CHE 241/240

Organic Chemistry

Instructor: Dr. Dexter L. Criss

Exam #3
(Learning Center Version)

Student's Full Name (Print) _____

Student's Full Name (Signature) _____

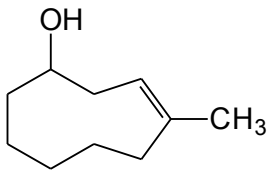
NOTE: You are allowed to use calculators on this exam. However, sharing of calculators is strictly prohibited. Violators will receive a "0" grade for the exam! NO PENS!!!

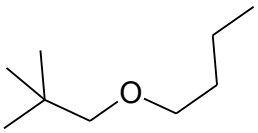
Remember, no hats or caps are allowed during the exam!

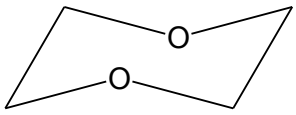
Good Luck!!!

I. Nomenclature *8 points*

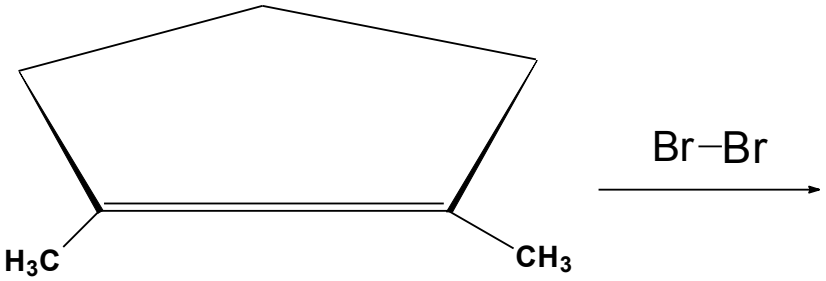
CH_3CH_2OH



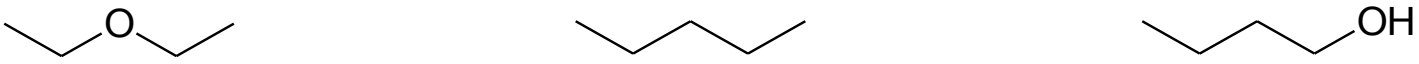




II. Give the mechanism and product for the reaction below. 12 *points*

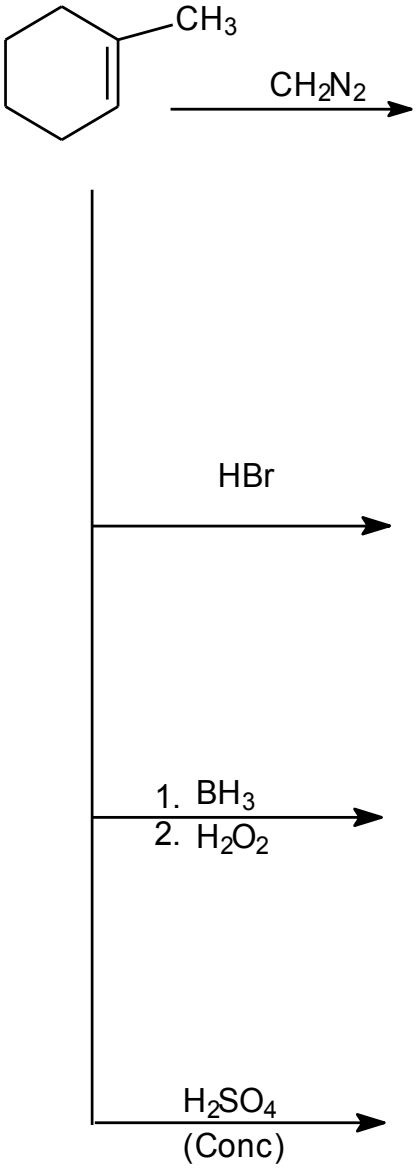


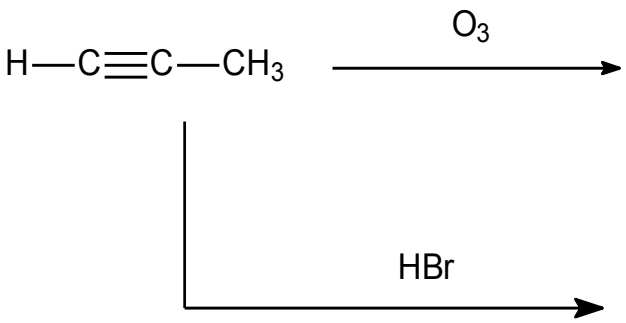
III. Which compound below would have the highest boiling point? Please explain your selection. 5 *points*

