

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. The molecular weight of one deoxyribose nucleotide is approximately 320g/mol. Calculate the number of moles in 0.64 microgram ( $\mu\text{g}$ ) of a single stranded DNA of 200 bases length. (5%)
2. In a double stranded conformation, the following two DNA sequences which have a lower melting temperature? Justify your answer briefly. (5%)
  - a) GCGTCCGGAATCGG
  - b) GTTTATAACATGAATC
3. What are polysaccharides? What are some examples of polysaccharides with important biological functions? (8%)
4. What are the roles for the 5' cap structure of eukaryotic mRNAs. (5%)
5. Sickle cell anemia results from a substitution of a valine for a glutamic acid. What do you expect the effect might be if the mutation were to have placed a leucine at that site? An aspartic acid? (5%)
6. Describe DNA methylation and its role in transcription regulation and gene silencing. (10%)
7. Name four components of a PCR reaction. (8%) Define the following terms for a DNA polymerase: i) processivity; ii) fidelity. (4%)
8. Name four DNA binding motifs commonly found in DNA binding proteins. Describe one of these motifs including details of how it contacts the DNA. (10%)

9. Describe the biosynthesis processes of microRNAs and how change in the length of the product can alter RNA interference. (10%)
  
10. Replication and segregation of eukaryotic chromosomes require three functional elements: replication origins, a centromere, and telomeres. Briefly describe how these three elements function. What is the role of telomerase in maintaining chromosome structure? (10%)
  
11. For each of the following metabolic pathways, describe where in the cell it occurs and identify the starting material and end product(s): a. Citric acid cycle; b. Glycolysis; c. Oxidative phosphorylation; d. Fatty acid synthesis. (12%)
  
12. Discuss the effects on the lipid phase transition of pure dimyristoyl phosphatidylcholine vesicles of added (a) divalent cations, (b) cholesterol, (c) distearoyl phosphatidylserine, and (d) integral membrane proteins. (8%)