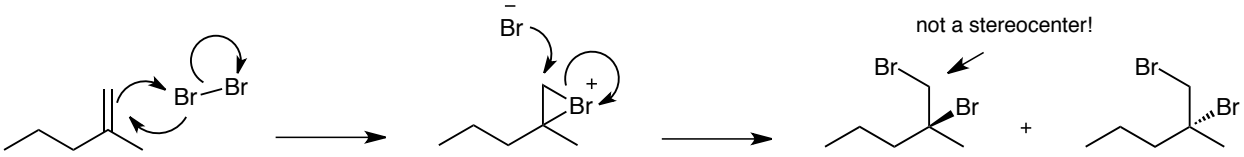
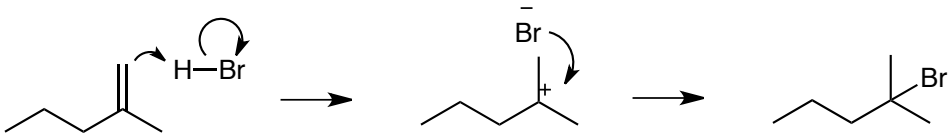
Disclaimer: Do not read through the answer key before legitimately attempting to do the practice exam. You will fail Wednesday's exam if you just pretend you know everything.

Question 1



5 points for correct mechanism.
Deductions: –0.5 for each missing formal charge, –1 for not showing both stereoisomers, –2 for each missing step



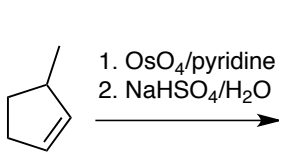
5 points for correct mechanism.
Deductions: –0.5 for each missing formal charge, –2 for incorrect product, –2 for each missing step

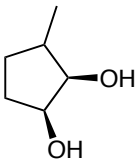
Question 2

(a) False. The Williamson ether synthesis proceeds through an SN2 mechanism between an alkoxide and a primary alkyl halide (or any primary alkane with a good LG)
(b) True.
(c) False. Ethanol can hydrogen bond with eachother. Ethers cannot.
(d) True, the primary carbocation can form because it is resonance stabilized.
(e) True.

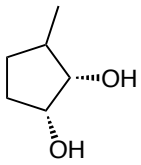
+2 for each correct answer.

Question 3





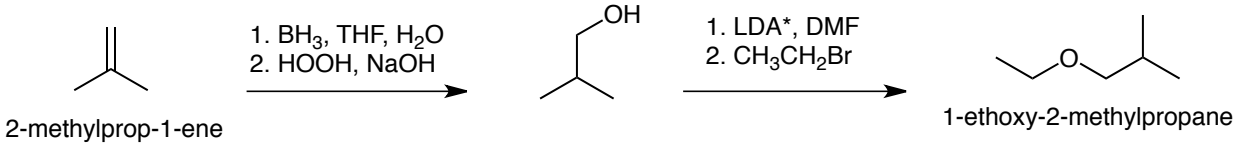
(1*S*,2*R*)-3-methylcyclopentane-1,2-diol



(1*R*,2*S*)-3-methylcyclopentane-1,2-diol

+3 for each correct structure, +2 for each correct IUPAC name

Question 4



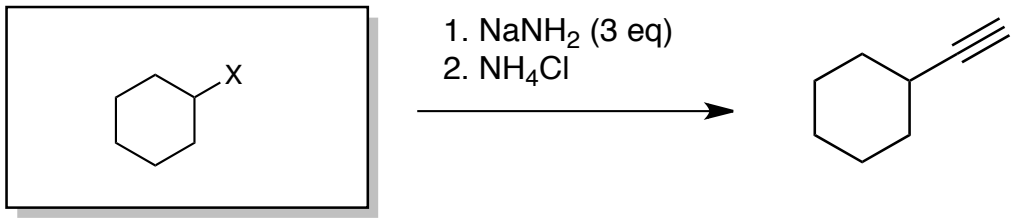
2-methylprop-1-ene

1-ethoxy-2-methylpropane

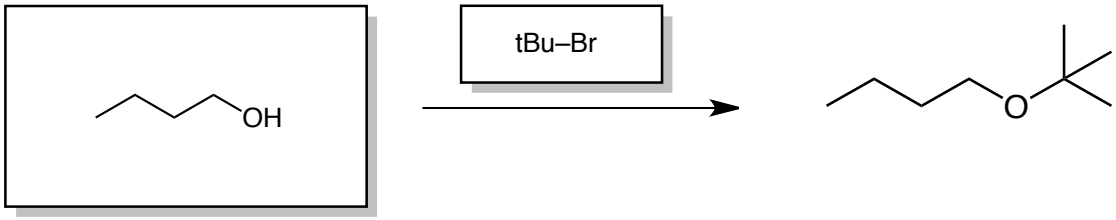
* Or any base with pKa > 16, so stuff like $NaNH_2$, NaH, etc... can work.

