

5.1 Evolution & Natural Selection

Question Paper

Course	DP IB Biology
Section	5. Evolution & Biodiversity
Topic	5.1 Evolution & Natural Selection
Difficulty	Medium

Time allowed: 60
Score: /46
Percentage: /100

Question 1a

- a) Researchers collected fish from a water source inside a cave and from the same water source in the open air.

They measured the diameter of the eyes of each fish as well as the length of its body. From these measurements they calculated the mean values for each site. Their results are shown in the table below.

	Fish in open air	Fish in cave
Mean diameter of eye / mm	0.23	0.10
Mean length of body / cm	8.49	5.82

An article published by a researcher several years before this study suggested that animals living in caves had similar adaptations; smaller eyes and a smaller body for decreased energy expenditure.

Evaluate this suggestion in the light of the data in the table above.

[2 marks]

Question 1b

- b) The researcher decided to continue their investigation and calculate the genetic diversity of the fish. Their results are shown in the table below.

Gene	Allele	Percentage of fish with this allele	
		In the open air	In the cave
PGI	P	2.4	1.0
	Q	4.5	0.0
	R	61.8	95.7
	S	6.8	1.0
	T	19.7	0.0
ACO2	A	4.7	0.0
	B	100.0	21.3
	C	0.0	100.0

State, with a reason, what can be concluded about the genetic diversity of fish in the open air in comparison to fish in the cave.

[2 marks]

Question 1c

- c) The percentage of fish with allele **C** in the open is different from the percentage of fish with allele **C** in the cave. Suggest a reason for this difference.

[3 marks]

Question 1d

- d) Suggest how the researcher could find out if the fish living in the open are still the same species as those living in the cave.

[1 mark]

Question 2a

- a) A group of biologists conducted an investigation on a remote archipelago (a collection of islands) in the Pacific Ocean. A species of mouse lives on these islands without any natural predators. The biologists measured the claw length of a large number of these mice.

On half of the islands, a species of snake was accidentally introduced that preys on the mice but that cannot climb trees. Several years after the snakes were introduced the biologists returned and found that on the islands with snakes, the claw length of the mice had changed. Some had shorter claws, enabling them to run faster, while others had longer claws, enabling them to climb trees.

Suggest the benefit to the scientists' investigation of there being islands without any snakes present.

[2 marks]

Question 2b

- b) The evolution of long claws in the mice in part (a) was made possible by a mutation in the gene controlling claw length.

Explain how a mutation could lead to a change in claw length.

[3 marks]

