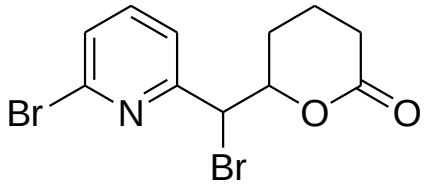
2007 Mechanisms Final **50 + 75 + 75 = 200 points** NAME:_____

1) (20pts) For the following molecule :



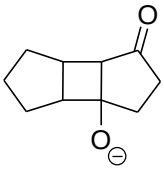
- How many Carbon atoms ?
- How many Hydrogen atoms ?
- How many Aromatic Rings ?
- How many lone pairs of electrons ?
- How many sp^2 Carbons ?
- How many π bonds ?
- How many chiral centers ?

- Indicate the most basic atom.

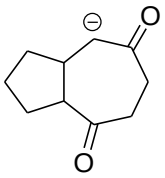
- Circle the ester functionality.

- Of the two Bromines, one is easily displaced by nucleophiles, the other is not. Circle the one which is easily displaced.

2) (10pts) For the below two anions:

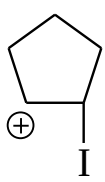


and

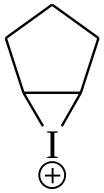


- Give two reasons why the right hand side species is more stable.
- Draw curly arrows to show how one converts into the other
- Which of these is correctly described as an *enolate* ?

3) (10pts) For the below two cations:



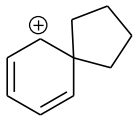
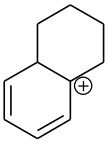
and



- Draw all the lone pairs on the following chemical species.
- Which has more ring strain ?
- Which has more chemical bonds ?
- Draw curly arrows to show how these species interconvert.
- Which is the more stable cation ?

(There is a bonus point if you can explain how you can <u>experimentally</u> verify your selection of the most stable cation).

4) (10pts) Consider the two carbocations below:

 and 

- Draw two additional resonance structures for the left hand side cation. (Include curly arrows to show the electron movement).

- Provide two reasons why the right hand side cation is more stable than the left hand side species.

- Draw the mechanism for the alkyl shift that converts one into the other.

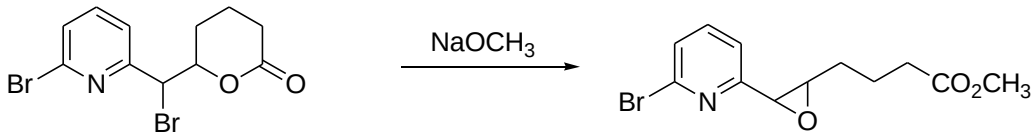
THE NEXT SECTION HAS 4
BASE / ANION PROBLEMS

(A) – (D)

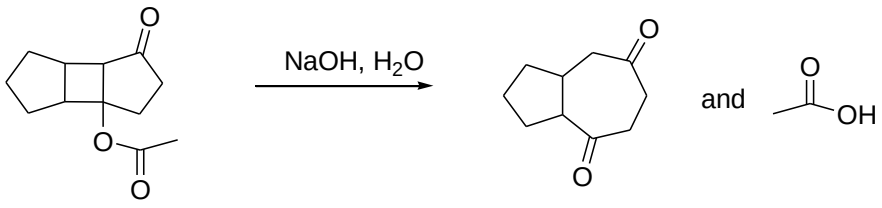
EACH WORTH 25 PTS

ANSWER ANY 3
(For 75 pts)

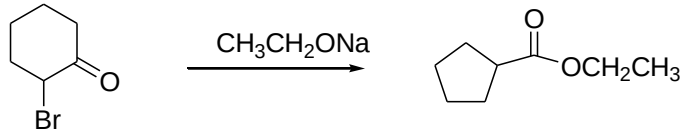
A) (25pts) Draw the mechanism for the following transformation.



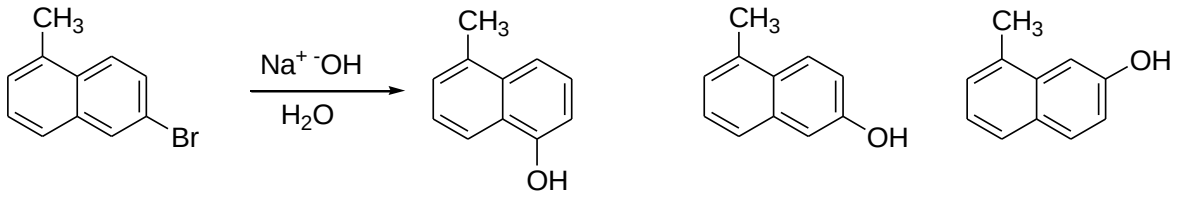
B) (25pts) Draw the mechanism for the following transformation.



C) (25pts) Draw the mechanism for the following transformation.



D) (25pts) Draw the mechanism for the following transformation, which produces the products in a 1:2:1 ratio.