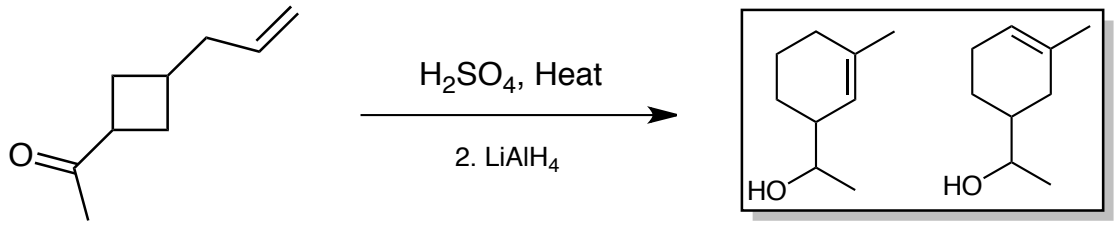
+3 for step 1 for identifying anti–markovnikov addition of OH, and suggesting suitable reagents
+2 for the intermediate structure
+3 for step 2, showing the Williamson ether synthesis

Question 5



X = good LG
i.e. Br, OTs, etc...



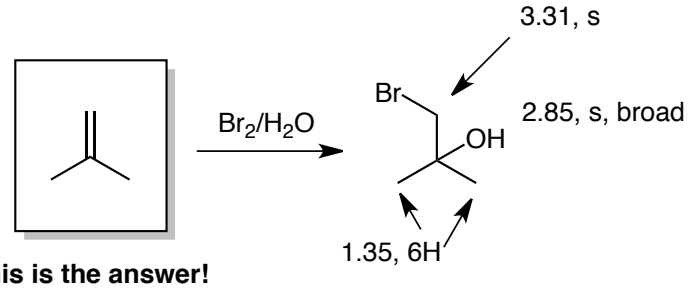


mixture

+3 points for each box correctly filled in.
Deductions: –1.5 for specifying only one structure for the last box.

Commentary: For reaction 2, the alcohol is butanol instead of tert–butyl alcohol because this reaction is restricted to the SN1 mechanism. For example, if we used bromobutane and tert–butyl alcohol instead, this reaction would not proceed. For one, the primary carbocation would never form. If we try to push this reaction along by adding base and generating tert butoxide, this would not undergo SN2, but rather E2.

