

CHEM 203

Final Exam
December 16, 2014

ANSWERS

Your name: _____

This a closed-notes, closed-book exam

You may use your set of molecular models

This test consists of 10 pages

Time: 2h 30 min

1. _____ / 20

2. _____ / 20

3. _____ / 30

4. _____ / 30

5. _____ / 30

6. _____ / 40

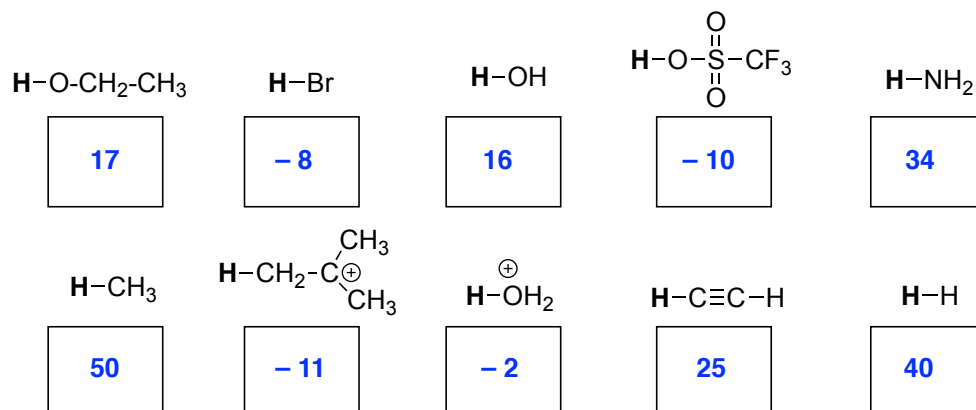
7. _____ / 40

8. _____ / 40

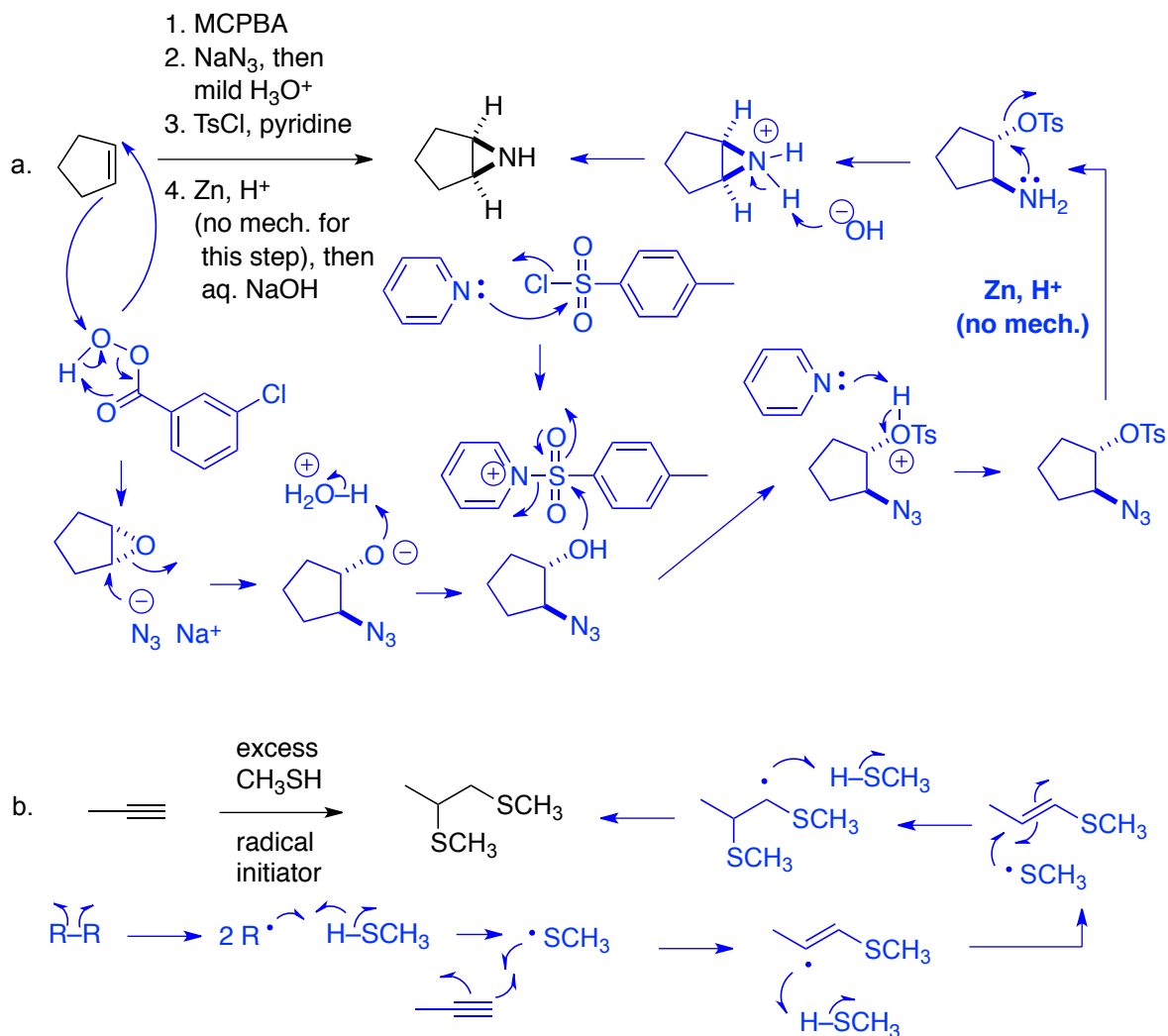
TOTAL _____ / 250 = _____ / 100

This exam counts for 37.5% of your CHEM 203 grade

1. (20 pts.) Indicate the approximate pKa for the dissociation of the protons in boldface in the following molecules (write your answers in the appropriate boxes):

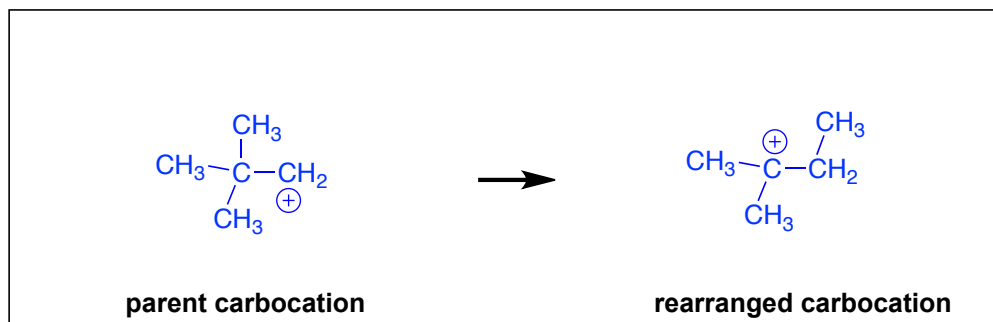


