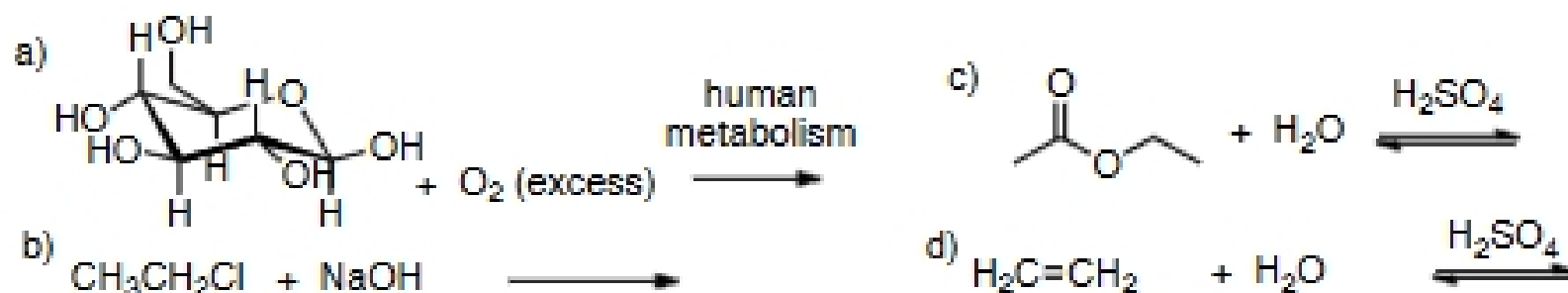
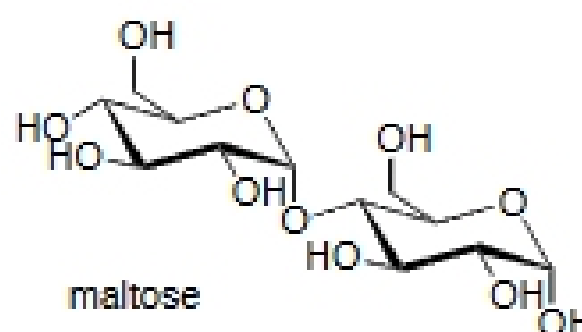


1. (3 points) Which reaction will **NOT** form ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ )? (a)

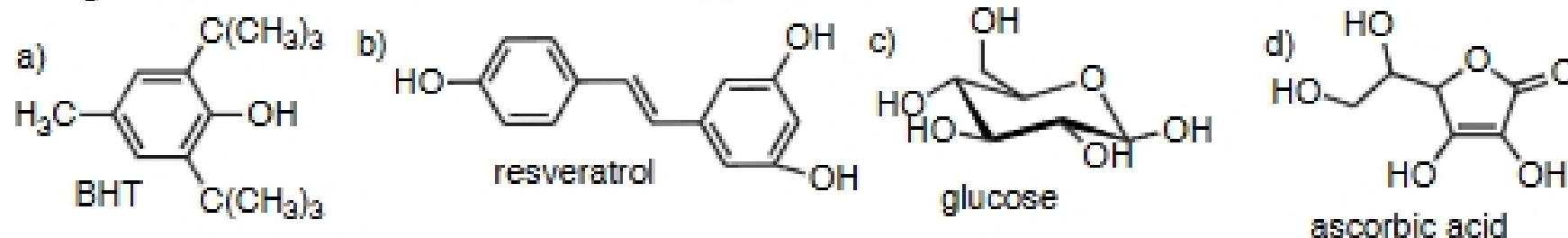


2. (3 points). Which functional group is **not** present in maltose? (d)

