

5.2 Classification & Cladistics

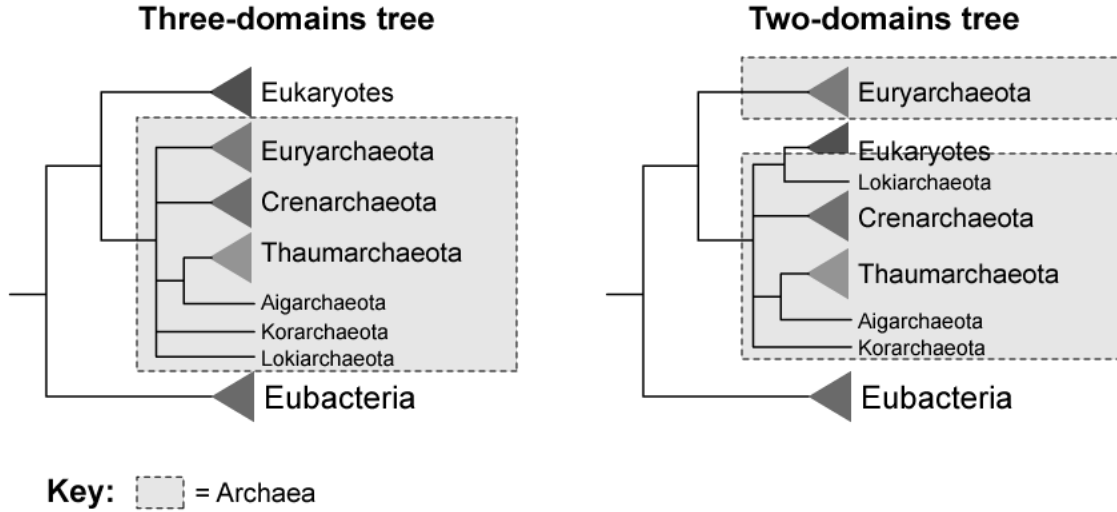
Question Paper

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

Time allowed: 10
Score: /5
Percentage: /100

Question 1

RNA analysis led to the development of the three domains system of classifying organisms. More recent methods of building evolutionary trees has led to the proposal of the two domains system. The image compares the three domains tree and the two domains tree.



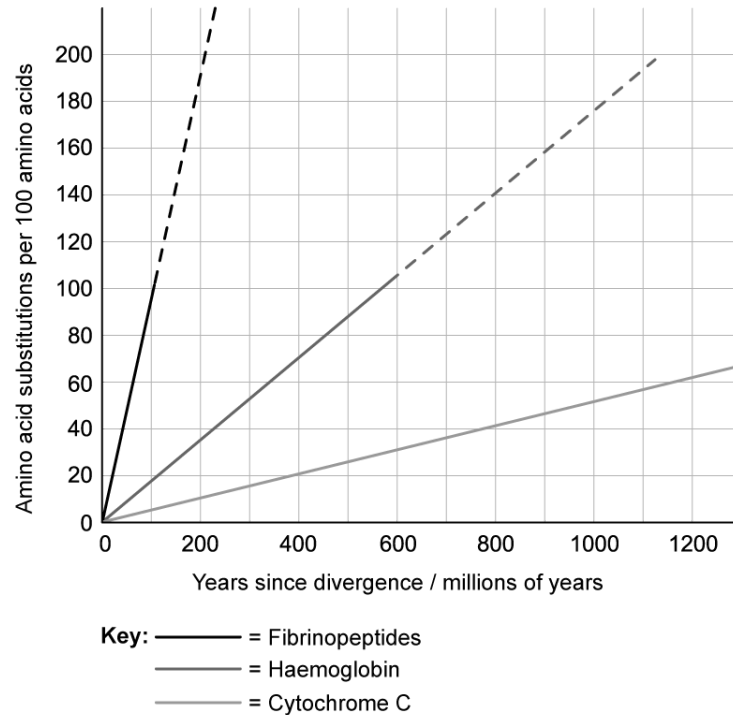
Which of the following pairs of statements correctly compares the three domains and two domains trees?

	Three domains	Two domains
A.	The eubacteria form a clade	The eubacteria form a clade
B.	The eukaryotes share a common ancestor with the archaea	The common ancestor of all the eukaryotes is within the archaea
C.	The archaea form a clade	The archaea form a clade
D.	The eukaryotes are more closely related to the euryarchaeota than to any other group	The eukaryotes are more closely related to the lokiarchaeota than to any other group

[1 mark]

Question 2

The graph shows the rate at which amino acids are substituted in three different types of protein; some amino acids can be substituted multiple times over a long period of time. Note that land plants are thought to have evolved around 500 million years ago, insects are thought to have evolved around 400 million years ago, and mammals around 170 million years ago.



Which of the statements about amino acid substitution are correct?

- I. Amino acids in cytochrome C proteins are substituted at a rate of 5 per 100 million years.
- II. All proteins are equally useful for determining the length of time since species diverged from each other.
- III. Cytochrome C proteins are likely to be involved in a chemical process that is highly conserved across all living organisms.
- IV. Analysis of amino acid sequences in fibrinopeptide proteins can be used to classify arthropoda.

