AFRICA UNIVERSITY
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"Investing in Africa's Future"

COLLEGE OF HEALTH, AGRICULTURE & NATURAL SCIENCES

DEPARTMENT OF HEALTH SCIENCES

BACHELOR OF MEDICAL LABORATORY SCIENCES HONOURS

SLS 105 GENETICS & MOLECULAR BIOLOGY

APRIL/MAY 2019 EXAMINATIONS

LECTURER: Dr E. MUGOMERI

DURATION: 3 HOURS

INSTRUCTIONS

The mark allocation for each question is indicated at the end of the question

Credit will be given for logical, systematic and neat presentations.

Section A comprises Multiple Choice Questions and is compulsory. Total **marks are 20.**

a) Answer ALL questions.

b) Each correct response for components is allocated 1 mark.

c) Indicate by circling correct answer on this question paper.

1. Gel electrophoresis separates DNA molecules on the basis of their
- **A.** Ability to bind to mRNA
- **B.** Size
- **C.** Solubility in water
- **D.** Solubility in agarose gel
- **E.** Secondary structure and purity

2. What are restriction enzymes?
- **A.** Enzymes that only work in restricted areas of the cell
- **B.** Enzymes that are specific for plasmids
- **C.** Enzymes that cut introns out of pre-mRNA
- **D.** Enzymes cut DNA molecules at specific recognition sites
- **E.** Enzymes that stop transcription

3. Which of the following best describes sticky ends?
- **A.** Sticky ends are DNA fragments that carry a higher charge than normal after they have been cleaved by restriction enzymes.
- **B.** Sticky ends are DNA fragments cleaved by a restriction enzyme so that one strand is longer than the other.
- **C.** Sticky ends are DNA fragments cleaved by a restriction enzyme so that both strands are the same length
- **D.** Sticky ends are DNA fragments that attract a carbohydrate molecule to one end after being cleaved by a restriction enzyme.

4. What are introns?
- **A.** Introns are coding regions of DNA molecules
- **B.** Introns are enzymes used to splice DNA
- **C.** Introns are noncoding regions of DNA molecules
- **D.** Introns are repeating segments of DNA that occur at the tips of most chromosomes

5. What is the true relationship between introns and exons?
- **A.** Introns often comprise more of the DNA molecule than exons
- **B.** Introns are found in eukaryotes; prokaryotes have only exons
- **C.** There appears to be an evolutionary relationship in intron-exon organization
- **D.** All of the above
- **E.** None of the above

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7. Interphase comprises which of the following stages?

- **A.** G1 and G2
- **B.** G1 and M
- **C.** G1, G2 and M
- **D.** G1, S and G2
- **E.** All of the above
- **F.** None of the above

8. A dominant allele is the most abundant in the population
- **A.** True
- **B.** False

9. Most sex-linked traits are recessive
- **A.** True
- **B.** False

10. DNA replication occurs in which phase of the cell cycle?
- **A.** S
- **B.** M
- **C.** G1
- **D.** G2
- **E.** All of the above
- **F.** None of the above

11. Which of the following enzymes re-anneals semi-conservative DNA strands and joins Okazaki fragments of the lagging strand?
- **A.** DNA helicase
- **B.** DNA polymerase
- **C.** Topoisomerase
- **D.** DNA ligase
- **E.** Primase

12. Which blotting technique can detect the presence of a specific protein from a cell?

A. Southern
B. Northern
C. Western
D. Eastern

13. _What blotting technique can be used for specific detection of RNA molecules?
A. Southern
B. Northern
C. Western
D. Eastern

14. cDNA synthesis is catalyzed by which enzyme?
A. Dideoxyribonuclease
B. Integrase
C. Reverse transcriptase
D. Restriction endonuclease
E. All of the above
F. None of the above

15. What is the primary purpose of a thermocycler?
A. Dideoxy terminator sequencing
B. Polymerase chain reactions
C. DNA footprinting
D. Colony hybridization
E. All of the above
F. None of the above

16. Southern blotting
A. Is a blotting isolation technique for DNA molecules
B. Is a blotting isolation technique for RNA molecules
C. Is a blotting isolation technique for proteins
D. Is a blotting isolation technique where molecules migrate southwards of the recovery membrane
E. All of the above
F. None of the above

17. In genetic engineering a chimera is
A. created by joining DNA fragments from unrelated genes
B. created by joining specific fragments that enable a gene to encode isomers
C. an enzyme that links DNA molecules
D. a virus that infects bacteria
E. all of the above
F. none of the above