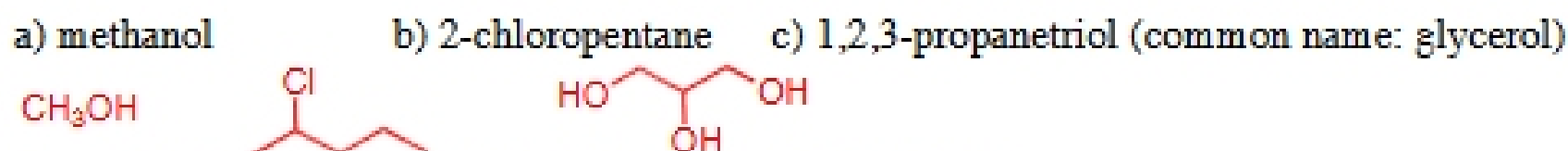
- a. alcohol
- b. hemiacetal
- c. acetal
- d. carboxylic acid



3. (3 points) Which is **not** an antioxidant? (c)

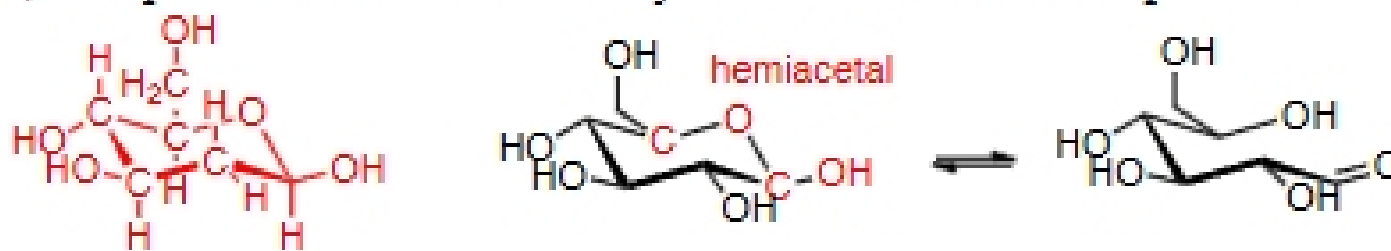


4. (4 points total, 2 points each) For **2 of the 3 names**, draw the corresponding structure. Either a line drawing or showing all the atoms and bonds is acceptable.

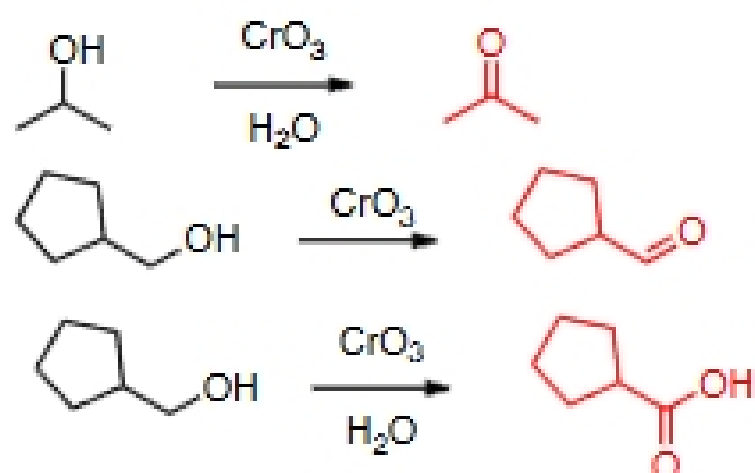


5. (11 points total) The structure of glucose is shown below.

