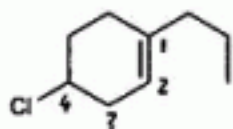


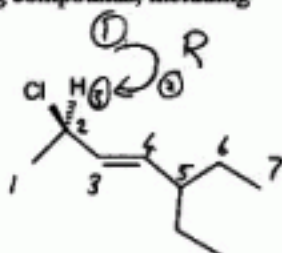
YOUR NAME _____

3 hours duration, 360 points total.

1. Give a systematic name for each of the following compounds, including stereochemistry:



4-chloro-1-propylcyclohexene



(2R)-chloro-5-ethyl-3-heptene

2. Which is the most stable from each set of three related structures?



Allows resonance
 \rightleftharpoons +

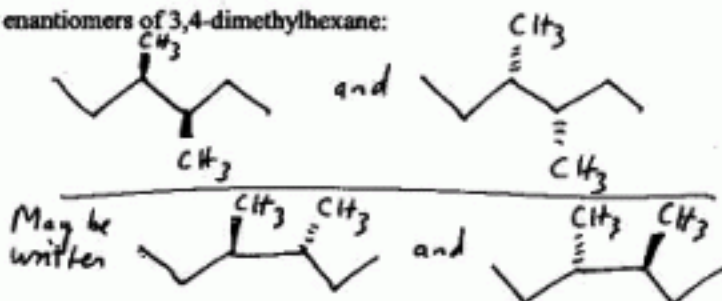
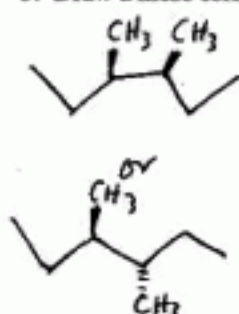


All double bonds trans,
no eclipsing
on central C-C bond

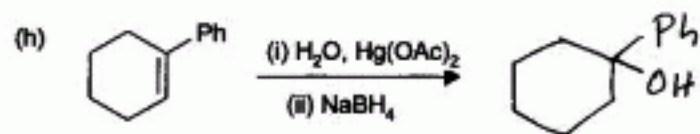
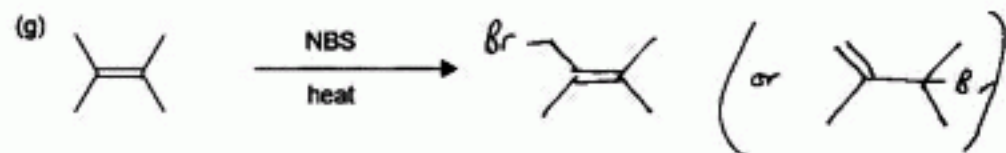
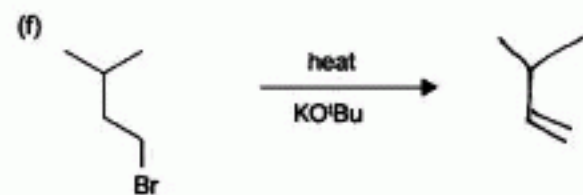
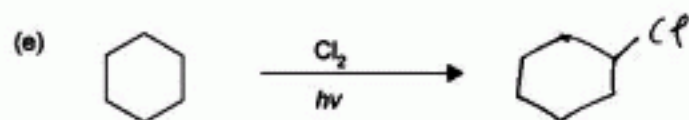
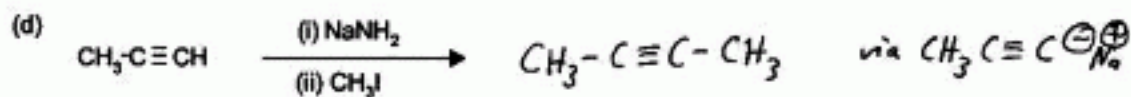
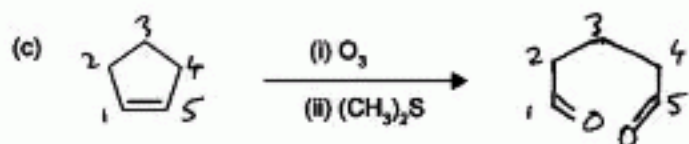
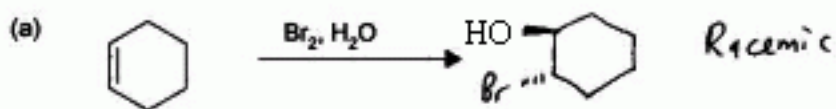


Chair with
CH₃ equatorial

3. Draw a meso form and two enantiomers of 3,4-dimethylhexane:



4. Predict the major product(s) of the following reactions (indicate stereochemistry):



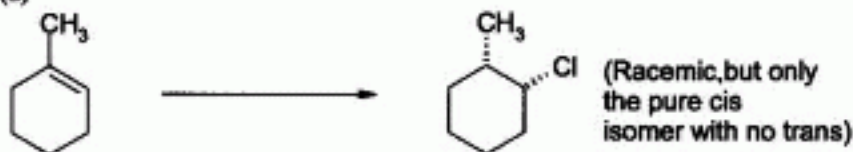
5. What reagent(s) might you use in order to effect the following transformations in a practicable manner? Indicate solvents and/or conditions (e.g. temp.) where appropriate.

