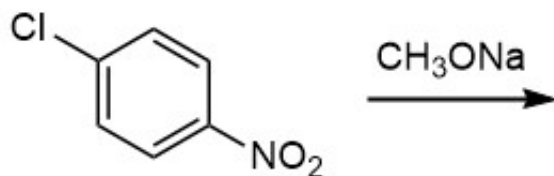
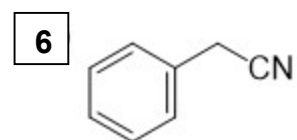
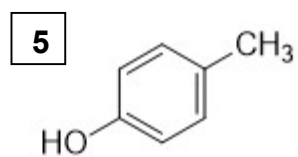
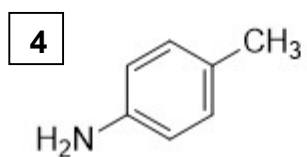
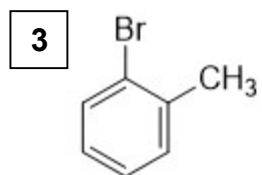


- 2 Predict the major product and provide a mechanism for the following reaction.

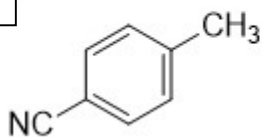


3-6 Prepare each of the following target molecules from **toluene**.

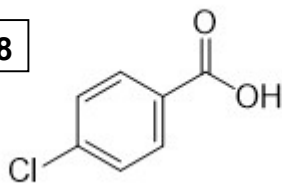


7-9 Prepare each of the following target molecules from **toluene**.

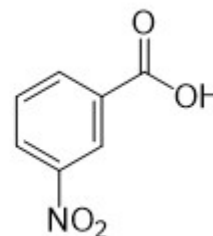
7



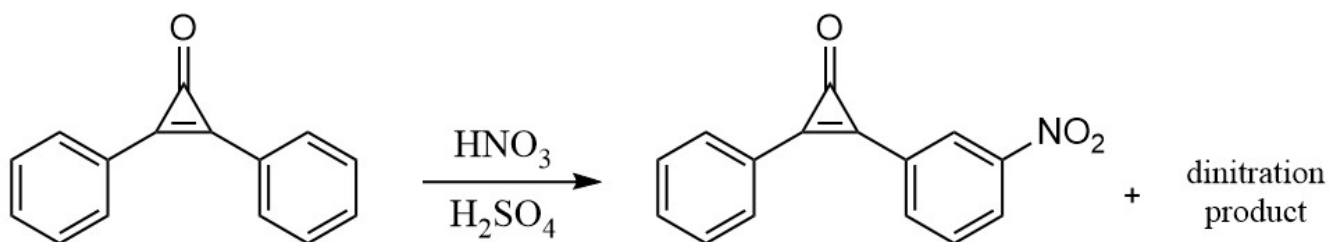
8



9



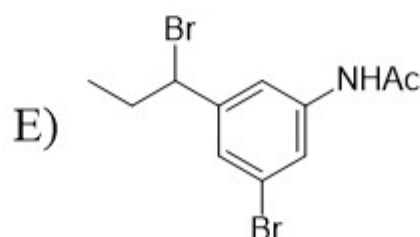
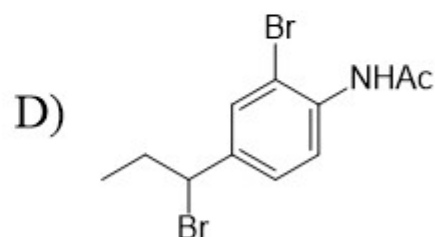
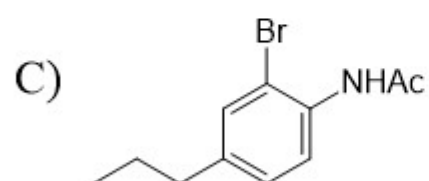
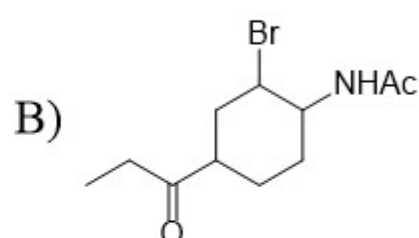
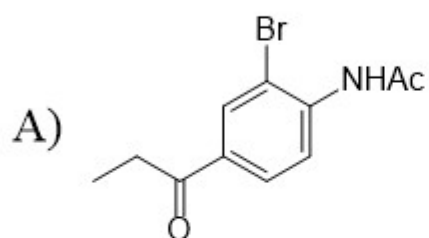
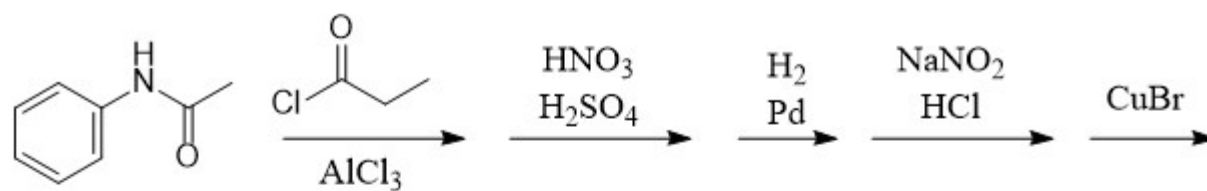
10



