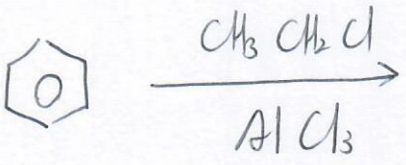
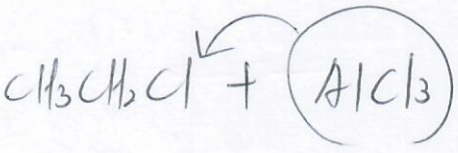
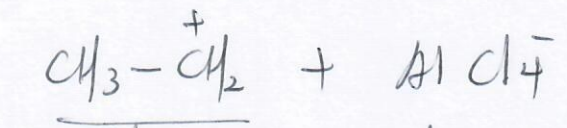
Problem 16.5 -1

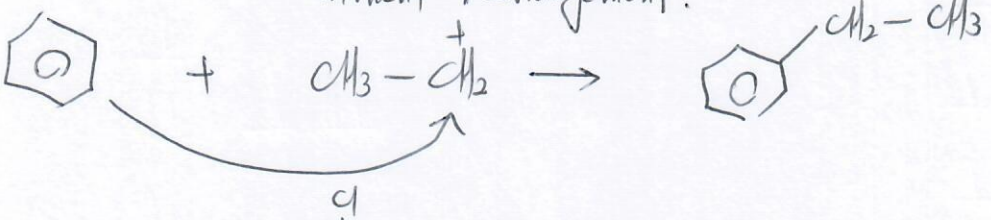
(a)



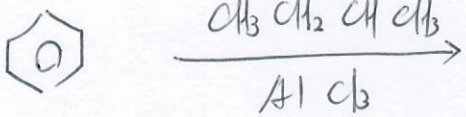


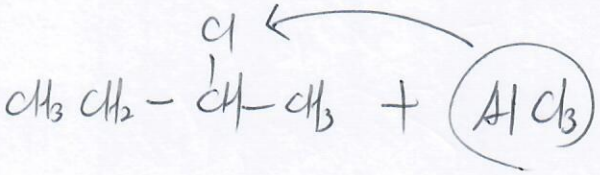


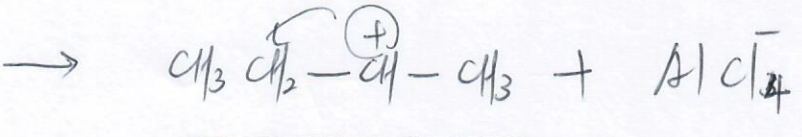
without rearrangement.



(b)

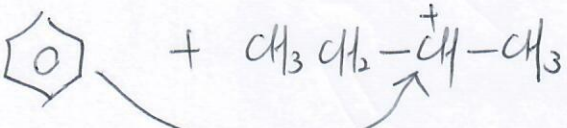


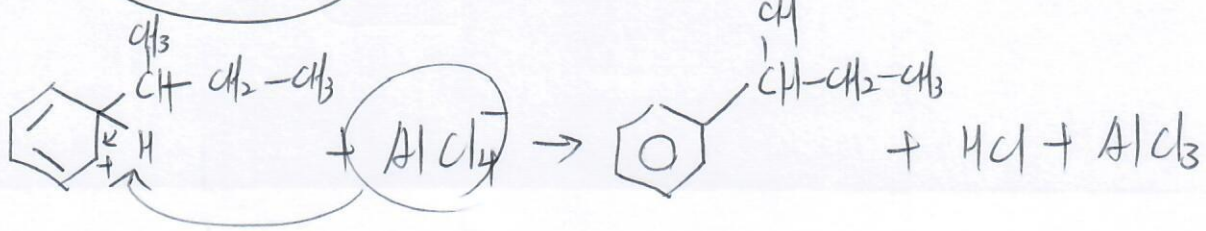




Secondary carboncation.

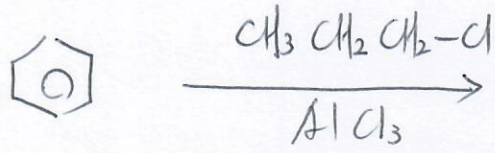
$CH_3\overset{+}{C}H-CH_2-CH_3$ → (This one is also secondary carboncation).





Problem 16.5 – 2

(c)



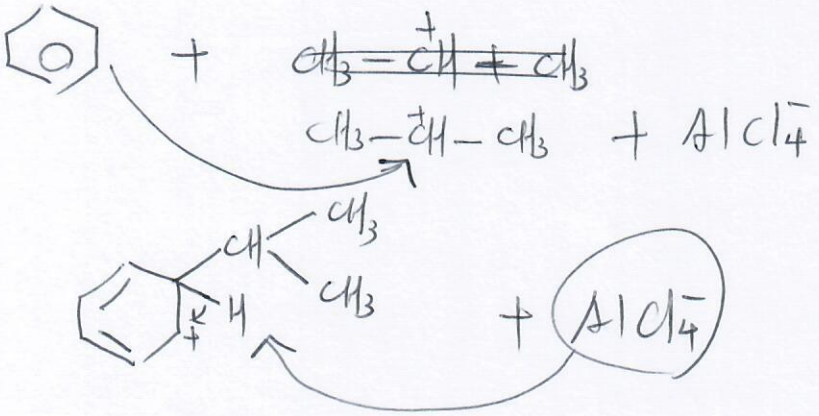
$CH_3CH_2CH_2-Cl + AlCl_3$

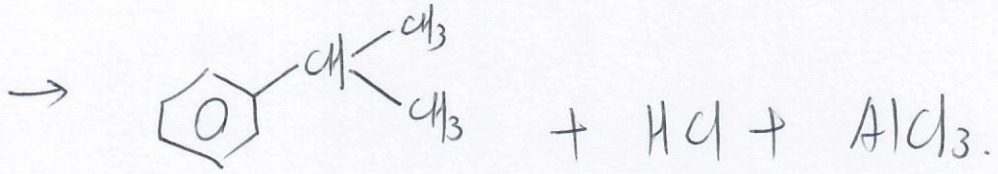
$\rightarrow CH_3CH_2\overset{+}{C}H_2 + AlCl_4^-$

Primary carbon cation

$CH_3-\overset{+}{C}H-CH_3$

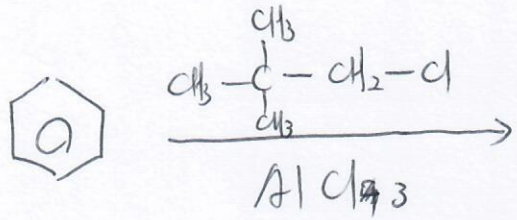
Secondary carbocation.

