Practice Evolution & Taxonomy Questions

[14 marks]

The diagram shows a leaf from Dryopteris arguta.

[https://commons.wikimedia.org/wiki/File:E20161208-0001%E2%80%94Dryopteris_arguta_(Reverse)%E2%80%94RPBG_(30698925004).jpg, E20161208-0001—Dryopteris arguta (Reverse)—RPBG Source: https://www.flickr.com/photos/john_d_rusk/30698925004/ Author: John Rusk from Berkeley, CA, United States of America, licensed under Creative Commons licence: https://creativecommons.org/licenses/by/4.0/legalcode]

1a. State the phylum of this plant. *[1 mark]*

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Markscheme

Filicinophyta/Filicinophytes/Pteridophytes

Reject "ferns"

Examiners report

[N/A]

1b. State **two** characteristics of plants from the phylum you stated in (a)(i). *[2 marks]*

. . . . . .

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Markscheme

a. have roots, stem and leaves

All three, roots, stem and leaves required

b. pinnate leaves/leaves divided «repeatedly» into leaflets

c. have vascular tissue/xylem and phloem

d. produce spores/sporangia

OR

no flowers/fruits/seeds

[Max 2 Marks]

Examiners report

[N/A]

1c. Outline why the number of trophic levels is limited in a food chain. *[1 mark]*

. . . . . .

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Markscheme

energy losses between trophic levels

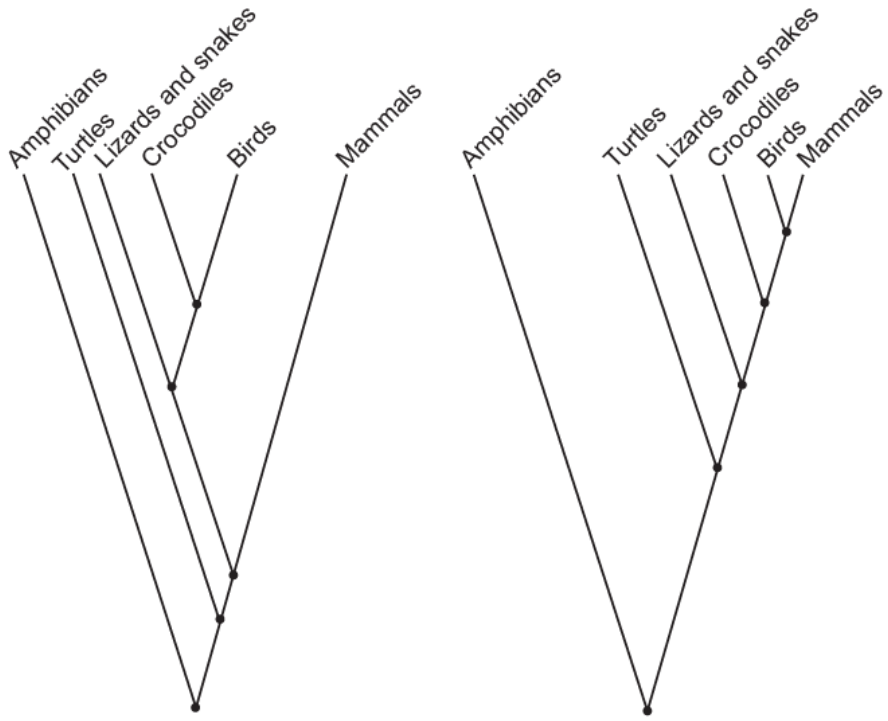
OR

only part of the energy in one trophic level will become part of the next trophic level

Examiners report

[N/A]

2. Cladograms can be created by comparing DNA or protein sequences. The cladogram on the left is based on DNA sequences and the cladogram on the right is based on comparing protein sequences. *[1 mark]*



What is the reason that cladograms based on DNA sequences are more reliable predictors of the phylogenetic relationship of species than cladograms based on protein sequences?

A. Amino acids are not as chemically stable as DNA nucleotides.

B. DNA mutates but amino acids do not.

C. Several different triplets of bases can code for the same amino acid.

D. There are 20 different amino acids but only 4 nucleotides.

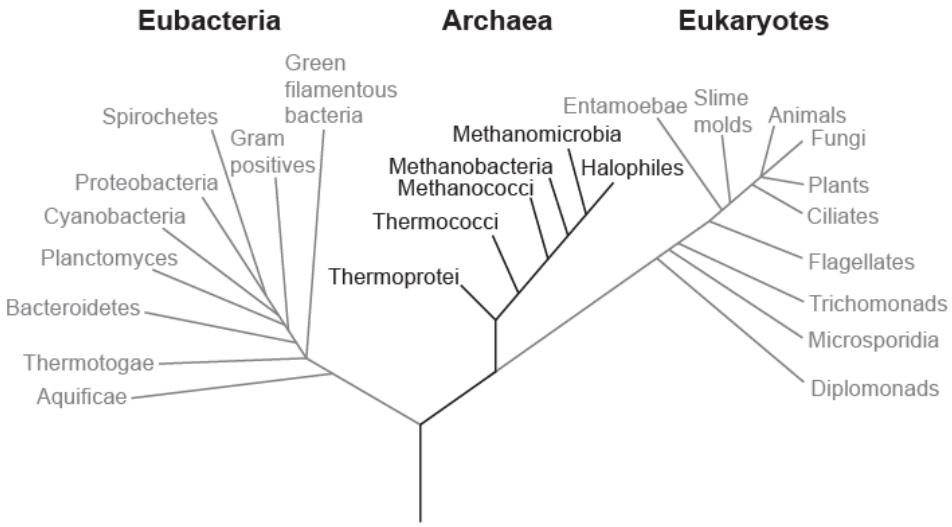
Markscheme

C

Examiners report

[N/A]

3. Below is a phylogenetic tree of the three domains. *[1 mark]*



There are important differences between the three domains. Which of these domains have organelles?

