
HL Paper 1

A biologist exploring an uninhabited island came across an unknown plant. She made the following notes:

- grows in a damp and shady corner of the island
- has large feathery leaves with spore cases (sporangia) arranged on the underside
- young leaves are tightly rolled up
- has roots.

In what phylum should she classify this plant?

- A. Angiospermophyta
- B. Bryophyta
- C. Coniferophyta
- D. Filicinophyta

Markscheme

D

Examiners report

Plant classification was tested in this question. The discrimination index was very high showing that the stronger candidates tended to answer it correctly but the weaker ones did not. The description of the newly discovered plant made it clear that it was a filicinophyte.

What promotes natural selection?

- I. Overpopulation
- II. Competition
- III. Variation

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

Markscheme

D

Examiners report

This was a good discriminator. Many of the weaker candidates failed to realise that overpopulation also promotes natural selection.

Which example provides evidence of evolution?

- A. White wings of a peppered moth turn black in industrial areas.
- B. Antibiotic resistant bacteria replace non-resistant bacteria over time.
- C. Some Galapagos finches' beaks become smaller during dry years.
- D. Polar bears are found in warmer latitudes following global warming.

Markscheme

B

Examiners report

For some candidates it was difficult to interpret whether the question was testing changes in individuals or in populations, therefore getting the wrong answer.

What type of process causes antibiotic resistance to develop in bacteria?

- A. Competition with viruses
- B. Overproduction of offspring
- C. Evolution due to environmental change
- D. Response by bacteria to an epidemic

Markscheme

C

Examiners report

Some teachers felt that answers B and C were both correct. Overproduction of offspring (B) is part of the Darwinian explanation of natural selection, but it does not in itself cause bacteria to develop resistance to antibiotics. The answer was evolution due to environmental change (C). Evolution is the process that causes antibiotic resistance to develop and the presence of antibiotics drives this. If a candidate thinks that there are two answers that are both partly or both wholly correct, they should always pick the best of the two answers. That was certainly C in this case. In fact few candidates chose B and a more popular wrong answer was D; response by bacteria to an epidemic.

How can molluscs and platyhelminthes be distinguished?

- A. Molluscs are unsegmented but platyhelminthes are segmented.
- B. Molluscs have a mouth and an anus but platyhelminthes do not.
- C. Molluscs are smooth but platyhelminthes have bristles.
- D. Molluscs remain attached to rock but platyhelminthes move around in water.

Markscheme

B

Examiners report

Some platyhelminthes do not have a mouth and none have an anus, therefore the correct answer is B.

Two different trees have been classified as *Pinus pinea* and *Pinus nigra*. Which of the following statements is correct?

- A. Both trees belong to the same class but a different genus.
- B. Both trees belong to the same family and same genus.
- C. The species name of both trees is *Pinus*.
- D. The family names are *pinea* and *nigra*.

Markscheme

B

Examiners report

This question discriminated surprisingly well with able candidates correctly choosing B.

A bacterial population with no resistance to an antibiotic may develop into a bacterial population with some resistance to an antibiotic. Which event could lead to this?

- A. Antibiotic resistance was inherited from an ancestral population.
- B. An antibiotic resistance plasmid is received from a bacterium in another population.
- C. The enzyme needed for antibiotic resistance is received from a bacterium in another population.
- D. The bacterial population mutated in response to antibiotics in the environment.

Markscheme

B

Examiners report

[N/A]

Which of the following is a characteristic of platyhelminthes?

- A. Many pairs of legs
- B. Flat body
- C. Hard exoskeleton
- D. Presence of cnidocytes

Markscheme

B

Examiners report

N/A

Based on binomial nomenclature, which two species are most closely related?

- I. Common barberry (*Berberis vulgaris*)
- II. Canadian bunchberry (*Cornus canadensis*)
- III. Smooth blackberry (*Rubus canadensis*)
- IV. Canadian barberry (*Berberis canadensis*)

- A. I and IV
- B. II and III
- C. II and IV
- D. III and IV

Markscheme

A

Examiners report

N/A

An animal shows radial symmetry, has only one opening leading to a digestive cavity and is soft without a skeleton. To which phylum does this animal belong?

- A. Platyhelmintha
- B. Annelida
- C. Mollusca
- D. Cnidaria

Markscheme

D

Examiners report

[N/A]

To which domain does *Carcharodon carcharias*, a shark, belong?

- A. Eukaryote
- B. Consumer
- C. Fish
- D. Chordata

Markscheme

A

Examiners report

N/A

What is the mechanism of natural selection?

- A. Any individuals in a population can be selected entirely by chance.
- B. After a change in the environment a species will evolve adaptations to the new conditions.
- C. If an adaptation to the environment is useful, an individual will develop it and pass it on to its offspring.
- D. Variations amongst individuals of a population are selected by a changing environment.

Markscheme

D

Examiners report

Many candidates considered that C was a correct answer. This shows a lack of understanding of the process of natural selection, as they considered Lamarckian inheritance part of natural selection.

To which group do sponges belong?