Explain the observed regiochemistry of the mononitration product, using drawings to support your explanation. (*Hint: note the acidic reaction conditions!*) There are several possible dinitration products, but only one is observed. Propose a structure of the dinitration product, and explain why that is the only one expected to form.

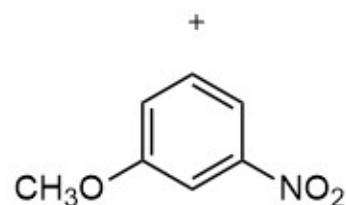
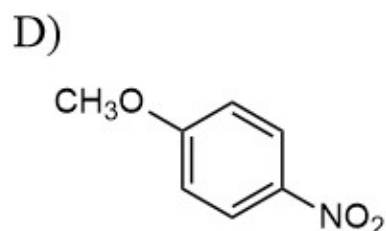
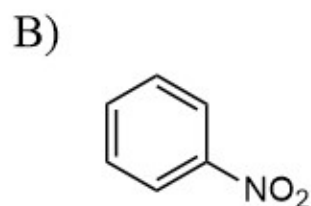
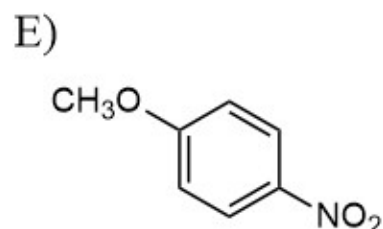
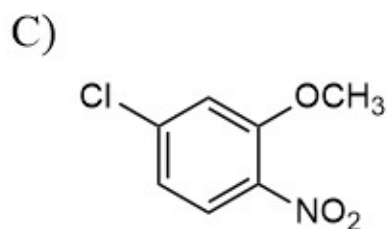
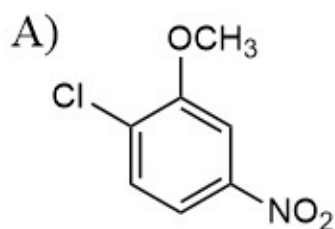
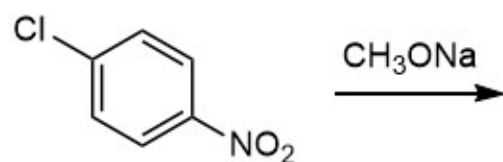
Predict the major product.

1



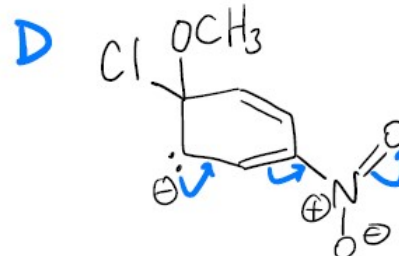
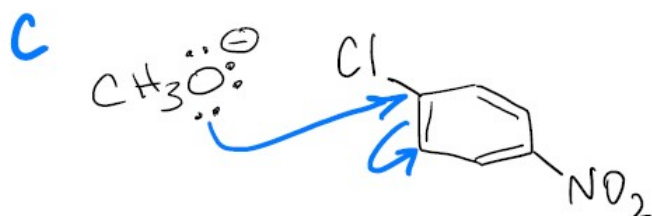
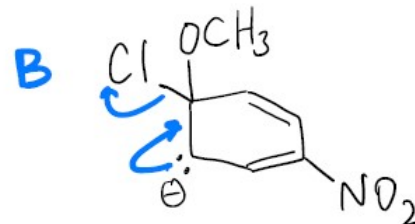
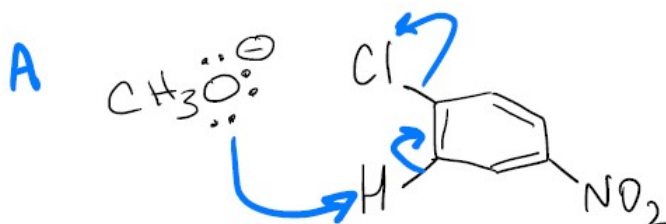
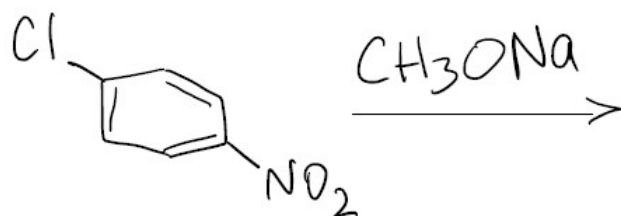
2a

