alone?

A Body weight

B Diet

C Eye colour

D Height

Your answer ☐ **[1]**

12. Nov 2020/Paper_J247/02/No.21

Hypercholesterolemia (HC) is caused by a dominant allele on chromosome 19. This allele has mutations which cause a change in the order of DNA nucleotides.

(a) Write the words **allele**, **chromosome** and **nucleotide** in the boxes to show their size from smallest feature to largest feature.

Smallest feature	
Largest feature	

[1]

(b) One in 500 people are heterozygous for HC.

There are 66 000 000 people in the UK.

Calculate how many people in the UK are heterozygous for HC.

Number of people = ... **[1]**

(c) A woman who does **not** have HC and a man who is heterozygous are expecting a baby.

What is the probability of the baby having HC?

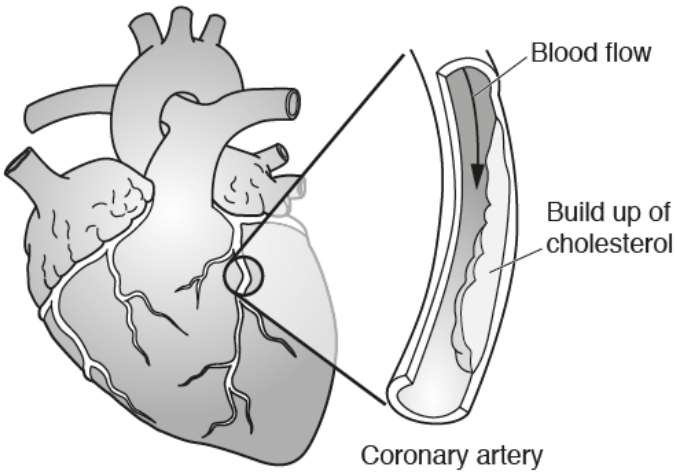
Complete the genetic diagram to explain your answer.

D is the dominant HC allele and **d** is the recessive allele.

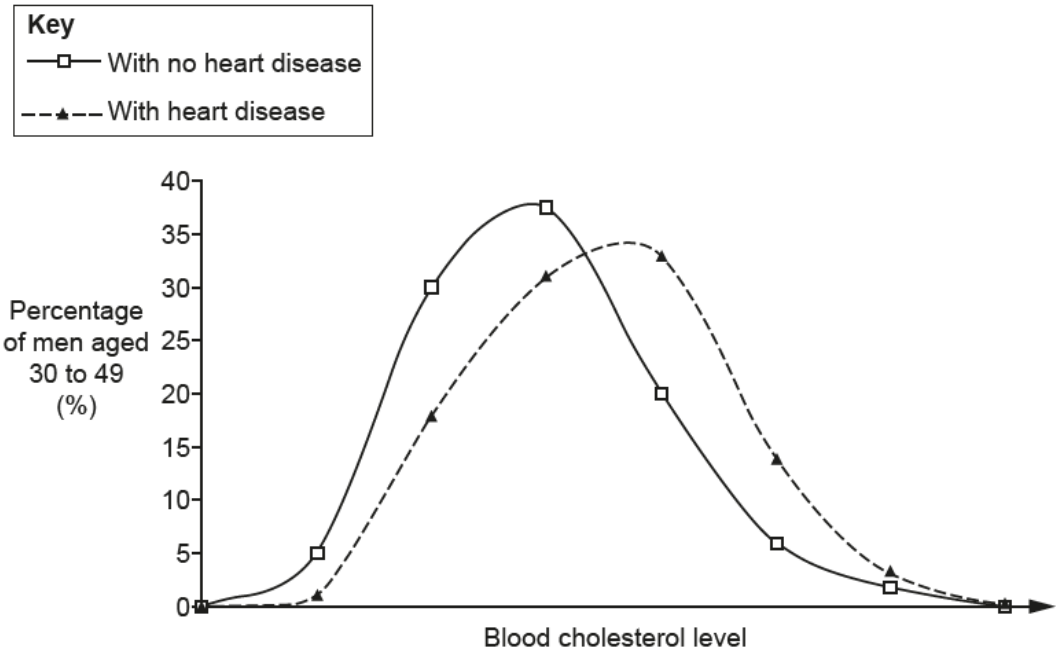
		Man	
		D	**d**
Woman	**d**		
	d		

Probability = ... **[2]**

(d)* People with HC are more likely to get heart disease. The diagram shows the heart of a person who has heart disease.