- A. Cnidaria
- B. Filicinophyta
- C. Porifera
- D. Mollusca

Markscheme

C

Examiners report

This question had a high discrimination index.

What features occur in all species of Angiospermophyta and Coniferophyta?

- A. Seeds
- B. Bark
- C. Cones
- D. Flowers

Markscheme

A

Examiners report

N/A

Which organisms have flowers?

- A. Bryophyta
- B. Porifera
- C. Angiospermophyta
- D. Cnidaria

Markscheme

C

Examiners report

N/A

An animal has radial symmetry, a sac-like body with only one opening and tentacles with stinging structures. To which phylum does this animal belong?

- A. Annelida
- B. Cnidaria
- C. Mollusca
- D. Porifera

Markscheme

B

Examiners report

N/A

What distinguishes Annelida from Platyhelminthes?

- A. Platyhelminthes have a segmented body but Annelida do not.
- B. Platyhelminthes reproduce sexually but Annelida do not.
- C. Platyhelminthes have radial symmetry but Annelida have bilateral symmetry.
- D. Annelida have both a mouth and an anus but Platyhelminthes do not.

Markscheme

D

Examiners report

Three teachers expressed concern over this question. Platyhelminthes having only one opening to their digestive tract is a distinguishing feature of most classes and can be arrived at through eliminating the other answers. Answer C was the most commonly chosen incorrect answer. Teachers are encouraged to review the distinction between radial symmetry and bilateral symmetry with their students.

What is accepted by scientists as evidence for evolution?

- I. Similarities in bone structure between the wings of a bat and the fins of a porpoise
- II. Changes in dog breeds caused by artificial selection
- III. Extinction of dinosaurs

- A. I only
- B. I and II only
- C. I and III only
- D. I, II and III

Markscheme

B

Examiners report

A significant number did not think that changes in dog breeds was evidence for evolution, answering A instead of B.

Which of the organisms A–D, identified by the key below, represents an Annelid?

- | | |
|----------------------------------|----------|
| 1. Shows bilateral symmetry | go to 2 |
| Does not show bilateral symmetry | Cnidaria |
| 2. Has a segmented body | go to 3 |
| Does not have a segmented body | go to 4 |
| 3. Has jointed legs | A |
| Does not have jointed legs | B |
| 4. Has a shell | C |
| Does not have a shell | D |

Markscheme

B

Examiners report

Some teachers were concerned this question was testing the use of dichotomous keys rather than Annelids. Both were being tested. This question had quite a good discrimination index.

How can species of bacteria evolve to be resistant to antibiotics?

- I. A variation within one bacterium's genome confers resistance.
- II. Antibiotics enable genes to become adapted through transcription and translation.
- III. An incomplete dose of antibiotics allows bacteria with a high resistance to survive and reproduce.

- A. I only
- B. I and II only
- C. I and III only
- D. III only

Markscheme

C

Examiners report

The wording of this question could have been clearer.

Ranunculus repens and *Hypericum repens* both have yellow flowers. Which statement is true?

- A. They are angiospermophytes.
- B. They are coniferophytes.
- C. They are members of the same species.
- D. They are members of the same genus.

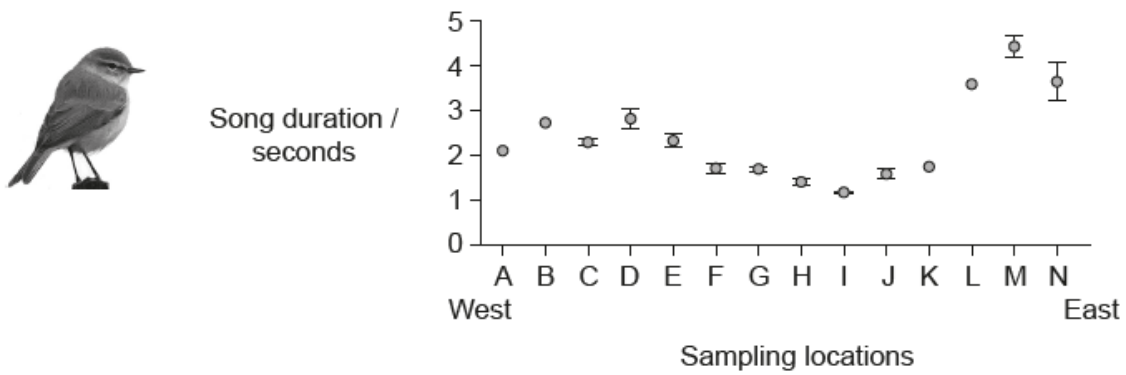
Markscheme

A

Examiners report

Question 18 was relatively poorly answered. Large numbers of candidates thought that two species with the same specific names but different generic names were of the same species. In fact some common specific names such as album or vulgaris are used for large numbers of different species.

The graph shows the song duration of birds from the genus *Phylloscopus* sampled from west to east throughout Northern Europe and Northern Asia.



[Source: adapted from DE Irwin, (2000), *Evolution*, 54 (3), Wiley, page 1006]

What concept do these data illustrate?

