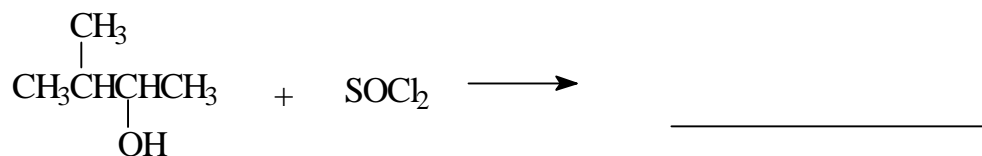


NAME: _____

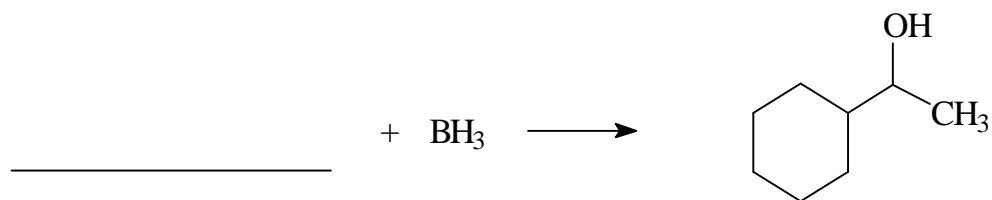
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1. Fill in the blank in the following equations with the correct structural formula. If stereochemical details are important, make sure your drawing shows these. Show any required catalysts over the arrow. [33 points]

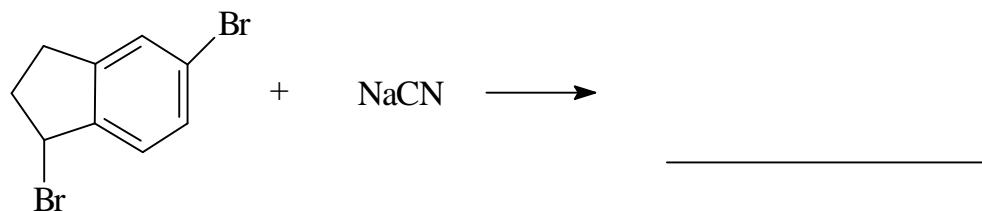
(a)



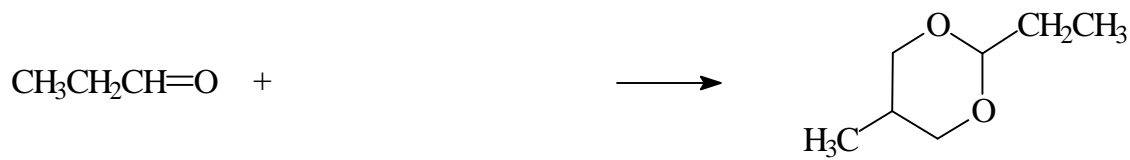
(b)



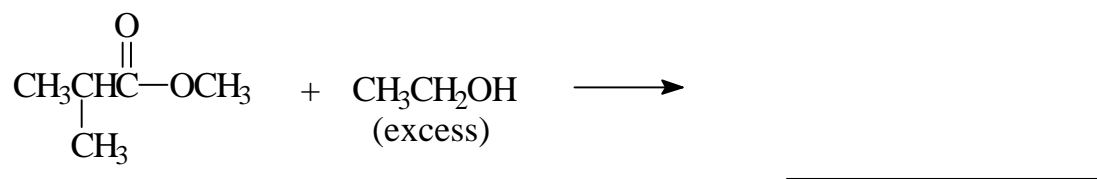
(c)



(d)



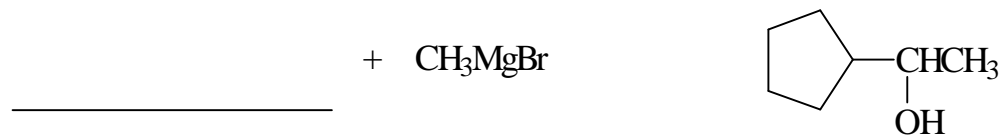
(e)



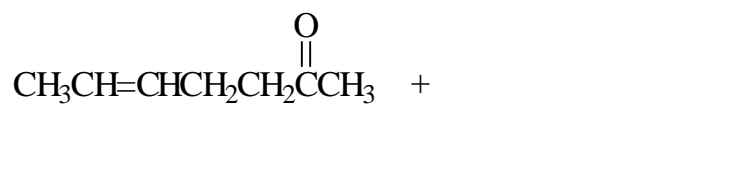
(f)



