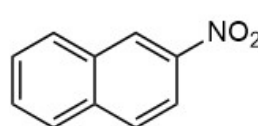
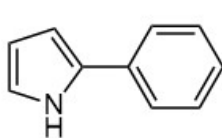
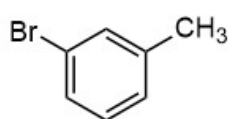
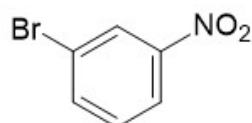
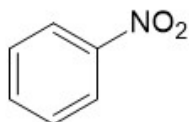
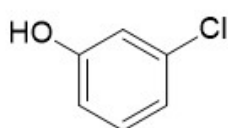




1 Provide an acceptable name for each compound.

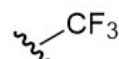
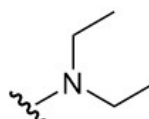
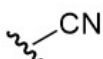
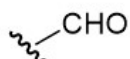


2 Determine whether each compound will readily undergo a **Nucleophilic Aromatic Substitution** ( $S_NAr$ ) and/or readily reacts (*i.e.*, is "activated") under **Electrophilic Aromatic Substitution** (EAS) conditions.



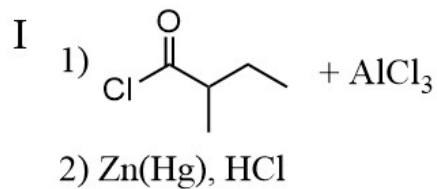
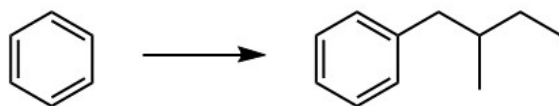
Categorize each of the following groups as an **ortho/para director** or a **meta director**.

3



4

Provide the reagents necessary to transform the given starting material into the desired product.



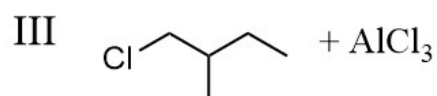
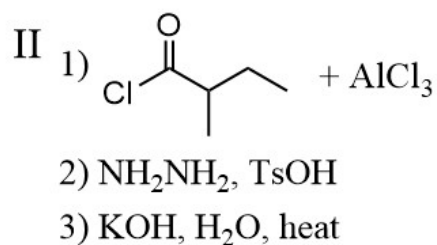
A) I only

B) II only

C) III only

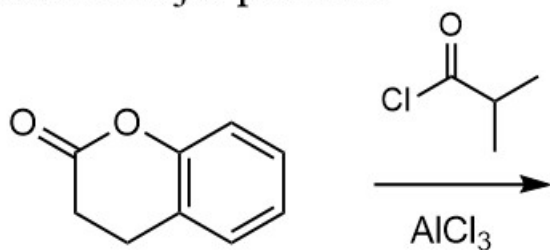
D) I and II only

E) I, II and III



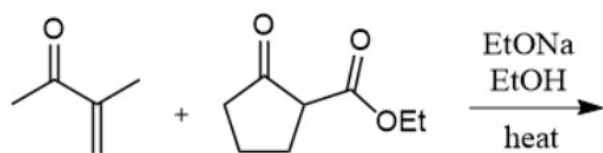
5

Predict the major product.



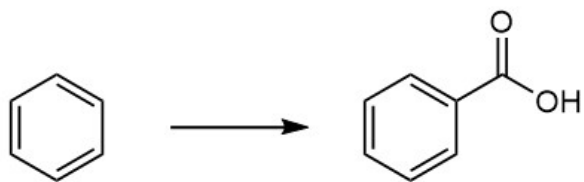
6

Predict the major Robinson annulation product.



