

Please read through each question carefully and answer in the spaces provided.

A good strategy is to go through the test and answer all the questions you can do easily. Then go back and tackle the more difficult problems.

Please make sure your structures are drawn clearly and indicate any necessary stereochemistry with bold or dashed bonds.

Finally, think about what you know. Reason and common sense can often help you out.

You may use the back of the pages for scratch paper.

Problem 1 23 pts _____

Problem 6 7 pts _____

Problem 2 17 pts _____

Problem 7 20 pts _____

Problem 3 9 pts _____

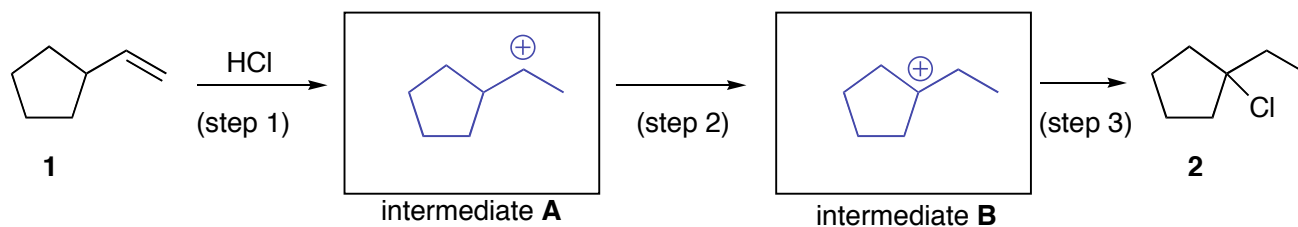
Problem 8 8 pts _____

Problem 4 6 pts _____

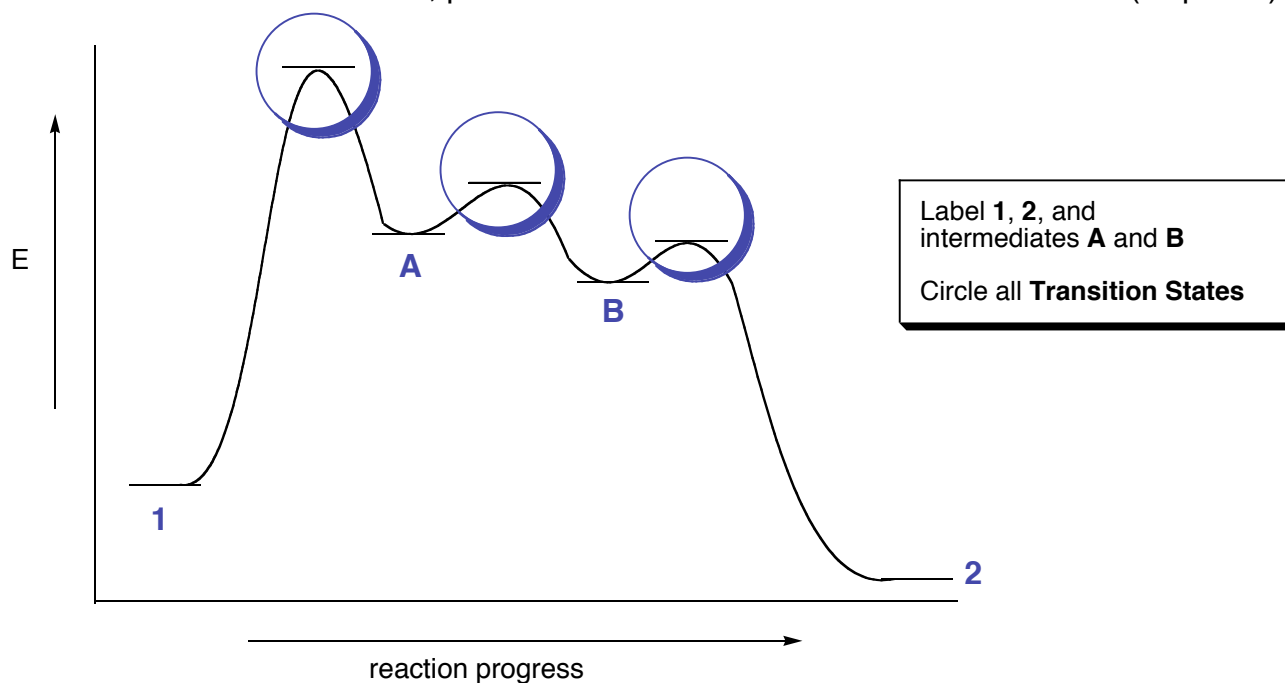
Problem 5 10 pts _____

TOTAL 100 pts _____

- 1) a) In the following reaction of the addition of HCl to vinylcyclopentane (**1**), one of the major products formed is 1-chloro-1-ethylcyclopentane (**2**). The mechanism for this reaction involves the formation of intermediate **A** which is converted into intermediate **B** and finally the product **2** is formed. In the boxes below, draw the structures of the intermediates showing any charges that are present. (6 points)