2. (20 pts.) Write an accurate mechanism for the following known reactions:

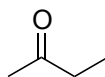


3. (30 pts) In the appropriate boxes, draw:

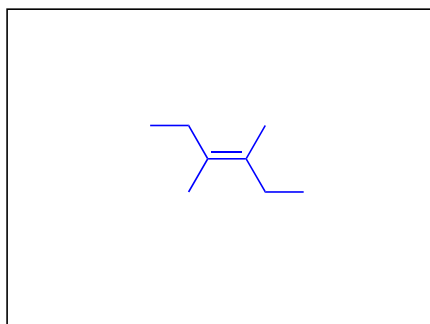
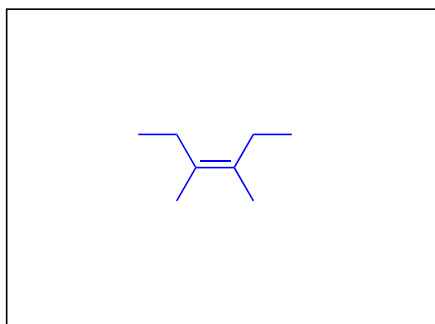
- a. The structure of a carbocation that is stabilized by **NO** hyperconjugative interactions with C–H bonds, and that will rearrange to form a new carbocation stabilized by eight hyperconjugative interactions with C–H bonds:



- b. The structures of **two** isomeric alkenes that furnish only compound **A** upon treatment with O_3 followed by Zn / H^+ (write your answers in the appropriate boxes):

