



Evolution and speciation: practice questions

5 questions · 18 marks · mark scheme at the back

For IB Diploma Biology SL undefined. **HL only** is additional higher level content, for HL students only.

Name

Total / 18

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.

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