- b) The following reaction energy diagram describes the reaction above. On the diagram, label the position of each compound in the reaction including the starting material **1**, the product **2**, and intermediates **A** and **B**. Also, please draw a circle around all transition states. (11 points)



- c) Is the reaction above exothermic or endothermic? (2 points)

Exothermic

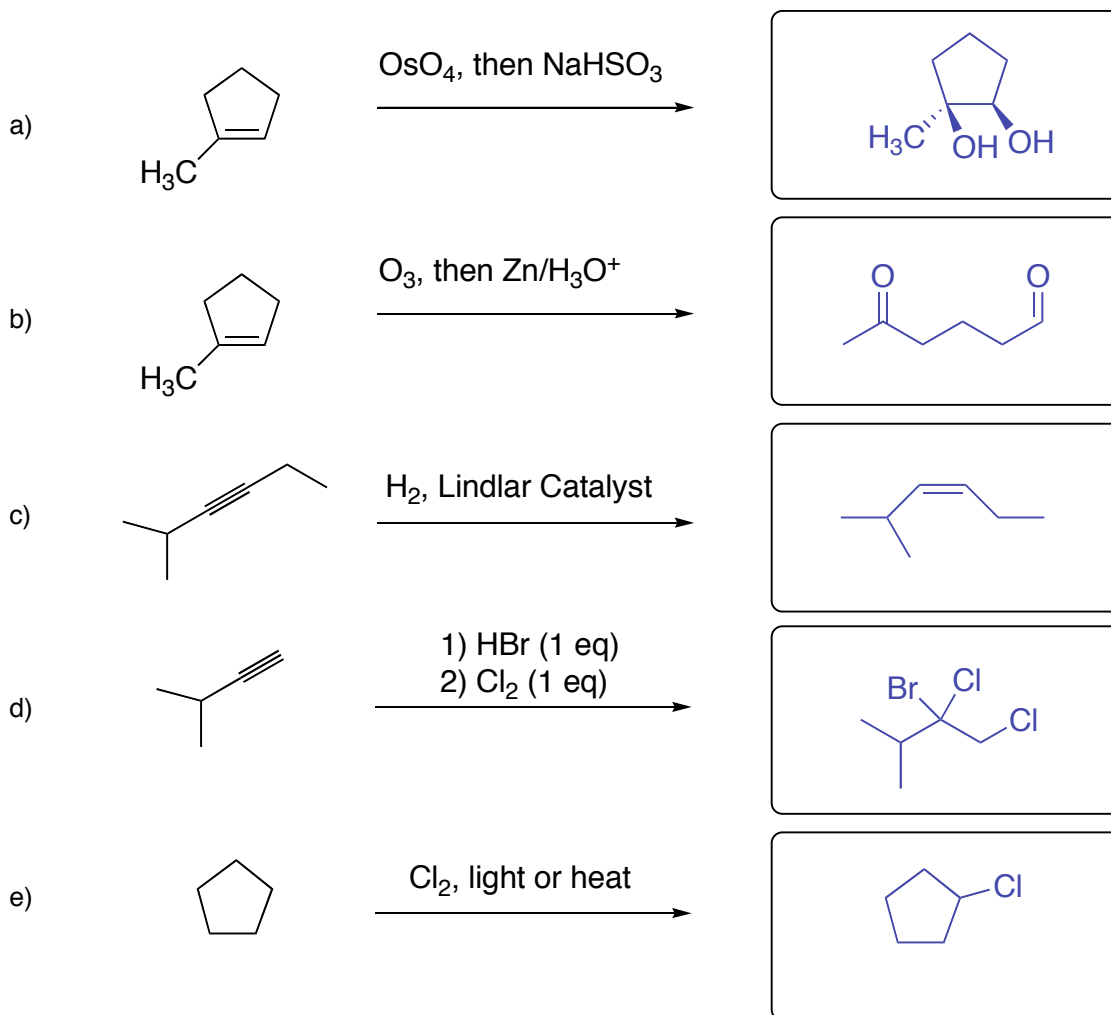
- d) Which step in this reaction is the rate determining step (the slowest step)? (2 points)

