



TRIAL TEST 7: GENE POOLS

Time allowed: 60 minutes

Total marks: 100

Section One – Multiple Choice

30 marks

Section Two – Short Answer

50 marks

Section Three – Extended Answer

20 marks

SECTION 1 – MULTIPLE CHOICE (30 MARKS)

1. Which of the following facilitates evolution?
 - (i) asexual reproduction.
 - (ii) rapid reproduction.
 - (iii) variation within a species.
 - (iv) stable environment.
 - (a) (i) and (iv) only.
 - (b) (ii) and (iii) only.
 - (c) (ii), (iii) and (iv).
 - (d) all of them.
2. 'Survival of the fittest' is a term often used in relation to natural selection. It refers to those organisms that:
 - (a) are the healthiest.
 - (b) are best suited to the environment.
 - (c) live the longest.
 - (d) produce the most offspring.
3. The term 'gene pool' refers to
 - (a) the allele frequencies in a population.
 - (b) all the genes in a population.
 - (c) genotype frequencies.
 - (d) asexually reproducing organisms.
4. Two tribes P and Q inhabit the same region but cannot interbreed because of a geographical barrier between them. However they are considered to be the same species because:
 - (a) they share a common gene pool.
 - (b) they live in the same territory.
 - (c) their environments are almost identical.
 - (d) they look very similar.
5. In the past, human females with the genetic disease haemophilia often died before they reached reproductive age. Modern medical treatment now allows most haemophiliacs to survive and enjoy a normal life span. What effect would this have on the frequency of the allele responsible for haemophilia?
 - (a) It will decrease in frequency.
 - (b) It will increase in frequency.
 - (c) It will not change in frequency.
 - (d) It is impossible to predict.

6. Genetic drift is most likely to occur in:
- (a) very small populations.
 - (b) very large populations.
 - (c) natural populations.
 - (d) artificial populations.
7. Natural selection that favours the average rather than the extreme phenotypes is:
- (a) stabilising selection.
 - (b) directional selection.
 - (c) disruptive selection.
 - (d) artificial selection.
8. Members of two different species that cannot interbreed and produce fertile offspring are reflecting:
- (a) natural selection.
 - (b) genetic drift.
 - (c) genetic equilibrium.
 - (d) reproductive isolation.
9. For each gene, a gene pool will usually contain:
- (a) no other alleles.
 - (b) one allele.
 - (c) two or more alleles.
 - (d) no more than two alleles.
10. Genetic equilibrium is maintained:
- (a) by natural selection.
 - (b) by movement of individuals between populations.
 - (c) in small populations.
 - (d) when mutations do not occur.

SECTION 2 – SHORT ANSWER (50 MARKS)

1. Write the appropriate term or word for each of the phrases below:
- (i) a record of an individual's ancestral history showing inheritance patterns for a particular trait

 - (ii) the gradual change in a species which generally occurs over thousands of years due to the cumulative effects of mutations and natural selection.

 - (iii) a group of organisms living together in the same place at the same time.

 - (iv) the genetic make-up of an organism.

 - (v) the random shuffling of the chromosomes (in metaphase) that end up in gametes.

- (vi) when individuals enter or leave a population.
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- (vii) the process in which only the organisms best adapted to their environment survive and reproduce.
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- (viii) when two chromosomes of a homologous pair exchange segments of DNA.
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- (ix) the source of new alleles.
-
- (x) the range of alleles in a population.
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- (xi) a characteristic that an organism inherits that helps it to survive in its environment.
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- (xii) the process of forming new species.
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[12 marks]

2. Are the following statements true or false?

- (a) Germ-line mutations occur in meiosis before fertilisation and somatic mutations occur after conception.
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- (b) You make new genes in crossing over.
-
- (c) Stronger genes are dominant.
-
- (d) If a mutation occurs during meiosis the offspring may have a new allele not found in the parents.
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- (e) Mutations can happen spontaneously and are helpful, beneficial or neutral.
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- (f) Natural selection is when an organism carrying a 'useless trait' dies.
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(g) Genetic variation is important because, over time, it allows evolution to occur.

(h) Not all mutations are expressed in the phenotype.

(i) In a founder population, the allele frequency will probably not represent the original population.

[9 marks]

3. Isolation and gene flow can both affect gene frequencies in populations.

(a) Define gene frequency.

[2 marks]

(b) State how isolation and gene flow each affect gene frequency.

[2 marks]

(c) Explain how each one causes this effect.

[4 marks]

4. (a) What is the Founder effect? Give an example.

[2 marks]

(b) What effect does the Founder effect have on gene pools?

[1 mark]

(c) Describe the bottleneck effect.

[2 marks]

(d) Give an example.

[1 mark]

5. Thalassaemia is caused by mutations to the DNA that makes haemoglobin: the more mutated genes the more severe is the thalassaemia. One type of thalassaemia is beta-thalassaemia which can affect a child's growth and life expectancy. It is determined by a pair of genes. If a child inherits mutated genes it develops the beta-thalassaemia trait. Carriers of the defective gene exhibit mild signs and symptoms of the condition.

Beta-thalassaemia is common in people of Italian, Greek, Middle Eastern, Asian and African descent.

(a) Why might the frequency of the defective gene be more common in these people than the rest of the population?

[2 marks]

(b) How could it be detected?

[1 mark]

(c) What treatment might be available for it in the future?

[2 marks]

6. Distinguish between immigration and emigration.

[2 marks]

7. Tay-Sachs disease is an autosomal recessive disease that usually kills those who inherit it before they reach 4 years of age. In descendants of central and eastern European Jews, known as the Ashkenazim, Tay-Sachs has a higher incidence than in the rest of the population.

(a) Explain how Tay-Sachs could be an example of the Founder effect.

[3 marks]

(b) Explain how natural selection could reduce the frequency of Tay-Sachs in the Ashkenazim people.

[3 marks]

It has been discovered that people who are heterozygous for Tay-Sachs have a greater resistance to tuberculosis (TB). In the recent past, the Ashkenazim people lived mainly in cities and towns where TB was a common disease.

(c) Using this information, explain why Tay-Sachs has continued to exist in the Ashkenazim people.

[2 marks]

[16 marks]

[4 marks]

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