

Natural Selection and Evolution

Total marks:20

Q1.

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



Fig. 17.1

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.

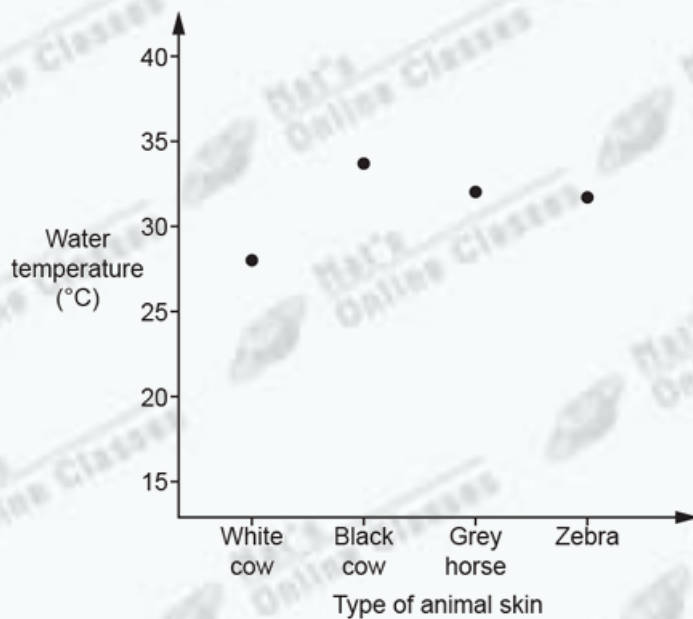


Fig. 17.2

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

[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.

[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.

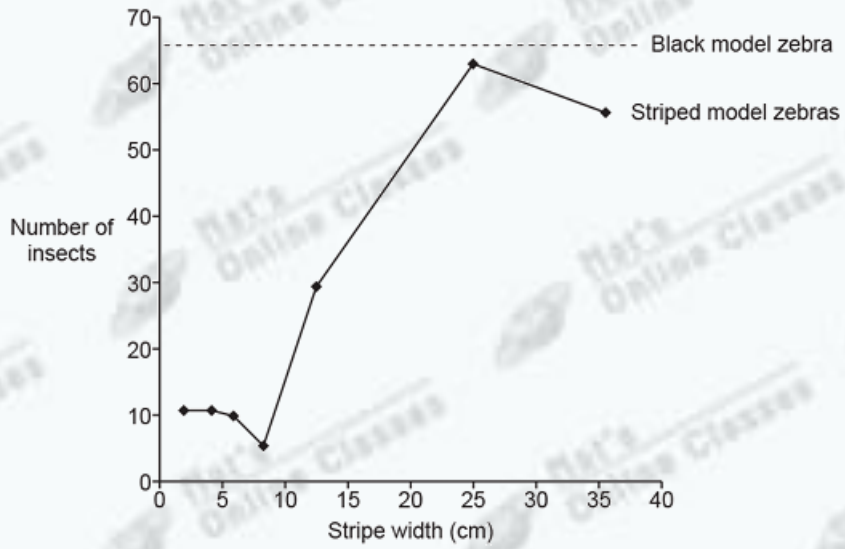


Fig. 17.3

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

[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.

[1]

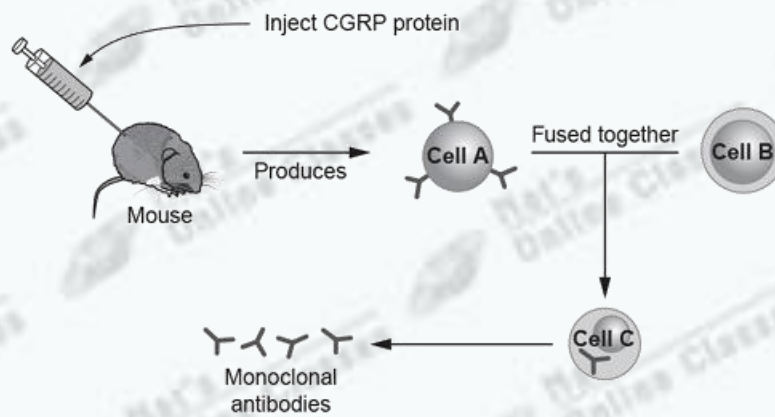
- iii. Biting insects can spread pathogens between animals.

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

[3]

Q2.

Some people get very painful headaches called migraines. Scientists think that this is caused by a protein in the brain called CGRP. Levels of the CGRP protein are higher in the brains of people who get migraines. Doctors are trying to find a treatment to prevent migraines. They have produced an antibody against the CGRP protein. The antibodies used in the investigation were monoclonal antibodies. They can be made by injecting CGRP protein into a mouse. The diagram shows this process.



Draw lines to identify each type of cell shown in the diagram.

- | | |
|-------------------------------------|--|
| <input type="text" value="Cell A"/> | <input type="text" value="Cancer cell"/> |
| <input type="text" value="Cell B"/> | <input type="text" value="Lymphocyte"/> |
| <input type="text" value="Cell C"/> | <input type="text" value="Hybridoma"/> |

[2]

Q3.

Hedgehogs are covered in small spines.

When they are frightened they often roll up into a ball and keep still.



- i. In country areas, where badgers live, this is an advantage to the hedgehogs.

In cities, where there are many roads, this is a disadvantage.

Explain these two conclusions.

[2]

- ii. Scientists have noticed that a new type of hedgehog is increasing in numbers in cities.

These hedgehogs do not roll up. They run away when frightened. The scientists think that genes control this behaviour.

Explain how this type of hedgehog may become more common in cities.

Use ideas about natural selection.

[4]

Q4.

Blue tits are small birds seen in gardens.

Many people in the UK feed birds nuts using a bird feeder, as shown in the diagram below.



Scientists measured the mean lengths of blue tits' beaks in the UK.

They found that blue tit beaks in the UK are slightly longer than blue tit beaks in the rest of Europe.

Very few people in the rest of Europe put bird feeders out for their birds.

Use Charles Darwin's theory of natural selection to explain why the blue tits in the UK have slightly longer beaks than those in the rest of Europe.

[4]