GSSHS– HB12 ATAR – Test 4 Mutations and Gene Pools

**PART A – MULTIPLE CHOICE QUESTIONS: 25 MARKS**

**Mark your answers on the Multiple-Choice Answer Sheet provided.**

1. A mutation is best described as:

a. A new characteristic appearing in an organism

b. A permanent change in genetic material

c. A changing in the mitotic process

d. Treatment by radiation

2. The advantage of sexual reproduction, from the evolutionary viewpoint, is that:

a. It reduces diversity

b. The offspring produced may be different from their parents

c. Sexually reproducing organisms can survive in a new environment

d. Sexual reproduction is necessary for change in appearance

3. Members of small, culturally distinct groups (for example, the religious sect known as the Dunkers in Pennsylvania, USA) can show markedly different allele frequencies from the general population, with whom they live, as they tend only to breed with other members of their group. These differences are **least** likely to be due to:

a. Founder effect

b. Isolation

c. Natural selection

d. Random genetic drift

4. Survival of the fittest means:

a. That when two animals fight, the strongest one wins

b. Animals learn through their life to adapt to their environment and pass this characteristic onto their offspring

c. All animals must fight for their food amongst the same species

d. Some animals are better adapted to their environment and these individuals tend to survive and pass these characteristics onto their offspring

5. When talking about population genetics, a favourite term for biologists to use is “gene pool”. What does this term refer to?

a. A barrier of some kind which prevents gene flow

b. A population of genes within the overall population being studied

c. Removal of genes from a population by any means

d. Evolution from a common ancestor to form a new population

6. Which of the following events would NOT assist in the development of a new species from an existing population?

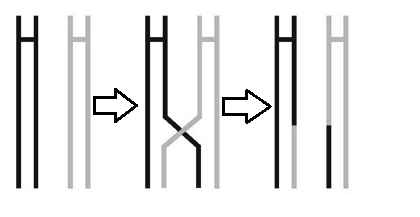
a. A wide range of anatomical and physiological variation within that population

b. An environmental catastrophe or hardship affecting all members of that population

c. A permanent separation of some members of the population form others

d. Different alleles being present in different members of the population

7. Look at the diagram below showing an event occurring during cell division.



Which of the following statements is NOT true?

a. This represents crossing over

b. This increases variation because new alleles are formed

c. This increases variation because genes are recombined

d. This happens during meiosis

8. A point mutation that changes a codon specifying an amino acid into a stop codon is called a:

a. Missense mutation

b. Nonsense mutation

c. Frameshift mutation

d. Deletion mutation

9. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mutation originates during meiosis, while a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mutation originates during mitosis.

a. germline, somatic

b. germline, spontaneous

c. somatic, germline

d. spontaneous, point

10. Changing the codon AGC to AGA represents a/n \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mutation

a. Insertion

b. Missense

c. Frameshift

d. Deletion

11. A spontaneous mutation usually originates as an error in

a. DNA replication

b. DNA transcription

c. Translation

d. Reverse transcription

12. A frameshift mutation:

a. Replaces one amino acid with another

b. Removes part of the protein

c. Introduces a section of amino acids not normally found

d. Joins two different proteins

13. A chromosomal mutation where part of a chromosome is removed is called a:

a. Duplication mutation

b. Deletion mutation

c. Translocation mutation

d. Inversion mutation

14. Crossing over occurs in the first division of meiosis. What is the importance of crossing over?

a. It increases the likelihood of that the cells produced contain different genetic material

b. It decreases the number of errors in meiosis

c. It produces extra genetic material, which is needed in the second division

d. It releases proteins that are then used to coil up the DNA after meiosis is complete

15. Which of the following disorders could be detected during a karyotype?

a. Sickle cell anaemia

b. Trisomy 21

c. Haemophilia

d. Tay-Sachs Disease

16. 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 pass on their favourable characteristics

c. There is variation within a species

d. All of the above

17. A new species can arise in a number of ways. The most important step which can produce a new species is described by which of the following?

a. Reproductive isolation

b. Adaptation to a new environment

c. Sudden appearance of new forms which then multiply

d. Selection of individuals with particular characteristics

18. Charles Darwin believe that the finch species found on the Galapagos Islands all developed from a common ancestor due to their many physical and behaviour similarities. This speciation was most probably caused by:

a. Natural evolution

b. Geographical isolation

c. Behavioural isolation

d. Reproductive isolation

19. The Dunkers are a religious group that moved from Germany to Pennsylvania in the mid-1700s. They do not marry outside of their own immediate community. Today, the Dunkers are genetically unique and differ in gene frequencies from all other populations, including their original homeland. Which of the following most likely explains the genetic uniqueness of this population?

a. Sexual selection and mutation

b. Mutation and natural selection

c. Founder effect and genetic drift

d. Geographical isolation and random mating

20. Populations that have become genetically isolated from one another:

a. Usually have the same gene frequencies for physical characteristics

b. Are not subject to random genetic drift

c. Are subject to similar environmental selection pressures

d. May develop into different subspecies

21. Height is an example of inheritance. People are not just short or tall; they have a variety of heights which run along a spectrum. Furthermore, height is also influences by environment. For example, someone born with tall genes could become short due to malnutrition or illness during childhood.