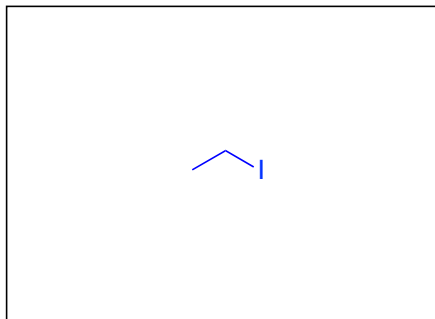


A

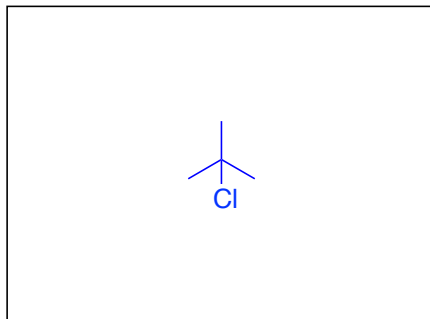


- c. The structure of an alkyl halide that is likely to react with CH_3ONa to give a product of substitution, and of one that is likely to react with CH_3ONa to give a product of elimination:

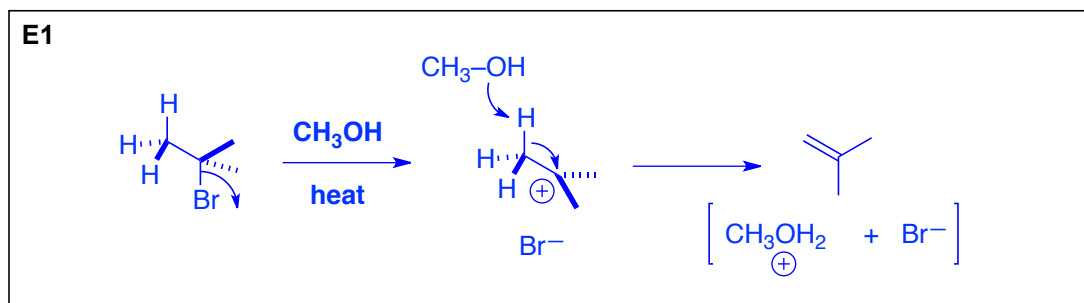
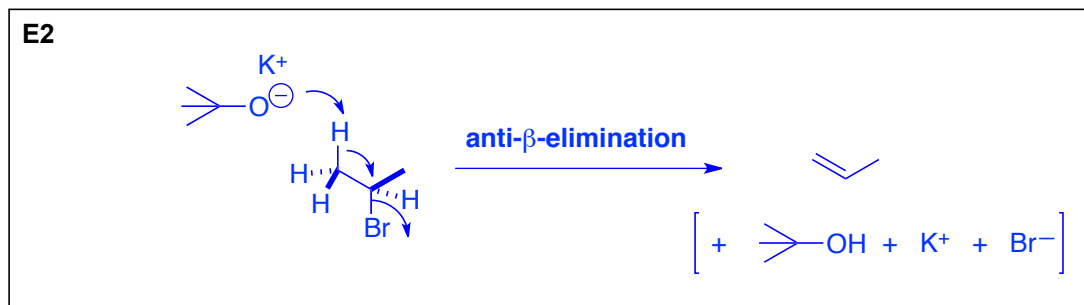
undergoes substitution



undergoes elimination

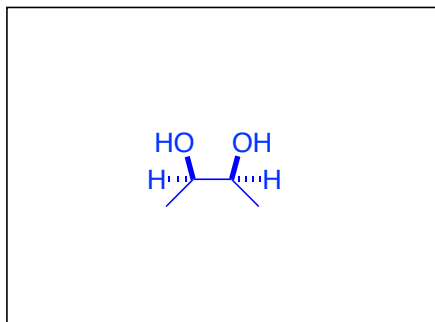


d. Accurate mechanisms for an example of E2 reaction and an example of E1 reaction:

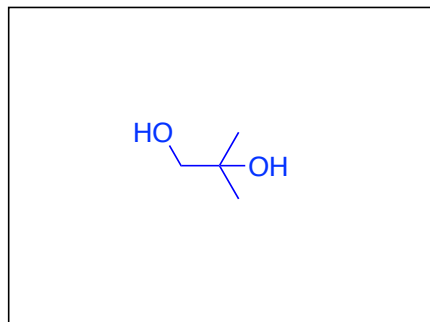


e. The structure of an achiral molecule that is a meso form, and that of an achiral molecule that is not a meso form:

achiral and meso

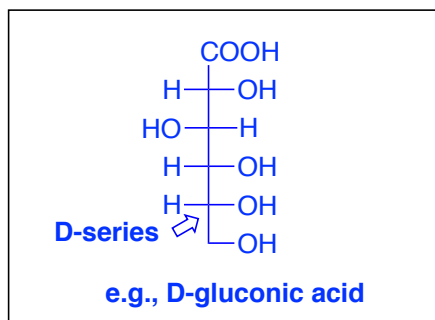


achiral, but not meso

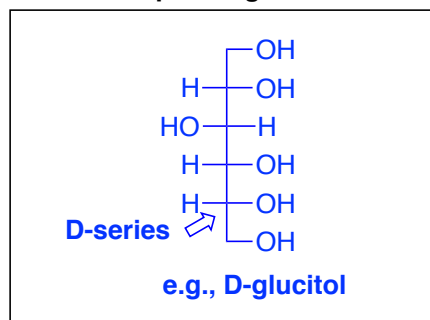


f. Fischer projections of a D-aldonic acid and of the corresponding D-alditol:

