國立嘉義大學九十六學年度

應用化學系碩士班招生考試（乙組）試題

科目：生物化學

1. Define “reducing sugar”, and Explain why sucrose is not a reducing sugar, even though both glucose and fructose are. (6 points)
2. Explain in molecular terms why humans cannot use cellulose as a nutrient, but goats and cattle can. (4 point)
3. Draw the basic structure of triacylglycerols and describe three functions (at least) of triacylglycerols in mammals. (10 points)
4. Arrange in order for the T_m value of phosphatidyl choline containing the following pairs of identical fatty acid chains: (a) n-Docosanote (b) n-Octadecanote (c) *trans*-$\triangle^9$-Octadecenoate (d) *cis*-$\triangle^9$-Octadecenoate (e) *cis*-$\triangle^9$, $\triangle^{12}$-Octadecadienoate. (5 points)
5. Derive Henderson-Hasselbalch equation from the reaction: $HA \rightarrow H^+ + A^-$, and at what condition pH will equal pK_a. (5 points)
6. For a simple unisubstrate enzyme with a k_{cat} of 800 sec^{-1}, you measure a rate of product formation of 2 nmoles (nanomoles) of product per sec in a 5 ml reaction solution. You have been clever enough to adjust the substrate concentration so that it is one thousand times greater than K_m. Calculate the enzyme concentration. (10 points)
7. What is the most likely secondary structure of $(Gly\text{-}Ser\text{-}Pro)_{10}$ in aqueous solution at neutral pH? Explain briefly. (10 points)
8. (a) (6 points) Give 3 major structural differences between DNA and RNA. (b) (2 points) Draw a simple structure of phosphodiester bond in the backbone of DNA. (c) (2 points) What are the two major forces that contribute to the stability of DNA helix. (d) (2 points) What is the definition of “DNA denaturation”? (e) (2 points) A double strand DNA contains 20% adenosine. What is the percentage of guanine contained in this DNA? (f) (2 points) What is the definition of DNA melting temperature, T_m?
9. (a) (3 points) Describe a common method to determine the molecular weight of a DNA molecule? (b) (4 points) How to use spectrophotometry to analyze the concentration and the purity of a DNA solution? (c) (2 points) Give a method (or reagent) that is commonly used to precipitate DNA or RNA.
10. (a) (3 points) Here is the sequence of a portion of a bacterial gene:

    5’GTATCGTATGCATGCATCGTGAC3’
    3’CATAGCATACGTACGTAGCACTG5’

    The template strand is the bottom strand. What would be the sequence of the mRNA derived from this fragment? (b) (3 points) Draw a diagram to indicate the structural elements in a typical prokaryotic gene promoter. (c) (3 points) What are the composed subunits in a prokaryotic RNA polymerase? (d) (3 points) Define a bacterial operon. (e) (3 points) Draw a diagram of the cloverleaf structure of tRNA and point out the site to which the amino acid attaches and the site of the anticodon.
11. (a) (2 points) What kind of enzyme is responsible for DNA replication? (b) (4 points) Replication is a semi-discontinuous and bidirectional process. What does this mean? (c) (4 points) What is the initiation codon in eukaryotic translation? Give one stop codon for translation termination.