bio letters

Biology
Standard and Higher level
A4.1 Evolution and speciation

12 May 2025

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

2 hours 30 minutes [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.
- Many of the questions here are original and written by me. Several questions are taken from external sources, which are referenced at the end of the paper. None of the questions are from IB past papers.
- The duration of this paper was scaled according to the number of marks available and based on how much time, on average, each mark is worth in examination settings. Since this is a practice paper, expect to need more time to complete it.
- The maximum mark for this paper 1A is **[100 marks]**.

1205–2025

1. What is evolution?

A. The gradual selection of beneficial heritable traits in populations

B. The gradual change in heritable traits of individuals and populations with time

C. The accumulation of genetic mutations in individuals that enhances species survival over time

D. The gradual change in heritable traits of a group of interbreeding individuals by different genetic mechanisms

2. Why is evolution often thought of as the “theme that ties all aspects of biology together”?

A. Because it explains the origins of life on Earth

B. Because it explains the diversity and unity of organism

C. Because it can be traced back to millions of years ago

D. Because it explains the hereditary change in organisms

3. Which of the following statement(s) explain(s) why a population is the smallest unit that can evolve?

I. Selection pressures at a particular location where the population is living in will result in the survival of the fittest

II. An individual may accumulate genetic changes within its lifetime

III. Induced mutations in populations by evolution causes adaptation

A. I only

B. II only

C. I and II only

D. II and III only

4. What does the modern theory of evolution include?

A. The idea that resources are not always unlimited

B. Inheritance of characteristics gained throughout an individual's lifetime

C. Differential reproduction and survival

D. Traits that are most beneficial during an individual's lifetime are passed on

5. Does evolution always cause improvements in organisms?

A. Yes, because the heritable changes in characteristics over time are beneficial

B. No, because not all mechanisms of change are beneficial

C. Yes, because selection favors the fitter individuals

D. No, because selection favors the fitter but not fittest individuals

6. Does evolutionary theory imply that all life evolved by stochastic (random) chance?

A. Yes, because all mechanisms of evolutionary change are stochastic

B. Yes, because evolutionary change does not operate with an intention

C. No, because not all mechanisms of evolutionary change are stochastic

D. No, because evolutionary change sometimes operates with intention

7. Which statement about modern evolutionary theory is false?

A. Evolution is the heritable change in population traits over time

B. Evolution can occur through different mechanisms

C. Evolution illustrates how organisms change with time

D. Evolution explains the origin of life

8. What is adaptation?

I. A trait that enhances the survival of a species

II. A process by which a species becomes better at surviving in an environment

III. A process and a trait by which organism characteristics change with time

A. I only

B. II only

C. I and II only

D. II and III only

9. Why are evolution and natural selection not the same?

A. Evolution is one mechanism of natural selection

B. Natural selection is one mechanism of evolution

C. Natural selection often focuses more on genes than evolution

D. Evolution often focuses more on genes than natural selection

10. **[AHL]** Which of the following can cause evolution without selective pressures?

A. Polygenic inheritance

B. Codominant alleles

C. Incompletely dominant alleles

D. Polyploidy

11. The wings of experimental fruit flies were clipped short each generation for 50 generations. The 51st generation emerged with normal-length wings. Which of the following theories would provide the least convincing evidence for this observation?

A. Inheritance of mutations

B. Inheritance of acquired traits

C. Natural selection

D. Survival of the fittest

12. Why is it important to have many different types of evidence for evolutionary theory?

A. They each depend on each other to support the theory

B. They independently support the theory

C. Some of them are only valid in certain species

D. Some evidence is more recent than others

13. A scientist conducts a biochemical analysis and finds that hemoglobin molecules found in monkeys are very similar to those in humans. Which observation does this analysis support?

A. Homologous structures exist in all vertebrates

B. Embryonic development in humans and monkeys is very similar

C. Monkeys and humans have a common ancestor

D. Invertebrates and vertebrates have a common ancestor

14. The chart shows the types of enzymes organisms A – D have. Which of the following organisms are most closely related?