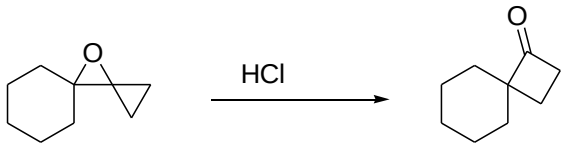
THE NEXT SECTION HAS 4 ACID / CATION PROBLEMS

(E) – (H)

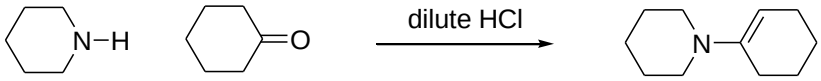
EACH WORTH 25 PTS

ANSWER ANY 3
(For 75 pts)

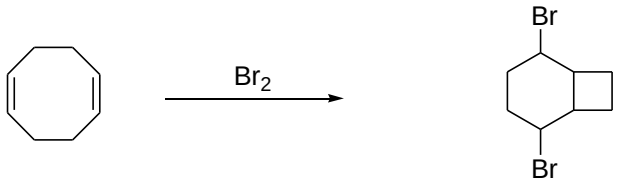
E) (25pts) Draw the mechanism for the following transformation.



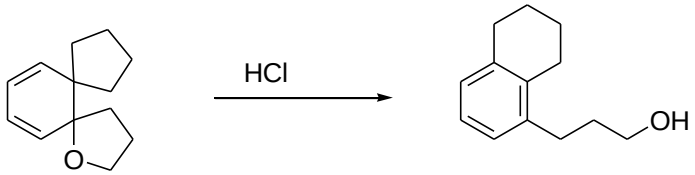
F) (25pts) Draw the mechanism for the following transformation.



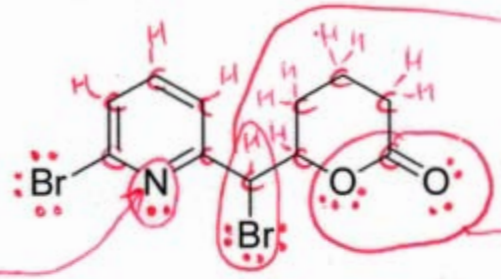
G) (25pts) Draw the mechanism for the following transformation.



H) (25pts) Draw the mechanism for the following transformation.



1) (20pts) For the following molecule :



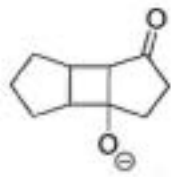
- How many Carbon atoms ? 11
- How many Hydrogen atoms ? 11
- How many Aromatic Rings ? ONE
- How many lone pairs of electrons ? 11
- How many sp^2 Carbons ? 6
- How many π bonds ? 4
- How many chiral centers ? 2

- Indicate the most basic atom.

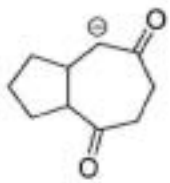
- Circle the ester functionality.

- Of the two Bromines, one is easily displaced by nucleophiles, the other is not. Circle the one which is easily displaced.

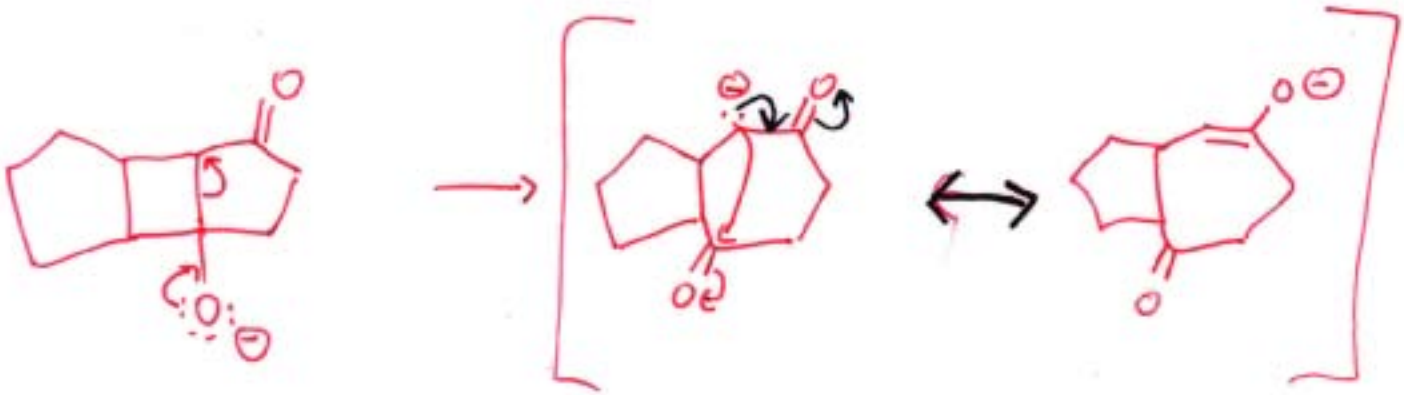
2) (10pts) For the below two anions:



and



- Give two reasons why the right hand side species is more stable.
- Draw curly arrows to show how one converts into the other
- Which of these is correctly described as an *enolate* ?



The right hand side anion is resonance stabilized.

The right hand side anion has less ring strain.