The graph shows the results of a study of men aged 30 to 49. The study measured the cholesterol levels in the blood of the men. It also recorded if the men developed signs of heart disease.



Explain the possible link between cholesterol and heart disease and if this link is supported by the graph.

Use evidence from the diagram and the graph in your answer.

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13. Nov 2021/Paper_J247/04/No.5

Which pair of genetic terms have the same meaning?

A Base and nucleotide

B Gene and allele

C Gene and genome

D Variant and allele

Your answer ☐ **[1]**

14. Nov 2021/Paper_J247/04/No.11

The diploid number of chromosomes in sheep is 54. Sex in sheep is determined in the same way as in humans.

Which is a possible chromosome combination in a **sperm cell** of a male sheep?

A 22 chromosomes + Y

B 26 chromosomes + X

C 52 chromosomes + XY

D 54 chromosomes + XY

Your answer ☐ **[1]**

15. Nov 2021/Paper_J247/04/No.13

The pea plants studied by Mendel were either tall or dwarf.

Scientists think that he was lucky to have chosen this characteristic because many other characteristics produce a range of different phenotypes.

Which statement about the types of inheritance discussed by the scientists is correct?

A Height in pea plants is controlled by a single allele.

B Height in pea plants is controlled by two different genes.

C Many characteristics are controlled by multiple genes working together.

D Many characteristics are completely controlled by the environment.

Your answer ☐ **[1]**

16. Nov 2021/Paper_J247/04/No.14

Researchers studied over 200 DNA samples from giraffe cells. Some populations of giraffe, which were geographically isolated, were found to be genetically very similar.

Which technique would the researchers have used to find that the giraffe populations were genetically similar?

A Cloning using stem cells

B DNA sequencing

C Genetic engineering

D Transcription

Your answer ☐ **[1]**

17. Nov 2021/Paper_J247/04/No.15

Scientists have found that only about 1% of our DNA codes for proteins.

The other 99% of DNA used to be called 'junk' DNA.

Why is the term 'junk' DNA **not** used anymore?

A Enzymes may be present in the 'junk' DNA.

B The 'junk' DNA can code for the production of carbohydrates.

C The 'junk' DNA is non-coding DNA that can control transcription.

D Translation can occur on the 'junk' DNA.

Your answer ☐ **[1]**

18. Nov 2021/Paper_J247/04/No.19

Cancer is caused by changes in cells.

(a) Describe the effects that cancer has on cells.

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..... **[2]**

(b) Cells usually become cancerous due to damage to their DNA.

Scientists have found a gene called *BRCA*. This gene usually produces a protein that repairs damage in DNA.

(i) There are 3×10^7 females in the UK and 1 in 400 of them has a mutation in their *BRCA* gene.

60% of women with this mutation are likely to develop breast cancer.

Calculate how many females in the UK could develop breast cancer due to a mutation in the *BRCA* gene.

Give your answer in **standard form**.

Number of females = ... **[3]**

(ii) Cancer can occur in the cells of the breast.

This type of cancer is often caused by breast cells being stimulated by the hormone oestrogen.

Use this information to suggest **two** possible treatments for breast cancer.

1 .....

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2 .....

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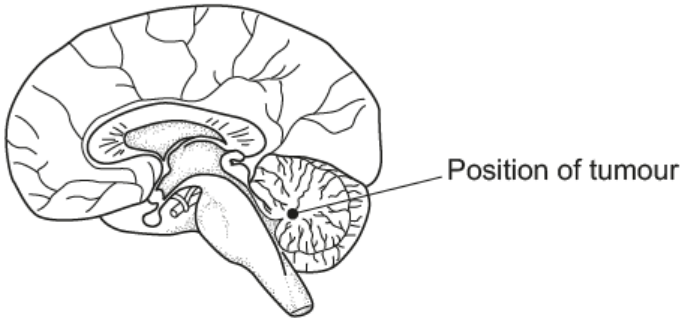
[2]

(c) Cancer can also occur in the brain.

The diagram shows the position of a tumour in the brain.



Explain why operating to remove this tumour could produce side effects.

Include in your answer **one** of the possible side effects.