		Enzyme type			
		1	**2**	**3**	**4**
Organism	**A**	X		X	
	B		X		X
	C	X	X	X	X
	D	X		X	X

A. A and B

B. B and C

C. C and D

D. D and B

15. Which of the following illustrates evolution without natural selection?

A. A beneficial mutation increasing in frequency

B. A neutral mutation increasing in frequency

C. A harmful mutation decreasing in frequency

D. A heterozygous genotype having the highest fitness

16. Is evolutionary theory useful to a doctor treating a patient with a non-genetic disorder?

A. Yes because it can help the doctor understand how the patient's health changes with time

B. No because evolution does not explain changes in individuals

C. Yes because it can help uncover inherited disorders

D. No because evolution is not a reliable theory

17. The table shows the percentage similarity of cytochrome c, an enzyme involved in cell respiration, between three organisms.

Organisms	Percentage similarity (%)
X and Y	88.0
X and Z	84.3
Y and Z	91.2

Which organisms are most related to each other?

A. X and Y

B. X and Z

C. Y and Z

D. None are related

18. The S-glycoprotein in coronaviruses binds to host tissue and mediates infection. The table shows the percentage similarity to the SARS-CoV-2 (COVID-19) virus of the S-glycoprotein amino acid sequence in several types of coronavirus.

Coronavirus type	Percentage similarity to SARS-CoV-2 virus (%)
SARS-CoV-1	75.88
Bat coronavirus	76.20
MERS coronavirus	34.46

Based on the data, which statement is best supported?

A. SARS-CoV-1 and bat coronavirus are almost equally distant from SARS-CoV-2

B. Since MERS is least similar to SARS-CoV-2, it is a common ancestor

C. MERS coronavirus is nearly as similar to SARS-CoV-2 as SARS-CoV-1

D. The bat coronavirus S-glycoprotein is slightly more similar to SARS-CoV-2 than that of SARS-CoV-1

19. **[AHL]** Data suggests that the COVID-19 virus was introduced to humans by bats. Which section of the S-glycoprotein in SARS-CoV-2 virus has most likely experienced the greatest evolution when compared to that of the bat coronavirus?

A. The region bound to the virus membrane

B. The region at the center of the glycoprotein

C. The region that binds to human receptors

D. The region connecting the protein with the sugar

20. Crystallins are soluble structural proteins found in the lens of vertebrate eyes. The same crystallins are found in the eyes of all vertebrates, yet other animals have different crystallins. What does this indicate?

A. Eyes have only evolved once

B. All vertebrates have the same number of crystallins

C. The structure of the complex eye is similar in all animals

D. Lenses evolved after vertebrates split from other animals

21. A scientist is studying the DNA of three species. Species A and species B have DNA that is 97% similar. Species C and species A have DNA that is 95% similar. Based on the evidence, what can the scientist conclude?

A. Species B is equally related to both species A and species C

B. Species B has a closer evolutionary relationship with species C than it does with species A

C. Species A has a closer evolutionary relationship with species B than it does with species C

D. Species A has a closer evolutionary relationship with species C than it does with species B

22. Which of the following is the most conclusive evidence used to establish the relationship of closely related species?

A. DNA sequencing

B. Homologous structures

C. Divergent evolution

D. Fossil record

23. Which option correctly compares a wild (non-domesticated) plant with a domesticated plant?

	Difference	**Similarity**
A.	Only domesticated plants experience evolution	Both contain genes that can change with time
B.	Only wild plants experience evolution	Both contain genes that can change with time
C.	Only domesticated plants experience selection	Both experience evolution
D.	Only domesticated plants experience artificial selection	Both experience evolution

24. How does artificial selection provide evidence for evolution?

A. It is a type of natural selection that changes heritable traits with time

B. It is a type of natural selection that makes organisms more adapted with time

C. It shows how heritable traits can change with time

D. It shows how organisms become more adapted with time

In the Illinois Long-Term Selection Experiment, high grain protein and oil concentrations were artificially selected for in maize (*Zea mays*) for many decades. Use this information to answer questions **25** and **26**.

25. If the researchers stopped artificial selection in the high-oil maize breeds and randomly bred them for 10 generations, what is the most likely outcome?

A. Oil concentrations will slightly decrease due to a loss of selection pressure

B. Oil concentrations will remain stable due to no selection pressure

C. Oil concentrations will return to the original population mean

D. Oil concentrations will change randomly due to chance

26. If selection was reversed (i.e. low grain protein and oil concentrations were instead selected for), what is the predicted response of the maize plants?

