CHEM 2410 – Principles of Organic Chemistry I – Summer 2016

Instructor: Paul Bracher

Quiz #4

Due: Sunday, June 19th, 2016

4:00 p.m. (online/Blackboard)

Student Name (Printed)	Solutions
Student Signature	N/A

Instructions & Scoring

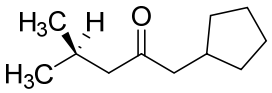
- Please post your answers to Blackboard. No answers marked in this booklet will be graded.
- You may use any resources you wish and collaborate with others.
- Any questions should be posted to the Blackboard discussion board so all students have equal access to the information.

Problem	Points Earned	Points Available
TOTAL		100

Questions, Required Information, Supplementary Information

Multiple choice (100 points total; +10 points for a correct answer, +3 points for answering with the letter "E", and 0 points for an incorrect answer). For each question, select the best answer of the choices given.

(1) B Not counting those corresponding to solvents or reference standards, how many signals appear in the ^{13}C NMR spectrum for compound **A**?



A

(A) seven or fewer
(B) eight
(C) nine
(D) ten or more

Note that the two methyl groups are equivalent.

(2) D Which isomer of C_4H_8O will give rise to the signal in an ^1H NMR spectrum that is the farthest downfield?

(A) (B) (C) (D)

(3) A An unknown compound has a molecular ion peak in its mass spectrum split into m/z 210:212:214 with relative intensities of 18:24:6. Which of the following statements is most likely to be true of the compound?

(A) it has one bromine atom and one chlorine atom
(B) it has two chlorine atoms
(C) it has two bromine atoms
(D) it has three bromine atoms

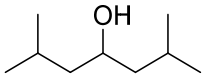
(4) C How many sets of inequivalent protons contribute to the ^{1}H NMR spectrum of compound **B**? Note that a set can contain as few as one proton, so long as it is magnetically inequivalent from the others.

B

(A) three
(B) four
(C) five
(D) six

It helps to draw a 3-D structure to see how different hydrogens have different distances/relationships to the chloride atom.

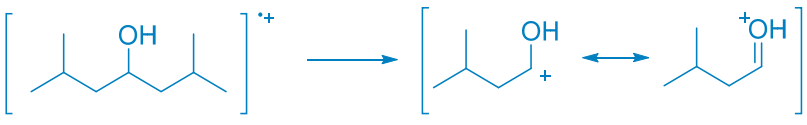
(5) C Of the four peaks listed below, which would you expect to have the greatest intensity in the mass spectrum of compound **C**?



C

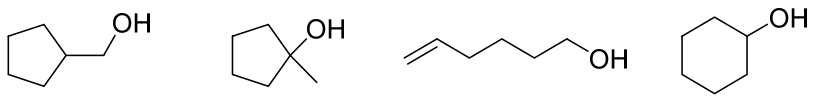
(A) m/z 15
(B) m/z 43
(C) m/z 87
(D) m/z 145

Alcohols have a tendency to form resonance-stabilized fragments after cleavage of the bonds between the α and β carbons:



m/z = 87

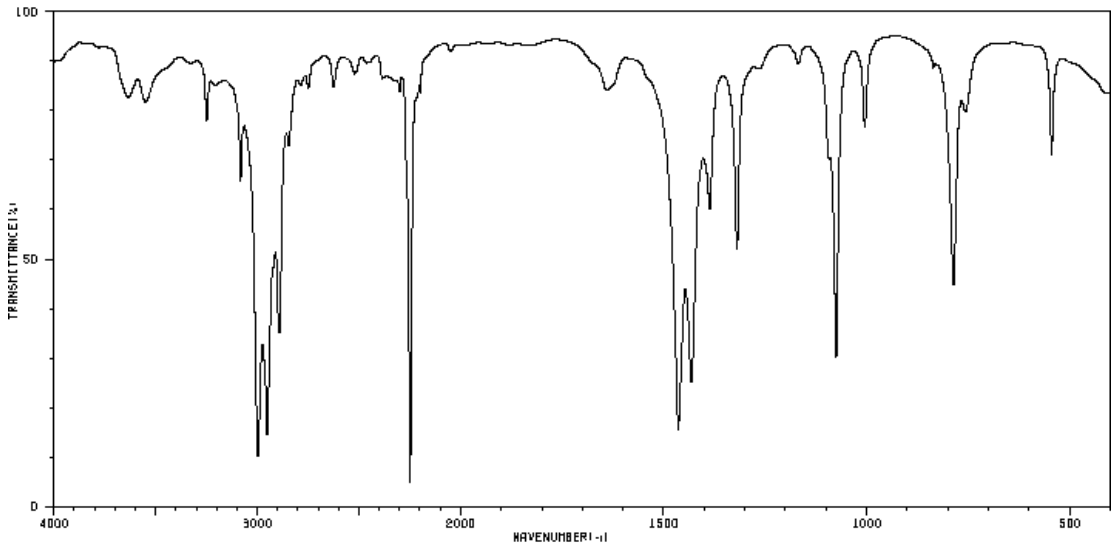
(6) B Which of the following isomers of $C_6H_{12}O$ will <u>not</u> be oxidized by pyridinium chlorochromate?



