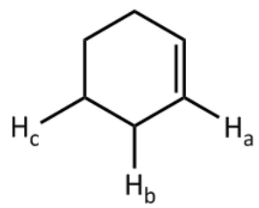
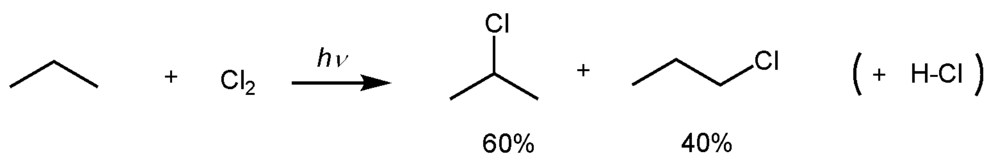
Name________________________________

1. For the compound shown below, the carbon-hydrogen bonds to the highlighted hydrogens H_a, H_b, and H_c, have bond dissociation enthalpies (BDEs) of 397, 364, 464 kJ/mol, *irrespectively*. Assign these values to the correct hydrogens and indicate which one is most likely to be abstracted in a *radical* reaction. (20 points)

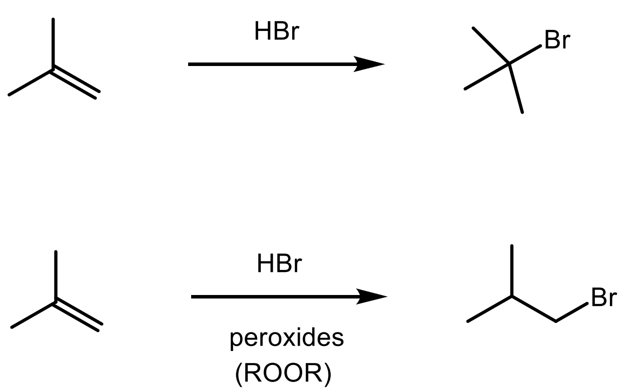


2. Explain why the mixture is obtained in the following halogenation reaction. (10 points)

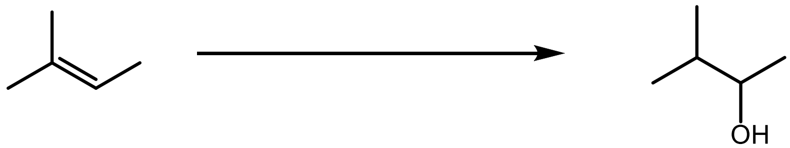


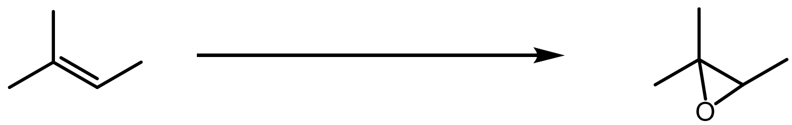
3. In terms of the mechanism of the reaction explain why the addition of peroxides changes the course of the addition reaction shown below. (10 points)

Extra Credit Historically, where did the peroxides come from that led to the discovery of the "peroxide effect"? (5 EC points)



4. Show how to make the following compounds from the given starting materials. Some of the transformations require more than one step. (20 points)

a. 

b. 

c. 

d. 

5. Provide structures for the following compounds (don't forget stereochemistry!). (15 points)

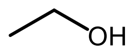
a. (1*R*,2*R*,4*R*)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol

b. (3*R*,4*S*)-4-chlorohexane-1,3,6-triol

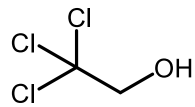
c. (1*E*,3*R*)-1-ethoxy-4-methylpent-1-en-3-ol

