

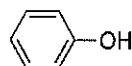
Organic Chemistry I

I – a

Answer the following questions in the reaction equilibrium.



The pK_a values of each compound are below.



5

6

10

- (1) Write the structure of the **A** and **B**.
- (2) Regarding acetic acid and carbonic acid in equation (1), which one is a stronger acid? Show how (what times) strong it is based on the pK_a value.
- (3) In equation (2), does the reaction equilibrium lie to the right or the left? Explain the reason based on the pK_a value?

I – b

Predict the major product and discuss the basis for the stereochemistry resulting from reaction of 1-methylcyclohexene with Br_2 .

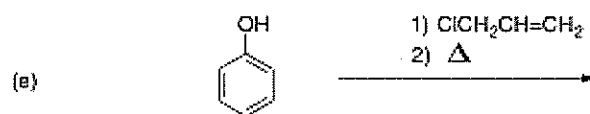
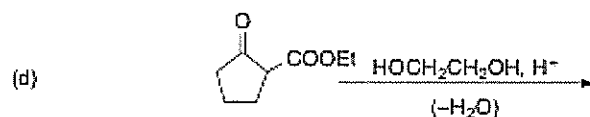
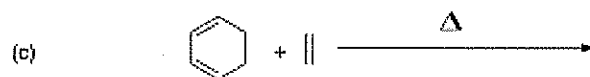
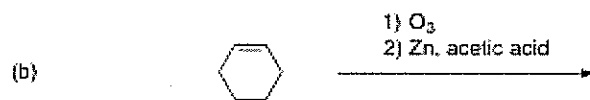
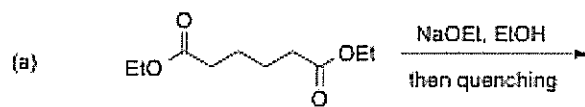
I – c

Predict the product and discuss the basis for the stereochemistry resulting from reaction of each of the following reagents with (*S*)-2-bromohexane.

- (1) NaI
- (2) KCN

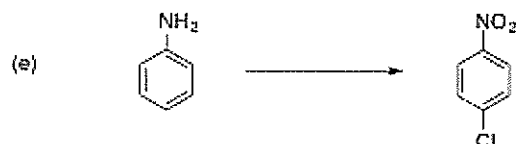
I - d

Give the structure of the product obtained from the following reactions.



I - e

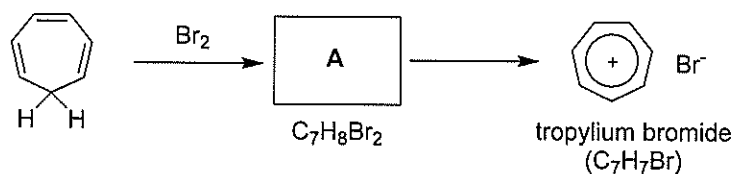
Give the reagents and/or conditions for the following transformations.



Organic Chemistry II

II – a

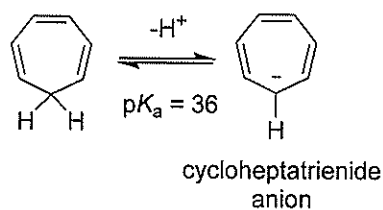
(1) Cycloheptatriene reacts with bromine to give compound A. Draw the structure of A.



(2) The distillation of compound A gave tropylium bromide as the yellow solid. Draw the reaction scheme.

(3) How many π electrons does tropylium ion have? Why is the ionic form more stable than the neutral form?

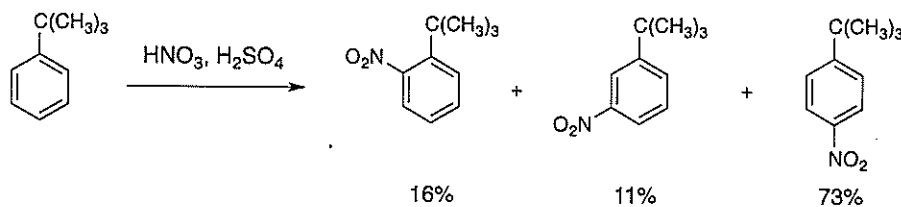
(4) The following show the $\text{p}K_a$ of cycloheptatriene. How many π electrons does its anion have?



(5) Why is cycloheptatrienide anion far less stable than tropylium ion?

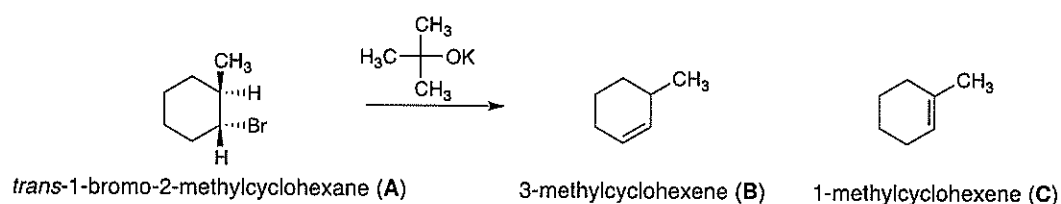
II – b

Nitration of *t*-butylbenzene affords *ortho*-, *meta*-, and *para*-substituted products with the indicated selectivity. Explain the reason for this selectivity with the reaction mechanism.



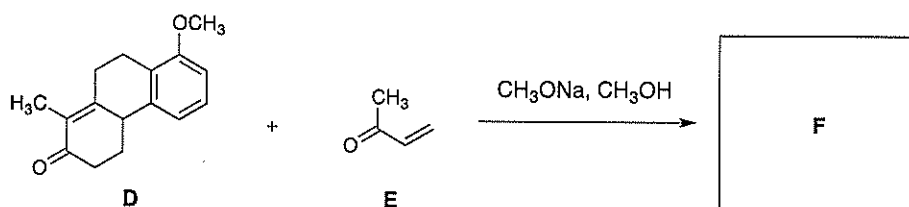
II – c

Reaction between *trans*-1-bromo-2-methylcyclohexane (**A**) and potassium *t*-butoxide affords methylcyclohexene through E2 *anti*-elimination mechanism. Answer which is the product, 3-methylcyclohexene (**B**) or 1-methylcyclohexene (**C**). And explain the reason with the reaction mechanism.



II – d

Compounds **D** and **E** undergo Michael addition and aldol condensation reactions to afford product **F**. Answer the structure of compound **F** and the reaction mechanism.



II – e

This scheme shows the synthesis of (*S*)-Actinidiolide. Answer the structure of product **G**.

