ORGANIC CHEMISTRY

WORKBOOK

PART II

Department of Chemistry (College Section)
Forman Christian College (A Chartered University), Lahore, Pakistan

Dear Students,

The faculty members of the Department of Chemistry (College Section) at Forman Christian College (A Chartered University) in Lahore, Pakistan, always strive to develop resources that meet the learning needs of the students. *The Organic Chemistry Workbook Part II* is one among many efforts made by the esteemed members of the department.

The Organic Chemistry Workbook is aimed at providing a thorough practice strategy for the organic reactions outlined in the Punjab textbook. Students can assess their understanding of organic content by solving the worksheets. Moreover, they can administer self-tests by shuffling the conversions provided in the workbook and solving them independently. Repeated practice of the blanks and conversions given in the workbook will help students retain the equations presented in the text. All they need is consistency, focus, dedication, and hard work. Students may choose to solve the blanks alongside their chapter learning or opt to test themselves by completing them at the end of each chapter.

It is emphasized in every organic chemistry class that practice is the key to success when attempting the organic portion in final exams. This workbook is an effort to pave the way for rigorous practice.

Teachers never give up on their students, so students should never give up on their studies. All the best for your endeavors in making organic chemistry an accessible subject.

God bless.

Table of Contents

Chapter 7

Fundamental Principles of Organic Chemistry

A. Learn the basic definitions

1. Organic Chemistry

Organic chemistry deals with the study of compounds of _____and _____and _____.

Re-write the definition (3 times).

_____

_____

_____

_____

_____

_____

_____

_____

_____

2. Catenation

The _____property of _____ is called catenation.

Re-write the definition (3 times).

_____

_____

_____

3. Carbonization/Destructive distillation

When coal is heated in the absence of _____ (temperature ranging from_____);

it is converted into _____, _____ and _____.

Re-write the definition (3 times).

4. Cracking

Breaking of _____ having _____boiling points into a variety of _____, which are more _____and have _____ boiling points is called cracking.

Re-write the definition (3 times).

5. Reforming

Conversion of _____ into _____chain by heating in the absence of _____ and in the presence of a _____.The _____ number of_____ is improved by a process called reforming.

Re-write the definition (3 times).

6. Functional group

An_____or _____or a _____bond or a _____bond whose presence imparts_____ to organic compounds is called a functional group, because they are the _____ parts of molecules.

Re-write the definition (3 times).

7. Isomerism

Two or more compounds having the same _____formula but different _____ formulas and _____are said to be _____and the phenomenon is called _____.

Re-write the definition (3 times).

8. Vital Force Theory

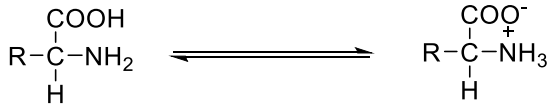
Organic compounds could be synthesized from _____. This theory was rejected by _____ by synthesizing urea from _____ on _____

Re-write the definition (3 times).

B. Match the columns for correct type of isomerism.

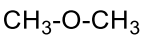
Type of isomerism	Definition
Position isomerism	Difference in the nature of the carbon chain
Functional group isomerism	Unequal distribution of carbon atoms on either side of the functional group
Tautomerism	Same structural formula, but differ with respect to the positions of the identical groups in space
Chain isomerism	Difference in the position of the same functional group on the carbon chain
Metamerism	Shifting of proton from one atom to other in the same molecule
Cis-trans/geometrical isomerism	Same molecular formula but different functional groups

C. Give the type of isomerism or the examples of isomerism according to the requirement.

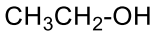
1. 

2. Metamerism

3.

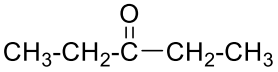


Dimethyl ether

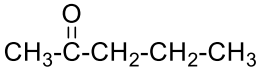


Ethyl alcohol

4.



Diethyl ketone



Methyl n-propyl ketone

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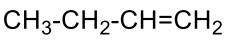
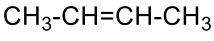
5. Position isomerism

6.



1-Butene



2-Butene

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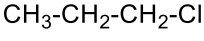
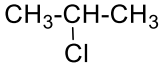
7. Chain isomerism

8.

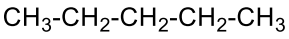


1-Chloropropane

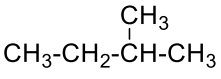


2-Chloropropane

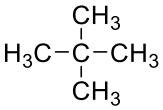
9.



n-Pentane

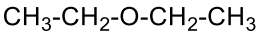


Isopentane

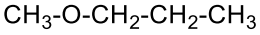


Neopentane

10.

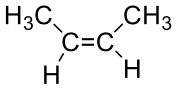


Diethyl ether

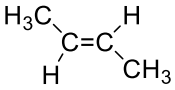


Methyl n-propyl ether

11.



Cis



Trans

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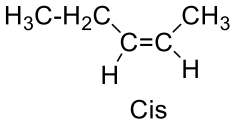
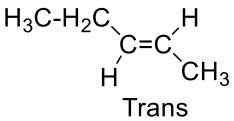
12. Cis-Trans/Geometric isomerism

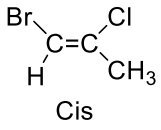


Cis

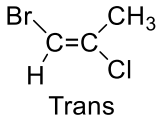


Trans

13. 2-Pentene



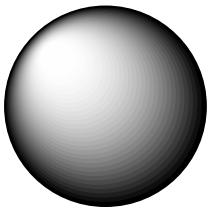
Cis



Trans

14. 1-bromo-2-chloro propene

D. Combine s and p sub-shells to draw sp^3, sp^2 and sp hybridized shapes. Also mention the bond angles.



s

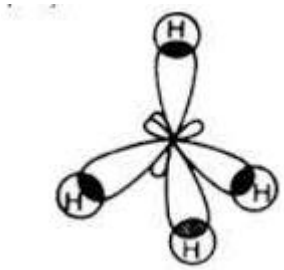
px

py

pz

E. Which hybridized structure belongs to which molecule? Also mention the bond angles.

1.



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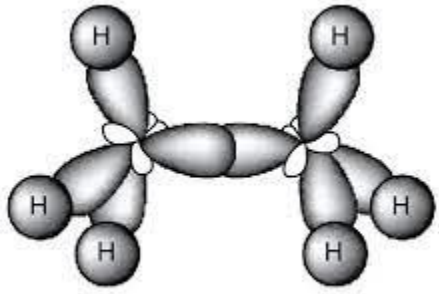

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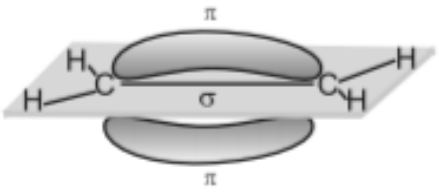

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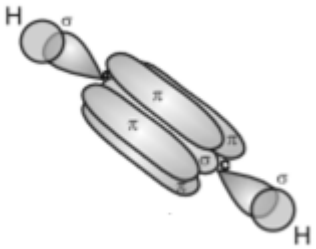


F. Fill in the blanks.

1. The open chain compounds are called_____

2. The organic compounds in which the carbon atoms are connected in series from one to the other are called_____

3. Those organic compounds in which the carbon atoms are attached on the sides of chain are called _____

4. The compounds which contain closed chains or rings of atoms and are known as _____

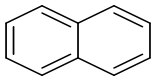
5. The compounds in which the ring consists of only carbon atoms are called_____

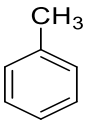
6. The homocyclic compounds which contain a ring of three or more carbon atoms and resembling aliphatic compounds are called _____

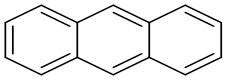
7. Those carbocyclic compounds which contain at least one benzene ring, six carbon atoms with three alternate double and single bonds are called _____

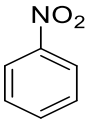
8. The compounds in which the ring consists of atoms of more than one kind are called _____

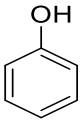
G. Either name the compounds or draw their structures. Moreover mention the class of organic compounds to which they belong.

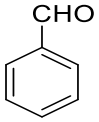


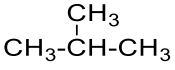


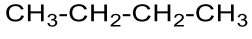












H. One word/two word answer.

1. The additive used in gasoline as an anti-knocking agent is called

_____

2. The IUPAC name of isooctane is

_____

3. The sharp metallic sound produced during combustion of fuel in engine is called

_____

4. The equation involved in cracking $C_{16}H_{34}$ is

---

5. Lower unsaturated hydrocarbons are obtained through

_____

6. The conditions for steam cracking are

---

7. The catalysts used in catalytic cracking are

_____

8. The temperature/pressure conditions employed in catalytic cracking are

9. Which type of cracking improves the quality of gasoline?

_____

10. The conditions for thermal cracking are

_____

11. Unsaturated hydrocarbons (ethene, propene) are obtained through

_____

J. Complete the cycle for the formation of different types of coal.

Wood
Dead
plants
and Trees → _____ → _____

→ _____ → _____

K. Mention the main features of organic compounds.

1._____

2._____

3._____

4._____

5._____

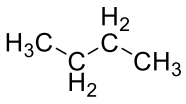
6._____

7._____

Chapter 8

Aliphatic Hydrocarbons

A. Name the following compounds according to IUPAC system.



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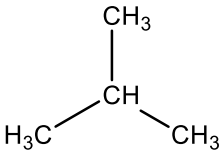

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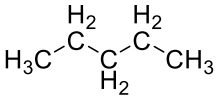

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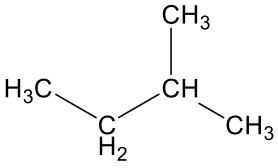

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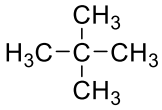

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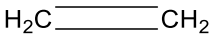

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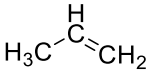

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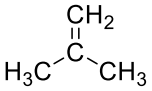

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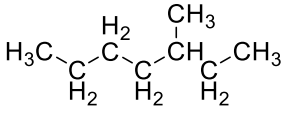

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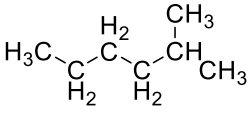

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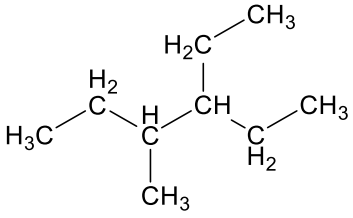

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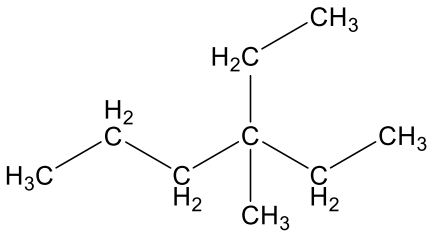

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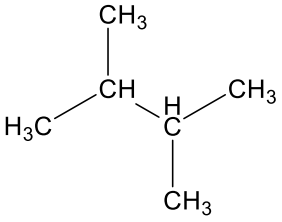

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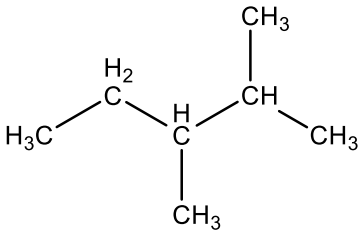
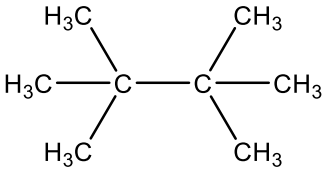
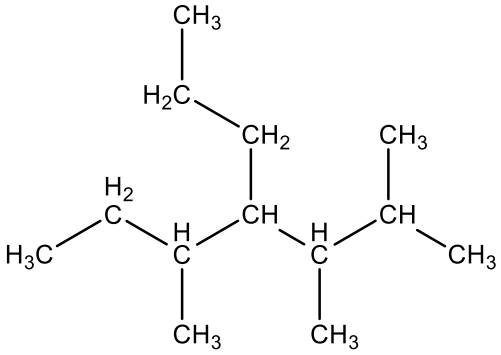
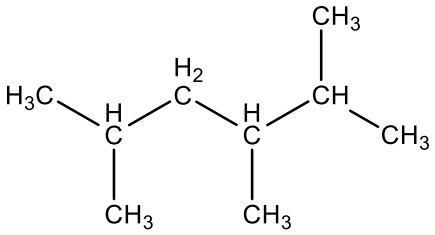
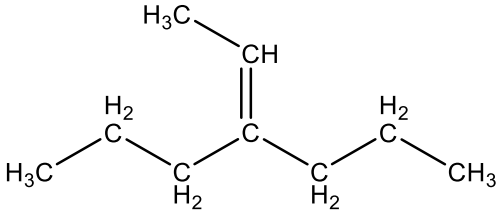
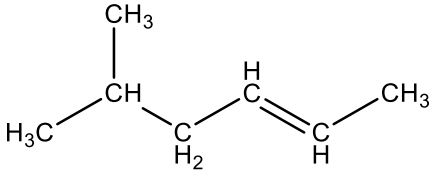


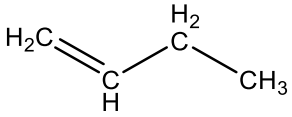


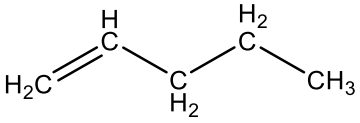


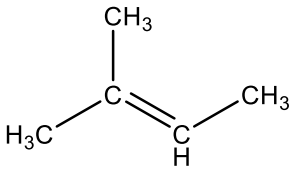


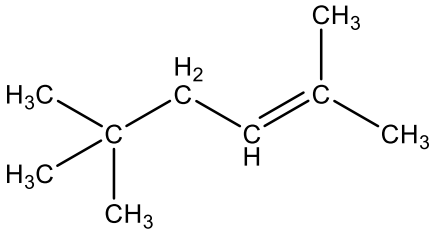


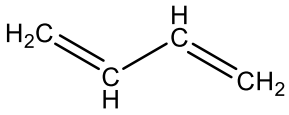


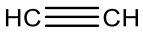


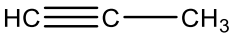


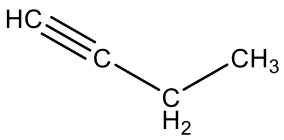


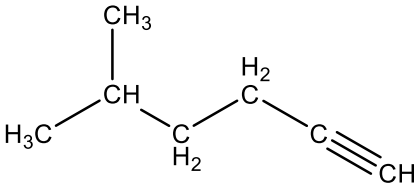


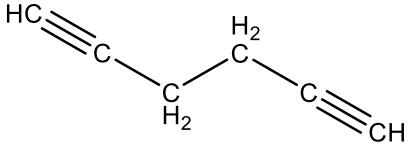


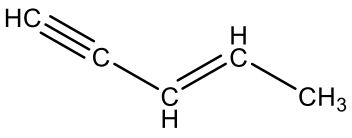


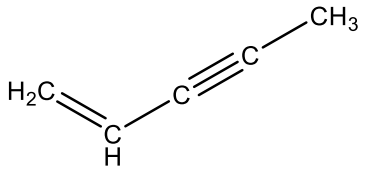


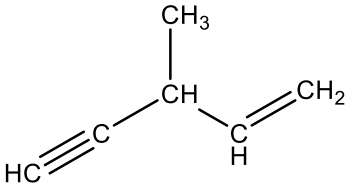












Learn the Reaction Conditions

- Sabatier-Sendem's reaction Ni/200-300 °C
- Hydrogenolysis Pd/C Δ
- Grignard reagent: Ether/H^+
- Nitration of alkanes: HNO_3/450 °C
- Dehydrohalogenation of alkyl halides: Alc. KOH
- Dehalogenation of vicinal dihalides: Zn/CH_3OH
- Partial hydrogenation of alkynes cis-alkene: Pd ($BaSO_4$) Quinoline, Trans-alkene: Na/liquid NH_3 -33 °C
- Addition of oxygen to alkenes: ½ O_2 / Ag_2O/ 300 °C
- Dehydrohalogenation of vicinal dihalides: 1. Alcohol/80 °C 2. Alcohol/150 °C
- Addition of halogens to alkynes: CCl_4
- Addition of ammonia to alkynes: Al_2O_3/300 °C
- Addition of hydrogen cyanide to alkynes: $Cu_2Cl_2/NH_4Cl/\Delta$
- Formation of sodium acetylide: liq. NH_3
- Decarboxylation: NaOH/CaO/Δ
- Clemmensen: Zn-Hg/HCl
- Wolf-Kishner: N_2H_4/KOH/200 °C
- Catalytic oxidation of alkanes: Cu/400 °C/200 atm
- Halogenation of alkanes: h*ν*
- Dehydration of Alcohols: Al_2O_3/340-450 °C. Pri-Alcohol: 75% H_2SO_4/140-170 °C. Sec-Alcohol: 60% H_2SO_4/100 °C. Tert-Alcohol: 20% H_2SO_4/85 °C
- Addition of sulphuric acid to alkenes: 100 °C
- Addition of halogens to alkenes: X_2/CCl_4
- Hydroxylation of alkenes: Cold 1% alkaline $KMnO_4$
- Polymerization of alkenes: 400 °C/100 atm pressure, traces of O_2 (0.1%)
- Addition of water to alkynes: $HgSO_4/H_2SO_4$
- Oxidation of alkynes/Hydroxylation of alkynes: alkaline $KMnO_4$
- Conversion of acetylene to divinyl acetylene: Cu_2Cl_2, NH_4Cl

