※ 考生請注意：本試題 □可 ☑不可 使用計算機

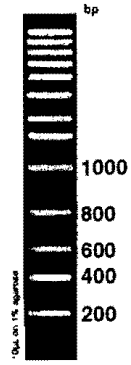
1. Folic acid deficiency, believed to be the most common vitamin deficiency, causes a type of anemia in which hemoglobin synthesis is impaired and erythrocytes do not mature properly. What is the metabolic relationship between hemoglobin synthesis and folic acid deficiency? (10%)

2. Glycerol 3-phosphate is requires for the biosynthesis of triacylglycerols. Adipocytes, specialized for the synthesis and degradation of triaclglycerols, cannot use glycerol directly, because they lack glycerol kinase, which catalyzes the reaction

Glycerol + ATP → glycerol 3-phosphate + ADP

How does adipose tissue obtain the glycerol 3-phosphate necessary for triacylglycerol synthesis? (10%)

3. Early evidence that helped researchers define nucleosome structure is illustrated by the agarose gel below, in which the thick bands represent DNA. It was generated by briefly treating chromatin with an enzyme that degrades DNA, then removing all protein and aubjecting the gel denote the position to which a linear DNA of the indicated size would migrate. Why are the DNA bands thick and spread out rather than sharply defined? (10%)



4. What factors promote the fidelity of replication during the synthesis of the leading strand of DNA? Would you expect the lagging strand to be made with the same fidelity? Give reasons for your answers. (10%)

5. What is the minimum number of transesterification reactions needed to splice an intron from an mRNA transcript? Explain. (10%)

6. A plot of V_0 vs $V_0/[S]$ for an enzyme-catalyzed reaction is shown below. The A curve was obtained in the absence of inhibitor. Which of the other curves (B, C, or D) shows the enzyme activity when a competitive inhibitor is added to the reaction mixture? (10%)

(背面仍有題目,請繼續作答)

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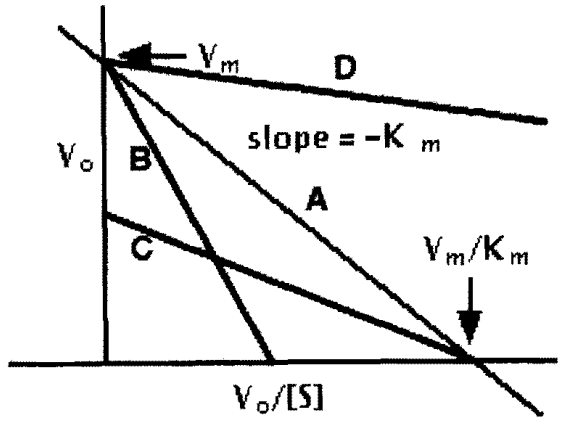

7. In samples of DNA isolated from two unidentified species of bacteria, X and Y, adenine makes up 32% and 17%, respectively, of the total bases. What relative proportions of adenine, guanine, thymine, and cytosine would you expect to find in the two DNA samples? What assumptions have you made? One of these species was isolated from a hot spring (64°C). Suggest which species is the thermophilic bacterium. What is the basis for your answer? (15%)

8. The reaction catalyzed by succinyl-CoA synthetase produces the high-energy compound GTP. How is the free energy contained in GTP incorporated into the cellular ATP pool? (10%)

9. Please describe the content of the Nobel Prize in Chemistry in 2009 (15%)