

1. Describe the relationship between DNA chromatin histones and nucleosomes? (5 points)
2. DNA replication is the process of producing two identical replicas from one original DNA molecule. Please list the mechanistic steps of DNA synthesis starting with the primed template and deoxynucleoside triphosphate (10 points)
3. How does translation initiation start in eukaryotes? Please describe the mechanisms in detail and factors involved in the initiation of translation in eukaryotes. (10 points)
4. Please explain how the polypeptide elongates and describe the roles of two elongation factors. (10 points)
5. Explain the following terms:
  - (1) Polycistronic (2 points):
  - (2) Kozak sequence (2 points):
  - (3) Wobble concept (2 points):
  - (4) Heterochromatin vs. euchromatin (3 points):
  - (5) topoisomerase (2 points)
  - (6) hnRNP (2 points)
  - (7) Abortive RNA (2 points)
6. Name one technique that can be used to detect the protein-DNA interaction and explain the principle of the method. (6 points)
7. Lambda phage has two distinct life cycles, lysogenic and lytic cycles. How does the expression of integrase and excisionase genes of the lambda phage is regulated? (8 points)
8. How do upstream ORF (uORFs) regulate the translation of GCN4, a transcription factor that directs amino acid biosynthesis in yeast? (8 points)
9. What is CRISPR-Cas system in bacteria? Explain how a bacterium defends an invading pathogen using CRISPR RNAs. (8 points)
10. Compare the following terms: (20 points)
  - (1) eIF4E and eIF4E-binding protein
  - (2) pri-miRNA and pre-miRNA
  - (3) Nonsense-mediated decay and nonstop-mediated decay
  - (4) Ser 2 and Ser 5 phosphorylation of CTD of RNA polymerase II
  - (5) Histone deacetylase and histone acetyltransferase