EXAM 3

Organic Chemistry

Chemistry 220a

Friday, November 5, 1999

NAME (print): _____

TA:_____ Day:_____ Section Time:_____

Important points are in **bold**.

Complete the section above and put your **name** on pages 2-6.

Take a few moments to look over the exam. Answer each question on the exam paper.

Do all **preliminary** drawing or computations on the **Work Sheets** at the end of the exam. **They will not be graded.**

A **Periodic Table** is on page 7 of the exam should you need it.

The exam is 55 minutes.

STOP writing when you are told to do so.

REMEMBER: Neatness is to your advantage.

1. (25 pts) _____

2. (20 pts) _____

3. (20 pts) _____

4. (20 pts) _____

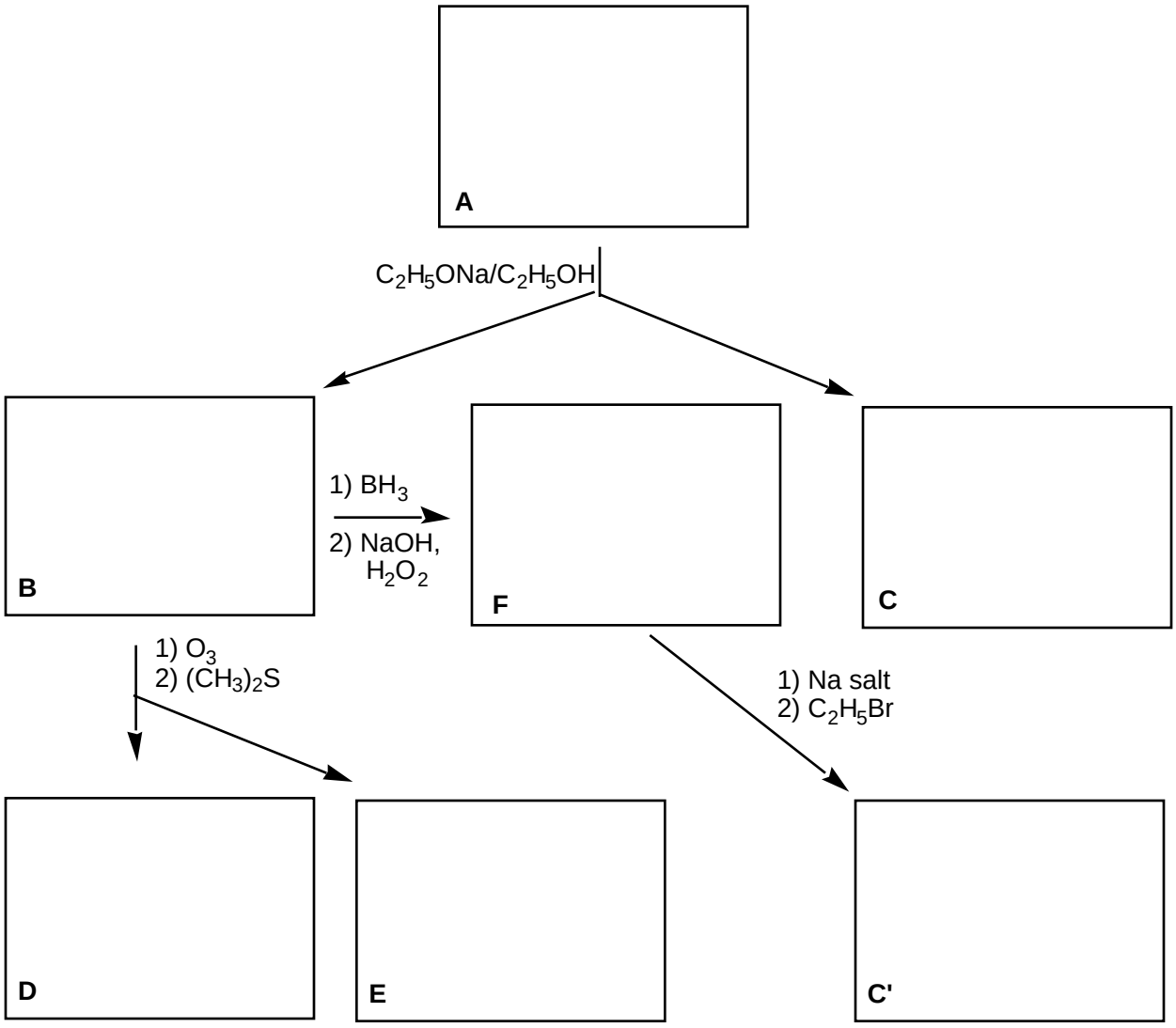
5. (15 pts) _____

_____

Total (100 pts)

1) (25 pts) An optically-active compound (*R*)-**A** ($C_5H_{11}Br$) reacts with C_2H_5ONa in C_2H_5OH to give **B** (C_5H_{10}) and **C** ($C_7H_{16}O$). Ozonolysis and dimethyl sulfide reduction of **B** produces ketone **D** and aldehyde **E**. Ketone **D** is shown not to be acetone (2-propanone)! Hydroboration and alkaline hydrogen peroxide oxidation of **B** gives **F** ($C_5H_{12}O$). The sodium salt of **F** reacts with ethyl bromide to form **C'**, which differs from **C** in one way.

a) Place the structures of **A**-**F** in the appropriate boxes with any **brief** commentary.

