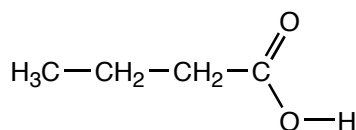


1. a. (8 pts) Identify the following functional groups.

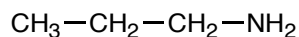
b. (8 pts) On each molecule, identify the most electrophilic carbon atom.

i.



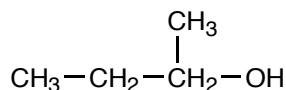
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ii.



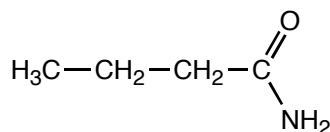
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iii.



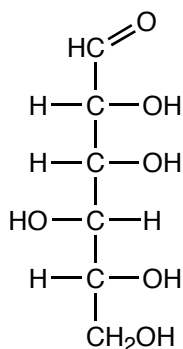
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iv.



\_\_\_\_\_

2. (12 pts) A sugar is drawn below.

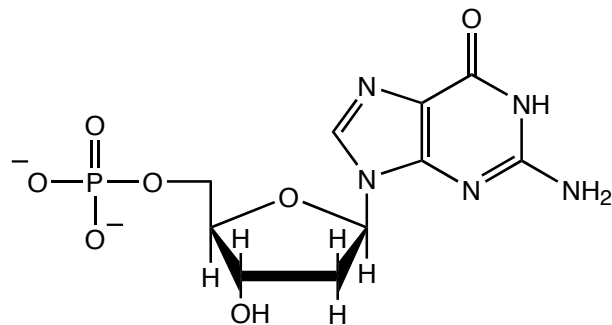


a. Identify (name) the functional groups on the sugar.

b. What intermolecular forces can sugar use to interact with water molecules.

c. Identify the nucleophilic and electrophilic atom(s) on the molecule.

3. (12 pts) Nucleic acids can form biopolymers.

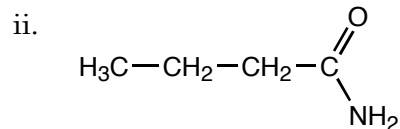
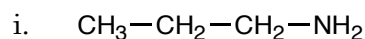


a. Which functional groups play the role of the nucleophile and the electrophile when forming DNA chains.

b. What force is responsible for “base pairing”.

c. Identify the functional groups on the molecule that play a role in “base pairing” and describe the role of each functional group (be specific)

4. (12 pts) The nitrogen atom on molecule i (below) is more nucleophilic than the nitrogen atom on molecule ii. Explain (drawing a resonance structure might help).



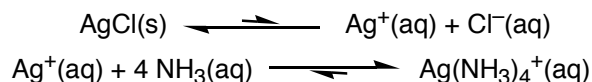
5. (12 pts) A solution of 0.5 mol of  $\text{NaH}_2\text{PO}_4$  and 0.5 mol of  $\text{Na}_2\text{HPO}_4$  dissolved in 1.0 L of water makes an effective buffer. Explain how this solution will minimize changes in pH.

6. (12 pts)  $\Delta G^\circ$  and K are related. In fact,  $\Delta G^\circ = -RT \ln K$

a. A large K implies what about a reaction (are products or reactants favored).

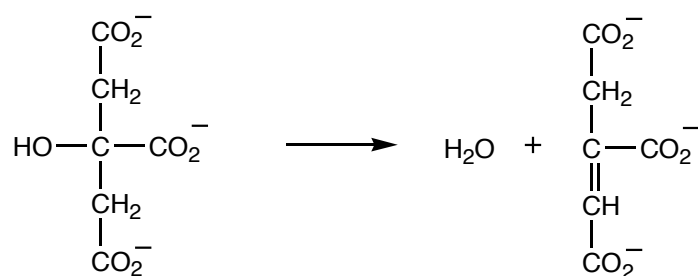
b. A positive  $\Delta G^\circ$  implies what about a reaction (are products or reactants favored).

7. (12 pts) Explain how a reaction with a favorable K can drive a reaction that has an unfavorable K. For example, adding ammonia to AgCl that is suspended in water causes the AgCl to dissolve.

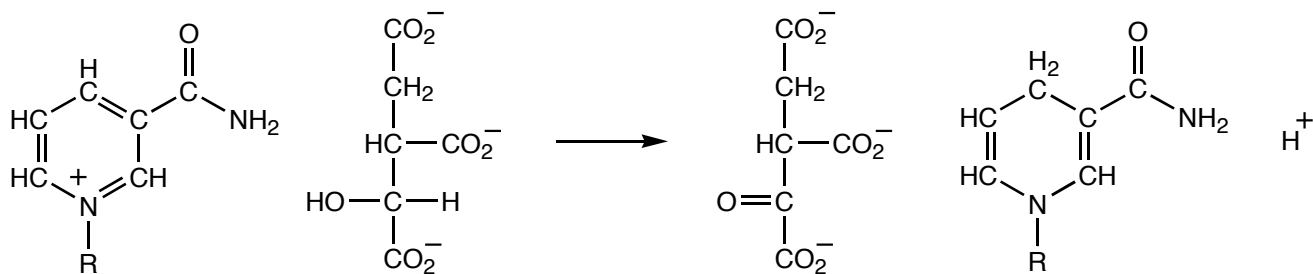


8. (12 pts.) For a given reaction,  $\Delta G = \Delta H - T\Delta S$ . The second law of thermodynamics says that for a process to occur, the entropy of the universe must increase. Can a process decrease the entropy of a system? Explain.

9. (12 pts.) Which of the two reactions is a redox reaction. Identify both reactions and explain how you can tell which reaction is the redox reaction.



Reaction I



NAD<sup>+</sup>

Reaction II

NADH