

※ 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. Please describe the following terms (3 points/answer, total 30 points):
 - (1) Telomerase
 - (2) Autophagosome
 - (3) Transcriptome
 - (4) Biomarker
 - (5) Embryonic stem cells
 - (6) Non-coding RNA
 - (7) Oncogenic virus
 - (8) Homologous recombination
 - (9) E3 ubiquitin ligase
 - (10) Histone deacetylase
2. Describe the biogenesis **and** function of microRNAs. (6 points)
3. How the lac **and** trp operons control gene expression? (12 points)
4. Describe the initiation, elongation, and termination of protein synthesis. (12 points)
5. Please describe the biochemical mechanisms of DNA repair discovered by (1) Tomas Lindahl and (2) Paul Modrich. (10 points)
6. Considering enzyme kinetics, please illustrate the differences between (1) competitive, (2) non-competitive and (3) uncompetitive inhibition with Lineweaver-Burk plots (double reciprocal plot) and specify the impacts of the inhibitors to the K_m and V_{max} of an enzyme under the assumption of steady-state kinetics. (10 points)
7. The genes encoding enzymes involved in tricarboxylic acid cycle (TCA cycle) are often called "house-keeping genes".
 - (1) Please define "house-keeping gene". (2 points)
 - (2) Why are those enzymes involved in TCA cycle considered "house-keeping genes"? Please be as specific as you can. (2 points)
 - (3) Please write down two reactions that generate NADH in TCA cycle and the names of the enzymes catalyzing the reactions. (6 points)

8. Please choose the most appropriate answer for each question from the list from (A) to (J) in the panel below (2 points/answer, total 10 points)

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- (1) _____ serves as an intracellular one-carbon carrier; deficiency is often associated with megaloblastic anemia and birth defects such as neural tube defects
- (2) _____ serves as an electron sink and coenzyme for most amino transferase; heavily involved in neurotransmitter biosynthesis; deficiency often leads to peripheral neuropathy
- (3) _____ a water soluble vitamin and strong antioxidant; deficiency is associated with Scurvy
- (4) _____ a fat-soluble vitamin involved in the post-translational modification of certain proteins requiring γ -carboxylation for complete activity, such as coagulation factor II, VII, IX and X; deficiency often leads to bleeding diathesis
- (5) _____ a fat-soluble secosteroids responsible for enhancing intestinal absorption of calcium, iron, magnesium, phosphate, and zinc; deficiency results in impaired bone mineralization and bone damage which leads to bone-softening diseases, such as Rickets and Osteomalacia

- A. Vitamin A (retinol)
- B. Vitamin B1 (thiamine)
- C. Vitamin B2 (riboflavin)
- D. Vitamin B6 (pyridoxine)
- E. Vitamin B9 (folic acid)
- F. Vitamin B12 (cyanocobalamin)
- G. Vitamin C
- H. Vitamin D
- I. Vitamin E
- J. Vitamin K