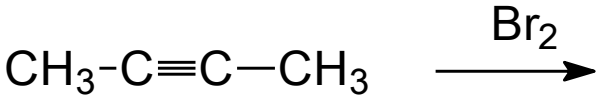


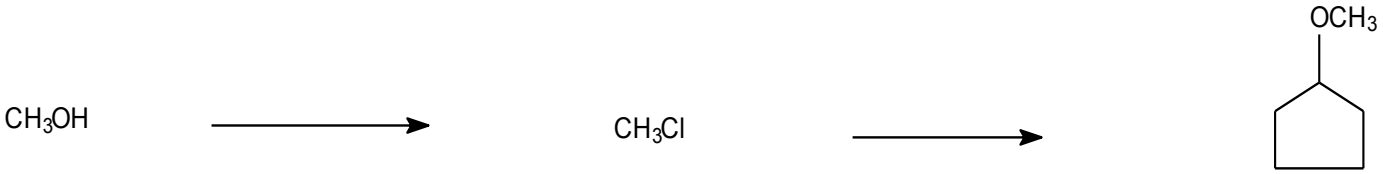
IV. Which alcohol is the stronger acid; methanol or ethanol? Explain your answer. *5 pts*

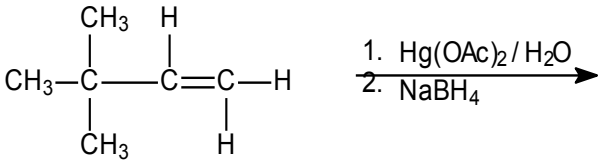
V. Reactions. *35 points*



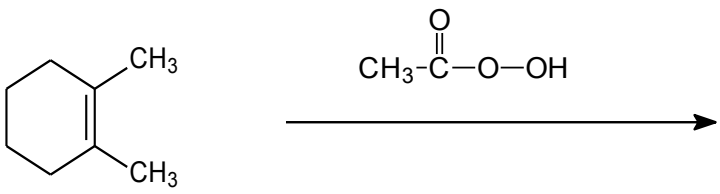

H—C≡C—CH3
O3
HBr

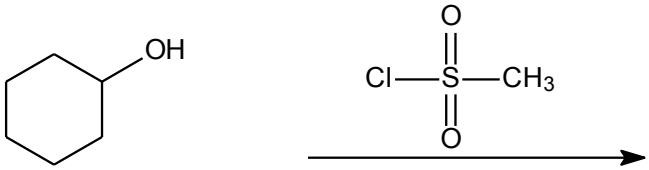

CH3-C≡C—CH3
Br2

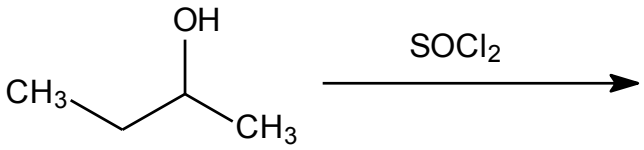

CH3OH
CH3Cl
OCH3

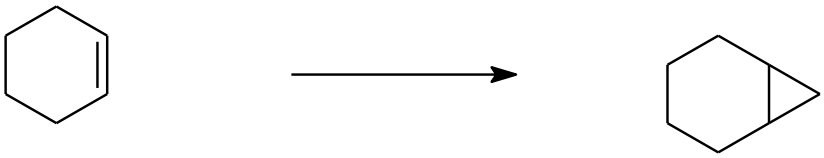