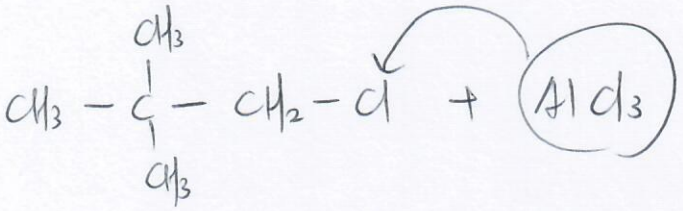


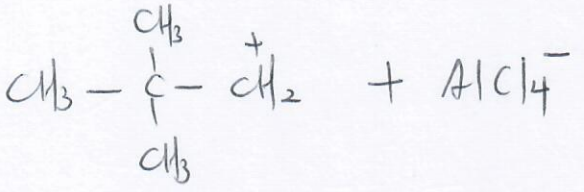


Problem 16.5-3

(d)

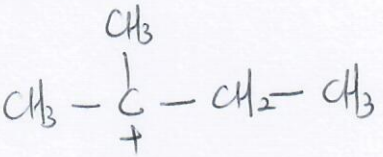




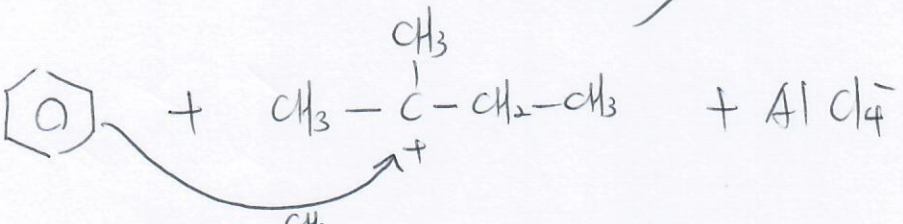


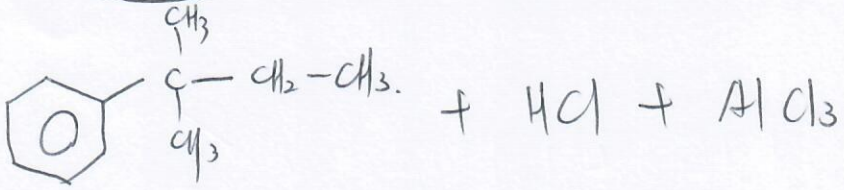
primary carboncation.

After alkyl shift

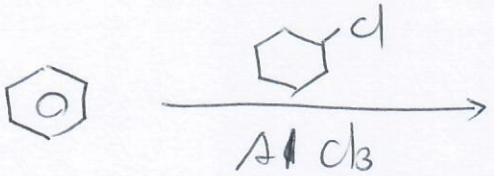


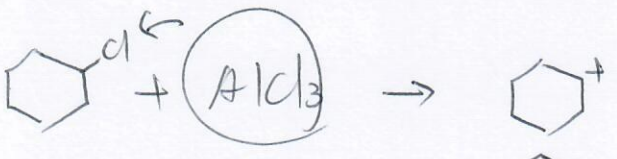
Tertiary carboncation.

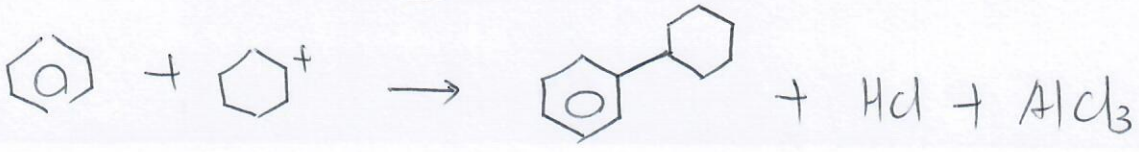




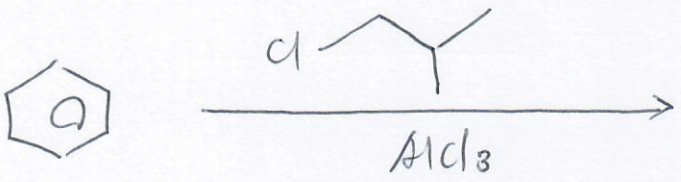
(e)

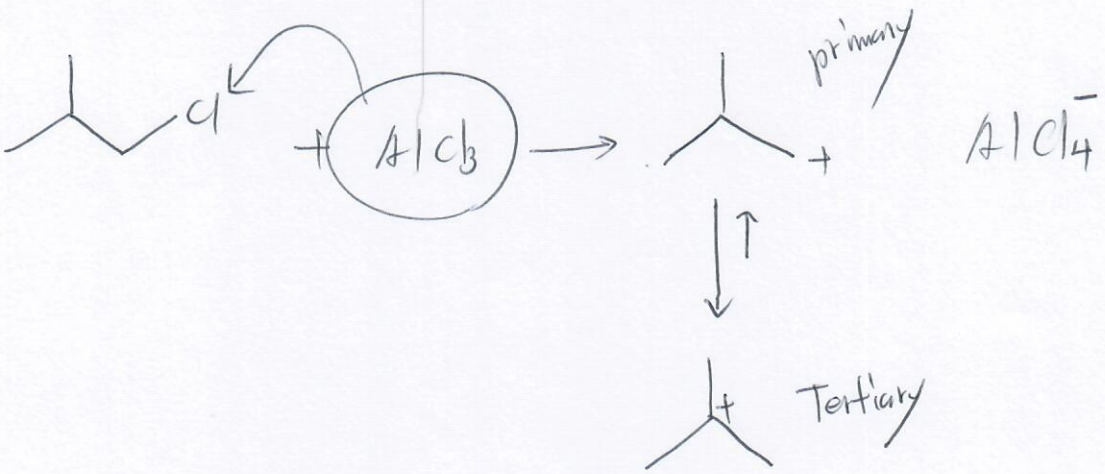




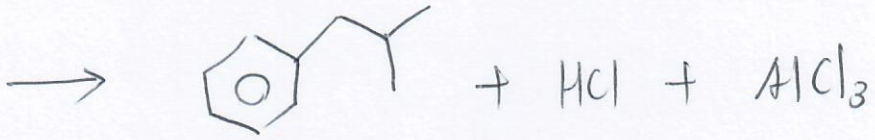


Problem 16. 6





i) 



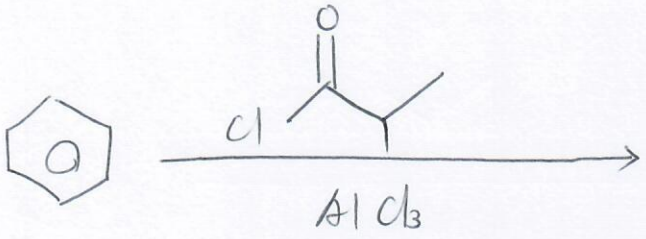
Minor product.
(iso-butylbenzene)

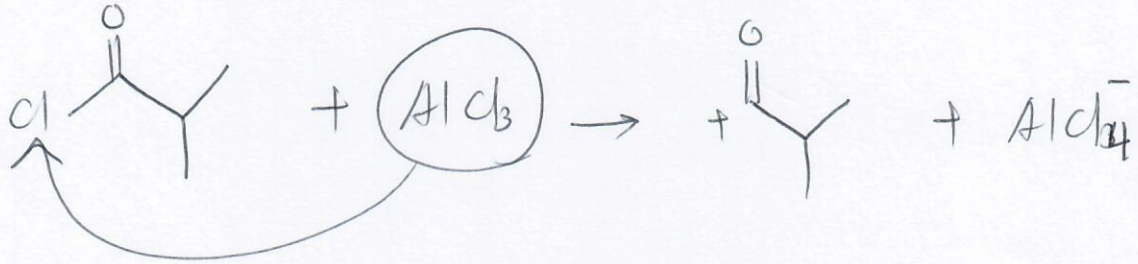
ii) 

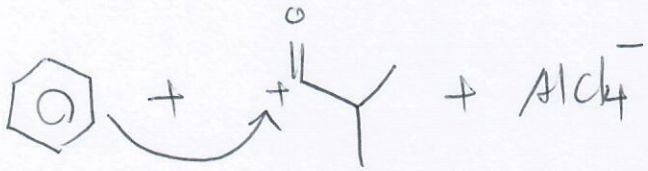
Major product.
(tert-butylbenzene)

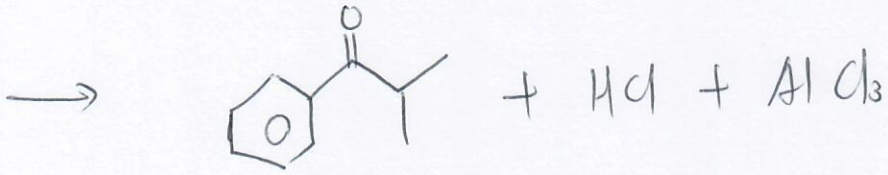
Problem 16.7.