A. They would evolve slower than if low yield was selected for from the start

B. They would initially resist but eventually evolve lower yield

C. Low grain protein and oil concentration alleles will increase in the population

D. Grain protein and oil concentrations will decrease but not to original levels

27. Why is evolution considered a pragmatic truth?

A. It is likely to be falsified

B. It is impossible to prove it by correspondence

C. It is supported by evidence that can be falsified

D. It explains a broad range of observations that cannot be falsified

28. The Irish Potato Famine of the 1840s was caused by a fungus that devastated potato crops. At the time, most of the potatoes grown in Ireland were genetically identical clones due to asexual reproduction from a select few ancestors. Which of the following is correct?

A. Only artificial selection contributed to the famine

B. Only asexual reproduction contributed to the famine

C. Artificial selection and asexual reproduction both contributed to the famine

D. Illegal farming contributed to the famine

29. What occurs when two species of different genealogy come to resemble each other as a result of adaptation?

A. Divergence

B. Convergence

C. Radiation

D. Coevolution

30. Why are several lines of evidence used to establish evolutionary relationships?

A. Some evidence is inaccurate

B. Some evidence is imprecise

C. Some evidence can be outdated

D. Some evidence can be misleading

31. How does domestication of crops and plants affect diversity?

A. It does not change genetic diversity as long as artificial selection is equal in strength to natural selection

B. It increases genetic diversity until there is no more variation

C. It increases genetic diversity

D. It decreases genetic diversity

32. In what way is natural selection different from artificial selection?

A. Only natural selection depends on variation

B. Only artificial selection is not limited by how much change can occur within a population

C. Only natural selection occurs within populations

D. Only artificial selection favors alleles that may not help the population survive

33. Which of these claims is most likely true of two species that share a recent common ancestor?

A. The two species have different developmental patterns

B. The two species share DNA sequences

C. The two species have similar arms and legs

D. The offspring of each species look very different

34. The table shows characteristics of three breeds of cattle.

Characteristic	Brahim cattle	English shorthorn cattle	Angus cattle
Quality of beef	Poor	Good	Good
Tolerance to heat	Good	Poor	Poor

Which of the following selective breeding programs would most likely result in cattle that are heat tolerant and are of good quality?

A. Breeding Brahmin cattle with Brahmin cattle

B. Breeding English shorthorn cattle with Angus cattle

C. Breeding Brahmin cattle with English shorthorn cattle

D. Breeding English shorthorn cattle with English shorthorn cattle

35. The bones in the forelimbs of birds, bats, humans, and whales are thought to be homologous. What will these bones be different in?

A. Ancestral origin

B. Embryological origin

C. Position in the body

D. Function

36. Dolphins and ichthyosaurs look similar but are not closely related to one another. They are considered to be which of the following?

