Investigating Diversity: AQA A Level Biology Exam Questions by Topic

16 questions · 42 marks · about 55 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Paper 1 · June 2025 · Q05.1 · 2 marks

0 5 . 1 Observable characteristics can be used to compare genetic diversity between species.

Give **two** other ways in which genetic diversity between species can be compared.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Question 2 · AS Paper 2 · June 2019 · Q08.1 · 2 marks

0 8 . 1 The genetic diversity of species is measured by comparing differences in the base sequence of DNA or differences in the base sequence of mRNA.

Give **two** other ways in which genetic diversity between species is measured.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Questions, mark schemes and examiners' report extracts © AQA.

Question 3 · AS Paper 1 · June 2016 · Q07.4 · 2 marks

0 7 . 4 There is genetic diversity within HPV.

Give **two** ways doctors could use base sequences to compare different types of HPV.

[2 marks]

1 _____

_____

2 _____

_____

Question 4 · AS Paper 1 · June 2023 · Q07.2 · 2 marks

0 7 . 2 Genetic diversity in soil species was traditionally inferred by making observations after growing prokaryotes on agar plates.

However, it is estimated that less than 10% of prokaryotes found in soil will grow if spread on an agar plate in a laboratory.

In recent years, our knowledge of prokaryotic biodiversity in the soil has increased.

Suggest why.

[2 marks]

_____

_____

_____

_____

_____

_____

Questions, mark schemes and examiners' report extracts © AQA.

Question 5 · AS Paper 2 · November 2020 · Q01.1 · 2 marks

0 1 . 1 *Littorina littorea* is a species of snail found on rocky sea shores.

A student investigated variation in snail shell height in two populations of snails.

Give **two** ways in which the student could ensure his samples would provide a reliable measure of the variation between individuals in each population.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Question 6 · AS Paper 2 · November 2020 · Q01.2 · 1 mark

0 1 . 2 The student could determine the median, mode and range from his measurement of shell heights in these populations.

Give **two** other statistical values the student could calculate from his measurement of shell heights in these populations.

[1 mark]

1 _____

2 _____

Questions, mark schemes and examiners' report extracts © AQA.

Question 7 · AS Paper 1 · June 2025 · Q05.2 · 2 marks

0 5 . 2 A student compares the mean surface area of leaves on the ground from two populations of wild cherry trees.

Describe **and** explain how the student should collect these leaves to obtain valid data.

[2 marks]

Questions, mark schemes and examiners' report extracts © AQA.

Question 8 · AS Paper 1 · June 2024 · Q05.1 · 5 marks

0 5 . 1 *Malva sylvestris* is a plant species.

A student wanted to determine the mean height of *M. sylvestris* plants growing in a field.

Describe how the student should obtain measurements of the plants **and** then process these measurements to obtain a reliable mean height of plants growing in that field.

[5 marks]

Questions, mark schemes and examiners' report extracts © AQA.

Question 9 · A level Paper 1 · June 2017 · Q10.3 · 5 marks

1 0 . 3 An environmental scientist investigated a possible relationship between air pollution and the size of seeds produced by one species of tree.

He was provided with a very large number of seeds collected from a population of trees in the centre of a city and also a very large number of seeds collected from a population of trees in the countryside.

Describe how he should collect and process data from these seeds to investigate whether there is a difference in seed size between these two populations of trees.

[5 marks]

Questions, mark schemes and examiners' report extracts © AQA.

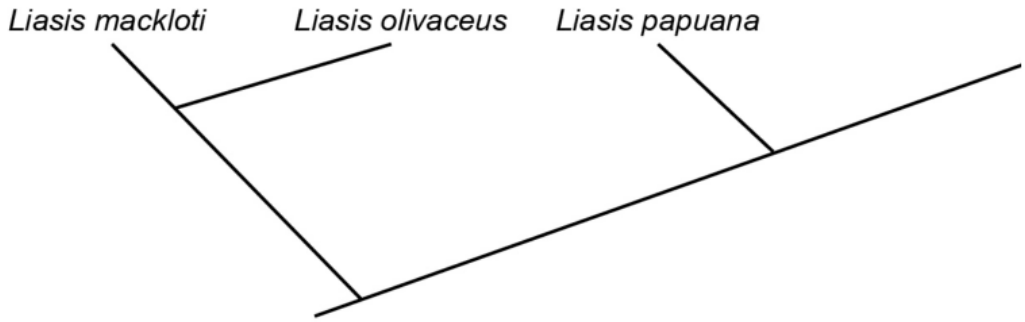
0 8 **Figure 3** shows two different ways of classifying the same three species of snake.

