UNIVERSITY OF JOHANNESBURG

FACULTY	: Science
DEPARTMENT	: Biotechnology and Food Technology
CAMPUS	: DFC
MODULE	: BTN1GB1 Fundamental Genetics
SEMESTER	: Second
EXAM	: Final Exam 2020

DATE	: 9 November 2020 9am -		: 10 November 2020 9am
ASSESSOR(S)	: DR MH Serepa-Dlamini		
MODERATOR	: Dr AM Abrahams		
DURATION	: 24 Hours	MARKS	: 100

NUMBER OF PAGES: 5 PAGES

INSTRUCTIONS:

1. Number your answers clearly.
2. Please submit a typed exam.
3. You have 24 hours to write this exam.
4. Submit on 10 November 2020 9am through email to Dr MH Serepa-Dlamini and **post a copy of your submission on Turn it in earlier or 30 minutes before due time.**
5. All the Best.

SECTION A

Question 1

a. Describe the roles of CRISPR/Cas9 and sgRNA in the nuclease system.
[10]

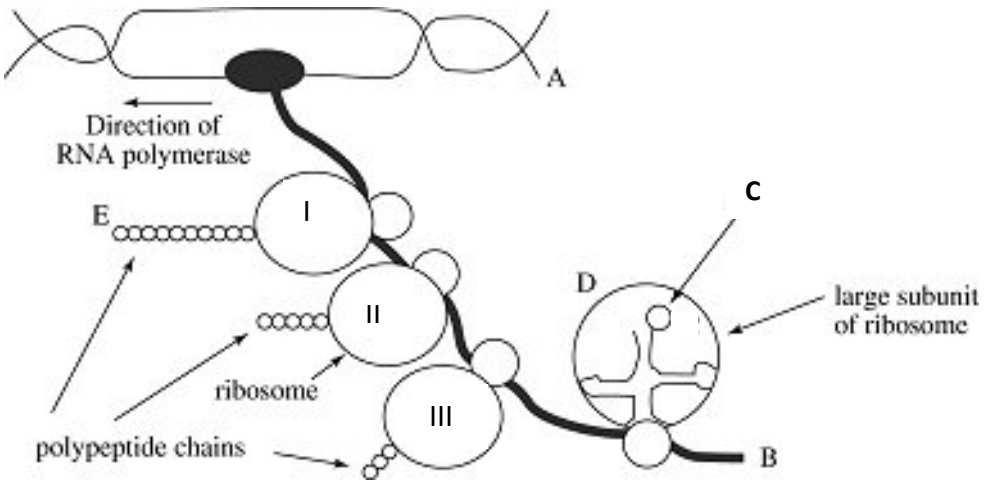
SECTION B

Question 1

1) 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)
2) The sequences of promoters tend to be rich in A and T residues. Explain why this is so. (2 Marks)
3) 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)
4) The gene encoding the E. coli enzyme β-galactosidase begins with the sequence 5' ATGACCATGATTACG 3'. What is the sequence of the mRNA transcript and amino acid names specified by this part of the gene? (8 Marks) **[25]**

Question 2

1) The drawing below represents a simultaneous transcription in bacteria. Answer the questions that follow, the direction of RNA pol is given by the arrow.



a) The letter B is nearest to which end of which molecule? (2)
b) Which end of the polypeptide chain is near to the letter E? (1)
c) Which ribosome began translation first? (1)
d) What type of RNA is within the large ribosomal subunit? (1)
e) What is the size of the large ribosomal subunit? (1)
f) Which subunit of the ribosome initiates translation? (1)
g) The letter A is next to which end of which molecule? (2)
h) What does the letter C represent? (1) **[10]**

Question 3

1) Translate the following mRNA into protein, starting from the first initiation codon. 5′CCGAUGGCCAUGGCAGCUCGGUGUUACAAGGCUUGCAUCAGUACCAGUUU GAAUCC-3′ (10 Marks)
2) Name and discuss the three steps involved in translation in both prokaryotes and eukaryote (15 Marks) **[25]**

Question 4

1) During mismatch repair, why is it necessary to distinguish between the template strand and the newly made daughter strand? How is this accomplished? (10 marks)
2) A double stranded DNA contains 10% guanine, what is the percentage of adenine. Show all your calculations (4 marks)
3) A tRNA has the anticodon sequence 3´–CAG–5´. What amino acid does it carry? (3 Marks)
4) The gene sequence below runs in the 5'-3' direction and codes for the bacterial ATP synthase subunit beta AtpD protein.

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  1 atggcaactg gaaagattgt ccagattatc ggcgccgttg ttgacgtcga attccctcag
 61 gacgcggtac cgcaagtgta cagcgccctc gaggttatga atggtgatgc gcgtctggtg
121 ctggaagttc agcagcagct cggcggcggc gtagtacgta ccatcgcaat gggtacgtct
181 gacggcctga agcgtggtct gagcgtcaac gacctgcaga aaccgattca ggtacccgtc
241 ggtaaagcga ccctgggccg tatcatgaac gttctcggcg agccaatcga tatgaaaggc
301 gagctgaaag aagaagatgg cagcgcagta gagatcgcct ctattcaccg cgcagcccct
361 tcttatgaag atcagtctaa ctcgcaggaa ctgctggaaa ccggcatcaa ggttatcgac
421 ctgatgtgtc cgtttgctaa aggcggtaaa gtcggtctgt tcggtggtgc gggtgtaggt
481 aaaaccgtca acatgatgga actgatccgt aacatcgcgg ctgaacactc aggttactca
541 gtgtttgccg gtgtgggtga gcgtactcgt gagggtaacg acttctacca cgaaatgact
601 gactctaacg ttatcgataa agttgcactg gtctatggcc agatgaacga gccgccgggt
661 aaccgtctgc gcgtagcact gaccggtctg accatggcgg aaaaattccg tgatgaaggc
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 721 cgcgacgttc tgctgttcat cgataacatc taccgttata ccctggccgg tacagaagtt
 781 tctgcactgc tgggtcgtat gccatctgcg gtaggttacc agccaacgct ggcagaagag
 841 atgggtgtgt tgcaggagcg tattacctcc accaagaccg gttcaatcac ctccgtacag
 901 gccgtttacg tccctgcgga tgacctgact gacccatcac cagcaactac ctttgcgcac
 961 ttagactcaa cggtaacgct gagccgtcag atcgcctctc tgggtatcta cccggccgtt
1021 gacccgctgg actctaccag ccgtcagctg gatccgctgg ttgtcggtca ggagcactat
1081 gatgttgcac gtggcgttca gtcactgctg cagcgttatc aggaactgaa agacatcatc
1141 gccatcctcg gtatggatga gctgtctgaa gaagacaaac tgctggtggc acgtgcgcgt
1201 aagattcagc gcttcctgtc tcagccgttc ttcgttgcag aagtattcac cggttcaccg
1261 ggcaaatacg tgacgctgaa agacactatc cgtggcttta aaggcatcat ggaaggtgag
1321 tttgaccacc tgccagagca ggccttctac atggttggcg ccatcgaaga agccgtggaa
1381 aaagcgaaga aactgtaa
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1. Design primers to amplify the gene. (6)
2. Calculate the Tm for each primer. (3)
3. Determine the suitable annealing temperature. (2)
4. What is the expected PCR product length in bp? (2) **[30]**