bio letters

Biology
Standard and Higher level
A3.1 Diversity of organisms Paper 1A

11 May 2026

Zone A afternoon | **Zone B** morning | **Zone C** afternoon

1 hour [Paper 1A]

Instructions to candidates

- Answer all questions.
- For each question, choose the answer you consider to be the best.
- A calculator is required for this paper.
- This paper generally presents questions in the same order the concepts are presented in the syllabus guide. The earlier questions are usually but not always easier than the later questions. Although most questions focus on this topic only, some are linked to other topics.
- This paper contains challenging IB-style problems. It is meant to enrich your learning and improve your mastery of the concepts presented in this topic after you have studied it.
- All of the questions here are original and written by me.
- **None of the questions are from past papers**.
- The maximum mark for paper 1A is **[40 marks]**.

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1. Why are no two individuals identical in all their traits?

A. Single nucleotide polymorphisms prevent two individuals from becoming genetically identical

B. Complex patterns of variation are a defining feature of life

C. All individuals have unique patterns of variation due to the complexity of life

D. Trait values are determined by a unique combination of genetic and environmental factors

2. Why are patterns of variation the basis for naming and classifying organisms?

A. It ensure that all organisms within a taxon have identical characteristics

B. It enables organisms to be classified according to similarities and differences

C. It shows which organisms are adapted to the same environment

D. It is driven by genetic and environmental factors that determine phenotype

3. What is most likely to cause two individuals of the same species to be **incorrectly** classified as different species using the morphological species concept?

A. Sexual dimorphism

B. Intraspecific competition

C. Interspecific competition

D. Competitive exclusion

4. Which scientific name is correctly written according to the binomial system?

A. *Homo Sapiens*

B. *Homo sapiens*

C. *homo sapiens*

D. *homo Sapiens*

5. What most likely indicates that two populations belong to different species according to the biological species concept?

A. They exist in different habitats

B. They belong to the same niche

C. They cannot exchange genes

D. They have different gene pools

6. Why do different species concepts exist?

A. They are used to classify different organisms

B. There is disagreement between scientists regarding the most correct concept

C. Many are historical concepts that are slowly being replaced by phylogeny

D. It is difficult to apply one definition to all the biodiversity on earth

7. Why are diverging populations difficult to classify?

A. Divergence is a discontinuous process

B. Divergence is a continuous process

C. The definition of divergence is debated

D. The definition of species is debated

8. What is the chromosome number of humans and chimpanzees?

	Humans	**Chimpanzees**
A.	48	48
B.	48	46
C.	46	48
D.	46	46

9. Why does the discovery of internal telomere sequences in human chromosome 2 support the fusion hypothesis?

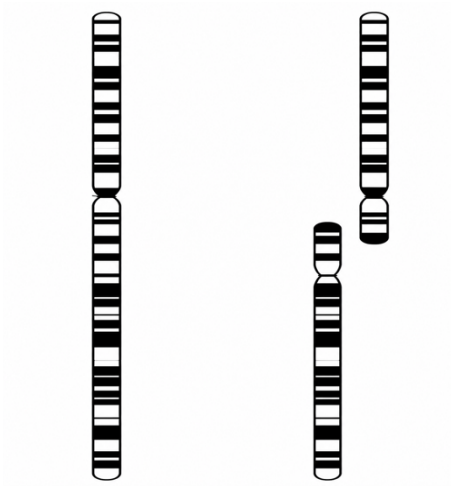
A. Telomeres are normally at the centromere

B. Errors in telomere exchange during crossing over may have caused fusion

C. Telomeres are normally at the end of DNA

D. Errors in replication of telomere sequences may have caused fusion

10. The diagram shows human chromosome 2 on the left and chimpanzee chromosomes 12 and 13 on the right.



What can be concluded as evidence for the fusion hypothesis?