D-aldonic acid



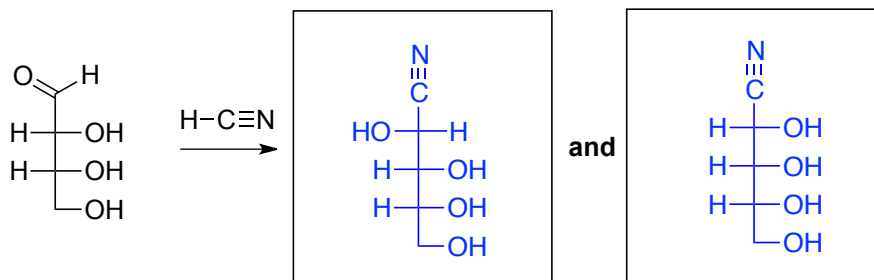
corresponding D-alditol



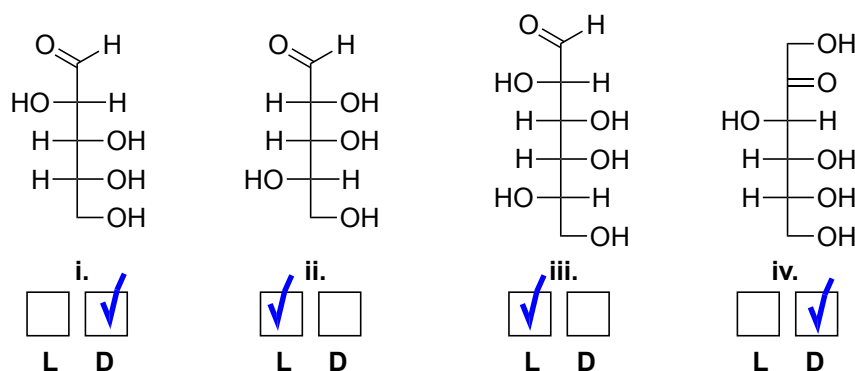
other answers may be acceptable

4. (30 pts.) Indicate:

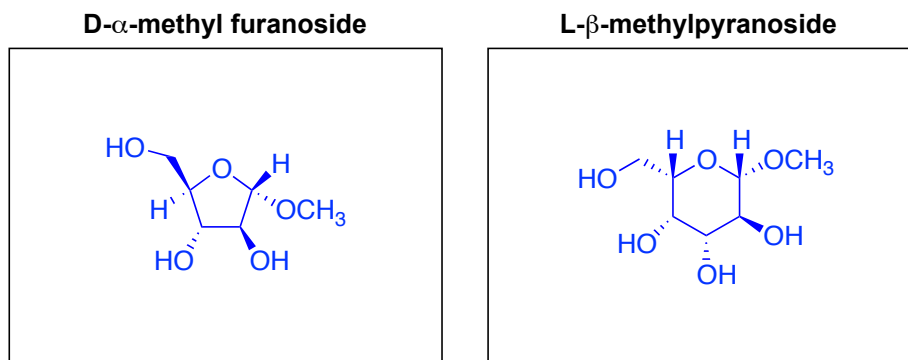
a. the structure of the products obtained from the following reaction:



b. whether sugars i.-iv. below belong to the D or the L series (check the appropriate box):



c. the structure of the α -methyl furanoside obtained upon reaction of the D-pentose shown in part b. with CH_3OH and acid, and that of the β -methyl pyranoside obtained upon reaction of the L-hexose shown in part b. also with CH_3OH and acid:

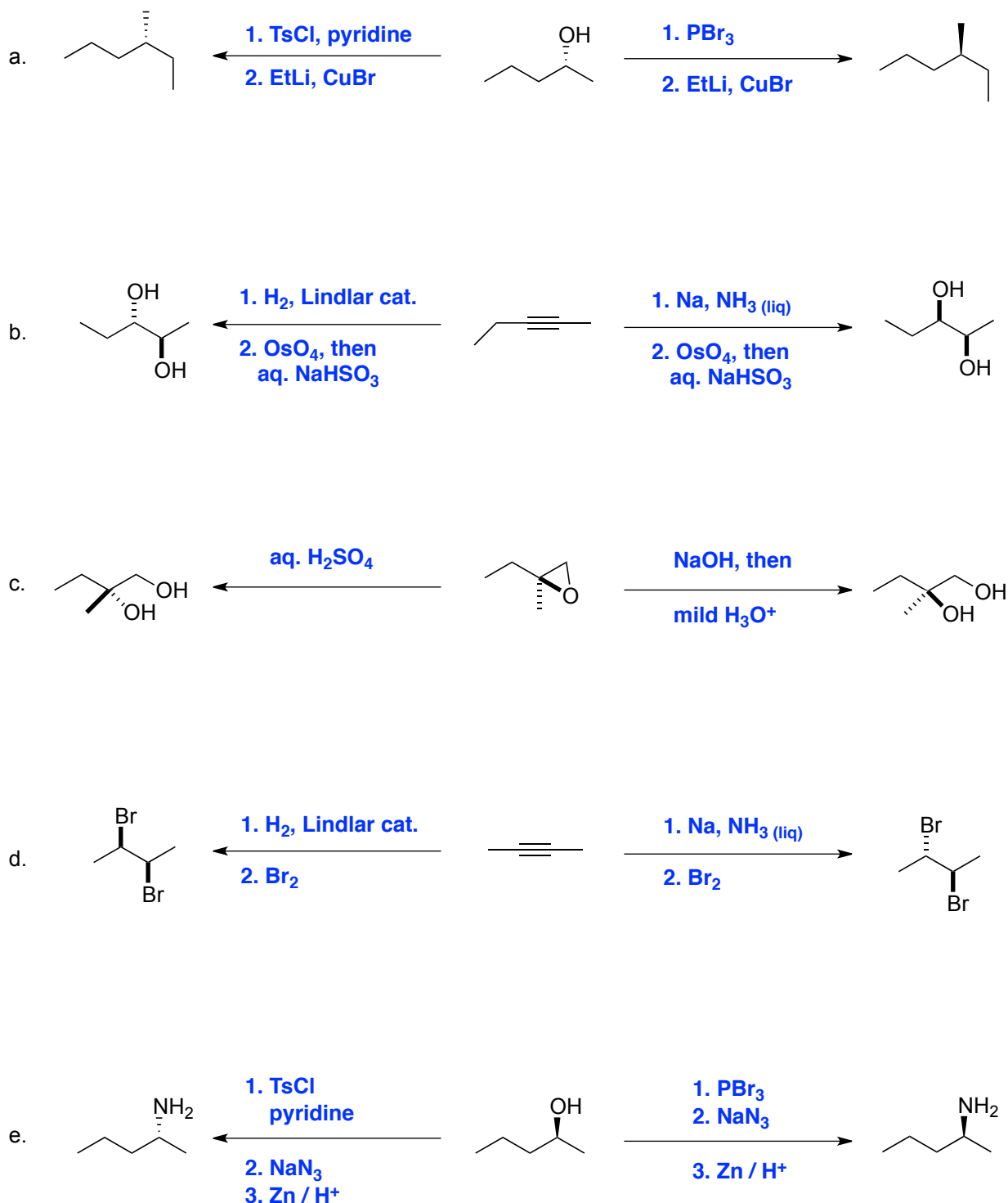


d. whether sugars i.-iv. above will react with NaBH_4 to give one or two products (check the appropriate box):