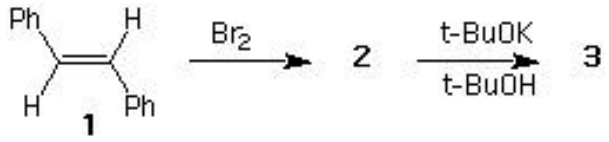


b) How do **C** and **C'** differ?

2) (20 pts) Design an **efficient** synthesis of 2-hexanone (a ketone) from acetylene and ethylene. All reagents are available to you.

3) (5 x 4 pts = 20 pts) In each of the following reactions, provide the reactant, product, or reagents as required. If there is more than one possible product or reactant, include it. **Pay attention to stereochemistry**.

a) from the Alkene module of ORGO:

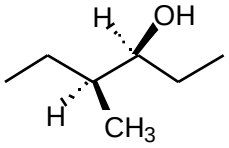


b) (E)-2-butene $\xrightarrow[2)\ NaOH]{1)\ Cl_2,\ H_2O}$

c) 2-hexyne $\longrightarrow$ (2R*, 3S*) -2,3-hexanediol

(racemic)

d) $\xrightarrow[2)\ H_2O_2,\ NaOH]{1)\ BH_3}$



(racemic)

e) $\xrightarrow[2)\ Zn]{1)\ O_3}$ iso-butyraldehyde

4) (5 x 4 pts = 20 pts) In each of the following questions, **circle** the appropriate answers.

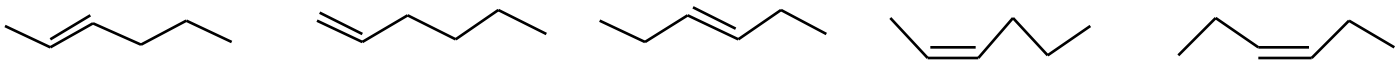
a) The best estimate (kcal/mol) for the DH_f^o of 2-butyne given that its DH^o of hydrogenation to n-butane is exothermic by 65 kcal/mol. [DH_f^o = -30 kcal/mol for n-butane]

+65 -95 -35 +35 +5 -5

b) Sodium acetylide will deprotonate which of the following acids

acetylene ethylene ammonia ethanol ethane ammonium ion

c) The alkene that liberates the greatest amount of heat upon hydrogenation

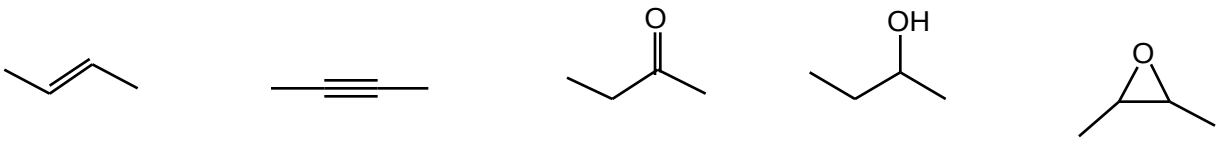


d) The reagents that give stereospecific reactions with both 2-butenes

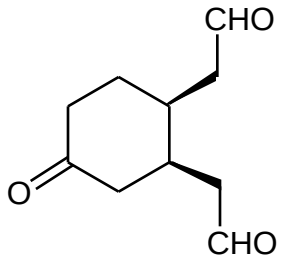
$CHCl_3$/NaOH BH_3;NaOOH Br_2/CCl_4

OsO_4/H_2O_2 $Zn(Cu)/CH_2I_2$

e) The most highly oxidized structures



5) (15 pts) Sunday night is turning into Monday morning as two Chem 220a students work on the last problem of their Problem Set. Compound **A** ($C_{10}H_{14}O$) undergoes ozonolysis to give the cis-ketodialdehyde **B**. He claims that because there are three carbonyl groups and no plane of symmetry in **B**, there are three possible structures for **A**. She says that his reasoning is conceptually correct but there is only one structure that can represent compound **A**. Outline their respective arguments.



B

Periodic Table

Work Sheets --- They will not be graded

Work Sheets --- They will not be graded

Work Sheets --- They will not be graded