The right hand side anion is an enolate (as shown by its resonance structure)

3) (10pts) For the below two cations:

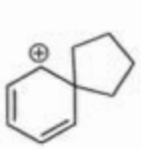
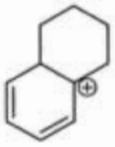
- Draw all the lone pairs on the following chemical species. ✓
- Which has more ring strain ? Right hand side
- Which has more chemical bonds ? Right hand side
- Draw curly arrows to show how these species interconvert. ✓
- Which is the more stable cation ? Right hand side

(There is a bonus point if you can explain how you can <u>experimentally</u> verify your selection of the most stable cation).

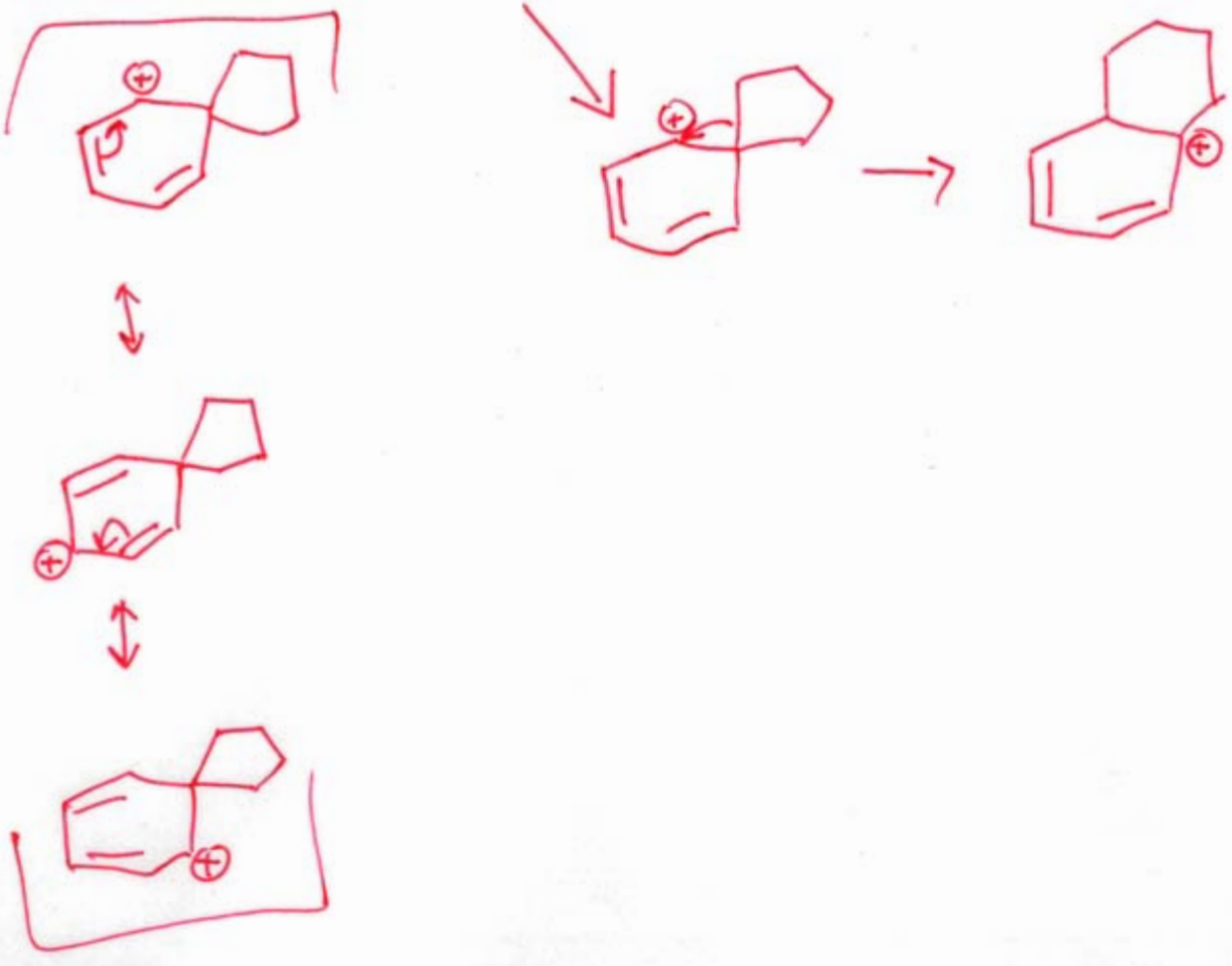
Because  & I2

anti di-iodide which implies the preferred intermediate is the iodonium ion which sees ring opened by SN2 attack.

4) (10pts) Consider the two carbocations below:

 and 

- Draw two additional resonance structures for the left hand side cation. (Include curly arrows to show the electron movement). ✓
- Provide two reasons why the right hand side cation is more stable than the left hand side species. Tertiary cation vs. secondary; less ring strain
- Draw the mechanism for the alkyl shift that converts one into the other.



