



KENYATTA UNIVERSITY

SUPPLEMENTARY/SPECIAL EXAMINATION 2022/2023

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

(MEDICAL LABORATORY SCIENCE)

HML 313: MOLECULAR BIOLOGY AND GENETICS

APRIL/MAY, 2023

TIME: 2 Hours

INSTRUCTIONS:

SECTION A: ANSWER ALL QUESTIONS (4 MARKS EACH)

1. Describe monosomy and trisomy (4 marks)
2. Explain Mendel's law of independent assortment (4 marks)
3. Differentiate between point mutation and missense mutation (4 marks)
4. Describe non-homologous end joining DNA repair mechanism (4 marks)
5. a) Explain Philadelphia chromosome (2 marks)

b) If the blood group of the father is A and that of the mother is B, what could be the possible blood group of their child? (Show your working) (2 marks)

SECTION B: ANSWER ANY ONE QUESTION (20 MARKS EACH)

6. a) Explain how lac I (regulatory) gene regulates gene expression in a lac (lactose) operon. (8 marks)
b) Describe DNA replication in eukaryotes (12 marks)
7. Discuss:
a) Applications of PCR (polymerase chain reaction) (10 marks)
b) Positive regulation of genes in an *Escherichia coli* operon (10 marks)

SECTION C: ANSWER ALL QUESTIONS IN THE ANSWER BOOKLET (½ MARK EACH)

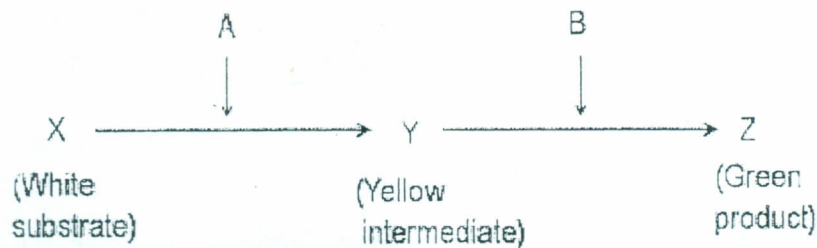
1. The end product of translation are:
 - a) Amino acids
 - b) Lipids
 - c) Polypeptides
 - d) All the above
2. The genetic instructions for forming a polypeptide chain are carried to the ribosome by the
 - a) tRNA
 - b) rRNA
 - c) mRNA
 - d) DNA
3. The lac operon in *E.coli* is involved in
 - a) Regulating the expression of a gene
 - b) Controlling DNA replication
 - c) Regulating the translation of mRNA
 - d) Controlling the formation of ribosomes
4. Genetic variation can be introduced into bacteria by all of the following methods except:
 - a) Transduction
 - b) Mutation
 - c) Transformation
 - d) DNA amplification
5. Which of the following is true?
 - a) A messenger RNA molecule has the form of a double helix
 - b) Ribosomes contain RNA nucleotides and amino acids
 - c) The uracil nucleotide consist of the uracil nitrogen base, a deoxyribose sugar and a phosphate group
 - d) In eukaryotes, DNA is manufactured in the nucleus and RNA is manufactured in the cytoplasm

- the largest molecules in our bodies are:
- nucleic acids
 - chromosomes
 - proteins
 - amino acids
7. Which of the following set are the pyrimidines found in RNA?
- Uracil and Cytosine
 - Adenine and Uracil
 - Guanine and Uracil
 - Thymine and Uracil
8. Turner's syndrome is characterized by:
- 46
 - 45
 - 47
 - 48
9. _____ is a chromosomal disorder that causes undeveloped feminine character and sterility
- Turner's syndrome
 - Klinefelter syndrome
 - Down's syndrome
 - Phenylketonuria
10. The basic structural and functional unit of heredity is:
- Nucleus
 - DNA
 - Gene
 - Chromosome
11. Cystic fibrosis is:
- Autosomal dominant disorder
 - Sex-linked recessive disorder
 - Sex-linked dominant disorder
 - Autosomal recessive disorder
12. Alleles are
- Linked genes
 - Alternate forms of genes
 - Homologous chromosomes
 - Chromosomes that have crossed over
13. Which of the following statements is true regarding the "law of segregation"?
- Segregation of factors is due to the segregation of chromosomes during meiosis
 - Law of segregation is the law of purity of genes
 - Alleles separate from each other during gametogenesis
 - All of the above

14. The genotypic ratio of a monohybrid cross is:

- a) 3:1
- b) 1:2:1
- c) 9:3:3:1
- d) 2:1:1

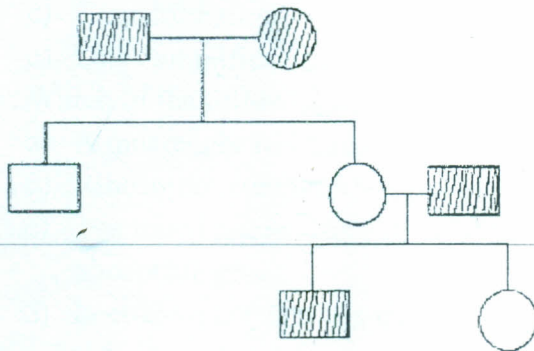
15. Following a hypothetical biochemical pathway responsible for pigmentation of leaves. The pathway is controlled by two independently assorting genes 'A' and 'B' encoding genes as shown below. Mutant alleles 'a' and 'b' code for non-functional proteins.



What is the expected progeny after selfing a plant with the genotype AaBb?

- a) Green (9) White (4) Yellow (3)
- b) Green (9) Yellow (4) White (3)
- c) Green (9) Yellow (6) White (1)
- d) Green (9) White (7)

16. The following pedigree chart shows inheritance of a given trait



The trait can be called:

- a) Autosomal dominant
- b) Autosomal recessive
- c) X-linked dominant
- d) Sex limited

Two interacting genes (independently assorting) were involved in the same pathway. Absence of either genes function leads to absence of the end product of the pathway. A dihybrid cross involving the two genes is carried out. What fraction of the F₂ progeny will show the presence of the end product?

- a) $\frac{1}{4}$
- b) $\frac{3}{4}$
- c) $\frac{9}{16}$
- d) $\frac{15}{16}$

18. Which of the following is a classic example of point mutation?

- a) Phenylketonuria
- b) Sickle cell anaemia
- c) Haemophilia
- d) Thalassemia

19. How many autosomes are present in a human being?

- a) 20 pairs
- b) 22 pairs
- c) 23 pairs
- d) 44 pairs

20. Which of the following is called the sex-linked disease?

- a) Leukemia
- b) Alzheimer's
- c) Malignancy
- d) Colour blindness