Exampro A-level Biology (7401/7402)

Name:

Class:

Taxonomy QP

Author:

Date:

Time: 53

Marks: 46

Comments:

Q1.Table 1 shows how a bird called the bluethroat (*Luscinia svecica*) is classified by biologists.

Table 1

Taxon	Name of taxon
Domain	Eukaryota
	Animalia
	Chordata
	Aves
	Passeriformes
	Muscicapidae
Genus	
Species	

(a) Complete **Table 1** by filling the seven blank spaces with the correct terms.

(2)

A group of scientists investigated genetic diversity in different species of bird. For each species, the scientists:

- collected feathers from a large number of birds
- extracted DNA from cells attached to each feather
- analysed the samples of DNA to find genetic diversity.

Table 2 summarises their results.

Table 2

Species of bird	Number of genes examined	Number of genes examined that showed genetic diversity
Willow flycatcher	708	197
House finch	269	80
Bluethroat	232	81

(b) In this investigation, what is meant by **genetic diversity?**

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(1)

(c) The scientists concluded that the bluethroat showed greater genetic diversity than the willow flycatcher. Explain why they reached this conclusion. Use calculations to support your answer.

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(2)
(Total 5 marks)

Q2. (a) An order is a taxonomic group. Fruit flies and mosquitoes belong to the same order of insects. Name the other **three** taxonomic groups to which fruit flies and mosquitoes both belong.

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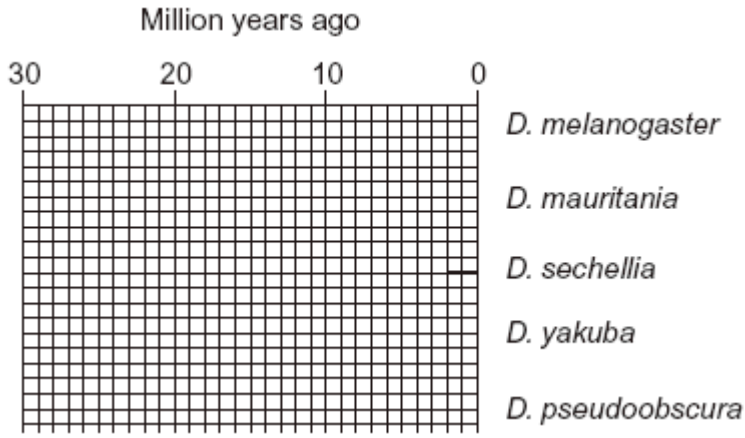
2 .....

3 .....

(2)

The diagram shows the phylogenetic relationship between five species of fruit fly that belong to the genus *Drosophila*.



(b) (i) Explain what is meant by a phylogenetic relationship.

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(1)

(ii) How many million years ago did *D. melanogaster* and *D. pseudoobscura* last share a common ancestor?

(1)

(c) Scientists used DNA hybridisation to confirm the relationship between *D. mauritania*, *D. sechellia* and *D. yakuba*.

(i) They made samples of hybrid DNA using a gene that was found in all three species.

Explain why it was important that they made samples of hybrid DNA from the same gene.

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(2)

(ii) The hybrid DNA formed between *D. mauritania* and *D. sechellia* separated at a higher temperature than the hybrid DNA formed between *D. mauritania* and *D. yakuba*.

Explain what caused the DNA to separate at a higher temperature.

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(2)
(Total 8 marks)

Q3. (a) The mammals form a class called the Mammalia within the animal kingdom. The grey wolf is a species of mammal. **Figure 1** shows the groups within the Mammalia to which the wolf (labelled **W**) belongs.

