



Additional Assessment Materials
Summer 2021

Pearson Edexcel GCE in AS Biology

Topic 3: Classification and Biodiversity

(Public release version)

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General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

1

Natural selection can lead to adaptations in organisms.

(a) Explain how evolution can occur through natural selection.

(3)

(b) (i) Which of the following is an example of a behavioural adaptation?

(1)

- A courtship display in sticklebacks
- B litter size in pigs
- C number of *Drosophila* eggs that hatch
- D pollen production in sycamore trees

(ii) Which of the following is an example of anatomical adaptation?

(1)

- A an alarm call by a song thrush
- B dominance behaviour in dairy cattle
- C limb structure in primates
- D water potential in root hair cells

(iii) Which of the following is an example of physiological adaptation?

(1)

- A increased number of stomata on leaf upper surface in a water lily
- B production of venom by a snake
- C reduction of leaves to spines in a cactus
- D salmon swimming upstream to mate

(c) Natural selection can lead to speciation.

(i) Which information about a new organism would lead to it being classified as a new species?

(1)

- A anatomical differences
- B behavioural differences
- C genetic differences
- D inability to produce fertile offspring with similar species

(ii) Give one method that a scientist might use to inform the scientific community about the discovery of a new species.

(1)

2 Minke whales, killer whales and dolphins are all cetaceans.

These animals are different species that all belong to the order Cetacea.

(a) The five-kingdom model of classification is hierarchical.

Part of this hierarchy is: kingdom

phylum

class

family

genus

Where in this hierarchy should the order Cetacea appear?

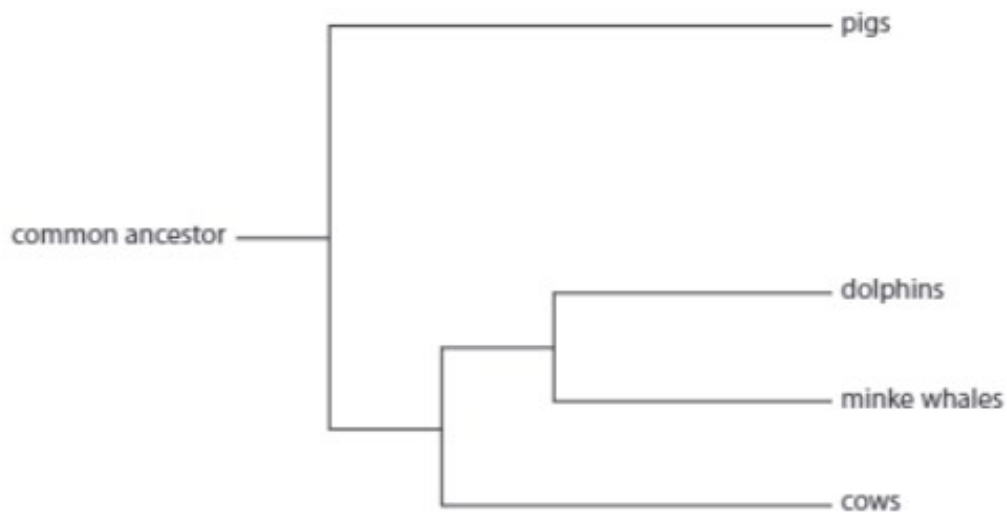
(1)

- A between kingdom and phylum
- B between phylum and class
- C between class and family
- D between family and genus

(b) Cetaceans evolved between 55 and 60 million years ago.

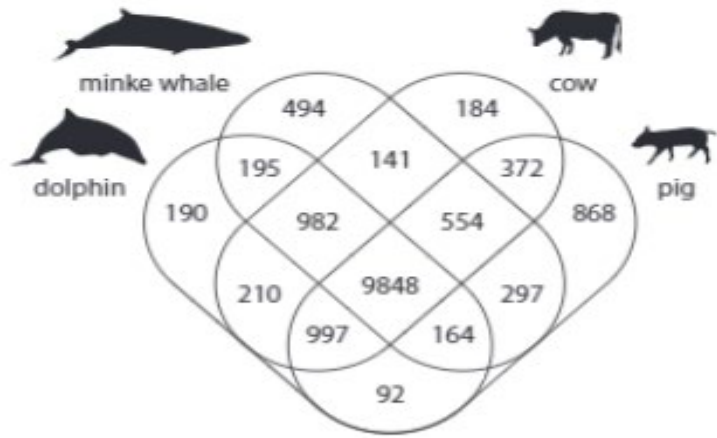
Their closest living relatives are thought to be pigs and cows.

The diagram shows the evolutionary relationship between minke whales, dolphins, pigs and cows.



Analyse the diagram to explain the evolutionary relationship between these four animals.
(3)

(c) The Venn diagram shows unique and shared gene families in the genomes of minke whales, dolphins, pigs and cows.



Calculate the percentage of a dolphin's gene families that are shared with the minke whale.
(2)

Answer%

(d) A wholphin is an extremely rare hybrid animal born from the mating of a female dolphin and a male killer whale.

Kekaimalu was a wholphin born in the United States in 1985. Kekaimalu was mated with a dolphin and on three occasions gave birth to live offspring.

Explain how this case study illustrates the limitations of the definition of a species.