- Conversion of acetylene to benzene: Cu-tube/300 ºC

B. Match the correct reaction condition.

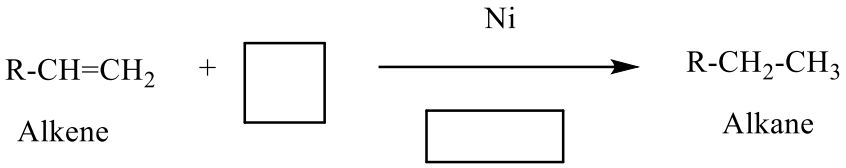
Reaction	Condition
Sabatier-Sendem's reaction	HNO_3/450 ºC
Nitration of alkanes	Pd/C Δ
Hydrogenolysis	Ni/200-300 ºC
Grignard reagent	Ether/H^+
Dehydrohalogenation of alkyl halides	Alc. KOH
Dehalogenation of vicinal dihalides	Zn/CH_3OH
Partial hydrogenation of alkynes cis-alkene	Pd ($BaSO_4$) Quinoline
Partial hydrogenation of alkynes Trans-alkene	Na/liquid NH_3 -33 ºC
Addition of oxygen to alkenes	½ O_2 / Ag_2O/ 300 ºC
Dehydrohalogenation of vicinal dihalides	Alcohol/80 ºC, Alcohol/150 ºC
Addition of halogens to alkynes	CCl_4
Addition of ammonia to alkynes	$Cu_2Cl_2/NH_4Cl/\Delta$
Addition of hydrogen cyanide to alkynes	Al_2O_3/300 ºC
Decarboxylation	liq. NH_3
Formation of sodium acetylide	NaOH/CaO/Δ
Conversion of acetylene to benzene	Cu-tube/300 ºC
Wolf-Kishner	400 ºC/100 atm pressure, traces of O_2 (0.1%)
Clemmensen	Cu_2Cl_2, NH_4Cl
Conversion of acetylene to divinyl acetylene	$HgSO_4/H_2SO_4$
Catalytic oxidation of alkanes	alkaline $KMnO_4$
Halogenation of alkanes	Cold 1% alkaline $KMnO_4$
Oxidation of alkynes/Hydroxylation of alkynes	X_2/CCl_4
Dehydration of Alcohols	100 ºC
Addition of sulphuric acid to alkenes	Al_2O_3/340-450 ºC. Pri-Alcohol: 75% H_2SO_4/140-170 ºC. Sec-Alcohol: 60% H_2SO_4/100 ºC. Tert-Alcohol: 20% H_2SO_4/85 ºC
Addition of water to alkynes	hν
Addition of halogens to alkenes	Cu/400 ºC/200 atm
Hydroxylation of alkenes	N_2H_4/KOH/200 ºC
Polymerization of alkenes	Zn-Hg/HCl

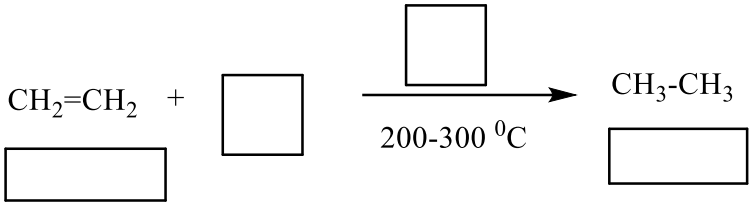
C. Learn through blanks.

Alkanes

Name of reaction: _____

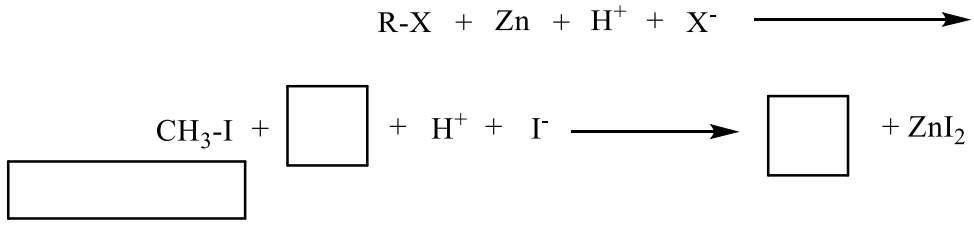
Application: _____



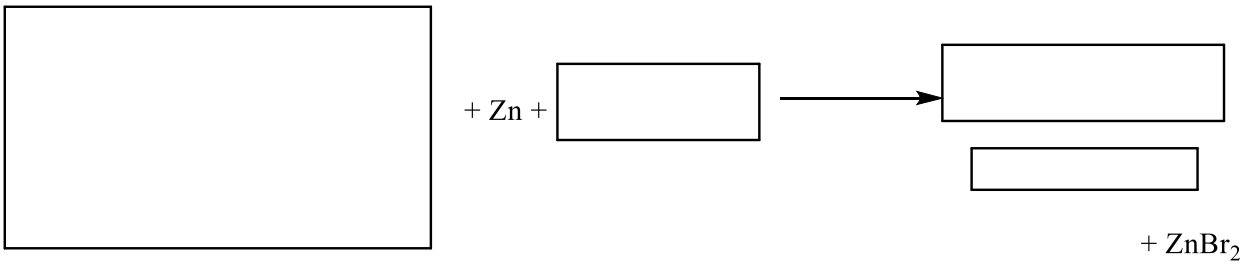


Practice Reaction

Name of reaction: _____



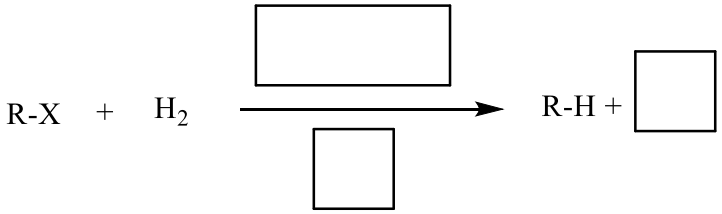
Practice Reaction

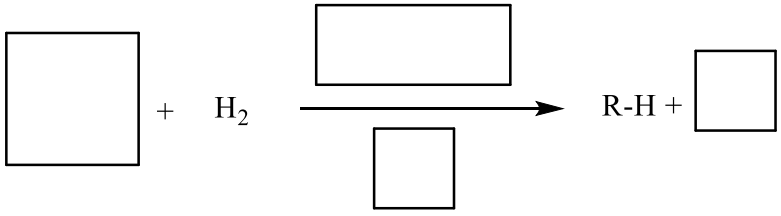


2-Bromo butane

Practice Reaction

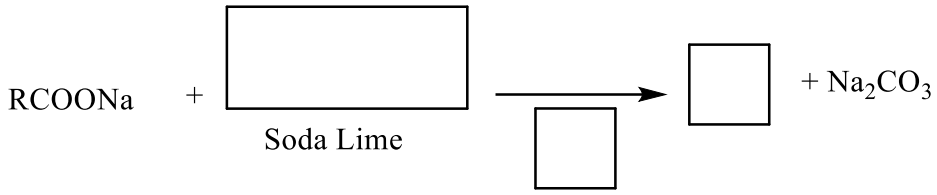
Name of reaction: _____

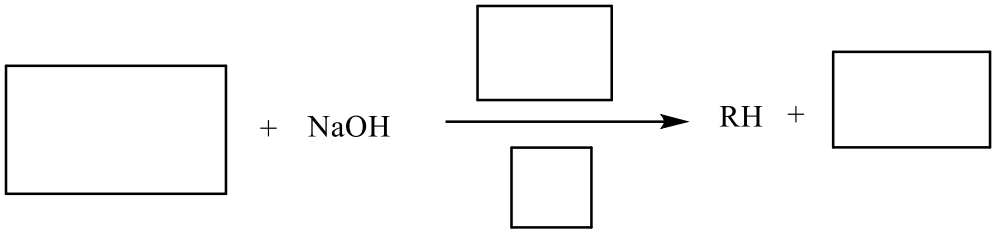




Practice Reaction

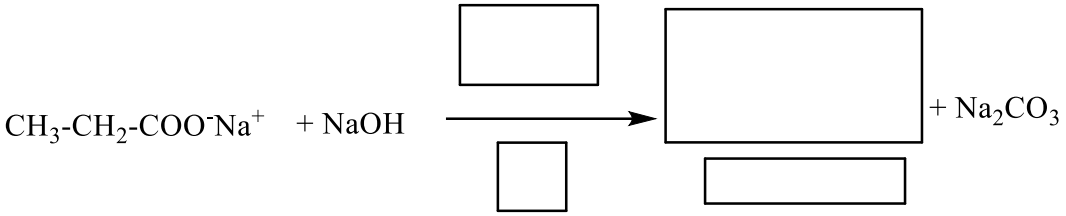
Name of reaction: _____

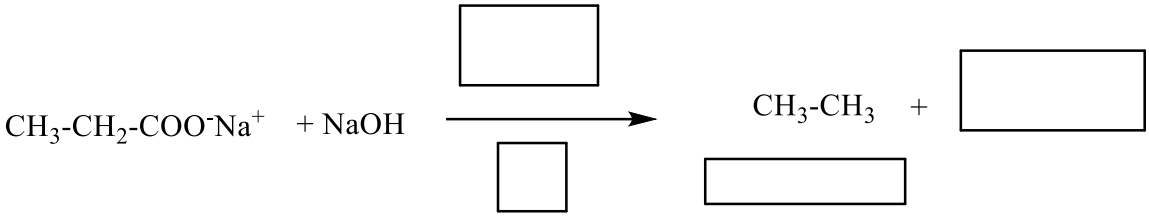




Practice Reaction

Name of reaction: _____





Practice Reaction

Name of Reaction: _____

$CH_3COOK \xrightleftharpoons{H_2O}$

At Anode

$CH_3COO^- \xrightarrow{\text{Electrolysis}}$ [ ] $+ 2e^-$

[ ]

[ ] $\longrightarrow CH_3\text{-}CH_3$

At Cathode

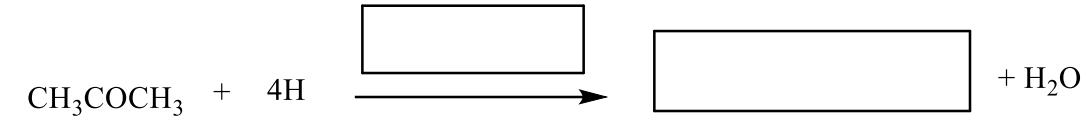
$2H_2O + 2e^- \longrightarrow$ [ ] $+ H_2$

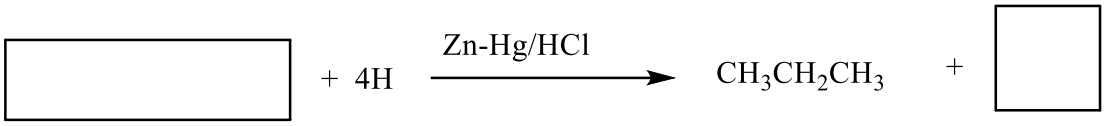
$2K^+ + 2\ OH^- \longrightarrow$ [ ]

Practice Reaction

[ ]

Name of Reaction:_____

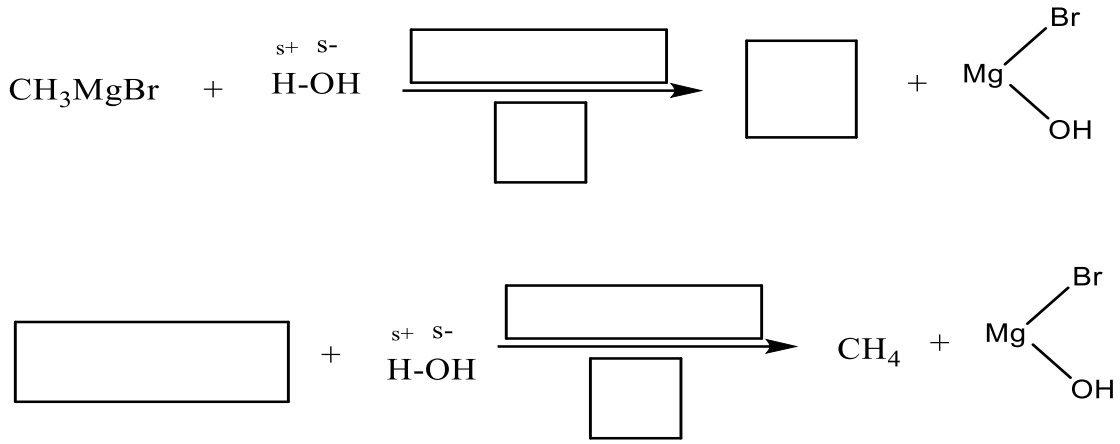




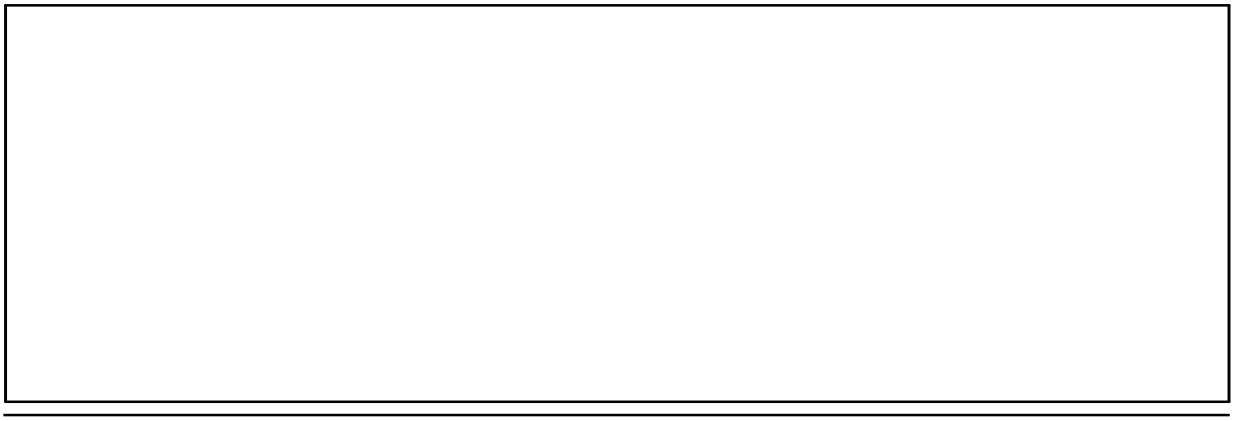
Practice Reaction

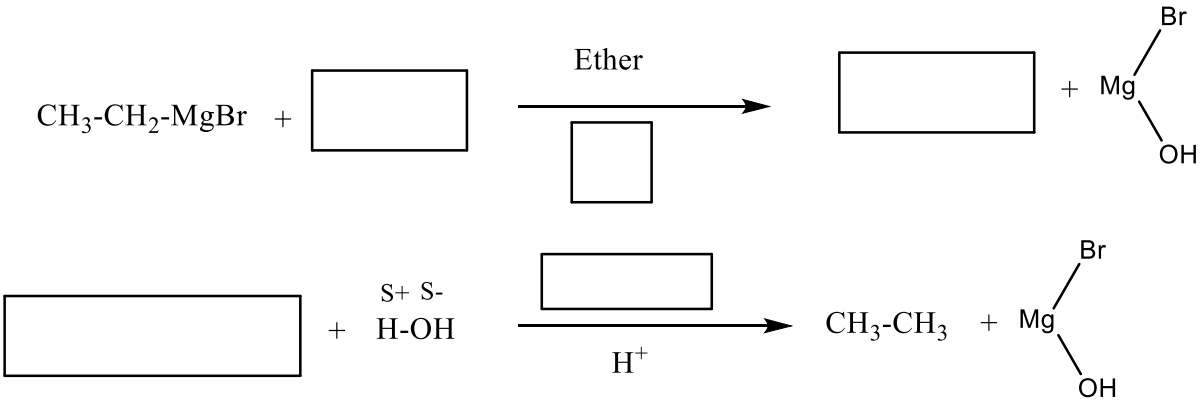
Practice Reaction

Name of Reaction:_____



Practice Reaction





Practice Reaction

Tell about the inertness of sigma bond.