- (a) $\text{Ph}-\text{C}\equiv\text{CH} \xrightarrow[\text{Lindlar catalyst}]{\text{H}_2} \text{Ph}-\text{C}(\text{H})=\text{CH}_2$
- (b) $\text{CH}_3-\text{C}(\text{H})=\text{C}(\text{H})-\text{CH}_3 \xrightarrow[\text{(ii) } (\text{CH}_3)_2\text{S}]{\text{(i) } \text{O}_3} 2 \text{ CH}_3-\text{C}(=\text{O})-\text{H}$
- (c) $\text{2,2,3-trimethylbutan-2-ol} \xrightarrow[\text{heat}]{\text{H}_2\text{SO}_4} \text{2,3-dimethylbut-2-ene}$
- (d) $\text{1-hexanol} \xrightarrow[\text{(or NaBr/H}_2\text{SO}_4 \text{ \& heat)}]{\text{PBr}_3} \text{1-bromohexane}$
- (e) $\text{1-bromo-3-methylpentane} \xrightarrow{\text{LiAlH}_4} \text{3-methylpentane}$
- (f) $\text{2-methyl-2-butene} \xrightarrow[\text{(ii) NaBH}_4]{\text{(i) H}_2(\text{OAc})_2, \text{CH}_3\text{OH}} \text{2-methoxy-2-methylbutane}$
- (g) $\text{trans-2-pentene} \xrightarrow{\text{OsO}_4} \text{trans-2,3-pentanediol}$
- (h) $\text{trans-1-bromo-2-methylcyclohexane} \xrightarrow[\text{heat}]{\text{KO}^+\text{B}_4} \text{1-methylcyclohexene}$

6. Show how you might perform **either one** of the syntheses shown below. You must use the starting material given as your sole source for all carbons in the product (you need not synthesize reagents which are not incorporated, however)

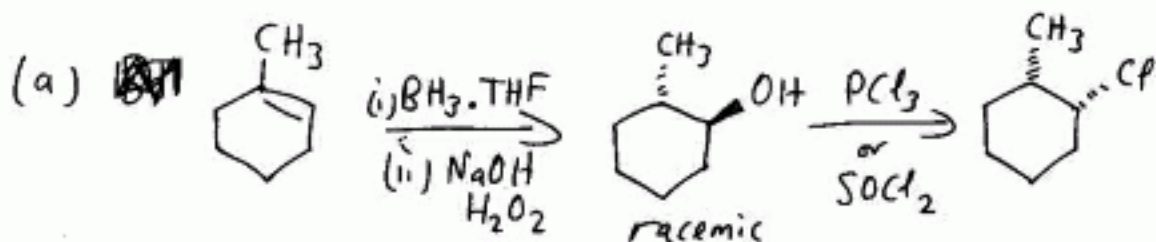
EITHER

(a)



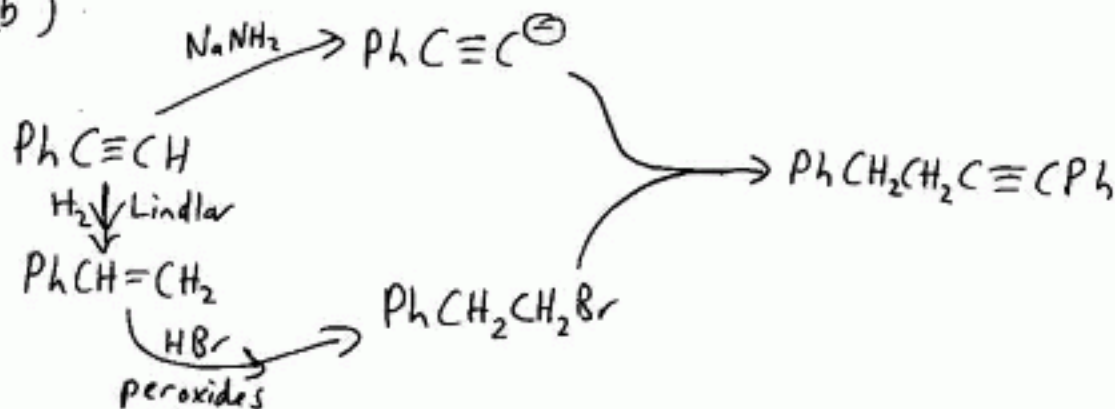
OR

(b)

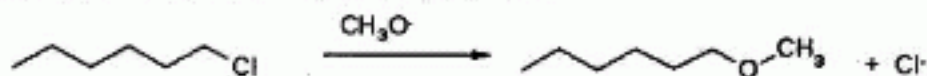


(Note: Under certain conditions SOCl_2 gives retention
 Under other - - - - - inversion
 PCl_3 usually does a std. $\text{S}_{\text{N}}2$, - - - - -
 Also HCl /peroxides won't work!