- Classification **X** is based on the frequency of observable characteristics
- Classification **Y** is based on other comparisons of genetic characteristics.

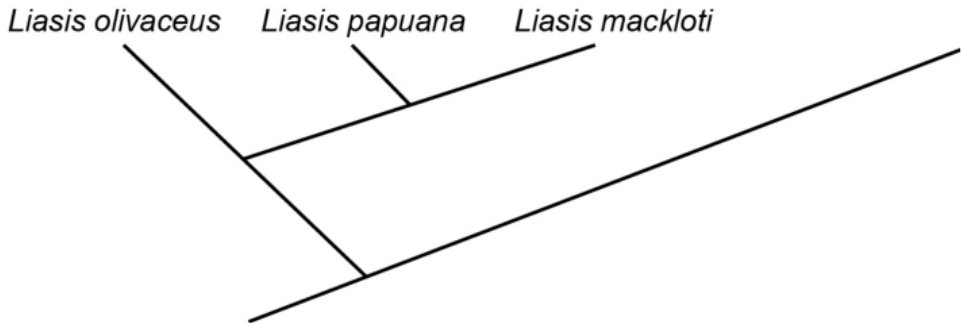
All three species of snake belong to the Python family.

Figure 3

Classification **X**



Classification **Y**



0 8 . 1 What do these classifications suggest about the evolutionary relationships between these species of snake?

[2 marks]

Classification **X** _____

Classification **Y** _____

Questions, mark schemes and examiners' report extracts © AQA.

0 9 . 2 Haemoglobins are chemically similar molecules found in many different species.

Differences in the primary structure of haemoglobin molecules can provide evidence of phylogenetic (evolutionary) relationships between species.

Explain how.

[5 marks]

Questions, mark schemes and examiners' report extracts © AQA.

Scientists investigated a phylogenetic relationship between individuals of five species of rhinoceros.

The scientists:

- determined the DNA base sequence of the *cyt b* gene of each rhinoceros
- compared each *cyt b* DNA base sequence with that of **one** Indian rhinoceros (called the reference rhinoceros)
- calculated the percentage difference between each *cyt b* DNA base sequence and that of the reference rhinoceros.

Table 2 shows their results.

Table 2

Investigated species of rhinoceros	Percentage difference in DNA base sequences compared with the reference Indian rhinoceros
Indian	2
Javan	5
Sumatran	13
White	14
Black	14

0 5 . 4 What can you conclude about the likely phylogenetic relationships between these species? Evaluate your conclusion.

[4 marks]

Questions, mark schemes and examiners' report extracts © AQA.

Question 13 · AS Paper 2 · June 2022 · Q05.5 · 2 marks

0 5 . 5 A scientist obtained a rhinoceros horn confiscated from poachers and wanted to identify the species of rhinoceros that was killed for its horn.

He used the procedure described in Question **05.4** and calculated the difference in *cyt b* DNA as 14%.

What can you conclude from this result? Explain your answer.

Suggest a change to the procedure that will more precisely identify the rhinoceros species that provided the horn.

[2 marks]

Conclusion and explanation _____

_____

_____

_____

Suggested change to the procedure _____

_____

_____

_____

Question 14 · information from earlier in the question

The percentage similarities in the non-coding multiple repeats of base sequences of four species of sweet potato are shown in **Table 3**.

Table 3

Species of sweet potato	Percentage similarity between non-coding multiple repeat base sequences			
	C	L	R	T
C		53.5	25.7	59.7
L	53.5		33.4	53.7
R	25.7	33.4		36.6
T	59.7	53.7	36.6	

Questions, mark schemes and examiners' report extracts © AQA.

Question 14 · A level Paper 1 · November 2020 · Q08.4 · 2 marks

0 8 . 4 The scientists studied five individuals from each species. Within the five individuals of **species T** they found a percentage similarity of 66%.