18. In which way is recombinant DNA technology playing an important role in human health?

- **A.** Helping to determine the molecular causes of disease
- **B.** Producing effective means to express proteins such as insulin and growth hormone
- **C.** Forensic medicine
- **D.** All of the above
- **E.** None of the above

19. DNA that assembled using processed mRNA molecules as template is

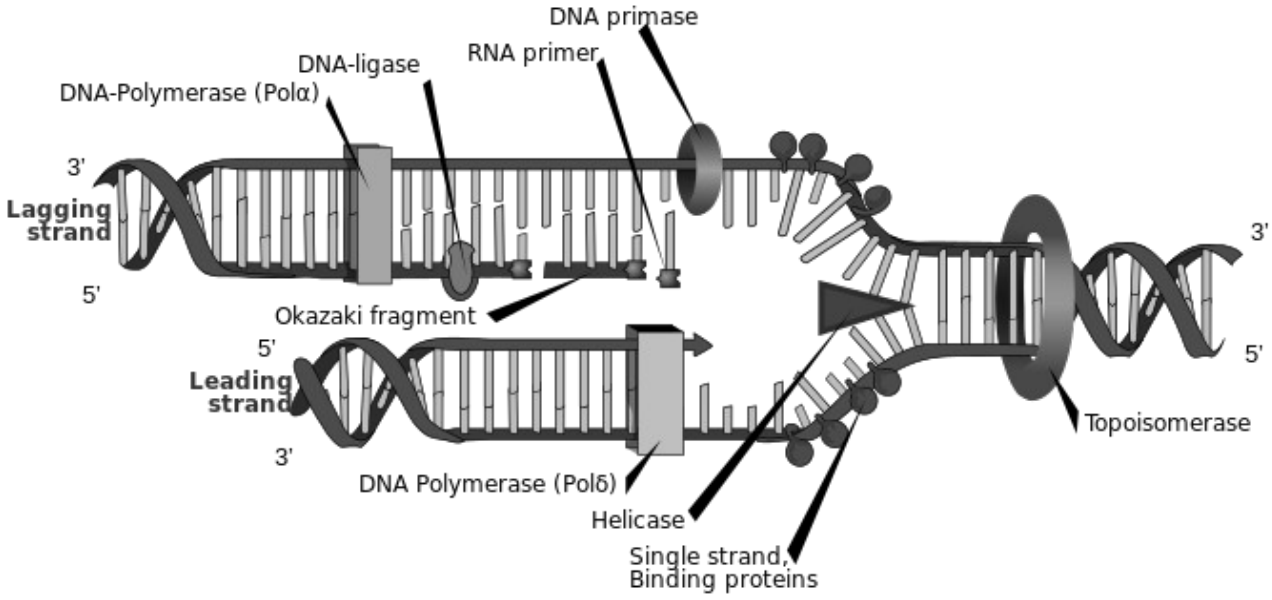
- **A.** rDNA
- **B.** mDNA
- **C.** cDNA
- **D.** all of the above
- **E.** none of the above

20. What is the molecular technique in which a DNA sequence flanked by two oligonucleotide primers can be amplified?

- **A.** Southern blotting
- **B.** Northern blotting
- **C.** Western blotting
- **D.** Polymerase chain reaction
- **E.** All of the above
- **F.** None of the above

SECTION B: Answer all questions (35 Marks)

1. Write short notes on DNA replication using the diagram below as aid:(15).



2. Using a diagrams, illustrate the difference between a nucleoside and a nucleotide(10)

3. Concerning Mendelian inheritance explain the meanings of the following terms (10)

(i) Allele (2)
(ii) Homozygous(2)
(iii) Heterozygous(2)
(iv) Genotype(2)
(v) Phenotype (2)

SECTION C: Answer any three questions (45 Marks)

1. Write short notes distinguishing the following types of mutation:
    a. Missense (2)
    b. Duplication (2)
    c. Deletion (2)
    d. Insertion (2)
    e. Frameshift (3)
    f. Nonsense (2)
    g. Repeat expansion (2)

2. Explain the genetic defect associated with the following disorders
    a. Cystic fibrosis (2)
    b. Sickle cell anaemia (2)
    c. Tay-sachs disease (2)
    d. Phenyketonuria (2)
    e. Haemophilia (3)
    f. Huntington's disease (2)
    g. Muscular dystrophy (2)

3. Describe in detail how mitosis differs from meiosis. (15)

4.Write an essay describing the process of protein synthesis in detail. (15)

TOTAL 100 MARKS