(a)

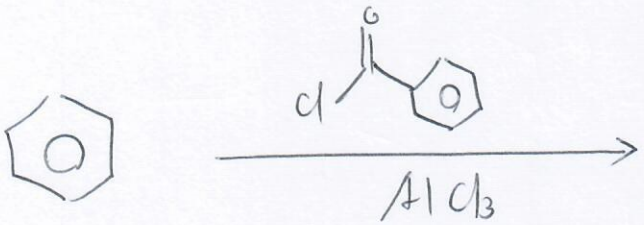


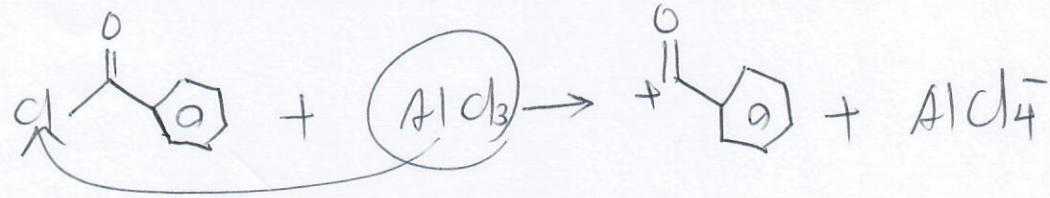


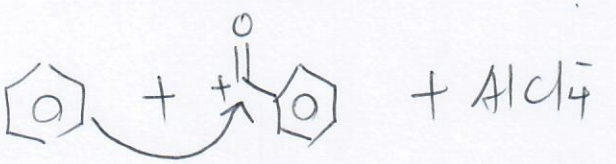


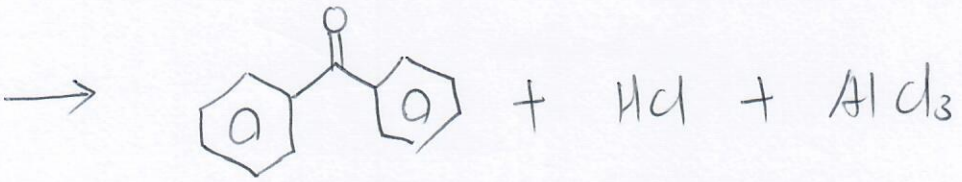


(b)

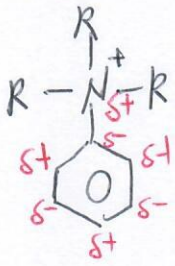


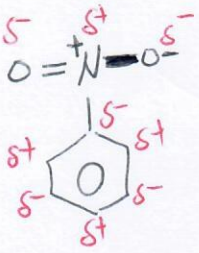


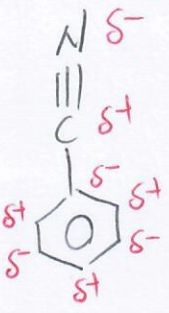


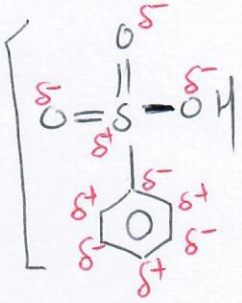


PPt p 33-1

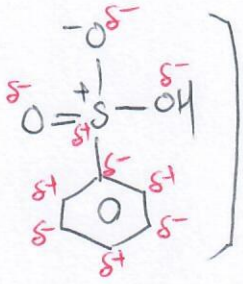


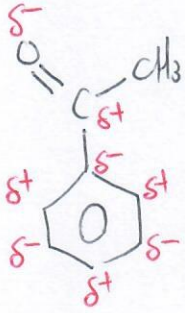


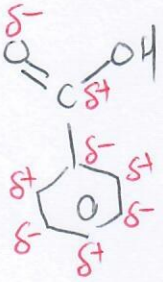


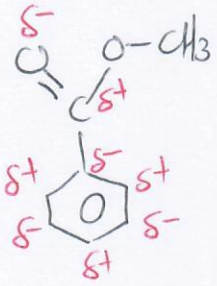


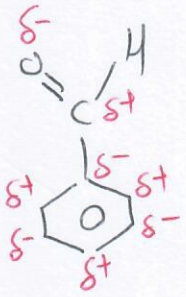
or











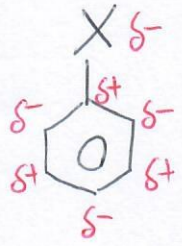
1) δ^- attacks the carbon cation.

So "meta-directing."

2) These substituents are electron-withdrawing groups.

So. "deactivators"

ppt p 33-2



X = I, Br, Cl, F.

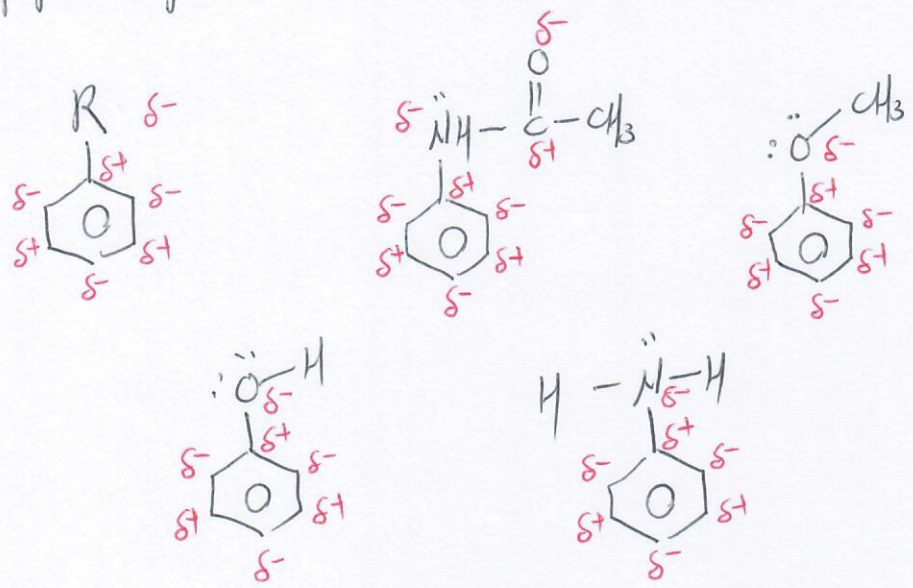
1) δ⁻ attacks the carboncation.

" ortho- and para-directing ".

2) Halogens are electron-withdrawing group.

" deactivators ".

ppt p 33-3



1) δ⁻ attacks the carboncation.