CH3
H
CH3—C—C=C—H
CH3
H
1. Hg(OAc)2 / H2O
2. NaBH4

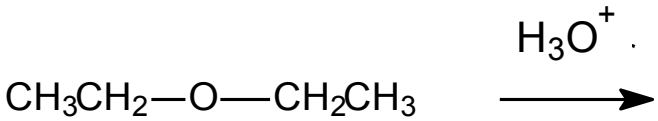

OH
CH3
CH3
CH3
C
O
CH3
CH3

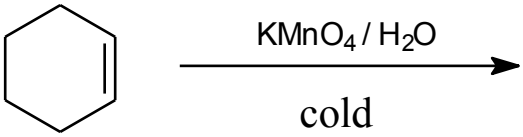

CH3
CH3
O
CH3-C—O—OH

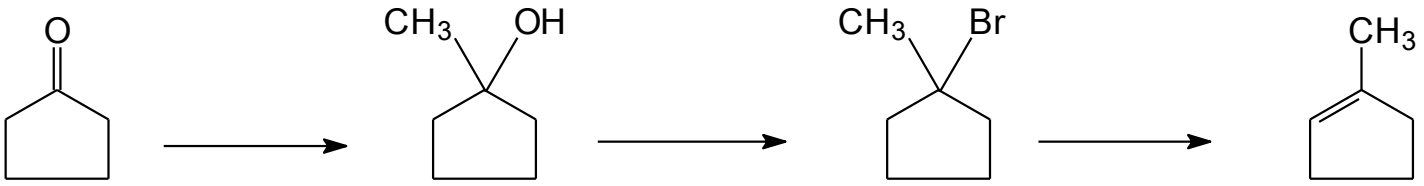

OH
O
Cl—S—CH3
O

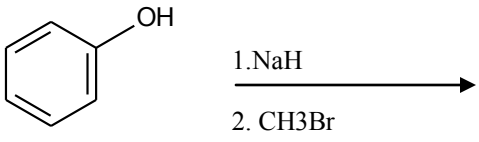

OH
CH3
CH3
SOCl2

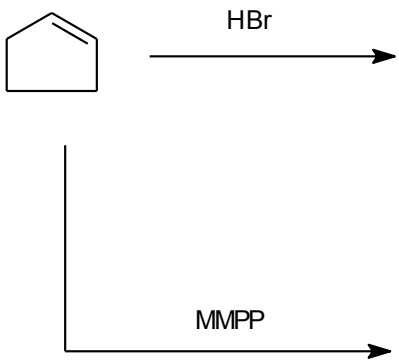


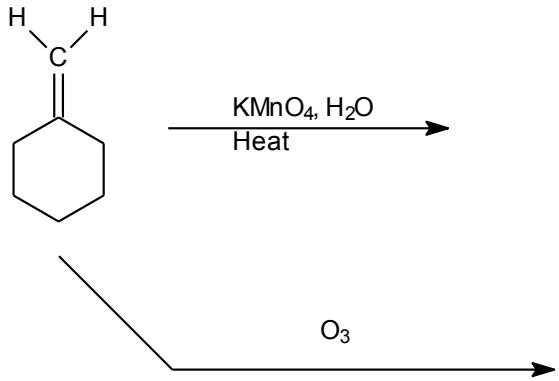

H3O+
CH3CH2—O—CH2CH3

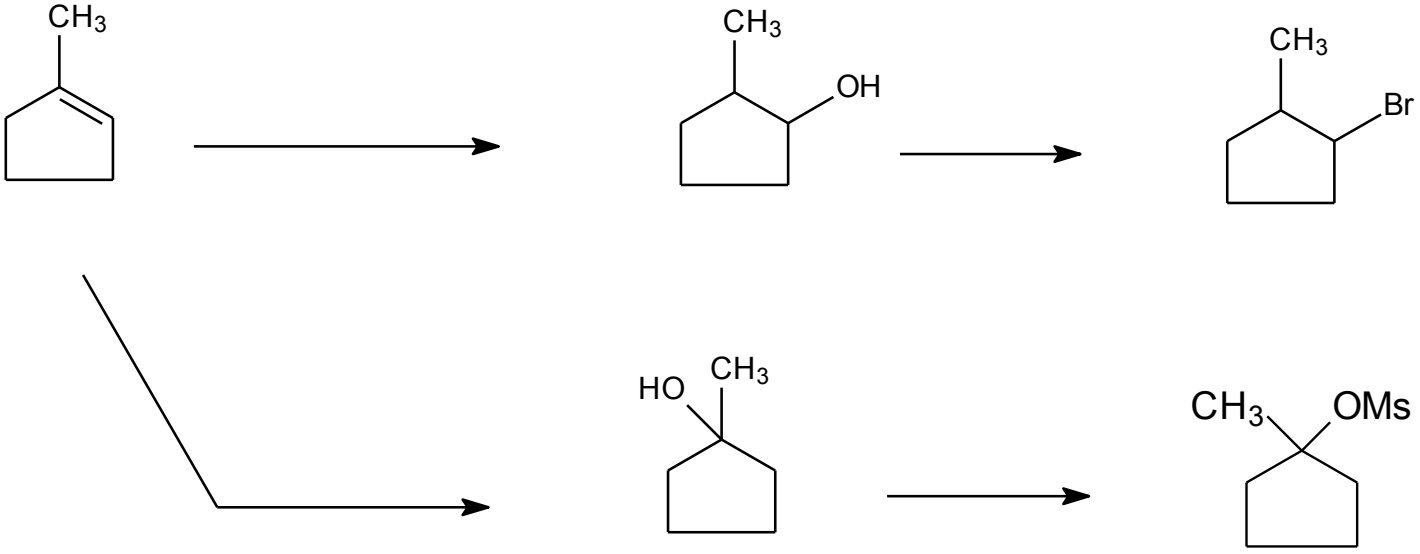

