

# 5.2 Classification & Cladistics

## Question Paper

Course	DP IB Biology
Section	5. Evolution & Biodiversity
Topic	5.2 Classification & Cladistics
Difficulty	Medium

**Time allowed:** 60  
**Score:** /44  
**Percentage:** /100

### Question 1a

- a) The common dogwood, *Cornus sanguinea*, is a broadleaved shrub of the family Cornaceae native to Europe and Western Asia. Some of the classification of the common dogwood is shown in the table below.

<b>Kingdom</b>	Plantae
(i)	
<b>Class</b>	Dicotyledonae
(ii)	Cornales
<b>Family</b>	(v)
(iii)	(vi)
(iv)	(vii)

Identify taxa (i)-(vii) from the table above. Note that one box has been left intentionally blank; you do **not** need to identify the taxon from the blank box.

[2 marks]

### Question 1b

- b) *Cornus canadensis* and *Cornus nuttallii* are similar in appearance and are both found across North America.

With the exception of breeding them together, state **two** ways in which scientists could determine that these dogwood varieties are two separate species.

[2 marks]

**Question 1c**

- c) The image below shows an illustration of *Cornus canadensis*.



Identify, with a reason, the phylum to which *C. canadensis* belongs.

[2 marks]

**Question 1d**

- d) Dogwood species are identified by the use of binomial names such as *Cornus canadensis* and *Cornus nuttallii*.

State the purpose of the binomial system of naming organisms.

[1 mark]

**Question 2a**

- a) Specimen **A** and specimen **B** are similar species of invertebrate.

Scientists wanted to determine whether specimen **A** and **B** are different species of invertebrate, or different forms of the same species.

In order to do this they caught large numbers of each specimen type and measured the body mass and length of each individual before calculating the means and standard deviations (SD). Their results are shown in the table below.

	<b>Specimen A</b>	<b>Specimen B</b>
<b>Mean mass / g (<math>\pm</math> SD)</b>	0.68 ( $\pm$ 0.02)	0.67 ( $\pm$ 0.01)
<b>Mean body length / mm (<math>\pm</math> SD)</b>	21.4 ( $\pm$ 0.9)	19.2 ( $\pm$ 0.7)

Explain how the standard deviation can help with the interpretation of this data.

[2 marks]

**Question 2b**

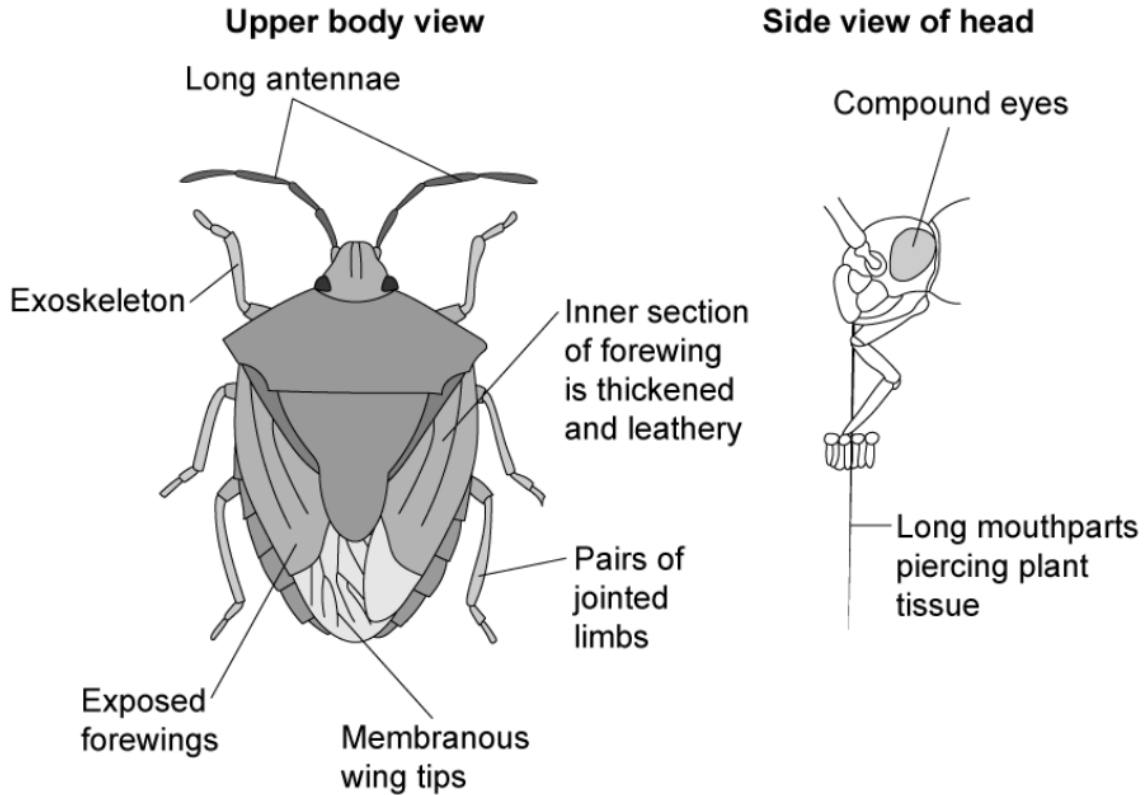
- b) The scientists hypothesised that the two specimens were different forms of the same invertebrate species.