Step 1

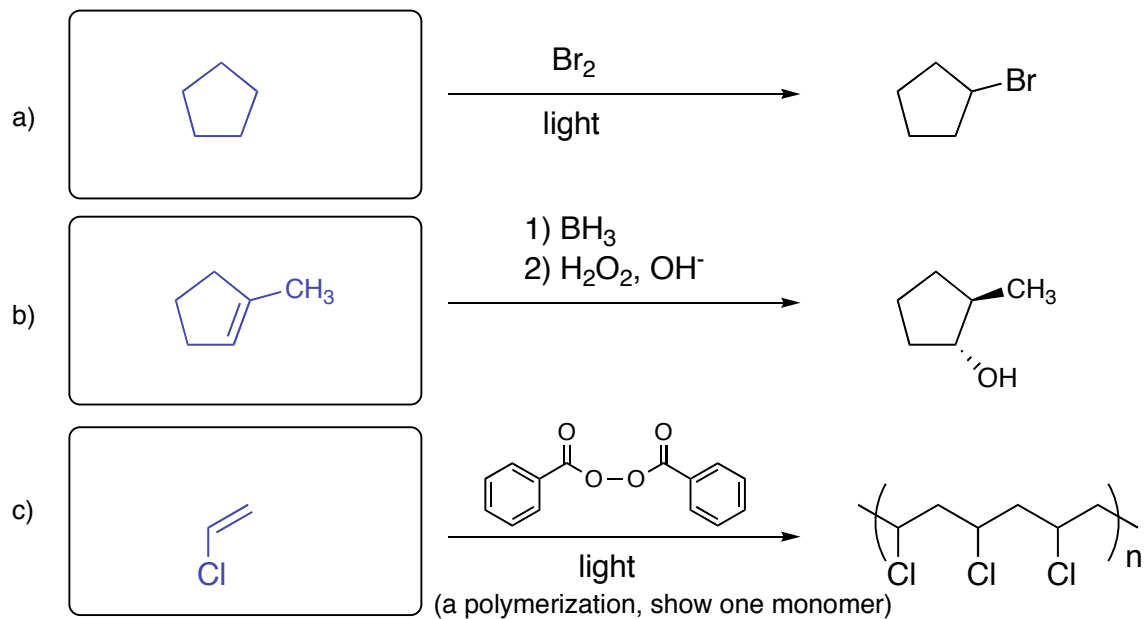
- e) Why does intermediate **A** convert into intermediate **B**? (one sentence) (2 points)

The carbocation will rearrange to form a more stable tertiary carbocation.

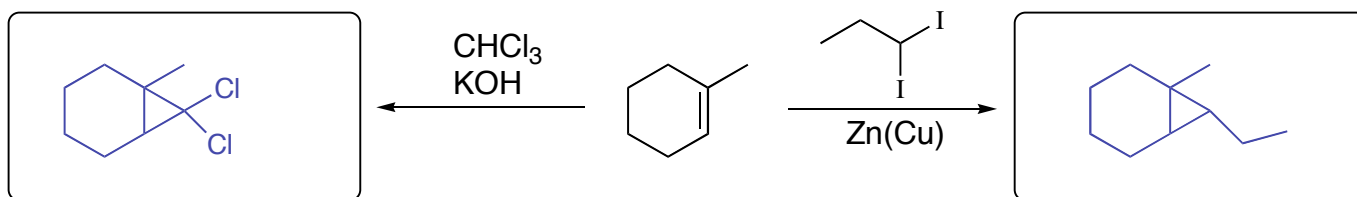
2. Provide the major organic product for the following reactions. (17 pts)



