Faculty of Science, Biotechnology and Food Technology Department

Recombinant DNA Technology 4/Molecular Biology 4

BTN1YD4/MCB41-1

November Examination 2019

Date: 16/11/2019 **Time:** 11H30-14H30

Examiner: Prof Ezekiel Green **Moderator:** Prof Samie Amidou

Pages: 3

Instructions:

- **Read carefully and answer all the questions.**
- **Remember to write your name, surname and student number on the answer booklet provided.**
- **Hand your question paper in with your answer booklet.**
- **It is in your best interest to write clearly and legibly.**
- **All the best!**

QUESTION 1 **[25 marks]**

A. Define the following terms as they are used in molecular biology.

i) Genomics

ii) Proteomics

iii) Structural genomics

iv) Functional genomics

v) Deoxyribonucleic acid. (2 Marks each)

B. The sequences of promoters tend to be rich in A and T residues. Suggest why this is so. (2 Marks)

C. The sequence of a consensus -10 region is TATAAT. If two genes, *tesA* and *tesB* have identical promoter sequences except in the -10 region, where the *tesA* sequence is TATAAT and the *tesB* sequence is TGTCGA, which gene do you expect to be more efficiently transcribed, and why? (5 Marks)

D. The gene encoding the *E. coli* enzyme β-galactosidase begins with the sequence ATGACCATGATTACG. What is the sequence of the mRNA transcript specified by this part of the gene? (8 Marks)

QUESTION 2. **[25 Marks]**

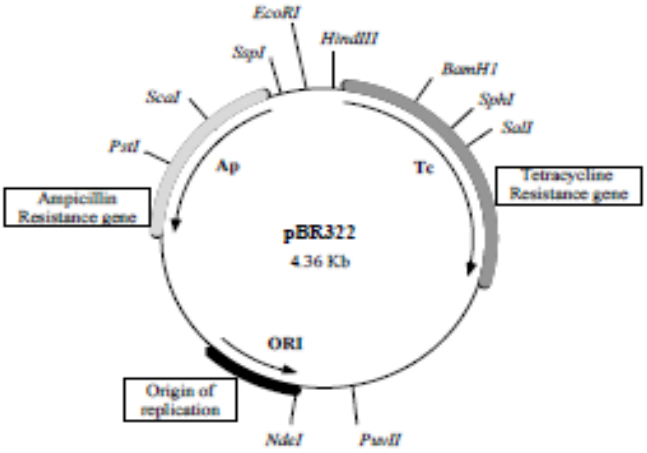
A. Translate the following mRNA into protein, starting from the first initiation codon.

5'-CCGAUGGCCAUGGCAGCUCGGUGUUACAAGGCUUGCAUCAGUACCAGUUUGAAUCC-3' (10 Marks)

B. Name and discuss the three steps involved in translation in both prokaryotes and eukaryote (15 Marks)

QUESTION 3 **[25 Marks]**

a) An ampicillin-resistant, tetracycline-resistant plasmid, pBR322, is cleaved with *Pst*I, which Cleaves within the ampicillin resistant gene. The cut plasmid is ligated *Pst*I-digested *Drosophila* DNA to prepare a genomic library, and the mixture is used to transform *E. coli* K12.



i) Which antibiotic should be added to the medium to select cells that have incorporated plasmid? Give reasons for your answer. (5 marks)

ii) What growth pattern should be selected to obtain plasmid containing *Drosophila* Inserts (4 Marks)

iii) How can you explain the presence of colonies that are resistant to both antibiotics? (4 Marks)

b) Write short notes on

i) Xeroderma pigmentosum (5 Marks)

ii) Transition mutations (4 Marks)

iii) Star activity of restriction enzyme (4 marks)

Question 4. **[25 Marks]**

i. In the CRISPR/Cas9 nuclease system, what is the role of the sgRNA (4 Marks)

ii. A double-stranded RNA genome isolated from a virus in the stool of a child with gastroenteritis was found to contain 15% uracil. What is the percentage of guanine in this genome? (8 marks)

iii. Describe type II endonuclease (8 Marks)

iii. Explain why p53 is referred to as a gate keeper (5 Marks)