Evaluate this hypothesis using the data in the table part (a).

[3 marks]

**Question 2c**

c) The appearance of specimen **A** is shown in the image below.



Use the dichotomous key below to deduce the order to which specimen **A** belongs.

1	Hard wing cases cover forewings . . . . .	Coleoptera
	Hard wing cases absent. . . . .	Go to 2
2	Partially leathery forewings. . . . .	Go to 3
	Entirely membranous forewings. . . . .	Go to 4
3	Mouthparts adapted for sucking. . . . .	Hemiptera
	Mouthparts adapted for biting. . . . .	Orthoptera
4	Wing pairs of roughly equal size. . . . .	Hymenoptera
	One pair of wings much larger than the other. . . . .	Diptera

[1 mark]

### Question 2d

- d) Use information provided in part (c) to identify, with a reason, the animal phylum to which specimen **A** belongs.

[2 marks]

### Question 3a

- a) Cytochrome c is a respiratory protein consisting of roughly 100 amino acids while haemoglobin is a quaternary protein found in red blood cells consisting of over 400 amino acids.

Suggest, with a reason, which of these two proteins is a better choice for use in identifying evolutionary relationships across plantae, fungi and animalia.

[2 marks]

### Question 3b

- b) Explain how biochemical sequence analysis, as opposed to other methods of classification, ensures that natural classification is carried out.

[1 mark]

**Question 3c**

- c) Scientists studied the amino acid sequence of cytochrome c in five different animals. The amino acid sequence was compared with **human** cytochrome c and the number of differences to the human sequence were recorded. The results are shown in the table below.

Animal	Number of differences in the amino acid sequence compared with human cytochrome c
Human	0
Dog	11
Duck	11
Turtle	15
Monkey	1
Pig	10

State, with a reason, **one** conclusion that can be reached from the data in the table above about the relationship of humans to other animals.

[2 marks]

**Question 3d**

- d) An assistant who looked at the results in the table in part (c) suggested that dogs were more closely related to ducks than to any of the other animals.

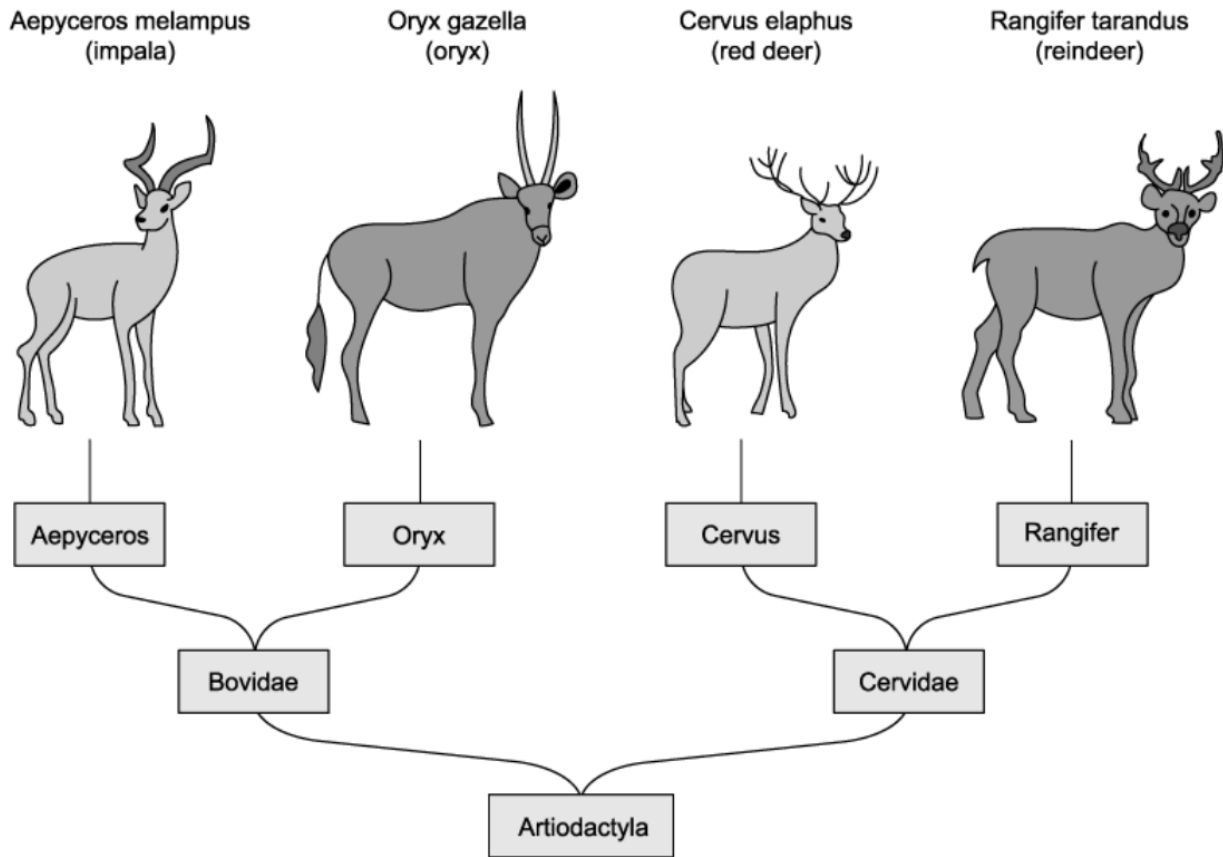
State, with a reason, whether or not the student's suggestion is valid.

