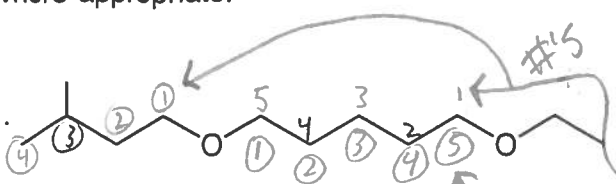
Exam 1, Sp Alt.

A. Nomenclature: (12 points)
Give an acceptable name for each of the following compounds. Be sure to indicate the **stereochemistry** where appropriate.

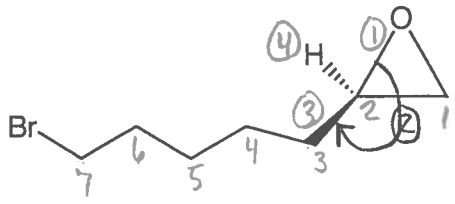
1.



1-ethoxy-5-(3-methylbutoxy)pentane
OR
1-ethoxy-5-isopentoxypentane
OR ②
5-ethoxypentyl isopentyl ether
OR ②
5-ethoxypentyl 3-methylbutyl ether

#'s

2.

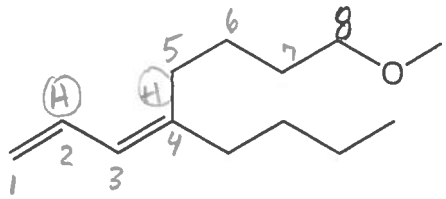


(R)-7-bromo-1,2-epoxyheptane

OR

(R)-2-(5-bromopentyl)oxirane

3.



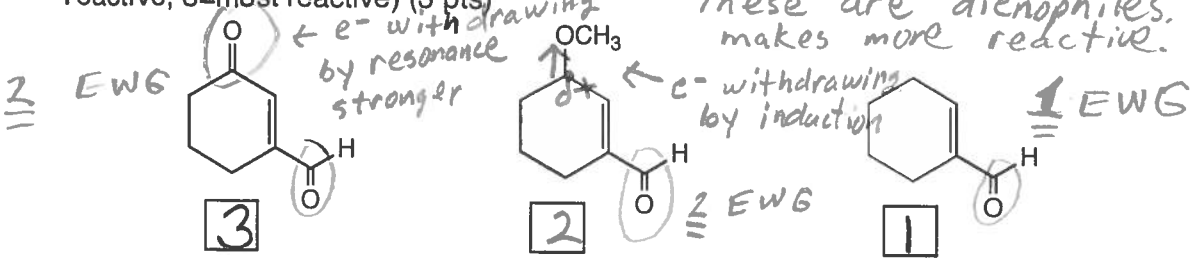
(Z)-4-butyl-8-methoxy-1,3-octadiene

*wrong numbers (-1)

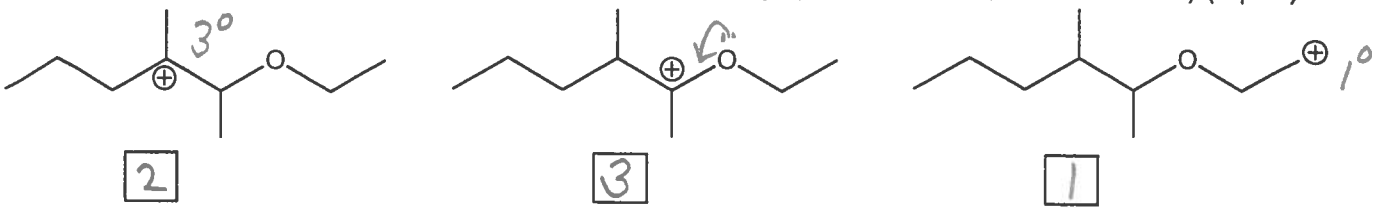
B. Facts: Total points = 16

1. Place the following compounds in order of increasing reactivity in a Diels-Alder reaction. (1=least reactive, 3=most reactive) (3 pts)

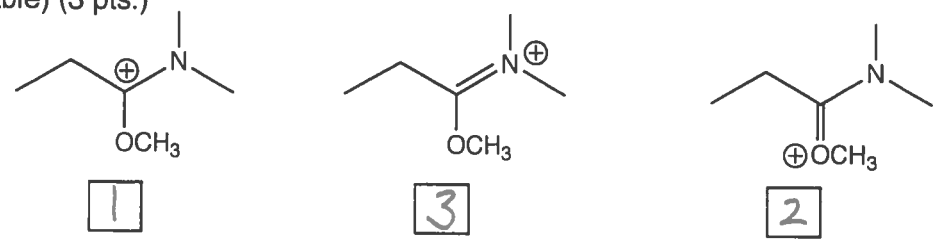
These are dienophiles. EWG makes more reactive. 1pt each bot