_____

_____

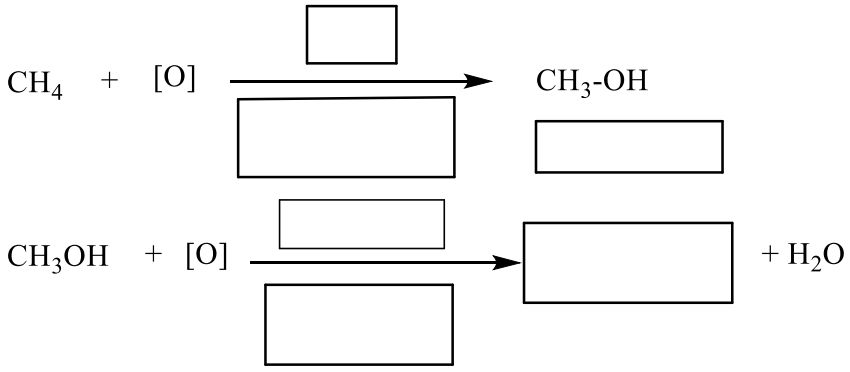
_____

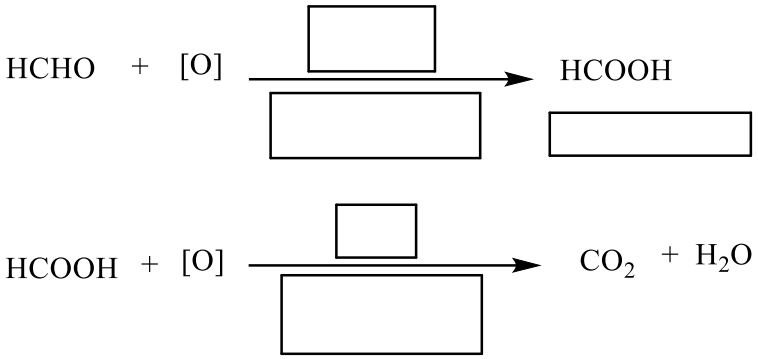
What is the difference of product of complete and incomplete oxidation of methane?

_____

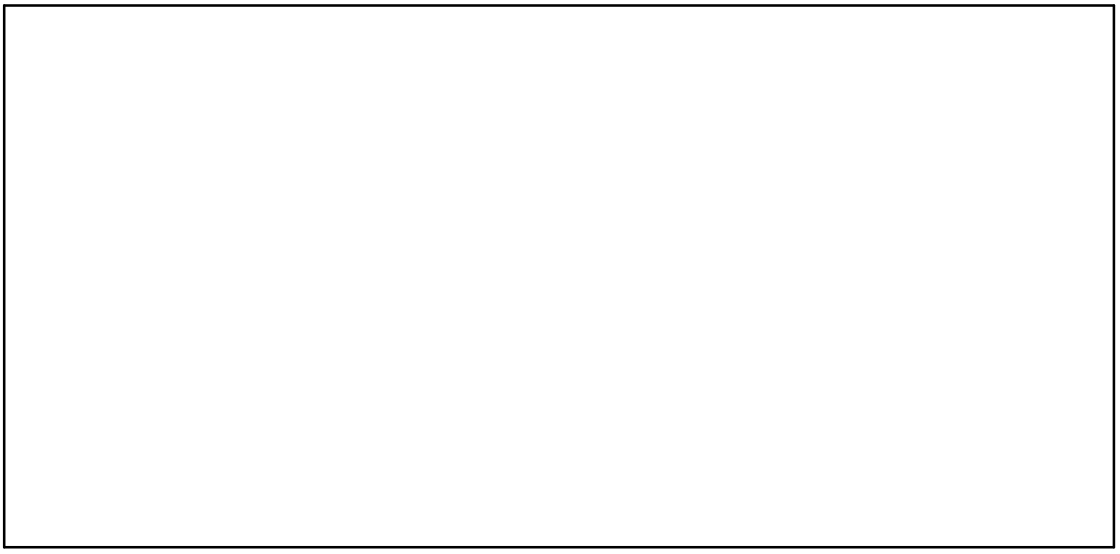
_____

Catalytic Oxidation

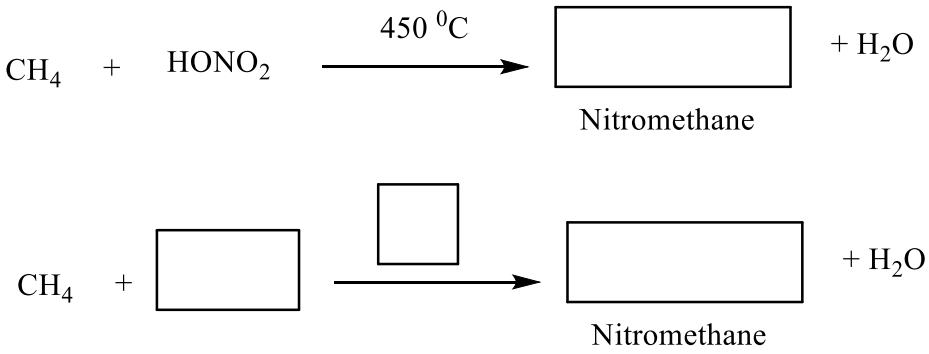




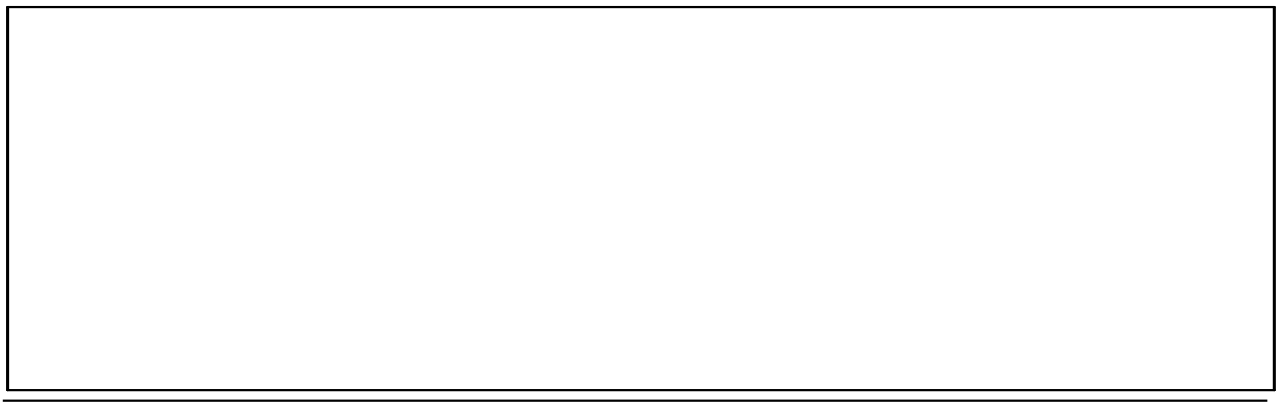
Practice Reaction



Nitration



Practice Reaction



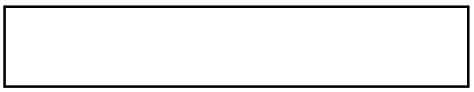
Halogenation

Initiation $Cl\text{-}Cl \xrightarrow{h\nu}$

Propagation $CH_3\text{-}H + Cl^{\bullet} \xrightarrow{h\nu}$

Termination $CH_3^{\bullet} + Cl^{\bullet} \xrightarrow{h\nu}$

Detail of Propagation

$CH_3Cl + Cl^{\bullet} \longrightarrow$ 

 $\longrightarrow CH_2Cl_2 + Cl^{\bullet}$

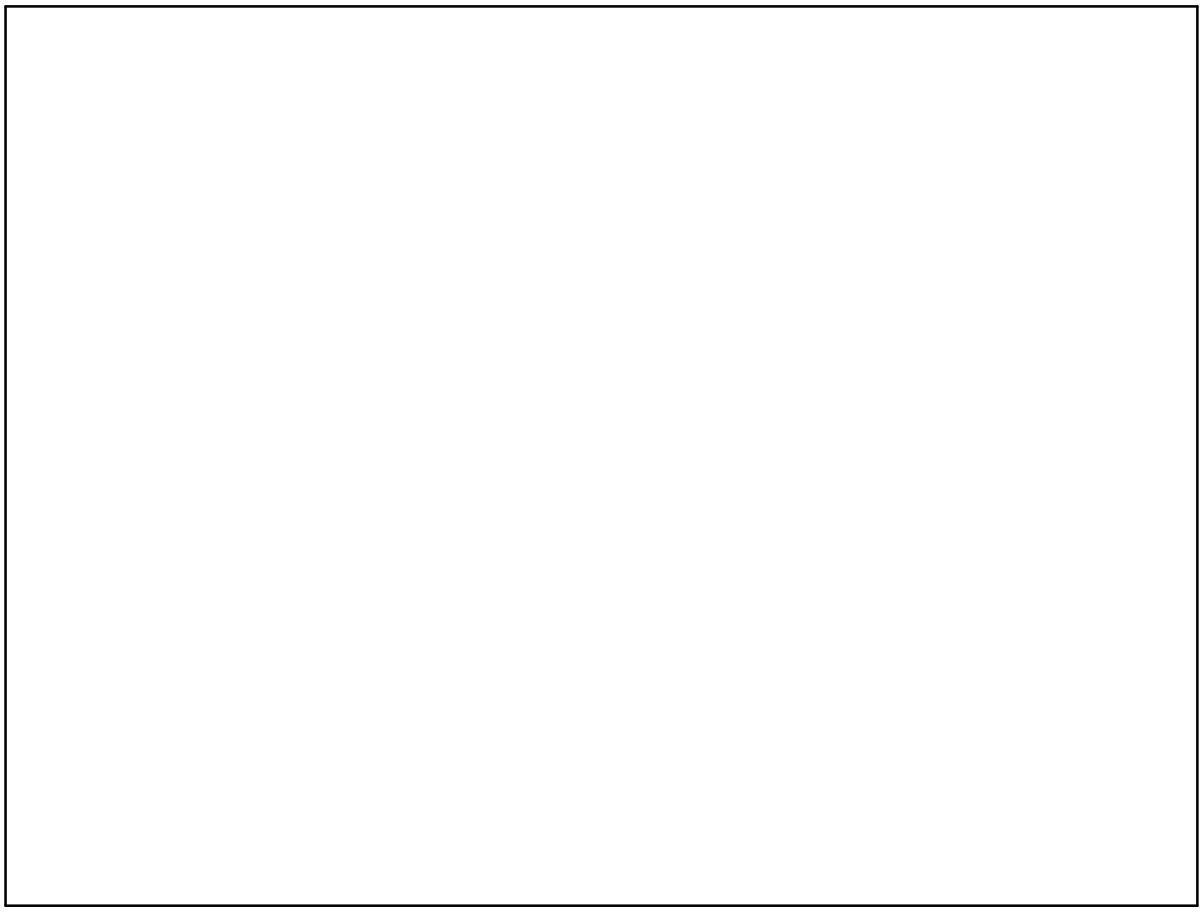
Dichloromethane

$^{\bullet}CHCl_2 + Cl\text{-}Cl \longrightarrow CHCl_3 + Cl^{\bullet}$

Chloroform

$\longrightarrow CCl_4 + Cl^{\bullet}$

Practice Reaction



Give any four uses of methane.

1._____

2._____

3._____

4._____

Mention any two physical characteristics of alkanes.

1._____

2._____

What is the effect of chain length on boiling point of alkanes?