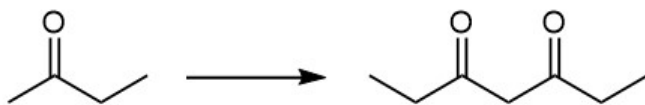
7

Provide THREE possible synthetic routes:

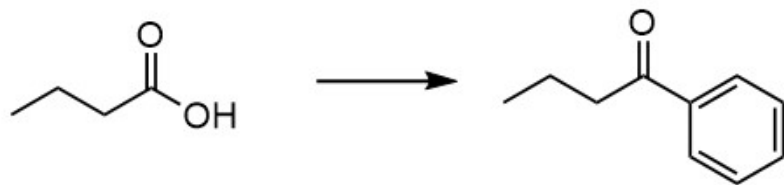


8

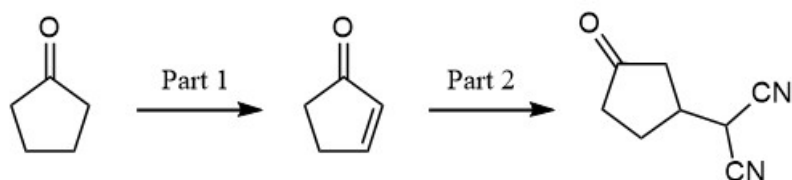
Provide the necessary reagents.



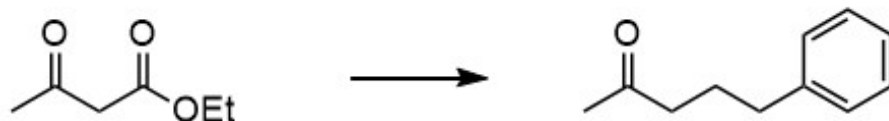
9



10 Provide the necessary reagents.

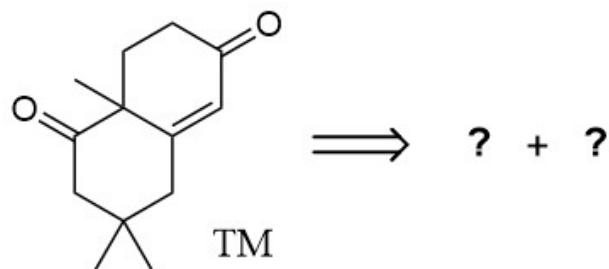


11

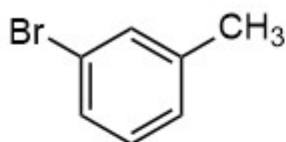


12

Provide the starting materials needed to prepare the given target molecule by a Robinson Annulation.



1 Provide an acceptable name for each compound.



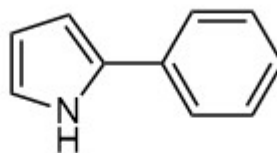
A) *meta*-bromotoluene

B) 3-bromotoluene

C) 1-bromo-3-methylbenzene

D) 3-bromo-1-methylbenzene

E) *meta*-bromomethylbenzene



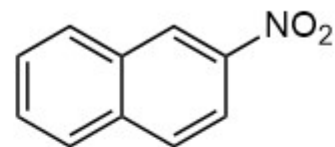
1-benzylpyridine

1-phenylpyridine

2-phenylpyrrole

1-phenylpyrrole

2-benzylpyrrole



2-nitrodibenzene

3-nitrodibenzene

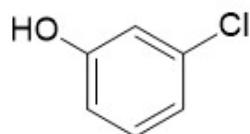
2-nitronaphthalene

3-nitronaphthalene

3-nitrodibenzene

2

Determine whether each compound will readily undergo a **Nucleophilic Aromatic Substitution** ( $S_NAr$ ) and/or readily reacts (*i.e.*, is "activated") under **Electrophilic Aromatic Substitution** (EAS) conditions.



