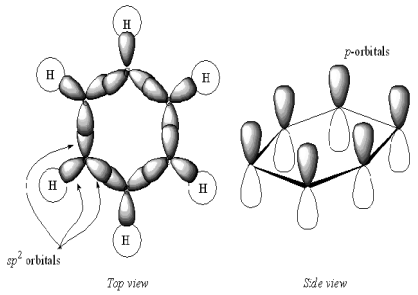
Name:_____

Organic Test #2 – SCH 4U

1. Given the following bond lengths

   - carbon to carbon single bond = 154 pm
   - carbon to carbon double bond = 134 pm
   - carbon to carbon bond found in benzene = 140 pm

   Explain these experimental observations given the nature of the "special type" of bonding in benzene.



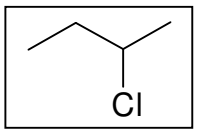
   - single bond is the weakest, therefore longest, double bond is the strongest, therefore shortest, the benzene bond is middle in strength and therefore middle in length
   - benzene is a conjugated aromatic ring system and as such the double bonds (π bonds) can flip position through an electronic resonance
   - the underlying single bond (σ bond) is unaffected by this electronic resonance and merely provides the framework for the delocalized double bond electrons
   - the bonding between carbons is as a result closer to a bond and a half and as such has strength and length that is intermediate between a single and a full double bond

2. Would you expect hexane to dissolve well in water or pentane? Explain the reasons for your choice.

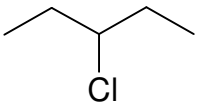
- hexane will dissolve well in pentane and not in water
- hexane and pentane are both non-polar molecules, while water is strongly polar
- like dissolves like means that the non-polar will mix with each other, but not with water
- replacement forces between water molecules cannot be provided by interactions this the non-polar hydrocarbons

3. For each pair of compounds, which compound would react faster in a substitution reaction and why. Circle the faster reacting substance. What concept is at work here?

- steric hindrance is at work!!

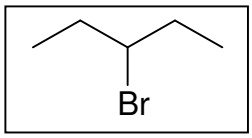


vs



- the longer the side chains, the greater the steric hindrance, therefore the first compound is faster

- both alkyl halides are second degree, therefore the comparison of chain length is all to consider



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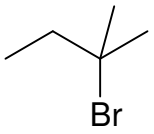


- second degree alkyl halide will have less steric hindrance that the third degree alkyl halide

- steric hindrance increase increase with degree (more important than chain length)

4. Explain the reactivity of alcohols (1^0, 2^0, & 3^0) when oxidized by an oxidizing agent such as potassium permanganate in water ($KMnO_4/H_2O$). Include clear reference (perhaps using diagrams) as to the hydrogen removal in each class of alcohols and be sure to indicate the nature of product for each class of alcohols.

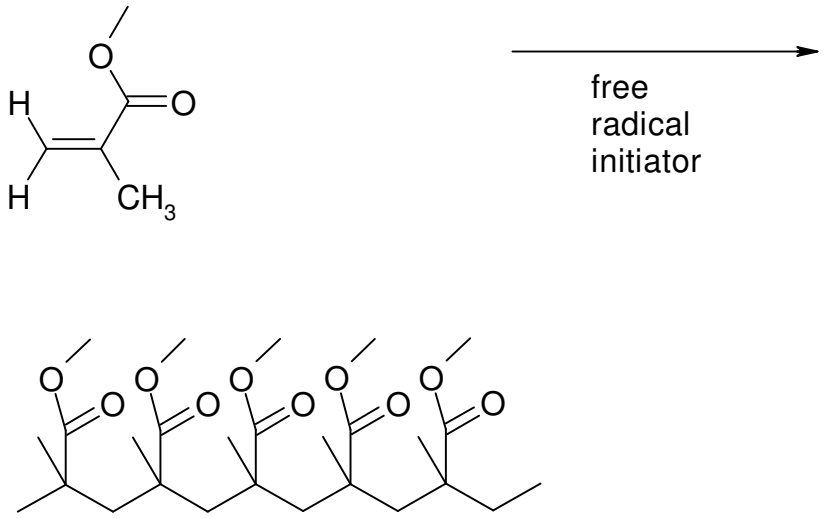
- first degree, one hydrogen each is removed from the alcohol group and the alcohol carbon, makes possible the formation of the double carbonyl bond (C=O bond), further oxidation of the resulting aldehyde intermediate forms a carboxylic acid

