

K	C	A	T
19	0	34	20

$$/73 = \underline{\hspace{2cm}} \%$$

Name: _____

SCH 4U - Organic Chemistry Part #2

1. Aromatic compounds have chemical properties that differ from those of regular double bonds. What do each of the following terms mean with respect to aromatic compounds?

conjugate double bonds	/1
delocalized electrons	/1
resonance stabilization	/1
electronic resonance	/1

/4K

Show two different resonant structures for the hydrocarbon with a chemical formula of $C_6H_5CH_3$ (i.e. toluene, a six membered aromatic ring with one methyl attachment)

/2K

If the bond length of a single C-C bond is 154 pm and the bond length of a double C=C bond is 134 pm, suggest a possible bond length for a the resonant bonds in the structures that you have drawn above (does not have to be the precise answer). What is your rationale?

/2T

How is it possible that all six bonds that make up the ring are all the same length?

/2T

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2. Given four carbon atoms, one bromine atom and enough hydrogens to provide full saturation (i.e. C_4H_9Br), draw in order of most reactive to least reactive with respect to a substitution reaction three structures that vary from fast to moderate to slow. Show the degree of each compound.

/6T

What is the factor at work? What is the principle? What are the details? What role does degree of reactive centre play?

/5K

3. Identify each of the following changes as either an oxidation or a reduction. State the reason for your choice. Please note that these changes do not represent balanced chemical changes. Hint: the rationale will be based on hydrogen and oxygen, lost or gained.

	Oxidation/Reduction	Rationale
$C_2H_5CHO \rightarrow C_2H_5COOH$		
$C_2H_4 \rightarrow C_2H_6$		
$C_3H_7OH \rightarrow C_2H_5COOH$		
$C_6H_{10} \rightarrow C_6H_{10}(OH)_2$		

/8K

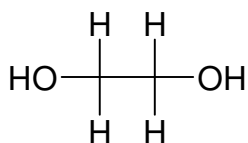
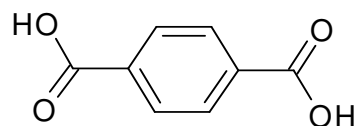
For a mere 2 bonus marks, provide complete structures and reaction conditions for all four of the above reactions. Use a separate piece of paper and attach to the back of your test.

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4. An asymmetric addition will occur whenever the following conditions are met:
- 2-butanol is treated with concentrated H_2SO_4 at high temperature
 - 1-butene is treated with H_2 and Pt catalyst
 - 2-pentene is treated with H_2O and dilute catalytic quantities of H_2SO_4
 - 2-butene is treated with HCl in water
 - 1-cyclohexene is treated with I_2 in water
5. Aromatic compounds:
- undergo electronic resonance only at high temperatures
 - are more reactive than corresponding alkenes
 - are not a part of normal biological systems
 - allow for the delocalization of π electrons (the pair of electrons that produces the second bond in a double bond)
 - were never mentioned in this course
6. For the property of steric hindrance:
- is identical for all first degree alcohols
 - the greater the steric hindrance, the more active the reactive site on the molecule
 - is never of concern in organic biological systems
 - depends more on length of blocking groups than the number of blocking groups (related to degree of reactive site)
 - one must consider both the length and the number of side chains adjacent to a reactive site
7. Sulphuric acid is used in many places in organic chemistry. Which of the following statements is true?
- concentrated sulphuric acid at high temperature will **always** dehydrate an alcohol to form an alkene (there is a bonus mark for providing a counter example - use the margin)
 - cannot perform asymmetric additions on alkenes
 - is the acid of choice to put the flavour into french fries
 - its function will depend on concentration and temperature
 - is needed to reduce primary alcohols to ketones
8. Which of the following statements is true:
- oxidations seldom if ever accompany a corresponding reduction
 - in order to oxidize alcohols, one must use a reducing agent such as LiAlH_4 in THF
 - alcohols cannot be oxidized because they have already lost electrons
 - alcohols can be oxidized but only if they are primary alcohols
 - in an oxidation in organic chemistry, oxygen is gained and/or hydrogen is lost