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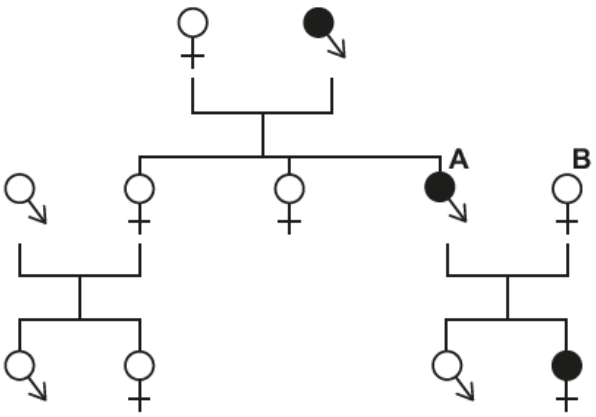
19. Nov 2021/Paper_J247/04/No.21

CJD is a group of diseases that occurs in the brain.
One type of CJD is caused by a **dominant allele**.

(a) The family tree shows the occurrence of this type of CJD in a family.



Key:

- male who will develop CJD
- female who will develop CJD
- male who will not develop CJD
- female who will not develop CJD

(i) Complete this table about the family tree.

Number of people who will develop CJD	**3**
Number of people that are homozygous recessive for this gene	.....
Number of people who are heterozygous for this gene	.....

[2]

(ii) Person **A** and person **B** are expecting another child.

Complete the genetic diagram to calculate the probability that the child will develop CJD.
(Use **D** to represent the dominant allele and **d** for the recessive allele.)

		Person **B**	
		.....	.....
Person **A**	.....	.....	.....
	.....	.....	.....

Probability = ... **[2]**

(b) This type of CJD, caused by a dominant allele, is called genetic CJD.

There is another type of CJD called sporadic CJD.

Scientists think that sporadic CJD can just suddenly occur in the brain without a genetic cause.

Give **one** reason why both these types of CJD are called non-communicable diseases.

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..... **[1]**

(c) CJD occurs when a protein made in the brain changes shape. This protein then attaches to other proteins, stopping them from working.

Scientists are working on a treatment for CJD. They have made an artificial antibody which they will inject into people with CJD.

(i) Explain why the body will not make its **own** antibodies against the CJD protein.

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(ii) The artificial antibodies have been tested on mice.

Suggest **two** reasons why some people argue against the testing of medicines on animals.

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[2]

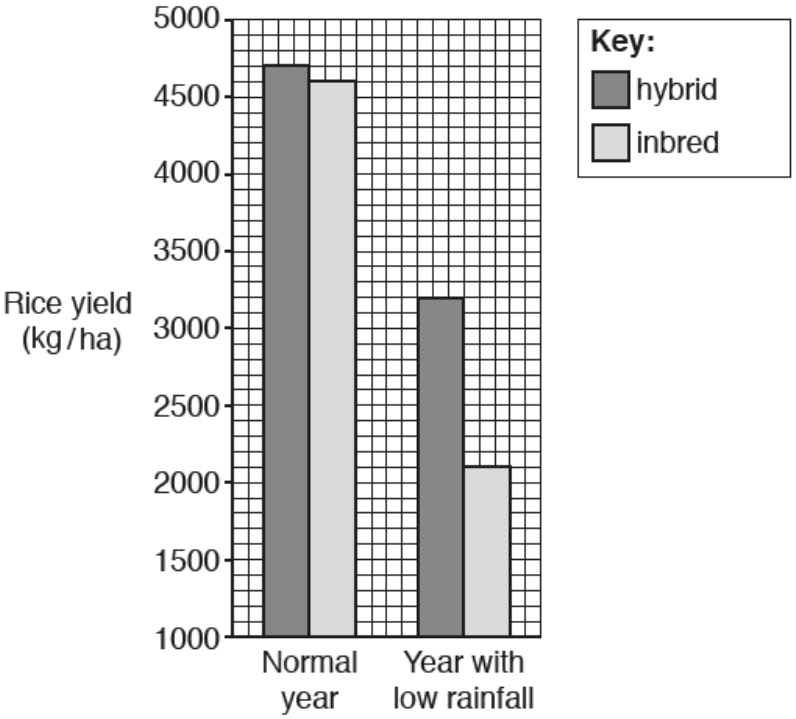
20. Nov 2021/Paper_J247/04/No.22

In China, many people rely on rice for their main food supply.

For many years people have grown the same varieties of rice (inbred rice).

New varieties of rice are now available. They are called hybrid rice.