2. Place the following cations in order of increasing stability. (1=least stable, 3=most stable) (3 pts.)



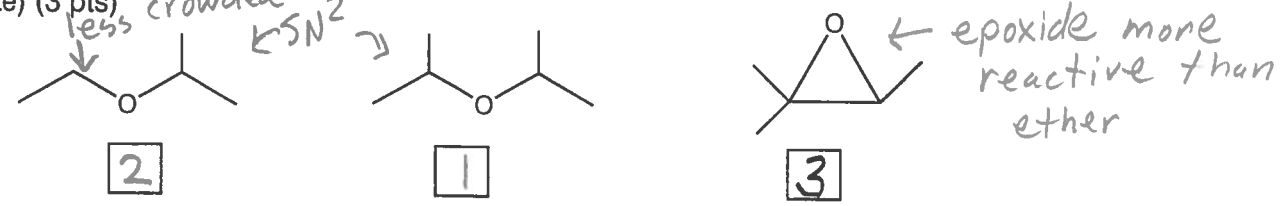
3. Place the following resonance contributors in order of increasing stability. (1=least stable, 3=most stable) (3 pts.)



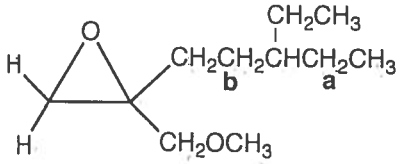
4. Rank the following compounds in order increasing reaction rate with HBr. (1=slowest rate, 3=fastest rate) (3 pts)

less crowded S_N2

epoxide more reactive than ether



5. Answer the following questions for the molecule below and place the answers in the appropriate boxes. (i) How many distinct types of protons are present in the molecule? (ii) How many distinct carbons are present? (iii) What is the theoretically predicited multiplicity(splitting pattern) of the signal for proton **a**? (iv) What is the multiplicity of the signal for carbon **b** in the proton-coupled ^{13}C NMR? (4 pts.)



(i) # of proton types [9]

(ii) # of carbon types [9]

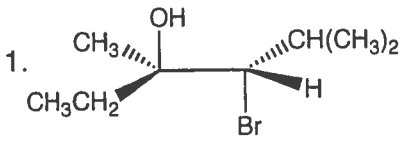
(iii) multiplicity of Ha [qd] or 8=(3+1)(1+1)

(iv) multiplicity of Cb [t] or 3

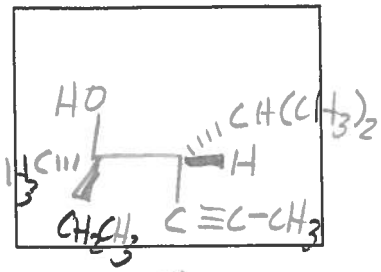
C. Reactions: Total = 36 points, 6 points each
Please provide the major product in the answer box unless indicated otherwise. Indicate **stereochemistry** with wedges and dashes if applicable. Partial credit is awarded only when intermediate products in a multi-step reaction are shown below the reaction.

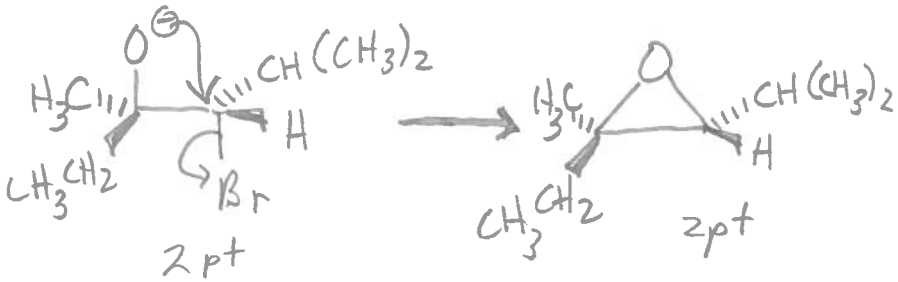
No stereo or incorrect stereo (-1)

1.



