"He played in an absolutely awful program. Some of his teammates were chemists."

WFAN talk show host, commenting on the
Vanderbilt quarterback's prospects in the NFL
draft - 2/25/06

1 (20 points). Shown below are two classic "aromatic substitution" problems. o/p means
"ortho-para director" and m means "meta director."

Your task is to design one problem of each kind along with answers. Please use different
o/p and m groups in each case. Anything we decide is clever enough to use gets a bonus.

o/p

m

m

o/p
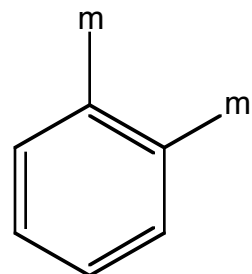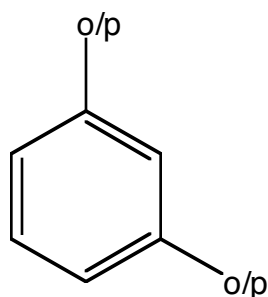
2 (16 points). Predict the products of reaction of **1** and **2** with the indicated sets of reagents.
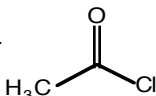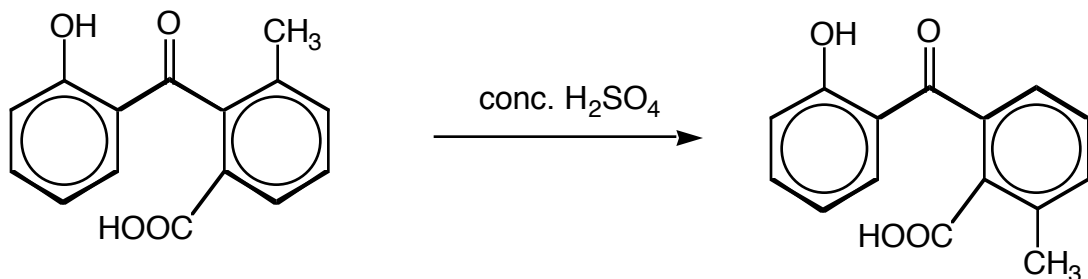"No Reaction" is a legitimate answer, but you have to explain briefly why there is no
reaction.

NO_2

NO_2

reagents

Cl

Cl
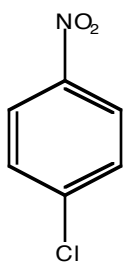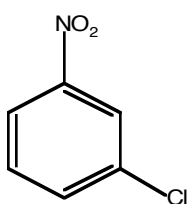
1. $Na^+\ ^-OCH_3/CH_3OH$

2. Br_2

Cl

3. $Br_2/FeBr_3$

1

2

4.

$AlCl_3$

H_3C Cl
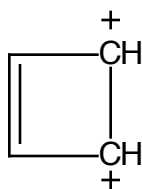
3 (16 points). Provide a mechanism for the following non-magical process, the Hayashi
reaction. Draw out all steps.

OH   O CH_3

conc. H_2SO_4

OH   O

HOOC

HOOC CH_3

4 (20 points). Provide an arrow formalism mechanism for the following reaction. What is the role of the Ag+? Provide an orbital analysis for the critical, ring-forming step. Is this step likely to be concerted or not?
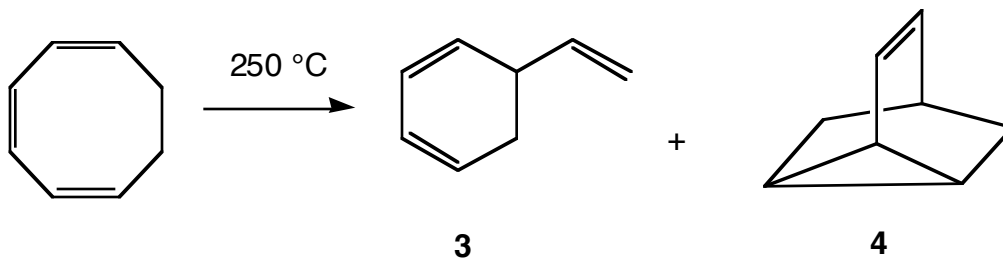
OCH₃

Br

+

Ag⁺

H₂O

OCH₃
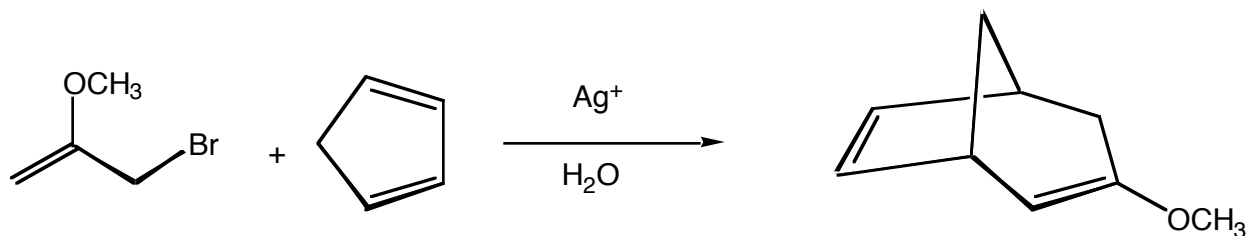
5 (12 points). One of the following compounds is square; one is rectangular. Which is which and why?
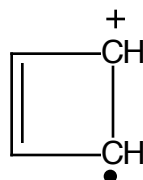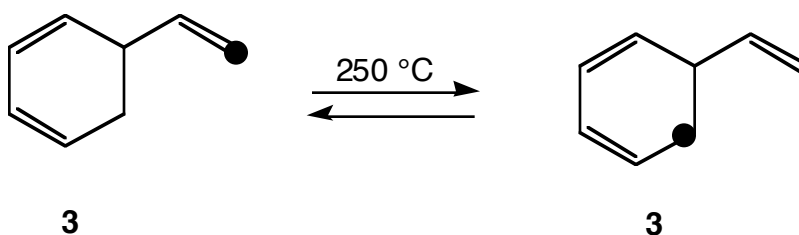
6 (16 points).

6 (16 points)
(a) Provide arrow formalisms for the following changes discovered by W. R Roth:

250 °C

+

3

4

(b) When Roth heated the labelled compound **3** shown below the label moved. Provide two different mechanisms for this change.

250 °C

3

3

"I pledge that I have not violated the Honour Code on this examination."