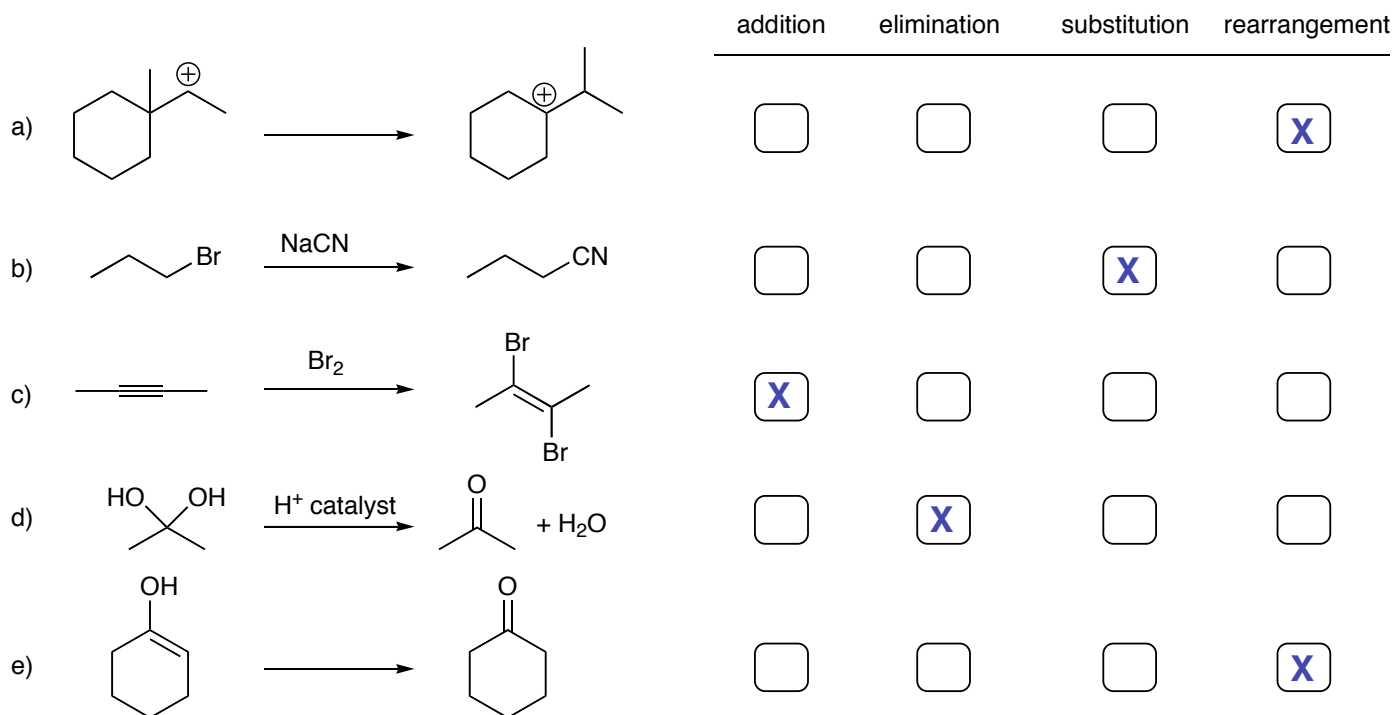
3. Provide the structure of the organic starting material for each of the following reactions. (9 pts)



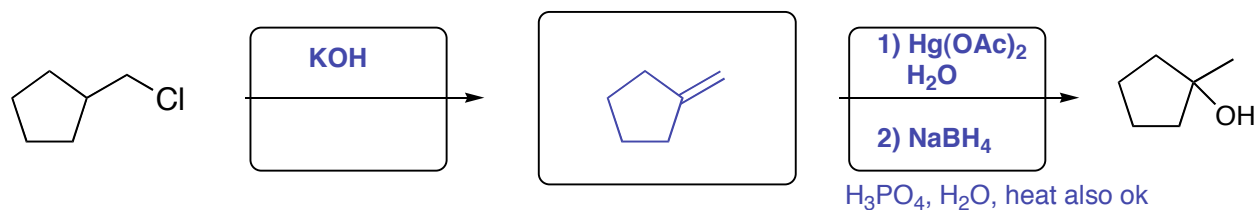
4. Provide the products for the following cyclopropanation reactions. (6 pts)



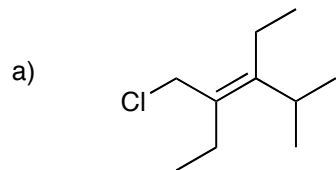
5. Classify each of the following reactions as either an addition, elimination, substitution or rearrangement (check the appropriate box). (10 pts)



6. The transformation of the alkyl chloride shown below into the alcohol cannot be accomplished in a single operation. Fill in the missing reagents and structures in the synthetic scheme below. (7 pts)



7. Draw the structure or provide a name for the following. (20 pts)

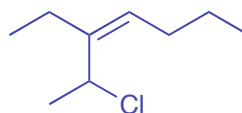


E-4-(chloromethyl)-3-ethyl-2-methyl-3-hexene

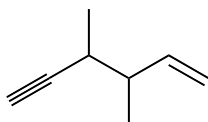
b) 3-chlorocyclopropene



c) Z-2-chloro-3-ethyl-3-heptene



d)



**3,4-dimethyl-1-hexen-5-yne or
3,4-dimethylhex-1-ene-5-yne**

e) *cis,trans*-2,4-hexadiene



8. For each of the following radical reaction steps, indicate whether it is an initiation reaction, propagation reaction or a termination reaction step. (8 pts)

