

Classification & evolution

Question Paper 1

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Biodiversity, evolution and disease
Topic	Classification & evolution
Booklet	Question Paper 1

Time allowed: 58 minutes

Score: /43

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

Which of the following statements about antibiotic resistance is correct?

- A. All antibiotics cause mutations in bacterial DNA.
- B. Antibiotic resistance in bacteria is evidence to support Darwin's theory of evolution by natural selection.
- C. The development of antibiotic resistance in bacteria is an example of genetic drift.
- D The development of antibiotic resistance in bacteria is an example of stabilising selection. **[1]**

Question 2

Biologists use both phylogeny and classification to understand how different species are related.

Which of the options, **A** to **D**, is a statement about phylogeny?

- A. There are 21 species of ladybird in the UK that belong to the sub-family Coccinellinae.
- B. *Homo sapiens* and *Pan bonobo* share a common ancestor.
- C. The lily family, Liliaceae, consists of fifteen genera.
- D. The great white shark, *Carcharodon carcharias*, is a member of the class Chondrichthyes.

[1]

Question 3

The image below shows a European badger, *Meles meles*, which is a member of the family Mustelidae.



The American badger belongs to a different genus within the same family.

Which of the options, **A** to **D**, is the correct binomial name for the American badger?

- A. *Meles leucurus*
- B. *mellivora capensis*
- C. *mustelidus Everetti*
- D. *Taxidea taxus*

[1]

Question 4

Two species of chimpanzees, the chimpanzee and the bonobo, are the closest living relatives of humans.

Fig. 19.1 is a diagram representing the current classification of chimpanzees and humans within the Family Hominidae.