KMnO4 / H2O
cold

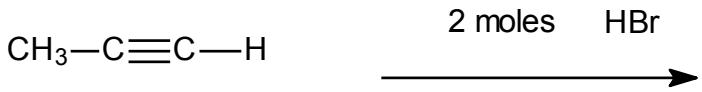

O
CH3
OH
CH3
Br
CH3

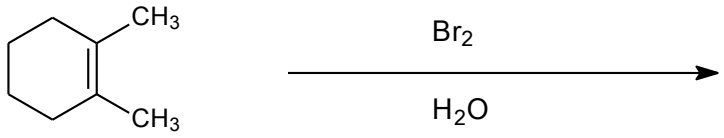

OH
1.NaH
2. CH3Br


HBr
MMPP

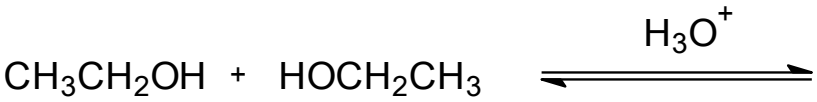

H
H
C
KMnO4, H2O
Heat
O3

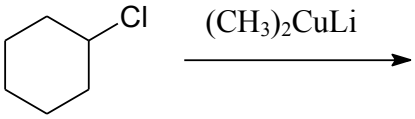

CH3
CH3
OH
CH3
Br
HO
CH3
CH3
OMs

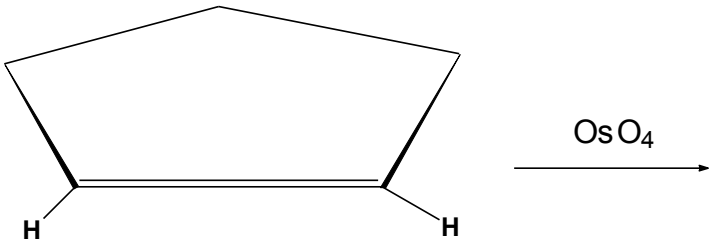

CH3—C≡C—H
2 moles HBr


CH3
CH3
Br2
H2O

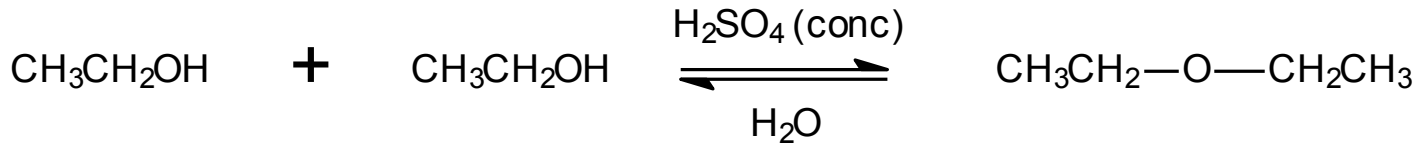

Br