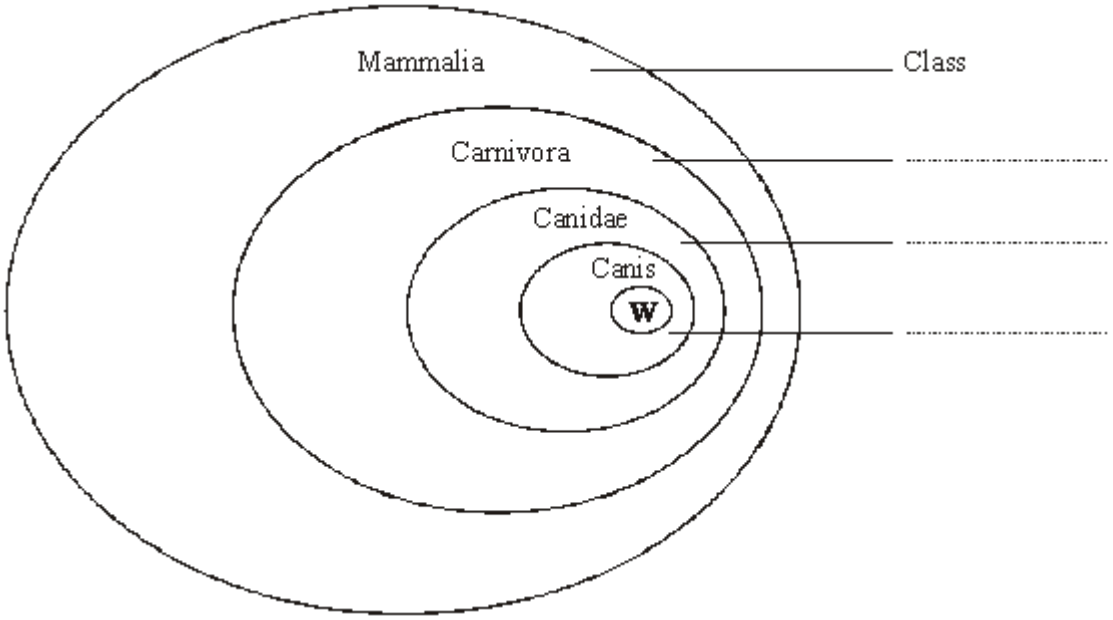

Figure 1

(i) Label **Figure 1** to show the names of the groups.

(2)

(ii) The lion, *Panthera leo*, belongs to another group in the Carnivora, called the Felidae. Add this information to **Figure 1**, using the letter L to represent the lion species.

(1)

(b) The diagrams show two systems of classification of mammals. **Figure 2** shows a simple hierarchy. **Figure 3** shows a phylogenetic system.

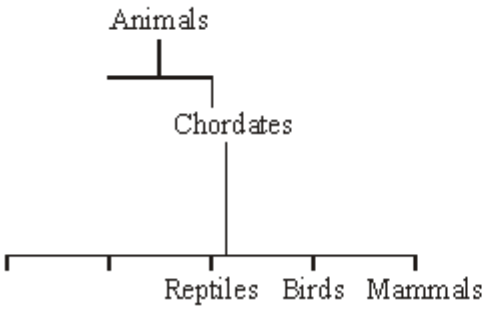

Figure 2

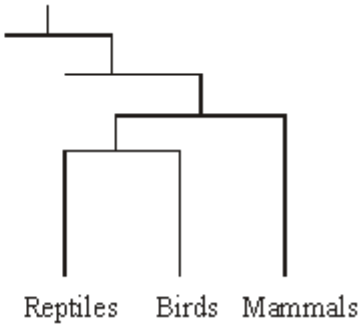

Figure 3

(i) What is meant by a hierarchy?

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(1)

(ii) By reference to **Figures 2** and **3**, explain how a phylogenetic system differs from a simple hierarchy.

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(3)
(Total 7 marks)

Q4. Organisms can be classified using a hierarchy of phylogenetic groups.

(a) Explain what is meant by:

(i) a hierarchy

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(2)

(ii) a phylogenetic group.

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(1)

(b) Cytochrome c is a protein involved in respiration. Scientists determined the amino acid sequence of human cytochrome c. They then:

- determined the amino acid sequences in cytochrome c from five other animals
- compared these amino acid sequences with that of human cytochrome c
- recorded the number of differences in the amino acid sequence compared with human cytochrome c.

The table shows their results.

Animal	**Number of differences in the amino acid sequence compared with human cytochrome c**
A	1
B	12
C	12
D	15
E	21

(i) Explain how these results suggest that animal **A** is the most closely related to humans.

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(2)

(ii) A student who looked at these results concluded that animals **B** and **C** are more closely related to each other than to any of the other animals.

Suggest **one** reason why this might **not** be a valid conclusion.

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(1)

(iii) Cytochrome c is more useful than haemoglobin for studying how closely related different organisms are. Suggest **one** reason why.