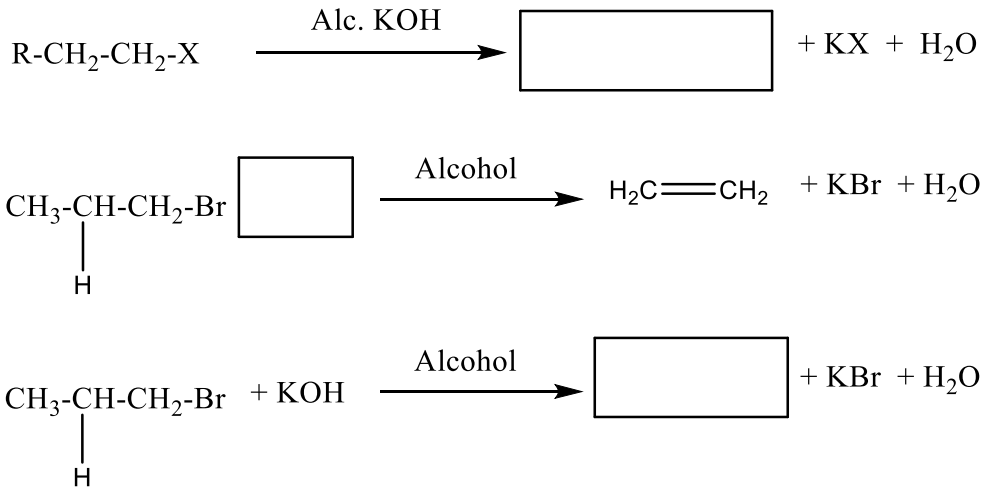
_____

_____

_____

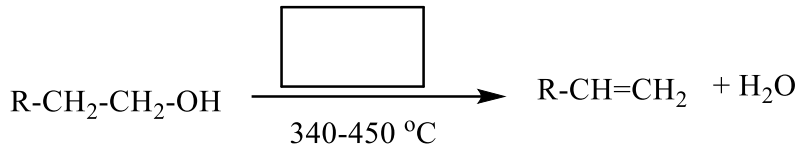
Alkenes

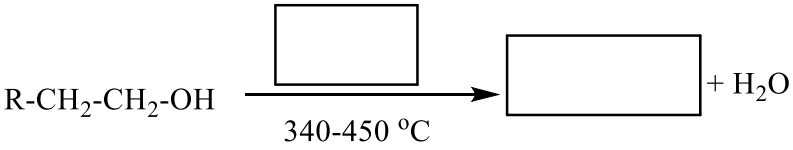
Name of Reaction: _____



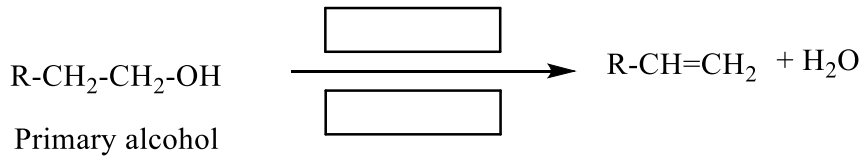
Practice Reaction

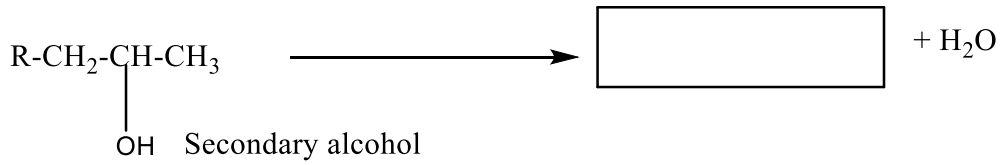
Name of Reaction:_____



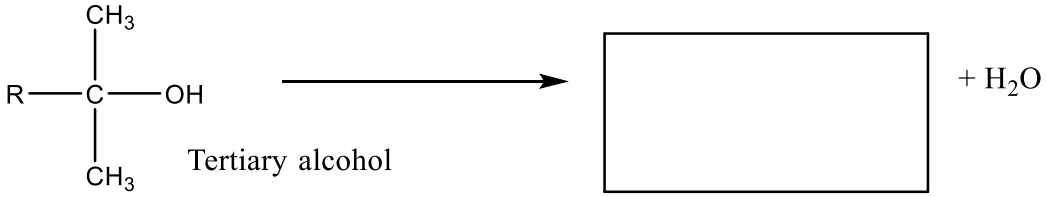


Practice Reaction



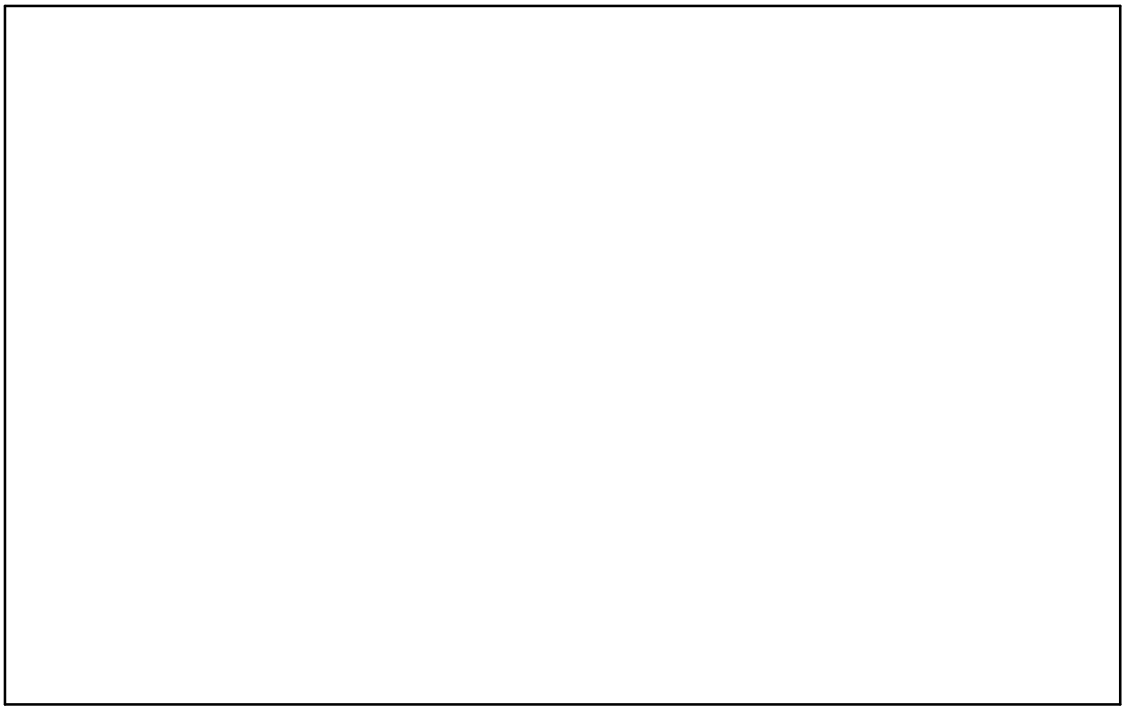


Secondary alcohol

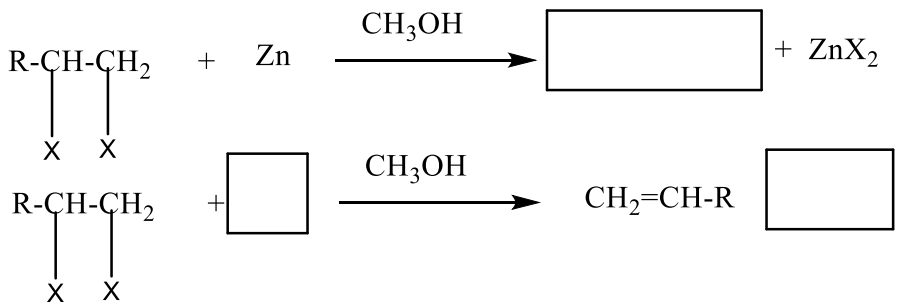


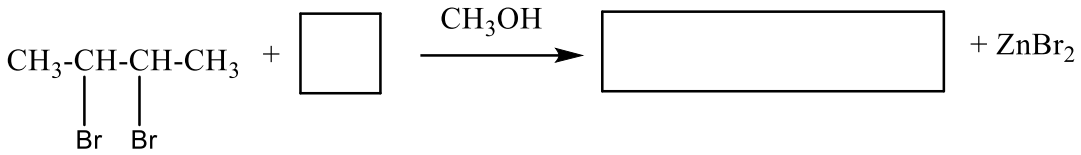
Tertiary alcohol

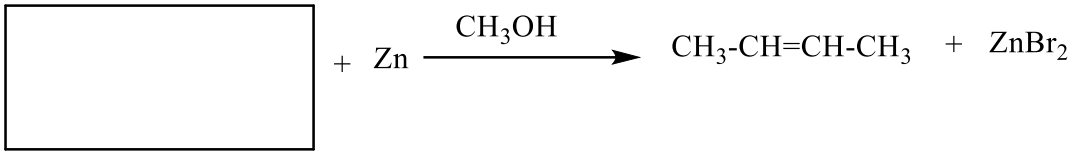
Practice Reaction



Name of Reaction: _____

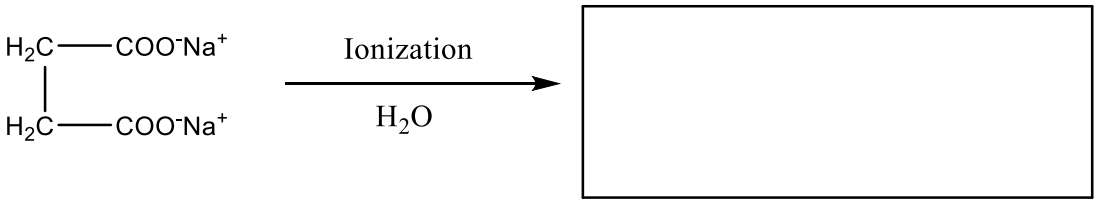




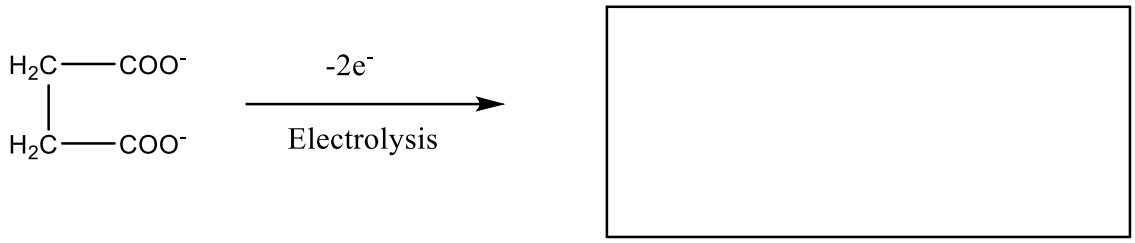


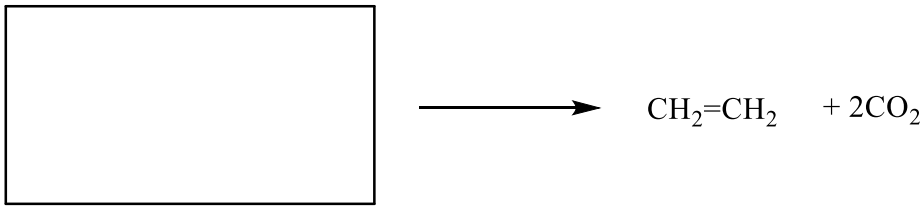
Practice Reactions

Name of Reaction:_____

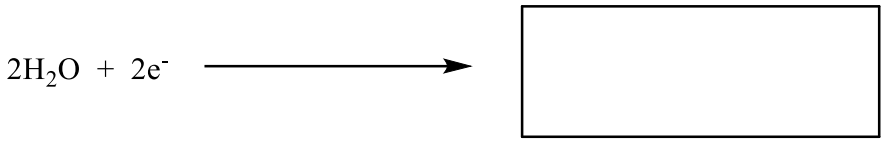


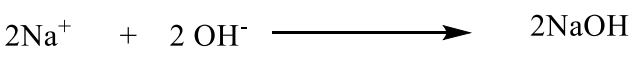
At Anode





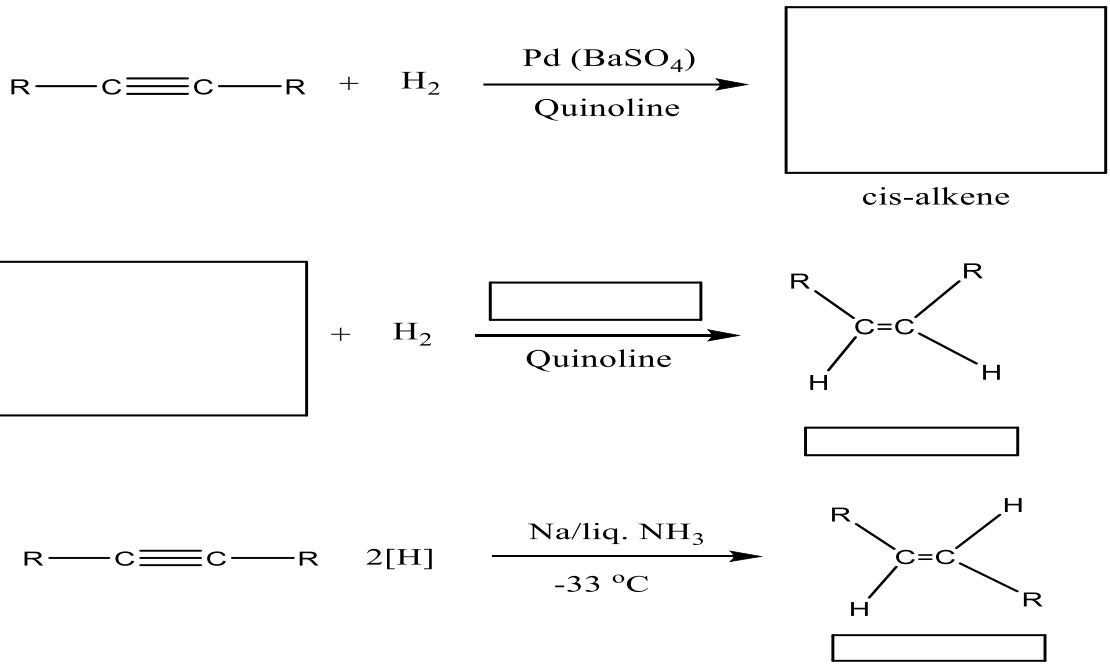
At Cathode



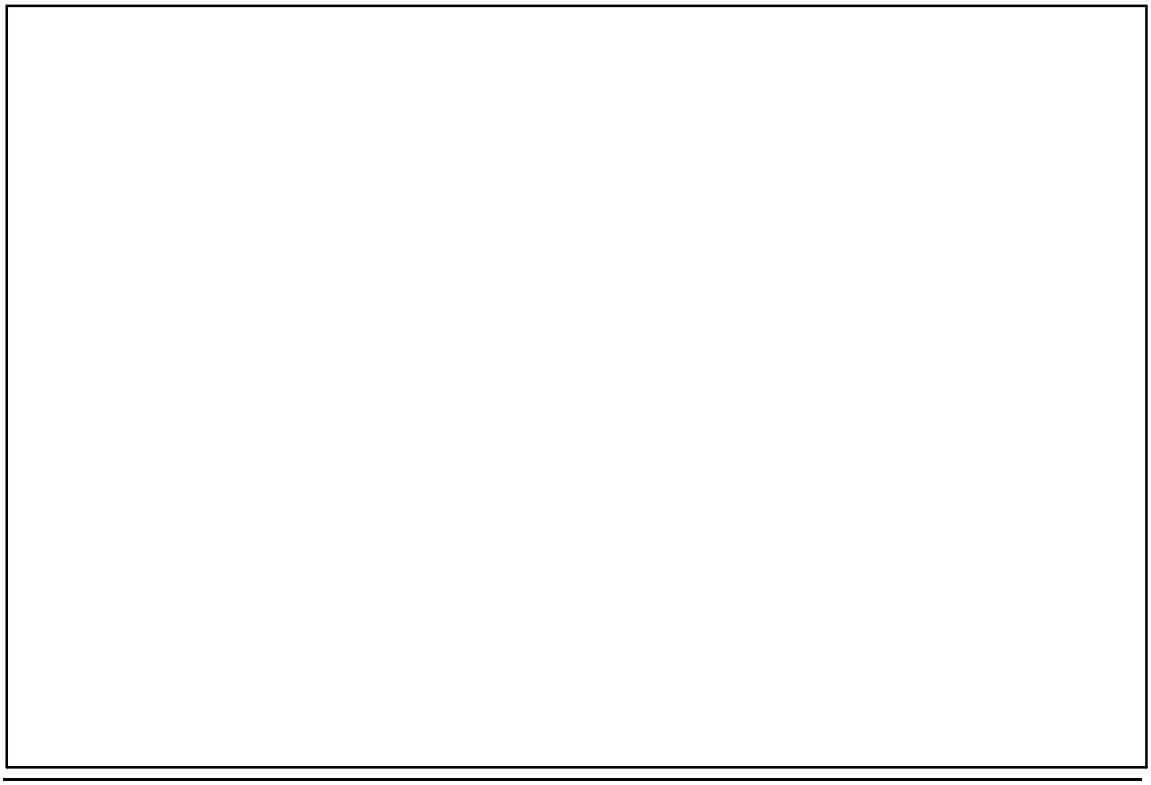


Practice Reaction

Name of Reaction:_____



Practice Reaction



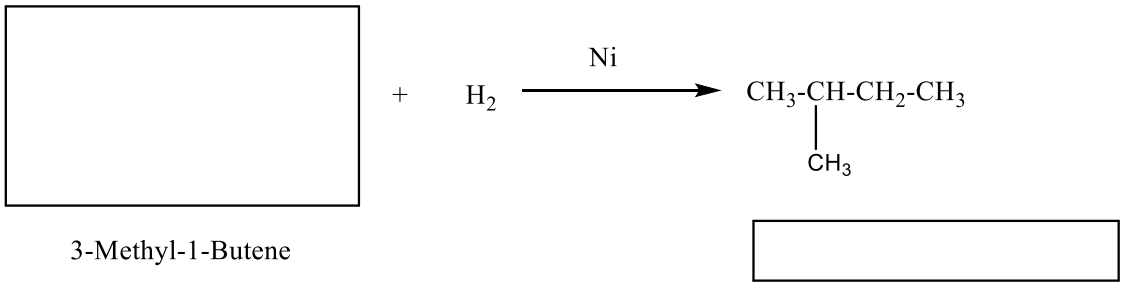
Hydrogenation

How Raney-Nickel catalyst is prepared?

