

BIO461 (S) 2020/21

UNIVERSITY OF ESWATINI
FACULTY OF SCIENCE AND ENGINEERING
DEPARTMENT OF BIOLOGICAL SCIENCES
SUPPLEMENTARY EXAMINATION PAPER 2020/2021

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 7 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.

DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE CHIEF INVIGILATOR

Section A

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

AQ1: Capsid is:

[1]

- a) the protein shell of a virus
- b) a type of cloning vector
- c) a type of expression vector
- d) all of the above
- e) none of the above

AQ2: M13 phage:

[1]

- a) is a filamentous phage that binds to 'male' *E. coli* cells
- b) contains single stranded DNA that encodes for 11 different proteins
- c) genome uptake is mediated by TolA receptors
- d) all of the above
- e) none of the above

AQ3: Phage display technology:

[1]

- a) enables protein-peptide linking
- b) directly links a phenotype to a genotype
- c) may use a phage library and polyclonal phage ELISA
- d) is a method of identifying target-binding proteins from millions of different proteins
- e) all of the above

AQ4: Phagemids vectors contain:

[1]

- a) an antibiotic marker for selection and propagation of the plasmid
- b) the gene encoding the fusion protein
- c) phage origin of replication for rolling circle amplification
- 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) Restriction endonucleases
- c) Expression vectors
- d) Ligases
- e) None of the above

AQ6: In enzyme technology, pure enzymes are produced from:

[1]

- a) animals
- b) bacteria
- c) plants
- d) yeasts
- e) all of the above

AQ7: Multiple protein expression forms are

[1]

- a) caused by post-translational modifications
- b) found on mRNA of transformed cells
- c) a result of mutations on the intron of DNA
- d) selective markers for cloning vectors
- e) found in all prokaryotic cells

- AQ8: A cosmid is: [1]
- a) a type of hybrid plasmid containing beta-phage DNA sequences
 - b) a type of expression vector than can accommodate 250kb of DNA
 - c) a type of cloning vector that can accommodate 250kb of DNA
 - d) a type of plasmid that contains one or more cohesive sites
 - a) contain an F-factor origin of replication

- AQ9: When testing a 6-week old infant for HIV: [1]
- a) a PCR test is chosen because antibodies from the mother would give a false negative
 - b) a PCR test is chosen because antibodies from the mother would give a false positive
 - c) an antibody test is chosen because viruses from the mother would give a false negative
 - d) an antibody test is chosen because viruses from the mother would give a false positive
 - e) no test is carried out because the child is too young and we should wait until the child is 2 years old.

- 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: Secondary antibodies can be: [1]
- a) used in direct ELISA assays
 - b) bound to an antigen during *insitu* hybridization
 - c) labelled with a fluorophore and used for *insitu* hybridization
 - d) used to highlight different chromosomes
 - e) none of the above

- AQ12: Virtue ethics is [1]
- a) Rational moral cost-benefit analysis
 - b) Doing the 'best' for the majority
 - c) Guided by human consciousness and intuition
 - d) All of the above
 - e) None of the above

- AQ13: Biotechnology patent officers often sit in which government ministry? [1]
- a) Ministry of Finance
 - b) Ministry of Health
 - c) Ministry of Transport
 - d) Ministry of Education
 - e) Ministry of Commerce

- AQ14: In plug flow bioprocessing: [1]
- a) Substrate concentration is constant throughout the bioreactor
 - b) There is a decrease in substrate concentration from inlet to inlet
 - c) There is an increase in substrate concentration from inlet to outlet
 - d) The culture is stirred using air
 - e) Foam production is a disadvantage

AQ15: When producing large quantities of recombinant human insulin using *E.coli*, you would: [1]

- a) Insert genomic DNA into an expression vector
- b) Insert complementary DNA into an expression vector
- c) Insert genomic DNA into a cloning vector
- d) Insert complementary DNA into an expression vector
- a) None of the above

AQ16: When using phenol during DNA extraction: [1]

- a) You must work in a laminar flow cabinet
- b) You must work in a biohazard level 2 cabinet
- c) You must work in a biohazard level 3 cabinet
- d) You must work in a fume hood
- e) You can work on the bench top

AQ17: What does the term 'karyotyping' mean? [1]

- b) simultaneously driving and typing on your phone
- c) pairing and ordering all the chromosomes of an organism
- d) inserting a plasmid into a host
- e) annealing two complementary DNA sequences together
- f) cutting of a palindromic sequence of DNA

AQ18: Plantibodies are: [1]

- a) antibody implants for the long acting drug therapy
- b) monoclonal antibodies made by plants
- c) engineered plant for better texture and palatability
- d) vaccines made by plants
- e) asexual propagation of plants

AQ19: You are growing Sf9 insect cell lines in your lab. Which of the following statements are correct? [1]

- a) cells should be grown at pH 7.4 in a petri-dish dry incubator at 27°C
- b) cells should be grown at pH 6.2 in a petri-dish in a humid incubator at 27°C
- c) cells should be grown at pH 7.4 in a sealed flask in a dry incubator at 37°C
- d) cells should be grown at pH 6.2 in a petri-dish in a humid incubator at 38.5°C
- e) None of the above

AQ20: Locus specific probes are: [1]

- a) RNA probes specific to the telomeres of all human chromosomes
- b) probes specific to a particular chromosomes
- c) probes that detect aneuploidy of any chromosome
- d) all of the above
- e) none of the above

AQ21: Golden Rice was genetically modified for better: [1]

- a) nutrition
- b) hardiness
- c) harvest yield
- d) flavour
- e) growth rate

- AQ22:** 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
- AQ23:** 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
- AQ24:** 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%
- AQ25:** Genetically modified organisms can normally be detected using: [1]
 a) 2D PAGE
 b) PCR
 c) *In situ* hybridisation
 d) Bioreactor
 e) Yeast artificial chromosomes

Section B

Total marks available: 50

There are seven (7) questions in this section. Answer **ALL** the questions in this section

- BQ1:** Outline the process of making edible vaccines. [10]
- BQ2:** Using a diagram, describe ONE method of cell transformation. [4]
- BQ3:** List three (3) benefits and three (3) challenges with intellectual property rights in biotechnology. [6]
- BQ4:** Describe five (5) benefits of biotechnology to the fashion industry. [5]
- BQ5:** List five types of reversible post-translational modifications that can occur in proteins. [5]
- BQ6:** Describe the role of transgenic animals in biomedical research. [5]
- BQ7:** With the aid of a diagram, explain the different molecular tools employed to visualize receptors in cell tissues. [15]

Section C

Total marks available: 25

There are two (2) questions in this section. Answer only **ONE** question

CQ1: You have been asked to appear on Eswatini TV to discuss the benefits of a new technology your laboratory is working on. Your new invention is a computer microchip that is injectable under the skin. The microchip can detect if the body is unwell before the person knows, and can transmit this information to a computer system e.g. to the person's "smart phone" or "smart watch" and alert the person they are not well (e.g. when the person has high blood pressure, high blood sugar, fever, infection, cancer etc). The technology will revolutionize modern medicine and you and your team have been nominated for a Nobel Prize. On the show, you will be joined by Dr. Nono Dlamini who is very against your new biotechnology invention.

Discuss the ethical issues of this new technology, including some of the concerns you expect Dr Dlamini to raise. [25]

OR

CQ2: Explain the use of cell culture in biotechnology. Your answer should also include the advantages and disadvantages of the use of cell culture. [25]

END OF EXAMINATION