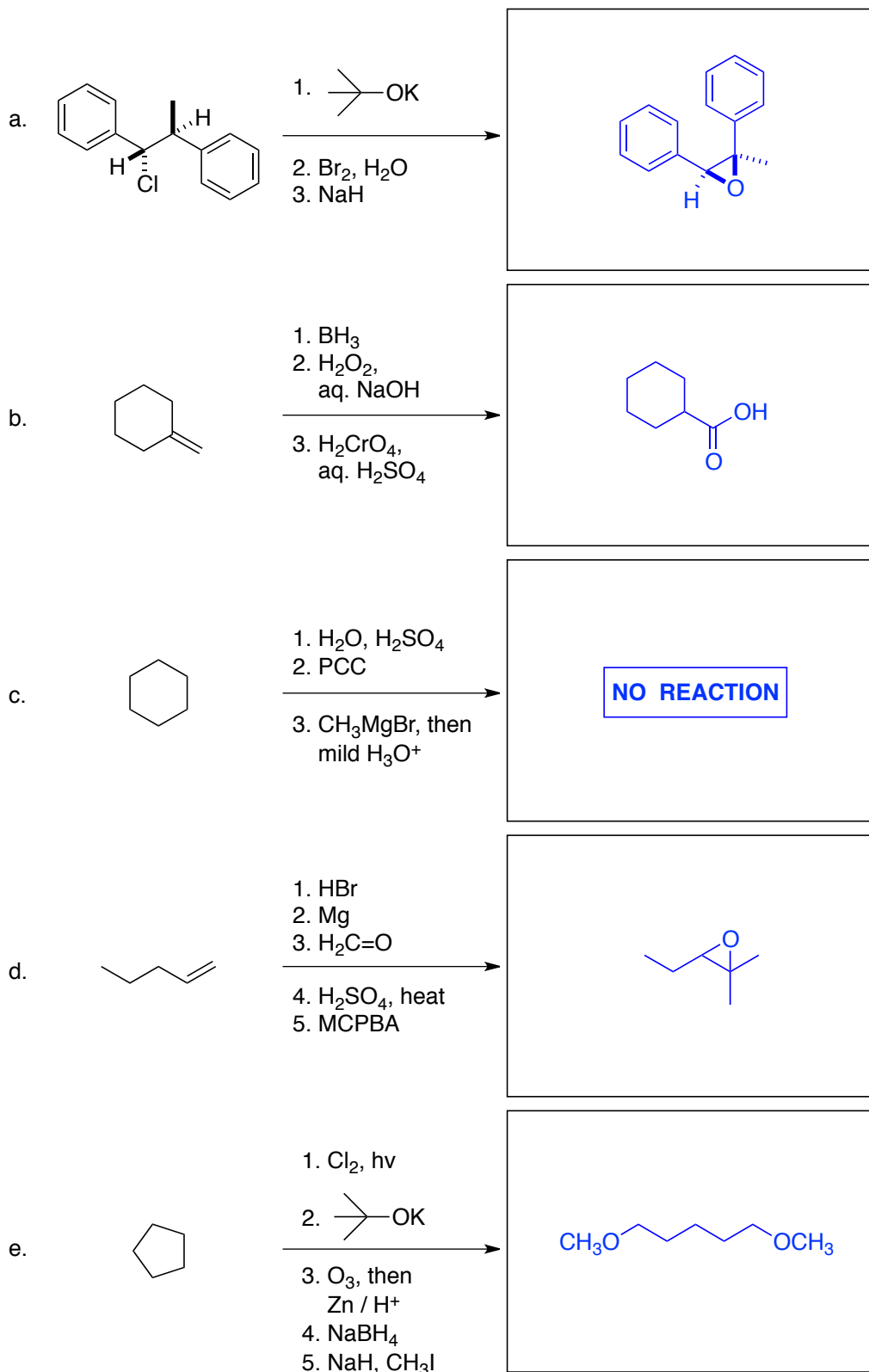
5. (30 pts) Complete the following equations by indicating all the reagents, in the correct order, that are required to achieve the stereoselective reactions shown. List the various reagents above / below the reaction arrows.

Note: it is understood that chiral products obtained from achiral substrates will be racemic