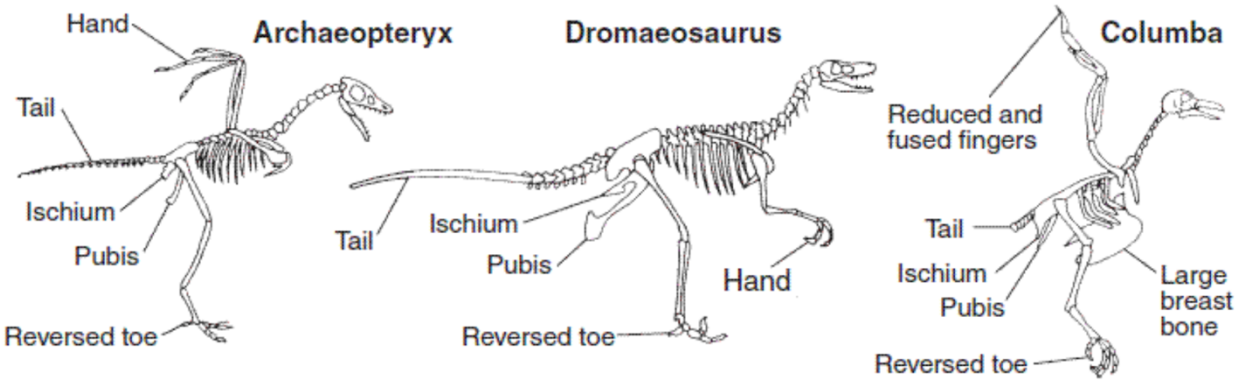
A. Homologous

B. Analogous

C. Homoplastic

D. Ancestors

37. What do the remains of the three organisms shown indicate about their relationships to each other?



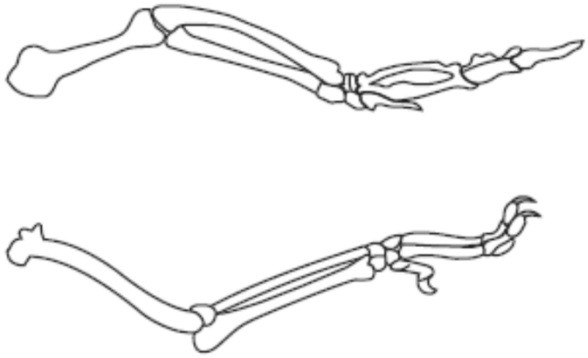
A. Identical niches

B. Habitat similarities

C. Ancestral similarities

D. Structural similarities

38. The diagram below represents the bones of the forelimbs of two animals alive today that most likely evolved from a common ancestor. Members of the original ancestral population were isolated into two groups by natural events.



If these two animals have a common ancestor, which statement would best explain why there are differences in the bones?

A. Changes occurred to help the animals return to their original environment

B. Changes contributed to the survival of the organisms in their new environment

C. Changes helped reduce competition within each group

D. Changes indicate the species are evolving to be more like the ancestral species

39. Two elephant species (X and Y) are classified in the genus *Loxodonta*, and a third species (Z) is placed in the genus *Elephas*. Which statement should be true?

A. Species X and Y are not related to species Z

B. Species X and Y are the result of artificial selection

C. Species X and Y share a common ancestor that is alive today

D. Species X and Y share a greater number of homologies with each other than either does with species Z

40. Which of the following is evidence of a unitary origin of life on Earth?

A. Convergent evolution

B. Embryological similarities

C. Homologous traits

D. Analogous traits

41. Arthropods and annelids (worms) have segmented bodies. If segmentation as a trait arose before arthropods and annelids branched from each other, what is its presence in both groups due to?

A. Analogy

B. Homology

C. Convergence

D. Divergence

42. What is the difference between homology and divergent evolution?

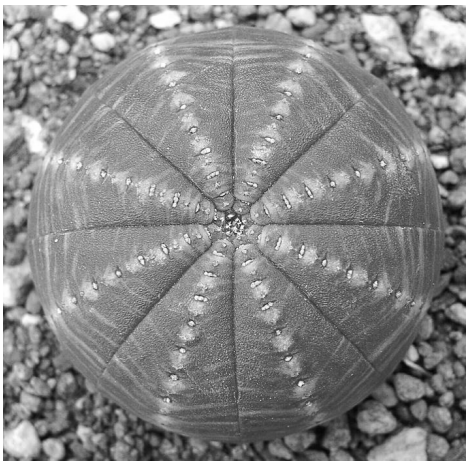
A. Both can be processes or traits depending on the context

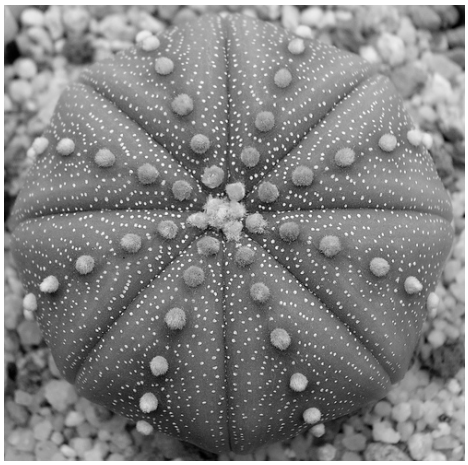
B. Only divergent evolution is a trait

C. Only homology is a process

D. Only homology is a trait

43. The plant shown on the left belongs to the genus *Euphorbia*, and the plant on the right is from the genus *Astrophytum*. What can be concluded about their ancestral relationship?