(2)

3

- (a) Explain the difference between biodiversity within a habitat and biodiversity within a species.

(2)

- (b) Biodiversity can be measured by calculating an index of diversity.

The following data were collected from a freshwater pond in England.

Species	Number of individuals (n)
Mayfly nymph	80
Freshwater shrimp	23
Freshwater hogsouse	14
Beetle larvae	9

- (i) Calculate the index of diversity (D) for this pond.
Use the formula

(3)

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

Answer

(ii) A pond in a different area had a lower index of diversity.

Explain how the composition of this second community could have resulted in this lower index of diversity.

(2)

4

Gel electrophoresis is used to separate biological molecules such as proteins.

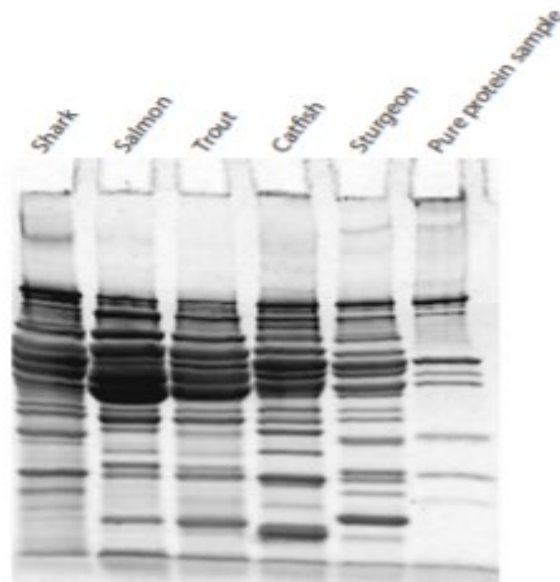
(a) Explain how gel electrophoresis separates molecules.

(2)

(b) Proteomics is the study of proteins that are produced in different species.

Scientists used gel electrophoresis to separate muscle proteins from five species of fish and from a pure protein sample.

The photograph shows the results of a gel separation of proteins from these fish and from the pure protein sample.



(i) Protein molecules in solution do not separate as easily as DNA fragments.

Explain how protein molecules in solution must be treated so that they can be separated by gel electrophoresis.

(2)

(ii) Analyse the information shown in the photograph to explain how this banding pattern can be used to confirm that these are separate species of fish.

(4)

(iii) Give a reason why pure protein samples were included in the gel.

(1)

(iv) The bands in the photograph vary in thickness.

State what the thickness of the bands indicates.

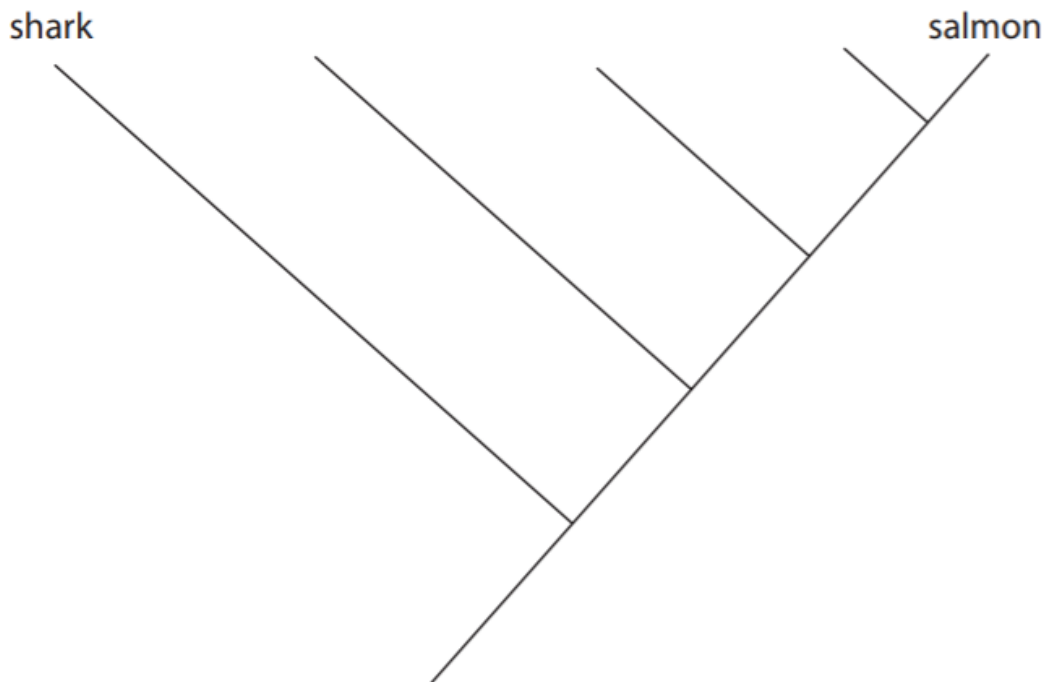
(1)

(c) The table shows the number of bands each fish has in common with the other species.

Species	Shark	Salmon	Trout	Catfish	Sturgeon
Shark	8	2	2	2	2
Salmon		10	10	5	3
Trout			13	5	4
Catfish				10	2
Sturgeon					12

Analyse the data to complete the diagram showing the evolutionary relationships between these species of fish.

(2)



TOTAL FOR TEST = 45 MARKS