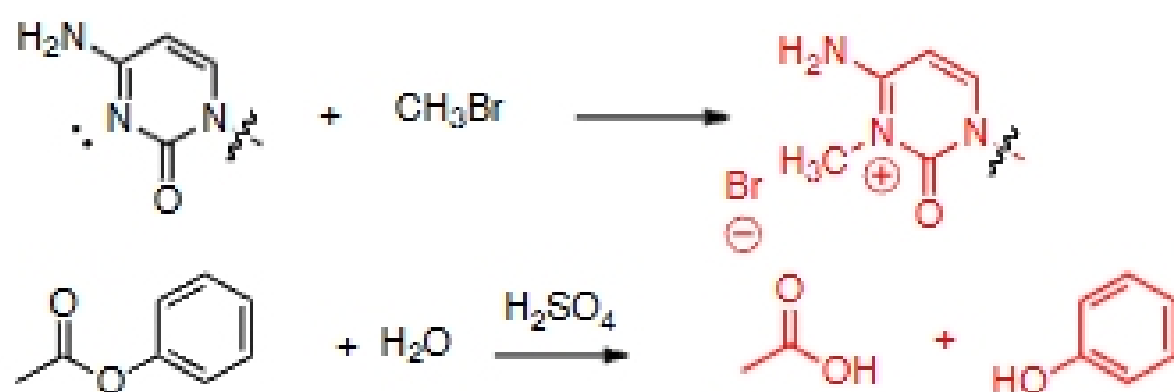
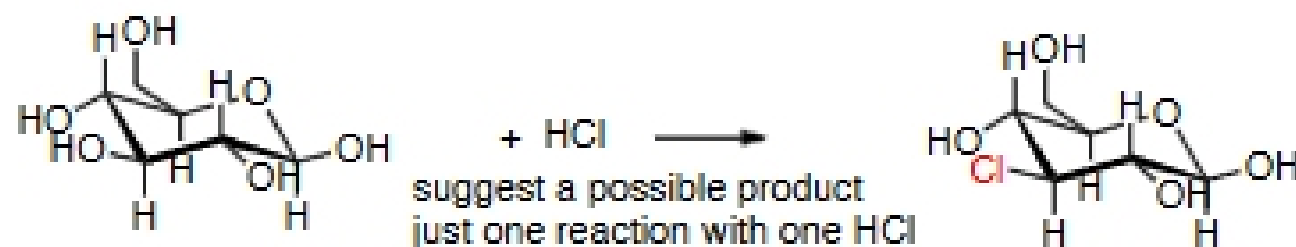
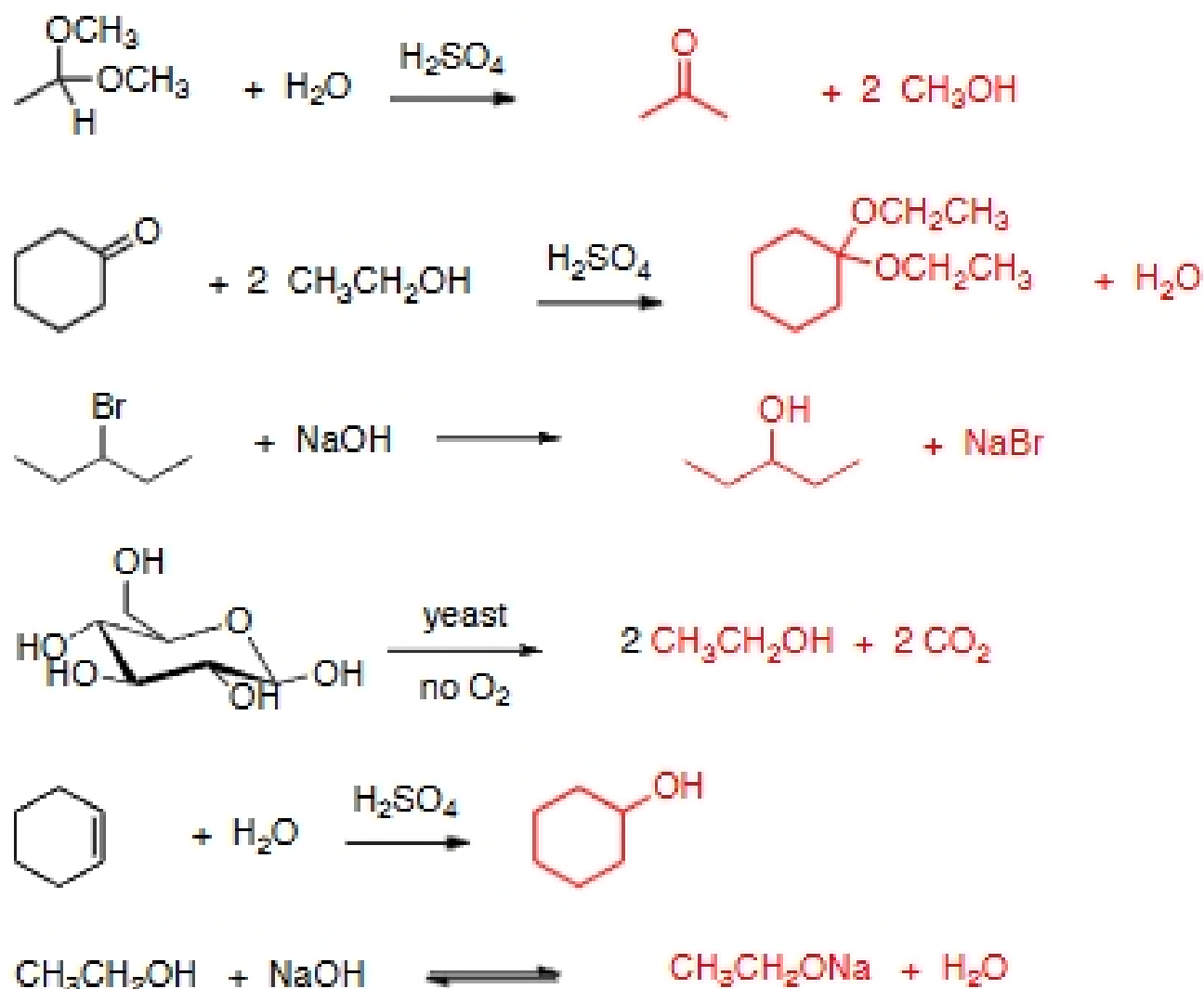
- a. (3 points) Redraw it, showing all the atoms and bonds.
- b. (2 points) What is the molecular formula of glucose and why is it a carbohydrate?  $\text{C}_6\text{H}_{12}\text{O}_6$  because the empirical formula is only carbon and water.
- c. (3 points) This structure contains a hemiacetal. Identify the 5 atoms that make it a hemiacetal.
- d. (3 points) Hemiacetals are always in equilibrium with an aldehyde or ketone and an alcohol. In this case, the equilibrium involves an aldehyde and alcohol. Draw the product.