Predict the major product.



2b

Which of the following is NOT a likely step (or likely resonance) in the mechanism of the following reaction?



3

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

A) $\text{Br}_2, \text{FeBr}_3$

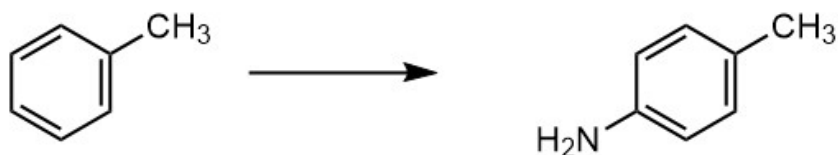
B) 1) SO_3
 H_2SO_4
 2) $\text{Br}_2, \text{FeBr}_3$
 3) H_3O^+

C) CuBr

D) 1) SO_3
 H_2SO_4
 2) CuBr
 3) H_3O^+

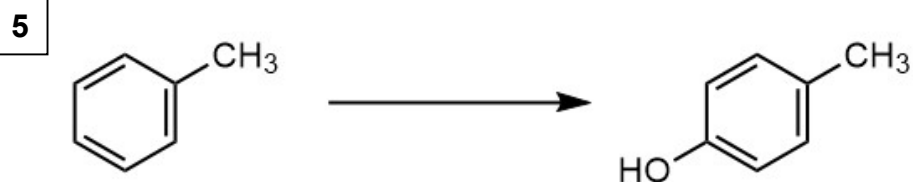
E) $\text{Br}_2, h\nu$

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



- A) $\text{NaNO}_2, \text{HCl}$ B) 1) HNO_3
 H_2SO_4
 2) H_2, Pd C) 1) $\text{Br}_2, \text{FeBr}_3$
 2) NaNH_2 D) 1) $\text{Br}_2, h\nu$
 2) NaNH_2

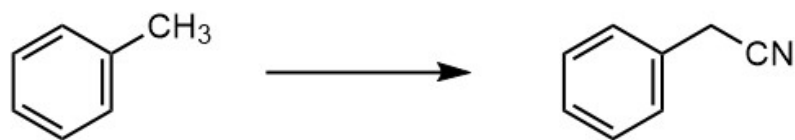
Provide the reagents necessary to transform the given starting material into the desired product.



- A) 1) HNO_3
 H_2SO_4
2) $\text{NaNO}_2, \text{HCl}$
3) H_3O^+ B) 1) HNO_3
 H_2SO_4
2) H_2, Pd
3) $\text{NaNO}_2, \text{HCl}$
4) H_3O^+ C) 1) $\text{Br}_2, \text{FeBr}_3$
 2) NaOH D) 1) $\text{Br}_2, h\nu$
 2) NaOH

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

6



A) 1) Br_2 , $h\nu$
2) NaNO_2 , HCl
3) CuCN

B) 1) Br_2 , FeBr_3
2) NaNO_2 , HCl
3) CuCN

C) 1) Br_2 , FeBr_3
2) NaCN

D) 1) Br_2 , $h\nu$
2) NaCN

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

7



A) 1) HNO_3
 H_2SO_4
2) NaNO_2 , HCl
3) CuCN

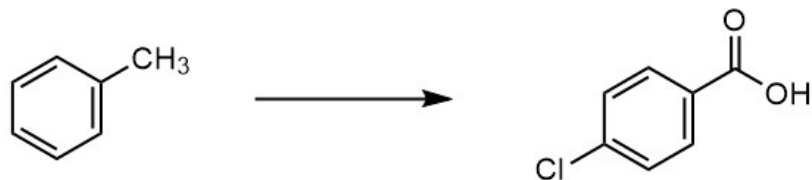
B) 1) Br_2 , FeBr_3
2) NaNH_2
3) NaNO_2 , HCl
4) CuCN