A. They have similar banding patterns

B. They have similar centromere positions

C. They have similar genomes

D. They have similar karyograms

11. Which of the following chromosomal features are used by scientists to construct a karyogram?

I. Nucleotide sequence

II. Centromere position

III. Banding pattern

A. I only

B. II only

C. II and III only

D. I and III only

12. Which of the following is a testable statement?

A. Organisms are classified correctly when they are sorted into groups

B. Evolution produces the fittest individuals

C. Similar organisms share common ancestry because common ancestry makes organisms similar

D. Organisms that are more similar have accumulated less DNA differences

13. What is **correct** about non-testable statements?

A. They can be used as evidence

B. They can be valid

C. They are always incorrect

D. They can be investigated by experiments

14. Which of the following is most likely to cause variation within species?

A. Chromosomal inversions

B. Frameshift mutations

C. Non-disjunction in meiosis

D. Single nucleotide polymorphisms

15. What does the genome include?

I. Protein-coding genes

II. Regulatory DNA sequences

III. DNA sequences for tRNA

A. I only

B. II only

C. II and III only

D. I, II and III

16. What is **correct** about variation?

A. Interspecies variation is larger than intraspecies variation

B. Interspecies variation is smaller than intraspecies variation

C. Interspecies variation causes more selection than intraspecies variation

D. Interspecies variation is more harmful than intraspecies variation

17. What is whole genome sequencing?

A. Sequencing an organism’s entire RNA sequence

B. Sequencing an organism’s entire coding regions

C. Sequencing an organism’s entire non-coding regions

D. Sequencing an organism’s entire DNA sequence

18. Why is personalized medicine a promising future use of whole genome sequencing?

A. It depends on changing a patient’s genes to cure disease

B. It depends on sequencing a patient’s genes to edit mutations

C. It depends on tailoring treatment to the genetic profile of patients

D. It depends on analyzing mitochondrial DNA to treat metabolic disorders

19. The table shows the estimated genome size and number of coding genes for some species.

Species and Common Name	Estimated Total Size of Genome (bp)	Estimated Number of Coding Genes
Saccharomyces cerevisiae (yeast)	12 million	6,000
Caenorhabditis elegans (nematode)	95.5 million	18,000
Drosophila melanogaster (fruit fly)	170 million	14,000
Oryza sativa (rice)	470 million	51,000
Gallus gallus (chicken)	1 billion	23,000
Canis familiaris (dog)	2.4 billion	19,000
Mus musculus (mouse)	2.5 billion	30,000
Homo sapiens (human)	2.9 billion	20,000

What can be concluded?

A. On average, complex organisms have more genes

B. Mice are more complex than humans

C. Non-coding genes need to be considered before a conclusion is made

D. Organism complexity is not an indicator of the amount of genetic material

20. What phase of the cell cycle is most appropriate for karyotyping?

A. Prophase

B. Metaphase

C. Anaphase

D. Telophase

21. What is the difference between a karyotype and a karyogram?

A. A karyotype shows centromeres but a karyogram shows chromosome number

B. A karyotype shows chromosome number but a karyogram shows centromeres

C. A karyotype is an individual trait but a karyogram is an image

D. A karyotype is an image but a karyogram is an individual trait

22. What is **correct** about this human karyotype?

A. The individual is a male with 46 chromosomes

B. The individual is a female with 46 chromosomes

C. The individual is a male missing 4 chromosome pairs

D. The individual is a male missing 5 chromosome pairs

23. **[AHL]** Why is the biological species concept difficult to apply to organisms that carry out horizontal gene transfer?

A. The biological species concept depends on gene flow by reproduction

B. The biological species concept depends on gene flow by homologous traits

C. The biological species concept depends on gene flow by nuclear material

D. The biological species concept depends on gene flow by heredity

24. **[AHL]** Why is the biological species concept difficult to apply to asexual organisms?

A. Asexual organisms produce large biodiversity that is difficult to group

B. Asexual organisms are small and their traits are difficult to analyze

C. Asexual organisms share too many similarities and differences to be classified

D. Asexual organisms violate the assumptions that the concept operates on

25. **[AHL]** Why does crossbreeding often produce infertile offspring?

A. Sexual selection

B. Natural selection

C. Chromosome incompatibilities

D. Karyogram differences

26. **[AHL]** What do all individuals within a species share?

A. The same alleles

B. The same chromosome number

C. The same chromosomes

D. The same phenotype

27. **[AHL]** What is a DNA barcode?

A. A short DNA sequence used to identify species

B. A short DNA sequence used to identify individuals

C. The characteristic genome of a species

D. The characteristic genome of an individual

28. **[AHL]** How are DNA barcodes chosen?

A. The DNA sequence must have more variation within than between species

B. The DNA sequence must have more variation between than within species

C. The DNA sequence cannot be conserved for greater variation between species

D. The DNA sequence must be conserved for greater variation within species

29. **[AHL]** What is environmental DNA?

A. A sample of DNA collected directly from organisms in their natural habitat

B. A sample of DNA collected directly from organisms in laboratory experiments

C. A sample of DNA collected from the natural environment

D. A sample of DNA collected from organisms captured in their habitat

30. **[AHL]** How are DNA barcodes used to identify species?