Use **Table 3** to evaluate how this information affects the validity of the phylogenetic tree.

[2 marks]

Question 15 · information from earlier in the question

0 4 Scientists investigated the effect of different types of animal farming on the diversity and number of dung beetles. They determined the number of dung beetle species and their total number on intensive (**I**), rough grazing (**R**) and organic (**O**) farms.

Figure 4 and **Figure 5** show some of their results.

Figure 4

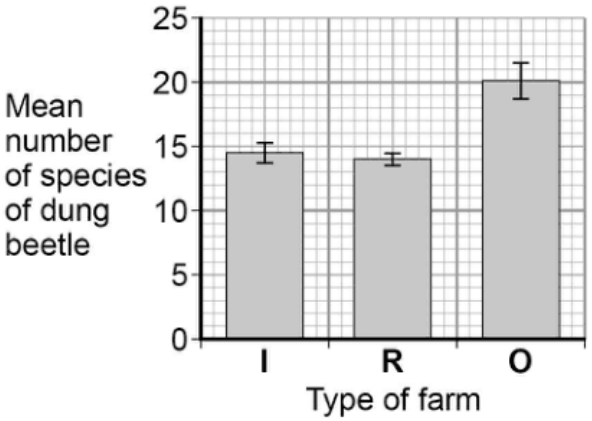
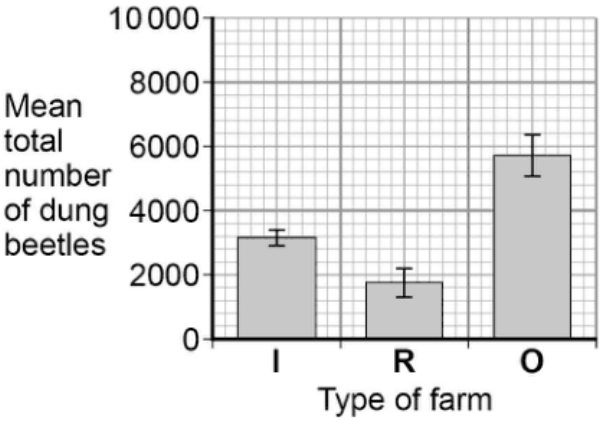


Figure 5



Key: I Standard deviation

Questions, mark schemes and examiners' report extracts © AQA.

Question 15 · AS Paper 2 · June 2016 · Q04.3 · 2 marks

0 4 . 3 Explain what the standard deviations suggest about the difference in mean total number of dung beetles between the different types of farm.

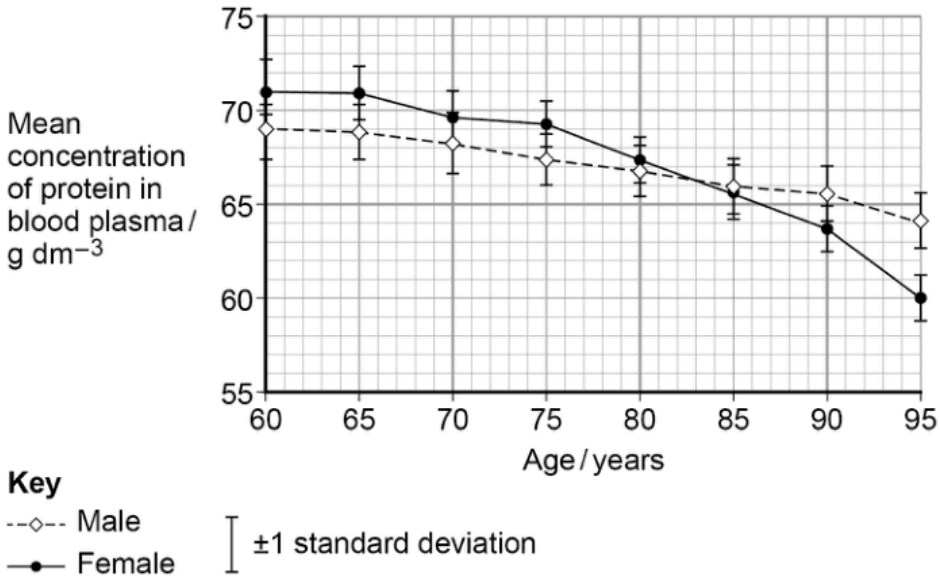
[2 marks]

Question 16 · information from earlier in the question

0 4 Scientists investigated how the concentration of protein in blood plasma changes in people between the ages of 60 and 95.