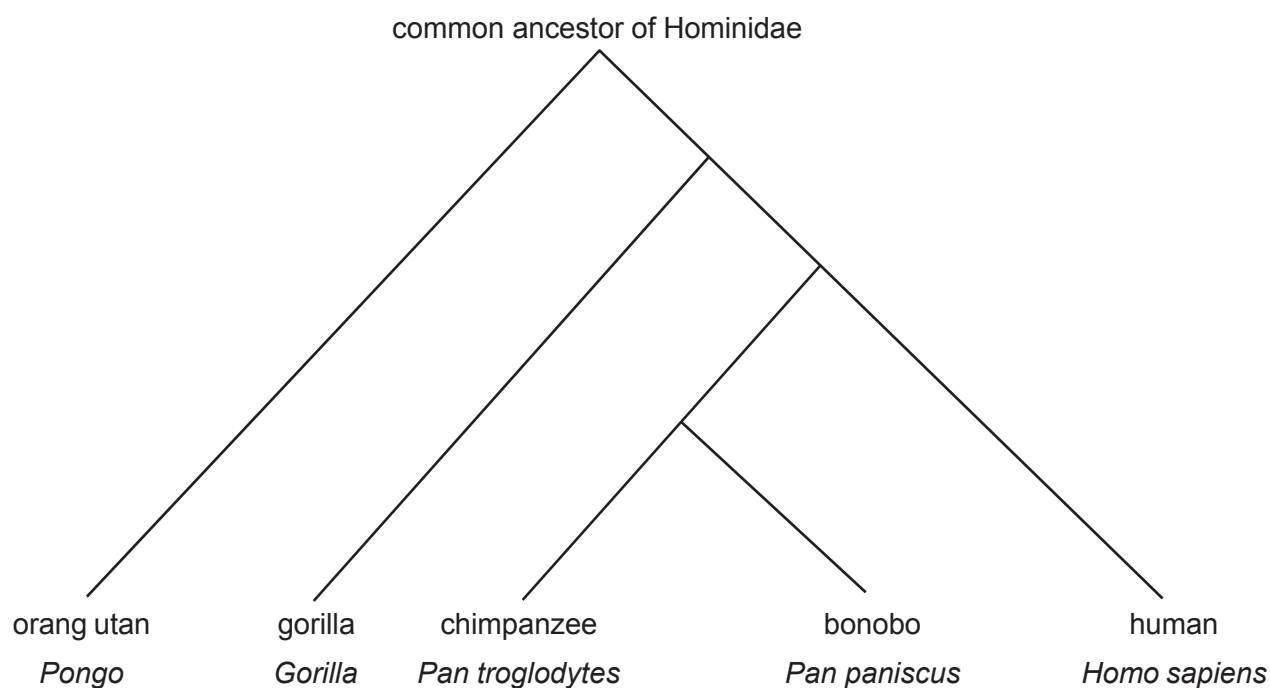


Fig. 19.1

(a) Humans and chimpanzees are currently classified within the same family.

Chimpanzees were once classified separately from humans in the Family Pongidae along with gorillas and orang utans.

Fig. 19.2 shows a human hand and a chimpanzee hand.

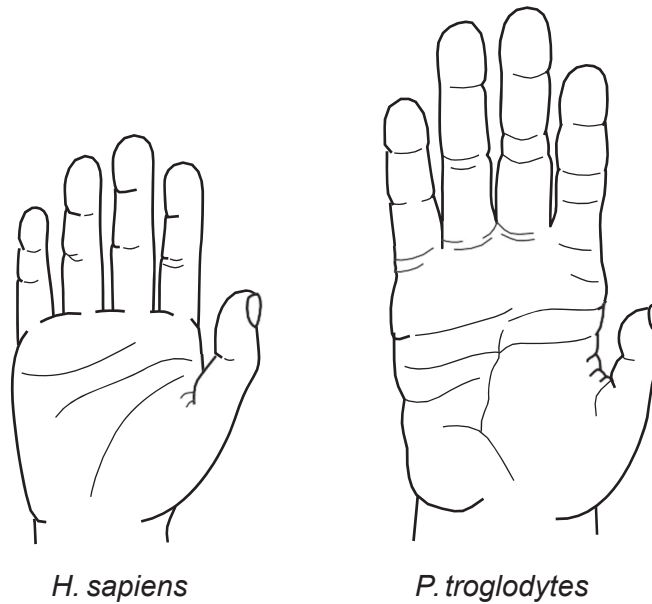


Fig. 19.2

Describe **two** differences between the two images that could have been used to classify humans and chimpanzees in separate families.

[2]

- (b) Differences between the nucleotide base sequences can be used to estimate the length of time since two species diverged from one another.

The greater the number of differences, the greater the length of time that has elapsed since the two organisms were part of the same species.

Fig. 19.3 shows the line of best fit for the differences in DNA between pairs of primate species plotted against the number of years since the two species diverged from a common ancestor.

