UNIVERSITY OF JOHANNESBURG

FACULTY	: Science
DEPARTMENT	: Biotechnology and Food Technology
CAMPUS	: DFC
MODULE	: BTN1GB1 Fundamental Genetics
SEMESTER	: Second
EXAM	: **Supplementary Exam 2019**

DATE	: 7 January 2020	**SESSION**	: 11:30am
ASSESSOR(S)	: DR MH Serepa-Dlamini		
MODERATOR	: Mr L Alagiozoglou		
DURATION	: 2 Hours	**MARKS**	: 100

NUMBER OF PAGES: 5 PAGES

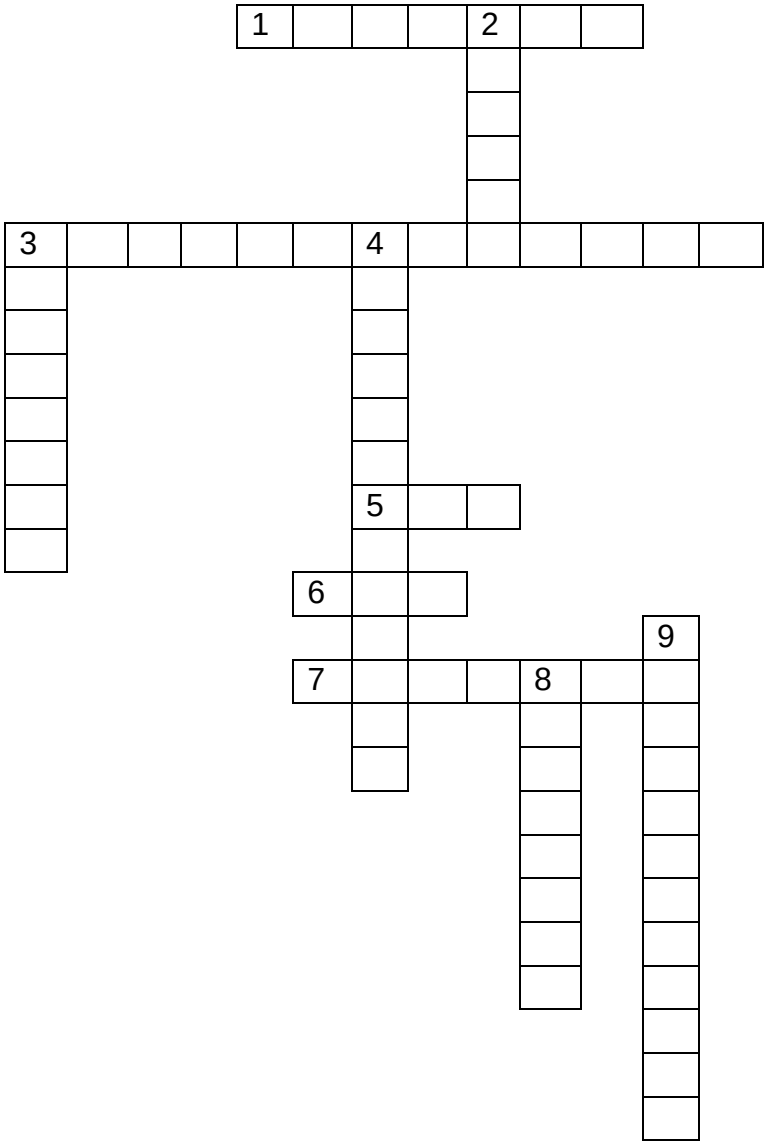
INSTRUCTIONS:

1. Number your answers clearly.
2. It is in your best interest to write clearly and legibly.
3. Submit the question paper with your answer book.
4. All the Best.

Question 1 Answer on the question paper.

1. Fill in the crossword puzzle below. (15)

Across:	**Down:**
1. Non-translated sequence molecule located downstream of the termination codon	2. Non-translated sequence molecule located upstream of the start codon
3.Messenger RNA molecule that direct the synthesis of more than one polypeptide	3. Complex of mRNA with several ribosomes
5. Start codon	4. Ribosomal binding site in bacterial and archaeal
6. Stop codon	8. Site of protein synthesis
7. Contains exons and introns	9. 60S unit



Student number:_____
Student Name:_____

Question 2

2.1 Write an essay comparing and contrasting DNA replication mechanism in prokaryotes and eukaryotes. (30)

2.2 Outline and explain the translation process in eukaryotic species. (20)

Question 3

3.1 Recombinant human insulin, produced by bacteria carrying a cloned insulin gene, is now the major form of insulin used to treat diabetes. The human insulin gene encodes an mRNA only 1430 nucleotides long, but the entire gene spans more than 4000 nucleotides. There are three exons and two introns. Answer the following questions based on this concept.

a) How many amino acids does the insulin gene give rise to, show your calculations? (3)
b) If we were to clone this gene directly from the nuclear DNA, bacteria would not be able to express the insulin protein. Explain why. (3)
c) Which technique should be used instead in order to get a functional insulin coding sequence cloned into bacteria? Describe briefly how this technique works. (10)
d) Every cell in the human body has the same DNA, so every cell has an insulin gene. However, in order to use the technique you described in "c," you would have to start with cells from the pancreas--the only body cells that actually produce the insulin protein. Why are these the only cells that would work? (4)

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Question 4

4.1 You are trying to find the gene responsible for a human genetic disorder. You have mapped the gene to a particular chromosome region, and examining the human genome sequence for that region gives you the nucleotide sequence below:

5'CATACTTACTACTAGATTACGATTAGACGATTAGGATGGCCGACTCGTGCAGTAACAGCATGACCGAGGCCTAGACCAGATTAGGAGCCGGACCAGGACGGACCAGCGACT3'

a) Assuming you are reading the non-coding strand and that there are no introns, find an open reading frame (ORF) in this region. Circle the points where translation will start and stop. (2)

b) State and box/shade the number of amino acids in the protein this gene would encode. (The genetic code table is provided). (7)

c) If you wanted to express this gene in *Escherichia coli*, what would you need to be present in your cloning vector to ensure that this gene will be transcribed and translated? (3)

d) How might the protein produced by *E. coli* differ from the protein produced from the same gene in a human cell? (3)

Genetic Code- Table

Second Letter

1st letter	U	C	A	G	3rd letter
U	UUU Phe UUC UUA Leu UUG	UCU UCC UCA UCG Ser	UAU Tyr UAC UAA UAG	UGU Cys UGC UGA UGG Trp	U C A G
C	CUU CUC CUA Leu CUG	CCU CCC CCA CCG Pro	CAU His CAC CAA Gln CAG	CGU CGC CGA Arg CGG	U C A G
A	AUU AUC Ile AUA AUG Met	ACU ACC ACA ACG Thr	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U C A G
G	GUU GUC Val GUA GUG	GCU GCC GCA Ala GCG	GAU Asp GAC GAA Glu GAG	GGU GGC GGA Gly GGG	U C A G