ARMADALE SENIOR HIGH SCHOOL

ATAR Human Biological Science Unit 3

Test 4 Evolutionary Mechanisms: Mutations and Gene Pools

Multiple choice question booklet

Structure of the paper

Section	Number of questions available	Marks allocated	Your Marks
Multiple Choice	16	16	
Short Answer	6	29	
Extended Answer	2	10	
Total		55	

SECTION A: Multiple Choice (16 marks)

1. Charles Darwin proposed a theory of how evolution occurred by a concept known as natural selection. This theory is based on the idea that:
    a) Favourable variations gradually become more common in the population
    b) Organisms that survive reproduce their favourable characteristics
    c) There is a variation within a species
    d) All of the above

2. A mutation is best described as:
    a) A new characteristics appearing in an organism
    b) A permanent change in genetic material
    c) A change in the mitotic process
    d) Treatment by radiation

3. Which of the following statements is INCORRECT?
    a) Mutations are kept at low frequency in the population by the action of natural selection
    b) Ionising radiation, such as X-rays, increases the mutation of genes in direct proportion to the radiation dosage
    c) Most mutations results in unfavourable characteristics
    d) Changes in a physical characteristic of a population can only come about following the mutation of a gene

4. Sickle cell anaemia is a fatal condition that affects the clotting of blood cells in homozygotes. However, the gene for sickle shaped cells has not been eliminated from the gene pool of malaria-affected countries. This is because:
    a) The allele for sickle cells is dominant to normal blood cells
    b) Individuals homozygous for sickle shaped blood cells are more resistant to malaria
    c) Individuals with two alleles for sickle cell usually do not live to reproduce
    d) Heterozygous individuals are more resistant to malaria

5. Mutations that affect reproductive cells are called:
    a) Chromosome mutations
    b) Germline mutations
    c) Somatic mutations
    d) Gamete mutations

6. Tay-Sachs is a hereditary disease that occurs in 1 in every 1500 births in the Ashkenazi Jewish population. The incidence of Tay-Sachs in other populations is very low, at around 1 in 500 000 births.

   Which of the following is not considered a reasonable explanation for this frequency of inheritance?

   a) Genetic drift: Jewish populations tend to be small and isolated, thus increasing the chance of allele frequency changes
   b) Founder effect: original migrating populations carried a high incidence of the allele, which has been maintained over subsequent generations
   c) Heterozygote advantage: carriers of the alleles have a survival advantage, so the allele is maintained in the population due to natural selection
   d) Late onset condition: sufferers of the disease are not affected until later in life, after they have already reproduced and passed the allele to their offspring

7. The Dunkers are a small religious group that moved from Germany to Pennsylvania, in the United States of America, in the 1700s. They mostly choose to marry only the members of their own community. Today, the Dunkers are genetically different from other populations, including those in Germany.

   Which of the following are the most likely explanations for the genetic uniqueness of the current Dunker population?

   a) Natural selection and mutation
   b) Natural selection and genetic drift
   c) Barriers to gene flow and genetic drift
   d) Barriers to gene flow and speciation

8. Which of the following is a series of events that leads to the formation of two separate species?

   a) Variation, natural selection, isolation, speciation
   b) Natural selection, isolation, speciation, variation
   c) Isolation, variation, speciation, natural selection
   d) Variation, isolation, natural selection, speciation

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9. A mutation that involves the deletion of a section of specific base pairs of the DNA, known as CCR5-Delta32, is believed to provide a resistance to HIV infection. Individuals with the homozygous condition for the mutation have almost complete resistance to HIV and individuals who are heterozygous for the mutation have a partial resistance to HIV, where the disease progression is slowed.

   This trait has a frequency of 10% in European populations but has not been found in African, Asian, Middle Eastern or American Indian populations. One theory for the geographical distribution of the mutation is that it also provided resistance to the bubonic plague. Given that European populations were most affected by the plague, the mutation has been inherited in these groups and not others.

   The pattern of occurrence of the CCR5-Delta32 mutation can be best attributed to:

   a) Random genetic drift
   b) The founder effect
   c) Natural selection
   d) A geographical barrier to gene flow

10. If you were listing items of evidence that supports Charles Darwin's theory of evolution occurring as a result of variation and natural selection, you would include all of the following statements, EXCEPT ONE. Which one is incorrect?

   a) In an undisturbed area the number of individuals of an established species remains fairly constant
   b) Many animal species alive today show exactly the same characteristics as their ancestors
   c) In a population of humans, other than identical twins, no two individuals are exactly the same
   d) Small populations show greater differences in allele frequency than the larger population from where they came

11. 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

12.Which of the following changes is most likely to result in a mutation in an offspring

a) A change to the DNA in a somatic cell
b) The deletion of a gene in the DNA of a sperm cell
c) Crossing over during meiosis
d) A mistake in the replication of DNA during mitosis

13.‘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

14.Genetic drift is most likely to occur in:

a) Very small populations
b) Very large populations
c) Natural populations
d) Artificial populations

15.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

16.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