

Chemistry 3351 Organic Chemistry  
Thursday: Oct. 21<sup>st</sup> / @ 7:00pm → 9:00 / 2<sup>nd</sup> Exam

Name: \_\_\_\_\_ (please print)

Page	Possible Points	Score
2	<u>9</u>	_____
3	<u>9</u>	_____
4	<u>10</u>	_____
5	<u>12</u>	_____
6	<u>10</u>	_____
7	<u>10</u>	_____
8	<u>9</u>	_____
9	<u>10</u>	_____
10	<u>10</u>	_____
11	<u>10</u>	_____
12	<u>10</u>	_____
TOTAL	<u>109</u>	_____

1. (3 pts each) *Clickers* in action:

i) Predict the major product in the reaction of 3-methyl-1-butene with 1 M  $\text{HNO}_3$ .

A) 3-Methyl-butan-1-ol

B) 3-Methyl-butan-2-ol

C) 2-Methyl-butan-2-ol

D) 3-Methyl-butan-1-ol

ii) Predict the major product in the reaction of 3-methyl-2-pentene with  $\text{Cl}_2$  in  $\text{H}_2\text{O}$  as the solvent.

A) 2-Chloro-3-methyl-pentan-3-ol

B) 3-Chloro-3-methyl-pentan-2-ol

C) 4-Chloro-3-methyl-pentan-3-ol

D) 3-Chloro-3-methyl-pentan-4-ol

iii) Predict the product in the reaction between 3-methyl-2-pentene and  $\text{Cl}_2$  in  $\text{CCl}_4$  as the solvent.

A) 2, 3-Dichloro-2-methylpentane

B) 2, 3-Dichloro-3-methylpentane

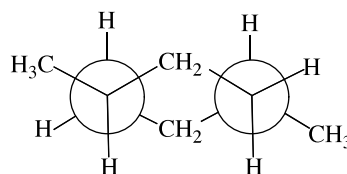
C) 2, 2-Dichloro-3-methylpentane

D) 3, 3-Dichloro-2-methylpentane

iv) Consider the reaction of 1-butene with  $\text{Br}_2$  in aqueous solution and identify the nucleophilic species that leads to the major product in this reaction.

- A)  $\text{Br}_2$
- B)  $\text{Br}^\ominus$
- C)  $\text{HO}^\ominus$
- D)  $\text{H}_2\text{O}$

v) The IUPAC name of the compound



is:

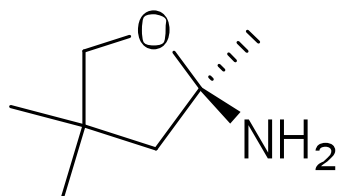
- A) *cis*-1, 3-dimethylcyclohexane.
- B) *trans*-1, 3-dimethylcyclohexane.
- C) *cis*-1, 4-dimethylcyclohexane.
- D) *trans*-1, 4-dimethylcyclohexane.

vi) Which reaction conditions would you select to synthesize 3-methylpentan-2-ol from 3-methylpent-2-ene?

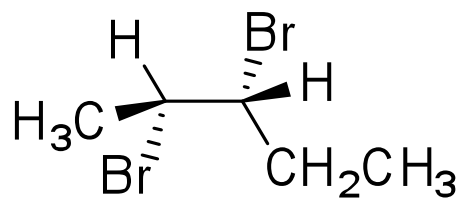
- A)  $\text{H}_2\text{O}$ , concentrated  $\text{H}_2\text{SO}_4$
- B)  $\text{Br}_2$ ,  $\text{H}_2\text{O}$
- C)  $\text{BH}_3$ , THF; followed by  $\text{H}_2\text{O}_2 / \text{OH}^\ominus$
- D)  $\text{Hg}(\text{OAc})_2$ , THF- $\text{H}_2\text{O}$ ; followed by  $\text{NaBH}_4$ ,  $\text{OH}^\ominus$

2. (10 pts) For each of the following compounds, assign **R** or **S** at each asymmetric carbon.