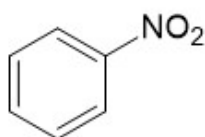
A) both

B) both

C) EAS only

D) EAS only

E) neither



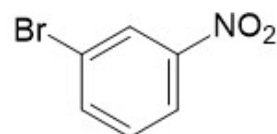
$S_NAr$  only

neither

$S_NAr$  only

neither

neither



both

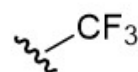
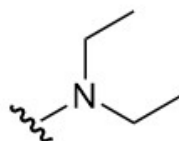
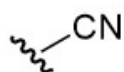
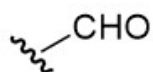
$S_NAr$  only

$S_NAr$  only

neither

$S_NAr$  only

3 Categorize each of the following groups as an **ortho/para director** or a **meta director**.



A) o/p

meta

o/p

meta

B) o/p

o/p

meta

meta

C) meta

meta

meta

o/p

D) o/p

o/p

meta

o/p

E) meta

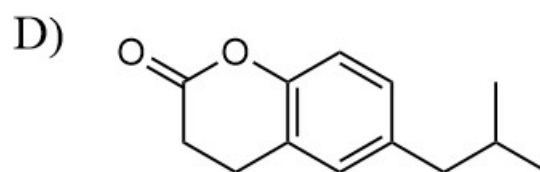
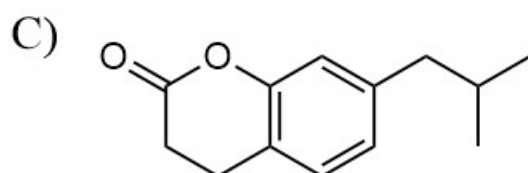
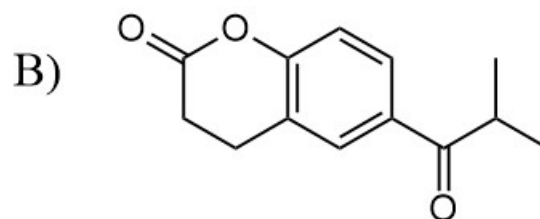
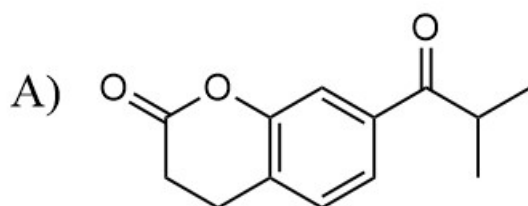
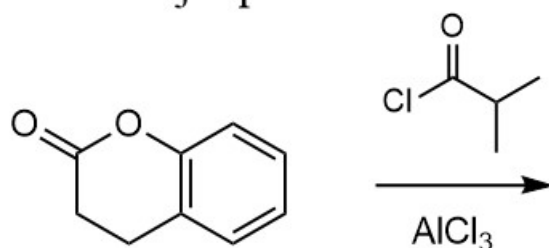
meta

o/p

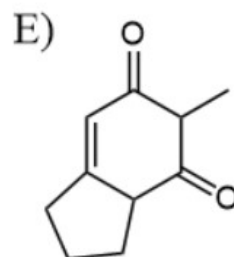
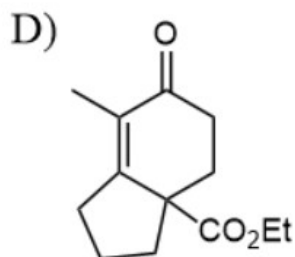
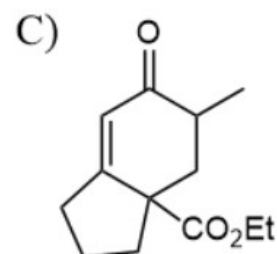
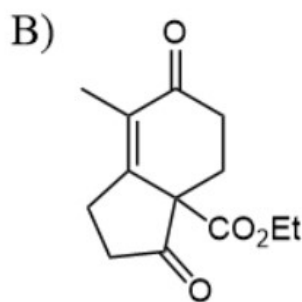
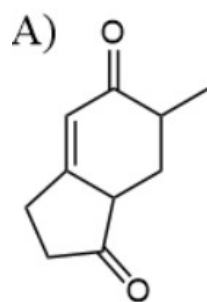
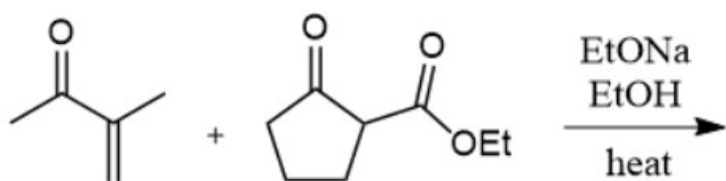
meta