A. They have similar body forms due to common ancestry

B. They have similar body forms due to similar selective pressures

C. They have similar body forms due to similar predators

D. They have similar body forms due to similar competitors

44. Can changes in enzymes over time be used as evidence for convergent evolution?

A. No, since convergent evolution produces analogous structures

B. No, since convergent evolution involves different functions

C. Yes, if the enzymes evolve similar structures

D. Yes, if the enzymes evolve similar catalytic roles over time

45. Mammals, whales, dolphins, bats, and monkeys have some common traits, but they also show significant differences. What is this due to?

A. Convergence

B. Divergence

C. Genetic drift

D. Random mutations

46. What is the purpose of evolution?

A. To preserve and increase biodiversity

B. To make species more adapted to their environments

C. To cause the development of more complex organisms

D. Evolution has no purpose

47. What is true when a new species emerges?

A. Sufficient mutations have accumulated in the new species

B. Its karyotype can be distinguished from its ancestor

C. Its DNA sequence but not karyotype can be distinguished from its ancestor

D. Its amino acid sequence but not karyotype can be distinguished from its ancestor

48. How does speciation affect biodiversity?

A. Always increases genetic diversity only

B. Always increases genetic diversity and sometimes species diversity

C. Sometimes increases genetic diversity and always species diversity

D. Always increases genetic and species diversity

49. Why cannot evolutionary theory predict how fast species will evolve?

A. Different mechanisms of change and evolutionary pressures exist

B. Mutation rates and selection pressures are highly variable

C. Evolution lacks intention or purpose

D. Genetic drift and mutations are highly variable

50. What is a consequence of geographic isolation?

A. Random splitting of pre-existing species

B. Random and non-random splitting of pre-existing species

C. Speciation through reproductive isolation

D. Reproductive isolation through speciation

51. Until recently, the myrtle warbler and the Audubon's warbler were thought to be separate species of birds because the males have very different appearances. Which of the following observations most likely led to the reclassification of these warblers as one species?

A. The myrtle warbler and the Audubon's warbler have the same diet

B. The myrtle warbler and the Audubon's warbler lay the same number of eggs

C. The myrtle warbler and the Audubon's warbler have overlapping geographical ranges

D. The myrtle warbler and the Audubon's warbler interbreed and produce offspring that can reproduce

52. Which of the following statements best explains why geographic isolation can lead to speciation?

A. Physical separation of populations reduces competition for each group

B. Physical separation of populations prevents mixing of gene pools

C. Physical separation of populations provides more resources for each group

D. Physical separation of populations influences rates of mutation

53. Which of the following statements gives the most likely explanation for the presence of two very similar species of squirrels living on opposite sides of the Grand Canyon?

A. One squirrel traveled across the canyon and started a new population on the other side

B. One squirrel traveled across the canyon and interbred with a different population on the other side

C. Members of a single squirrel species were separated by the formation of the canyon

D. Members of two different squirrel species migrated from two different places to opposite sides of the canyon

54. Geographical isolation can lead to speciation. What would increase the likelihood of a geographically isolated population to diverge from the main population?

A. Similar initial allelic frequencies

B. A gene that decreases the rate of mutations

C. Similar fundamental niches

D. Different environmental conditions

55. The rock pipit (*Anthus berthelotii*) and the water pipit (*Anthus spinoletta*) are two types of birds found in Europe. They have similar appearances and their habitat ranges overlap. Which of the following observations most likely caused scientists to classify the birds as separate species?

A. A small but consistent difference in average wing length with $p > 0.05$ across all habitats

B. A shared range of ecological niches with no significant divergence

C. A statistically significant difference ($p < 0.01$) between the mitochondrial DNA sequences of rock and water pipit populations

D. Variation in beak size with high standard deviation and $p > 0.05$

56. **[AHL]** Which observation would provide the strongest evidence **against** geographic isolation but **not** adaptive radiation?

A. Homologous structures in two species living in a stable environment

B. Analogous structures in two species living in a stable environment

C. Homologous structures in two species living in an unstable environment

D. Analogous structures in two species living in an unstable environment

57. **[AHL]** What is the difference between reproductive isolation and sympatric speciation?

A. Sympatric speciation leads to reproductive isolation

B. Reproductive isolation leads to sympatric speciation

C. Reproductive isolation is one way to achieve sympatric speciation

D. Sympatric speciation is one way to achieve geographic isolation

58. **[AHL]** Within the past 2 million years in Lake Malawi, over 400 species of fish have descended from a single common ancestral species. Some of these species may have developed when fluctuating water levels isolated small sub-populations of the original ancestral species and prevented interbreeding. What type of speciation does this demonstrate?

