Evolution Past Papers

1 Which of the following formulae would allow absolute fitness to be calculated?

A $\frac{\text{number of surviving offspring per individual of a particular genotype}}{\text{number of surviving offspring per individual of the most successful genotype}}$

B $\frac{\text{number of surviving offspring per individual of the most successful genotype}}{\text{number of surviving offspring per individual of a particular genotype}}$

C $\frac{\text{frequency of a particular genotype before selection}}{\text{frequency of a particular genotype after selection}}$

D $\frac{\text{frequency of a particular genotype after selection}}{\text{frequency of a particular genotype before selection}}$

2. In pea plants, the allele for yellow peas is dominant to the allele for green peas.

A sample of 100 peas contained 84 yellow and 16 green peas.

What is the frequency of the yellow allele in this population?

A 0.36
B 0.40
C 0.60
D 0.84

3 The fundamental niche of a species is one that it occupies in

A the absence of any intraspecific competition
B the absence of any interspecific competition
C response to interspecific competition
D response to intraspecific competition.

4 The cheetah is a large cat native to Africa and central Iran.

The level of genetic variation in cheetahs is between 0.1% and 4% of that in an average living species.

The decrease in genetic variation was caused by two events in the evolutionary history of the species.

Event 1

100 000 years ago, cheetahs rapidly expanded their range into Asia, Europe, and Africa. This expansion meant that cheetahs were dispersed over a very large area. This restricted the ability to exchange alleles between members of the population.

Event 2

12 000 years ago, an extinction event occurred that caused the cheetahs in Europe to go extinct. This meant that the remaining populations could only be found in Africa and Asia. This event prevented any gene flow between populations.

Use the information to identify the correct terms describing events 1 and 2 and changes in allele frequency.

	Event 1	Event 2	Changes in allele frequency
A	founder effect	bottleneck effect	random
B	founder effect	bottleneck effect	non-random
C	bottleneck effect	founder effect	random
D	bottleneck effect	founder effect	non-random

Evolution Past Papers

5 The table shows information concerning some characteristics of three species of MacArthur's warblers, which are closely related species of insectivorous songbirds living in spruce forests in north-eastern USA.

	Species of MacArthur's warblers		
	Setophaga fusca	*Setophaga coronata*	*Setophaga castanea*
Foraging zone	treetops	trunk area of trees	middle interior portions of trees
Nesting sites	high in trees near tips of branches	horizontal branches in trees up to 15 m	lower portions of spruce and fir trees
Food sources	insect larvae, spiders and spruce budworm	insects, insect larvae and spruce budworm	insects, spiders and spruce budworm
Nesting period	May–July	May–July	May–July

The strongest evidence of resource partitioning between these three species comes from the analysis of their:

A foraging zone and nesting period
B nesting sites and food sources
C nesting period and food sources
D foraging zone and nesting sites.

6 The allele (T) for the ability to taste the bitter chemical phenylthiocarbamide (PTC), is dominant over the allele (t) for the inability to taste the chemical.

400 biology students were tested and 64 were found to be non-tasters.

The percentage of heterozygous students is

A 16%
B 27%
C 32%
D 48%

7 There are approximately 40 species of birds of paradise in New Guinea, on islands nearby, and in areas of mainland Australia. They are thought to have evolved from a crow-like common ancestor that lived 20 million years ago.

The list describes processes that are likely to have contributed to the evolution of the different species.

X The food availability on a certain part of one island favoured the survival of male and female individuals with slender curved bills.

Y On one island with abundant food choices, females choose mates whose head feathers have elongated plumes.

Z Some males and females of a species of crow-like mainland bird were blown by a freak storm to some of the islands.

Which row in the table matches processes of evolution with descriptions from the list?

	Processes of evolution		
	Genetic drift	Selection	
		Natural	Sexual
A	X	Z	Y
B	Z	X	Y
C	Z	Y	X
D	Y	X	Z

8 Which row in the table indicates factors that can all lead to a high rate of evolution?

	Factor		
	Selection pressure	Generation time	Gene transfer
A	high	long	asexual reproduction
B	low	short	horizontal
C	low	long	horizontal
D	high	short	sexual reproduction

Evolution Past Papers

9 Which of the following adaptations can be explained using the Red Queen hypothesis?

1. Acceleration of cheetahs is related to the speed of the antelope they prey on
2. Migration of insectivorous birds is influenced by the availability of insects
3. Resistance of insect larvae to parasitic wasp infection is a response to these wasps
4. Ornamental head plumes of some male birds are attractive to females

A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 3 and 4 only

10 Humans and many other primates have opposable thumbs. In the giant panda, a modified wrist bone forms a false 'thumb' which is used along with the five digits to manipulate bamboo.

The list shows processes related to evolution.

1 Convergent evolution
2 Divergent evolution
3 Natural selection

Evolution of the thumbs of primates and the false 'thumbs' of giant pandas has involved

A 1 only
B 2 only
C 1 and 3 only
D 2 and 3 only.

11 Which of the following formulae would allow relative fitness to be calculated?

A $\frac{\text{frequency of a particular genotype after selection}}{\text{frequency of a particular genotype before selection}}$

B $\frac{\text{frequency of a particular genotype before selection}}{\text{frequency of a particular genotype after selection}}$

C $\frac{\text{number of surviving offspring of a particular genotype}}{\text{number of surviving offspring of other genotypes}}$

D $\frac{\text{number of surviving offspring of other genotypes}}{\text{number of surviving offspring of a particular genotype}}$

12 Ellis-van Creveld syndrome is a rare genetic condition. It is much more common in an isolated population in North America, which was founded by a small number of individuals, than in the general population.