Figure 4 shows the scientists' results. The bars show ±1 standard deviation.

Figure 4



Questions, mark schemes and examiners' report extracts © AQA.

Question 16 · AS Paper 2 · June 2017 · Q04.3 · 2 marks

0 4 . 3 What can you conclude from **Figure 4** about the effect of ageing on the mean concentration of protein in the blood plasma in males and females?

[2 marks]

Questions, mark schemes and examiners' report extracts © AQA.

Mark schemes

Question 1 · AS Paper 1 · June 2025 · Q05.1 · 2 marks

05.1	1. **Base** sequence of DNA; 2. **Base** sequence of mRNA; 3. Amino acid **sequence** of (same) polypeptides/ proteins;	2 max (2 x AO1)

1 and 2. Only penalise once if the word 'base' is not used

Accept:
1. DNA hybridisation with reference to bases
3. Immunological comparisons using proteins/ antibodies/antigens

Question 2 · AS Paper 2 · June 2019 · Q08.1 · 2 marks

08.1	1. Comparing (measurable/observable) features/characteristics; 2. Comparing amino acid sequences/primary structures (of a/named/the same protein);	2 max	Must have idea of comparison/ differences/similarities Ignore courtship/ behaviour/mutations/ number of chromosomes/allele frequency/species richness/index of diversity Accept comparing amount of antibody bound to antigen/protein (in different species)

Questions, mark schemes and examiners' report extracts © AQA.

Question 3 · AS Paper 1 · June 2016 · Q07.4 · 2 marks

07.4	1. Compare (base sequences of) DNA; 2. Look for mutations/named mutations (that change the base sequence); 3. Compare (base sequences of) (m)RNA;	2 max	1 and 3 accept triplet/codon sequences for comparisons Ignore references to 'introns/non-coding DNA'

Question 4 · AS Paper 1 · June 2023 · Q07.2 · 2 marks

07.2	1. DNA/genome sequencing now used; 2. (Now) can analyse every/more prokaryote species (in the community); 3. Rather than just recording measurable/observable characteristics;	2 max (2 x AO2)	1. Accept RNA/amino acid sequencing 2. Accept 'identify' for analyse

Question 5 · AS Paper 2 · November 2020 · Q01.1 · 2 marks

01.1	1. Select at random; 2. Large sample/number (of snails)/>10;	2	1. Accept description of random technique 2. Ignore 'many'

Question 6 · AS Paper 2 · November 2020 · Q01.2 · 1 mark

01.2	Mean **and** standard deviation;	1	Accept **2** correct statistical values for 1 mark Accept any order Accept average for mean Accept standard error for standard deviation Accept interquartile range

Questions, mark schemes and examiners' report extracts © AQA.

05.2	1. Random sample **so** no bias; 2. Large sample/number **so** representative **OR** Large sample/number **so** can calculate **reliable** mean **OR** Large sample /number **so** (sufficient) for statistical test;	2 (2 x AO1)	2. Accept ≥ 10 for large number 2. Accept many/multiple but ignore several

Questions, mark schemes and examiners' report extracts © AQA.

Question 8 · AS Paper 1 · June 2024 · Q05.1 · 5 marks

05.1	1. Use a grid **OR** Divide area into squares/sections/plots; 2. Method of obtaining random coordinates/numbers; 3. Use same method of measurement (of the plants each time); 4. Repeat a large number of times **OR** Measure a large number of plants; 5. (Find the) sum of heights and divide by number of plants; 6. Calculate a running mean until number becomes (fairly) constant;	5 max (5 x AO1)

1. Accept use tape measures for 'use a grid'

2. Accept calculator/computer/ random numbers table/generator for method

3. Accept descriptions of measurements eg from soil/ground to highest leaf or to top of plant or to (shoot) tip or to highest part/bit

4. Accept ≥ 10 for large number

4. Accept many/multiple but

Questions, mark schemes and examiners' report extracts © AQA.

