

AQA – Genetics, populations, evolutions and ecosystems – A2 Biology

1. June/2021/Paper_2/No.4

0 4

In fruit flies, males have the sex chromosomes XY and the females have XX.
In fruit flies, a gene for eye colour is carried on the X chromosome. The allele for red eyes, **R**, is dominant to the allele for white eyes, **r**.

0 4 . 1

Male fruit flies are more likely than female fruit flies to have white eyes.

Explain why.

[2 marks]

0 4 . 2

A female fruit fly with white eyes was crossed with a male fruit fly with red eyes to produce a large number of offspring.

Tick (✓) **one** box next to the statement which correctly describes the phenotypes produced from this cross.

[1 mark]

All offspring red-eyed

All females red-eyed, all males white-eyed

All males red-eyed, all females white-eyed

All males white-eyed, females red-eyed and females white-eyed

In fruit flies, the genes for body colour and for wing development are **not** on the sex chromosomes. The allele for grey body colour, **G**, is dominant to the allele for black body colour, **g**. The allele for long wings, **L**, is dominant to the allele for short wings, **l**.

A geneticist carried out a cross between fruit flies with grey bodies and long wings (heterozygous for both genes) and fruit flies with black bodies and short wings.

Table 2 shows the results of this cross.

Table 2

Phenotype of offspring	Number of offspring
Grey body and long wings	223
Black body and short wings	218

0 4 . 3 Explain the results in **Table 2**.

[3 marks]

0 4 . 4 The **first** generation of a population of fruit flies had 50 females.

Calculate how many female fruit flies would be produced from this population in the **fifth** generation.

You can assume:

- each female produces 400 offspring each generation
- half the offspring produced each generation are female
- there is no immigration or emigration
- no flies die before reproducing.

Show your working.

Give your answer in standard form.

[3 marks]

Answer _____

2. June/2021/Paper_2/No.8

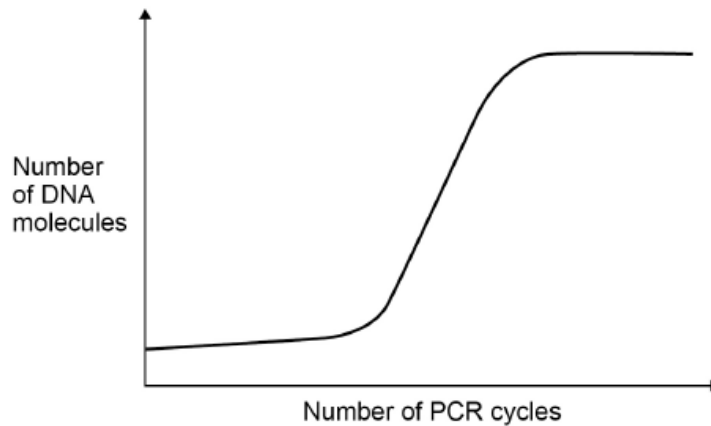
0 8 . 1

Describe and explain how the polymerase chain reaction (PCR) is used to amplify a DNA fragment.

[4 marks]

Figure 9 shows the number of DNA molecules produced using a PCR.

Figure 9



0 8 . 2

Explain the shape of the curve in Figure 9.

[2 marks]

3. June/2021/Paper_2/No.9

0 9

A coral reef is an underwater ecosystem formed as a ridge of mainly calcium carbonate deposits. Algae are photosynthesising organisms. Some algae grow on coral reefs. Succession results in a wide variety of fish living on coral reefs.

0 9 . 1

Describe a method that could be used to determine the mean percentage cover of algae on a coral reef.

Do not include information on the difficulties of using your method underwater.

[3 marks]

0 9 . 2

Explain how succession results in a wide variety of fish living on coral reefs.

Do not describe the process of succession in your answer.

[2 marks]

Ecologists investigated the effect of two fish species, the redband parrotfish and the ocean surgeonfish, on algal growth on an artificial reef. They made this artificial reef by submerging many large concrete blocks at a depth of 16–18 metres off the coast of Florida. They attached four large wire cages, **A**, **B**, **C** and **D**, to each block and populated the cages as shown.

A – No fish

B – Two redband parrotfish

C – Two ocean surgeonfish

D – One redband parrotfish and one ocean surgeonfish

After 34 weeks, the ecologists measured the mean percentage cover of all algae within each set of wire cages. The ecologists used a statistical test to find out whether the mean for each set of cages was significantly lower than the mean for set **A**.

Table 3 shows the probability (*P*) values that the ecologists obtained using this statistical test.

Table 3

Set of cages	<i>P</i> value
B	=0.841
C	<0.001
D	=0.634

0 9 . 3

Using all the information, evaluate the effect of the two fish species on algal growth on coral reefs.

[5 marks]

4. June/2021/Paper_2/No.10

1 0

Read the following passage.

Lake Malawi in East Africa has more species of fish than any other lake in the world. Many of these species have evolved from a common ancestor. Lake Malawi is one of the largest lakes in the world and was formed several million years ago. Since then, the water level has fluctuated greatly. As a result, what is now a large lake was at one time many smaller, separate lakes. 5

The country of Malawi has a total area of 118 000 km². The actual land area is only 94 080 km², because approximately one-fifth of the country is Lake Malawi.

In December 1990, forests covered 41.4% of the actual land area of Malawi. In December 2016, forests covered 26.4% of the actual land area of Malawi. 10

Deforestation and farming along the shores of Lake Malawi have caused increased soil erosion and loss of nutrients into the lake. This has resulted in a decrease in some fish populations. The mark-release-recapture method can be used to estimate the size of a fish population. However, this method can produce unreliable results in very large lakes. 15

Use the information in the passage and your own knowledge to answer the following questions.

1 0 . 1

Lake Malawi in East Africa has more species of fish than any other lake in the world (line 1).

Suggest and explain how this speciation may have occurred.

[4 marks]