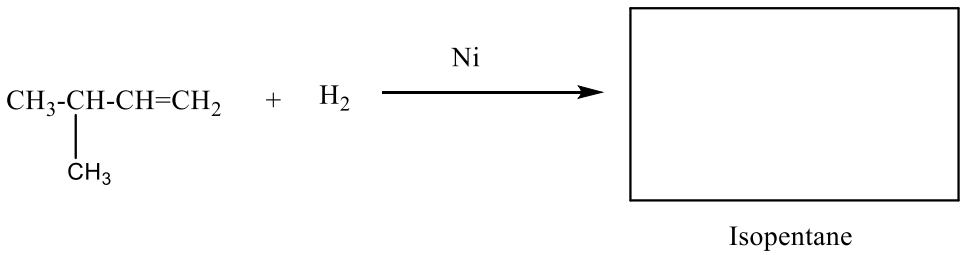
_____

_____

_____

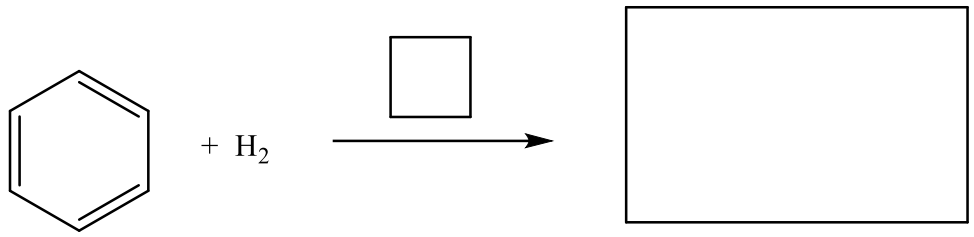


3-Methyl-1-Butene

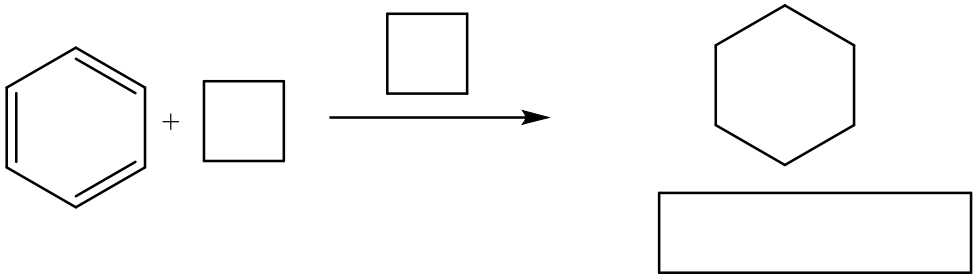


Isopentane

Practice Reaction

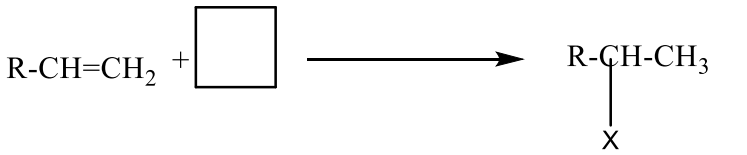


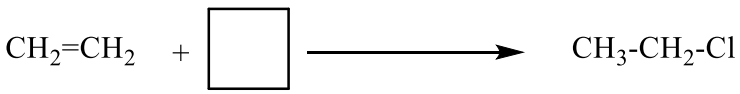
Cyclohexane

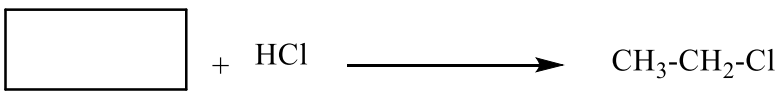


Practice Reaction

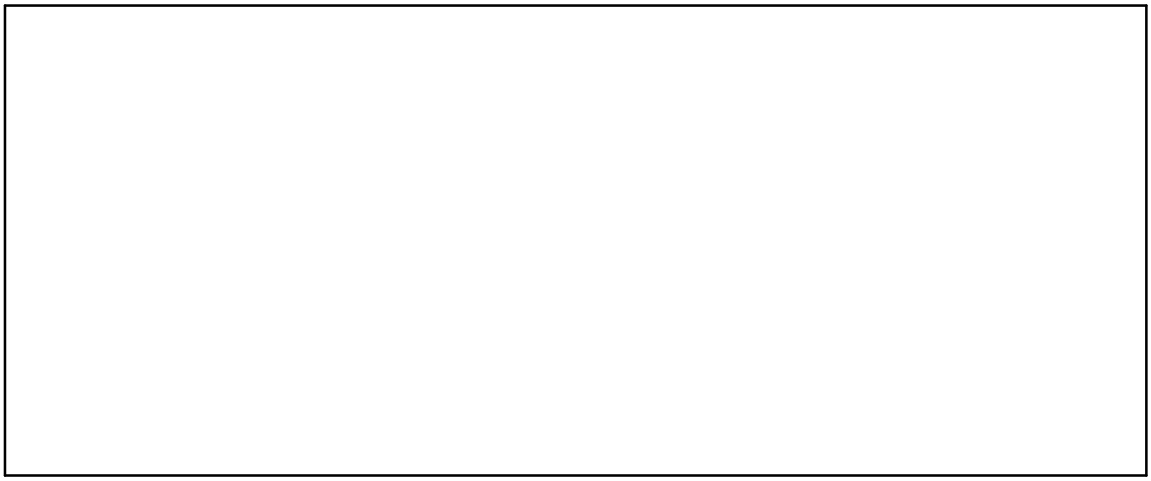
Addition of Hydrogen Halides



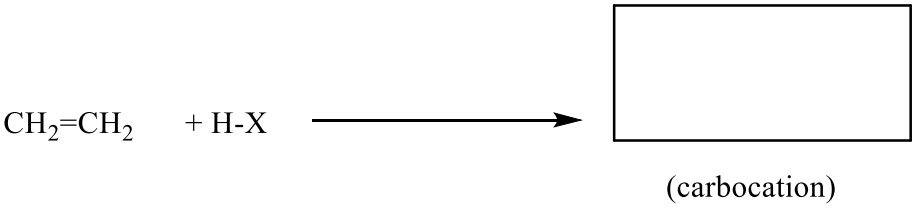


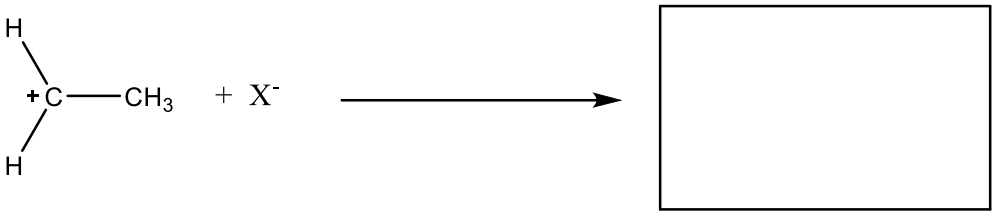


Practice Reaction

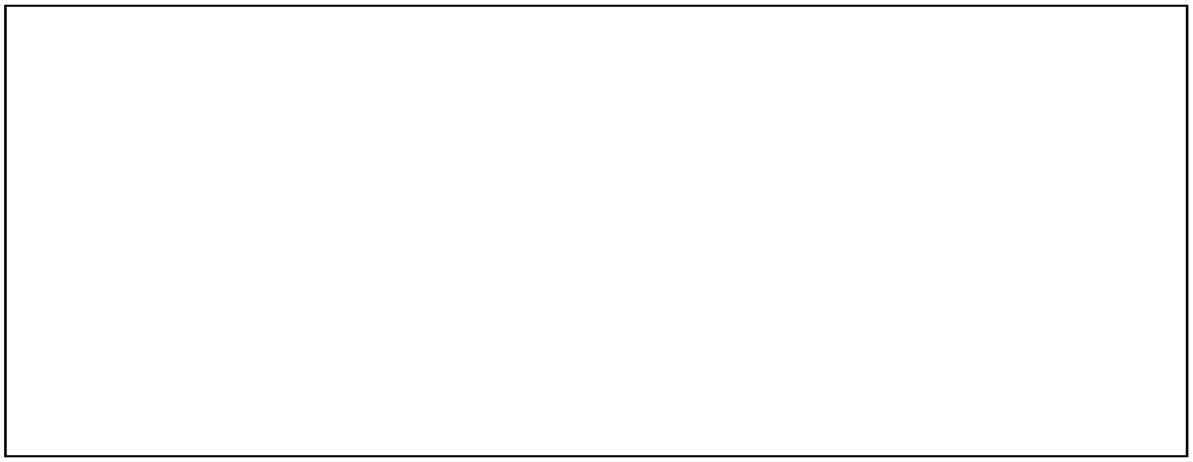


Mechanism

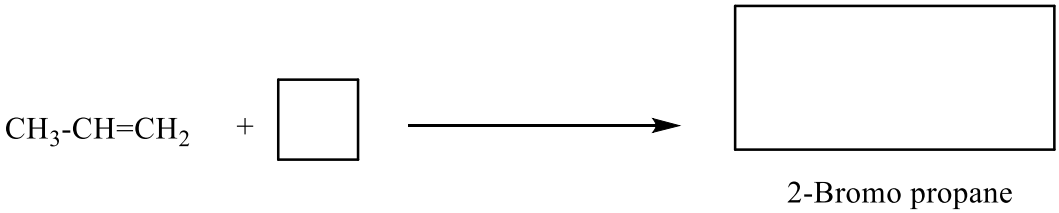




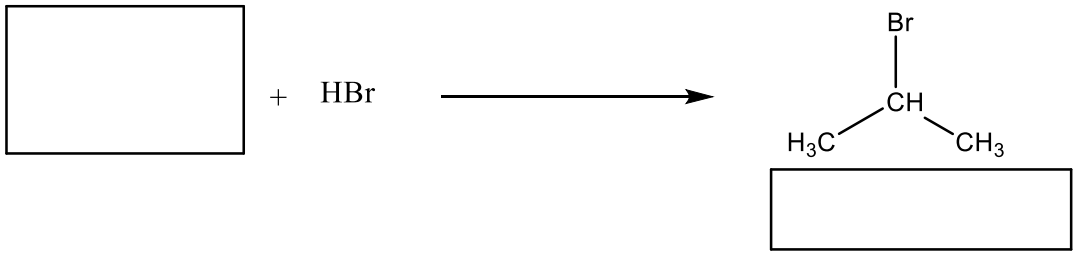
Practice Reaction



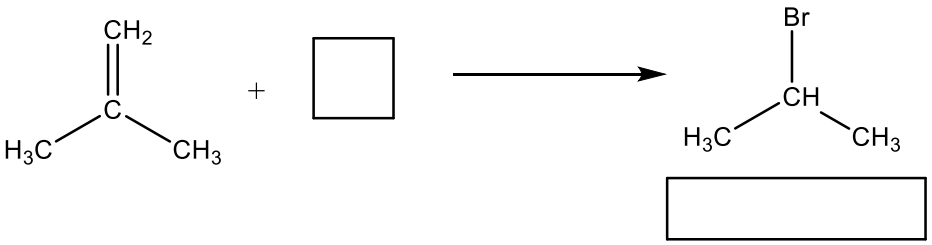
State Markownikov's rule

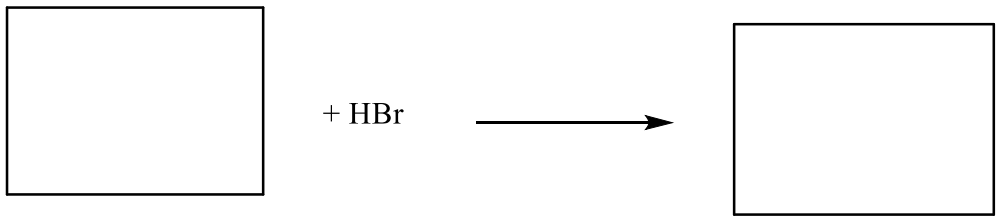


2-Bromo propane



Practice Reaction



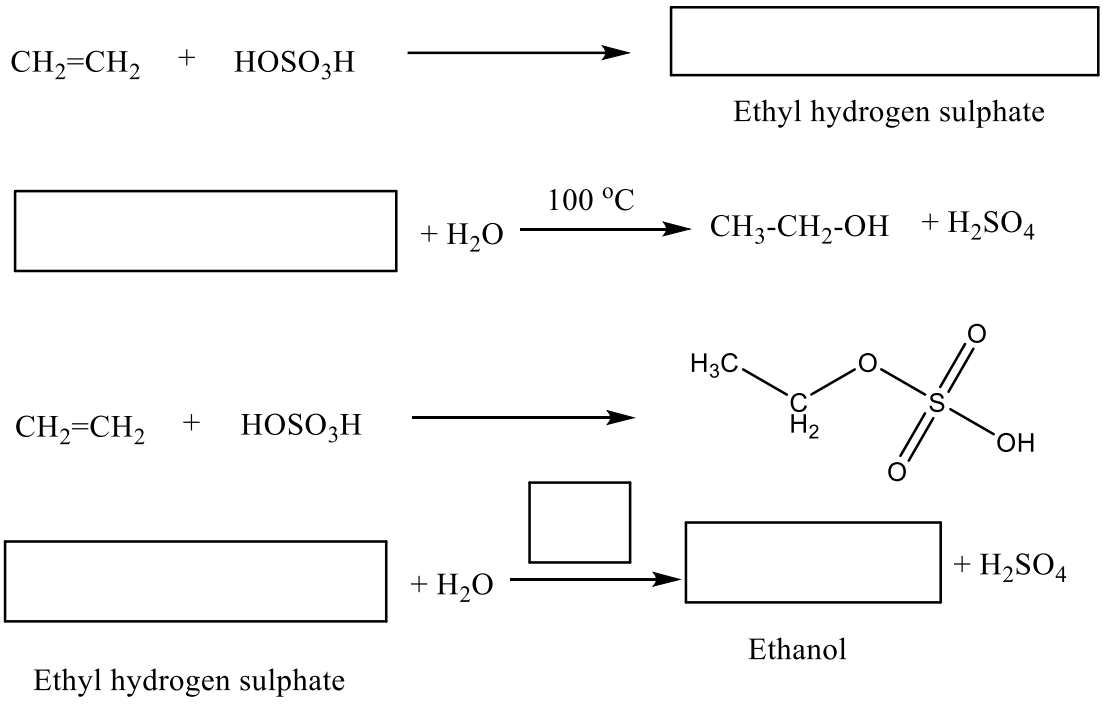


2-Methyl-1-propene

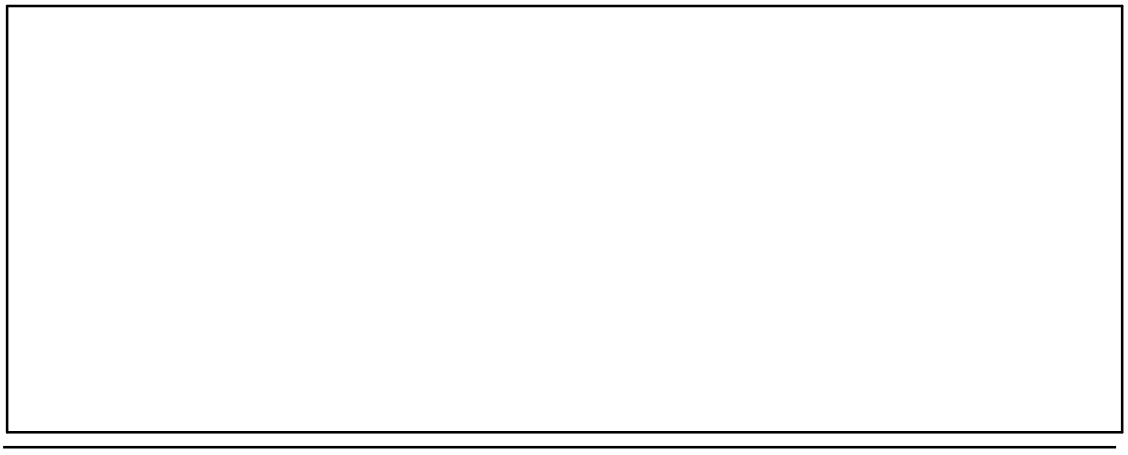
2-Bromo propane

Practice Reaction

