00035

THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. SPECIAL DEGREE PROGRAMME
FINAL EXAMINATION 2016/2017
COURSE TITLE: MOLECULAR BIOLOGY
COURSE CODE: ZLU4183

DATE: 23rd JANAUARY 2018 TIME: 1.30 p.m. – 4.00 p.m.

ANSWER ANY FOUR (04) QUESTIONS.
ILLUSTRATE ANSWERS WITH LABELLED DIAGRAMS WHERE NECESSARY.

---

1. (i). DNA and RNA differ in their structure. How do these differences in structure relate to their functions? (60 marks)

(ii). Compare between prokaryotic and eukaryotic genomes. (40 marks)

2. (i). Justify the following statements (60 marks)
   (a). DNA replication is semiconservative
   (b). DNA replication is semi-discontinuous

(ii). DNA polymerase maintains high accuracy during DNA replication. (40 marks)

3. Write short notes on any **two (02)** of the following.
   (a). DNA fingerprinting (50 marks)
   (b). Molecular cloning (50 marks)
   (c). PCR (50 marks)

4. The following is a segment of DNA containing a gene accountable for a secretory function in the human intestinal cells.

5'- ATG ACA CGA TAT GAG ATA TGC ATA GAA AGC GAA TAT AGA TAG- 3''

3'- TAC TGT GCT ATA CTC TAT ACG TAT CTT TCG CTT ATA TCT ATC -5'

(i). Which one of the above strands serves as a template for RNA polymerase to transcribe the gene? (5 marks)

(ii). What will be the sequence of the mRNA? (5 marks)

(ii). What is the amino acid sequence of the peptide that would be translated from the mRNA. Label the N- and the C-terminus amino acids. (15 marks)

(iv). What types of modifications may occur to this RNA before it leaves the nucleus. (25 marks)

(v). Once in the cytoplasm how is the mRNA translated to a protein? (30 marks)

(vi). Which one of the following mutations would have the greatest effect on the structure of the protein coded by the above gene? Explain. (20 marks)

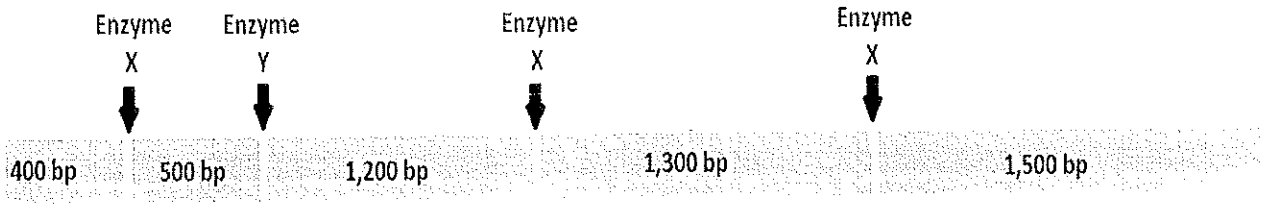
(a). Deletion of the underlined 'GC' pair

(b). Substitution of TA pair for the underlined GC pair

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

The genetic code- in the mRNA form

5. The diagram below shows a segment of DNA with a total length of 4900 base pairs. The arrows indicate reaction sites for two restriction enzymes (Enzyme X and Enzyme Y).



(i). Explain how the principles of gel electrophoresis allow for the separation of DNA fragments. (40 marks)

(ii). Describe the results you would expect from the electrophoretic separation of fragments from the following treatments on the DNA segment given above. Assume that the digestions occurred under appropriate conditions and went to completion. (20 marks)

(a). DNA digested with only Enzyme X

(b). DNA digested with only Enzyme Y

(c). DNA digested with both Enzyme X and Enzyme Y

(d). Undigested DNA

(iii). You are provided with PCR products of a particular gene (LDH) of two species of *Dinopium* woodpeckers; *D. psarodes* and *D. benghalense*. Each product is similar to the above gene with a total length of 4900 base pairs. Both enzymes X and Y are active in *D. psarodes* gene sequence, while only enzyme X is active in *D. benghalense*. Design an experiment to differentiate the two species, outlining the expected results. (40 marks)

****