

**Answer the following questions:**

- (1) The pKa values for phosphoric acid are 2.2, 7.2 and 12.3. (6%)
  - a) Write down the predominant ionic forms at pH 0, pH 4, pH 9 and pH 14.
  - b) What would be the pH of an equimolar mixture of  $\text{NaH}_2\text{PO}_4$  and  $\text{Na}_2\text{HPO}_4$ ?
  - c) Suppose that you wanted a buffer fairly close to physiological pH and all you had available were the 20 amino acids found in proteins; which one would be the most suitable?
- (2) What is the peculiar structural feature of elastin that gives it its elastic properties? (4%)
- (3) Explain how the amount of energy required to transport a solute into a cell can be calculated. Assuming that the concentration of a solute outside and that inside to be in the ratio of 10/1, calculate the energy required to transport 1 mol into the cell. (4%)
- (4)
  - a) Which and why digestive enzymes are produced in an inactive zymogen form? (4%)
  - b) Why do you think amylase is not produced as an inactive zymogen? (4%)
- (5)
  - a) What reaction do the two enzymes glucokinase and hexokinase catalyze? (4%)
  - b) Why should the liver have glucokinase while brain and other tissues have hexokinase? (4%)
- (6) It is stated that the yield of ATP from the complete oxidation of a molecule of glucose in *E. coli* is greater than in eukaryote cells, explain why? (4%)
- (7) Explain how a monounsaturated fat ( $\Delta^5$ ) is broken down to acetyl-CoA? (4%)
- (8)
  - a) What are eicosanoids? (2%)
  - b) What are they made from? (2%)
  - c) Briefly describe their physiological significance. (3%)
  - d) What is the relevance of aspirin in this area of metabolism? (2%)
- (9) Does muscle have the enzyme glucose-6-phosphatase? Explain your answer? (4%)

(背面仍有題目,請繼續作答)

- (10) a) Describe the two models that explain homotropic cooperative binding of substrate to an enzyme. (5%)  
b) What is the main feature of allosteric control that makes it such tremendously important concept? (3%)
- (11) Mature red blood cells have no need for nucleotide or fat synthesis. Why do then they have glucose-6-phosphate dehydrogenase? (3%)
- (12) Why should the level of urea cycle enzymes be increased both in the situation of a high intake of amino acids and in starvation? (3%)
- (13) a) What is superoxide? (3%)  
b) What mechanisms exist for guarding against the deleterious effects of superoxide? (4%)
- (14) a) RNA almost certainly evolved before DNA. Why do you think DNA evolved? (2%)  
b) What is a nucleosome? (3%)  
c) What are Alu sequences? (3%)
- (15) a) What is telomerase? (4%)  
b) Explain how the DNA shortening problem in replication is coped with telomerase. (4%)
- (16) What are the families of transcriptional factors in terms of structural motifs? (4%)
- (17) a) Explain the role of chaperones in protein synthesis. (4%)  
b) What is the prion diseases and the relationship between these diseases and protein folding? (4%)