6. (32 points total, 4 points each) For 8 of the 12 reactions, predict the product(s).



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7. (6 points total, 3 point each) For **two** of the last nine reactions in question 6 (below the asterisks) explain what is favored by  $\Delta S$ ,  $\Delta H$  and  $\Delta G$ .

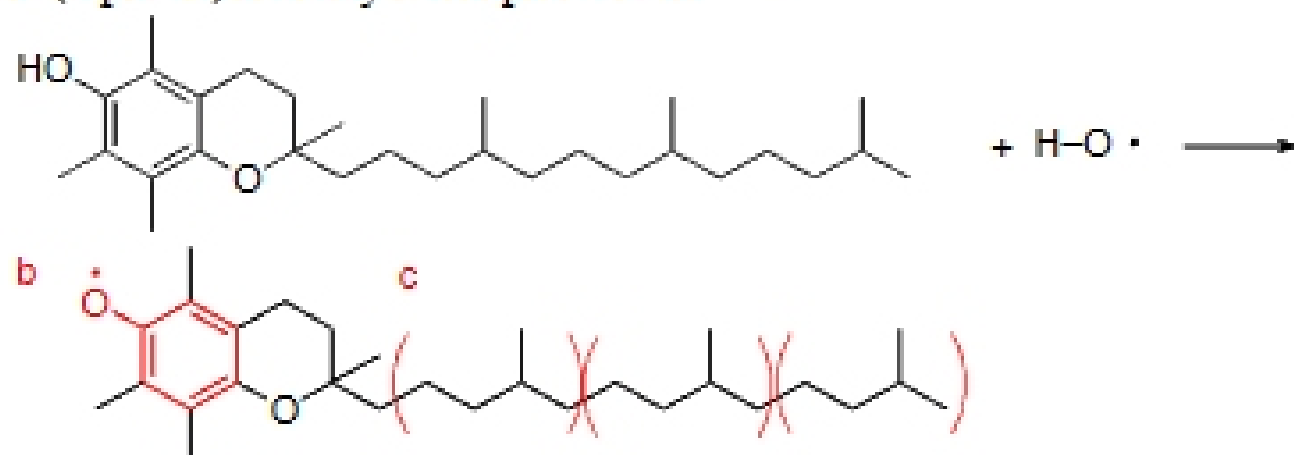
8. (10 points total) **Answer either Part I or Part II.**