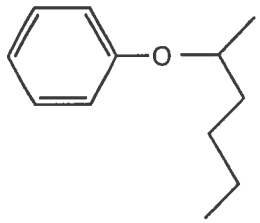
1. NaOH
2. $CH_3-C\equiv C:^-\ Na^+$, then H_3O^+



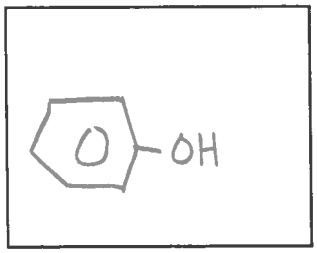


2pt 2pt

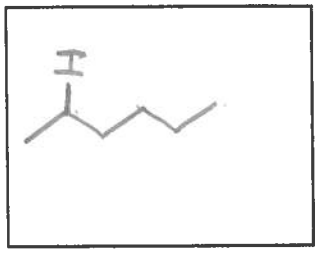
2.



HI (1 eq) / heat

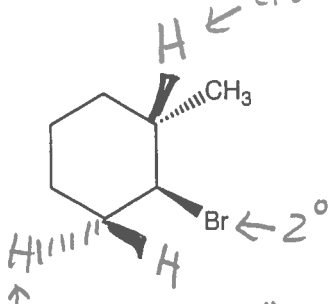


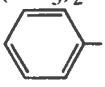
+



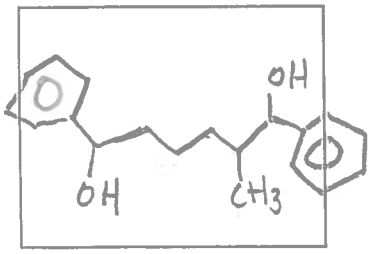
3pts 3pts

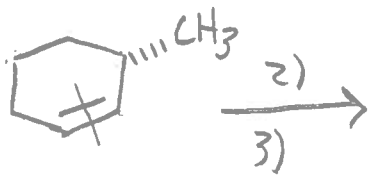
3.



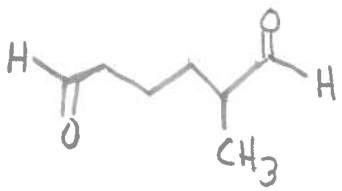
1. $CH_3CH_2O^-\ Na^+$
2. O_3
3. $(CH_3)_2S$
4.  $-MgBr$, then H_3O^+ (XS)

E2 → needs trans diaxial

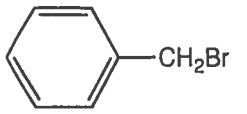




2pts

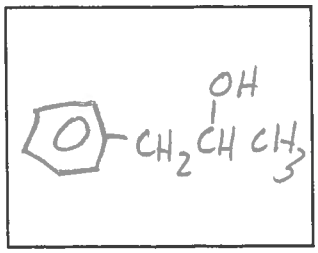


2pts

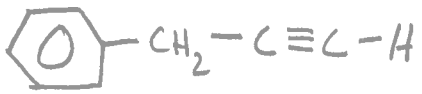
4. 

1. $H-C\equiv C:^{-}\ Na^{+}$

2. $HgSO_4 / H_2SO_4 / H_2O$
3. $NaBH_4 / EtOH$

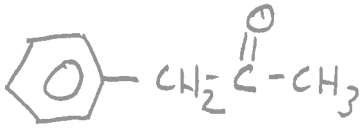


1) ↓



2pts

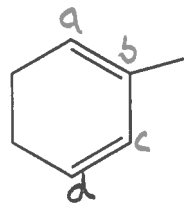
2) →



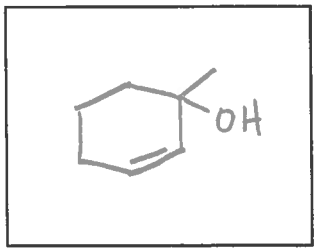
2pts

3) ↑

Low T → look at TS

5. 

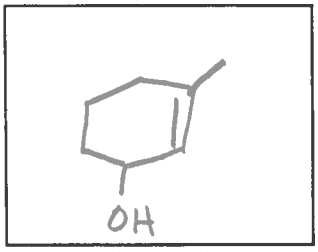
H_3O^{+} / 0°C →



Major product

3pts

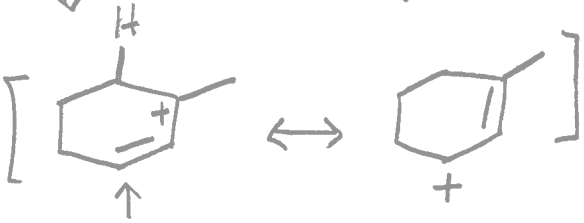
+



Minor Product

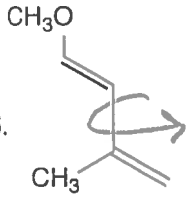
3pts

$C_a = C_1$ more stable than $C_d = C_1$ ↓

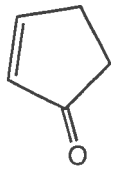


↑ leads to more stable TS

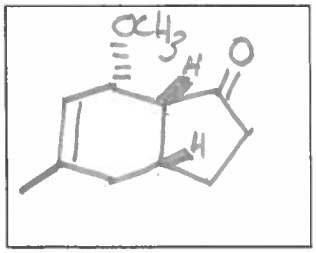
* if answers reversed 4pts max

6. 