5

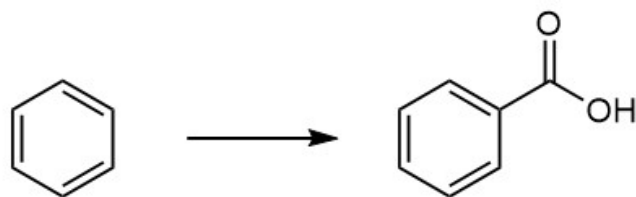
Predict the major product.



6 Predict the major Robinson annulation product.



7 Which of the following sets of reagents would NOT successfully transform the given starting material into the desired product?



A

- 1)  $\text{Br}_2$ ,  $\text{FeBr}_3$
- 2)  $\text{EtO}_2\text{C}-\text{CH}_2-\text{CO}_2\text{Et}$   
+  $\text{NaOEt}$
- 3)  $\text{H}_3\text{O}^+$ , heat

B

- 1)  $\text{Br}_2$ ,  $\text{FeBr}_3$
- 2)  $\text{Mg}$
- 3)  $\text{CO}_2$
- 4)  $\text{H}_3\text{O}^+$

C

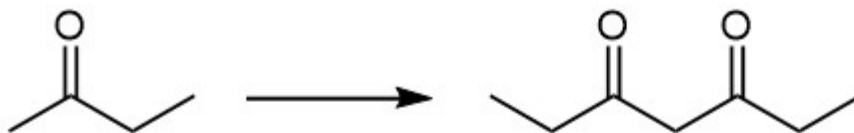
- 1)  $\text{CH}_3\text{I}$ ,  $\text{AlCl}_3$
- 2)  $\text{Na}_2\text{Cr}_2\text{O}_7$   
 $\text{H}_2\text{SO}_4$

D

- 1)  $\text{HNO}_3$   
 $\text{H}_2\text{SO}_4$
- 2)  $\text{H}_2$ ,  $\text{Pd}$
- 3)  $\text{NaNO}_2$ ,  $\text{HCl}$
- 4)  $\text{CuCN}$
- 5)  $\text{H}_3\text{O}^+$ , heat

8a

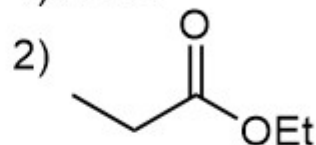
Provide the necessary reagents.



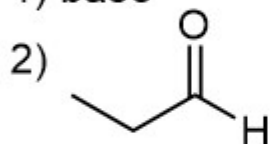
A) 1) base



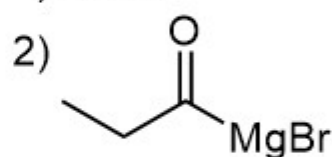
C) 1) base



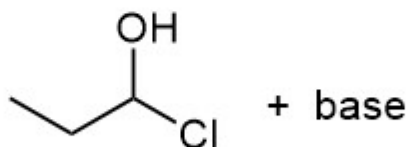
B) 1) base



D) 1) base



E)



8b

Identify suitable reaction conditions for the "base" above.

A) LDA,  $-78^{\circ}\text{C}$ C) NaH,  $25^{\circ}\text{C}$ B) NaOH,  $-78^{\circ}\text{C}$ D) NaOH,  $25^{\circ}\text{C}$ 

