FACULTY	AGRICULTURE AND NATURAL RESOURCES		
DEPARTMENT	ANIMAL PRODUCTION, AGRIBUSINESS & ECONOMICS		
SUBJECT	MOLECULAR GENETICS		
SUBJECT CODE	F3532AG		
DATE	NOVEMBER 2023		
DURATION	3 HOURS	Marks	100

SECOND OPPORTUNITY EXAMINATION

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This question paper consists of five **(5)** pages including this front page.

Additional materials to be supplied: **None**

Instructions

This question paper consists of **five (5)** questions. Attempt **all of them.**

Each question carries 20 marks.

You may use a calculator.

UNIVERSITY OF NAMIBIA EXAMINATIONS

QUESTION ONE **[20]**

Multiple choice questions, select the most correct answer. Each question is worth 1 mark

1. In DNA, which of the following determines the traits of an organism?
   A. Amount of Adenine
   B. Number of sugars
   C. Sequence of nitrogen bases
   D. Strength of hydrogen bonds

2. The central dogma states that genetic information flows from _____.
   A. DNA to proteins to amino acids
   B. RNA to DNA to Proteins
   C. DNA to ribosomes to cells
   D. DNA to RNA to Proteins

3. Hemophilia in humans is due to an X-chromosome mutation. What will be the results of mating between a normal (non-carrier) female and a hemophilic male?
   a. Half of daughters are normal and half of sons are hemophilic.
   b. All sons are normal and all daughters are carriers.
   c. Half of sons are normal and half are hemophilic; all daughters are carriers.
   d. All daughters are normal and all sons are carriers.

4. The tendency of two or more than two genes to stay together during inheritance is called
   A. Mutation
   B. Gene interaction
   C. Crossing over
   D. Linkage

5. The gene that encodes for a protein (testis determining factor) which turns on other genes needed for male development is called:
   A. SYR
   B. tfm
   C. SSRY
   D. SRY
   E. TDF

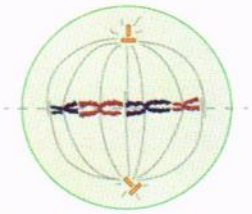
6. An environmental factor that can cause a change in the DNA of an organism is called a
   a. Toxin
   b. Mutagen
   c. Nitrogenous base
   d. Nucleotide
   e. Mutant

7. Which of these could be a normal gamete?
   A. GgRr
   B. GRr
   C. Gr
   D. GgR
   E. None of these are correct

8. In which of the following organelles can we find genomes?
   (a) Nucleus only
   (b) Nucleus and chloroplast
   (c) Nucleus, chloroplast and mitochondrion
   (d) Nucleus, mitochondrion and ribosome
   (e) Nucleus, chloroplast and ribosome

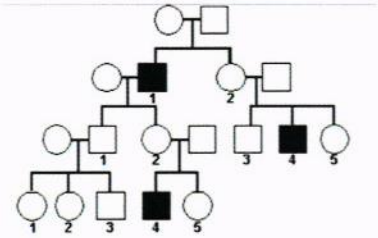
9. Which of the following molecules is translated to produce a protein?
(a) mRNA
(b) snRNA
(c) tRNA
(d) rRNA
(e) All but (b) are correct

10. How many chromosomes are shown in this picture? How many chromatids?



A. 4 chromosomes and 4 chromatids
B. 4 chromosomes and 8 chromatids
C. 8 chromosomes and 4 chromatids
D. 8 chromosomes and 8 chromatids
E. 16 chromosomes and 8 chromatids

11. What type of heredity is shown in the pedigree?



(A) Sex linked dominant
(B) Sex linked recessive
(C) Autosomal (normal) dominant
(D) Autosomal (normal) recessive

12. Which of these could be a normal gamete?
A. AaBc
B. AabCc
C. abc
D. AaBbCc

13. If you crossed two heterozygous plants, what proportion of the offspring will also be heterozygous?

a) all
b) half
c) 3/4
d) 1/4

14. Which component of the gel electrophoresis apparatus is responsible for creating the electric field?
a) Gel
b) Buffer
c) Electrophoresis chamber

d) Power supply

15. Which enzyme is commonly used to "cut" DNA at specific sequences in recombinant DNA technology?

    a) DNA polymerase
    b) RNA polymerase
    c) Restriction enzyme
    d) Ligase enzyme

16. What is the primary function of DNA replication?
    a) To create mRNA for protein synthesis
    b) To create genetic diversity
    c) To produce two identical copies of DNA
    d) To transcribe RNA into DNA

17. Suppose *GeneX* and *GeneQ* are 12 map units apart. An organism is heterozygous for both genes, with dominant *XQ* on one chromosome and recessive *xq* on the homologous chromosome. What are the genotypes of recombinant chromosomes that could be produced during meiosis?

    a) XQ and xq
    b) Xq and xQ
    c) XQ and Xq
    d) XQ, xq, Xq, and xQ

18. What are Okazaki fragments?

    a) Short pieces of RNA used as primers in DNA replication
    b) Short DNA segments synthesized on the lagging strand
    c) DNA repair enzymes
    d) Long stretches of DNA on the leading strand

19. Suppose *GeneX* and *GeneQ* are 12 map units apart. An organism is heterozygous for both genes, with dominant *XQ* alleles on one chromosome and recessive *xq* alleles on the homologous chromosome. What percentage of gametes will have the recessive allele for both genes *(xq)*?

    a) 6%
    b) 12%
    c)25%
    d)88%
    e)44%

20. A missense mutation causing the substitution of a chemically different amino acid is referred to as

    A. Non-synonymous substitution
    B. Synonymous substitution
    C. Silent substitution
    D. Nonsense mutation

QUESTION TWO

A Layer poultry farmer approached you for help with the following problem. He has 50 newly hatched chicks and is only interested in keeping the female chicks and wants to get rid of the males, he cannot determine the sex of the chicks as the chicks are only one day old. As a molecular genetics student, explain in detail the techniques and steps you would follow to assist the farmer. **[20]**

QUESTION THREE

a) Compare and contrast the organization of genetic material in prokaryotic and eukaryotic cells? Use a table **[10]**

b) Describe the procedures of making recombinant DNA **[7]**

c) Outline 3 disadvantages of cloning animals **[3]**

QUESTION FOUR

a) Describe sex-determination in mammals. **[8]**

b) Write short notes on the following: **[12]**

i. How ionising radiation causes mutation

ii. How transposable genetic elements (transposons) cause mutation

iii. Nucleosome

QUESTION FIVE **[20]**

Five major genes in mice interact to give each animal a particular coat colour and pattern. Write an essay to explain how the following coat patterns arise – dilute cinnamon, piebald with black and white spots, and albino – with reference to as many of these genes as necessary.

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