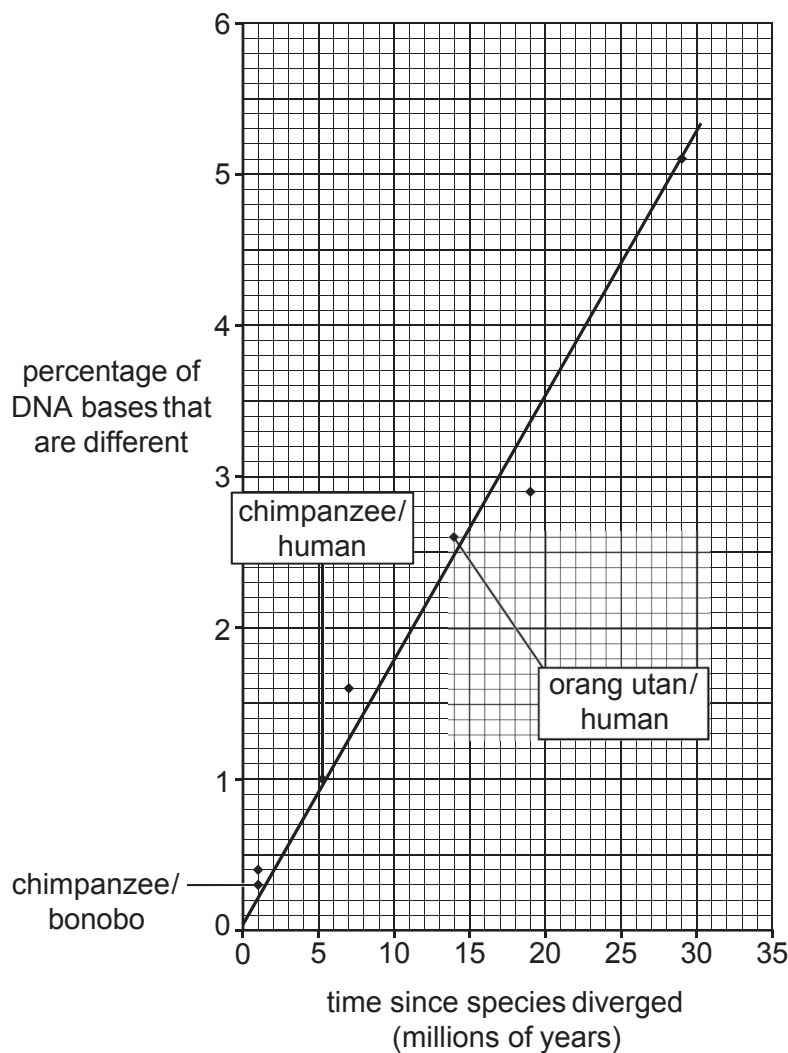


Fig. 19.3

- (i) Calculate the rate of DNA change using the data in Fig. 19.3.

Give your answer to **three** significant figures.

[2]

- (ii) The mutation rate in mammals can vary by as much as 20% between species.

Use **Fig. 19.3** to calculate the time since the phylogeny of humans diverged from chimpanzees, and the range over which this estimate may vary. **[2]**

- (iii)* Some scientists have suggested that humans and chimpanzees should be reclassified as belonging to the same **genus**.

Evaluate their suggestion using evidence from **Figs. 19.1 to 19.3** and your own knowledge of the scientific basis for the classification of organisms. **[6]**

- (iv) One type of gene is known as a homeobox gene.

The base sequences of homeobox genes in humans and chimpanzees are almost identical.

What conclusions about the evolutionary relationship between humans and chimpanzees can be drawn from this piece of evidence? **[1]**

[Total: 13]

Question 5

Bats are the only mammals that have wings. Many species of bat hunt flying insects at night. Bats are able to use echolocation (sound waves) in order to help them find their prey in the dark.

- (a) (i) Explain why bats and birds, despite not being closely related, have both evolved wings.

[3]

- (ii) Suggest why the vast majority of bird species have not evolved the ability to echolocate.

[1]

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
Common pipistrelle	5.5	0.22	52 – 60	medium to dark brown	woodland, hedgerows, grassland, farmland, suburban and urban
Soprano pipistrelle	5.5	0.21	42 – 47	medium to dark brown	wetland, woodland edge, tree lines, hedgerows, suburban gardens and parks

Table 5.1

A researcher made the following claim:

‘The common pipistrelle and soprano pipistrelle must be distinct species.’

Evaluate the researcher’s claim by using the evidence in **Table 5.1** to support and to challenge the researcher’s conclusion.

[6]

[Total: 10]

Question 6

Six major groups of organisms are listed below:

animals

bacteria

plants

archaea

fungi

protocists

- (a) A teacher constructed a **dichotomous key** to help her students distinguish between each of these groups.

The key consisted of a series of questions with '**yes**' or '**no**' answers.

- (i) The first question is shown in the box below. Complete the key by choosing the correct answer from the groups of organisms listed.

Question 1: Does the organism have walls made of chitin?

Yes =

No go to question 2

[1]

- (ii) Write a question in the box below to distinguish plants and protocists from the remaining groups of organisms.

Question 2:

Yes = plants or protocists

No go to question 3

[1]

- (iii) Write a question in the box below to distinguish the archaea and bacteria from animals.

