

**UNIVERSITY OF ESWATINI
FACULTY OF SCIENCE AND ENGINEERING
DEPARTMENT OF BIOLOGICAL SCIENCES
MAIN EXAMINATION PAPER 2019/2020**

COURSE CODE: BIO461

TITLE OF PAPER: BIOTECHNOLOGY

TIME ALLOWED: **THREE (3) HOURS**

INSTRUCTIONS: NUMBERS IN BRACKETS DENOTE THE NUMBER OF MARKS

THIS PAPER COMPRISES OF **THREE SECTIONS**. SECTION A COMPRISES OF 25 QUESTIONS. SECTION B COMPRISES OF 8 QUESTIONS. ANSWER ALL QUESTIONS IN SECTIONS A AND B. SECTION C HAS TWO QUESTIONS. ANSWER ONLY ONE QUESTION FROM SECTION C.

CLEARLY INDICATE THE SECTION AND QUESTION NUMBER ON YOUR ANSWER PAPER.

NO ADDITIONAL MATERIAL (E.G. NOTES, CALCULATORS ETC) MAY BE TAKEN INTO THE EXAMINATION.

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Section A

Total marks available: 25

There are twenty-five (25) questions in this section. Answer **ALL** the questions in this section

- AQ1: What are the branches of biotechnology? [1]
- a) Food production, bioinformatics, agriculture
 - b) Industry, deserts, marine
 - c) War, medical & pharmaceutical, ethics
 - d) All of the above
 - e) None of the above
- AQ2: Ethics can be described as: [1]
- a) Moral principles that govern a person's behavior or the conducting of an activity
 - b) Concern about ourselves and our immediate family
 - c) Framework to navigate data analysis issues in biotechnology
 - d) A moral map that has a right answer
 - e) All of the above
- AQ3: Intellectual property rights are [1]
- a) Outlined in the universal declaration of human rights article 21
 - b) Designed to protect the inventor and have little to do with society
 - c) To enable a more equal society
 - d) All of the above
 - e) None of the above
- AQ4: When extracting DNA, one should [1]
- a) Pipette as fast as possible
 - b) Store the extracted DNA at -20°C
 - c) Break the cells e.g. using an electroporation device
 - d) All of the above
 - e) None of the above
- AQ5: Palindromic sequences are used by which of the following to cut DNA [1]
- a) Control vectors
 - b) Expression vectors
 - c) Restriction endonucleases
 - d) Ligases
 - e) Selective markers
- AQ6: The 'ori' can be found in: [1]
- a) Endoplasmic reticulum
 - b) cDNA
 - c) DNA ligase
 - d) cloning vectors
 - e) Cell wall

- AQ7: Multiple protein expression forms are [1]
- a) found on mRNA of transformed cells
 - b) a result of mutations on the intron of DNA
 - c) selective markers for cloning vectors
 - d) found in all prokaryotic cells
 - e) caused by post-translational modifications
- AQ8: What molecular biology tools are *not* used to understand the mechanism of disease? [1]
- a) Proteomics
 - b) Gram staining
 - c) Radioimmunoassays
 - d) Transgenic animal models
 - e) RT-PCR
- AQ9: Bioreactors support growth of: [1]
- a) bacteria
 - b) yeast
 - c) fungi
 - d) antibodies
 - e) all of the above
- AQ10: In batch bioreactors processes: [1]
- a) medium and inoculum are added at the beginning and reactor sealed until the end of the process
 - b) medium and inoculum is continuously added to the reactor
 - c) medium and nutrients are continuously added to the reactor
 - d) all of the above
 - e) none of the above
- AQ11: DNA can be safely stored in [1]
- a) expression vectors
 - b) methyltransferase
 - c) cloning vectors
 - d) 2D PAGE
 - e) Golgi apparatus
- AQ12: "Golden rice" is a genetically modified crop that improves what characteristic of rice? [1]
- a) Flavor
 - b) Texture
 - c) Pest resistance
 - d) Harvest yield
 - e) Nutrition
- AQ13: Biotechnology patent officers often sit in which government ministry? [1]
- a) Ministry of Health
 - b) Ministry of Commerce
 - c) Ministry of Finance
 - d) Ministry of Education
 - e) Ministry of Transport