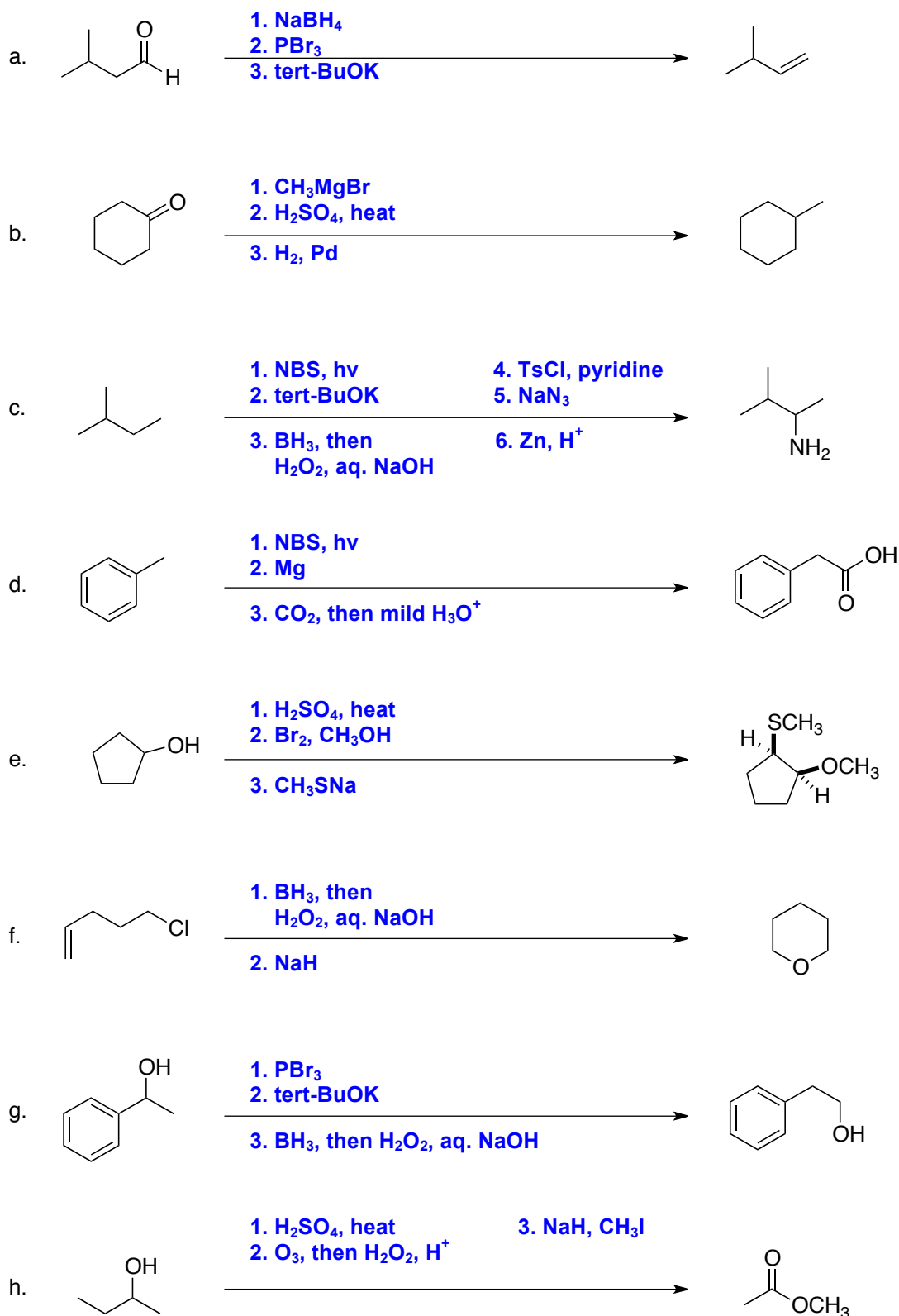


other answers may be acceptable

6. (40 pts.) Draw the structure of the major product expected from the following reactions (write your answer in the boxes). If no change is predicted, answer "NO REACTION."



7. (40 pts.) Indicate all the reagents, catalysts, etc., in the correct order, that are necessary to induce the transformations shown below. List such reagents above / below the reaction arrows. **NOTE:** aqueous workups are understood and do not need to be shown.



other answers may be acceptable

8. (40 pts.) Propose a good synthesis of the molecules shown below using **only methanol**, **acetylene** and **ethylene oxide** (see below) as the sources of carbon atoms. Intermediates / products obtained during an earlier sequence may be employed in a subsequent procedure. Assume the availability of all necessary reagents (such as bases, acids, BH_3 , Mg , TsCl , PCC , PBr_3 , MCPBA , etc.).

