



*(University of Choice)*

# **MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)**

**(MAIN CAMPUSES)**

**UNIVERSITY EXAMINATIONS  
2018/2019 ACADEMIC YEAR**

**SPECIAL/SUPPLEMENTARY EXAMINATIONS**

**FOR**

**1. THE BACHELOR OF SCIENCE  
IN MEDICAL LABORATORY SCIENCES**

**2. THE BACHELOR OF SCIENCE  
IN MEDICAL BIOTECHNOLOGY**

**COURSE CODE: BML 222**

**COURSE TITLE: MOLECULAR BIOLOGY AND GENETICS**

**DATE:**

**TIME:**

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**INSTRUCTIONS:**

**ANSWER ALL QUESTIONS IN THIS EXAMINATION**

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 6 Printed Pages. Please Turn Over

## SECTION A: MULTIPLE CHOICE QUESTIONS (20 MARKS)

1. In DNA therapeutic delivery into cells
  - (a) Bacteria can carry agent for introduction
  - (b) Repeated treatments are required
  - (c) Viral methods offer large scale production advantages
  - (d) Electroporation and *in situ* hybridization mediate agent transfers
  
2. Post translational modification
  - (a) Causes splicing of protein disulphides
  - (b) Takes place inside SER
  - (c) Starts after entry into cisternae mediated by a leader sequence
  - (d) Involves moiety addition in RER
  
3. Molecular evolution
  - (a) Commences with transposon drifts
  - (b) Explains principles of computational biology
  - (c) Emphasizes effects of single nucleotide changes
  - (d) Deals with depurination effects on assortative outcomes
  
4. In Northern blotting
  - (a) Endonucleases target specific recognition sites
  - (b) Data outcomes can be used to quantify stress levels
  - (c) DNA molecules are blotted onto nitrocellulose
  - (d) DNA ligase plays a DNA regulatory role
  
5. From NNI definition molecular nanoparticles
  - (a) Range in size from 1 to 110 nm
  - (b) Can be generated in plasmids
  - (c) Can be attrition-prepared
  - (d) Can be generated using transcription mechanosynthesis
  
6. Select a property that DOES NOT apply to DNA probes
  - (a) Fragment lengths range from 100-1000 nucleobases
  - (b) They strictly target complementary sequences for detection

- (c) They are expressible *in vivo* via plasmids
- (d) They can be accompanied by  $^{32}\text{P}$  markers

7. nc RNAs

- (a) Include subsets encoded in extranuclear positions
- (b) Mediate central dogma special transfers
- (c) Transfer sequence information in hnRNA synthesis
- (d) Include primary mRNA transcripts

8. Recombinant expression vectors

- (a) Can be used for anti-diabetic insulin production
- (b) Are hot plasmids for injection into viral replicons
- (c) Are cloned by DNA splitting ligases
- (d) Are extracted using DEAE-dextran

9. Lambda phage vectors

- (a) Are coliphage derivatives
- (b) Are potent replicons
- (c) Are inserted into targets with poly A tails
- (d) Are commonly applied in expression of insulin

10. Transcription

- (a) Utilises DNA polymerase activities
- (b) Is mediated by tRNA-involving decoding
- (c) Translocates rRNA from the nucleus
- (d) Takes place in the nucleus

11. Gene knock-outs

- (a) Can be generated by insertion of cDNA
- (b) Can be created using short oligonucleotide reagents
- (c) Are processed using RSC pathways
- (d) Are altered in the transcriptome

12. The Boveri–Sutton chromosome theory of inheritance
  - a) Were integrated with Mendel's theories by Thomas Hunt Morgan in 1915
  - b) Are the basis for population genetics and modern evolutionary synthesis
  - c) Says an organism with one dominant allele will display the dominant allele
  - d) Explains the law of dominance in phenotypic determination
  
13. Allele frequency
  - (a) Is the fraction of all chromosomes in a population that carry an allele
  - (b) Provides a raw material for molecular evolution
  - (c) Can be analysed using error-prone replication by-pass
  - (d) Is independent of the total number of chromosome copies in a population
  
14. In transcription regulation
  - (a) Enhancers bond with activators
  - (b) Special transfers are tRNA-decoded
  - (c) Activators bind mRNA to the polysome
  - (d) Probes anneal exons into the P-site
  
15. Molecular tautomerism
  - (a) Causes loss of a purine
  - (b) Causes loss of a pyrimidine
  - (c) Alters hydrogen bonding patterns
  - (d) Generates hypoxanthine from 5-methyl cytosine
  
16. The PCR technique
  - (a) Has an occasional final elongation at 70°C to 74°C
  - (b) Involves Taq-polymerase-mediated elongation at 76°C to 87°C
  - (c) Involves annealing for 60 minutes
  - (d) Can only be done via automation thermocycling
  
17. In DNA extraction
  - (a) Used surfactants also serve in cell lysis
  - (b) RNase purifies DNA
  - (c) Sonication aids in protein removal

(d) Chelating agents sequester trivalent ions

18. The Creutzfeldt-Jakob disease

- (a) Originated from cadaver HGH effects
- (b) Emanated following transposition
- (c) Is an outcome of a glycine-altering point mutation
- (d) Is triggered by insertional activation of rDNA

19. The following statements are UNTRUE of molecular transfection EXCEPT

- (a) It can involve supercoiled plasmid DNA
- (b) Gene gun coupling can be used for chemical DNA delivery
- (c) Optical methods mediate impalefection
- (d) Transduction is done with a virus

20. Which one of the following statements is NOT TRUE concerning TFs

- (a) They bind to promoter DNA zones
- (b) They have DBDs for adjacent positioning
- (c) They mediate DNA polymerase attachment to ssDNA templates
- (d) They independently mediate codon sequence copying

**SECTION B: SHORT ANSWER QUESTIONS**

**[40 MARKS]**

1. Explain the TF operation mechanisms **(4 marks)**
2. Give examples of antibiotics that inhibit protein translation cycles **(4 marks)**
3. What is DNA supercoiling **(4 marks)**
4. Describe the PCR annealing step events **(4 marks)**
5. Is the use of recombinant DNA technology non-controversial? **(4 marks)**
6. Draw a tRNA molecule and give its function **(4 marks)**
7. Distinguish between deamination and tautomerism **(4 marks)**
8. Explain the molecular evolution **(4 marks)**
9. Give the mechanisms involved in post-transcriptional gene regulation **(4 marks)**
10. Distinguish between:
  - (a) Introns and exons **(2 marks)**
  - (b) Primary transcripts and hnRNA molecules **(2 marks)**

**SECTION C: LONG ANSWER QUESTIONS**

**[40 MARKS]**

1. Discuss the four major types of vectors used in gene cloning **(10 marks)**
2. Describe the DNA extraction process **(10 marks)**
3. Discuss DNA damage and repair mechanisms **(20 marks)**