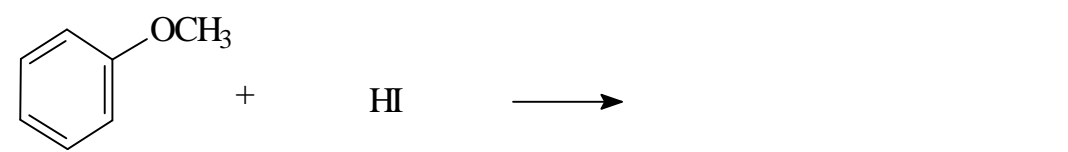
(g)



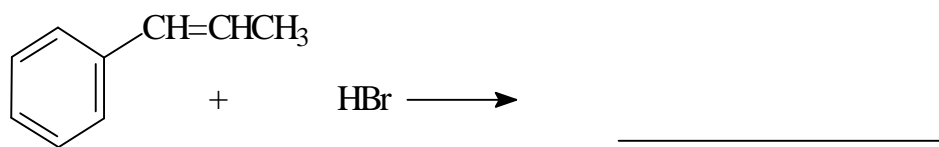
(h)



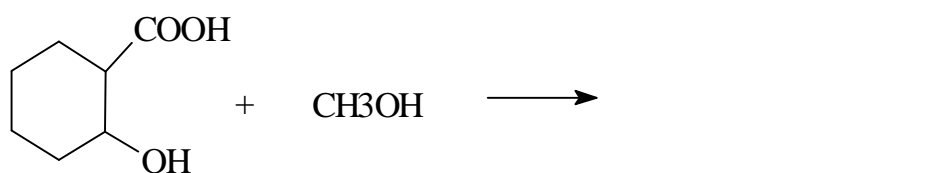
(i)



(j)

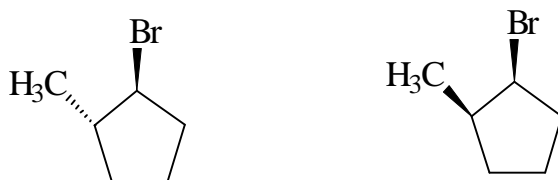


(k)

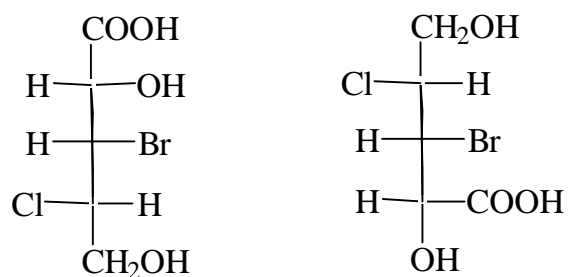


2. (a) Pick the word (enantiomer, diastereomer, identical, positional isomer) which correctly describes the relationship between each of the pairs of compounds shown below. [8 points]

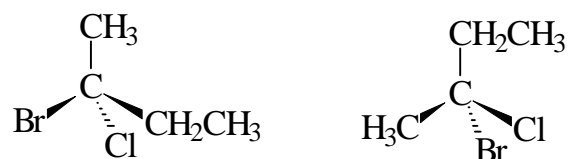
(i)



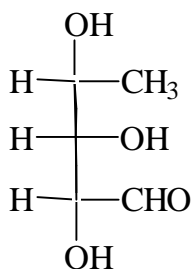
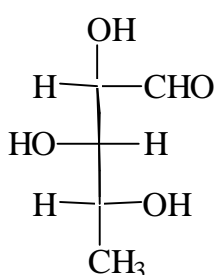
(ii)



(iii)



(iv)



(b) For each of the chiral centers in the left drawing of question 2(a)(iv), give the correct stereochemical descriptor (R or S). Show the priorities for each substituent and how you arrived at your answers. [6 points]

(c) Draw the Fischer projection of any meso form of the molecule with the general structure $\text{CH}_3\text{CH}(\text{OH})\text{CH}(\text{Br})\text{CH}(\text{OH})\text{CH}_3$. [3 points]

(d) Draw the NEWMAN projection of the less stable chair conformation of trans 3-methylcyclohexanol and label the substituents as being axial or equatorial. [4 points]

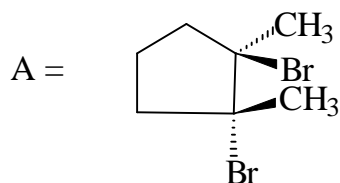
3. DO EITHER PART A OR PART B, NOT BOTH!!