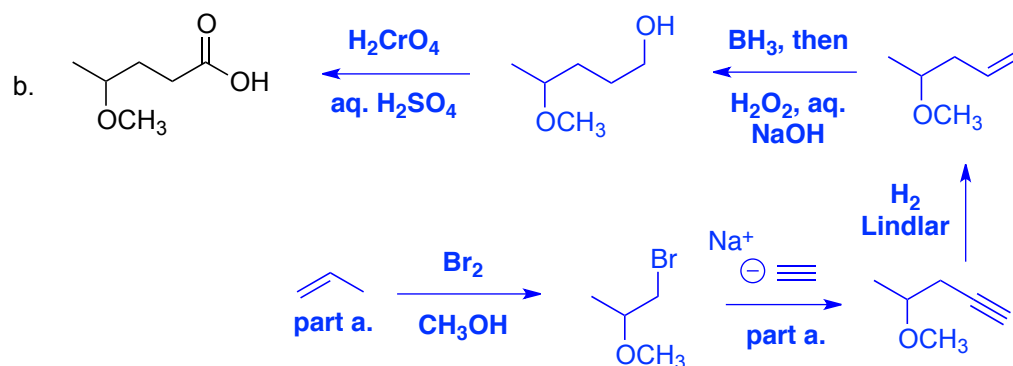
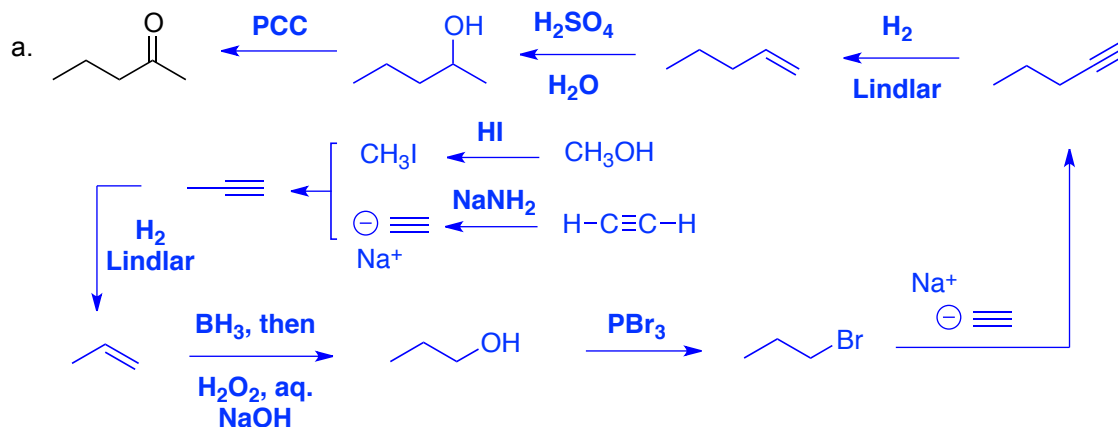
methanol: CH_3OH

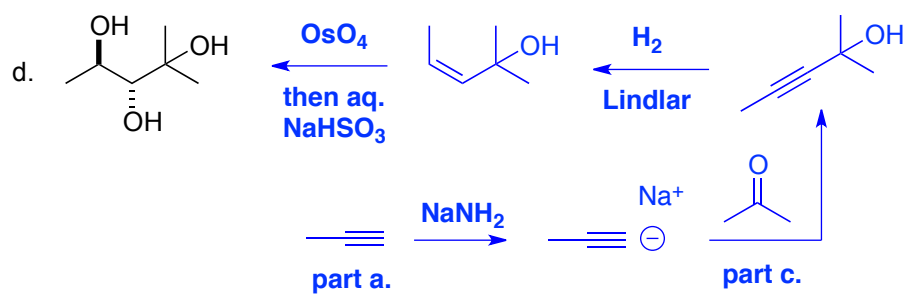
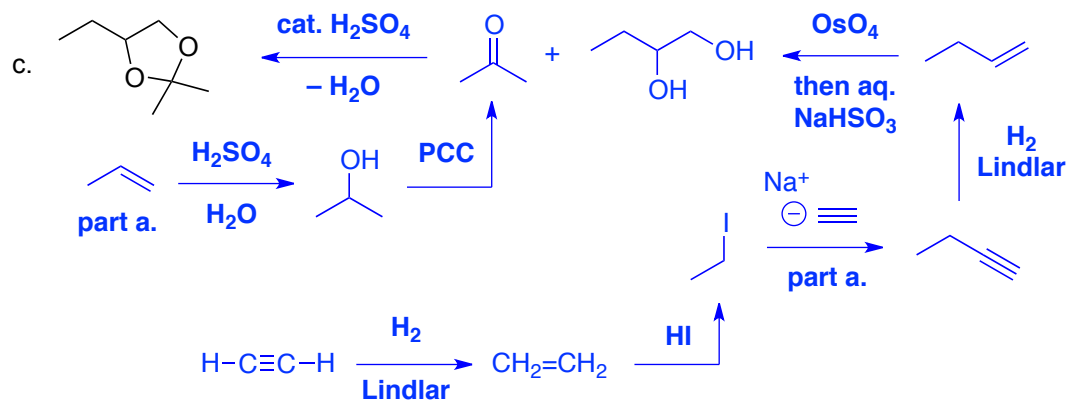
acetylene: $\text{H}-\text{C}\equiv\text{C}-\text{H}$

ethylene oxide: $\text{H}_2\text{C}-\overset{\text{O}}{\text{C}}-\text{CH}_2$

Important:

- Aqueous workups at the end of each reaction are understood and need not to be shown.
- It is not necessary to write mechanisms.





other answers may be acceptable

Happy Holidays!