The most likely explanation for this is

A natural selection
B sexual selection
C random mutation
D genetic drift.

13 The frequency of a given allele in a population is a measure of how common that allele is as a proportion of the total number of copies of all alleles at a specific locus. For a locus with one dominant allele (A) and one recessive allele (a), the frequency of the dominant allele (p) and the frequency of the recessive allele (q) can be used to calculate the genetic variation of a population using the equations below.

$p + q = 1$ — p = frequency of A allele; q = frequency of a allele

$p^2 + 2pq + q^2 = 1$ — p^2 = frequency of homozygous (AA) individuals; q^2 = frequency of homozygous (aa) individuals; $2pq$ = frequency of heterozygous (Aa) individuals

If the allele frequency of the recessive allele is 0·7, the proportion of individuals that would be heterozygous is

A 0·09
B 0·21
C 0·42
D 0·49.

14 Which of the following factors increases the rate of evolution?

A Longer generation times
B Cold environments
C Horizontal gene transfer
D Low selection pressure

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15 Shags and cormorants both belong to the genus *Phalacrocorax*. They look very similar and nest near each other on the same cliffs. The table below shows the main components of each bird's diet.

Prey	*Percentage composition of diet*	
	Shag (Phalacrocorax aristotelis)	*Cormorant (Phalacrocorax carbo)*
sand eels	33	0
sprats	49	1
flatfish	1	26
shrimps	2	33
gobies	4	17
other fish	4	18

The data in the table show

A competitive exclusion
B competition within each species
C resource partitioning
D the fundamental niche of each species.

16 Northern elephant seals, intensely hunted in the 19th century, have significantly less genetic variation than southern elephant seals that were hunted less in the same period.

This reduced genetic diversity is most likely a result of

A sexual selection
B genetic drift
C mutation
D natural selection.

17 Which of the following would be true if a population's gene pool remained unaltered for many generations?

A Mating was random
B Migration was common
C Genetic drift had occurred
D Certain alleles had a selective advantage

18 From the following list, identify all the possible sources of DNA during horizontal gene transfer.

1 viruses
2 plasmids
3 bacterial cells
4 gametes

A 1 and 2 only
B 2 and 3 only
C 1, 2 and 3 only
D 1, 2 ,3 and 4

19 Which line in the table correctly identifies genetic drift?

	Type of process	*Size of population from which alleles are likely to be lost*
A	random	small
B	random	large
C	non-random	small
D	non-random	large

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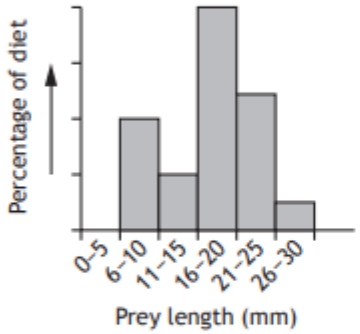
20 *Anolis* lizards are found on Caribbean islands. They feed on prey of various sizes.

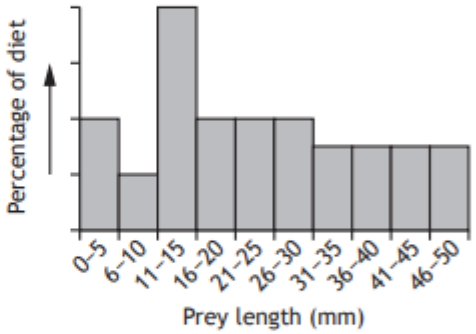
Histogram 1 shows the range of prey length eaten by *Anolis marmoratus* on the island of Jarabacoa, where there are five other *Anolis* species.

Histogram 2 shows the range of prey length eaten by *Anolis marmoratus* on the island of Marie Galante, where it is the only *Anolis* species.

Histogram 1: Jarabacoa



Histogram 2: Marie Galante Island



Which of the following statements could explain the different range of prey sizes eaten by *Anolis marmoratus* on the two islands?

A Larger numbers of prey are found on Marie Galante.

B *Anolis marmoratus* occupies its fundamental niche on Jarabacoa.

C *Anolis marmoratus* occupies its realised niche on Marie Galante.

D Resource partitioning takes place on Jarabacoa.

21. The fundamental niche of a species

A includes the set of resources available in the absence of competitors

B includes the set of resources available in the presence of competitors

C permits coexistence in a community

D permits sharing of resources with other species.

22. Which line in the table below correctly describes processes underpinning evolution?

	Random	*Non-random*
A	Mutation	Genetic drift
B	Genetic drift	Mutation
C	Genetic drift	Sexual selection
D	Natural selection	Genetic drift

23 In evolutionary theory, fitness can be described in absolute or relative terms.

Absolute fitness is the ratio of

A surviving offspring of one phenotype compared with other phenotypes

B surviving offspring of one genotype compared with other genotypes

C frequencies of a particular phenotype from one generation to the next generation

D frequencies of a particular genotype from one generation to the next generation.

24 Which of the following is **not** a source of DNA during horizontal gene transfer in bacteria?

A Virus

B Plasmids

C Bacterial cells

D Gametes

Evolution Past Paper Answers

1. A
2. C
3. B
4. A
5. D
6. D
7. B
8. D
9. B
10. C
11. C
12. D
13. C
14. C
15. C
16. B
17. A
18. C
19. A
20. D
21. A
22. C
23. B
24. D