A Draw the complete mechanism for the acid catalyzed reaction of excess methanol with 3-methylbutanal. Make sure you indicate which steps are reversible. Give the equation for the overall reaction AND give the IUPAC name for the product.

OR

B Draw the complete mechanism for the acid catalyzed reaction of methanol with ethyl 3-methylbutanoate. Make sure you indicate which steps are reversible. Give the equation for the overall reaction AND give the IUPAC name for the product. [10 points]

4. (a) Addition of Br_2 to 1,2-dimethylcyclopentene gives the trans dibromide **A** but addition of HBr to the same alkene gives two compounds. What are these, how are they related and why are they formed? [5 points]



(b) Show by equation how pentanoic acid can be prepared from each of the indicated starting materials. [4 points]

1-pentanol

1-bromobutane

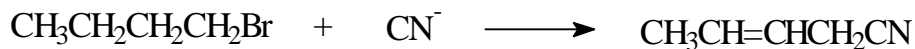
1-hexene

5-decene

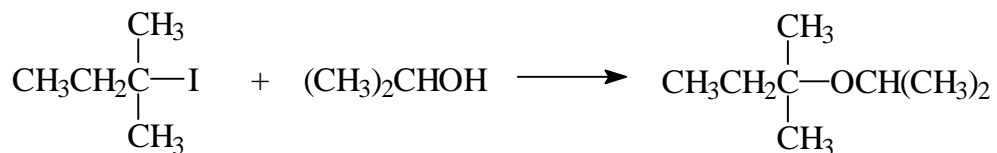
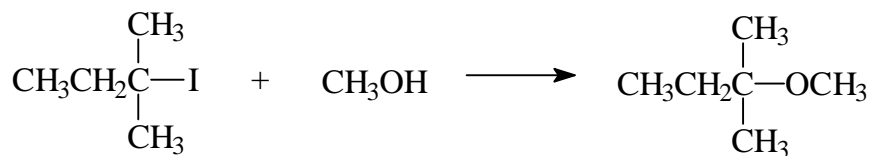
(c) The molecule IBr adds to alkenes by an electrophilic addition mechanism. If 1-methylcyclohexene is used as the alkene, predict the structure of the product. Your answer should include both stereochemistry and regiochemistry (i.e. which atom goes where). [5 points]

5. For each of the following pairs of reactions, answer the question asked and give a reason for your choice. [3 points each]

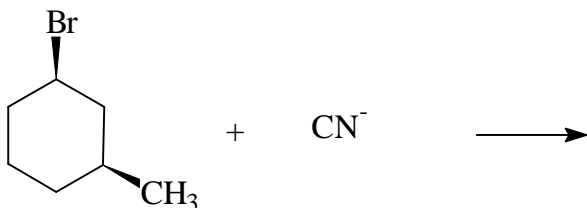
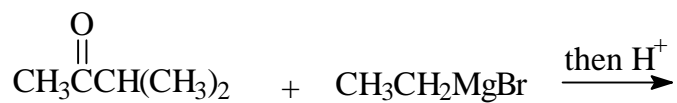
(a) Which reaction is more likely to proceed via a $\text{S}_\text{N}2$ mechanism?



(b) Which reaction is faster?



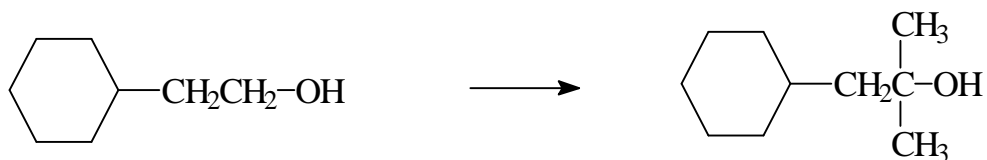
(c) Which reaction is more likely to give an optically active product?



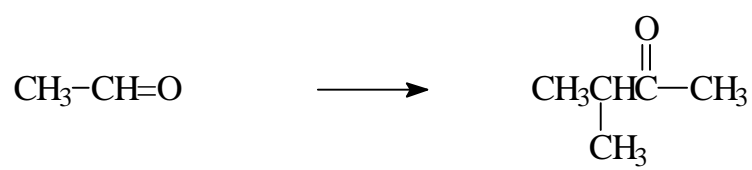
7. DO ANY TWO OF THE FOLLOWING THREE PARTS

Show by equation how you could convert the indicated starting material into the product shown. Each transformation may require up to three steps [8 points]

(a)



(b)



(c)

