(5) 1. DNA from a bacterial virus was analyzed and found to have the composition: 21% A, 28% G, 26% T, and 24% C. 
(a) What is unusual about this composition?
(b) What does the composition suggest to you about the structure of this DNA?

(12) 2. Name the following structures, and indicate whether they can be found in DNA, RNA, or both.

(9) 3. Which form of DNA helix (A, B, or Z): (put answer in blank)

____ has the greatest tilt angle of the base pairs? 
____ has deoxyguanosine in the syn conformation? 
____ is favored by high GC content? 
____ has a left-handed helix? 
____ is favored by low humidity? 
____ is formed by RNA-DNA hybrids?
4. Both the Sanger and the Maxam-Gilbert methods of sequencing DNA generate sets of nested oligodeoxynucleotide fragments, each set ending at one of the four deoxynucleotides. The fragments are then separated according to size by electrophoresis. Briefly explain how the fragments are generated in each case.

5. Describe the 3'-end of transfer RNA.

6. Name the six classes of enzymes according to the International Commission on Enzymes classification scheme.

7. To which of the classes from question 6 would the following enzymes belong?
   (a) Trypsin (cleaves peptide bond at lysine or arginine residue)
   (b) Hexokinase (catalyzes reaction between glucose and ATP to form glucose-6-phosphate and ADP)
   (c) Fumarase (catalyzes addition of water to the double bond of fumarate to form L-malate.

8. Explain the difference between coenzymes that are classified as cosubstrates and those classified as prosthetic groups.
9. An enzyme which follows the simple Michaelis-Menten rate law shows the following kinetic constants for two different substrates which have related but slightly different structures:

<table>
<thead>
<tr>
<th>Substrate</th>
<th>( \text{Km} )</th>
<th>( \text{Vm} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.061 M</td>
<td>35 ( \text{mol-min}^{-1} \cdot \text{mg}^{-1} )</td>
</tr>
<tr>
<td>B</td>
<td>2.6 M</td>
<td>195 ( \text{mol-min}^{-1} \cdot \text{mg}^{-1} )</td>
</tr>
</tbody>
</table>

(a) Using the Michaelis-Menten equation determine the velocity of reaction of each substrate at a concentration of 0.015 M.

(b) Calculate the velocity of reaction of each substrate at a concentration of 1.5 M.

(c) For which substrate has the enzyme achieved the highest catalytic efficiency for working at very low substrate concentration?
(8) 10. Which of the following are **not** assumptions made in the derivation of the Michaelis-Menten equation for a one-substrate, one-product reaction? (Put a check by the inappropriate assumptions.)

- [ ] \([S] \gg [E_{\text{total}}]\).  
- [ ] The rate of formation of ES equals its rate of breakdown.  
- [ ] The rate of breakdown of ES to E + P is much faster than the rate of breakdown of ES back to E + S.  
- [ ] The concentration of ES is small relative to the concentration of E_{\text{total}}.  
- [ ] \([E_{\text{total}}] \gg [E_{\text{free}}]\).  
- [ ] The rate of reaction is equal to \(k_2[ES]\).  
- [ ] \(K_M = [E][S]/[ES]\).  
- [ ] The velocity of the catalyzed reaction is equal to \(k_1[E][S]\).  

(10) 11. The following graph shows three idealized curves that could describe oxygen binding to a transport protein such as hemoglobin or myoglobin. Identify by letter the curve or curves that represent the situations described in the comparisons below.

![Graph](image-url)

(a) Comparing ______ to ______ could represent the comparison of fetal hemoglobin to normal hemoglobin A.

(b) Comparing ______ to ______ could represent the comparison of hemoglobin to myoglobin.

(c) Comparing ______ to ______ could represent the shift in oxygen binding to hemoglobin when the pH is decreased from 7.4 to 7.2.

(d) Comparing ______ to ______ could represent the change in oxygen binding to hemoglobin when hemoglobin is dissociated into its subunits.

(e) Comparing ______ to ______ could represent the change in oxygen binding to hemoglobin if the concentration of bis-phosphoglycerate (BPG) is decreased.