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

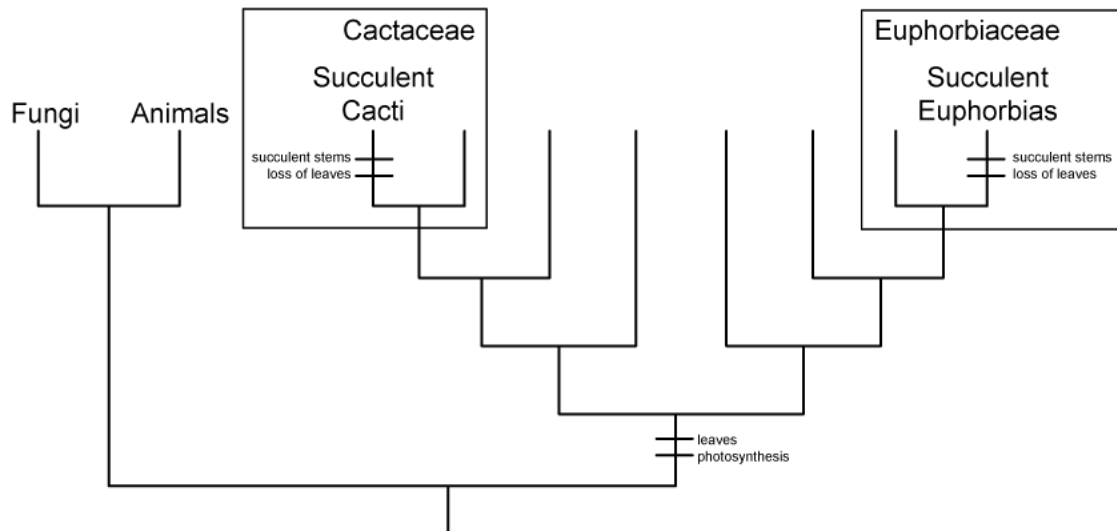
[1 mark]

Question 3

The photograph shows a succulent cactus plant (left) of the family cactaceae and a succulent euphorbia plant (right) of the family euphorbiaceae. The diagram below shows a representation of a cladogram that includes both plant types. The horizontal lines crossing the branches of the cladogram indicate the evolution of some plant characteristics.



Cactus image courtesy of Nabin K Sapkota licensed under the Creative Commons Attribution-Share Alike 4.0 International license, and adapted and redistributed under conditions found at <https://creativecommons.org/licenses/by-sa/4.0/deed.en> and euphorbia image courtesy of Bernard Dupont licensed under the Creative Commons Attribution-Share Alike 1.0 Generic license, and adapted and redistributed under conditions found at <https://creativecommons.org/licenses/by-sa/2.0/>



Which statement correctly explains the appearance of succulent cacti and euphorbias?

- A. The features of cacti and euphorbias are homologous as they have been inherited from a common ancestor.
- B. The features of cacti and euphorbias are homologous as they are structurally similar but have a different role.
- C. The features of cacti and euphorbias are analogous as they are structurally different but have a similar role.
- D. The features of cacti and euphorbias are analogous as they evolved independently of each other from different ancestors.

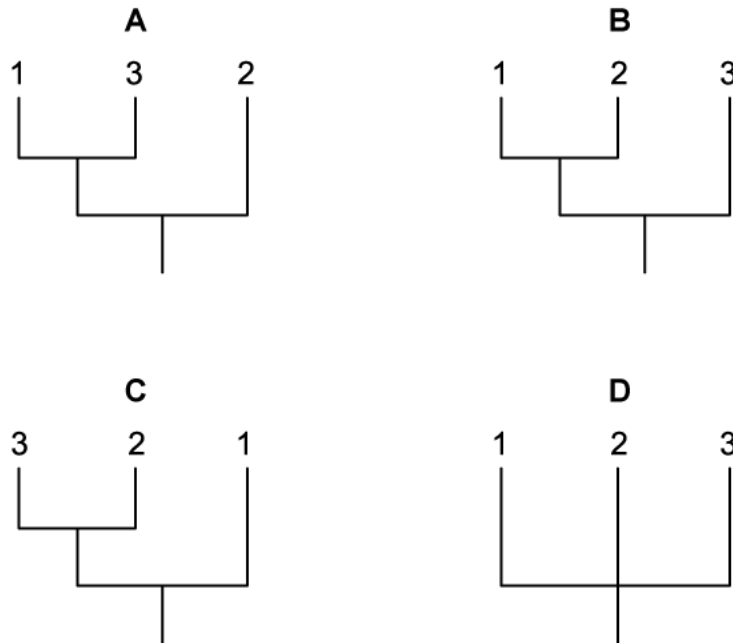
[1 mark]

Question 4

The table shows a short section of the DNA base sequence of three different species.

Species	Base sequence
1	ATCTGC
2	CCTGGT
3	ACCTAC

Which cladogram best represents the relationships between species 1, 2, and 3?



[1 mark]

Question 5

The table contains a dichotomous key for identifying several animal species.

1.	Body plan has some form of symmetry.....	Go to 2
	Body plan has no symmetry.....	<i>Suberites carnosus</i>
2.	Single gut opening for mouth and anus.....	Go to 3
	Separate gut openings for mouth and anus.....	Go to 4
3.	Radial symmetry.....	<i>Chrysaora colorata</i>
	Bilateral symmetry.....	<i>Pseudoceros dimidiatus</i>
4.	Closed circulatory system.....	<i>Hermodice carunculata</i>
	Open circulatory system.....	Go to 5
5.	Soft body.....	<i>Philomycus carolinianus</i>
	Body has a hard exoskeleton.....	<i>Melo proscarabaeus</i>

Which species belongs to the phylum annelida?

- A. *Pseudoceros dimidiatus*
- B. *Hermodice carunculata*
- C. *Philomycus carolinianus*
- D. *Suberites carnosus*

[1 mark]