[2 marks]



**Question 4a**

a) The image below shows the classification of some animals with antlers and horns.



State the number of different orders that are present in the image above.

[1 mark]

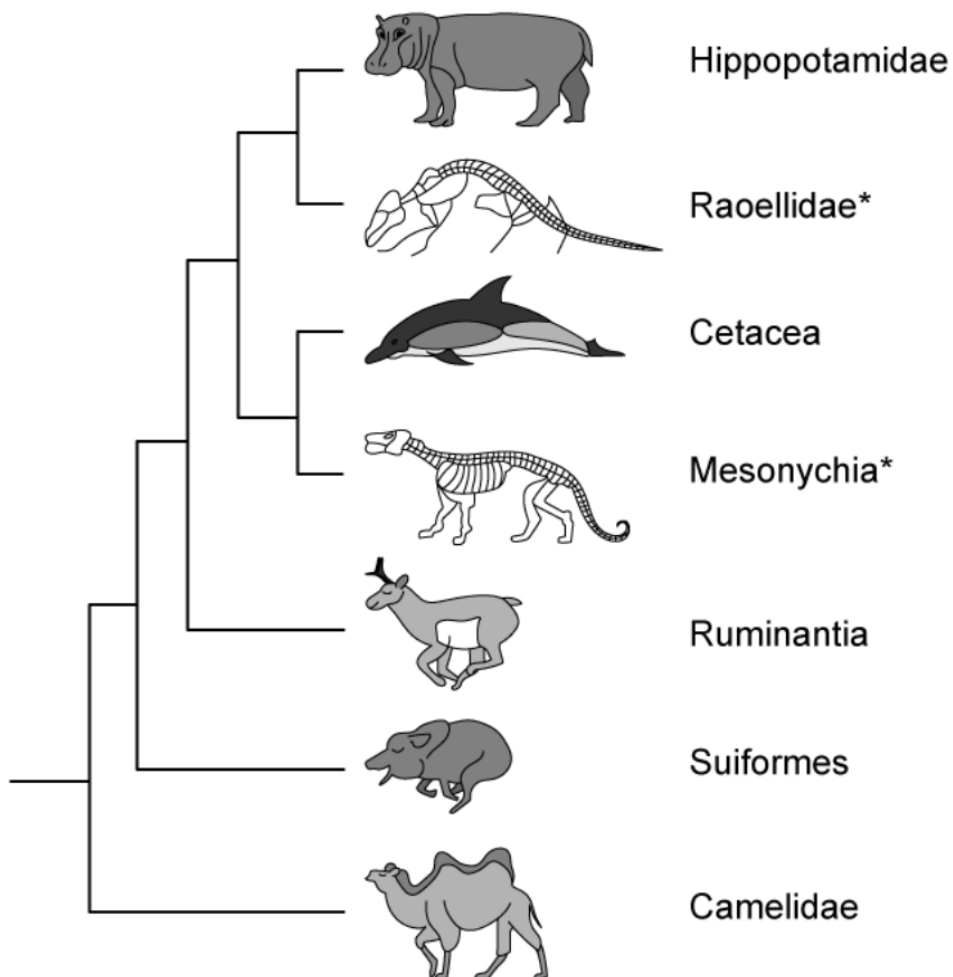
**Question 4b**

b) Compare and contrast the sciences of taxonomy and cladistics.

[2 marks]

**Question 4c**

- c) Deer are members of the suborder (a smaller division within an order) ruminantia, which are themselves members of the order artiodactyla. The relationships between the artiodactyla are shown on the cladogram below. \* denotes a now extinct taxon.



Identify, with a reason, an example of the closest evolutionary relationship shown in the cladogram.

[2 marks]

**Question 4d**

- d) A student reading the cladogram in part (c) identified the ruminantia as a clade.

Explain why the student was incorrect in their identification of the ruminantia as a clade.

[2 marks]

**Question 5a**

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

- a) Describe the features of archaea that mean they are classified as a distinct domain in the three domains system of classification.

[3 marks]

**Question 5b**

- b) Compare and contrast phylum annelida and phylum platyhelminthes.

[7 marks]

**Question 5c**

- c) Outline the reclassification of the scrophulariaceae, or figwort family.

[5 marks]