The graph shows the yield of inbred rice and hybrid rice in a normal year and in a year with low rainfall.



(a) When there was low rainfall, the yield of the inbred rice dropped from 4600 kg/ha to 2100 kg/ha. That is a 54% decrease.

Calculate the **percentage decrease** of the hybrid rice when there is low rainfall.

Give your answer to **2** significant figures.

Percentage decrease = ... **[2]**

(b) Explain why hybrid rice may be important if global warming causes changes in the climate in China.

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..... **[2]**

(c) Hybrid rice is produced by breeding inbred rice with other types of rice found growing in the wild.

Explain why seedbanks might be useful if the climate changes in the future.

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21. Nov 2021/Paper_J247/04/No.23

This question is about the evolution of plants and animals on Earth.

(a) What is meant by the term evolution?

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(b) Describe the work of Charles Darwin which led him to develop a theory of how evolution could occur.

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(c)* For many millions of years the most complex organisms on Earth were bacteria.

- They lived in an environment that contained little oxygen.
- They made glucose by photosynthesis using hydrogen sulfide (H_2S).
- Sulfur was made as a waste product.

hydrogen sulfide + carbon dioxide $\rightarrow$ glucose + sulfur

About 2.3 billion years ago, plants evolved to use water rather than hydrogen sulfide.

- These plants produced a different waste product.
- This waste product allowed animals feeding on the plants to use aerobic respiration.
- These animals could therefore grow larger, allowing secondary consumers to exist.

Explain why the change from using hydrogen sulfide to water allowed larger primary consumers to live and why this meant that secondary consumers could also exist.

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(d) Scientists think that the presence of secondary consumers (predators) caused primary consumers (prey) to evolve much more quickly.

Explain why this statement may be true.

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..... **[2]**

22. Nov 2020/Paper_J247/03/No.4

A student models the process of mitosis using cookies and sprinkles.

Mitosis is part of the cell cycle.

Which process in the cell cycle has the student modelled?

A Cell division

B Chromosome movement

C DNA replication

D Growth of cell

Your answer ☐ **[1]**

23. Nov 2020/Paper_J247/04/No.5

Why are the effects of most mutations **not** observed?

A Most mutations do not affect the genotype or phenotype.

B Most mutations do not affect the phenotype.

C Mutations mainly affect internal body processes.

D Mutations often kill the organism.

Your answer ☐ **[1]**

24. Nov 2020/Paper_J247/04/No.6

Which of these is a **similarity** between selective breeding and natural selection?

A Cause a change in organisms' genotypes but not phenotypes.

B Humans decide which organisms will reproduce.

C Only some organisms reproduce.

D Take place over many thousands of years.

Your answer ☐ **[1]**

25. Nov 2020/Paper_J247/04/No.7

The table describes meiosis.

	Genetic description of cells made	Genetic variation introduced	Type of cells made
A	haploid	✓	body cells
B	diploid	✗	body cells
C	haploid	✓	gametes
D	diploid	✓	gametes

Which row in the table is correct?

Your answer ☐ **[1]**

26. Nov 2020/Paper_J247/04/No.8

Darwin and Wallace both developed theories of natural selection. Both of their theories were developed after making observations on islands.

What is the most likely explanation for this?

A Conditions on neighbouring islands are very similar.

B Different characteristics were observed in organisms on islands compared to the mainland.

C There are no selection pressures for organisms on islands.