+



heat →

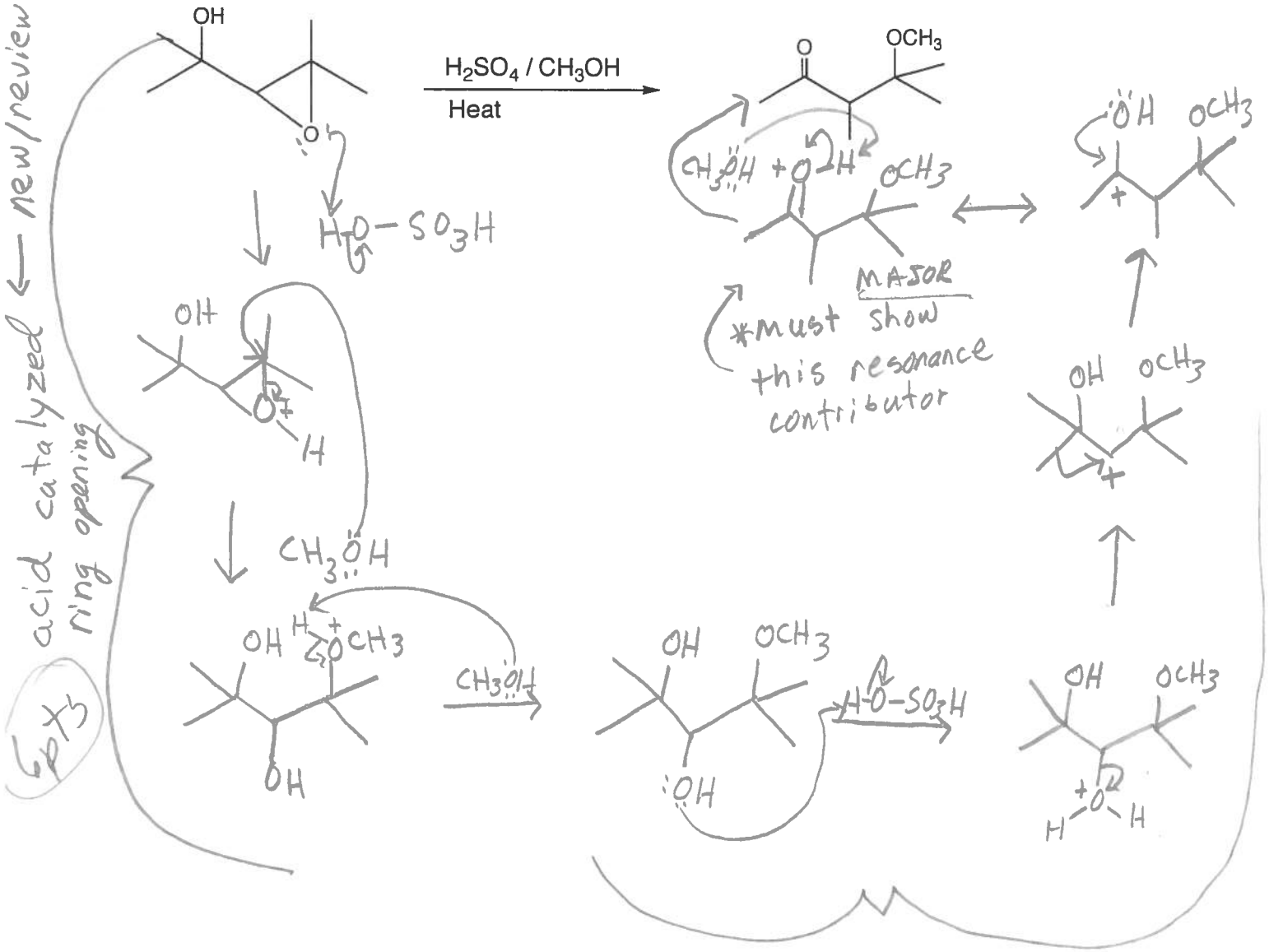


↓

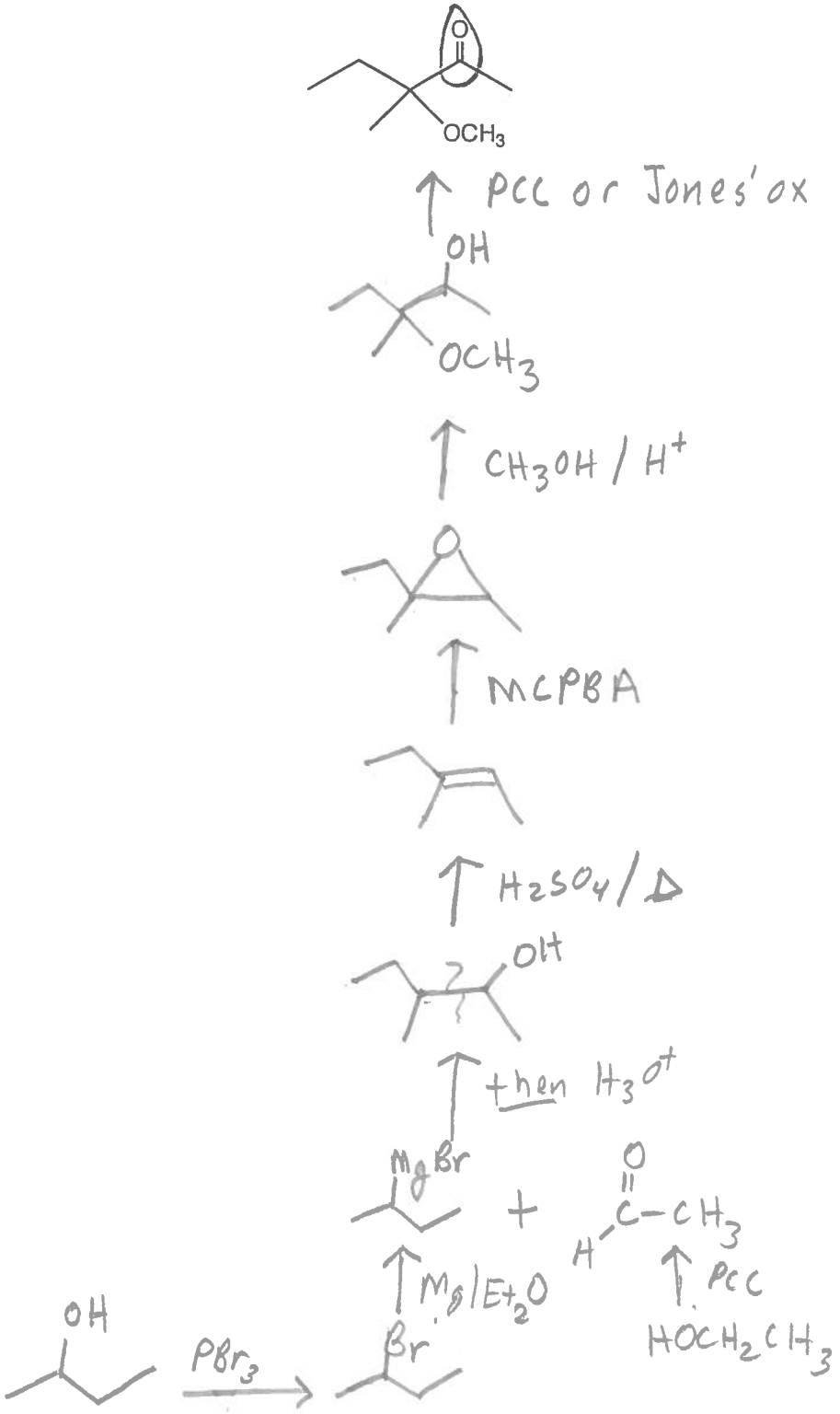
2pts → Diels-Alder
2pts → Stereo
2pts → regio

2012

D. Mechanism: (12 points)
Provide a clear mechanism to explain the formation of the product. Use curved arrows to indicate "electron flow". Remember to show only one step at a time. **Show all intermediates and all formal charges. Do not show transition states!**



E. Synthesis: 12 Points
Synthesize the molecule below using any of the following reagents: alcohols, alkanes, and/or alkenes of **four carbons or less**, any inorganic reagents, any oxidizing or reducing agents, and any peroxyacids.



F. Spectroscopy: 12 Points

A compound with the formula $C_5H_{10}O$ exhibits the IR, ^1H NMR and proton decoupled ^{13}C NMR spectra shown below. Please identify this compound and draw the structure in the box provided below.