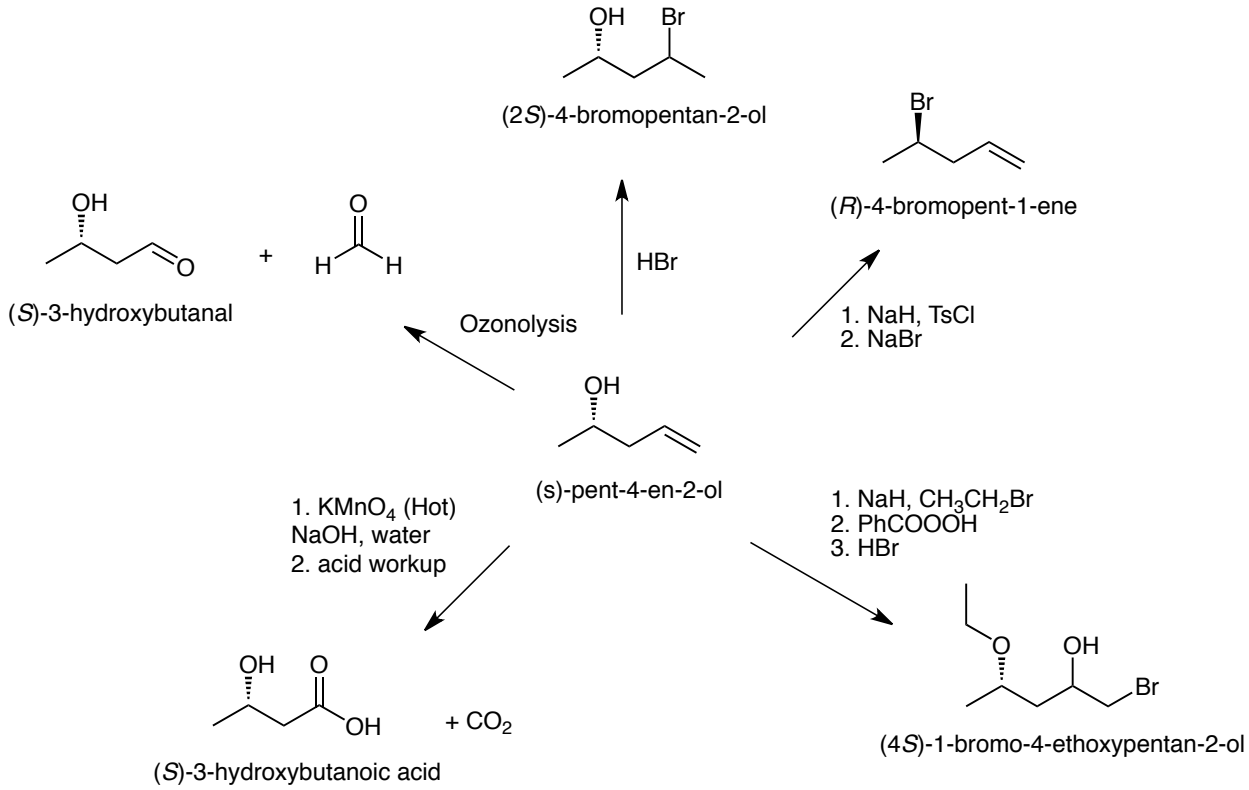
Question 6



This is the answer!

+3 for correctly identifying the alcohol product. +4 for correctly back–tracking and identifying the alkene.

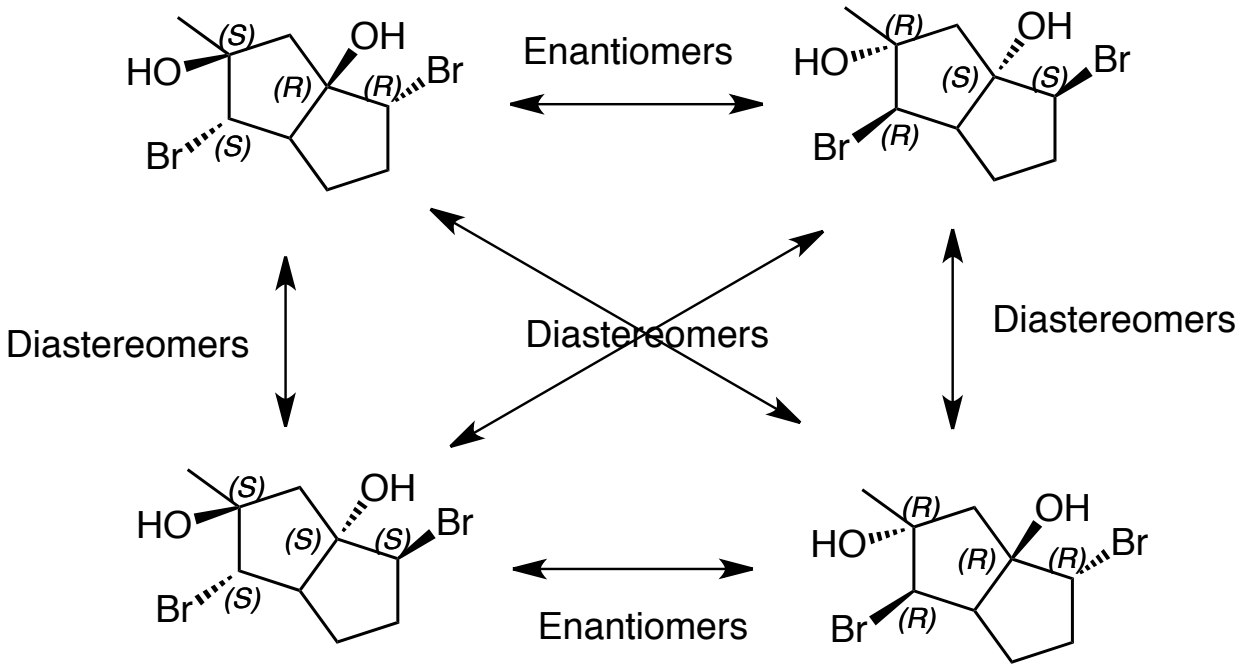
Question 7



+3 points for correctly determining the products of each reaction.
+2 points for correct IUPAC names

Deductions: –1.5 for failure to include both products in the oxidation reactions.

Question 8



10 points: +2.5 for each correct structure drawn
6 points: +1 for each relationship identified (6 relationships total)

Commentary: Enantiomeric relationships exist when *all stereocenters* are inverted. Diastereomeric relationships exist only when *some* of the stereocenters are inverted. (*R*) and (*S*) are shown for clarity. Note: You do **not** have to do R/S to figure this problem out!

Question 9

a) Oxidation reaction: 1. KMnO4 (Hot), NaOH, water. 2. Acid workup
b) Reduction: Use LiAlH4
c) Deprotection (basic conditions): TBAF/THF (TBAF = tetra–*n*–butylammonium fluoride, Lecture 29, slide 8)
d) Anti–markovnikov addition of OH; Hydroboration/oxidation: 1. BH3, THF, H2O; 2. HOOH. NaOH
e) Cyclization by intramolecular SN2. 1. NaH (1eq), BrCH2CH2Br (1eq), DMF, 2. NaH (1eq), DMF

+2 points for each step. Full credit given if the “big picture” is there— a little slip–up in reagents is OKAY, but if the reaction is totally wrong, then no credit.