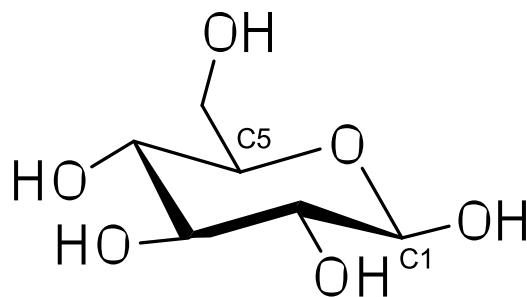
a)



b)



c) Assign C1 and C5 carbons only:



3. (12 pts) Draw structures for each of the following compounds.

a) (1*R*, 3*R*)-1, 3-dimethylcyclohexane

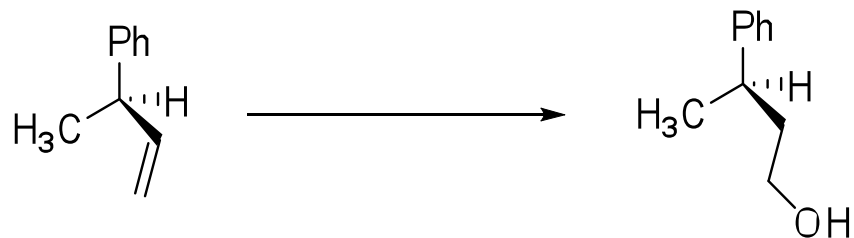
b) (3*S*, 4*R*)-3-bromo-4-methylhexane

c) The *meso* isomer of 1, 3-dimethylcyclopentane

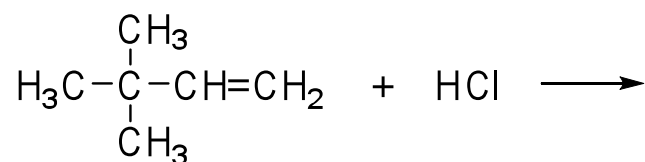
d) An optically active isomer of 1, 2-dichlorocyclobutane

4. (10 pts)

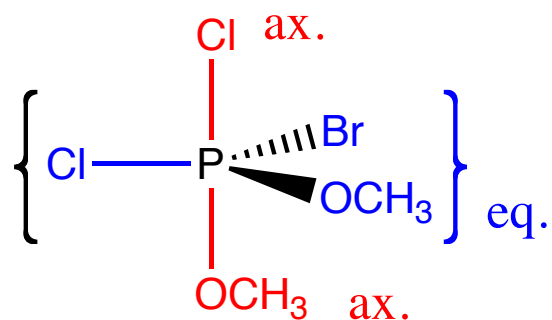
a) Show how the following conversions might be accomplished.



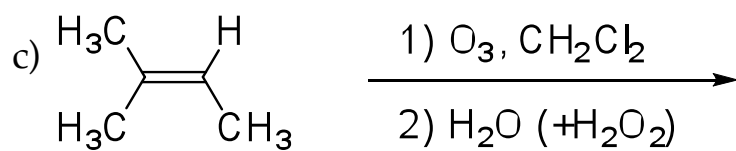
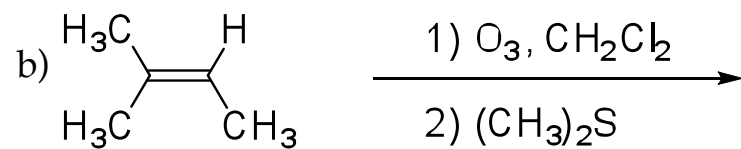
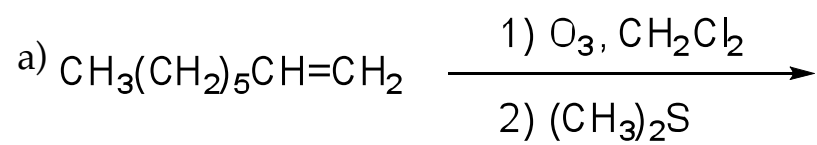
b) Show the products of these addition reactions. Show the mechanism for the addition step(s).



