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BIOLOGY

GENETICS, BIODIVERSITY & CLASSIFICATION

Level & Board	AQA (A-LEVEL)
TOPIC:	INVESTIGATING DIVERSITY
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	5
TOTAL MARKS	24

Investigating Diversity QP 1

1.

(a) By analyzing variations in the base sequences of DNA or mRNA, one can determine the genetic diversity of a species.

Name two more methods for measuring genetic diversity between species.

(2)

260 bird species in North America were compared for differences using the base sequence of a gene found in mitochondrial DNA. Every bird's gene base sequence was compared to that of every other 259 species. They determined the % variation in base sequence for each comparison.

(b) The nucleotide sequence for a portion of the gene in two species is displayed in Figure 1.
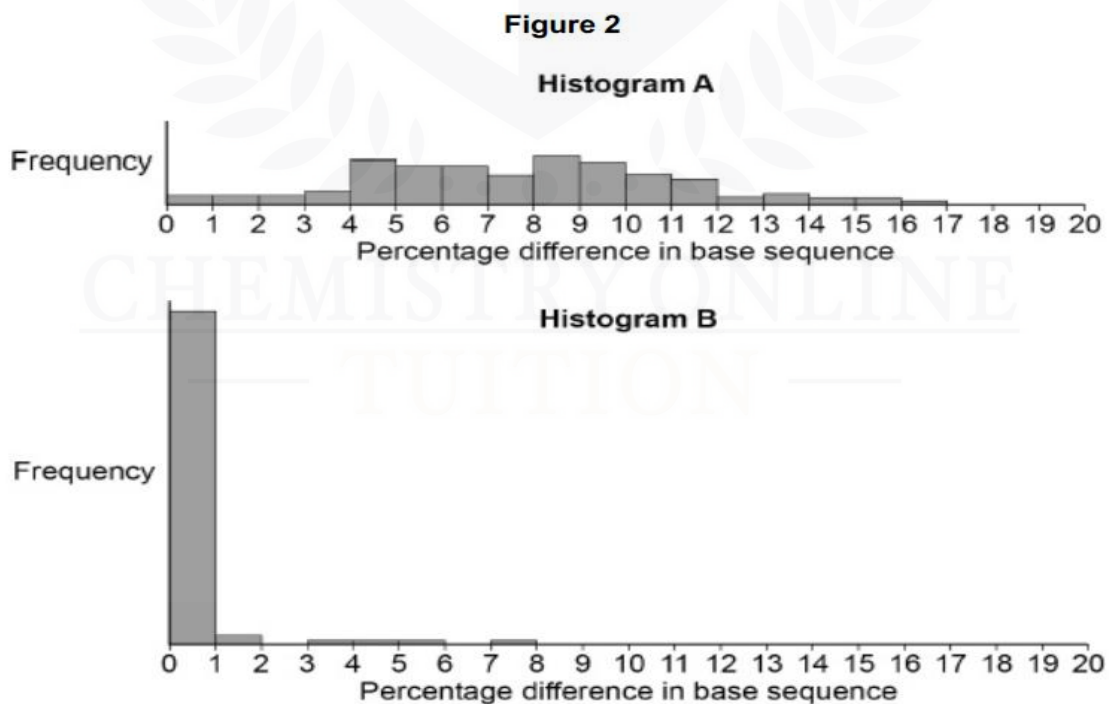
Figure 1

| Species 1 | A G C T G C C T A G A |
| Species 2 | A T G T G G C A A G A |

Determine the proportion that these base sequences differ from one another.

(1)

(c) In birds of the same species, in birds of different species within the same genus, and in birds of different species within the same family, the scientists compared base sequences.

Figure 2 displays the results of the scientists.

Figure 2

Histogram A

Histogram B
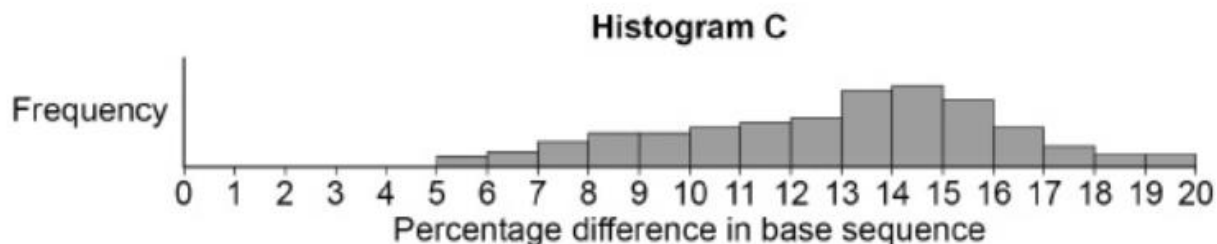
Histogram C

(c) Fill in the table by entering A, B, or C in the appropriate box to match each of the figure 2 histograms' statements to the appropriate statement. **(1)**

Statement	Histogram
Base sequences of birds of the same species.	
Base sequences of birds of the same genus.	
Base sequences of birds of the same family.	

(d) The scientists first tallied the number of bases and base variances in order to determine the percentage variation in base sequences.

In order to determine whether the number of bases that separate the birds in Histogram A from those in Histogram C is statistically significant, what statistical test should the scientists run?

Tick the box (✓) next to the statistical test that you plan to use.

Explain your response. **(2)**

Chi-squared ☐

Correlation coefficient ☐

Student's t-test ☐

2.

Biologists classification of the bluethroat (Luscinia svecica) bird is displayed in Table 1.

Table 1

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

(a) Complete Table 1 by entering the right terms in each of the seven blank spots. **(2)**

(b) Scientists looked into the genetic diversity of several bird species. The researchers did the following for each species: they gathered feathers from a sizable number of birds; they separated DNA from the cells that were connected to each feather; and they examined the DNA samples to determine genetic variety.

Their findings are summarized in Table 2.

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) What does "genetic diversity" mean in this context? **(1)**

(c) The researchers came to the conclusion that the bluethroat and willow flycatcher have different levels of genetic diversity. Describe the reasoning behind their decision. Make computations to back up your response. **(2)**

3.

The taxa and their names that are used to categorize a single species of otter are displayed in the table. They are not in the proper sequence.

	Taxon	Name of taxon
J	Family	Mustelidae
K	Kingdom	Animalia
L	Genus	Lutra
M	Class	Mammalia
N	Order	Carnivora
O	Phylum	Chordata
P	Domain	Eukarya
Q	Species	lutra

(a) Sort the letters in the above table into the appropriate boxes. For you, a few boxes have already been finished. **(1)**

		O	M			L	Q

(b) Identify this otter by its scientific name. **(1)**

I am Sorry !!!!!

(c) Regarding the impact of hunting on otter genetic diversity, what conclusions can you draw? Utilize information from the above figure to bolster your response. **(2)**

4.

(a) Certain unhunted animal populations exhibit extremely low levels of genetic diversity.

Give two explanations for why groups might have extremely low levels of genetic diversity besides hunting. **(2)**

5.

Biodiversity within a community can be measured using species richness and an index of diversity.

(a) How do these two biodiversity metrics differ from one another? (2)

(b) The species diversity in the canopy is higher than that of the understorey by how many times? Display your work.

The formula for calculating species diversity is as follows.

$$d = \frac{N(N-1)}{\sum n(n-1)}$$

where n is the total number of creatures in each species and N is the total number of organisms in all species combined. **(3)**

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(c) To determine whether the variation in each species' distribution between the canopy and understorey was random, the scientists ran a statistical test. The table displays the P values that were found.

Describe the findings of these statistical tests. **(3)**

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