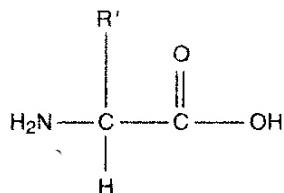
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9. For the following monomers, write:
- whether the monomer will undergo an addition or condensation polymerization
 - a polymer structure that is at least four monomer units long
 - necessary reaction condition for addition reactions
 - stable by-product for condensation reactions
- It may be helpful to show all carbons and all hydrogens



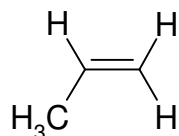
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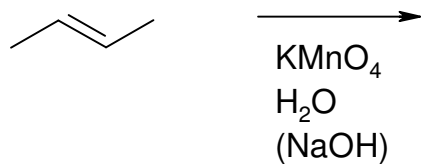


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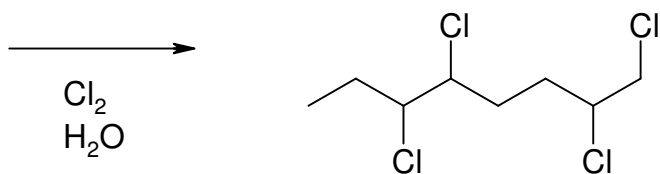
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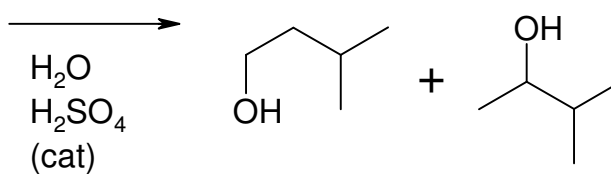
10. Complete each reaction sequence by providing reactants, product and/or conditions under the reaction arrow as required:



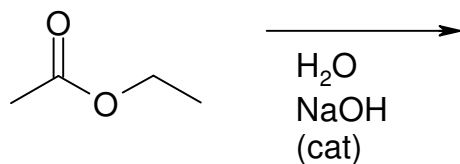
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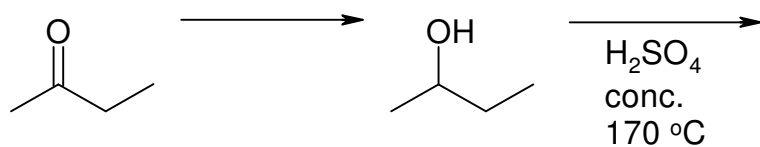
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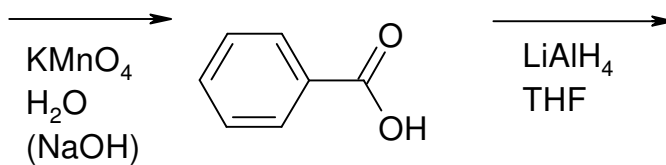
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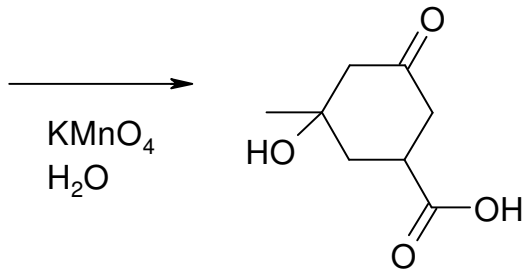


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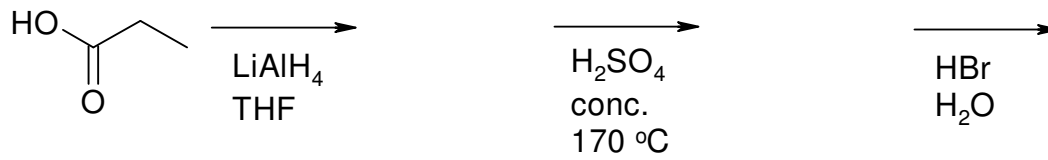
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/3



/3



/4

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