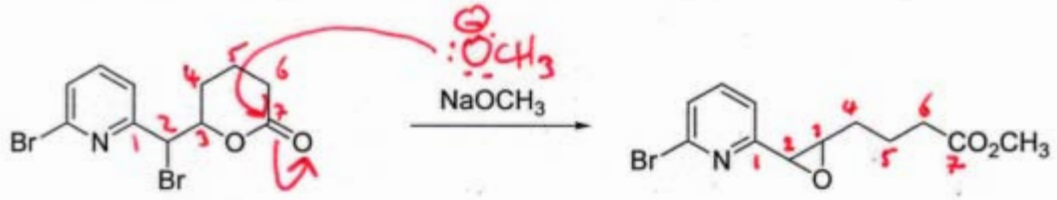
THE NEXT SECTION HAS 4 BASE / ANION PROBLEMS

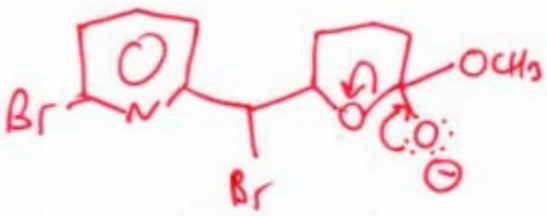
(A) – (D)

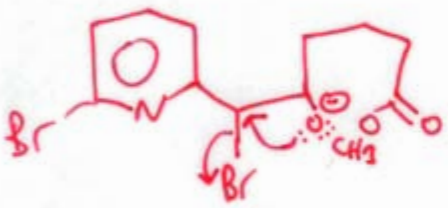
EACH WORTH 25 PTS

ANSWER ANY 3
(For 75 pts)

A) (25pts) Draw the mechanism for the following transformation.







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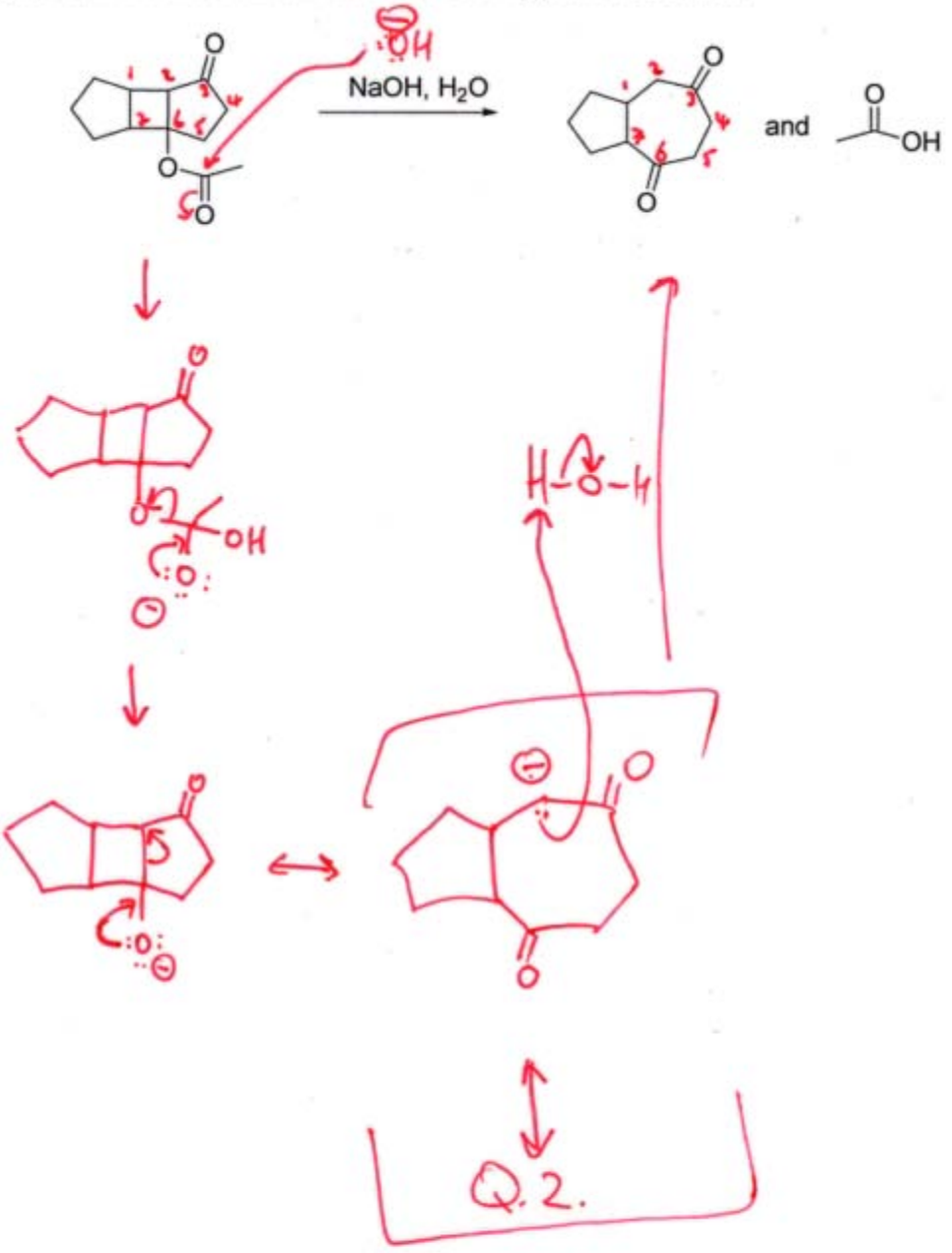