- second degree, one hydrogen each is removed from the alcohol group and the alcohol carbon, makes possible the formation of the double carbonyl bond (C=O bond), the result is a ketone

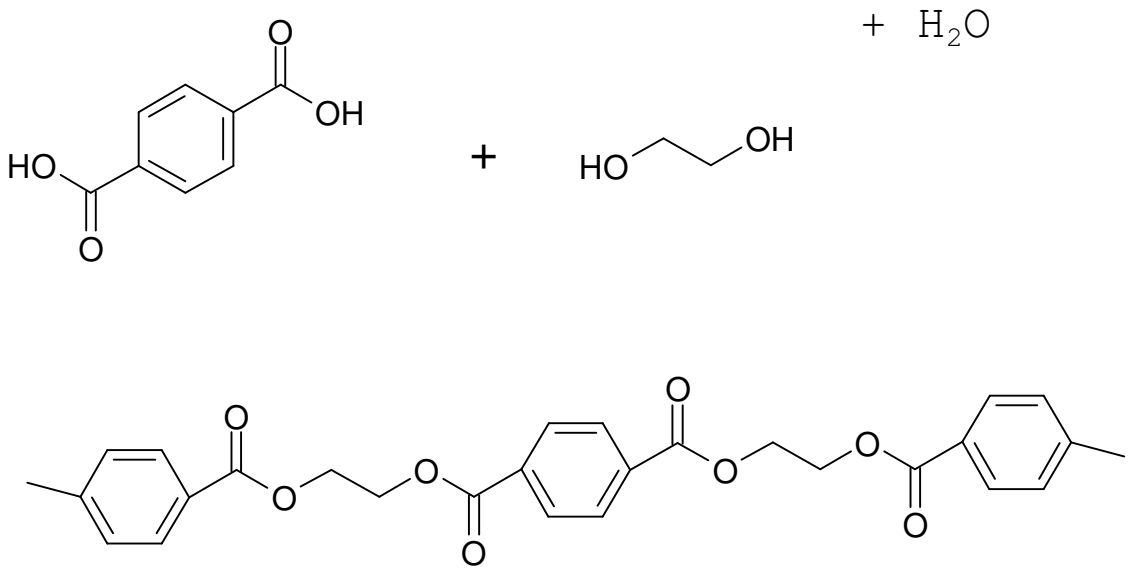
- third degree, due to the absence of a hydrogen on the alcohol carbon the formation of the carbonyl bond is not possible and therefore no oxidation occurs

5. For the following monomers, write:
a) whether the monomer will undergo and addition of condensation polymerization
b) a polymer structure that is at least four monomer units long
c) necessary reaction condition for addition reactions
d) stable by-product for condensation reactions

