

# 10.3 Gene Pools & Speciation

## Question Paper

Course	DP IB Biology
Section	10. Genetics & Evolution (HL Only)
Topic	10.3 Gene Pools & Speciation
Difficulty	Easy

**Time allowed:** 50  
**Score:** /39  
**Percentage:** /100

### Question 1a

a)

Define the term **gene pool**.

[1 mark]

[1 mark]

### Question 1b

b)

The proportion of the times that an allele occurs within a gene pool is known as the allele frequency.

State and explain **one** reason why the frequency of an allele might change over time.

[2 marks]

[2 marks]

### Question 1c

c)

Different alleles in a population lead to the presence of different phenotypes.

State why it is easier to calculate a phenotype frequency than an allele frequency.

[1 mark]

[1 mark]

### Question 1d

d)

In a population of cattle, 12 individuals are white, 15 are red, and 28 are roan.

Calculate the frequency of the red phenotype.

[2 marks]

[2 marks]

### Question 2a

a)

A population of guppies has two alleles for a specific gene as part of its gene pool. The frequencies of the alleles are shown in the table below.

A mutation occurs in the population that leads to the formation of a new allele for the gene.

Complete the table below with the allele frequencies of the new allele from March to July.

Month	Frequency of Allele 1	Frequency of Allele 2	Frequency of New Allele
January	0.81	0.19	0
February	0.78	0.22	0
March	0.77	0.21	
April	0.65	0.27	
May	0.51	0.34	
June	0.43	0.33	
July	0.40	0.24	

[1 mark]

[1 mark]

### Question 2b

b)

The new allele was a dominant allele that provided the guppies with a survival advantage within their population.

Predict what will happen to the frequencies of all three alleles for the next five months from August to December.

[2 marks]

[2 marks]

### Question 2c

c)

A few individuals with the mutated allele from the original population travelled to a new area and merged with a different population of guppies.

In the new population the allele frequency remained low over many generations and then decreased.

Suggest a reason for the difference in the allele frequency of the mutated allele between the population from part (a) and this new population.

[2 marks]

[2 marks]

### Question 3a

a)

In the times before modern medicine, giving birth used to be a very dangerous time for women. There were often complications with the delivery that meant that babies were less likely to survive than they are today.

Babies that were very small when they were born were more likely die during their infancy. Babies that were very large when they were born were more likely to be too difficult for the mothers to deliver on their own and could lead to fatal complications during their delivery.

State the type of selection that occurred during this time.

[1 mark]

[1 mark]

### Question 3b

b)

In today's society human evolution is exceptionally minimal in the majority of populations.

Suggest **two** reasons why human evolution is minimal in the majority of populations.

[2 marks]

[2 marks]

### Question 3c

c)

A scientific study was carried out in 2017 on a small community of people in Berne, Indiana called the Amish. This community mixes very infrequently with the wider US population and tend to have children with people in their own community.

The study found that a large number of individuals in their community possessed a mutated allele that increased their life expectancy by ten years on average.

Explain why this allele is found in much higher percentages in this community compared to the rest of the US population.

[2 marks]

[2 marks]

### Question 3d

d)

Isolated groups, such as the Amish, make excellent subjects for scientific study.

Suggest **one** reason why scientists often focus on isolated groups for studies into inheritance and genetics.

[1 mark]

[1 mark]

### Question 4a

a)

What is the definition of a population?

[1 mark]

[1 mark]

### Question 4b

b)

A population of beetles exists in an area of forest.

The beetle's outer shell that protects their wings is called an elytra. These can appear in different colours and patterns.

The beetles in the forest live mostly in leaf litter that is brown and green in colour.

They are hunted by predators such as birds.

Explain how the beetle population changed from having a large diversity of different elytra colours to having mostly brown and green.

[4 marks]

[4 marks]

### Question 4c

c)

The humans that live near the forest build a road through the beetles' habitat.

The road is too wide for the beetles to cross, causing the two populations to become isolated from each other.

On one side of the road the leaf litter is cleared and a population of plants with red berries starts to colonise the area.

State the type of speciation that could occur in this instance, and describe how that speciation could occur.

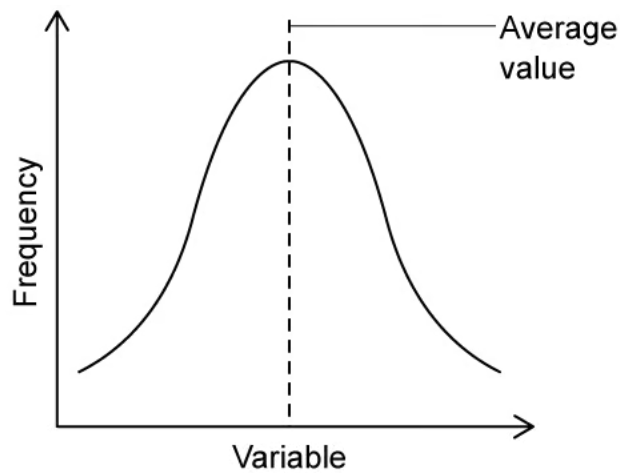
[4 marks]

[4 marks]

### Question 5a

One mark is available for clarity of communication throughout this question.

a)  
The image below shows a normal distribution curve.



Sketch three graphs to show how this normal distribution curve would change if the population is exposed to directional selection, stabilising selection, and disruptive selection.

[3 marks]

[3 marks]

### Question 5b

b)  
Explain how a population of bacteria could become resistant to a new type of antibiotic.

[5 marks]

[5 marks]

**Question 5c**

c)

Compare and contrast the processes of gradualism and punctuated equilibrium.

**[5 marks]****[5 marks]**