

E5 Practice iii

1. (32 points) Circle the letter *on the right* which corresponds to the answer to each question. There is only one correct answer for each question.

(i) Aromatic compounds *must* have which of the following attributes?

i. $4n$ π electrons

ii. $(4n+2)$ π electrons

iii. a cyclic array of p -orbitals

iv. a neutral charge

v. a parallel alignment of p -orbitals

A only i and iii

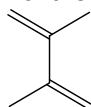
B only i, iii, iv and v

C only ii, iii and v

D only ii and v

A
B
C
D

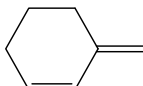
(i) Which of the following dienes *cannot* undergo a Diels-Alder reaction with an appropriate dienophile?



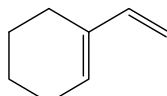
E



F



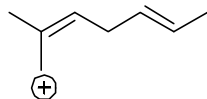
G



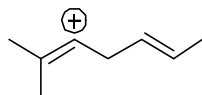
H

E
F
G
H

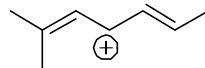
(iii) Which of the following carbocations is most stable (remember to take resonance structures into account)?



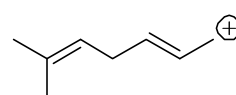
I



J



K



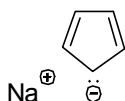
L

I
J
K
L

(iv) Which of the following compounds is *not* stable at room temperature?



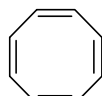
M



N



O



P

M
N
O
P

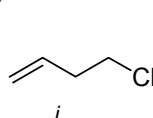
(v) What is the correct order of increasing reactivity (least reactive < most reactive) of the following compounds to solvolysis (S_N1) conditions?

Q $i < ii < iii$

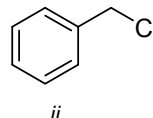
R $ii < i < iii$

S $iii < ii < i$

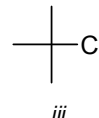
T $iii < i < ii$



i



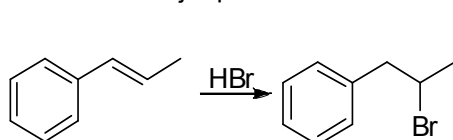
ii



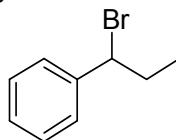
iii

Q
R
S
T

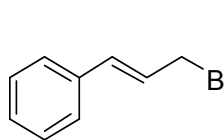
(vi) What is the major product of the following reaction?



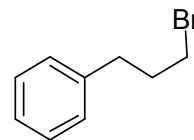
U



V



W



X

U
V
W
X

(vii) How many isomers of dichlorobenzoic acid are possible?

Y 3

Z 4

AA 5

BB 6

Y
Z
AA
BB

(viii) Which of the following is the *thermodynamic* product obtained upon treatment of 1,3-butadiene with one mole of HCl at elevated temperature?