CH3CH2OH + HOCH2CH3
H3O+


Cl
(CH3)2CuLi

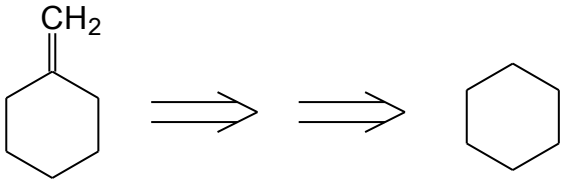

H
H
OsO4

VI. Give a plausible mechanism for the reaction below. *12 points*



VII. Draw the major product and mechanism for the reaction below. *10 points*

VIII. Write a **retrosynthetic** analysis that could be used to synthesize the product below from cyclohexane. 10 points

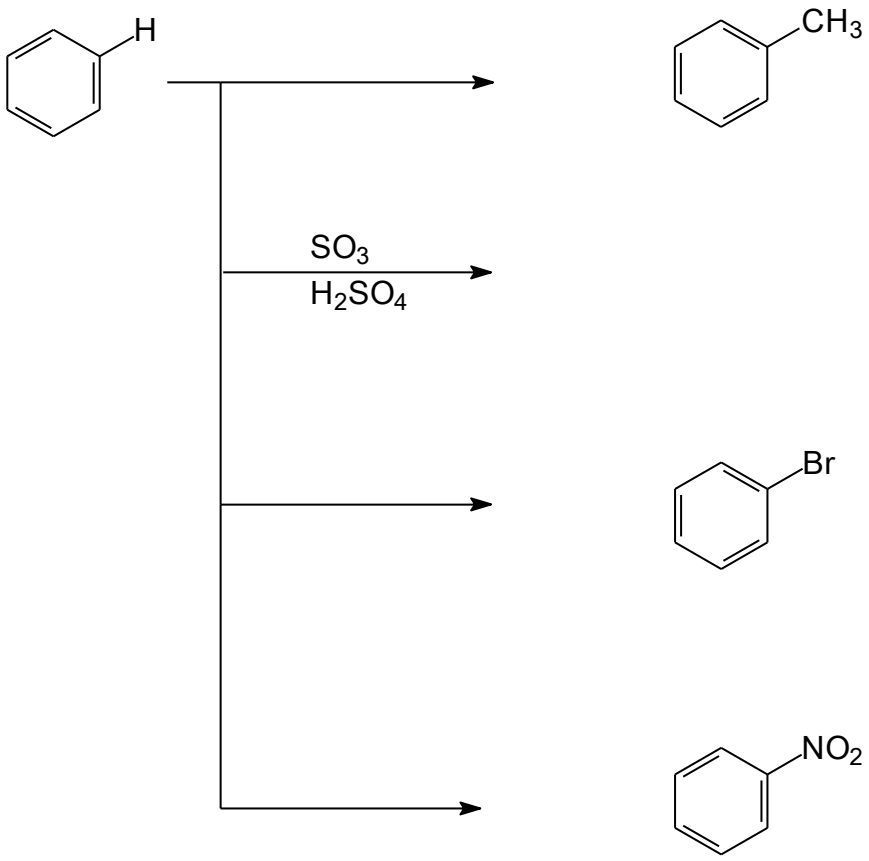


Retrosynthesis

Synthesis

CHE 240 ONLY!!!!!!