A. Sympatric

B. Allopatric

C. Parapatric

D. Polypatric

59. **[AHL]** Which observation would provide the strongest evidence **against** behavioral isolation?

A. A female bird will mate only with males that perform the best courtship displays

B. Females choose males that have a specific set of characteristics similar to themselves

C. Males look for females that are distinctly different in appearance from themselves

D. Males are more likely mate with any females they encounter than not

60. **[AHL]** Which observation would provide the strongest evidence **against** behavioral isolation but **not** sexual selection?

A. Members of both populations ignore each other’s mating signals and do not attempt to mate

B. No courtship behaviors are observed in one population but mating occurs at equal rates with both populations

C. Individuals from both populations perform courtship behaviors recognized by others but consistently prefer mates from their own population

D. Courtship behaviors differ slightly, but hybrid offspring are sterile even after successful mating

61. **[AHL]** Why is allopatric speciation easier to find evidence for than sympatric speciation?

A. Allopatric speciation typically results in stronger reproductive isolation mechanisms

B. The lack of overlapping ranges in allopatric speciation makes genetic divergence less likely to reverse

C. Geographic separation in allopatric speciation provides clear historical evidence of reduced gene flow

D. Genetic divergence in sympatric speciation usually results in incomplete reproductive isolation

62. **[AHL]** How are sympatric speciation and natural selection similar?

A. They are both non-random

B. They are both random

C. They are both dependent on random processes

D. They are both dependent on non-random environments

63. **[AHL]** How can adaptive radiation be considered a solution to competitive exclusion?

A. It reduces competition

B. It increases competition

C. It reduces competition until both species adapt to new niches

D. It reduces competition until both species grow sufficient populations

64. **[AHL]** What type of evolution is similar to adaptive radiation?

A. Convergent evolution

B. Divergent evolution

C. Allopatric evolution

D. Sympatric evolution

65. **[AHL]** Apple maggot fruit flies (*Rhaeoletis pomenella*) are parasites that can experience sympatric speciation when introduced to new host plants. What might enable this species to undergo this type of reproductive isolation?

A. Adult flies develop mating behaviors influenced by surrounding host plants

B. Females choose males based on physical appearances

C. Most hybrid offspring are fertile

D. Mating preferences are linked to the host plant

66. **[AHL]** Bird guides once listed the myrtle warbler and Audubon's warbler as distinct species that lived side by side in parts of their ranges. However, recent books show them as eastern and western forms of the same biological species, the yellow-rumped warbler. What must be true in light of the new findings?

A. The birds exhibit similar morphology

B. The birds are merging to form one singular species

C. The birds interbreed successfully

D. The birds live in different habitats

67. **[AHL]** What is the difference between the mean phenotypic values of the progeny of a few select plants and those of the original population?

A. Mean value difference

B. Selection differential

C. Standardized difference

D. Standard deviation

68. **[AHL]** How might have new sets of chromosomes in eukaryotes evolved?

A. Hybridization

B. Polyploidy

C. Mutations

D. Natural selection

69. **[AHL]** Is speciation always a gradual process?

A. Yes

B. No

C. It depends on the selection pressures

D. It depends on the mechanism of speciation

70. **[AHL]** Why are there barriers to hybridization if hybrid vigor leads to useful traits from both parents in the offspring?

A. The offspring may be unfit to survive

B. The offspring may not contribute to either parents' gene pools

C. The offspring might compete with the parents for resources

D. The parents' gene pools might be too small

71. **[AHL]** In which phase of meiosis could an error result in polyploidy?

A. Metaphase I

B. Metaphase II

C. Anaphase I

D. Anaphase II

72. **[AHL]** Which 'type' of chromosomes are involved in polyploidy?

A. Non-homologous chromosomes

B. Non-sister chromatids

C. Sister chromatids

D. Homologous chromosomes

73. **[AHL]** Which gamete fusion would result in a fertile autopolyploid?

A. Haploid gamete x haploid gamete

B. Diploid gamete x haploid gamete

C. Triploid gamete x diploid gamete

D. Diploid gamete x diploid gamete

74. **[AHL]** What is an example of allopolyploidy?