C) 1) HNO_3
 H_2SO_4
2) Zn , HCl
3) NaOH
4) NaNO_2 , HCl
5) CuCN

D) 1) Br_2 , FeBr_3
2) NaCN

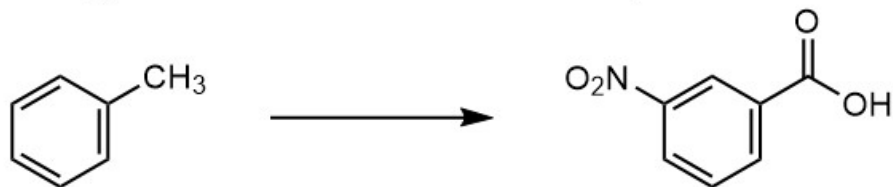
8

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

A) 1) Br_2 , $h\nu$ 2) Mg 3) CO_2 4) H_3O^+ 5) Cl_2 , FeCl_3 B) 1) Cl_2 , FeCl_3 2) Br_2 , $h\nu$ 3) Mg 4) CO_2 5) H_3O^+ C) 1) $\text{Na}_2\text{Cr}_2\text{O}_7$ H_2SO_4 2) Cl_2 , FeCl_3 D) 1) Cl_2 , FeCl_3 2) $\text{Na}_2\text{Cr}_2\text{O}_7$ H_2SO_4

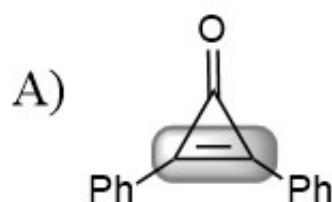
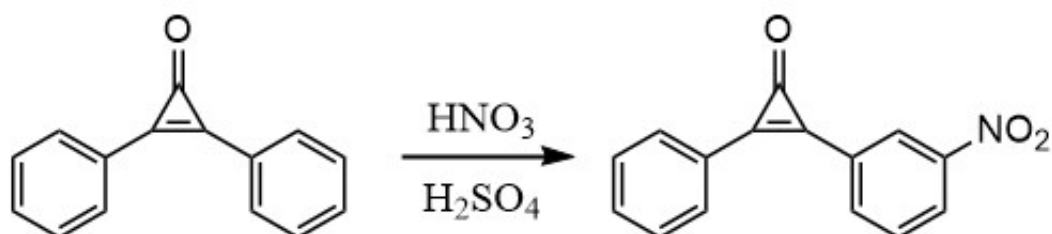
9

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

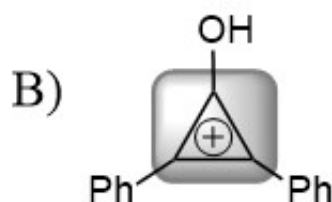
A) 1) KMnO_4
 H_2O , heat2) H_3O^+ 3) HNO_3
 H_2SO_4 B) 1) HNO_3
 H_2SO_4 2) KMnO_4
 H_2O , heat3) H_3O^+ C) 1) KMnO_4
 H_2O , heat2) H_3O^+ 3) NaNO_2 , HCl D) 1) NaNO_2 , HCl
2) KMnO_4 H_2O , heat3) H_3O^+

10a

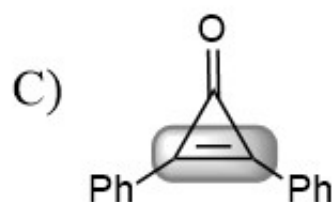
Explain the observed regiochemistry for the following reaction.



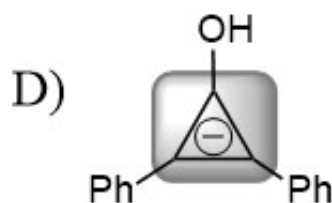
The highlighted group is an electron-withdrawing group and a meta director.



The highlighted group is an electron-withdrawing group and a meta director.



The highlighted group is an electron-donating group and a meta director.



The highlighted group is an electron-donating group and a meta director.

Identify the structure of the observed dinitration product, and explain your choice.

