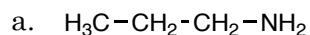
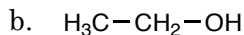


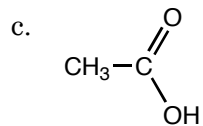
1. (5 pts. each) Identify the following functional groups.



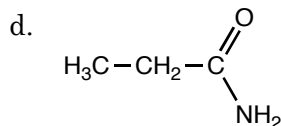
\_\_\_\_\_



\_\_\_\_\_

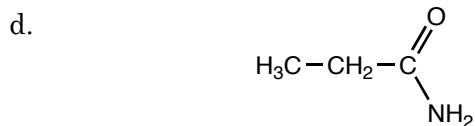
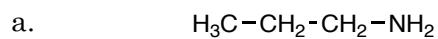


\_\_\_\_\_

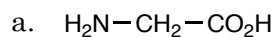


\_\_\_\_\_

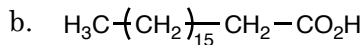
2. (16 pts.) Identify the nucleophilic atoms and identify electrophilic carbon atoms.



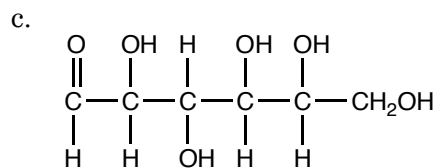
3. (5 pts. each) Identify the following classes of biomolecules.



\_\_\_\_\_



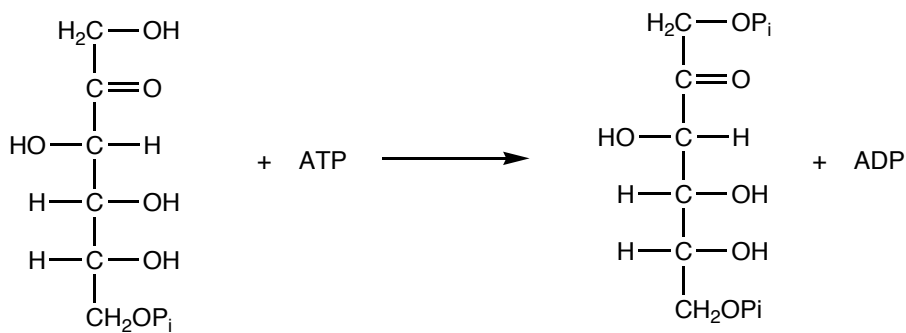
\_\_\_\_\_



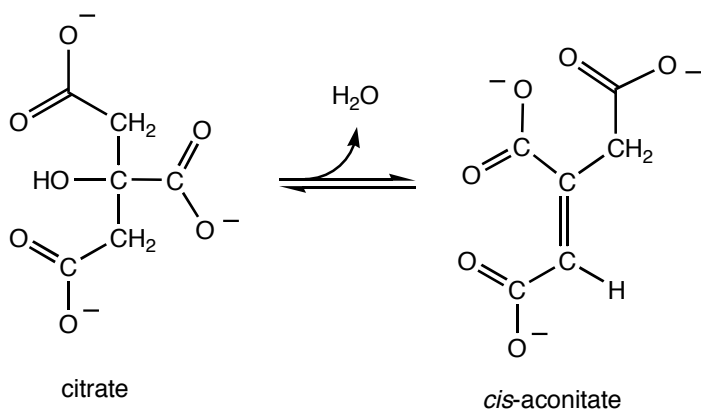
\_\_\_\_\_

4. (5 pts. each) Classify the following reactions as oxidation reduction, nucleophilic substitution, addition, elimination, isomerization

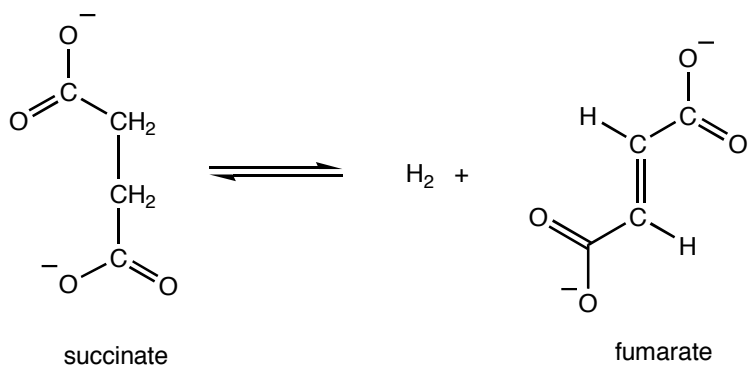
a.



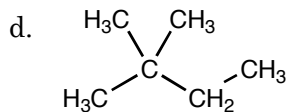
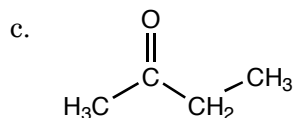
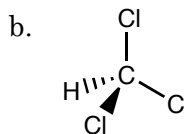
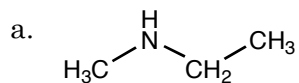
b.



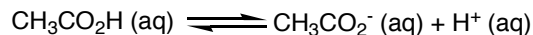
c.



5. (12 pts.) Describe how a water molecule interacts with the following molecules. (List the intermolecular forces that are involved.)



6. (8 pts.) A buffer can be made by combining acetic acid and sodium acetate.



Describe how an acetic acid buffer can consume excess protons.

Describe how an acetic acid–acetate buffer can release protons in response to the addition of a base.

7. (5 pts.) According to the 2nd Law of thermodynamics,  $\Delta S_{\text{universe}}$  must be positive. Can a reaction have a negative  $\Delta S$ ?

8. (5 pts.) A negative  $\Delta H$  indicates what?

9. (8 pts.) A positive  $\Delta G$  implies a large or a small  $K$ ? Would this reaction favor the reactants or the products.

10. (8 pts.) The formation of ATP from ADP and  $\text{P}_i$  is an endergonic process as the following equation indicates.



Can the formation of ATP be driven by the hydrolysis of 1,3-bisphosphoglycerate?



Explain.