The type of inheritance mentioned above is called:

a. Polygenic with the environment

b. Polygenic without the environment

c. Phenotypic

d. Monohybrid

22. Genetic drift:

a. Is the result of selection

b. Only occurs in large populations

c. Results from a sudden increase in population size

d. Is a chance loss of an allele in a population

23. Which of the following statements about gene flow in human populations is correct?

a. Gene flow only occurs as a result of immigration

b. The frequency of alleles in a population is not influenced by gene flow

c. Gene flow causes new alleles to entre a gene pool

d. Mutation rates are higher in population with higher gene flow

24. Mutations in genes and chromosomes have a role to play in evolution. Mutations:

a. Are useful changes in genetic material which increase the chances of survival

b. Are usually lethal but occasionally a beneficial mutation occurs, and this permits natural selection to act

c. Sometimes have no effect on the phenotype, but they increase the amount of variation in the gene pool

d. Sometimes cause cancer, and harmful mutations can often be passed onto offspring

25. Offspring of individuals who are better adapted to their environment are expected to make up a greater proportion of the next generation. The most likely explanation for this prediction is based on:

a. Mutations and the occurrence of non-random mating

b. The amount of gene flow and random genetic drift

c. Mutations and the process of natural selection

d. The process of natural selection and random genetic drift

**END OF SECTION A**



**Year 12 ATAR Human Biology**

**Stage 4 2019**

**Assessment Task 11**

**Test 4 – Mutations & Gene Pools**

**Name:** ……………………………………..

**Teacher:** ………………………………….

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| --- | --- | --- |
| Part A | Multiple Choice Section | / 25 |
| Part B | Short Answer Section | / 30 |
| TOTAL | | / 55 |
| PERCENTAGE | | % |

**YEAR 12 ATAR HUMAN BIOLOGY STAGE 4 2019**

**MULTIPLE CHOICE ANSWER SHEET – MUTATIONS & GENE POOLS WRITTEN TEST**

**NAME:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**TEACHER:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**SECTION A: MULTIPLE CHOICE: (25 MARKS):**

***Place an* X *through the correct response:***

1. [A] [B] [C] [D] 16. [A] [B] [C] [D]

2. [A] [B] [C] [D] 17. [A] [B] [C] [D]

3. [A] [B] [C] [D] 18. [A] [B] [C] [D]

4. [A] [B] [C] [D] 19. [A] [B] [C] [D]

5. [A] [B] [C] [D] 20. [A] [B] [C] [D]

6. [A] [B] [C] [D] 21. [A] [B] [C] [D]

7. [A] [B] [C] [D] 22. [A] [B] [C] [D]

8. [A] [B] [C] [D] 23. [A] [B] [C] [D]

9. [A] [B] [C] [D] 24. [A] [B] [C] [D]

10. [A] [B] [C] [D] 25. [A] [B] [C] [D]

11. [A] [B] [C] [D] 26. [A] [B] [C] [D]

12. [A] [B] [C] [D] 27. [A] [B] [C] [D]

13. [A] [B] [C] [D] 28. [A] [B] [C] [D]

14. [A] [B] [C] [D] 29. [A] [B] [C] [D]

15. [A] [B] [C] [D] 30. [A] [B] [C] [D]

**SECTION B – SHORT ANSWERS: 30 MARKS**

**Write your answers in the spaces provided.**

1. Genetic recombination in eukaryotes occurs via two processes during meiosis. Describe each of these processes and briefly explain how they produce genetic variation. [4]

2. a. What is a mutation? [1]

b. Describe two different ways that mutations occur. [2]

c. Describe the effect of a nonsense mutation. [2]

d. Sickle-cell anaemia is caused by a mutation in the 20th nucleotide of the gene for the beta chain of haemoglobin. This results is one codon, GAG, becoming GTG and the resulting amino acid changes from glutamic acid to valine. Name the type of mutation involved. [1]

2. a. Explain the difference between genetic drift and natural selection as processes that result in evolution. Explain carefully how you might determine whether observations of evolution were due to selection or to genetic drift. [7]

b. Discuss two circumstances in which genetic drift is likely to occur. Explain why. [3]

3. a. Describe two mechanisms of isolation. [2]

b. What effect can isolation have on populations and therefore evolution [1]

4. Sickle cell anaemia is an inherited recessive condition which affects the shape of red blood cells. These abnormal cells tend to clump together which block the capillaries. This causes great pain and can result in death if the blockages occur in the brain, heart and kidney. Homozygotes for the condition die. Heterozygotes under normal conditions produce normal shaped red blood cells. If oxygen is limited, such as being at high altitude, the cells change shape.

i. Two heterozygote individuals have children. What are the probabilities of the genotypes of the offspring? Show your working. [3]

ii. The sickle cell allele is mainly found in black Africans or people of black African ancestry. Approximately 40% of these people living in the tropical areas of African have this allele. Why would a potentially fatal disease be found in such high proportions? [1]

iii. Explain, using your knowledge of evolutionary mechanisms why the proportions are greater in these areas. [3]

**END OF SECTION B**