5. (10 pts) In a structure containing a pentacoordinate phosphorus atom, the bonds to three of the groups bound to phosphorus (equatorial) lie in a plane containing the phosphorus atom and the bonds to other two groups (axial) are perpendicular to this plan. Is this compound chiral? Explain.

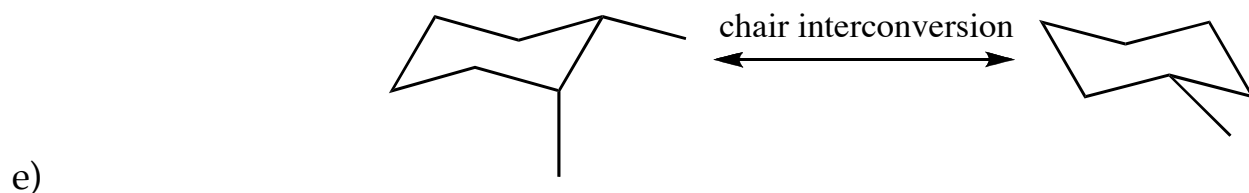
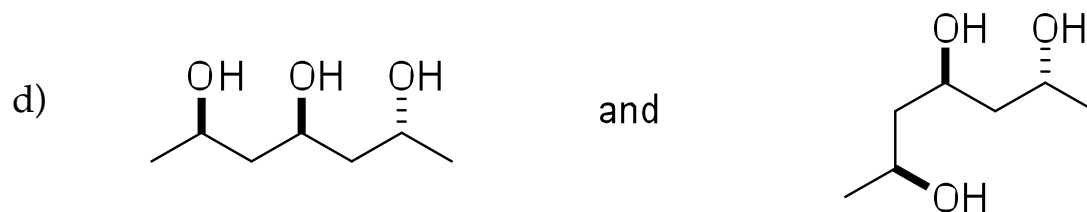
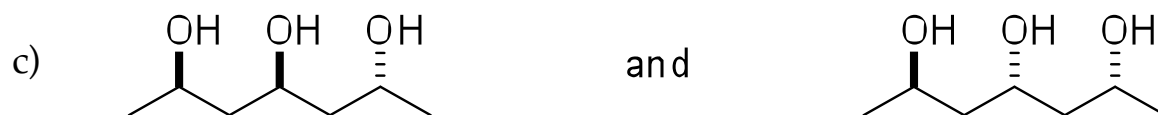
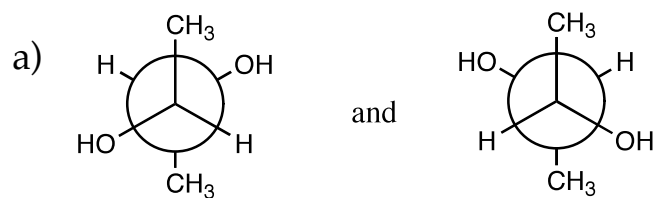


6. (12 pts) Provide the ozonolysis products.

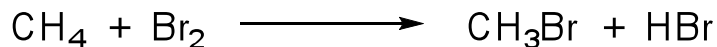




7. (10 pts) Determine the relationship (i.e. identical, enantiomers, diastereomers, constitutional isomers) between each of the following pairs of molecules.



8. (10 pts) Draw a mechanism for the two propagation steps in the bromination of methane. The overall reaction is shown here:



For full credit, include all curved arrows, unpaired electrons, lone pairs of electrons, and any non-zero formal charges.

First propagation step:

Second propagation step:

Calculate the overall enthalpy change for this bromination. The bond dissociation energies you will need are given below. Draw a box around your answer.

C-H in methane: 104 kcal/mol; Br-Br: 46 kcal/mol; H-Br: 88 kcal/mol

C-Br in CH<sub>3</sub>Br: 70 kcal/mol

9. (10 pts) Give the structure of every stereoisomer of 1,2,3-trimethylcyclohexane (ignore conformational isomers). Label the enantiomeric pairs and show the plane of symmetry in each achiral stereoisomer.

10. (10 pts) How many distinct *meso* compounds are possible for  $C_6H_{12}Cl_2$ ? Draw the structures of each *meso* compound and indicate plane of symmetry.

!

!

!