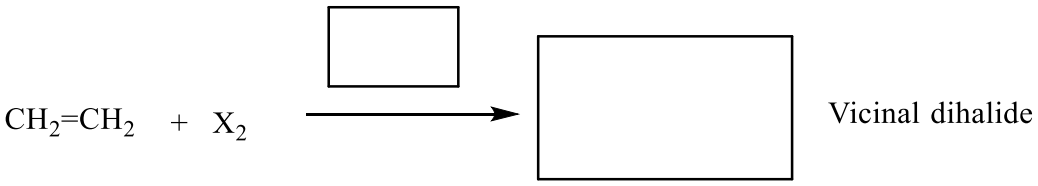
Addition of Sulphuric Acid

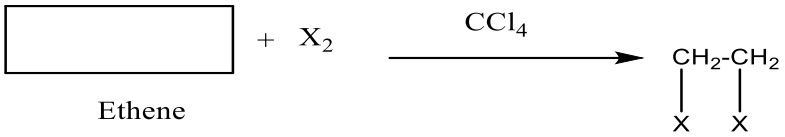


Practice Reaction



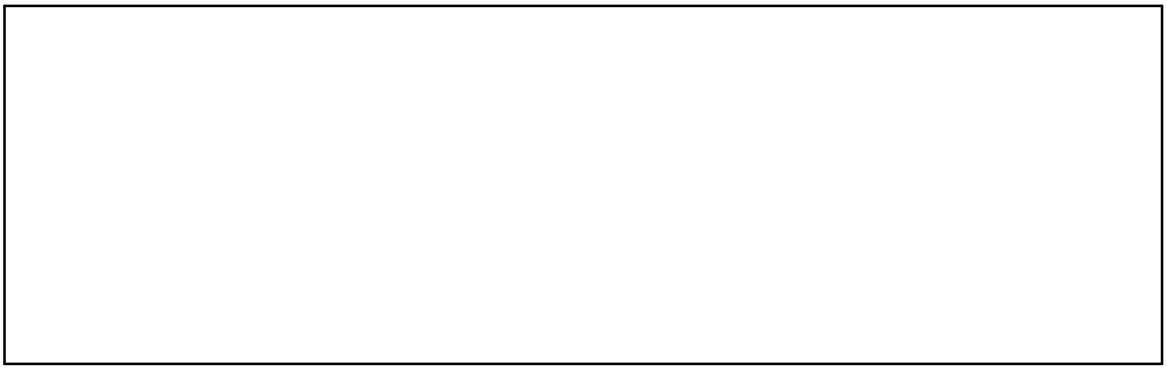
Addition of Halogens

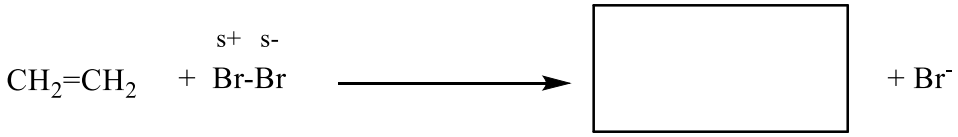




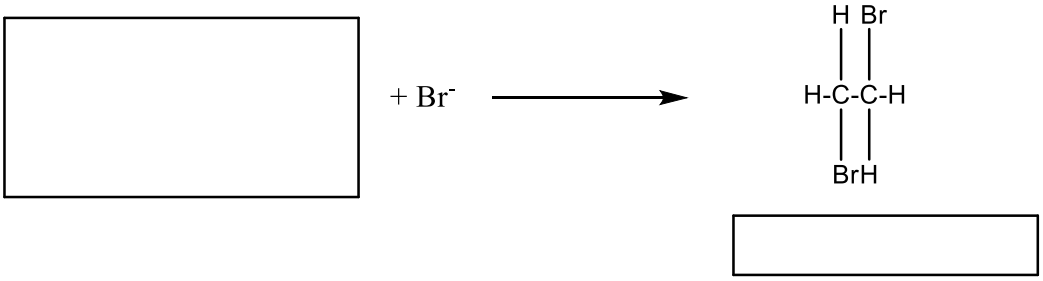
Ethene

Practice Reaction

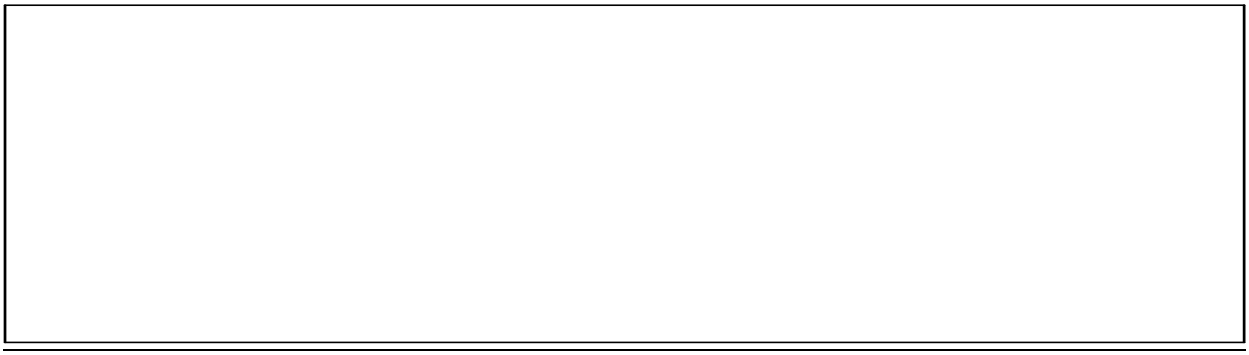




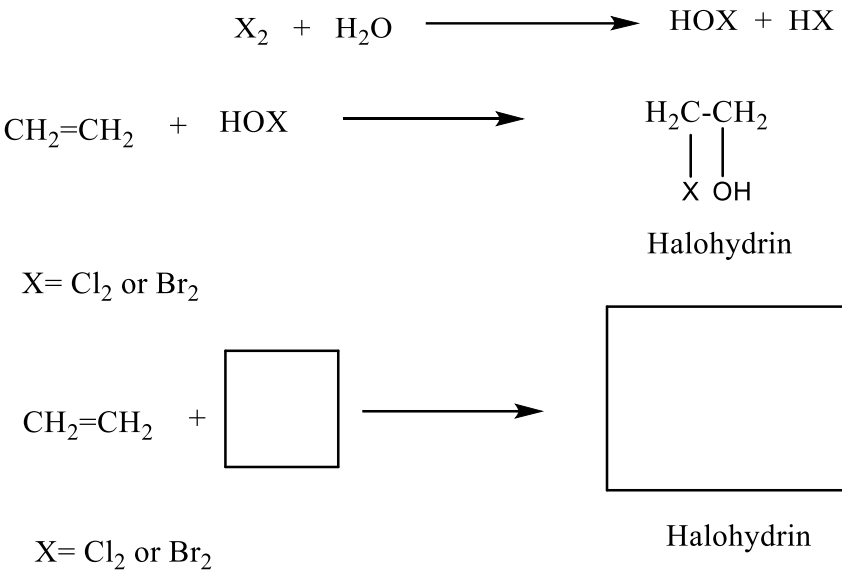
Bromonium ion



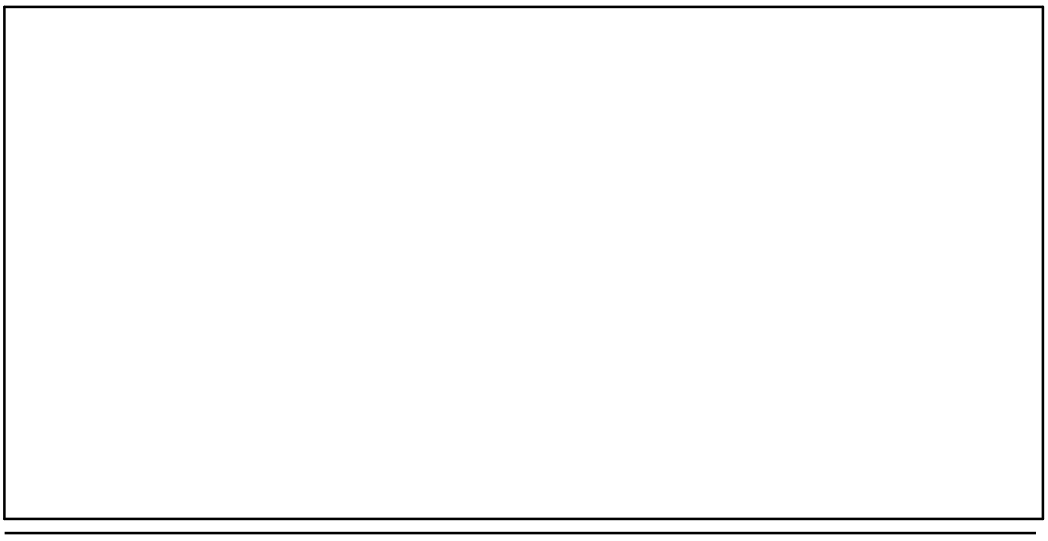
Practice Reaction



Addition of Hypohalous Acid (HOX)

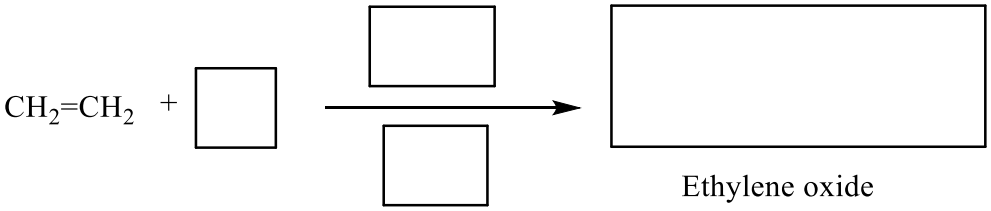


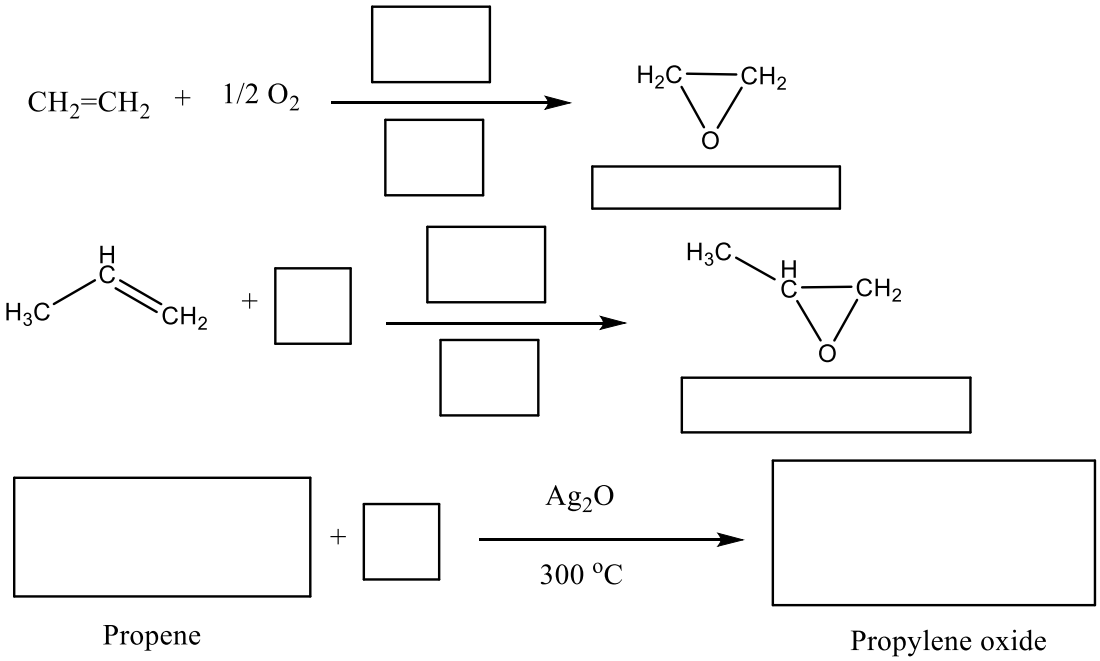
Practice Reaction



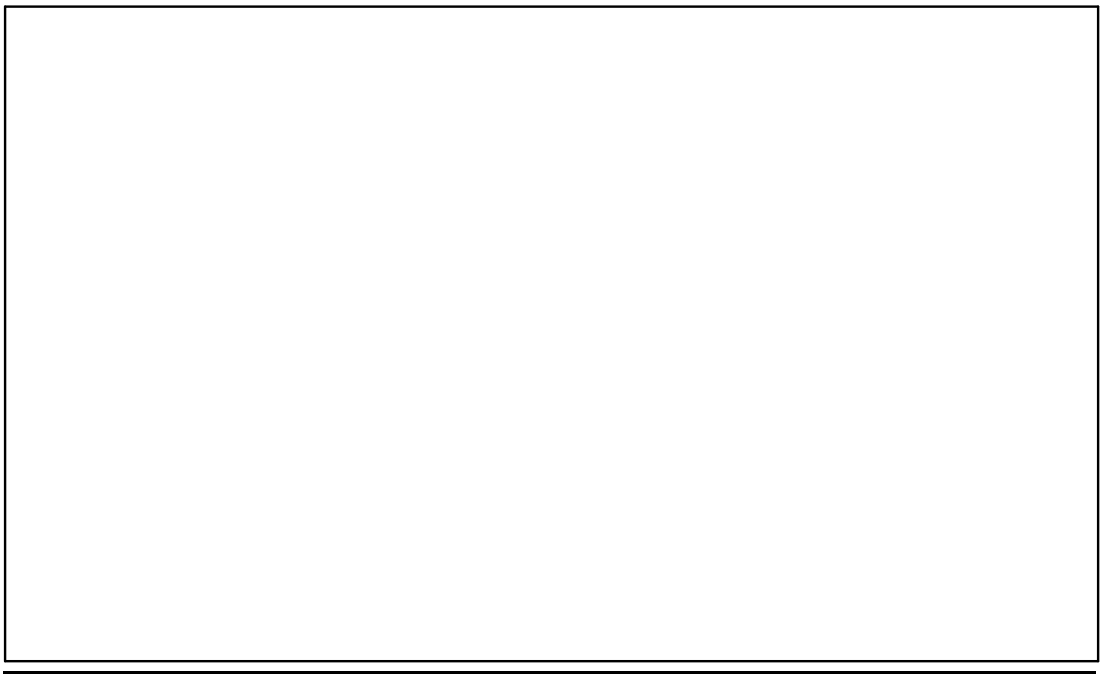
Oxidation Reactions

Addition of oxygen

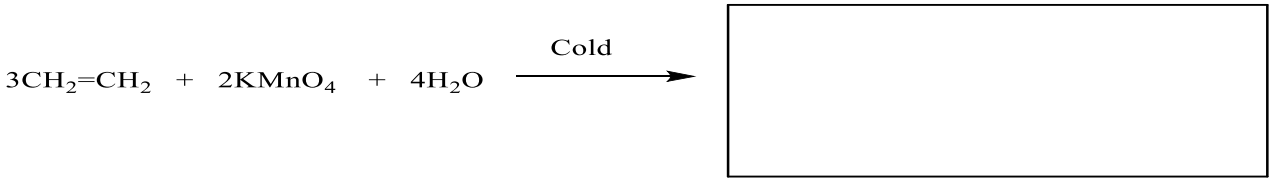


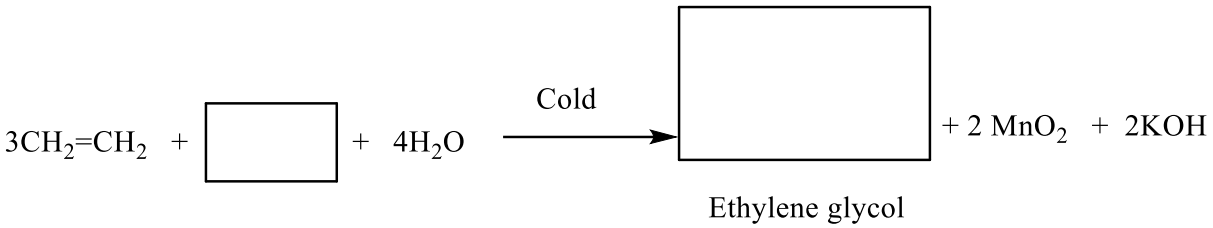


Practice Reaction

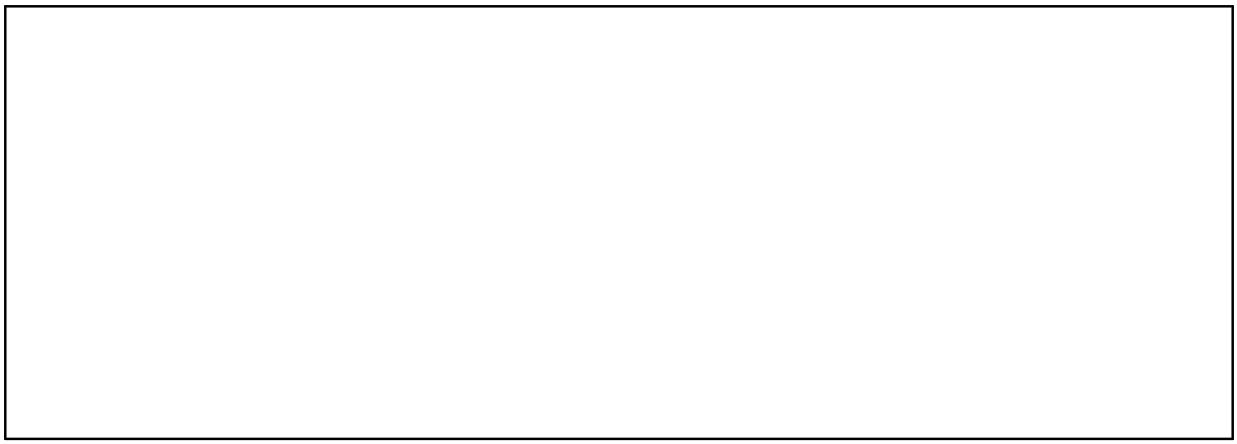


Hydroxylation



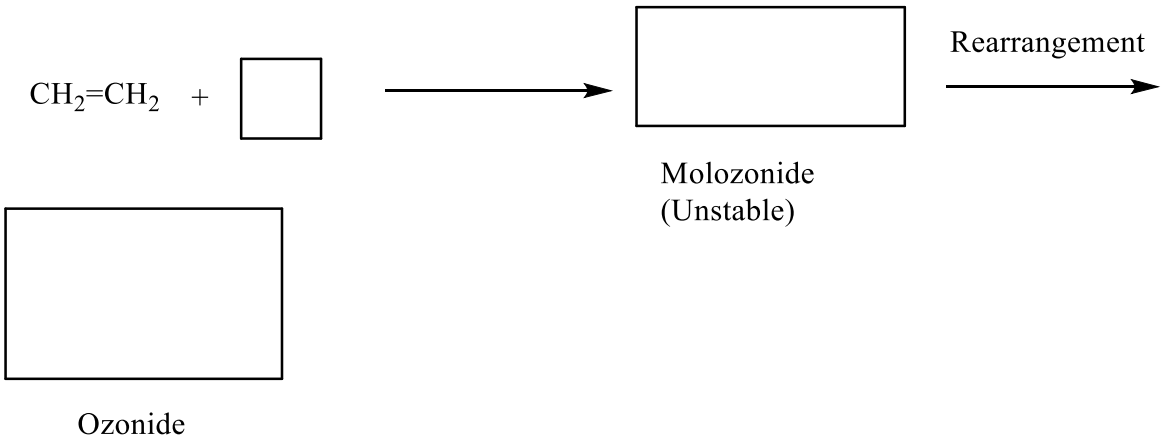


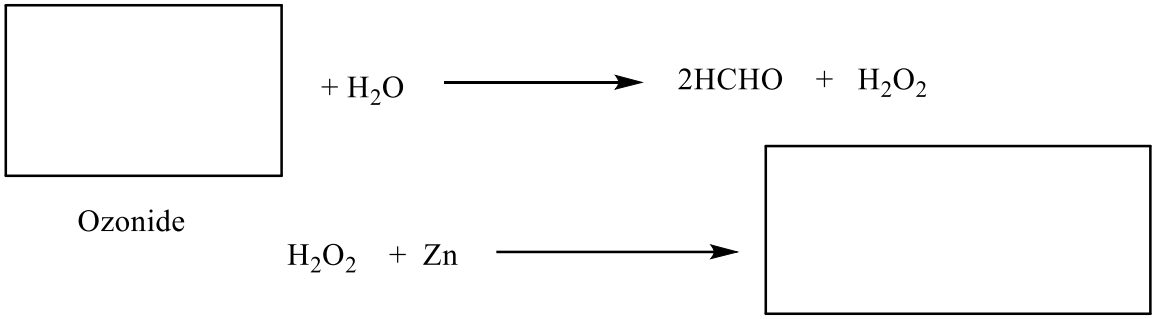
Practice Reaction



Give the products of combustion of ethene.