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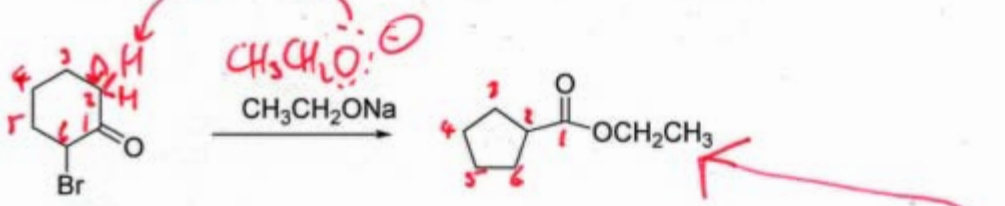
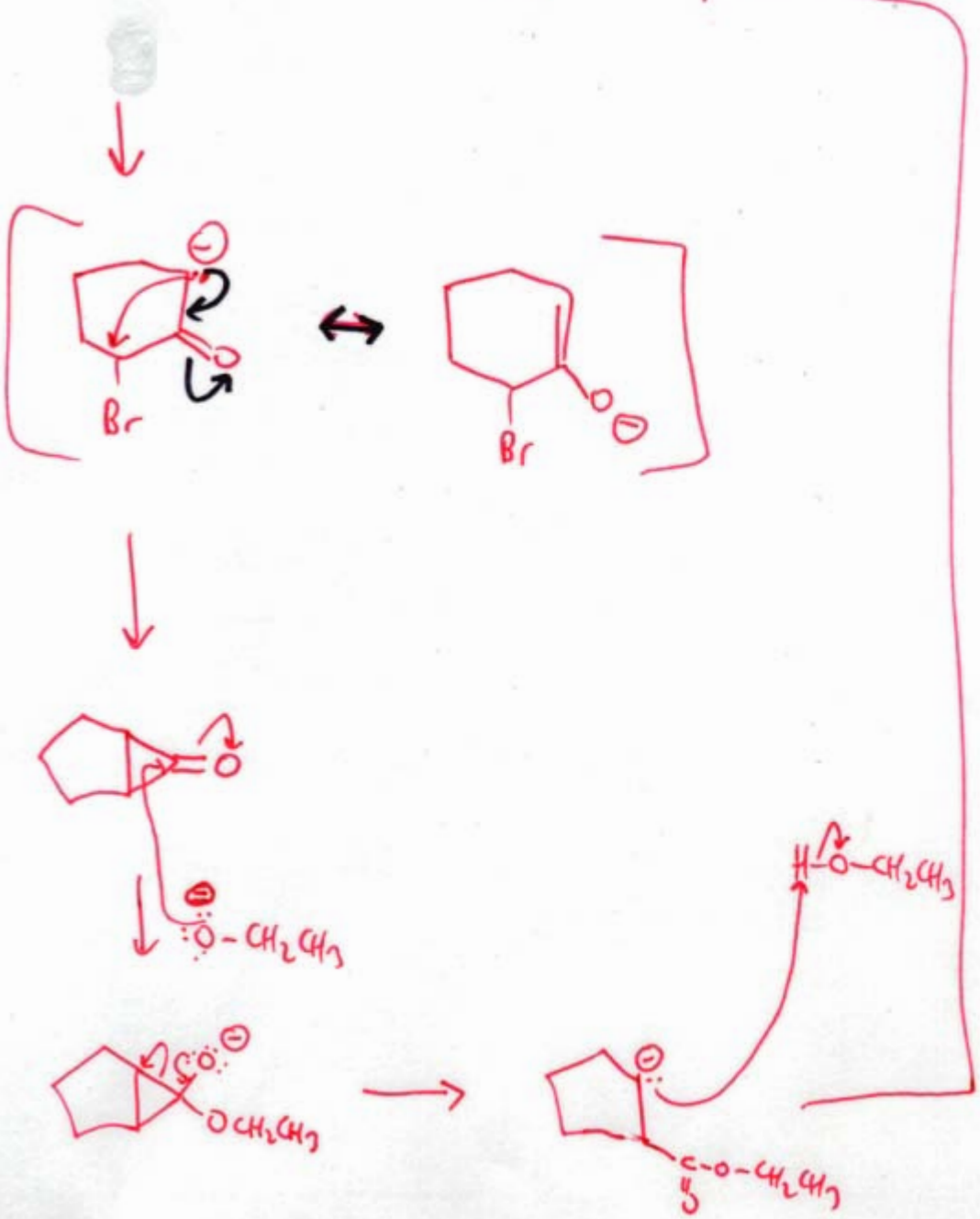
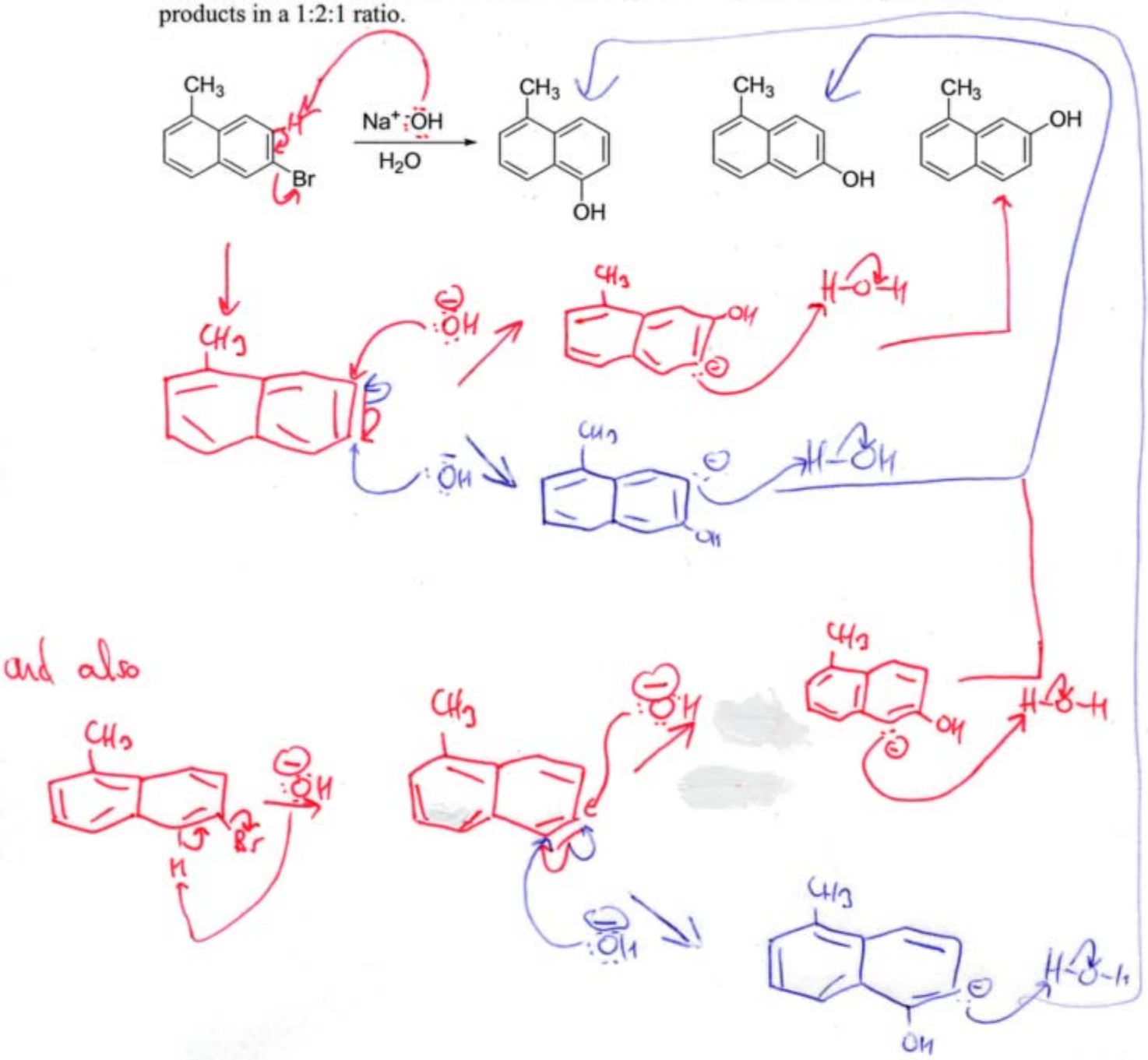