(b)



7. 1-Chlorohexane reacts with ${}^-\text{OCH}_3$ ion as shown:

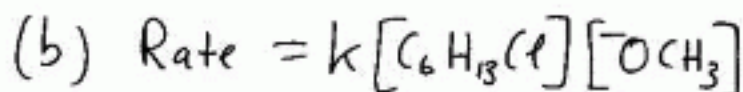
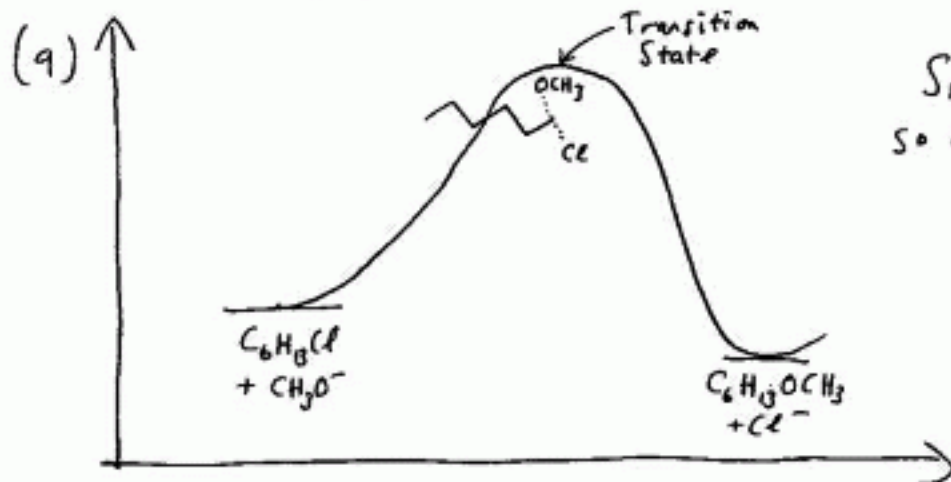


(a) Draw an energy curve for the reaction, and indicate which points on the curve correspond to any intermediates or transition states.

(b) Write a rate equation for the reaction.

(c) Which would you expect to be more reactive as a substrate in this reaction, 1-chlorohexane or 1-bromohexane?

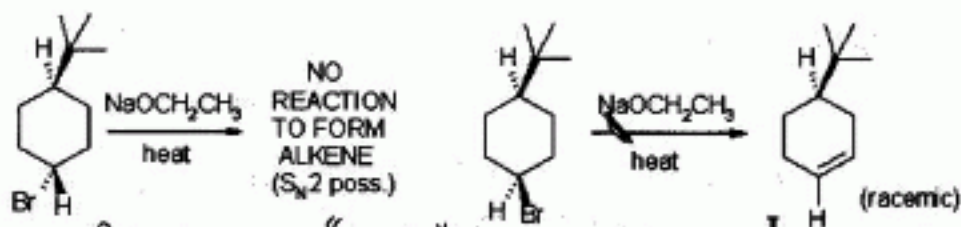
(d) What functional group has been formed in this reaction?



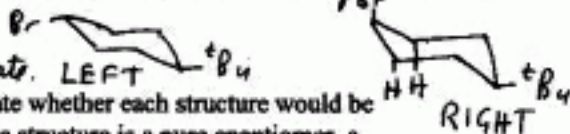
(c) 1-bromohexane

(d) Ether.

8. Explain why *trans*-1-bromo-4-*tert*-butylcyclohexane fails to react when heated with sodium ethoxide, whereas *cis*-1-bromo-4-*tert*-butylcyclohexane forms mainly alkene I.



The *tert*-butyl group "locks" the cyclohexane ring into one single chair, since a *tert*-butyl is too large to go axial. For elimination via E2 to occur, the H and the Br must be "anti" to one another - this requires both to be axial. With the left hand compound, the Br is locked equatorial, can't eliminate, but the Br in the right hand compound is axial & can eliminate.



9. In the reaction sequence shown below, indicate whether each structure would be expected to be optically active or not. Also, if the structure is a pure enantiomer, a racemic pair of enantiomers, or a mixture of diastereomers, indicate this. You will have to fill in the final structure (major one only) for yourself!