Ozonolysis





Practice Reaction

Give the reaction for polymerization of ethene. Mention the catalysts.

_____

_____

_____

Give reaction for the preparation of Mustard gas.

_____

_____

_____

_____

_____

Give any four uses of ethene.

1._____

2._____

3._____

4._____

Mention any two physical characteristics of alkenes.

1._____

2._____

What is the effect of chain length on boiling point of alkenes?

_____

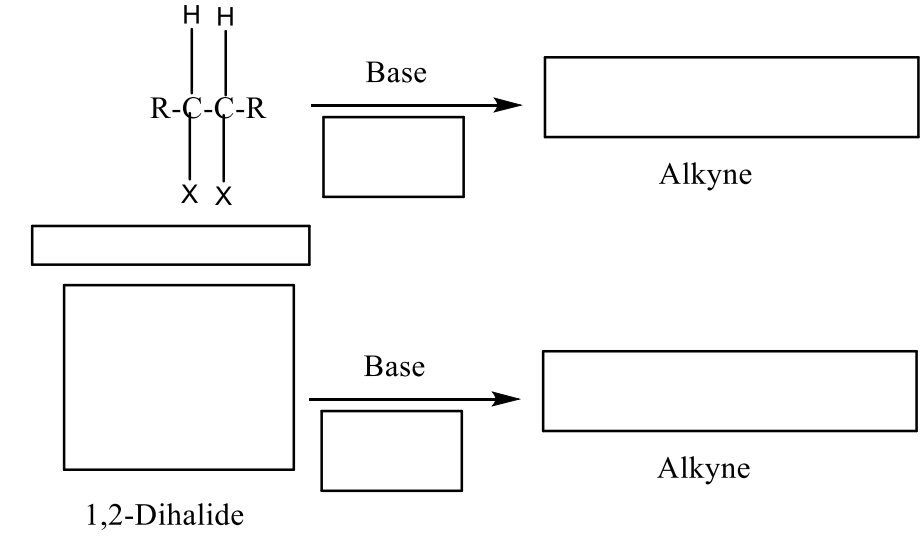
_____

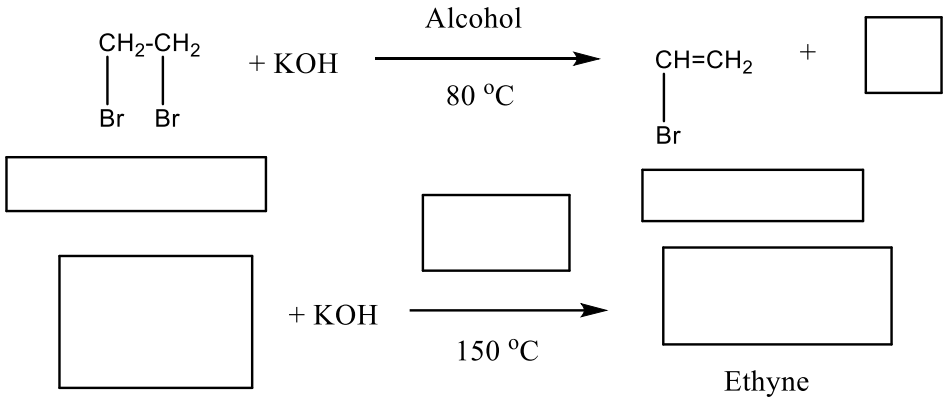
_____

_____

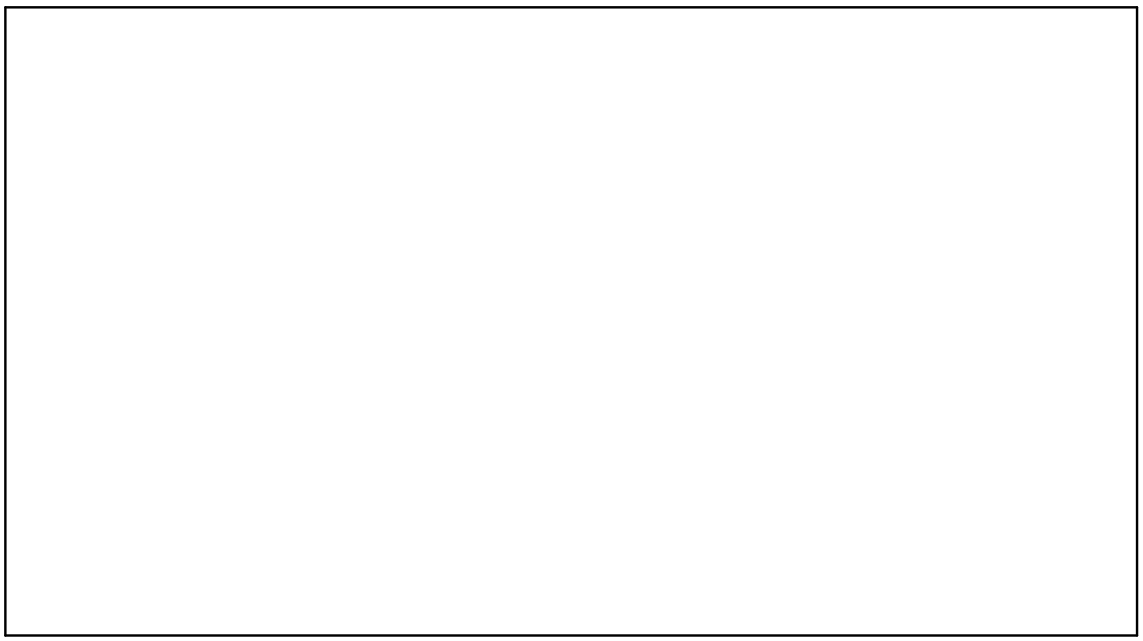
Alkynes

Name of Reaction:_____

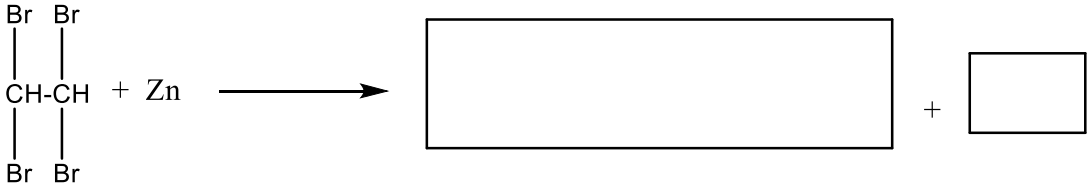


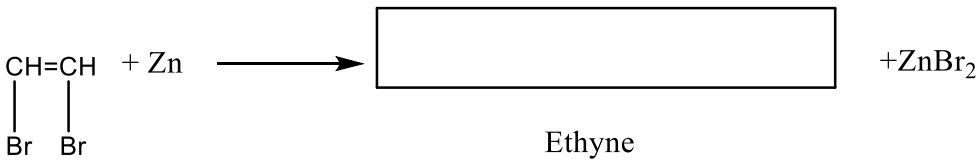


Practice Reaction

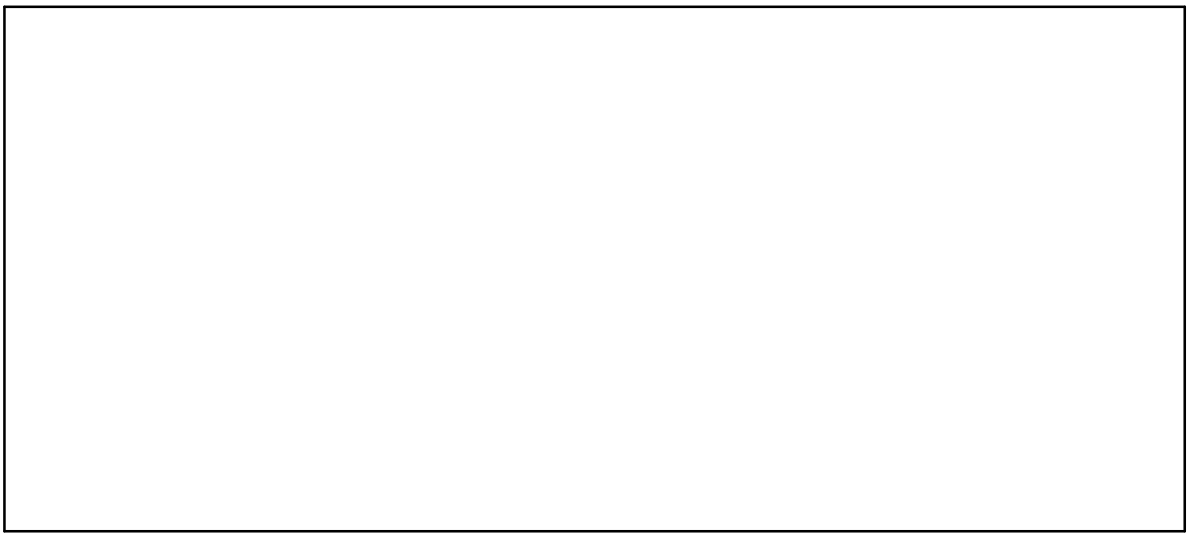


Name of Reaction:_____



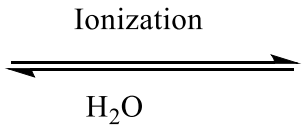


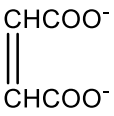
Practice Reaction



Name of Reaction:_____

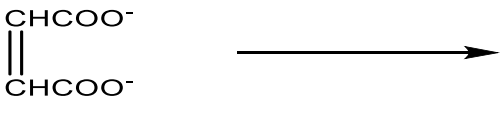
Potassium maleate

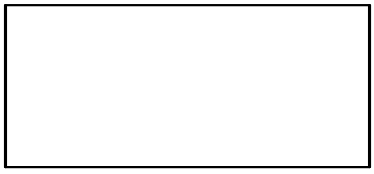




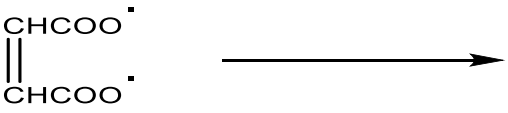
$+ 2K^+$

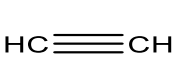
At Anode





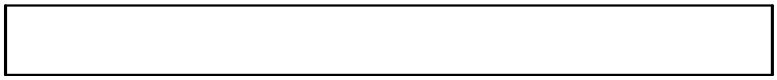
$+ 2e^-$





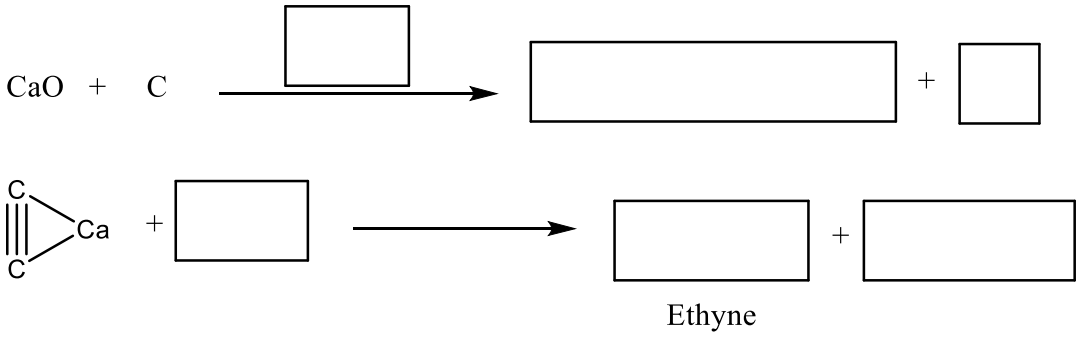
At Cathode

$2H_2O + 2e^- \longrightarrow 2\ OH^-$



Practice Reaction

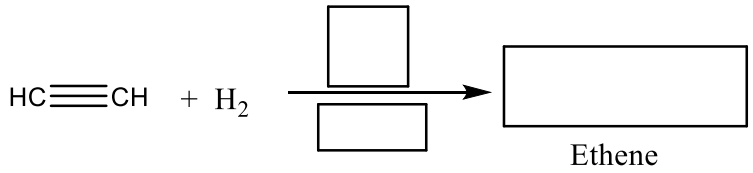
Name of Reaction:_____

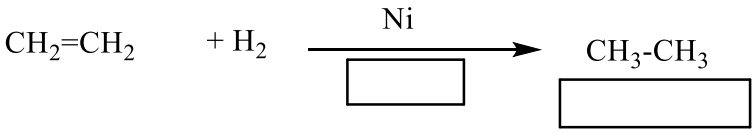


Ethyne

Practice Reaction

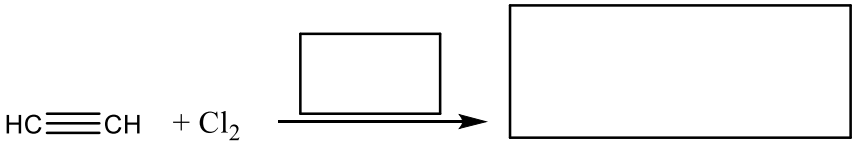
Addition of Hydrogen



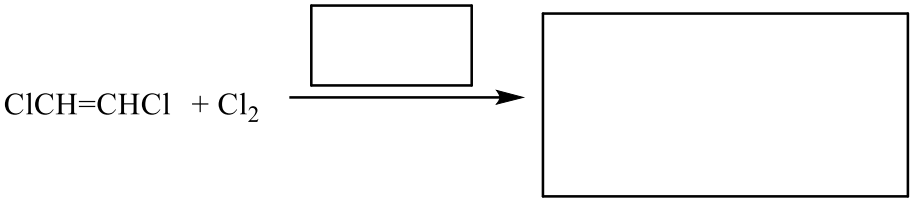


Practice Reaction

Addition of Halogens



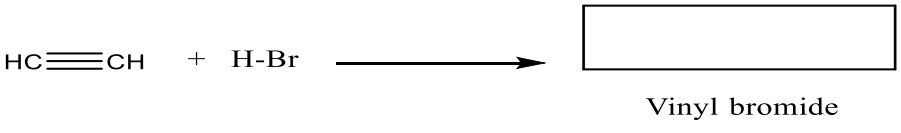
1,2-Dichloroethane



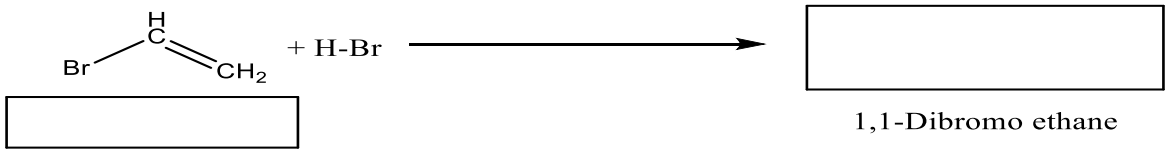
1,1,2,2-Tetrachloro Ethane

Practice Reaction

Addition of Halogen Acids



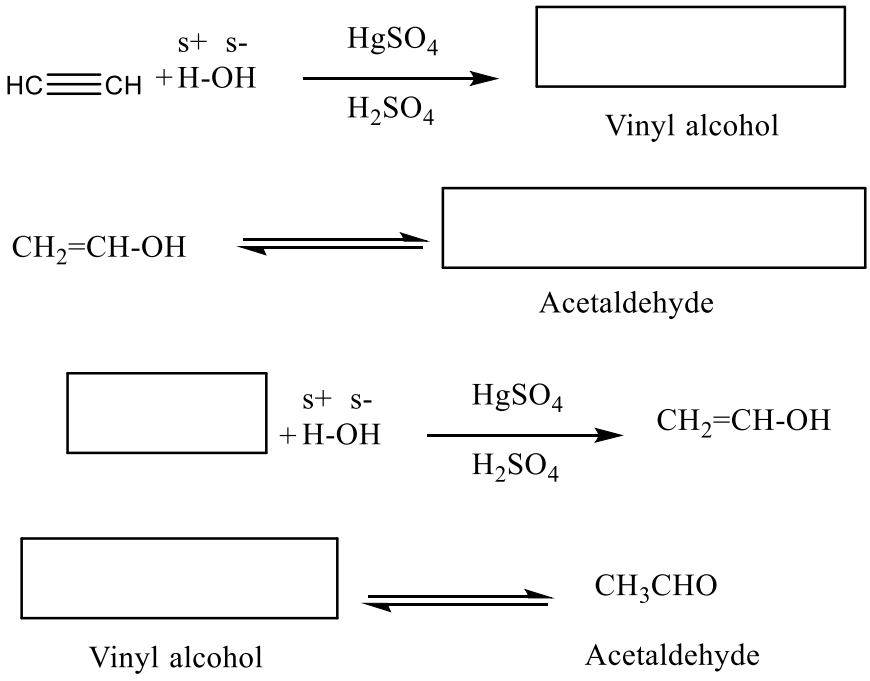