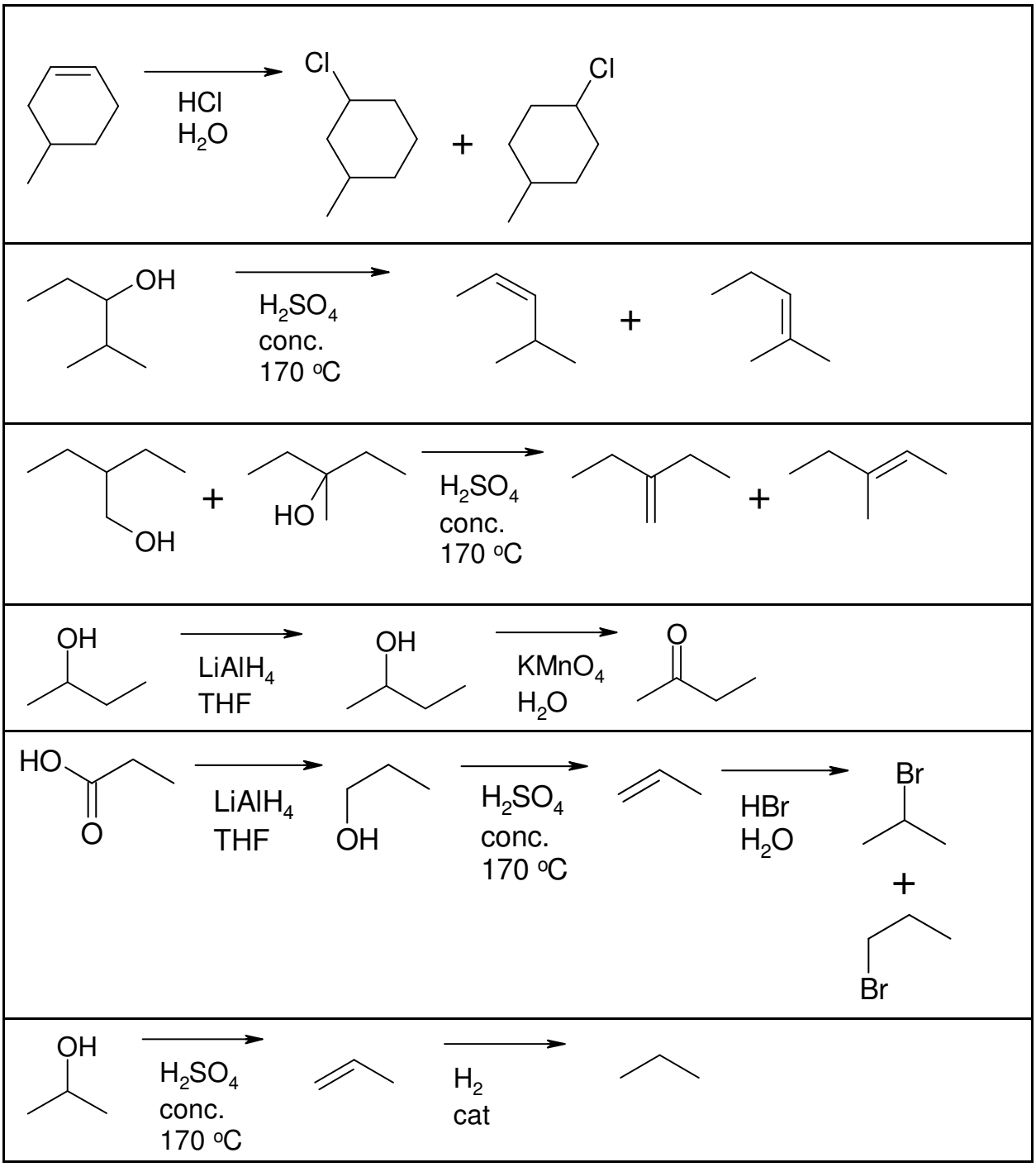
Type: addition polymerization

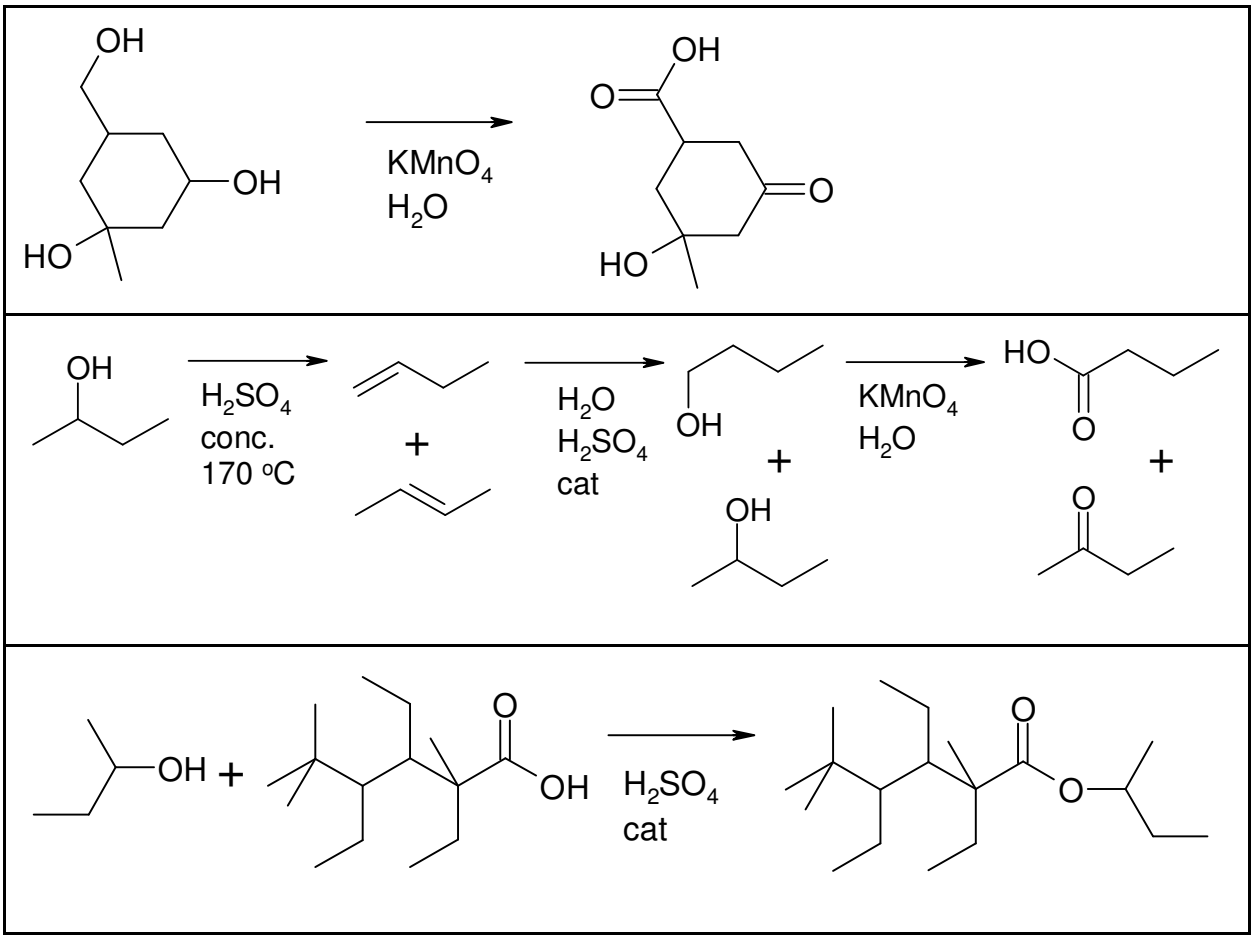


Type: condensation polymerization



6. Complete all reactions be providing reactants, products, intermediates and all reaction conditions, whatever is required. The marking scheme will help indicate if more than one reactant, product or intermediate is possible. One mark per structure or reaction condition.





7. What is the chemical formula of:

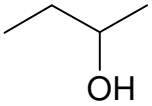
C_6H_{12}

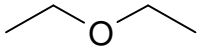
8. Is the above structure saturated? What would the formula become if it was saturated?

no, unsaturated (because of the double bond – more hydrogen could be added to saturate)

C_6H_{14}

9. Are these two structures isomer? Explain





isomers, both have the formula $C_4H_{10}O$ (same number of atoms but different structural arrangement)

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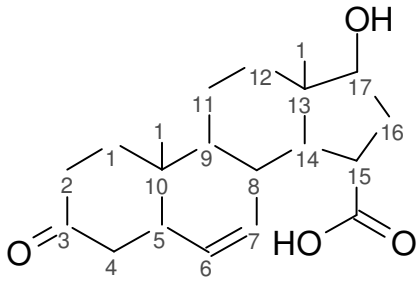
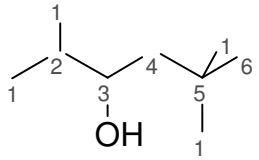
10. Write the full I.U.P.A.C. name of one of the following:



AutoNom Name:

17-Hydroxy-10,13-dimethyl-3-oxo-2,3
,4,5,8,9,10,11,12,13,14,15,16,17-te
tradecahydro-1H-cyclopenta[a]phenan
threne-15-carboxylic acid

or



AutoNom Name:

2,5,5-Trimethyl-hexan-3-ol