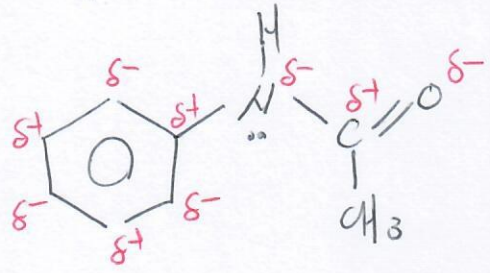
" ortho- and para- directing "

2) These substituents are electron-donating groups.

" activators ".

Problem 16.12.

Explain why acetanilide is less reactive than aniline?



1) δ⁻ attacks the carboncation.

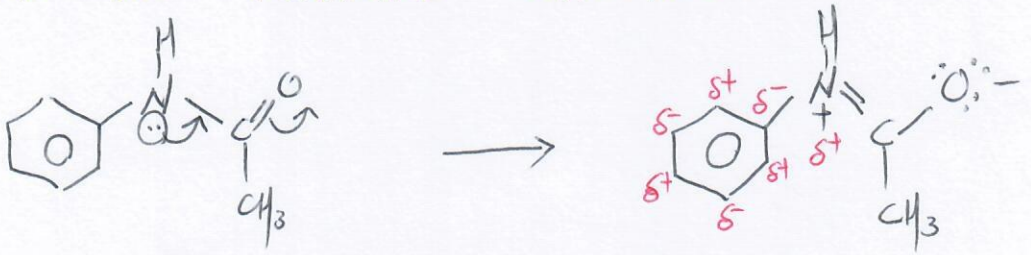
" ortho- and para-directing ".

2) ~~These substitu~~

This substituent is electron-donating group.

" activators ". by lone-pair electron.

Check the resonance structure.



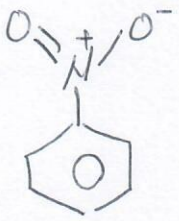
1) δ⁻ attacks the carboncation.

" meta-directing ".

2) Electron-donating group?

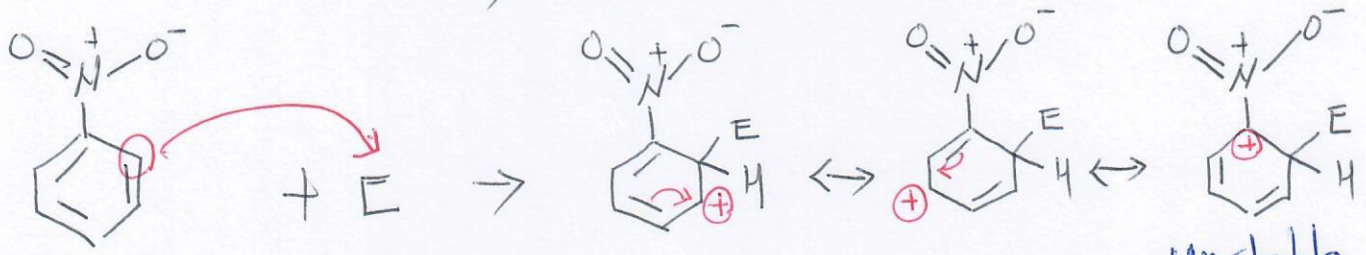
N does not have lone-pair electron.

problem 16. 13.



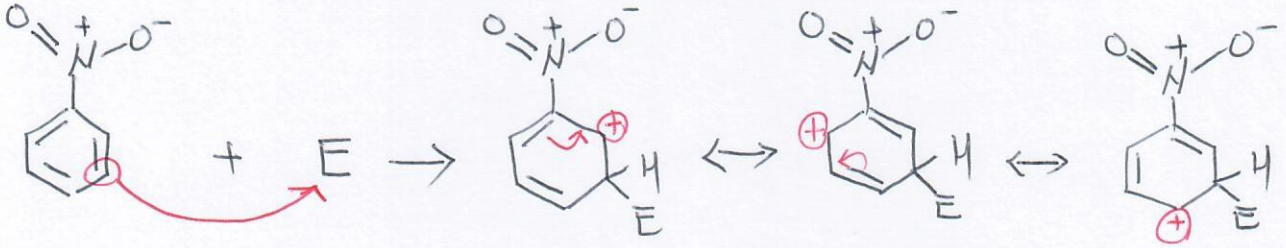
+ E.

< ortho attack >

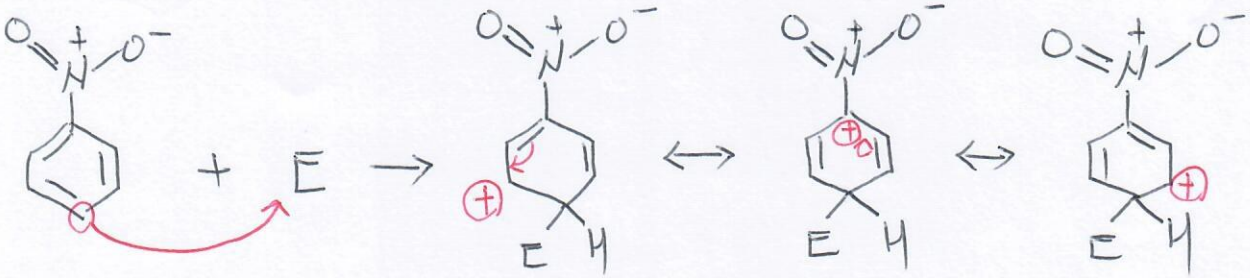


unstable.

< meta attack >



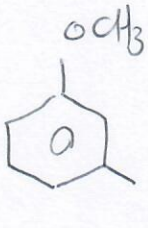
< para attack >



unstable

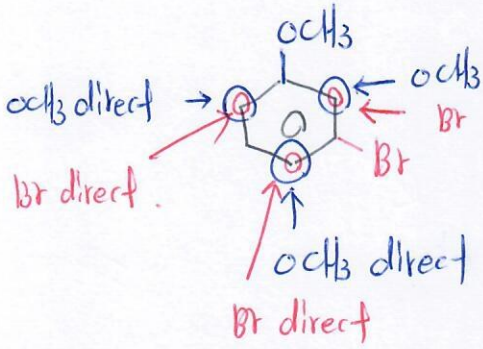
problem 16.14-1

(a)

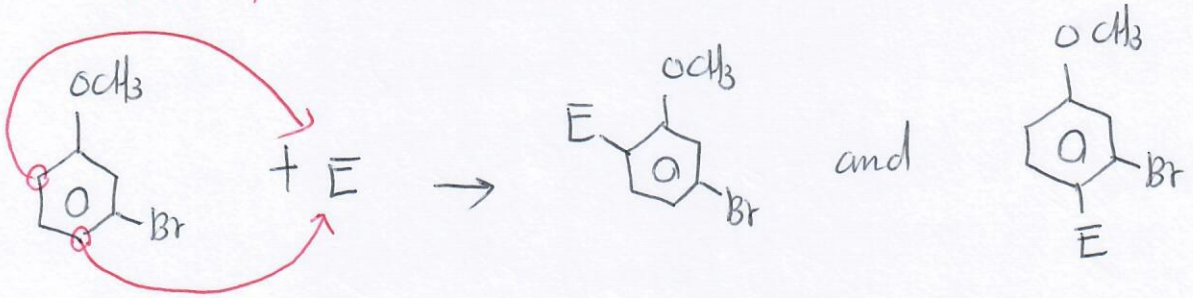


$-OCH_3$: ortho- and para-directing.