CC 1,4-dichloro-2-butene

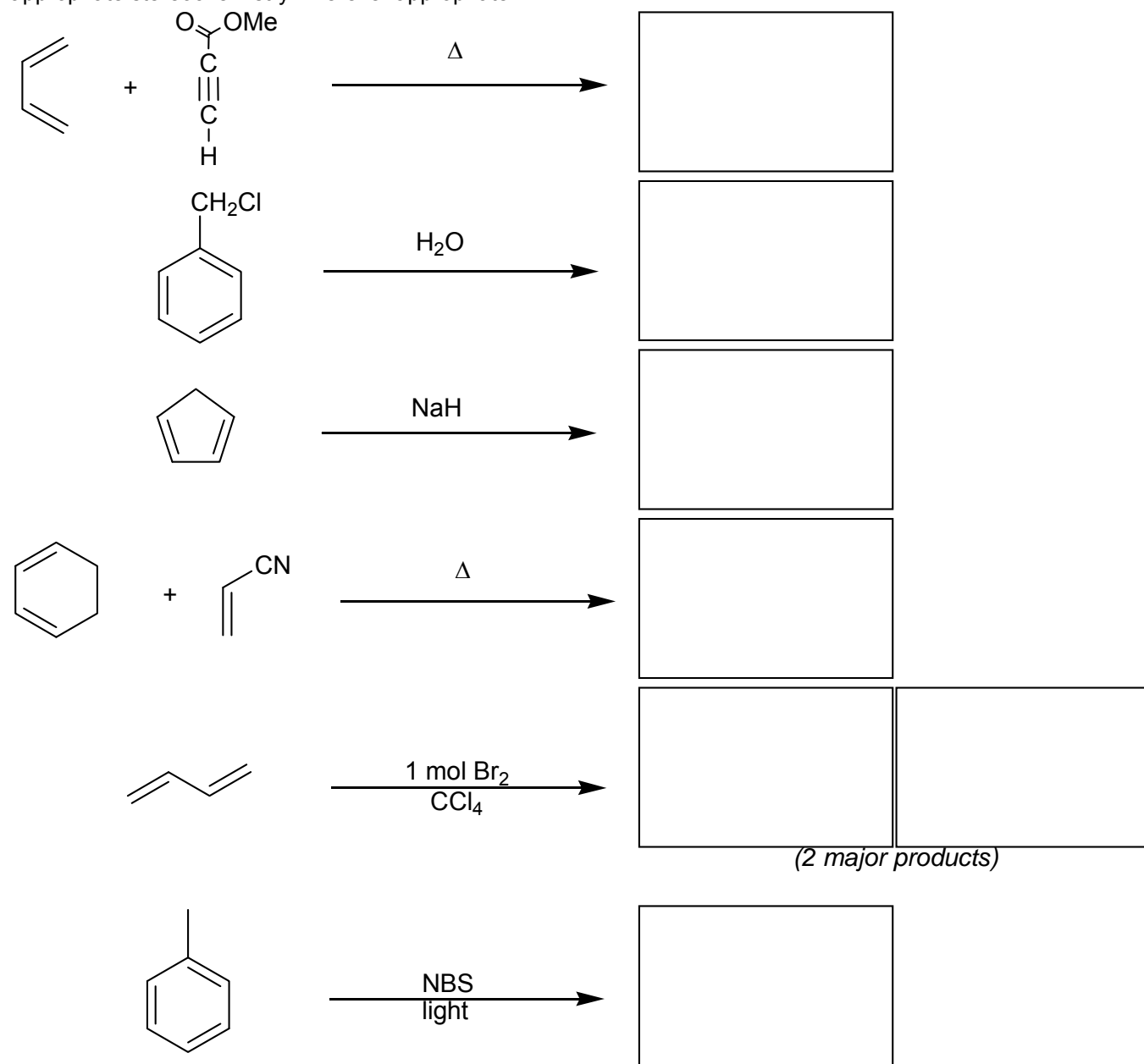
DD 4-chloro-1-butene

EE 3-chloro-1-butene

FF 1-chloro-2-butene

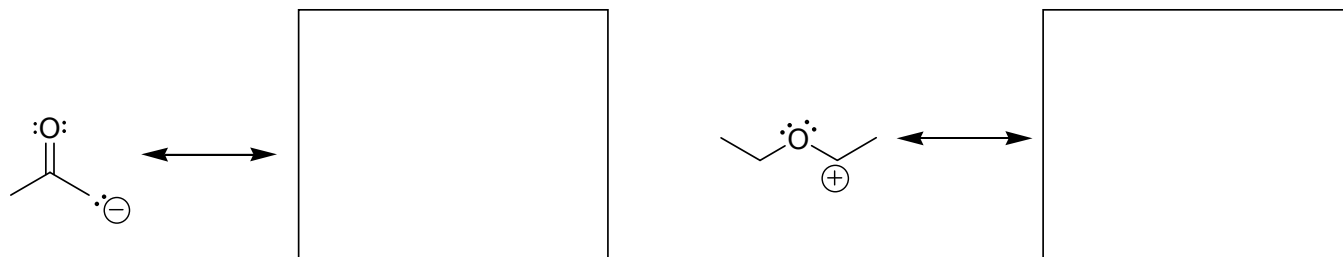
CC
DD
EE
FF

2. (a) (4 points each) Provide the structure of the major organic product of each of the following reactions, indicating appropriate stereochemistry wherever appropriate.

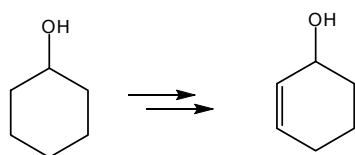
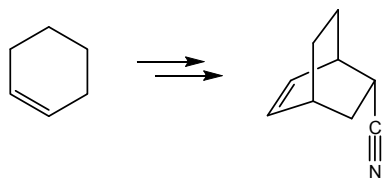


(2 major products)

(b) (5 points each) Draw another major resonance structure for each of the species below.



3. (15 points) The following transformations cannot be completed in a single step. Provide a sequence of reactions to perform each transformation, showing the reagents and structures of *all isolated synthetic intermediates*. The synthesis must use the given starting materials; you may also use any other starting materials with 3 or fewer carbon atoms. You may use any reagents. Do *not* show mechanisms or the structures of reactive intermediates. Shorter, more efficient syntheses are preferred; overly long or inefficient sequences will lose some credit.



4. (15 points) Provide a neatly drawn and detailed mechanism that accounts for the formation of *both* of the products of the addition reaction below. [Use curved arrows to show the movement of electrons, all structures should be valid Lewis structures].

