

1. A woman is a carrier of hemophilia, an X-linked disorder. What is the probability for her having a son? What is the probability for her having an affected child? What is the probability for her having a child who is both male and affected? (10%)
2. Aspirin is a small white pill that you can get from any drug store. It is an effective painkiller. Doctor also tells you that one tablet of aspirin a day will reduce the risk of heart attack. It had also been used as birth control drug. Explain how can aspirin do all of these. (10%)
3. Please describe in brief what is the Mendel's Law (孟德爾定律)? (10%)
4. In our body, oxygen is transported by hemoglobin. The first step of this process is the binding of oxygen molecules to hemoglobin. Describe the effect of: (a) partial pressure of carbon dioxide ( $P_{CO_2}$ ), (b) oxygen ( $P_{O_2}$ ), (c)  $H^+$  concentration, (d) temperature, and (e) 2,3-diphosphoglycerate (DPG) on the binding affinity of oxygen and hemoglobin. (10%)
5. In a population study, 5000 individuals were typed for the *MN* locus, an autosomal codominant trait. There were 2400 *MM* individuals, 2400 *MN* individuals, and 200 *NN* individuals. What are the allele frequencies for *M* and *N* alleles? Is this population in Hardy-Weinberg equilibrium? (10%)
6. Cloning is the state-of-the-art technique. Scientists have now cloned sheep, cows, and monkeys from somatic cells of these animals. Describe the principle and the potential problems (scientifically not ethically) of this technique. (10%)
7. Sildenafil (viagra) was originally used to treat cardiovascular diseases but was famous for its miracle act in curing impotency. Describe the mechanism of how sildenafil prolongs erection. (10%)
8. What are the primary, secondary, tertiary, and quaternary structures of a protein molecule. (10%)
9. The F1 from a cross of *AB/AB* × *ab/ab* is test-crossed, resulting in the following phenotypic ratios:
 

<i>A B</i>	308
<i>A b</i>	190
<i>a b</i>	292
<i>a B</i>	210

 What is the frequency of recombination between genes *a* and *b*? (10%)
10. Describe the major function of the followings (2% each):
  - a. Vitamin K
  - b. Glucogan
  - c. NADPH
  - d. Chaperonins
  - e. Thrombin