1. Write out the type of glycosidic linkage in (a) starch (b) glycogen (c) cellulose. (12%)

2. Explain, based on the metabolic viewpoint, why BeriBeri becomes a serious health problem in the Far East area.   (8%)

3. Write out the principle of the following biochemical methods: (20%)

   (a) dialysis   (b) affinity chromatography   (c) ion-exchange chromatography

   (d) two-dimensional electrophoresis   (e) gel chromatography.

4. 15 µg of an enzyme of M_r 30,000 working at V_{max} catalyzes the conversion of 60 µmol of substrate into product in 3 min.   What is the enzyme's turnover number (k_{cat})? (10%)

5. Arrange in increasing order for the T_m value of phosphatidyl choline containing the following pairs of identical fatty acid chains: (5%)
   (a) n-Docosanote   (b) n-Octadecanote   (c) $trans$-Δ^9-Octadecenoate
   (d) cis-Δ^9-Octadecenoate   (e) cis-Δ^9- Δ^{12}-Octadecadienoate.

6. A closed circular piece of DNA of 6000 bp (base pair) is prepared in a state where the DNA helix is B Form (10 bp/turn) and the plasmid itself contains 20 positive super twists. (20%)

   (a) Is the DNA overwound or underwound?
   (b) What is the linking number associated with this plasmid?
   (c) How many super twists (magnitude and sign) should the plasmid contain if the conformation of the DNA helix is changed from B Form to A Form (12 bp/turn) without breaking the original molecule?

7. What structural features of DNA cause the major groove and the minor groove to form? (5%)

8. Explain how the Messelson-Stahl experiment supports the semi-conservative model of DNA replication.   (10%)

9. Estimate the minimum number of ATP and GTP molecules required to polymerize 100 amino acids.   (10%)