

1. Which common coenzyme(s) is (are) required for the reactions of carboxylation and decarboxylation? What is the role of these coenzymes in above reactions? (5%)
2. Describe the difference of the mechanisms for the movement of flagellum in bacteria (*Escherichia coli*) and sperm. (5%)
3. MG-132 is a drug that is in clinical trial for certain lymphoma. Its main target within cell is proteasome. Explain the possible mechanism of the effects of MG-132. (5%)
4. Can UV-induced T-T dimmer be repaired by mismatch repair system and why? (5%)
5. Calculate the ATP yield per mole of lactose metabolized by anaerobic glycolysis starting with (a) hydrolytic cleavage and (b) phosphorytic cleavage. (5%)
6. Name a hormone whose concentration would probably not be amenable to analysis by ELISA, and explain your answer. (5%)
7. Assume the following is portion of a DNA double helix. Write all possible mRNA sequences that can code a peptide *in vivo* (it means "open reading frame"). (5%)

5' ----ACTGCCCATGGGGCTCAGCGACGGGGAATGGCACTTCATC----3'

3' ----TGACGGGTACCCCGAGTCGCTGCCCTTACCGTGAAGTAG----5'
8. Sphingomyelin has important roles in nervous system and the process of apoptosis. Is this statement correct? Why? (5%)
9. Explain the difference between polyclonal antibody and monoclonal antibody, and how are they produced? (5%)
10. Pulse labeling, pulse-chase labeling, and equilibrium labeling techniques are frequently used for studying the signals of RNA or protein. What kinds of information can be derived from each technique? (10%)
11. A recent paper reports that, in mammalian cells, genes that are expressed in a particular cell are replicated during the first half of S phase, and genes not expressed in that cells are replicated in the latter half of S phase. Design an experiment that could lead to this conclusion. (10%)
12. ATP, NADH, Acetyl-CoA, Mg^{2+} , and Ca^{2+} can regulate the metabolism of Pyruvate to Acetyl-CoA through different mechanisms. Explain the control mechanism of each molecule in this reaction. (10%)
13. Devise two experiments that can demonstrate two proteins, A and B, forming complex following hormone stimulation. Compare the advantage and disadvantage of using these two protocols. (10%)
14. (A) Describe the important difference between two cells in that one cell does not produce cAMP in response to glucocorticoid stimulation and the other cell could produce cAMP in same condition. (B) Then design experiment to prove your hypothesis. (15%)