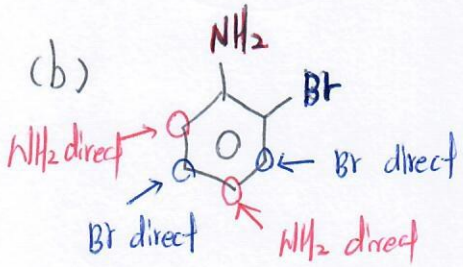
$-Br$: ortho- and para-directing.



) steric hindrance



(b)

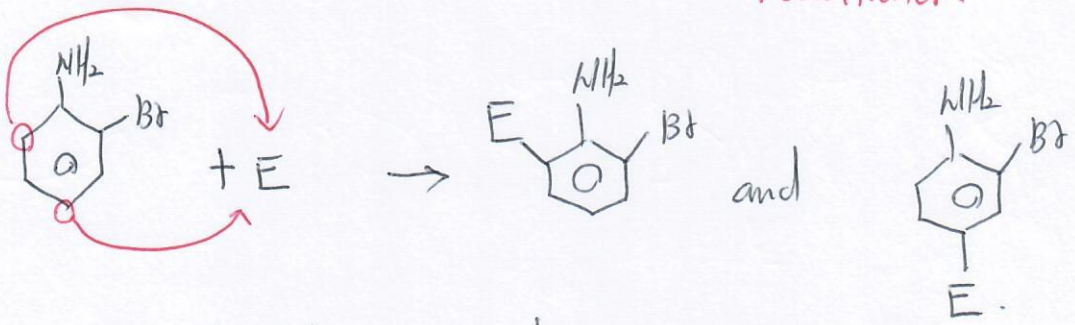


$-NH_2$: ortho- and para- directing

Activator

$-Br$: ortho- and para- directing

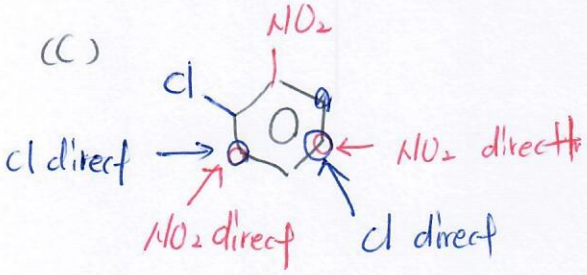
Deactivator.



$-NH_2$ is activator.

Problem 16.14-2

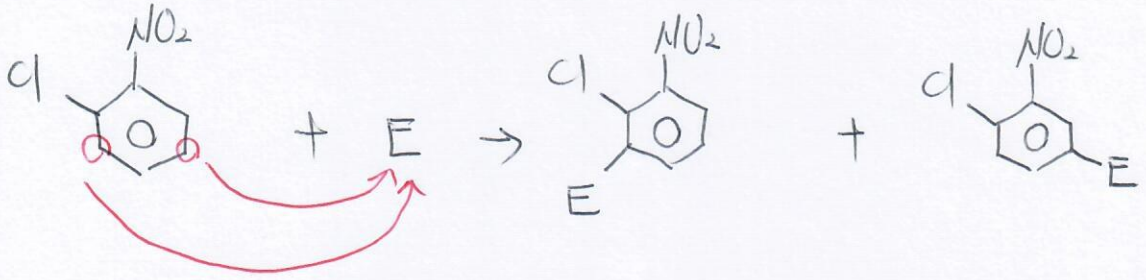
(c)



$-NO_2$: meta directing

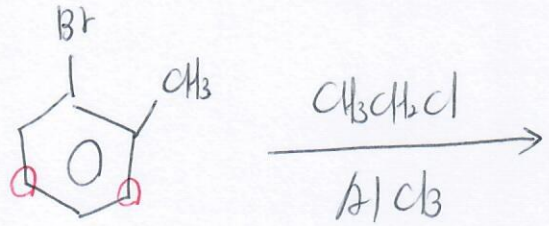
$-Cl$: ortho- and para directing

Both are deactivators.

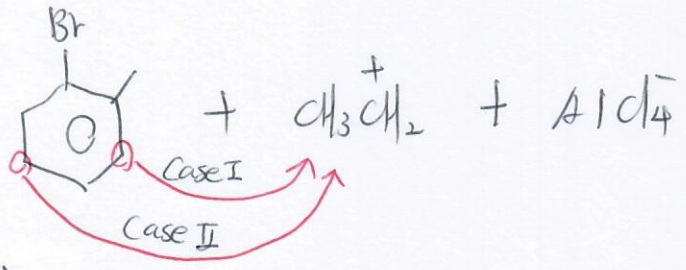


Problem 16.15.-1

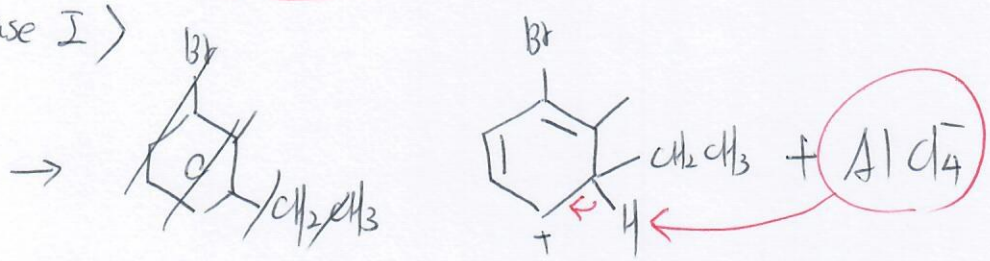
(a)