6. Explain the two trends in acidity for the following compounds (10 points)

Trend 1

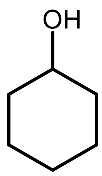


$pK_a = 16$

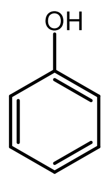


$pK_a = 12.2$

Trend 2

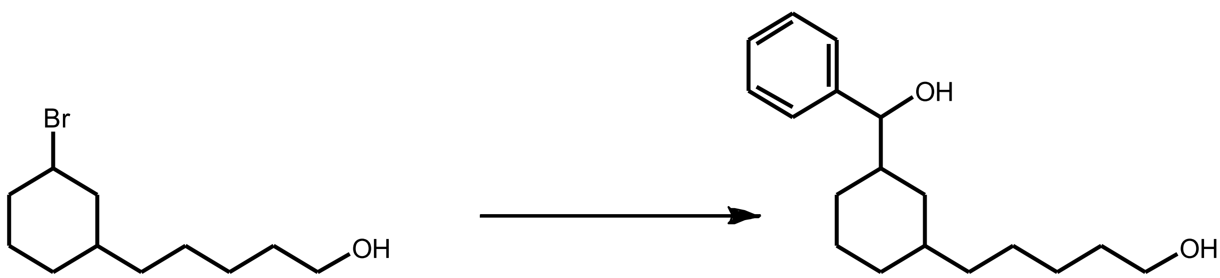


$pK_a = 18$



$pK_a = 10$

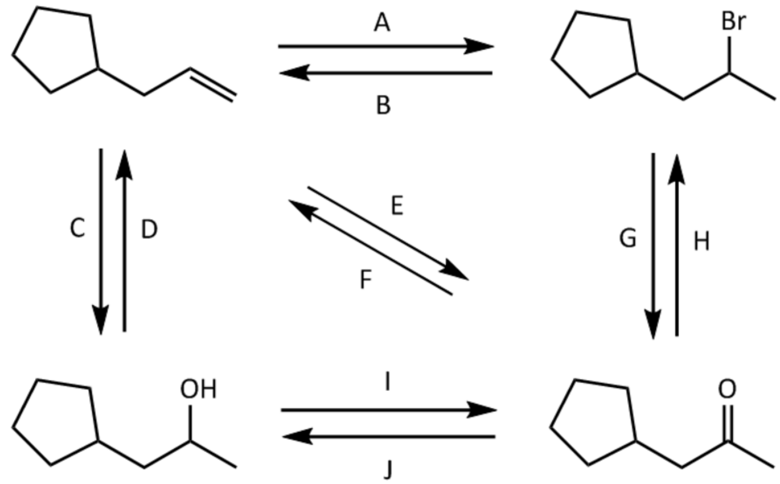
7. Show reagents and conditions to accomplish the following – show all intermediates. (Note that you will need to use a protecting group to be successful) (10 points)



8. For the following series of reactions, fill in the reagents necessary to accomplish each transformation (some of them require more than one step – be sure to use numbers (1., 2., etc) to show separate steps when necessary. You do not need to show any intermediates. Fill in your answers at the left: (50 points)

A.

B.



C.

D.

E.

F.

G.

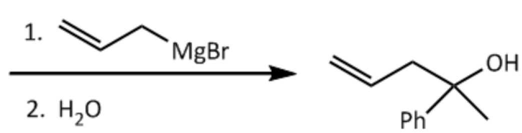
H.

I.

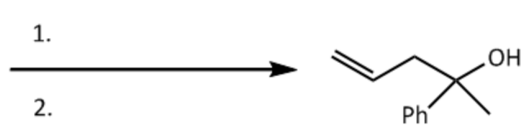
J.

9. Show all three possible methods to prepare the product alcohol using the using a Grignard reaction (a hint is given for the first case. (25 points)

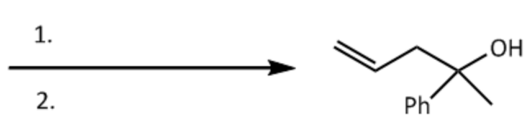
a.



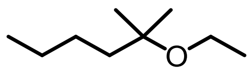
b.



c.



10. Show two (2) different syntheses of the following compound. One of the syntheses should be a Williamson ether synthesis, but there are several correct possibilities for the other. (10 points)

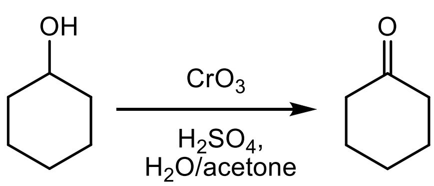


11. Name the product shown in Questions 9 and compound shown in Question 10. (10 points)

Question 9 ____

Question 10 ____

12. Show the mechanism for the oxidation of cyclohexanol to cyclohexanone using Jones' reagent. (Hint: consider what the chromium looks like in water in the presence of strong acid) (10 points)



13. *Challenge Extra Credit Problem.* The following reaction is known as the Meerwein-Ponndorf-Verley reduction (the MPV reaction). Suggest a mechanism for the transformation. This mechanism mimics the biochemical reaction of NAD+/NADH.

[Notice the reactant, isopropyl alcohol (*i*-PrOH) is involved also as a solvent and is attached to the aluminum as isopropoxide (*i*-PrO$^-$).] (10 points)