A. Eubacteria and archaea

B. Archaea only

C. Eukaryotes and archaea

D. Eukaryotes only

Markscheme

D

Examiners report

[N/A]

4. Which is a characteristic of both bryophyta and filicinophyta? *[1 mark]*

A. Vascular tissue

B. Membranous leaves

C. Release of spores

D. Evergreen spines

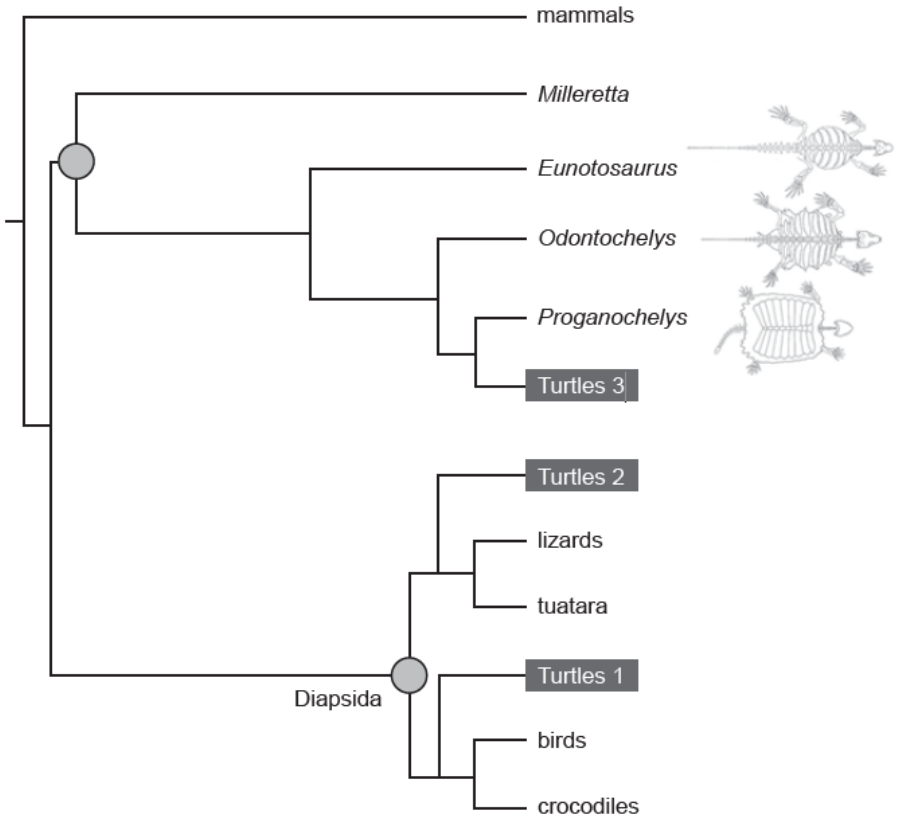
Markscheme

C

Examiners report

[N/A]

The following cladogram shows three possible evolutionary routes for the turtle (Turtles 1, Turtles 2 and Turtles 3). The taxa in italics are extinct.



[Source: Tyler R. *et al.*, Transitional fossils and the origin of turtles, *Biology Letters* 6, Dec 23, 2010, pages 830–833, by permission of the Royal Society.]

5a. State the organism most closely related to the lizards. *[1 mark]*

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. . . . . .

Markscheme

Tuatara

Examiners report

[N/A]

5b. Based on the taxa shown, deduce a difficulty in gathering data to study turtle ancestry. *[1 mark]*

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. . . . . .

. . . . . .

Markscheme

some «taxa» are extinct
OR
convergence «of body form» could have occurred (confusing interpretation of the data)

Examiners report

[N/A]

5c. Molecular evidence is often used to construct a cladogram. Describe **one** type of molecular-based evidence to identify members of a clade. *[2 marks]*

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Markscheme

a. base sequences of a gene/DNA/mtDNA
OR
amino acid sequences of a protein

b. species with the most similarities «in base sequence/amino acid sequence/genomes» have recently diverged/a common ancestor/are closely related
OR
members of a clade accumulate the fewest mutations on same base sequences/ *vice versa* / OWTTE

Examiners report

[N/A]

5d. Suggest **one** type of additional evidence that could provide strong support for Turtles 3 as the evolutionary route for turtles rather than Turtles 1 or Turtles 2. *[1 mark]*

. . . . . .

. . . . . .

. . . . . .

Markscheme

fossils / comparative anatomy / homologous structures / vestigial structures

Examiners report

[N/A]

5e. Taxonomists aim to place species into genera, families and higher taxa according to their evolutionary origins. This is known as natural classification. *[2 marks]*

Explain the usefulness of natural classification in biodiversity research.

. . . . . .

. . . . . .

. . . . . .

Markscheme

a. «because» it allows easier identification of a species

b. «because» it can help identify common ancestors/evolutionary paths/close relationships (showing degree of biodiversity) / OWTTE

c. «because» it is universal/cross-cultural language that avoids problems of local names of organisms
OR
«because» it promotes international collaboration
OR
«because» it facilitates access to the history/background of the species /indexing for retrieval of relevant «taxonomic» information / OWTTE

d. «because» it allows «biodiversity» research of larger taxa «*ie* examination of a family of large cats rather than one species»

Examiners report

[N/A]