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(1)
(Total 7 marks)

Q5. Cranes are large birds. One of the earliest methods of classifying cranes was based on the calls they make during the breeding season.

(a) Explain why biologists could use calls to investigate relationships between different species of crane.

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(2)

(b) More recently, biologists have used DNA hybridisation to confirm the relationships

between different species of crane. They made samples of hybrid DNA from the same and from different species. They measured the percentage of hybridisation of each sample. The results are shown in the table.

Species of crane from which hybrid DNA was made			**Percentage DNA hybridisation**
Grus americana	and	*Grus monachus*	97.4
Grus monachus	and	*Grus rubicunda*	95.7
Grus americana	and	*Grus rubicunda*	95.5
Grus rubicunda	and	*Grus rubicunda*	99.9
Grus americana	and	*Grus americana*	99.9
Grus monachus	and	*Grus monachus*	99.8

Which **two** species seem to be the most closely related? Explain your answer.

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(2)

(c) Biologists can also use protein structure to investigate the relationship between different species of crane. Explain why.

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(2)

(Total 6 marks)

Q6. Finches are small birds. Fourteen species of finch are found on the Galapagos Islands.

(a) What is a species?

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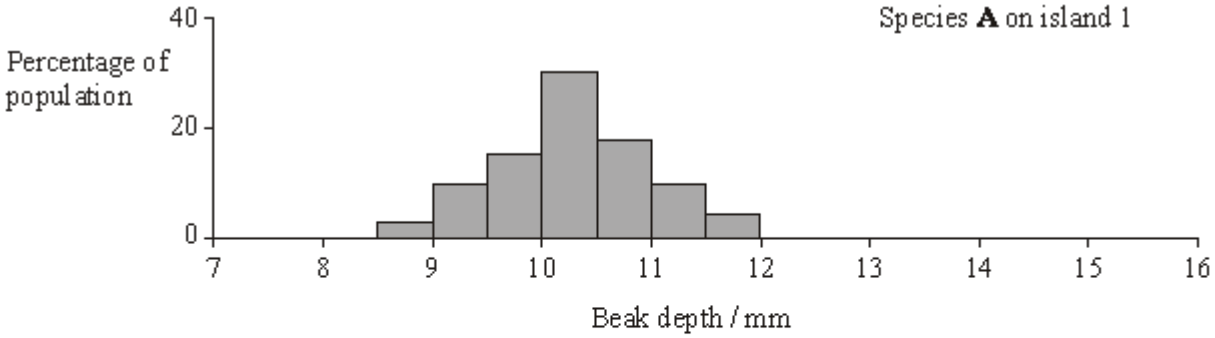
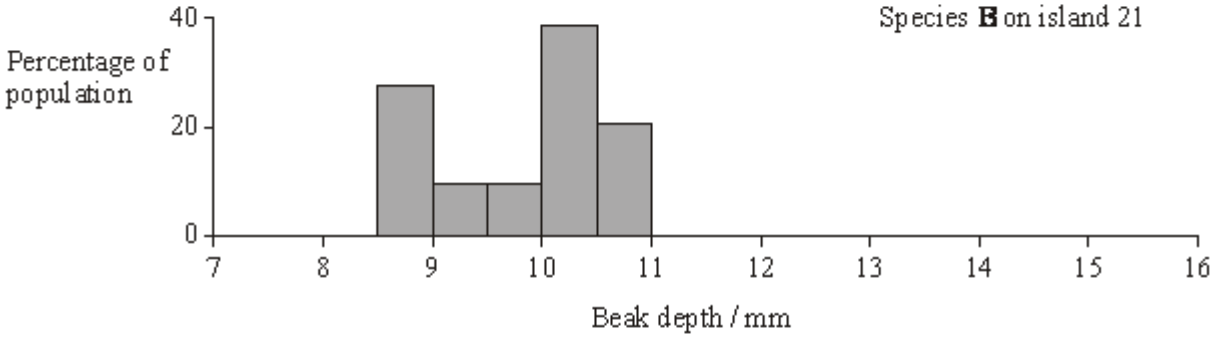
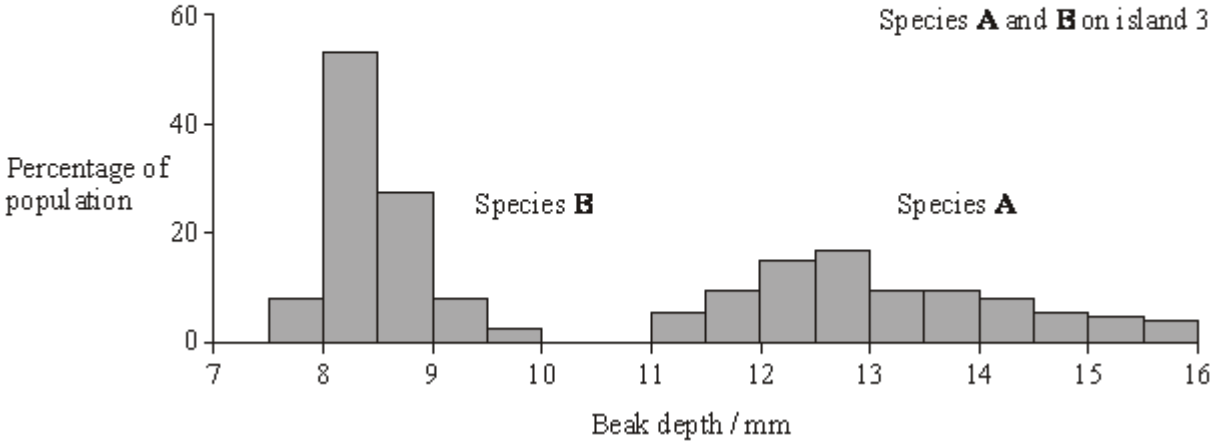
(2)