Question 2c

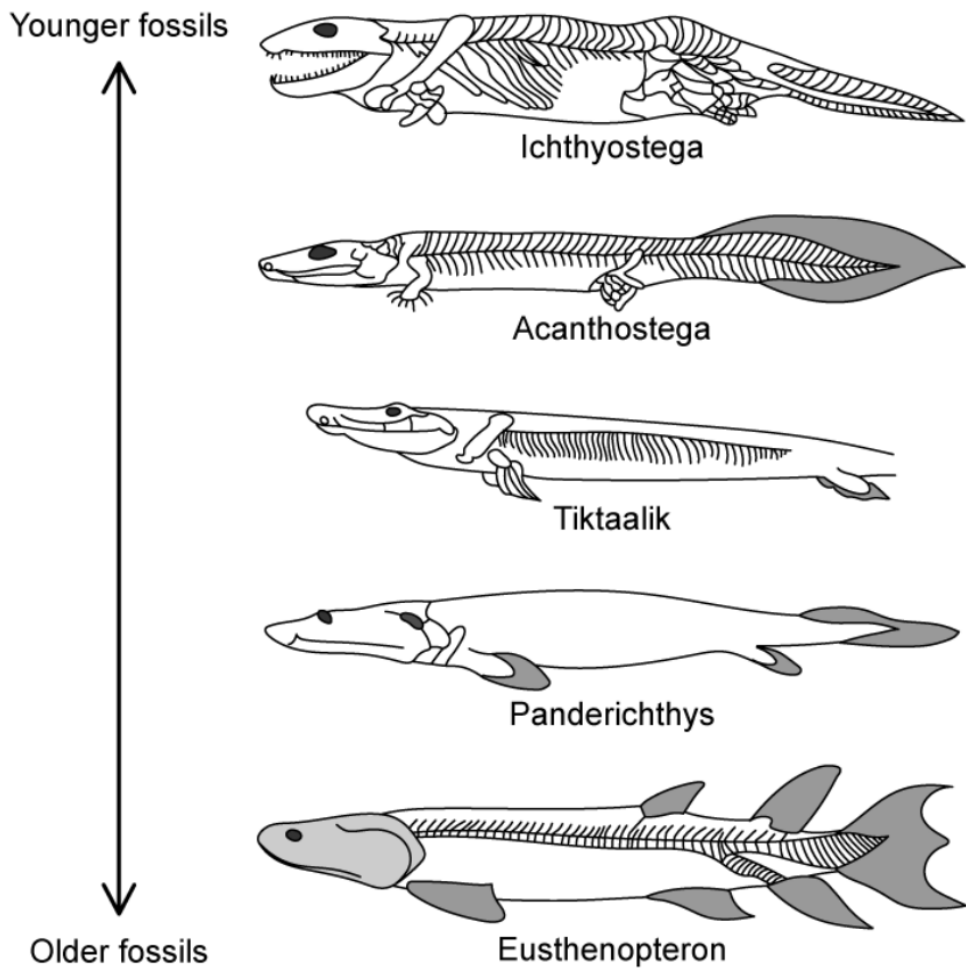
- c) When the biologists conducted the investigation in part (a), flooding of the islands was very rare. Now, due to climate change, flooding of the islands occurs more regularly. This flooding can regularly wipe out large numbers of ground-living species.

Using this information and the information from part (a), explain how the claw length of the mice on the islands are likely to be changing now.

[3 marks]

Question 3a

- a) The image below shows a series of fossils in varying states of completeness. *Eusthenopteron* is an extinct genus of fish while *Ichthyostega* is an extinct genus of partially aquatic tetrapod (four-legged vertebrates).



Compare and contrast the fossil *Ichthyostega* with *Acanthostega*.

[3 marks]

Question 3b

- b) Outline how this set of fossils provides evidence for the process of evolution.

[2 marks]

Question 3c

- c) Suggest one limitation of fossil evidence for evolution visible in the image in part (a).

[1 mark]

Question 3d

- d) The limbs of *Ichthyostega* and of modern tetrapods, taken together with the fins of marine mammals and the wings of birds are also considered to provide evidence for evolution.

Explain how these structures provide evidence for evolution.

[2 marks]

Question 4a

- a) The Pyrenean desman (*Galemys pyrenaicus*) is a small, semi-aquatic, globally threatened mammal related to moles and shrews. It lives in the Pyrenees, a mountain range between France and Spain, and can be seen in the image below.



Suggest two adaptive features of the Pyrenean desman.

[2 marks]

Question 4b

- b) The scientists found that there were two populations of desman living in the Pyrenees; a northern and southern population. Analysis showed that there was variation between the two populations. Some of the variation could be accounted for by environmental factors such as food availability, but some could not.

Outline a source of variation **other** than environmental factors.

[2 marks]

Question 4c

- c) During a study that lasted many years, scientists found that the number of desman travelling from the northern population to the southern side of the mountain range was extremely low. The scientists suspect that the original desman species may have split into two different species.

Explain how the original desman species may have split into two separate species.

[3 marks]

Question 5a

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

- a) Explain the importance of heritable variation in evolution.

[3 marks]

Question 5b

- b) Outline the equivalent features of selective breeding and evolution by natural selection.

[5 marks]

Question 5c

- c) Explain how natural selection can account for the development of antibiotic resistant bacterial strains.

[7 marks]