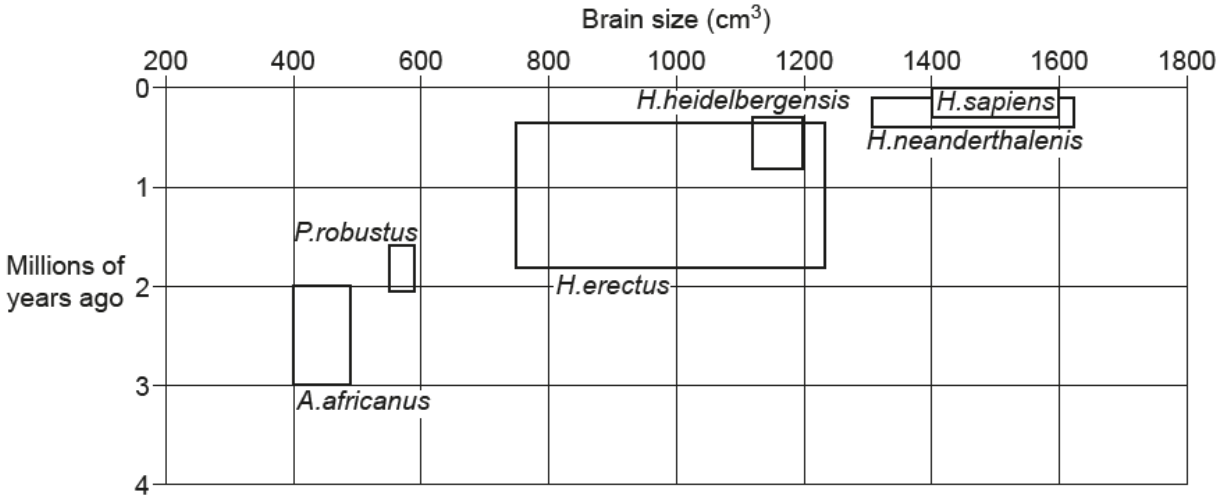
D There is no competition for food on islands.

Your answer ☐ **[1]**

27. Nov 2020/Paper_J247/04/No.9

Humans belong to the species *H.sapiens*.

H.sapiens have evolved from a number of possible ancestors. The graph shows five of these ancestors.



What conclusion about human evolution can be made from the graph?

A A larger brain meant that the species were better adapted to their environment.

B *H.sapiens* outcompeted the other species which then became extinct.

C In general, the more recently a species first appears, the larger its brain size.

D There is no correlation between brain size and when a species first appeared.

Your answer ☐ **[1]**

28. Nov 2020/Paper_J247/04/No.13

When a person has measles they are unlikely to be ill again with the disease for many years.

What is the reason for this?

A Antigens from the pathogen remain in the body.

B Memory cells remain in the blood and can release antibodies.

C The disease can now be treated with antibiotics.

D White blood cells engulf the pathogens before antibodies are made.

Your answer ☐ **[1]**

29. Nov 2020/Paper_J247/04/No.15

What is meant by the term phylogenetics?

A Classifying organisms using many common characteristics.

B Constructing diagrams to predict how characteristics are inherited.

C The study of evolutionary relationships based on molecular studies.

D Using a single common feature to determine evolutionary relationships.

Your answer ☐ **[1]**

30. Nov 2020/Paper_J247/04/No.17

Zebras (**Fig. 17.1**) have evolved to live in hot grassland in Africa.

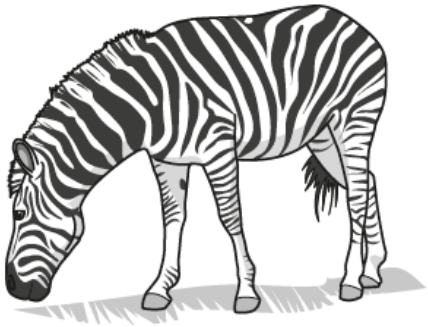


Fig. 17.1

(a) Scientists have tried to find out why zebras have evolved stripes on their body.

One theory is that the stripes help to keep the zebra cooler than other colours. Scientists did an experiment to test this theory. They covered barrels of cold water with the skin of different animals. Then they measured the temperature of the water several hours later.

The results are shown in **Fig. 17.2**.