(b) Measurements were made of the beak depth of two species of finch (species **A** and species **B**) on different islands. Species **A** is found on island 1, species **B** is found on island 2. Both species are found on island 3. They are thought to have colonised island 3 from islands 1 and 2 respectively. The graphs show the ranges of beak depths of the two species on the different islands.







What type of natural selection took place in the populations of both species after they had colonised island 3? Explain your answer.

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(3)

(Total 5 marks)

Q7. The Amazonian forest today contains a very high diversity of bird species.

- Over the last 2 000 000 years, long periods of dry climate caused this forest to separate into a number of smaller forests.
- Different plant communities developed in each of these smaller forests.
- Each time the climate became wetter again, the smaller forests grew in size and merged to reform the Amazonian forest.

(a) Use the information provided to explain how a very high diversity of bird species has developed in the Amazonian forest.

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(Extra space).....

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(5)

(b) Speciation is far less frequent in the reformed Amazonian forest. Suggest one reason for this.

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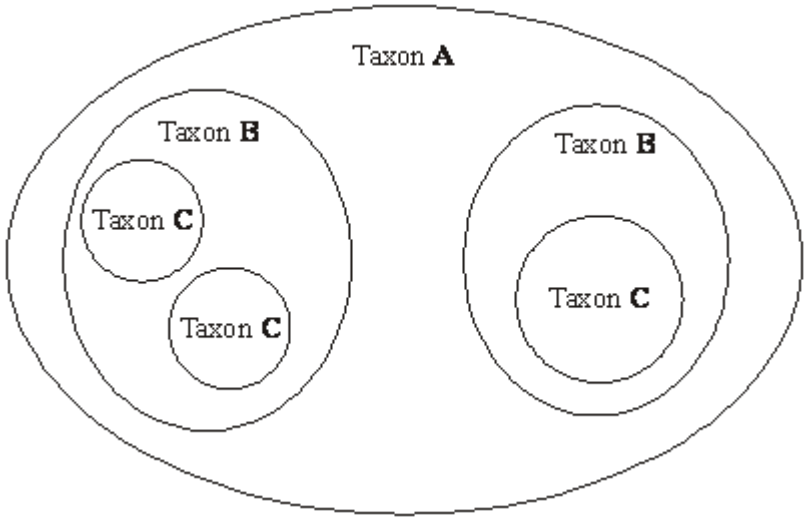
(1)
(Total 6 marks)

Q8. In taxonomy, each of the levels of classification (class, family, genus, kingdom, order, phylum and species) is called a taxon. The diagram represents just three of these levels of classification.



Explain which of these levels of classification could **not** be

(i) a genus;.....

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(ii) a phylum.....

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(Total 2 marks)