A. Every species has a unique DNA barcode that allows them to be identified

B. Every species has a unique banding pattern that allows them to be identified

C. Every species has identical variation for the DNA barcode

D. Every species has distinct variation for the DNA barcode

31. **[AHL]** Scientists use DNA barcoding to identify an endangered fish species from a sample of soil. What is a **correct** conclusion?

A. The species has a small population size near the collected area

B. The species has a large population size near the collected area

C. An individual from the species was previously present near the collected area

D. An individual from the species was captured near the collected area

32. **[AHL]** What is a dichotomous key used for?

A. Classifying species

B. Identifying species

C. Sorting species

D. Grouping species

33. **[AHL]** What kind of trait is used to develop dichotomous keys?

A. Physical traits

B. Biochemical traits

C. Physiological traits

D. Genetic traits

34. **[AHL]** A dichotomous key for 4 insects is shown.

1a. Wings present → go to step 2
1b. Wings absent → go to step 3

2a. One pair of wings → Species W
2b. Two pairs of wings → Species X

3a. Six legs → Species Y
3b. More than six legs → Species Z

An organism with no wings and 8 legs belongs to which species?

A. W

B. X

C. Y

D. Z

35. **[AHL]** What is **correct** about developing a dichotomous key?

A. Using the most common trait before rarer traits

B. Arranging organisms from most to least evolved

C. Writing mutually exclusive statements at each step

D. Grouping organisms by overall similarity at each step

36. **[AHL]** A dichotomous key is used to identify 5 organisms, but 2 different organisms end up classified as the same species. What is the most likely issue?

A. A dichotomous key identifies organisms in samples with an even number only

B. The organisms were separated using too many characteristics

C. The key stopped dividing a group before every organism was uniquely identified

D. Too many statements were written in the dichotomous key

37. **[AHL]** A student is developing a dichotomous key for a sample of 8 local insects. In the first step, the student writes:

1a. Wings present → go to step 2
1b. Body width greater than 2cm → go to step 3

What is a **correct** evaluation of the student's work?

A. The student is incorrect because numerical values cannot be used in dichotomous keys

B. The student is incorrect because the statements must describe the same characteristic

C. The student is correct because the statements identify opposing characteristics

D. The student is correct because the statements clearly guide the reader to other steps

38. **[AHL]** A student is developing a dichotomous key for a sample of 6 local plants. In the first step, the student writes:

1a. Stem height greater than 8cm → go to step 2
1b. Stem height greater than 6cm → go to step 3

What is a **correct** evaluation of the student's work?

A. The student is incorrect because some organisms can satisfy both statements

B. The student is incorrect because the statements describe different traits

C. The student is correct because the statements describe the same trait

D. The student is correct because some organisms are shorter than 6cm

39. **[AHL]** A student records the following physical traits for 8 local animals to construct a dichotomous key.

Animal	Wings	Antennae	More than six legs	Aquatic	Red markings
A	Present	Present	No	No	Yes
B	Present	Present	No	No	No
C	Present	Absent	No	Yes	No
D	Present	Absent	No	Yes	No
E	Absent	Present	Yes	No	No
F	Absent	Present	Yes	No	No
G	Absent	Present	No	Yes	No
H	Absent	Absent	No	No	No

Which pair of statements would be best used in the first step of the dichotomous key?

A. Antennae present / Antennae absent

B. Aquatic / Not aquatic

C. Six or more legs / Less than six legs

D. Wings present / Wings absent

40. **[AHL]** In a study, the DNA sequence variation of the cytochrome c oxidase subunit I (COI) gene was analyzed in a group of passerine birds. Average variation within species was measured at 0.41% and between species at 18.6%.

What is a **correct** conclusion?

A. COI gene variation between species is too high to be used as a DNA barcode

B. COI gene variation within species is too low to be used as a DNA barcode

C. The COI gene is an effective DNA barcode for identifying passerine birds

D. Further studies need are required before using the COI gene in DNA barcoding

References:

10. http://www.evolutionpages.com/chromosome_2.htm

19. Pray, L. (2008) Eukaryotic genome complexity. Nature Education 1(1):96

40. Javaheri Tehrani S, Rezazadeh E, Alaei Kakhki N, et al. DNA barcoding of passerine birds in Iran. Zookeys. 2025;1236:19 39. Published 2025 Apr 24. doi:10.3897/zookeys.1236.143336

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