A. A diploid plant undergoing chromosome duplication to become tetraploid

B. A sterile hybrid plant between two species becoming fertile after chromosome doubling

C. A mutation causing triploidy in a single species due to nondisjunction

D. A population of tetraploid plants slowly losing one set of chromosomes over time

75. **[AHL]** Which of the following supports the view that change occurs within species?

A. Polyploid hybridization in plants

B. Fossils with characteristics intermediate between those of land mammals and modern whales

C. Genetic sequences shared by humans, gorillas, and chimpanzees

D. Antibiotic resistance in bacteria

76. **[AHL]** Which of the following consequences of climate change are most likely to promote sympatric speciation in bees?

A. Phenological shift

B. Rising global temperatures

C. Rising sea levels

D. Loss of permafrost and associated habitats

77. **[AHL]** Which group of plants contain many organisms that have evolved through polyploidy?

A. Legume family (Fabaceae)

B. Figwort family (*Scrophulariaceae*)

C. Orchid family (Orchidaceae)

D. Knotweed or smartweed (*Persicaria*)

78. **[AHL]** If a fertile offspring's genome was a result of autopolyploidy, what must have been the ploidy of the parents?

A. One parent was haploid and the other tetraploid, causing genome duplication

B. Both parents were tetraploid and meiosis occurred normally

C. One parent was triploid and the other diploid

D. Both parents were diploid and disjunction occurred

79. **[AHL]** In a lake, three cichlid species show distinct feeding morphologies. DNA phylogeny dates their split at 10,000 years ago, coincident with lake formation. Which statement best supports adaptive radiation rather than allopatric speciation as the main mechanism of speciation?

A. Each species occupies a different depth zone but can interbreed in overlap regions

B. Morphological divergence correlates with jaw-related gene expression differences

C. Populations on separate ponds show similar morphologies independently

D. In the past century, one species has recolonized all depth zones without gene flow

80. **[AHL]** A wild grass population shows sudden emergence of a fertile hexaploid (6n) individual. Over subsequent years, hexaploids remain localized but expand. Which prediction follows if this is a case of autopolyploid speciation?

A. Hexaploids will self-fertilize and form a closed gene pool

B. Hexaploids will mate freely with diploids and blur species boundaries

C. Hexaploids will backcross with diploids to produce fertile tetraploids

D. Hexaploids will be outcompeted by diploids due to reduced vigor

81. **[AHL]** Speciation is often a slow, gradual process, but can sometimes occur suddenly and rapidly. What might cause this?

A. High number of mutations in a short period of time

B. Hybridization and polyploidy

C. Allopatric speciation

D. Sympatric speciation

82. **[AHL]** Which of the following is not a barrier to hybridization?

A. Mismatched chromosome numbers preventing meiosis

B. Different courtship behaviors between two populations

C. Reduced hybrid fertility in offspring

D. High genetic similarity between populations

83. **[AHL]** Predators have evolved to recognize the wing patterns of poisonous *Heliconius* butterflies and thus avoid them. How might hybdrization of *Heliconius* butterflies affect this?

A. It might enhance butterfly fitness by improving camouflage

B. It would increase butterfly fitness due to hybrid vigor

C. It might disrupt predator recognition and lower hybrid fitness

D. It would lower parent butterfly fitness as hybrids are better adapted

84. **[AHL]** How does gene flow affect sympatric speciation?

A. It weakens it

B. It strengthens it

C. It causes it to occur faster

D. It does not change it

85. **[AHL]** Since most hybrid organisms are sterile, what role do they have in evolution?

A. Heritability is a requirement of evolution so sterile hybrids have no evolutionary role

B. They contribute to the intraspecific competition that drives non-random mechanisms of change

C. Sterile hybrids cannot pass on their genes so they cannot affect gene pools

D. They only contribute to random mechanisms of change

86. **[AHL]** Can fertility be restored in sterile plants that are a result of hybridization?

A. Yes, through autopolyploidy

B. Yes, through allopolyploidy

C. No, disjunction causes irreversible sterility

D. No, meiotic errors are permanent

87. **[AHL]** What is most likely to occur after an extinction event that results in many empty niches?

