※ 考生請注意：本試題不可使用計算機

1. Please describe and explain: (total 10 points)
    (a). What are mutational hotspots? (4 points)
    (b). How it can be applied in biotechnology? Please give at least an example. (6 points)

2. A DNA sequence may contain coding and nocoding regions. (total 10 points)
    (a). Please define what are promoter, enhancer, 5'UTR, 3'UTR and intron? (5 points)
    (b). What experiments you could do to confirm a particular DNA sequence is located at exon?
        Please describe at least one approach. (5 points)

3. Please describe or explain and draw: What are nucleosomes and their structures? (10 points)

4. Please describe and draw: The rolling circle mechanism of bacteriophage in replication. (10 points)

5. Please answer following questions regarding transcription. (total 10 points)
    (a). Please compare bacterial RNA polymerase and bacteriaphage T7 RNA polymerase? (5 points)
    (b). What is *in vitro* transcription? What are the basic components for this system to work well? (5 points)

6. Please describe what are CpG islands? Also please explain its roles in genome? (total 10 points)

7. Please answer following questions regarding mRNA. (total 10 points)
    (a). What are the difference in the 3' end of mRNA between prokaryotes and eukaryotes? (3 points)
    (b). Please describe the process for the 3' end mRNA formation in the eukaryotes? (7 points)

8. A scientist bought a "bacterial *in vitro* translation kit" from a local biotechnology company, and he (or she) would like to use it to do translation for protein production in a test tube, instead of inside bacterial cells. Please describe in detail what components are required in the test tube and their functional roles in order for his (her) experiments to work well. (10 points)

9. What are the roles of modified bases in tRNA? (6 points)

10. The insertion sequences (IS) are the simplest bacterial transposon. Please describe the characteristics of IS. (6 points)

11. What is nonhomologous end-joining (NHEJ)? (4 points)

12. What is puromycin? How does it work? (4 points)