**Part I.** Vitamin E is an anti-oxidant.

a. (3 points) Is it water soluble or fat soluble? Do you need to eat some every day? **It is fat soluble (not enough C-OH groups to hydrogen bond to water, in proportion to C-H's) so you don't need to eat it every day.**

b. (5 points) Predict the product formed by the reaction with  $\text{H-O}\cdot$ .

c. (2 points) Identify an isoprene unit.

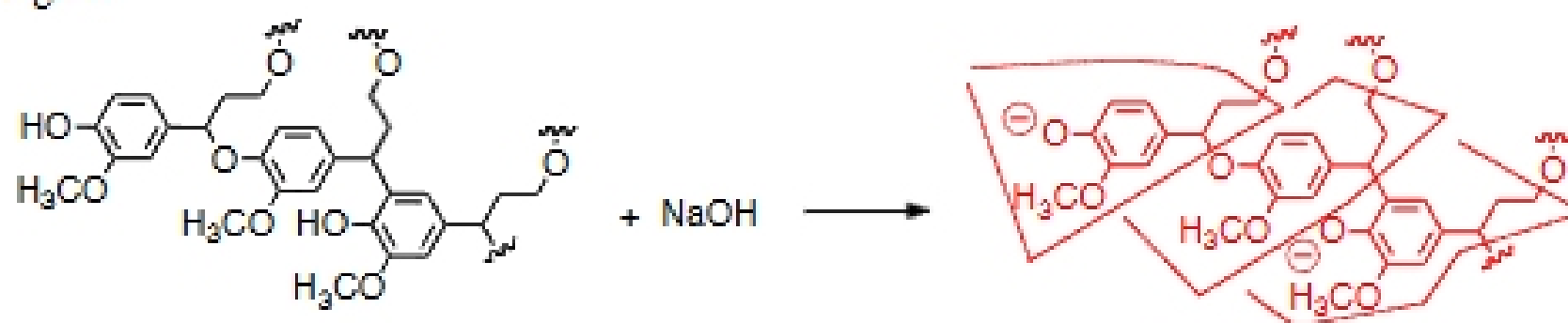


**Part II.** Lignin is a huge molecule. I've drawn just a little part of it.

a. (3 points) Will lignin burn? Explain.

b. (5 points) Lignin contributes to the acidity of soil. Predict the product of its reaction with sodium hydroxide.

c. (2 points) Lignin is an irregular polymer. Identify one of the monomers in this portion of lignin.



9. (7 point) Capsaicin is the compound that makes peppers taste hot.

a. (4 points) Why does milk or ice cream, but not water help cool your mouth when you eat peppers? (Hint: think about solubility.) **Capsaicin does not dissolve in water, but it does dissolve in the fat of milk.**

b. (3 points) Capsaicin might be expected to be an antioxidant. Briefly explain why.

**The phenol functional group is an antioxidant.**