- A. Gradual divergence
- B. Adaptive radiation
- C. Interbreeding populations
- D. Punctuated equilibrium

Markscheme

A

Examiners report

[N/A]

The scientific name of the great egret has recently been changed from *Casmerodius albus* to *Ardea alba*.



[Source: <http://images.freeimages.com/images/previews/218/ardea-alba-2-1250856.jpg>, by sxc]

What is a possible reason for the reclassification of egrets?

- A. Allopatric speciation
- B. Discovery of different ancestry
- C. A change in the mating behaviours
- D. Change in habitat and geographic range

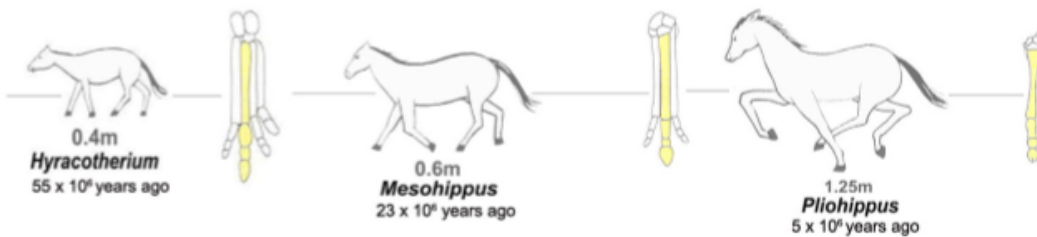
Markscheme

B

Examiners report

[N/A]

The following diagrams (not to scale) represent the fossilized forelimbs of three horses living at different times, none of which are alive today.



Images by Alex Brollo

The diagrams provide evidence for which of the following?

- A. Pentadactyl limb
- B. Domestication of animals
- C. Homologous structures
- D. Change in the characteristics of species

Markscheme

D

Examiners report

This question provoked a lot of controversy and proved to be a poorly discriminating question. The question proved to be hard for more able students to answer. Many candidates chose homologous structures. One probable reason is that the answer referred to change in species throughout time but the question was showing the progression in change in different genera. As this question was correct, it was decided not to eliminate it but the grade boundary for 6/7 was carefully considered to ensure fairness.

The image shows an *Acacia tortilis* tree which is one of 13 species of Acacia. All such flowering trees are examples of Fabaceae.



[Source: adapted from www.elicriso.it]

What is the highest level of taxa for *Acacia tortilis*?

- A. *Acacia*
- B. *Tortilis*
- C. Fabaceae
- D. Angiospermophyta

Markscheme

D

Examiners report

This proved to be a very easy question. Only a few candidates failed to realize that the *Acacia* are Angiosperms (flowering plants).

The photograph shows an animal of the species *Eisenia fetida*.



[Source: "Redwiggler1" by Mihai Duguleana; - Transferred from en.wikipedia to Commons.
Licensed under Public Domain via Wikimedia Commons -
<https://commons.wikimedia.org/wiki/File:Redwiggler1.jpg#/media/File:Redwiggler1.jpg>]

Which phylum does it belong to?

- A. Cnidaria
- B. Platyhelminthes
- C. Annelida
- D. Arthropoda

Markscheme

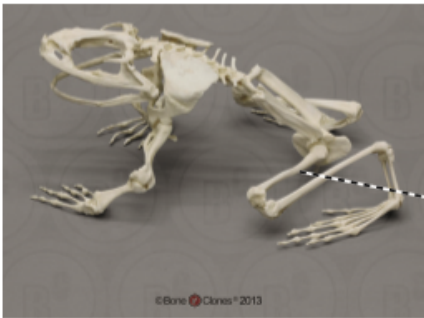
C

Examiners report

[N/A]

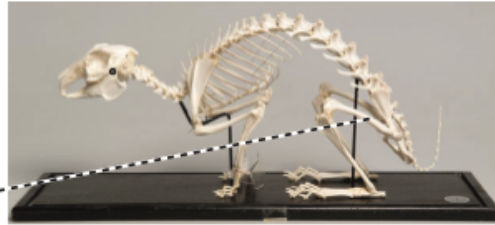
The pictures show skeletons of a frog (*Conraua goliath*) and of a domestic rabbit (*Oryctolagus cuniculus*).

Frog



[Source: © Bone Clones, www.boneclones.com]

Rabbit



[Source: © CSG CIC Glasgow Museums and Libraries Collections]

What is the evolutionary relationship between X and Y?

- A. They are analogous.
- B. X is analogous and Y is homologous.
- C. They are homologous.
- D. They are neither homologous nor analogous.

Markscheme

C

Examiners report

This question had low discrimination as good candidates were confused by it. Many answered that the structures were analogous, but rabbits jump and frogs swim, so they are homologous. The question was related to the structure of the pentadactyl limb.

The photograph shows vegetation in a rocky area.



[Source: © International Baccalaureate Organization 2017]

Which characteristic of the plants indicates that the area in which they are growing is probably dry?

- A. Relatively small size
- B. Small flowers
- C. Narrow leaf surface
- D. Small root system

Markscheme

C

Examiners report

[N/A]
