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RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Third year – Semester I Examination – November/December 2016

BOT 3101 – MOLECULAR BIOLOGY

Time: One and half ($1^1/_2$) hours

Part A – Multiple choice questions. Answer all.
Underline the correct option on the script itself.

1. Weak bonds are important in,

   (a) DNA replication
   (b) transcription
   (c) translation
   (d) all of the above

2. Which of the following is **false** about H bonds?

   (a) Nonspecific
   (b) Directional
   (c) Weak
   (d) Polar

3. Uracil is not found in natural DNA because it can affect,

   (a) DNA replication
   (b) transcription
   (c) DNA repair
   (d) all of the above

4. Which of the following scientists demonstrated the DNA in cell free extracts?

   (a) Ernest Haeckel
   (b) Frederick Griffith
   (c) Arthur Kornberg
   (d) Erwin Chargaff

5. Which of the following enzyme-function couple is correct?

(a) DNA gyrase – Introduce negative supercoiling
(b) DNA polymerase III – Fills gaps between Okazaki fragments
(c) DNA polymerase I – Replicate DNA
(d) Helicase – Seals nicks

6. Natural DNA replication is always,

(a) discontinuous
(b) bidirectional
(c) both (a) and (b)
(c) semi conservative

7. RNA Polymerase core enzyme,

(a) can proofread
(b) contains the sigma factor
(c) cannot initiate transcription
(d) has RNase H activity

8. Which of the following is correct?

(a) RNA polymerase requires primers for transcription
(b) SOS is not a DNA repair mechanism
(c) Ribosomes fully assemble in the nucleus
(d) tRNAs are found inside the nucleus

9. An mRNA molecule that yields more than one protein is called,

(a) a promoter
(b) an operon
(c) a polycistron
(d) a regulator

10. The incorrect match is,

(a) initiation codon: 5'-AUG-3', 5'-GUG-3', 5'-UUG-3'
(b) GTP: energy source for elongation phase of translation
(c) 16S rRNA: located in the large sub unit of the ribosome
(d) Shine-Dalgarno sequence: ribosome binding site of bacteria

11. The PCR technique was developed by,

(a) Kary Mullis
(b) David Kohler
(c) Grigori Milstein
(d) Edward Altman

12. The purpose of PCR is to,

(a) make more copies of DNA primers to increase protein synthesis
(b) make many copies of an organism's DNA that would be enough to be identified
(c) make more RNA to increase the protein synthesis
(d) recycle DNA using thermo cycler

13. If *E. coli* is grown in a medium where both lactose and glucose present, what would happen in terms of *lac* operon regulation?

(a) Both CAP and *lac* repressor would bind to the DNA
(b) CAP would bind to the DNA but the *lac* repressor would not
(c) *lac* repressor would bind to the DNA but CAP would not
(d) Neither the CAP or *lac* repressor would bind to the DNA

14. An experimenter has altered the 3' end of the tRNA corresponding to the amino acid Methionine in such a way as to remove the 3' AC. Which of the following hypotheses describes the most likely result?

(a) The tRNA molecule will not form a cloverleaf (secondary structure)
(b) The nearby stem end will pair improperly
(c) The amino acid methionine will not bind
(d) The anticodon will not bind to the codon in the mRNA

15. Which of the following statements about the 3' poly (A) tail of mRNA is **false**?

(a) It helps align eukaryotic mRNA on the ribosome during translation
(b) It is added to the primary transcript in the nucleus
(c) It is not essential for protein synthesis
(d) It helps contribute to the stability and lifespan of mRNA

(2x15=30 marks)

Part B – Structured essay questions.
Answer all <u>two (02)</u> in the provided spaces.

1. a) Give a concise justification for your assertion of a given fragment of nucleotides possessing a sequence of ATG as a codon or an anticodon?

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b) Briefly explain the regulation of *lac* operon in *E. coli* in the presence of a medium enriched with lactose but with no glucose.

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c) Briefly explain the process of gel electrophoresis.

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2 a) Indicate the importance of each constituent of the optimal prokaryotic promoter (include all important constituents).

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b) List 5 functions of RNA polymerases.

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c) Illustrate *rho* independent termination of transcription

(15x2=30 marks)

Part C – Essay Questions.
Answer any <u>one (01)</u> of your choice.

1. a) Compare and contrast between the eukaryotic and prokaryotic "Initiation factors" with a significance to their roles in initiation of protein synthesis.

(10 marks)

b) Given that out of the 64 codons of mRNA, 61 codify amino acids. What would be the functions of the 03 remaining codons?

(05 marks)

c) Discuss the role of RNA in translation. Use diagrams of the molecules where they fit into the process to assist your answer.

(25 marks)

2. a) Using illustrations of an experiment of your choice, conclude why DNA replication follows the semi conservative model rather than conservative and dispersive models.

(20 marks)

b) Appraise the role of Taq polymerase in PCR technique as opposed to other enzymes involved in natural DNA replication (your answer should not be confined to DNA polymerases).

(20 marks)

(40marks)

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