E) All of the above conditions are suitable

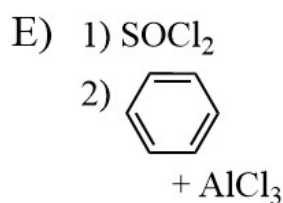
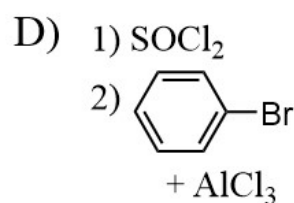
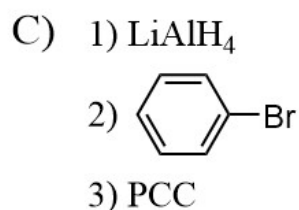
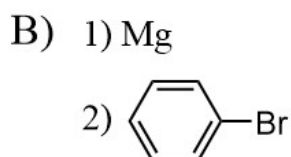
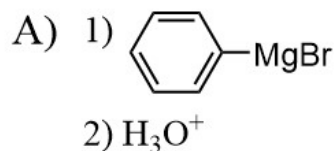
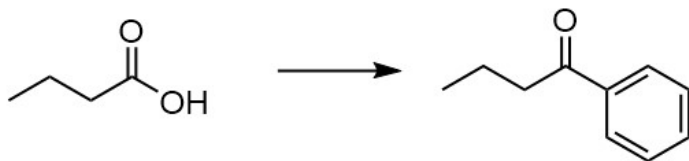
8c

- A) Base should be added slowly to a solution of the ketone.
- B) Ketone should be added slowly to a solution of the base.
- C) The order of addition does not matter (both A and B give the same results).



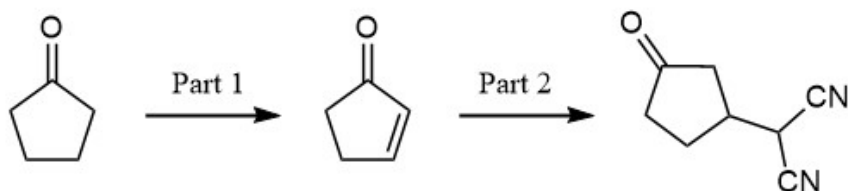
9

Provide the reagents necessary to transform the given starting material into the desired product.

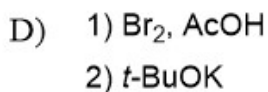
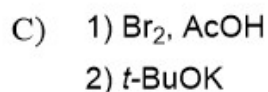
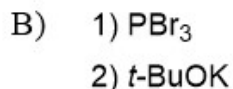
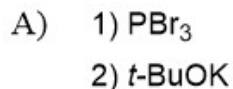


10

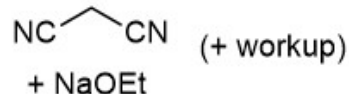
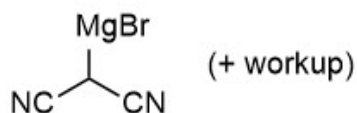
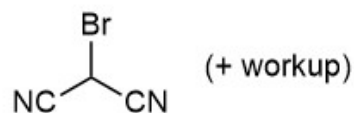
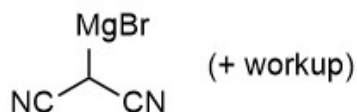
Provide the necessary reagents.



Part 1

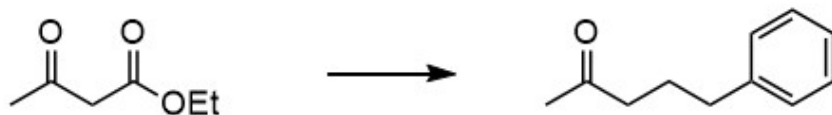


Part 2



11

Provide the reagents necessary to transform the given starting material into the desired product.



A) 1) NaOEt  
2) PhCl  
3)  $\text{H}_3\text{O}^+$ , heat

B) 1) NaOEt  
2)  $\text{PhCH}_2\text{Cl}$   
3)  $\text{H}_3\text{O}^+$ , heat

C) 1) NaOEt  
2)  $\text{PhCH}_2\text{CH}_2\text{Cl}$   
3)  $\text{H}_3\text{O}^+$ , heat

D) 1) NaOEt  
2)  $\text{PhCH}_2\text{CH}_2\text{CH}_2\text{Cl}$   
3)  $\text{H}_3\text{O}^+$ , heat

12

Provide the starting materials needed to prepare the given target molecule by a Robinson Annulation.