IXa. 8 points



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IXb. Compound **A** has the molecular formula C_5H_8 and shows a peak near 1650 cm-1 (moderate) in its IR spectrum. Compound **A** rapidly decolorizes liquid bromine. In addition, the compound is soluble in cold concentrated H_2SO_4. Treatment of **A** with hydrogen gas and nickle catalyst yields compound **B** (C_5H_{10}). Treatment of **A** with cold aqueous $KMnO_4$ gave a diol **C**. However **A** gave a positive test with hot aqueous $KMnO_4$. Propose a structure for **A, B, C.** *8 points*

The Periodic Table of the Elements

1 **H** Hydrogen 1.00794																	2 **He** Helium 4.003
3 **Li** Lithium 6.941	4 **Be** Beryllium 9.012182											5 **B** Boron 10.811	6 **C** Carbon 12.0107	7 **N** Nitrogen 14.00674	8 **O** Oxygen 15.9994	9 **F** Fluorine 18.9984032	10 **Ne** Neon 20.1797
11 **Na** Sodium 22.989770	12 **Mg** Magnesium 24.3050											13 **Al** Aluminum 26.981538	14 **Si** Silicon 28.0855	15 **P** Phosphorus 30.973761	16 **S** Sulfur 32.066	17 **Cl** Chlorine 35.4527	18 **Ar** Argon 39.948
19 **K** Potassium 39.0983	20 **Ca** Calcium 40.078	21 **Sc** Scandium 44.955910	22 **Ti** Titanium 47.867	23 **V** Vanadium 50.9415	24 **Cr** Chromium 51.9961	25 **Mn** Manganese 54.938049	26 **Fe** Iron 55.845	27 **Co** Cobalt 58.933200	28 **Ni** Nickel 58.6934	29 **Cu** Copper 63.546	30 **Zn** Zinc 65.39	31 **Ga** Gallium 69.723	32 **Ge** Germanium 72.61	33 **As** Arsenic 74.92160	34 **Se** Selenium 78.96	35 **Br** Bromine 79.904	36 **Kr** Krypton 83.80

IR Table

Group		Frequency Range (cm^{-1})	Intensity[a]
A. Alkyl			
C—H (stretching)		2853–2962	(m–s)
Isopropyl, —$CH(CH_3)_2$		1380–1385	(s)
	and	1365–1370	(s)
tert-Butyl, —$C(CH_3)_3$		1385–1395	(m)
	and	~1365	(s)
B. Alkenyl			
C—H (stretching)		3010–3095	(m)
C=C (stretching)		1620–1680	(v)
R—CH=CH_2		985–1000	(s)
	and	905–920	(s)
$R_2C=CH_2$		880–900	(s)
cis-RCH=CHR		675–730	(s)
trans-RCH=CHR		960–975	(s)
C. Alkynyl			
≡C—H (stretching)		~3300	(s)
C≡C (stretching)		2100–2260	(v)
D. Aromatic			
Ar—H (stretching)		~3030	(v)
Aromatic substitution type (C—H out-of-plane bendings)			
Monosubstituted		690–710	(very s)
o-Disubstituted	and	730–770	(very s)
m-Disubstituted		735–770	(s)
		680–725	(s)
	and	750–810	(very s)
p-Disubstituted		800–860	(very s)
E. Alcohols, Phenols, and Carboxylic Acids			
O—H (stretching)			
Alcohols, phenols (dilute solutions)		3590–3650	(sharp, v)
Alcohols, phenols (hydrogen bonded)		3200–3550	(broad, s)
Carboxylic acids (hydrogen bonded)		2500–3000	(broad, v)
F. Aldehydes, Ketones, Esters, and Carboxylic Acids			
C=O (stretching)		1630–1780	(s)
Aldehydes		1690–1740	(s)
Ketones		1680–1750	(s)
Esters		1735–1750	(s)
Carboxylic acids		1710–1780	(s)
Amides		1630–1690	(s)
G. Amines			
N—H		3300–3500	(m)
H. Nitriles			
C≡N		2220–2260	(m)

[a]Abbreviations: s = strong, m = medium, w = weak, v = variable, ~ = approximately.