- AQ14: Which of the following are examples of biopharmaceuticals [1]
- a) aspirin
 - b) edible vaccines
 - c) HIV treatment (e.g. tenofovir-lamivudine-dolutegravir)
 - d) All of the above
 - e) None of the above
- AQ15: PCR arrays can be used to: [1]
- a) directly measure genomic DNA methylation
 - b) measure changes in protein profile as a result of disease
 - c) produce biofuels
 - d) compare changes in the transcriptome
 - e) store cDNA
- AQ16: Secondary protein structure is the: [1]
- a) amino acid sequence
 - b) 3D organization of the polypeptide chain
 - c) due to non-covalent bonding
 - d) all of the above
 - e) none of the above
- AQ17: What does the term 'karyotyping' mean? [1]
- a) simultaneously driving and typing on your phone
 - b) pairing and ordering all the chromosomes of an organism
 - c) inserting a plasmid into a host
 - d) annealing two complementary DNA sequences together
 - e) cutting of a palindromic sequence of DNA
- AQ18: Plantibodies are: [1]
- a) plants used to produce monoclonal antibodies
 - b) antibody implants for the long acting drug therapy
 - c) vaccines made in plants
 - d) engineered plant for better texture and palatability
 - e) asexual propagation of plants
- AQ19: The 'Central Dogma' involves: [1]
- a) Translation of DNA to mRNA
 - b) Production of proteins directly from DNA
 - c) Transcription of proteins to RNA
 - d) mRNA to protein translation
 - e) unwinding of DNA using DNA ligase
- AQ20: Telomeric probes are: [1]
- a) RNA probes specific to the telomeres of all human chromosomes
 - b) peptide probes specific to the telomeres of all human chromosomes
 - c) probes that detect aneuploidy of any chromosome
 - d) all of the above
 - e) none of the above
- AQ21: Confluence occurs when [1]

- a) the bioprocessor cycle ends
- b) a recombinant plasmid has entered a host cell
- c) antibiotic resistance has been disrupted
- d) a monoclonal antibody is produced by a cell
- e) none of the above

AQ22: 3D cell culture [1]

- a) better mimics the *in vivo* environment
- b) requires a hydrophobic structure to support cell growth
- c) must use more than one cell line
- d) is the most common form of cell culture
- e) none of the above

AQ23: When hybridizing a probe for FISH analysis, the hybridization step requires you to: [1]

- a) Freeze the slides first
- b) Wash the slides in saline-sodium citrate buffer
- c) Denature the proteins on the slide using heat
- d) Denature the nucleic acids on the slide using an alkali
- e) Dehydrate the slide using ethanol 70%

AQ24: A cryostat is [1]

- a) a method of preserving embryos for IVF
- b) the immediate freezing of harvested tissues or cells
- c) an example of a monoclonal antibody used to treat rheumatoid arthritis
- d) a type of intellectual property used to protect architectural designs
- e) a microtome used to cut frozen tissue into 4 μ m slices

AQ25: Molecular markers are: [1]

- a) used to flag the position of a particular gene
 - b) found at specific locations of the sequence
 - c) specific fragments of DNA identifiable within a whole genome
 - d) can be a sequence of DNA or protein whose inheritance can be monitored
 - e) all of the above
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Section B

Total marks available: 50

There are eight questions in this section. Answer **ALL** the questions in this section

- BQ1:** List the patentability criteria. [4]
- BQ2:** Give five (5) examples of biotechnology fermentation products. [5]
- BQ3:** Using a diagram, describe the operation of **ONE** type of bioreactor. [5]
- BQ4:** List three (3) advantages and three (3) disadvantages of single-use and multi-use bioreactors. [6]
- BQ5:** Describe five (5) benefits of biotechnology to the fashion industry. [5]
- BQ6:** Describe the role of transgenic animals in biomedical research. [5]
- BQ7:** Using an example, briefly explain why **AND** how a eukaryotic expression vector would be used to express a gene. [10]
- BQ8:** Briefly describe five (5) methods of host cell transfection. [10]
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Section C

Total marks available: 25

There are two questions in this section. Answer only **ONE** question

- CQ1:** Discuss the ethical considerations of using plant biotechnology in agriculture. [25]

OR

- CQ2:** Explain the application of recombinant DNA technology in medicine and medical science. [25]
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END OF EXAMINATION