



Ecosystems (Unity and diversity) practice questions

16 questions • 52 marks • mark scheme at the back

For IB Diploma Biology, Standard Level and Higher Level (first assessment 2025). **HL only** is additional higher level content, for HL students only.

Name

Total / 52

Evolution and speciation **Spec A4.1**

1 PAPER 1A STYLE

[1 mark]

Which observation is an example of evolution?

- A. ☐ A giraffe's neck lengthening during its life as it stretches for leaves
- B. ☐ An increase over many generations in the frequency of an allele for dark wing colour in a moth population
- C. ☐ A person developing larger muscles through regular weight training
- D. ☐ Plants of one variety growing taller when given more fertiliser

2

[5 marks]

Cytochrome c is a protein of 104 amino acids found in a wide range of organisms. The table shows the number of amino acid differences between human cytochrome c and that of other organisms (data for practice). (a) Identify the organism most closely related to humans, according to the data. [1] (b) Calculate the percentage of amino acids in horse cytochrome c that differ from human cytochrome c. [1] (c) Explain how the data provide evidence for evolution. [2] (d) Suggest why comparing the base sequences of the cytochrome c gene might show more differences than comparing the amino acid sequences. [1]

Amino acid differences from human cytochrome c (data for practice)	
Organism	Number of differences
Chimpanzee	0
Rhesus monkey	1
Dog	11
Horse	12
Chicken	13
Tuna	21
Yeast	44

[illegible]

3

[2 marks]

Kale, broccoli and cauliflower are all varieties of one species, *Brassica oleracea*, produced from wild cabbage by selective breeding. Outline how this provides evidence for evolution.

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4 PAPER 2A STYLE

[4 marks]

Distinguish between homologous structures and analogous structures, using one named example of each.

5 PAPER 2B STYLE

[6 marks]

Explain how a pre-existing species can split into two species, using the example of bonobos and common chimpanzees.

6 PAPER 1A STYLE

[1 mark]

HL only

Which statement describes adaptive radiation?

- A. ☐ Unrelated species evolve similar structures because they live in similar environments
- B. ☐ A species gradually changes over time without splitting
- C. ☐ Many species evolve rapidly from one ancestral species, each adapted to a different niche
- D. ☐ Two species hybridize and the hybrid doubles its chromosome number

7 PAPER 2A STYLE

[4 marks]

HL only

Compare and contrast sympatric and allopatric speciation.

8 PAPER 2B STYLE

[6 marks]

HL only

Explain how the alleles of different species are kept separate, and how hybridization can lead to abrupt speciation in plants such as *Persicaria*.

Conservation of biodiversity Spec A4.2

9 PAPER 1A STYLE

[1 mark]

Which is an example of genetic diversity?

- A. ☐ A reef with many species of coral
- B. ☐ A coastline with mangroves, seagrass beds and coral reefs
- C. ☐ A woodland in which one species of tree is far more common than the others
- D. ☐ Many varieties of rice with different alleles for grain size

10 PAPER 1A STYLE

[1 mark]

Which species would the EDGE of Existence programme give the highest priority?

- A. ☐ A critically endangered species with many close living relatives
- B. ☐ A critically endangered species that is the only living member of its family
- C. ☐ A species of least concern that is the only living member of its family
- D. ☐ A common species that is important to the local economy

Volunteers and scientists surveyed the birds of a wetland in 2004 and repeated the survey in 2024, using the same method at the same sites. The table shows the number of each species counted (data for practice). (a) State the species richness in 2004 and in 2024. [1] (b) Calculate the percentage change in the total number of birds counted between 2004 and 2024. [2] (c) Deduce how species evenness changed between 2004 and 2024. [1] (d) Suggest one concern about using data recorded by volunteer (citizen) scientists. [1]

Birds counted on a wetland survey (data for practice)		
Species	2004	2024
A	12	10
B	18	15
C	25	48
D	30	0
E	6	2
F	9	0
Total	100	75

Answer =

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Outline the causes of the extinction of the North Island giant moa (*Dinornis novaeseelandiae*) and the Caribbean monk seal (*Neomonachus tropicalis*).

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13 PAPER 2A STYLE

[3 marks]

Describe the causes of the loss of mixed dipterocarp forest in Southeast Asia.

[illegible]

14 PAPER 2A STYLE

[2 marks]

Outline how the current number of species on Earth compares with past levels of biodiversity, and why the current number is uncertain.

15 PAPER 2A STYLE

[2 marks]

Explain how global transport contributes to the current biodiversity crisis.

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16 PAPER 2B STYLE

[6 marks]

Discuss the need for several approaches to the conservation of biodiversity.

[illegible]

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B; [1]

2. [5]

- (a) chimpanzee; [1]
- (b) $12 \div 104 \times 100 = 11.5\%$ / 11.5; [1] Accept 11.54 / 12 %
- (c) differences arise by mutation and accumulate over time after lineages split; [1]
- (c) fewer differences show more recent common ancestry, e.g. humans and chimpanzees / more differences show more distant ancestry, e.g. yeast; [1]
- (c) the same protein in all these organisms suggests a common origin / common ancestor; [1]
- (d) genetic code is degenerate / more than one codon codes for the same amino acid, so some base changes do not change the amino acid; [1] OWTTE
- max 5

3. [2]

- humans selected and bred plants with desired (heritable) traits over many generations; [1]
- large differences between varieties and from the wild species show heritable characteristics of a population can change; [1]
- change happened rapidly / in a short time, so natural selection over much longer periods could produce larger changes; [1]
- max 2