Question 3:

Yes = animals

No archaea or bacteria

[1]

- (b) (i) Fig. 6.1 is a diagram representing the taxonomic hierarchy of organisms within the animal kingdom.

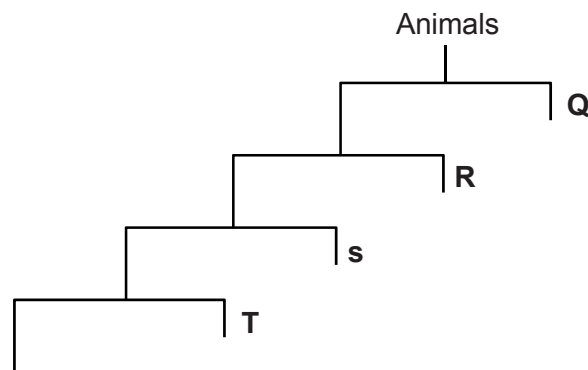


Fig. 6.1

State the level of taxonomic group represented by the letters **Q**, **R**, **S** and **T**. **[2]**

- (ii) Fig. 6.2 shows a diagram representing the phylogenies of some groups of organisms.

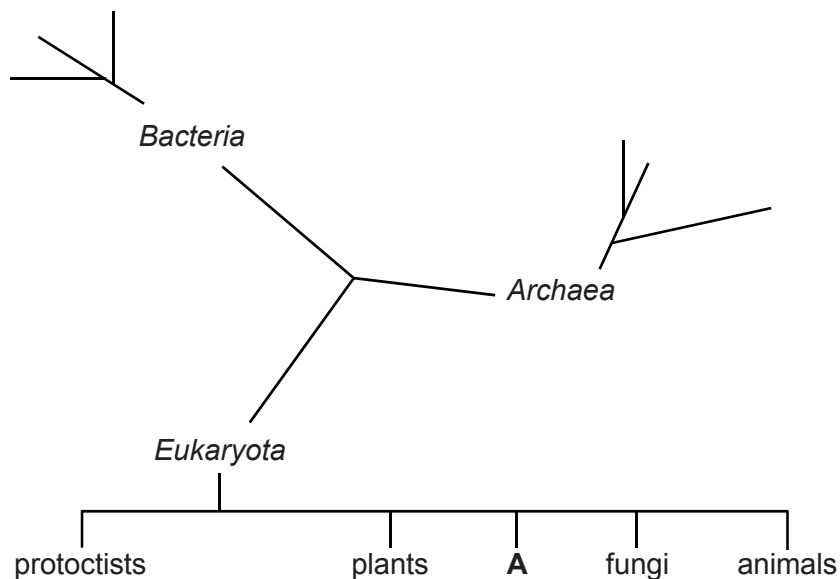


Fig. 6.2

The letter '**A**' on Fig.6.2 represents a group of organisms called slime moulds.

With reference to Fig. 6.2, discuss the **classification** of slime moulds and include the range of evidence on which this classification might be based. **[3]**

- (iii) State **three** reasons why the three-domain classification system is now used in preference to the five-kingdom system. **[3]**

[Total: 11]

Question 7

The leaves of flowering plants have the ability to develop differently, depending on environmental conditions such as the amount of sun or shade a leaf receives.

A student carried out an investigation into sun and shade leaves from different parts of the same plant. Her observations and results are shown in Table 6.1.

Table 6.1

type of leaf	number of leaves studied	mean no. of stomata per mm ² on lower surface	mean thickness of leaf (μm)	cuticle
sun	55	170	208	thick
shade	8	92	93	thin

- (a) Calculate the percentage difference in the **mean thickness** of the sun leaves compared to the shade leaves.

Show your working.

[2]

- (b) Suggest **and** explain one benefit of the greater **mean number** of stomata per mm² on the lower surfaces of the sun leaves.

[2]

- (c) Describe **two** ways in which the student could improve her investigation.

[2]

[Total: 6]