

臺北醫學大學九十學年度研究所博士班招生考試題目卷

九十學年度博士班

藥學研究所

基礎生物化學

考試時間：90分鐘

題目試卷共一張，本試卷為第一張

1. (20%) Recently, you may read a reproductive biology report from newspaper concerning mitochondria-implanted egg can increase the fertilization rate for those sterile women.
 - (1) President a-ban (阿扁總統) wants to know what mitochondrion is and the cellular roles of mitochondria. Please describe it to your lovely President.
 - (2) Most sterile women are eager to know why mitochondria-implanted egg can work. Could you describe the possible mechanism?
 - (3) Why did the Department of Health (衛生署) disagree the implantation of mitochondria for those sterile women?
 - (4) The carbon-carbon bond distance for single-bonded carbons such as those in a saturated fatty acyl chain is about 1.5 Å. Estimate the length of a single molecule of palmitate (16:0) in its fully extended form. Can you also estimate the thickness of outer membrane of mitochondria.
2. (20%) The catalytic efficiency of many enzymes depends on pH. Chymotrypsin shows a maximum value of k_{cat}/K_M at pH 8. Detailed analysis shows that k_{cat} increases rapidly between pH 6 and 7 and remains constant at higher pH. K_M increases rapidly between pH 8 and 10. Suggest explanations for these observations. (In the structure of chymotrypsin, Asp 102, His 57 and Ser 195 are critical in the active site. The substrate pocket lies just below and to right of Ser 195.)
3. (20%) Give the following sequence for one strand of a double-strand oligonucleotide:
5'CAGGTCGGTAACGCAAGCGTTACCG3'
 - (1) Write the sequence of the RNA complementary to the strand shown above.
 - (2) Find a secondary structure of RNA that will be maximally stable.
 - (3) Estimate the molecular weight of the double strand DNA (ds DNA).
 - (4) Calculate the GC content and estimate the melting point of the ds DNA (a linear relationship between GC content and melting point: GC 100% vs. mp 110°C; GC 0% vs. mp 70°C).
4. (10%) The fructose in honey is mainly in the β -D-pyranose form. This is one of the sweetest substances known, about twice as sweet as glucose. The β -D-furanose form of fructose is much less sweet. The sweetness of honey gradually decreases at a high temperature. Also, high-fructose corn syrup (a commercial product in which much of the glucose in corn syrup is converted to fructose) is used for sweetening cold but not hot drinks. What chemical property of fructose could account for both of these observations?
5. (10%) People with beriberi, a disease caused by thiamin deficiency, have elevated levels of blood pyruvate and α -ketoglutarate, especially after consuming a meal rich in glucose. How are these effects related to thiamin deficiency?
6. (10%) Allopurinol, an inhibitor of xanthine oxidase, is used to treat chronic gout. Explain the biochemical basis for the treatment.
7. (10%) Describe TATA box, TATA-binding protein and DNA-binding transactivators?