國　立　清　華　大　學　命　題　紙

九十三學年度　原子科學　系（所）　甲　組碩士班入學考試

科目　生物化學　科號　3502　共　1　頁第　1　頁　*請在試卷【答案卷】內作答

1. (a) Write the oxidation process from glucose to pyruvate. You need to write all substrates and co-enzymes involved in this process. (b) Indicate the key regulatory steps for this process. You need to write the all positive and negative regulators for those steps. (c) Explain the physiological meaning of these regulations for this process. (10%)
2. Compare the regulation mechanisms of the expression of *lac* and *trp* operons in prokaryotes under different physiological conditions. (10%)
3. Describe the lytic and lysogenic cycles of a bacteriophage. Use Lamda (λ) phage as an example to explain the control mechanism for the transition between these two cycles. (10%)
4. Calculate values for the following topological properties of a closed-circular DNA molecule containing 2,000 base pairs (for simplicity, assume there are 10 base pairs per turn in the relaxed DNA). (10%)
   (a) the linking number when the DNA is relaxed
   (b) the linking number when the DNA has been underwound by 10 enzymatic turnovers of DNA gyrase (+ATP)
   (c) the linking number when the DNA has been underwound by binding 5 nucleosomes followed by complete relaxation by a eukaryotic topoisomerase
   (d) the superhelical density of the DNA molecule in (b)
   (e) the superhelical density of the DNA molecule in (c)
5. Describe the Q cycle during the electron transport in mictochondria and explain the biological importance of Q cycle. In other words, compare the electron transport with and without Q cycle. (10%)
6. Define each in about two sentences: (a) hypersensitive sites in eukaryotic DNA; (b) enhancers (upstream activator sequences); (c) zinc fingers; (d) maternal genes in Drosophila; (e) homeoboxes in eukaryotes. (10%)
7. Describe five possible fates of amino acids arriving in the liver after intestinal uptake. (10%)
8. Two molecules of lipoic acids are found in a pyruvate dehydrogenase complex. Explain the roles of these lipoic acids in the function of this enzyme and why it needs 2 molecules instead of 1 molecule of lipoic acid. (5%)
9. What are the major differences in structure and function of the prokaryotic and eukaryotic RNA polymerases. (5%)
10. What distinguishes eicosanoids from other potent biological signaling molecules such as epinephrine? (5%)
11. Describe briefly the relationship between chromatin structure and transcription in eukaryotes. (5%)
12. Describe the steps of the RT-PCR, and explain what is going on at each step. (5%)
13. What is the essential difference between a genomic library and a cDNA library? (5%)