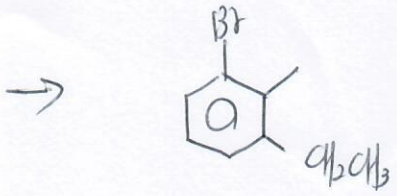


$CH_3CH_2Cl + AlCl_3 \rightarrow CH_3\overset{+}{C}H_2 + AlCl_4^-$

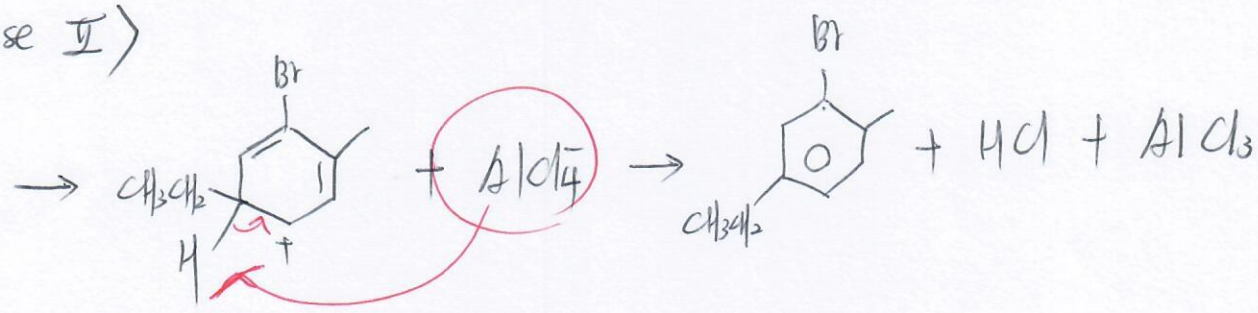


〈Case I〉



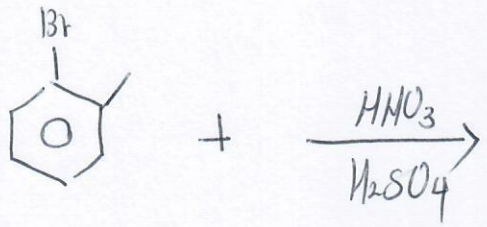


〈Case II〉

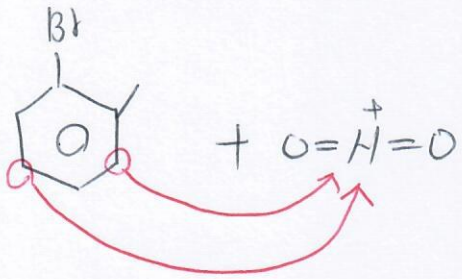


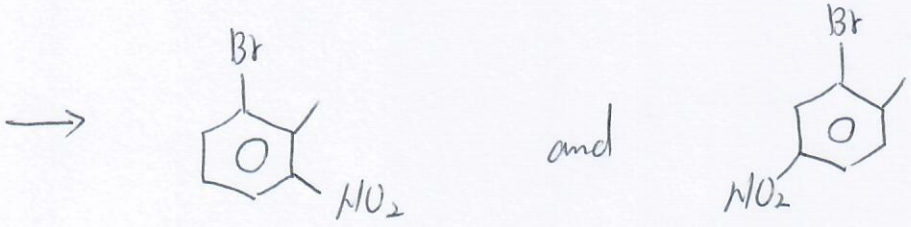
Final product

Problem 16.15-2



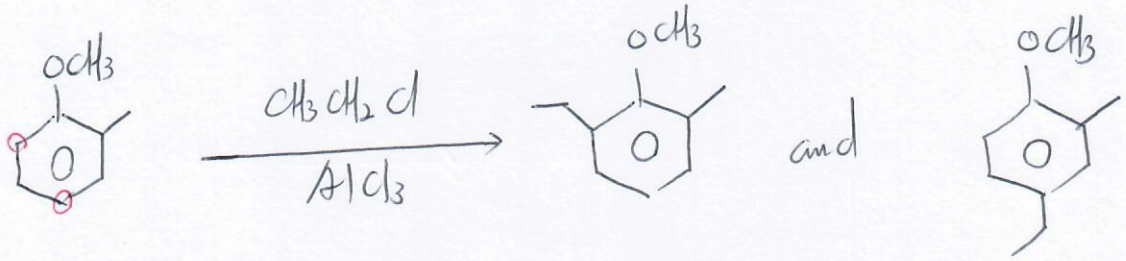
$$HNO_3 + H_2SO_4 \rightarrow \overset{+}{N}O_2 + H_2O + HSO_4^-$$





problem 16.15-3

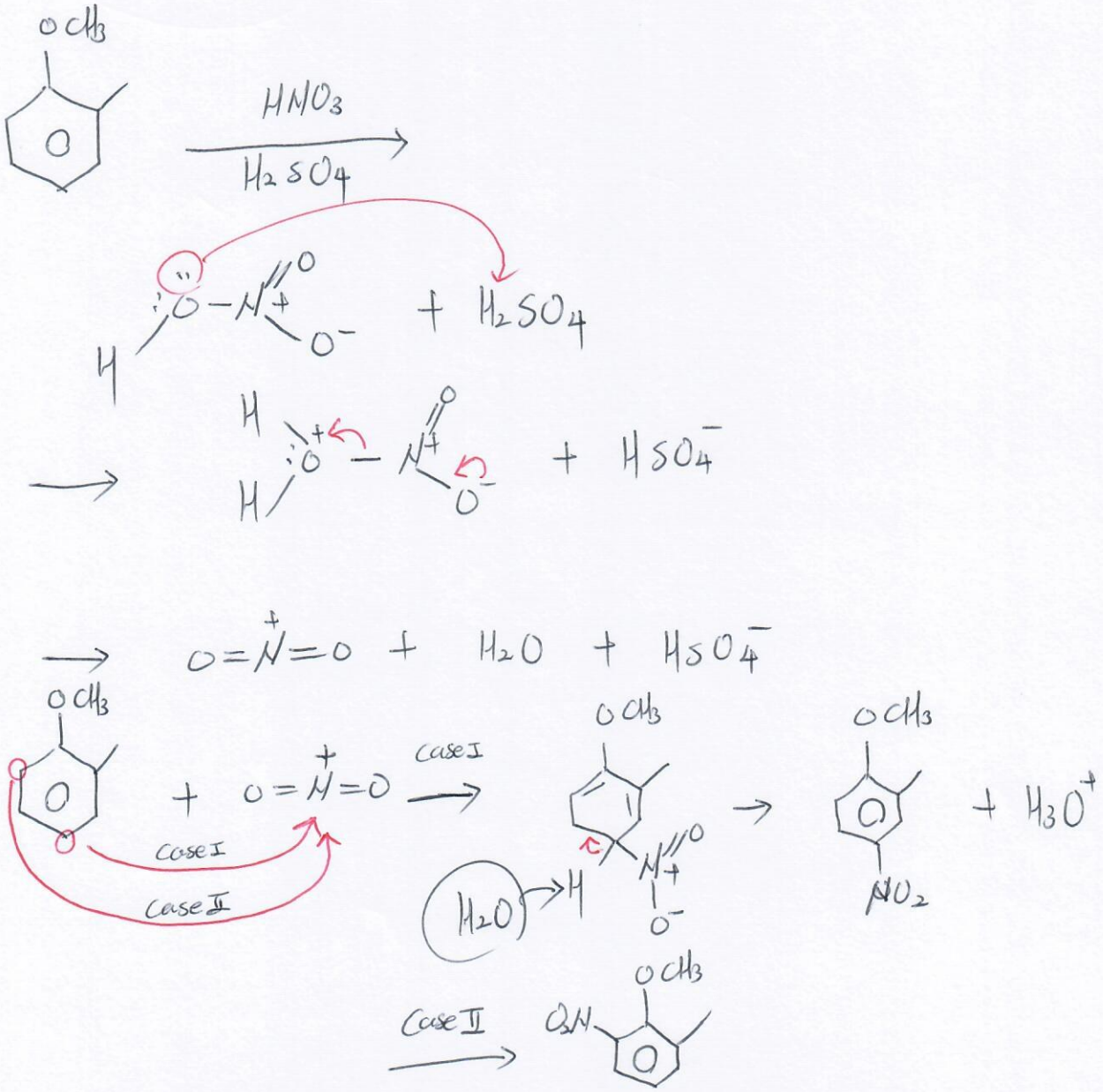
(b)



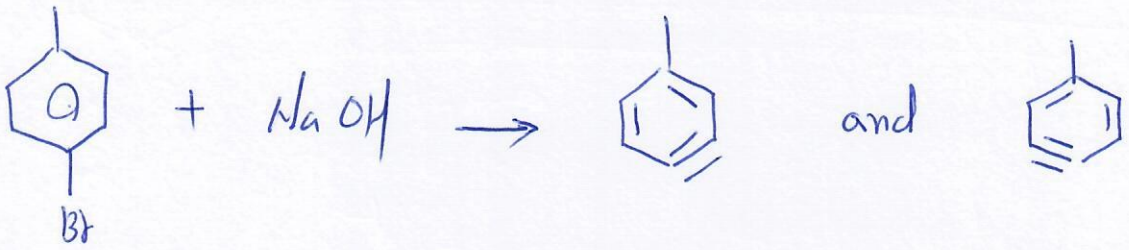
$-OCH_3$ is ortho- and para-directing.