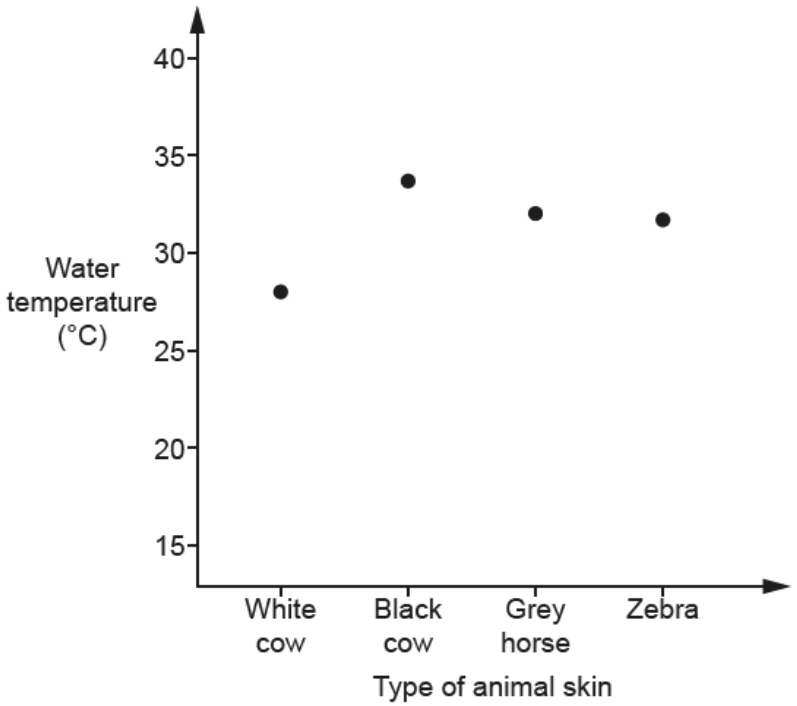


Fig. 17.2

(i) Do the results in **Fig. 17.2** support the theory that stripes keep zebras cool? Explain your answer.

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..... **[1]**

(ii) The scientists were aiming to investigate if it was **only** the colour of the skin that affected temperature regulation.

Suggest **one** improvement the scientists could make to ensure they **only** investigate the **colour** of the skin.

Explain your answer.

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..... **[1]**

(b) Another theory says that the stripes make a zebra less likely to be bitten by insects.

To test this theory scientists made models of zebras and covered them with sticky tape. One model was black. The other models had different widths of stripes.

Fig. 17.3 shows the number of insects that stuck to the tape.

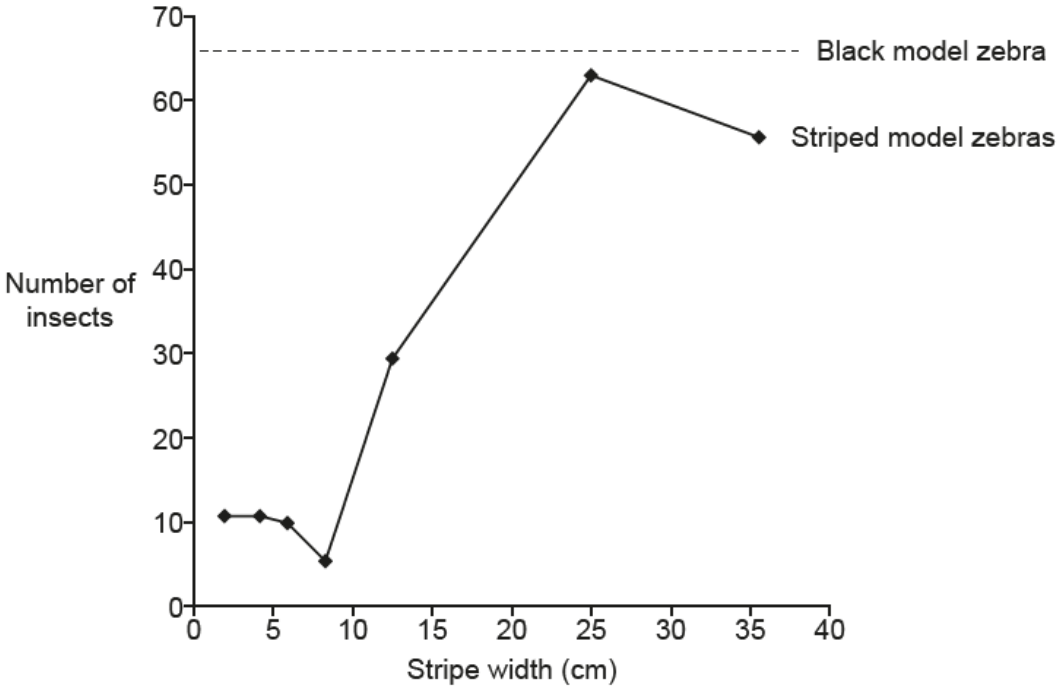

Fig. 17.3

(i) Describe what **Fig. 17.3** shows about the link between zebra stripes and protection from insects.

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..... **[2]**

(ii) Horse blankets are used to cover horses when they are outside. Companies have started to produce horse blankets with zebra stripes.

Use the information in **Fig. 17.3** to suggest what width of stripe should be used to reduce insect bites.

Explain your answer.

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(iii) Biting insects can spread pathogens between animals.

Use the theory of natural selection to explain how zebra stripes could have developed.

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