10.3

1. Use random sample of seeds (from each population);
2. Use (large enough) sample to be representative of whole population;
3. Indication of what size was measured eg mass;
4. Calculate a mean and standard deviation (for each population);
5. Use the (Student's) t-test;
6. Analyse whether there is a significant difference between (the means of) the two populations;

5 max	1. Accept described, suitable method of random sampling. 1. Reject description of inappropriate method of random sampling (eg random coordinates in the field/use of quadrats) 2. Accept 'running mean does not change' 2. For representative accept 'reliable, reproducible, repeatable' OR a mean close to the true value. 5. Accept 'Use 95% confidence limits'

Questions, mark schemes and examiners' report extracts © AQA.

Question 10 · A level Paper 1 · June 2017 · Q08.1 · 2 marks

8.1	1. (Without genetic analysis/**X**) *mackloti* and *olivaceus* have a more recent common ancestor with each other (than with *papuana)*; 2. (Genetic analysis indicates/**Y**) *papuana* and *mackloti* have a more recent common ancestor with one another (than with *olivaceus)*;	2	Accept 'more closely related to' for 'more recent common ancestor'

Questions, mark schemes and examiners' report extracts © AQA.

09.2	1. Mutations change base / nucleotide (sequence); 2. (Causing) change in amino acid sequence; 3. Mutations build up over time; 4. More mutations / more differences (in amino acid / base / nucleotide sequence / primary structure) between distantly related species; OR Few(er) mutations / differences (in amino acid / base / nucleotide sequence / primary structure) in closely related species; 5. Distantly related species have earlier common ancestor; OR Closely related species have recent common ancestor;	5

Accept “order” for “sequence”

1. Reject if mutation in amino acid

If neither MP4 or MP5 accept for 1 mark, idea of more mutations /differences as evidence of earlier common ancestor OR converse

Questions, mark schemes and examiners' report extracts © AQA.

05.4	1. (Genetic) variation/difference (exists) between Indian rhinos; 2. Indian rhinos most/more related to Javan rhinos; 3. Indian rhinos least/less related to White/Black rhinos; 4. Comparisons only made to one Indian rhino **OR** Sample size (of other rhinos) not known; 5. Cannot conclude anything about relationship between other species (with each other) **OR** (same) percentage differences may not refer to same base sequences;	4 max (4 x AO3)

2. Accept more recent common ancestor for 'most/more related'

3. Ignore 'Sumatran'

4. Ignore 'sample size too small'

Questions, mark schemes and examiners' report extracts © AQA.

05.5	1. (Likely) either White or Black (rhinoceros) as identical/same/14 percentage **OR** Not from Indian/Javan (rhinoceros) as (very) different percentages **OR** Cannot be certain as White, Black and Sumatran have similar percentages; 2. Use a different reference (species of) rhinoceros **OR** Use a different gene/protein **OR** Use more than one gene **OR** Compare (DNA) base sequence (not percentage differences) **OR** Compare amino acid sequences **OR** Compare mRNA sequences;	2 (2 x AO3)

2. Accept black/white rhino, but reject Javan/Sumatran if named

2. Ignore amino acid sequence of cyt b

Questions, mark schemes and examiners' report extracts © AQA.

Question 14 · A level Paper 1 · November 2020 · Q08.4 · 2 marks

08.4	1. (Supported) more similar than with any other species; 2. (Not supported) high (intraspecific) variation in species T (compared with variation between T and C); 3. Small sample OR Only five (individuals);	2 max

2. Accept idea that species T has nearly as much variation as between T and C. 2. Accept 'Low/close similarity in species T (in relation to similarity between T and C)'

Question 15 · AS Paper 2 · June 2016 · Q04.3 · 2 marks

04.3	1. No overlap in standard deviations; 2. (Difference in mean total) significant/is not due to chance/is real;	2	Accept: no overlap in error bars.

Questions, mark schemes and examiners' report extracts © AQA.

04.3	1. Protein content decreases with age and decreases more in females; 2. Difference (between sexes) only significant at 95 years because SDs do not overlap; OR Differences not significant because 2 x SD would overlap;	2

Questions, mark schemes and examiners' report extracts © AQA.