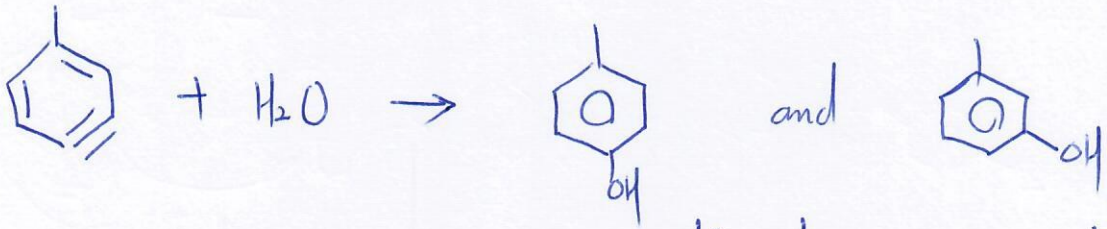
$-CH_3$ is also ortho- and para-directing.

$-OCH_3$ is more active than $-CH_3$.

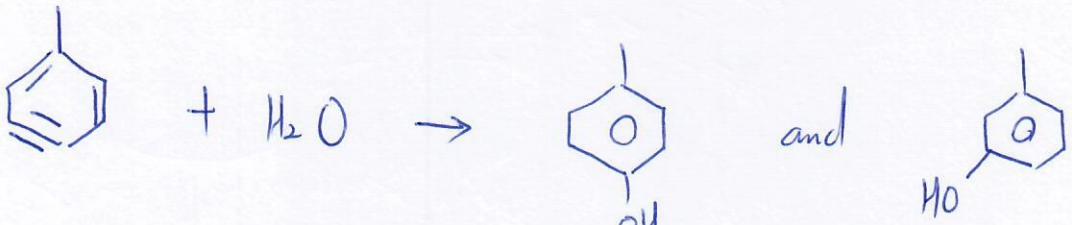


Problem 16.17.

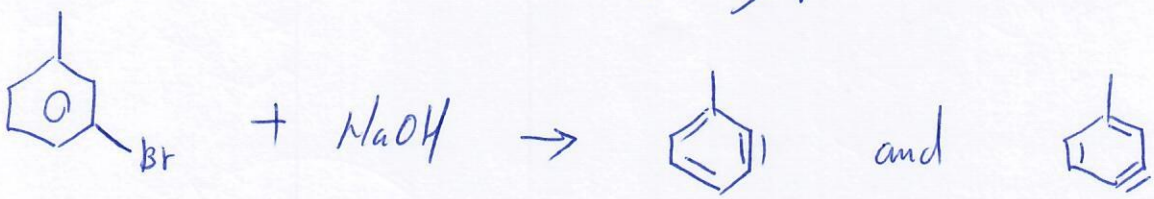


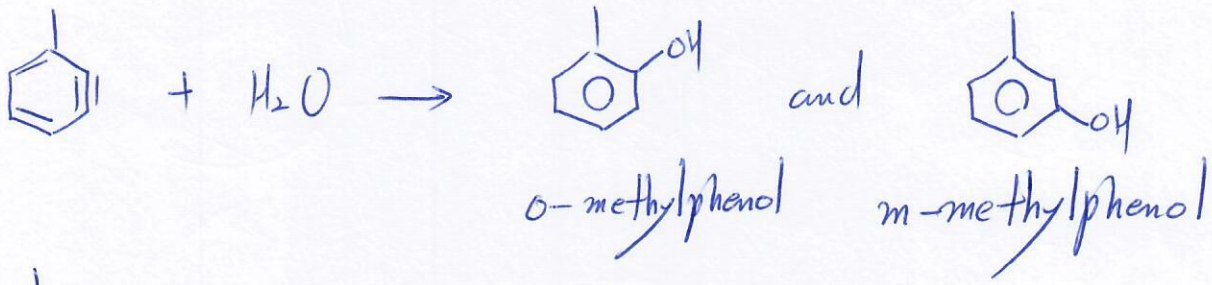


p-methylphenol m-methylphenol.

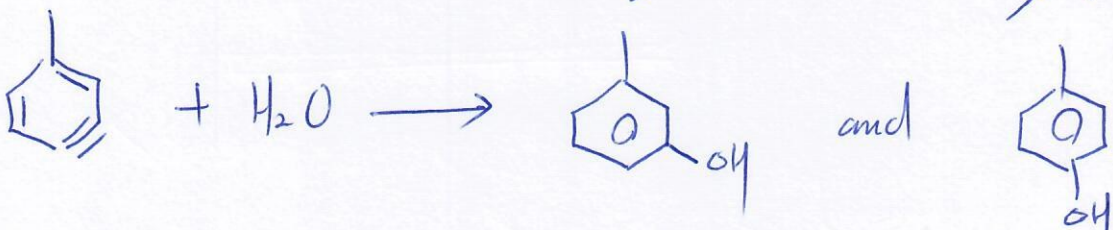


p-methylphenol m-methylphenol.





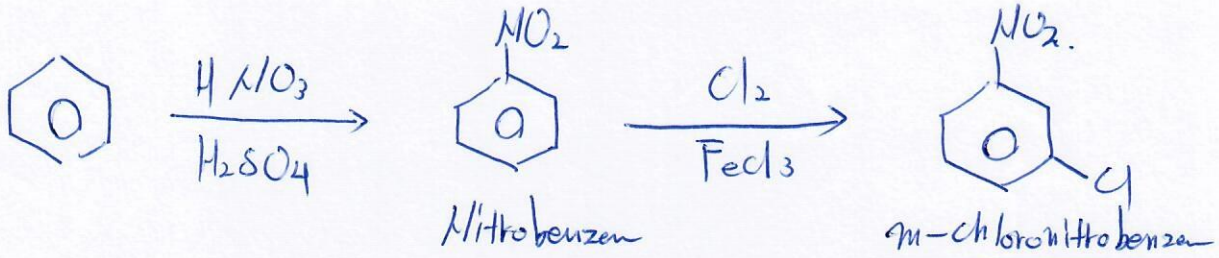
o-methylphenol m-methylphenol



m-methylphenol p-methylphenol.

