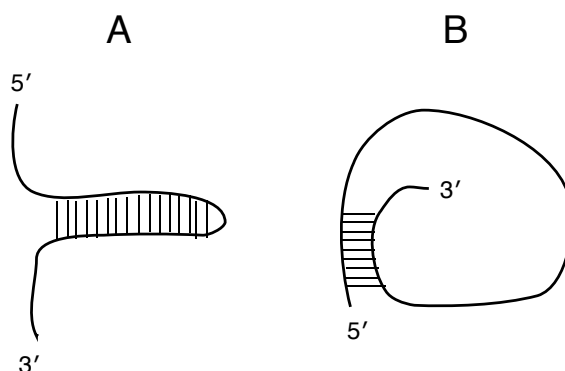


## CHEM1200 Exercises (Chemistry of Life & Metabolism)

1. In the three-dimensional structure of a protein, if glutamic acid and lysine residues are adjacently located, what kind of chemical bond would they form? Also, draw chemical structures to explain how they form the chemical bond.

2. Which of the following arrangements is/are possible in an RNA molecule? Please explain why. Note that the small lines represent hydrogen bonds.



3. RNA is less stable than DNA. Try to explain why (remember the structural difference between DNA and RNA).

4. Suppose a cellulose molecule consists of 3000 glucose monomers. How many carbon, hydrogen, and oxygen atoms would it have?

5. We humans can digest starch but not cellulose. Why?

6. Consider an enzyme that utilizes glutamic acid as a catalytic residue. This glutamate residue serves as a general acid to initiate the enzymatic reaction. When the glutamate was substituted with aspartate, the enzyme was still active. However, when substituted with glutamine, the enzyme completely lost its activity. Provide a plausible explanation for this observation.

7. Related to question 6, you are now working on another enzyme with a glutamate residue that serves as a general acid to initiate the reaction. In this case, the substitution of glutamate with aspartate has led to the complete abolishment of the enzymatic activity. Provide a plausible explanation for this observation.

8. You are now investigating the function of an enzyme and found that the enzymatic reaction is inhibited in the presence of a small molecule **A**. What experiment would you design to tell whether **A** serves as a competitive or a noncompetitive inhibitor?

9. Use the Michaelis-Menten equation to complete the enzyme kinetic data set, when  $K_M$  is known to have a value of 1.00 mM (= mmol/L).

[S] (mM)	$V(\mu\text{M}/\text{min})$
0.500	50.0
1.00	-
2.00	-
3.00	-
10.0	-