4. [4]

- homologous structures have the same basic structure / same arrangement of parts; [1]
- homologous structures are inherited from a common ancestor / have the same evolutionary origin, but may have different functions; [1]
- named homologous example, e.g. pentadactyl limbs of human arm, bat wing and whale flipper; [1]
- analogous structures have the same function but different evolutionary origins; [1]
- analogous structures result from convergent evolution / similar selection pressures on unrelated groups; [1]
- named analogous example, e.g. wings of birds and insects / eyes of octopus and vertebrates / fins of shark and dolphin; [1]
- max 4

5. [6]

- speciation is the splitting of a pre-existing species into two (or more); [1]
- a population becomes reproductively isolated / stops interbreeding; [1]
- so there is no gene flow between the populations; [1]
- geographical isolation is one cause / a barrier separates the populations; [1]
- ancestral Pan population separated by the Congo River, which the apes cannot cross; [1] Accept either the river forming or ancestral bonobos crossing it at low water.
- bonobos south of the river and common chimpanzees north of it; [1]
- differential selection / different selection pressures in each area favour different alleles; [1]
- e.g. gorillas compete for food north of the river but not south of it, OWTTE; [1]
- gene pools / allele frequencies diverge over many generations; [1]
- until the populations can no longer interbreed to produce fertile offspring / are separate species; [1]
- speciation increases the number of species; gradual change within one species is not speciation; [1]
- max 6

6. [1] HL only

C C; [1]

7. [4] HL only

- both require reproductive isolation / the end of gene flow between populations; [1]
- both involve divergence of gene pools / differential selection; [1]
- both produce new species that cannot interbreed (with the original); [1]
- allopatric speciation involves geographic isolation / populations in different areas; [1]
- sympatric speciation occurs in the same area / without a geographical barrier; [1]
- sympatric isolation is behavioural or temporal (or by polyploidy); [1]
- max 4. At least one similarity and one difference are needed for full marks.

8. [6] HL only

- courtship behaviour (often) prevents hybridization in animals; [1]
- courtship signals are species-specific so individuals only mate with their own species; [1]
- interspecific hybrids are often sterile, e.g. mule (horse × donkey); [1]
- mule has 63 chromosomes / an odd number, which cannot form homologous pairs in meiosis, so no viable gametes; [1]
- so alleles are not passed from one species' gene pool into the other; [1]
- in plants, a hybrid of two species is sterile as its chromosome sets are not homologous; [1]
- doubling of the chromosome number (polyploidy) gives every chromosome a partner; [1]
- the polyploid can carry out meiosis and is fertile; [1]
- crosses with either parent give sterile offspring (e.g. triploids), so the polyploid is reproductively isolated / a new species; [1]
- this happens in one generation / abruptly; [1]
- Persicaria contains many species formed by hybridization and polyploidy; [1]
- max 6

9. [1]

D D; [1]

10. [1]

B B; [1]

11. [5]

- (a) 6 (in 2004) and 4 (in 2024); [1] Both required.
- (b) change = $75 - 100 = -25$ / $(75 - 100) \div 100 \times 100$; [1]
- (b) -25 % / a decrease of 25 %; [1] ECF from working
- (c) evenness decreased because species C now dominates / makes up most of the birds (48 of 75); [1]
- (d) species may be misidentified / observers vary in skill or effort / records may be biased towards accessible sites; [1] OWTTE

12. [3]

- moa: hunted by human settlers (for meat) / eggs collected; [1]
- moa: forest habitat burned / cleared; [1]
- moa: slow breeding / no fear of land predators so populations could not recover; [1]
- monk seal: hunted for oil from blubber / meat / skins; [1]
- monk seal: overfishing reduced its food / disturbance of resting beaches; [1]
- max 3. At least one cause for each species is needed for full marks.

13. [3]

- logging for (valuable) hardwood timber; [1]
- clearance of land for oil palm plantations; [1]
- clearance for other crops, e.g. rubber / pulpwood; [1]
- fires used to clear land, spreading in drought / on drained peat; [1]
- roads / mining open up forest and fragment it; [1]
- max 3

14. [2]

- fossil evidence suggests more species are alive now than at any time in the past; [1]
- many species have not yet been discovered / described, so the total is only estimated; [1]
- species counts depend on how species are classified / splitters and lumpers; [1]
- max 2

15. [2]

- transports pests / diseases / invasive alien species to new areas; [1]
- native species have no defences / evolved adaptations against them, so are outcompeted / eaten / infected; [1]
- named example, e.g. chytrid fungus in amphibians / brown tree snake on Guam; [1]
- max 2

16. [6]

- no single approach is sufficient / different species need different measures; [1]
- in situ conservation protects species in their natural habitat; [1]
- in situ keeps species interacting with their community / evolving naturally; [1]
- nature reserves need active management, e.g. control of invasive species / anti-poaching / managing grazing; [1]
- rewilding reintroduces lost species to restore natural processes, e.g. wolves in Yellowstone; [1]
- reclamation restores degraded ecosystems, e.g. replanting mangroves; [1]
- ex situ conservation in zoos allows captive breeding when wild numbers are very low; [1]
- captive-bred animals can be reintroduced, e.g. Arabian oryx; [1]
- but captive populations are small with low genetic diversity / habitat may still be lost; [1]
- botanic gardens and seed / tissue banks store germ plasm / genetic diversity of plants; [1]
- seed banks are cheap and compact but seeds are kept out of their ecosystem / do not evolve; [1]
- max 6