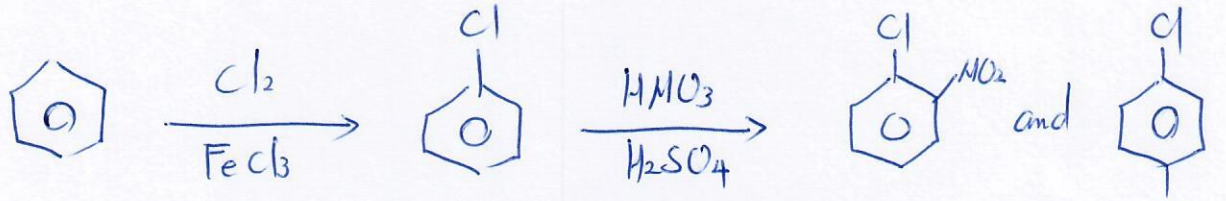
Problem 16. 22 – 1

(a)



Nitrobenzen — m-chloronitrobenzen

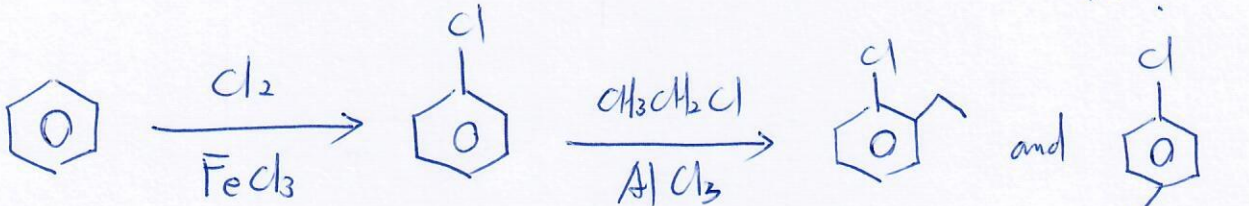
O. K.



ortho- para-

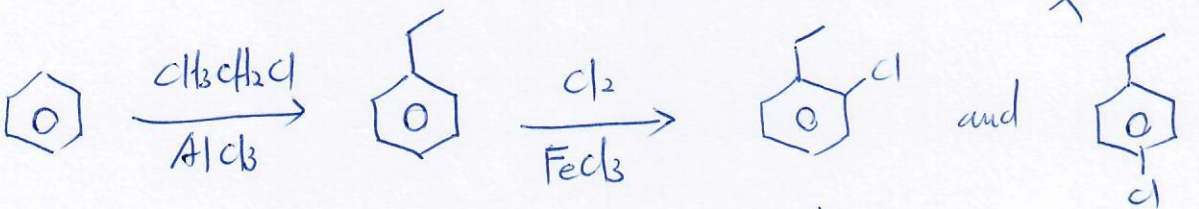
X

(b)



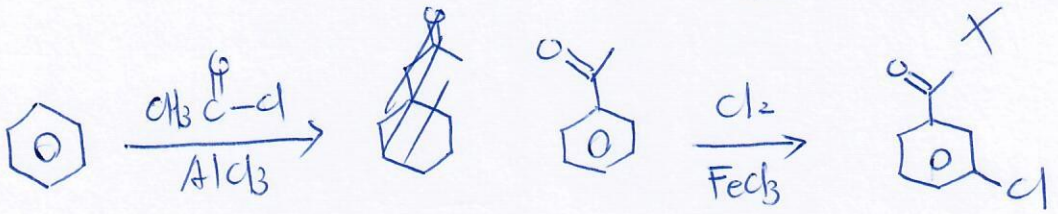
ortho- para-

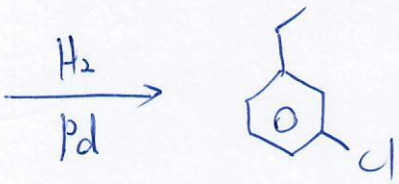
X



ortho- para-

X

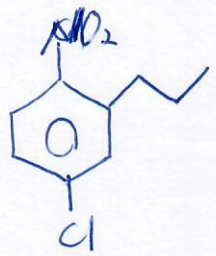


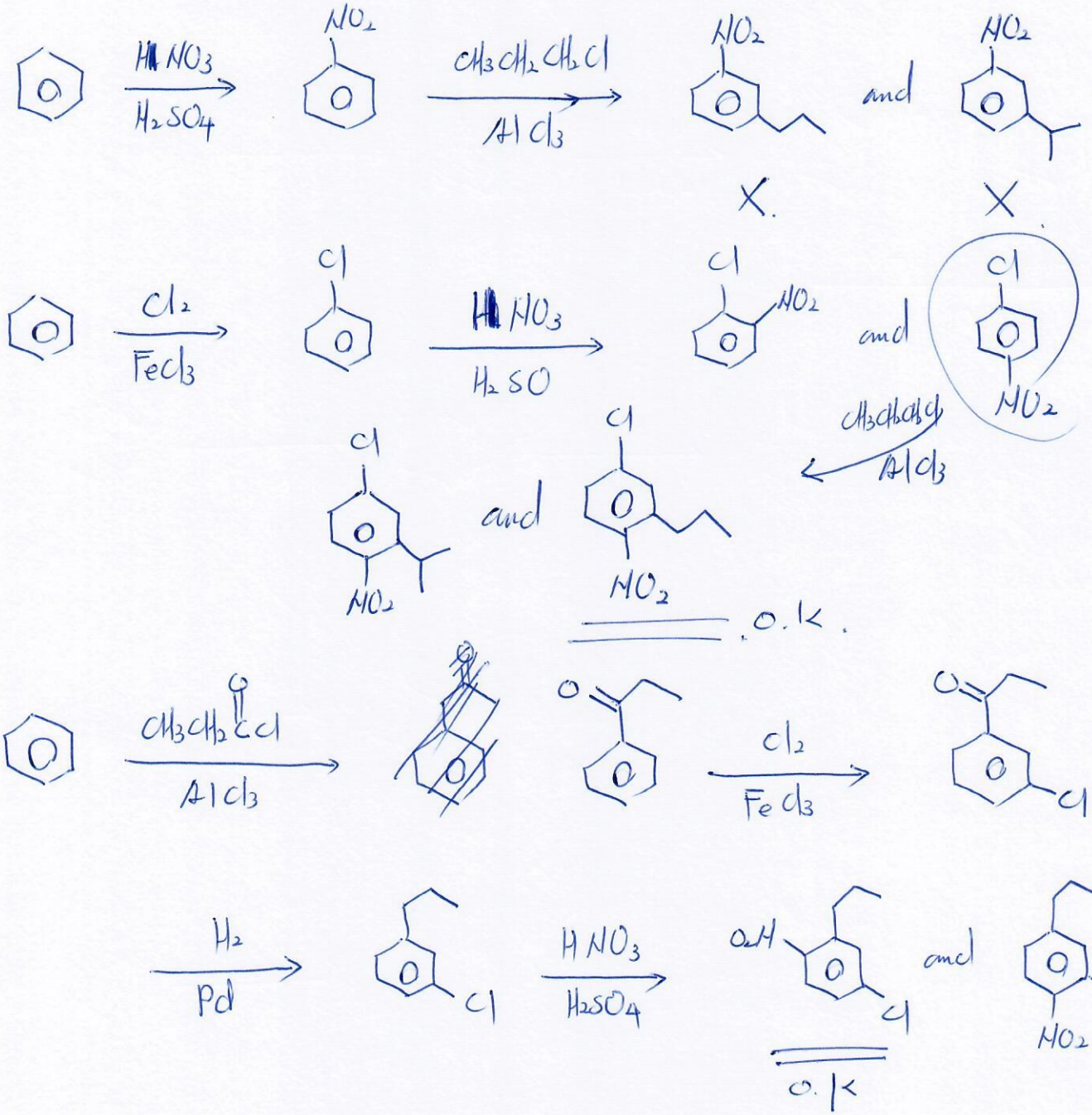


m – chloroethylbenzene.

Problem 16.22 – 2

(c)





Problem 16.22-3

(d) 3-Bromo-2-methylbenzenesulfonic acid.