D) (25pts) Draw the mechanism for the following transformation, which produces the products in a 1:2:1 ratio.



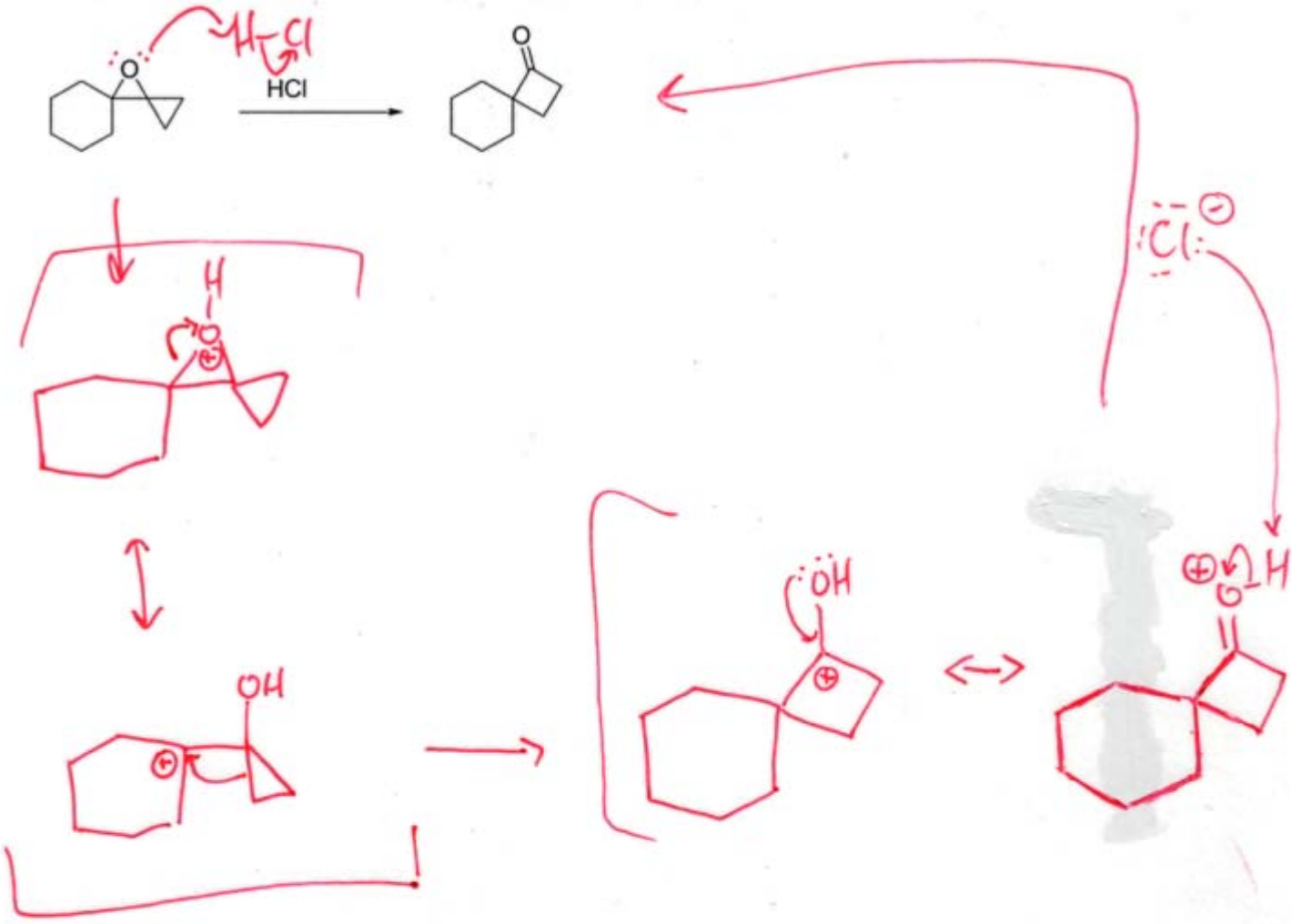
THE NEXT SECTION HAS 4 ACID / CATION PROBLEMS

(E) – (H)

EACH WORTH 25 PTS

ANSWER ANY 3
(For 75 pts)

E) (25pts) Draw the mechanism for the following transformation.



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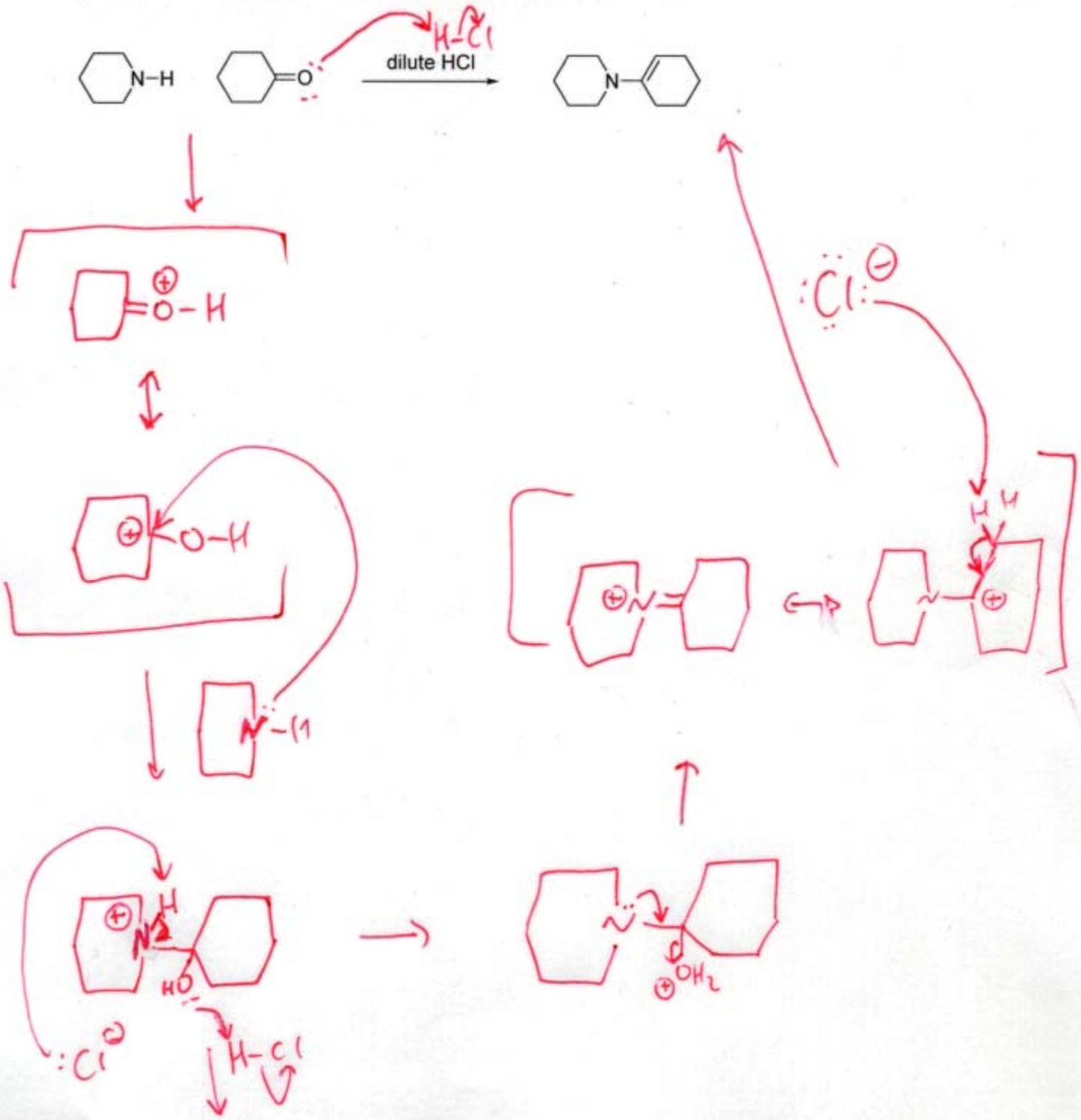

