A4.1 Evolution and speciation: data-based questions

What the Cell · DP Biology · data-based questions

Name _____ **Date** _____ **Total** _____ / 19

Read the data carefully before you answer. The number of marks shows how many separate points to make. Show your working in calculations.

1 Speciation in ferns

7 marks

Two groups of closely related fern species were studied. Group A (three species) grows on rocks in temperate forests of North America; its species look almost identical but cannot interbreed. Group B (four species) grows on trees in tropical forests; its species look clearly different. The table shows the percentage difference in a DNA sequence between each pair of species in a group.

Group	Sequence difference between pairs of species / %					
A (temperate, 3 species)	0.8	1.1	1.3			
B (tropical, 4 species)	3.2	4.5	5.1	2.8	3.9	4.4

a **Calculate** the mean sequence difference between species in group B. **[2]**

b **Identify**, giving a reason, which group is more genetically diverse. **[1]**

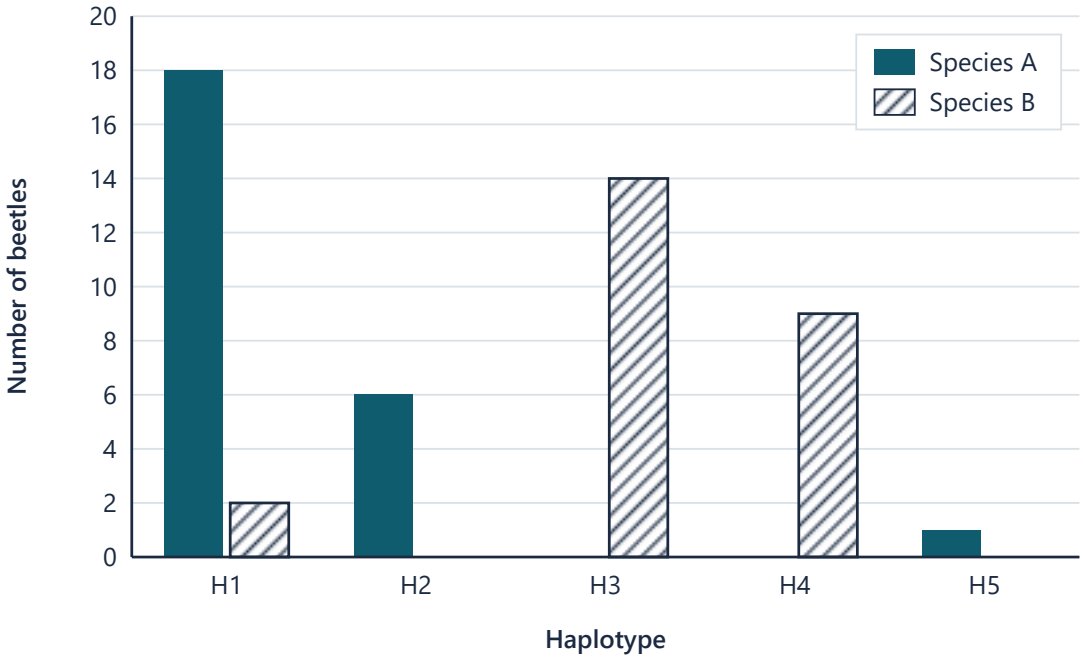
c **Suggest** how the species in group A can look identical yet be separate species. **[2]**

d **Outline** how geographical isolation could lead to new species forming. **[2]**

2 Beetles in neighbouring valleys

6 marks

Two species of ground beetle live in neighbouring valleys in the mountains of Japan. A section of mitochondrial DNA was sequenced in 25 beetles of each species. Each different sequence is called a haplotype.



a **State** the most common haplotype in species B. **[1]**

b **Compare** the haplotypes of the two species. **[2]**

c **Suggest** two reasons why haplotype H1 is found in both species. **[2]**

d Mitochondrial DNA is inherited only from the mother. **State** one reason this makes it useful for tracing ancestry. **[1]**

3 Feathers and flight

6 marks

Each main flight feather has a vane on each side of the central shaft. In flying birds the front vane is much narrower than the back vane, so the feather is asymmetric. Asymmetry was measured as the width of the back vane divided by the width of the front vane.

Flying birds	Asymmetry	Flightless birds	Asymmetry
Pigeon	2.9	**Ostrich**	1.0
Golden eagle	3.2	**Emu**	1.1
Herring gull	2.7	**Kiwi**	1.2
House sparrow	3.0	**Flightless cormorant**	1.3

a **Calculate** the mean asymmetry of the flightless birds. Show your working. **[2]**

b **Explain** why asymmetric feathers help a bird to fly. **[1]**

c A fossil bird has feathers with a mean asymmetry of 2.4. **Predict**, with a reason, whether it could fly. **[2]**

d The flightless cormorant evolved from flying ancestors. **Suggest** why its feathers became nearly symmetric. **[1]**