A. An increase in biodiversity

B. A decrease in biodiversity

C. Lower population sizes

D. Lower population growth

88. **[AHL]** Why is evidence for allopatric speciation often stronger than that for sympatric speciation?

A. Sympatric speciation involves convergence, which is difficult to prove

B. Allopatric speciation involves stronger selection pressures

C. Geographic isolation makes it easier to claim divergence

D. Random mechanisms of change are easier to prove than non-random ones

89. **[AHL]** Which situation would most likely lead to allopatric speciation?

A. A flood causes the formation of a new lake

B. A storm causes several large trees to fall down

C. A mutation causes a new trait to develop

D. An injury causes an organism to seek out a new food source

90. **[AHL]** What is the difference between autopolyploidy and allopolyploidy?

A. The number of chromosomes

B. The functionality of the chromosomes

C. The source of extra chromosomes

D. The number of mutations in the extra chromosomes

91. **[AHL]** Which variable would increase the likelihood of allopatric speciation taking place more quickly?

A. Lower mutation rates

B. Longer distance between divided populations

C. Increased instances of hybridization

D. Equivalent number of individuals in each population

92. Which condition is the basis for a species to be reproductively isolated from other members?

A. It does not share its habitat with related species

B. It does not exist out of a single habitat

C. It does not exchange genetic information with other species

D. It does not undergo evolutionary changes for a significant period of time

93. **[AHL]** Which reproductive combination produces hybrids?

A. When individuals of the same species in different geographical areas reproduce

B. When any two individuals sharing the same habitat reproduce

C. When members of closely related species reproduce

D. When offspring of the same parents reproduce

94. **[AHL]** Is there a relationship between differences in easily observable traits and the strength of reproductive isolation between two populations?

A. Yes

B. No

C. It depends

D. Only in plants

95. Humans are increasing species extinction rates. Which factor is going to most affect the likelihood of an endangered species recovering solely through evolution?

A. The strength of natural selection

B. The current population density of the species

C. The amount of fitness reduced during the period of demographic decline

D. The strength of all evolutionary mechanisms combine

96. **[AHL]** How might changes in transcription factor binding sites contribute to evolutionary differences between closely related species?

A. They alter mRNA codons and lead to new proteins

B. They influence mutation rates and thus the speed of evolution

C. They influence gene expression without changing protein-coding sequences

D. They downregulate most genes in a population’s genome

97. **[AHL]** Researchers studied populations of the plant *Anthoxanthum odoratum*. One population was growing in soil contaminated by heavy metals from a nearby mine, and another contiguous population was growing in uncontaminated soil. They found differences in flowering time in the two populations. Why are these differences likely to be important in further differentiation of the populations?

A. They prevent gene flow between the locally adapted populations

B. Population distributions have changed over time

C. Flowering is delayed by exposure to the toxins

D. Plant tolerance to toxins is costly

98. **[AHL]** In sea urchins, the protein *bindin* enables sperm to attach to eggs, and is thought to play an important role in successful fertilization in the ocean. *Bindin* genes differ substantially among sea urchin species. The *bindin* gene is therefore likely to play a major role in which of the following?

A. Allopatric speciation

B. Sympatric speciation

C. Hybridization

D. Polyploidy

99. **[AHL]** Two species of fish had recently undergone sympatric speciation. The males of each species had a different coloring through which the females could identify and choose a partner from her own species. After some time, pollution made the lake so cloudy that it was hard for females to distinguish colors. What might take place in this situation?

A. Hybridization rates decrease as the ability to choose mates decreases

B. The two species become more genetically distant as sexual selection decreases

C. Reproduction isolation is weakened and hybridization rates will increase

D. Sexual selection weakens and hybridization rates decrease

100. **[AHL]** A population of fish living in a lake have been monitored by scientists for the past 50 years. Across time, scientists observed changes in the behavior of the fish that seem to split the population into two distinct subpopulations. Under the biological species concept, which of the following lines of evidence is **least** useful in confirming whether allopatric or sympatric speciation has occurred or will occur?

A. Correlations between genetic divergence of the two populations with historical changes in habitat geography

B. Tracking genetic changes in traits that determine sexual characteristics

C. Observing mating behavior and timing

D. Comparing polygenic traits across environmental gradients in the two subpopulations

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