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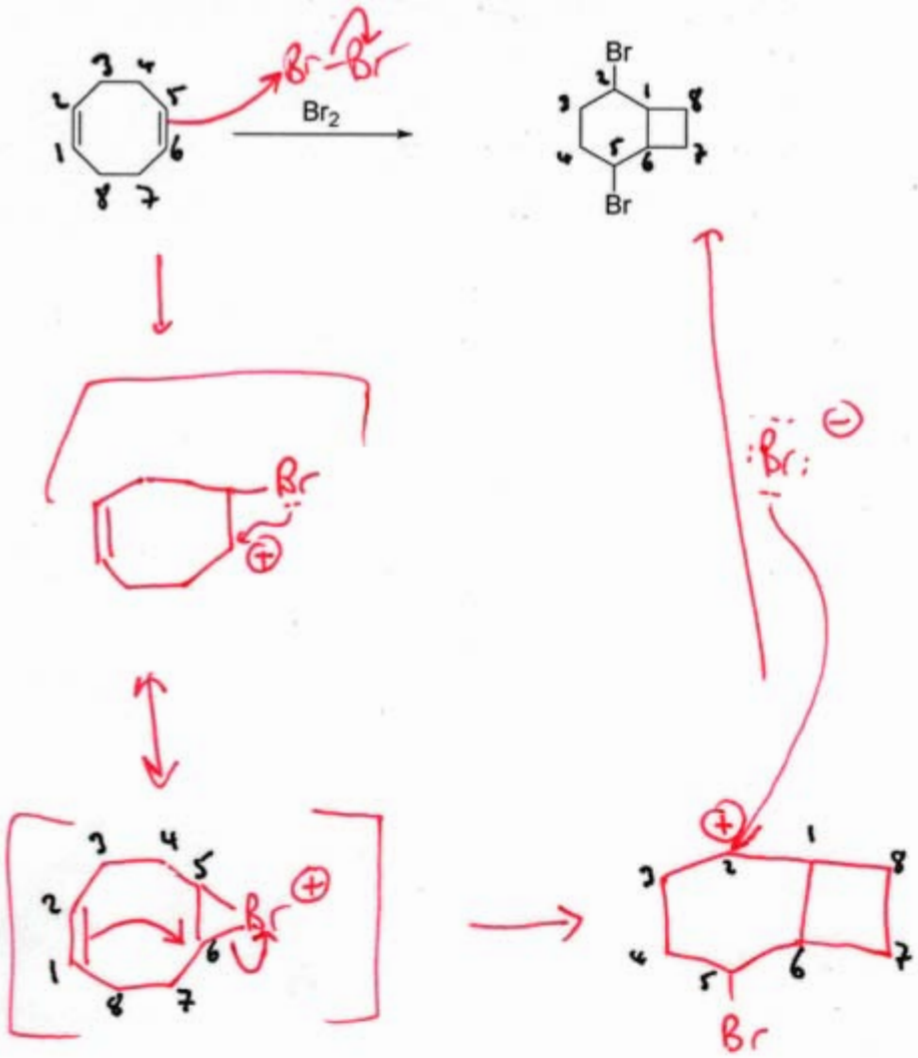

H) (25pts) Draw the mechanism for the following transformation.