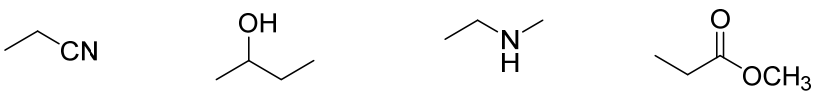
(A) (B) (C) (D)

Tertiary alcohols cannot be oxidized directly by any reagents we have learned.

(7) A Which of the following compounds is consistent with the following IR spectrum?



Source: Spectral Database for Organic Compounds, #957
http://sdbs.db.aist.go.jp/



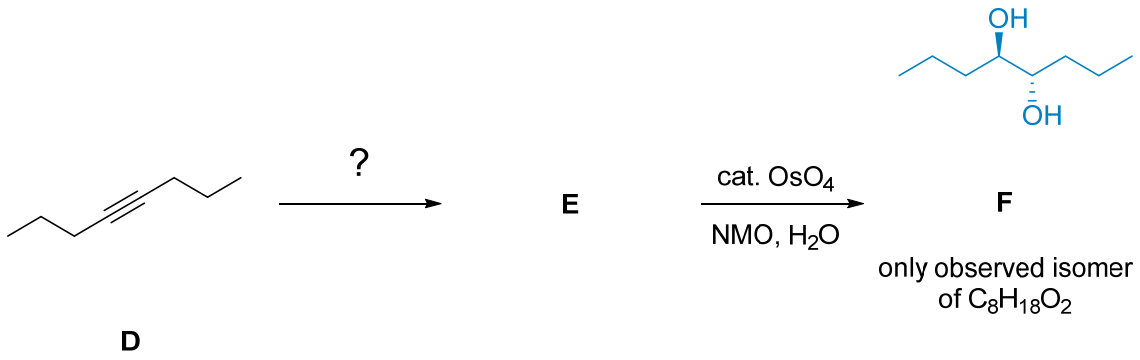
(A) (B) (C) (D)

(8) A Which of the following compounds is least likely to be found in the reaction mixture when 2-hexyne is treated with one equivalent of H_2 in the presence of a catalytic quantity of palladium on carbon (Pd-C)?

(A) (*E*)-2-hexene
(B) (*Z*)-2-hexene
(C) 2-hexyne
(D) hexane

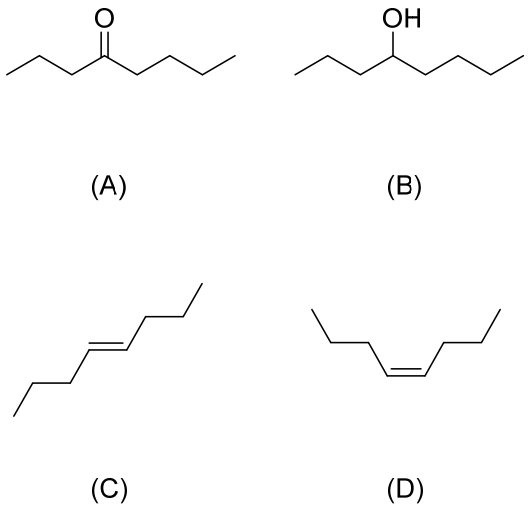
Because (i) the starting material has two π bonds and only 1 equivalent of H_2 is used and (ii) Pd-C is not a selective catalyst, the hydrogenation will be incomplete. But since each hydrogenation step proceeds selectively with syn stereochemistry, we wouldn't expect to find much *E*/*trans* alkene.

For questions 9 and 10, refer to the following reaction scheme, in which compound **D** is converted to compound **E**, which in turn is subjected to the Upjohn dihydroxylation to produce one isomer of $C_8H_{18}O_2$ as the major product, in excellent yield.



Since the dihydroxylated product has only one isomer, we expect it to be a meso compound. Since the Upjohn dihydroxylation proceeds with syn addition, we require the *cis* alkene as the starting material if we want to make the meso product.

(9) D Which of the following is compound **E**?



(10) A What reagent(s) are required for the conversion of **D** to **E**?

(A) H_2, Lindlar catalyst
(B) Na / NH_3
(C) PCC
(D) 1. $LiAlH_4$; 2. H_2O