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1. Why are persons on a high-protein diet advised to drink lots of water? Please include appropriate metabolic cycle in your answer for illustration. (6%)

2. The following kinetic data were obtained for an enzyme in the absence of any inhibitor (1), and in the presence of two different inhibitors (2) and (3) at 5 mM concentration. Assume $[E_T]$ used is the same in each experiment. (8 %)

[S] (mM)	(1) v (μ mol/sec)	(2) v (μ mol/sec)	(3) v (μ mol/sec)
1	12	4.3	5.5
2	20	8	9
4	29	14	13
8	35	21	16
12	40	26	18

a. Please circle the answer that is closest to the V_{max} and K_m for the enzyme and list your calculating procedure (points will be given only when calculating procedure is presented):
   A. V_{max} = 500 μ mol/s and K_m = 60 mM
   B. V_{max} = 120 μ mol/s and K_m = 38 mM
   C. V_{max} = 51 μ mol/s and K_m = 3.2 mM
   D. V_{max} = 2.5 μ mol/s and K_m = 0.4mM

b. Please circle the answer and provide the proper graphs to support your choice (points will be given only when graphs are provided).
   A. inhibitor 2 is a competitive inhibitor; inhibitor 3 is a non-competitive inhibitor
   B. inhibitor 2 is a non-competitive inhibitor; inhibitor 2 is a competitive inhibitor
   C. both inhibitor 2 and 3 are competitive inhibitors
   D. both inhibitor 2 and 3 are non-competitive inhibitors
   E. none of above

3. Drug X binds to serum albumin with an association constant (KD) of 10^{-6} M. If the total concentration of drug X in the bloodstream is 10 μM, what is the concentration of free (unbound) drug X in blood? (3%)

4. Explain why, for proteins with a single transmembrane segment, the segment is a hydrophobic helix. Why a helix? Why hydrophobic residues? (2%)

(背面仍有題目,請繼續作答)

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5. What is the Shine-Dalgarno sequence? What does it do? The efficiency of protein synthesis initiation may vary by as much as 100-fold for different mRNAs. How might the Shine-Dalgarno sequence be responsible for this difference? (6%)

6. Answer questions based on the following statements: (10%)

BACKGROUND: Sodium fluoride is the preferred agent to inhibit glycolysis. Its action is not immediate, however, and complete inhibition is delayed for up to 4 hours. A more effective method is needed. Acidification of blood combined with the addition of NaF and EDTA appears to be such a method. We studied whether acidification was indeed more effective than NaF.
METHODS: We conducted 6 independent studies over a 10-month period at 3 Quest Diagnostics laboratory sites. In each study, we drew venous blood from 6–24 nonfasting employee volunteers into 3 or 4 different serum- or plasma-collection tubes, which were stored under different conditions and aliquoted at different times. We analyzed the aliquots in duplicate by means of a hexokinase-based enzymatic method.
RESULTS: The mean glucose concentration decreased by 0.3% at 2 h and by 1.2% at 24 h when blood was drawn into tubes containing citrate buffer, NaF, and EDTA. In contrast, the mean glucose concentration decreased by 4.6% at 2 h and by 7.0% at 24 h when blood was drawn into tubes containing NaF and sodium oxalate.
CONCLUSIONS: Acidification should replace NaF alone as the recommended method for obtaining an accurate glucose concentration. Diagnostic cut points based on blood samples collected into tubes containing NaF as the only inhibitor of glycolysis are likely to be too low.

1- 6-1. Why do we need NaF and EDTA added in the blood collecting tube for glucose measurement?
2- 6-2. Based on the author's results, what is the author's recommendation for a better agent to inhibit glycolysis?

7. The prevalence of obesity, impaired glucose tolerance, and type 2 diabetes mellitus is escalating at an alarming rate. The development of safer antidiabetic agents is highly needed. Use the following figures to compare the activity of peroxisome- proliferator-activated receptor γ (PPAR γ) in lean and obese subjects. Why do these ligands have the anti-diabetic effect? (10%)

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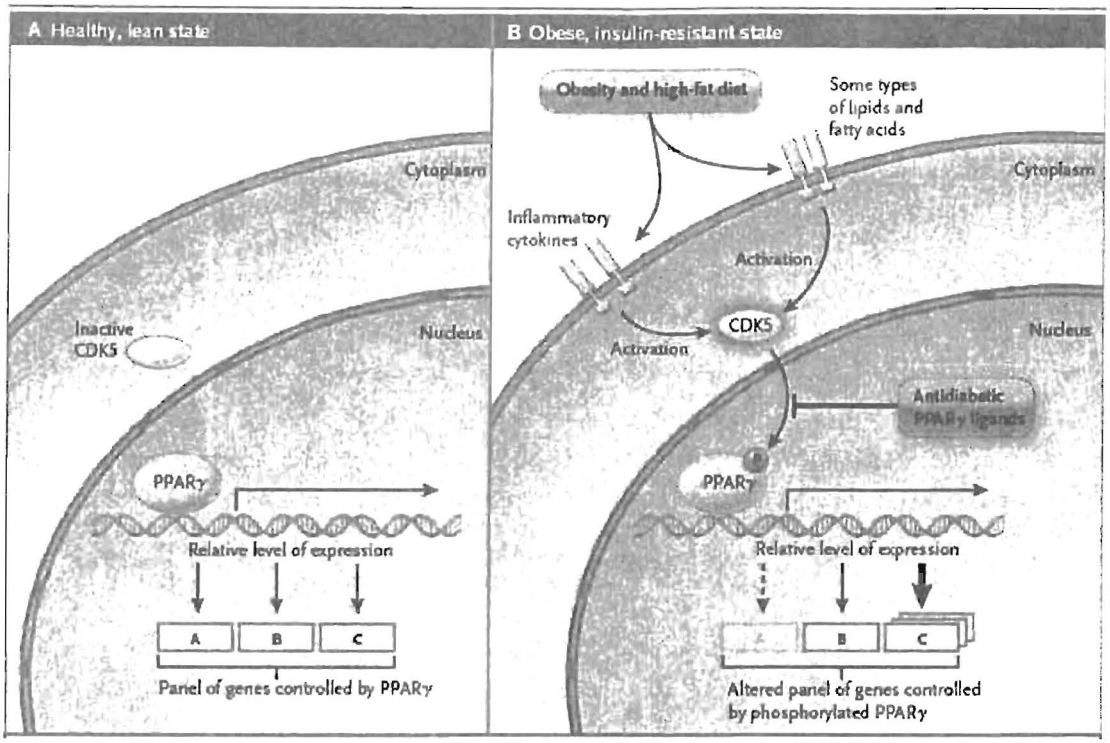

8. What are the essential amino acids in humans? Describe three methods to measure quantitatively these amino acids in biological fluids. (5%)

9. MicroRNAs are ubiquitous regulators in eukaryotes.
   Please describe the general principle of microRNAs production. (7%)
   How might microRNAs regulate gene expression? (7%)

10. What is epigenetics? (5%)
    Please give an example of how the epigenetic effect might regulate gene expression? (6%)

11. Define the following terms (解釋名詞):

a. Pharmacogenomics (4%)
b. trinucleotide repeat expansion (4%)
c. chromosome karyotyping (4%)
d. post-translational modification (5%)
e. homologous recombination (4%)
f. gene regulatory operon (4%)