Vinyl bromide



1,1-Dibromo ethane

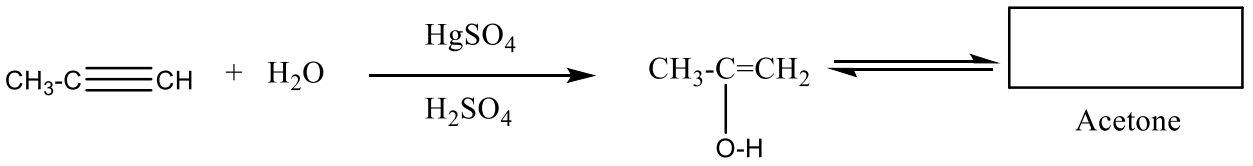
Practice Reaction

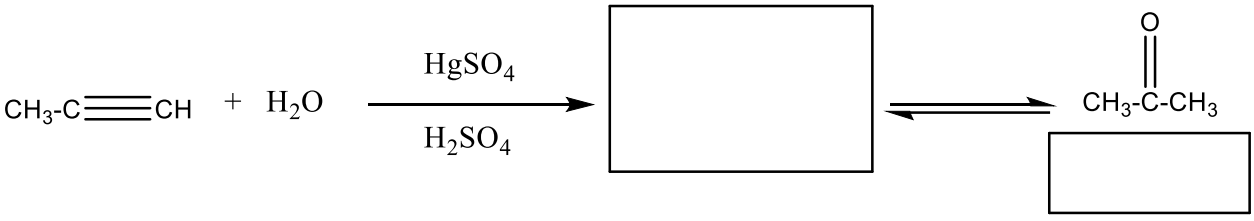
Addition of Water



Practice Reaction

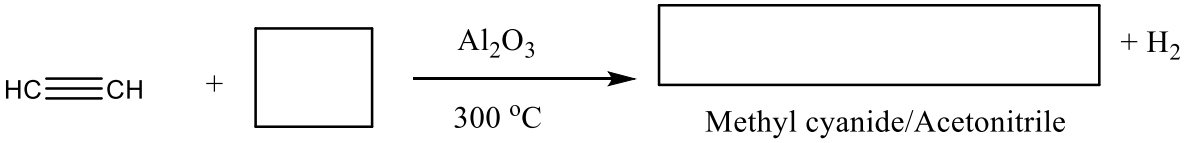
Addition of Water

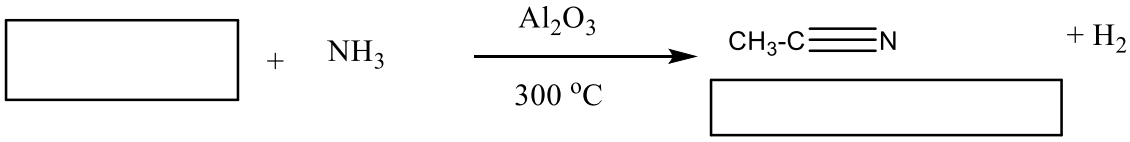




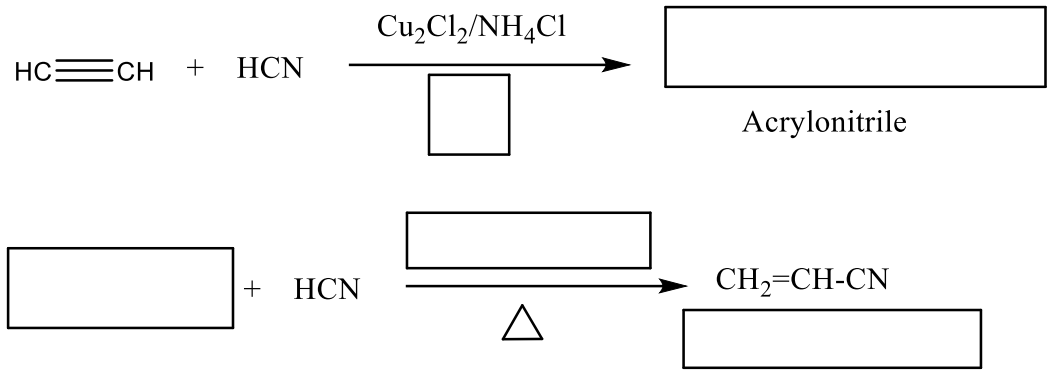
Practice Reaction

Addition of Ammonia and Hydrogen Cyanide





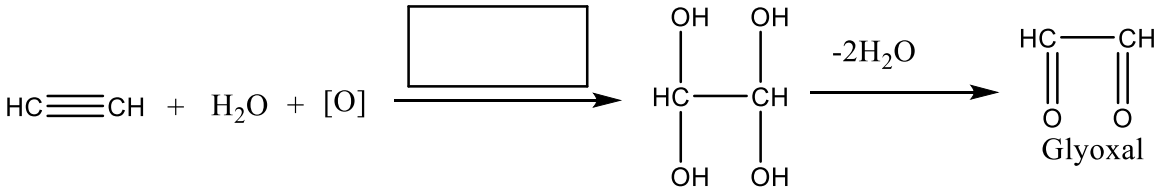
Practice Reaction

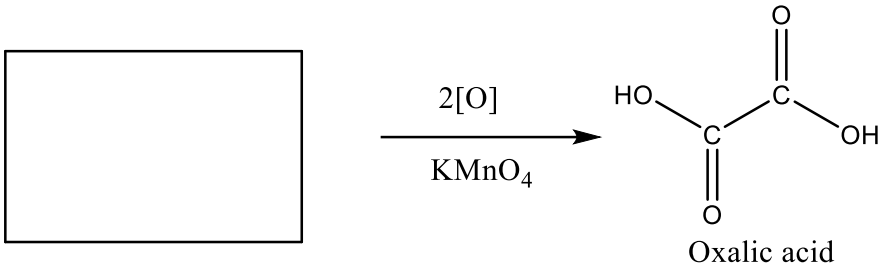


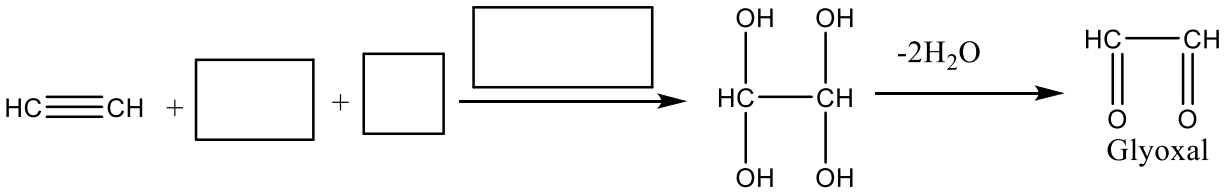
Practice Reaction

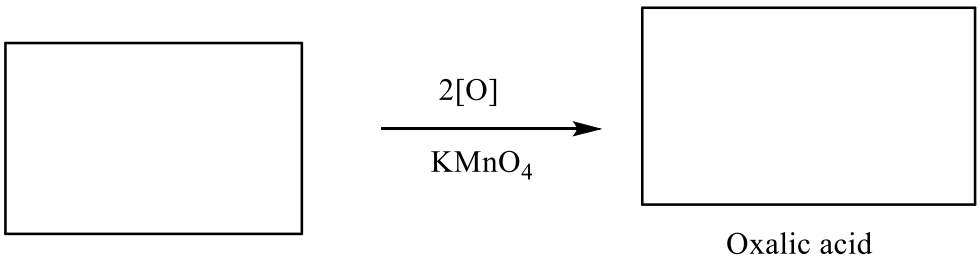
Oxidation Reactions

What are the products of combustion of ethyne?





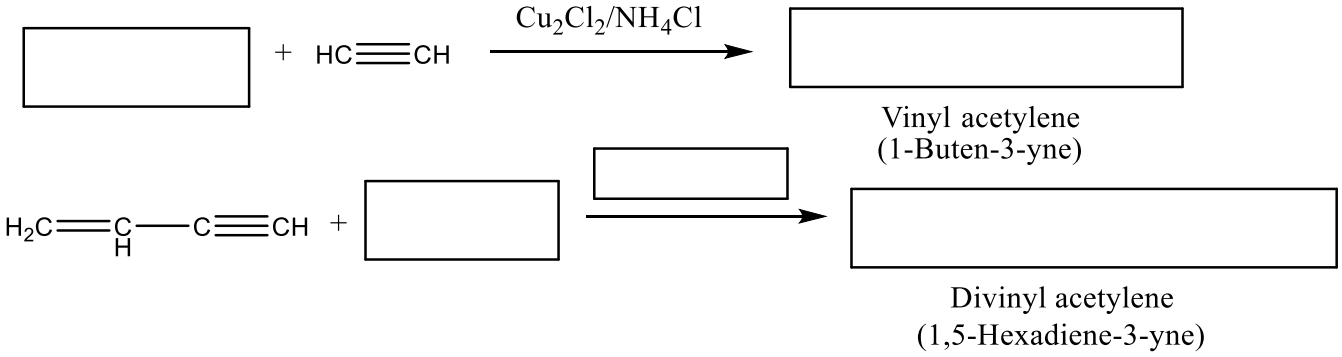




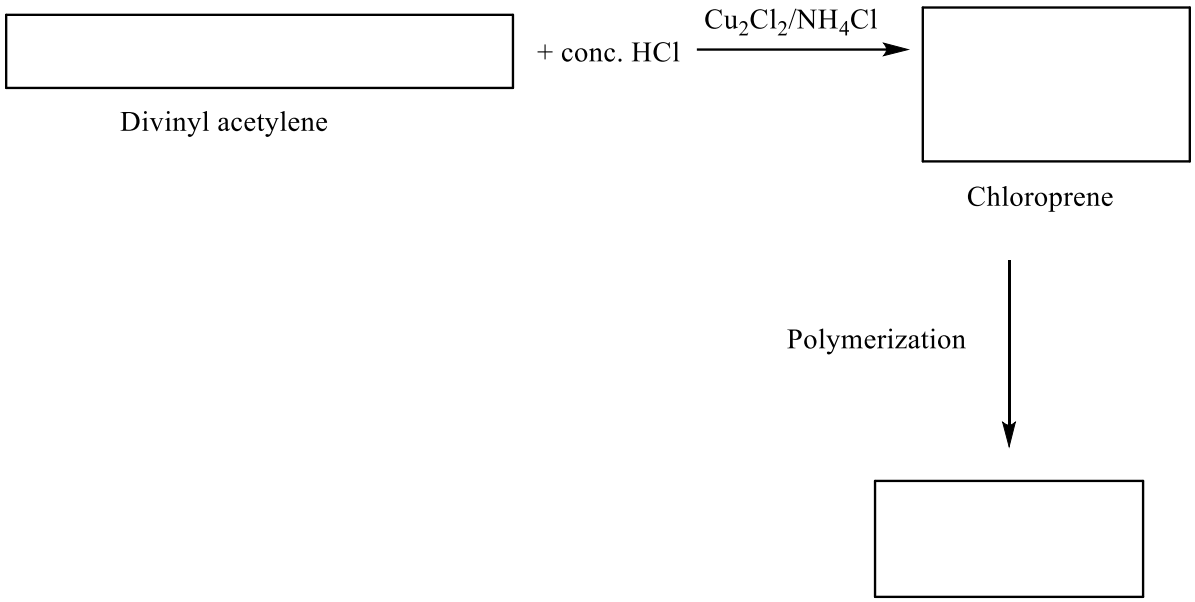
Practice Reaction

Polymerization

Conversion of Acetylene to Divinyl Acetylene

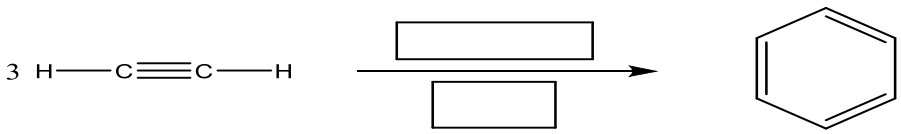


Practice Reaction



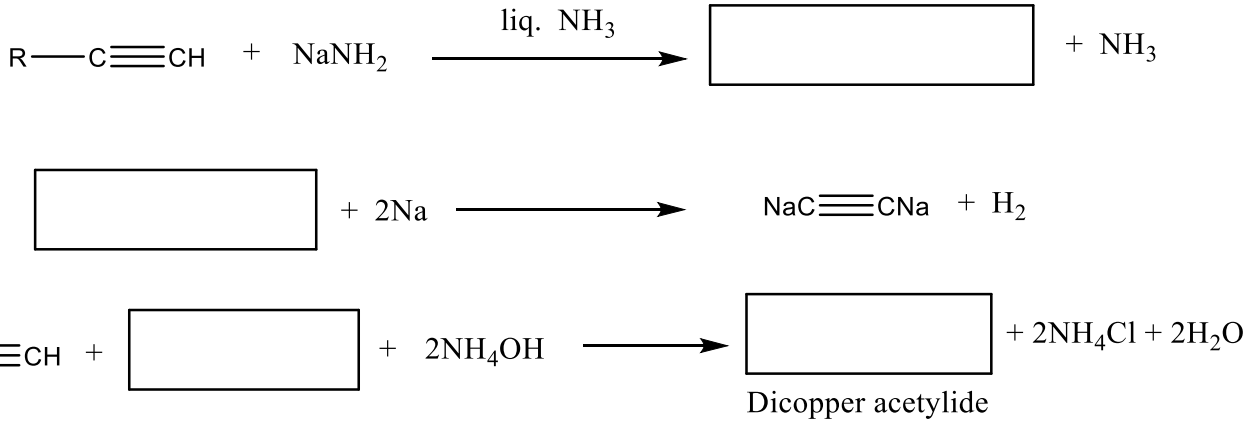
Practice Reaction

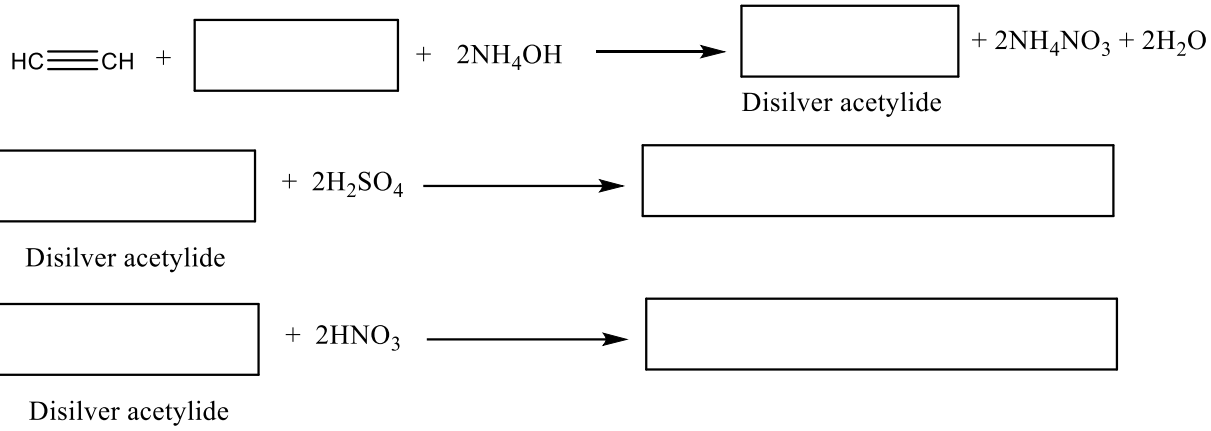
Conversion of Acetylene to Benzene



Practice Reaction with Arrows

Tell about acidic nature of alkynes.





Practice Reaction

Give any four uses of ethyne.

1._____

2._____

3._____

4._____

Give any two physical characteristics of alkynes.

1._____

2._____

What is the effect of chain length on the boiling point of alkynes?

_____
_____
_____
_____

Compare reactivity of alkanes, alkenes and alkynes

_____
_____
_____
_____

D. Conversion questions (according to order in book).

Worksheet 1

1. Convert alkene to alkane

_____

2. Convert ethene to ethane

3. Convert alkyl halide to alkane

4. Convert methyl iodide to methane

5. Convert 2-Bromo-butane to n-butane

6. Convert sodium salt of a carboxylic acid to an alkane.

7. Convert sodium propionate to ethane

8. Explain mechanism of Kolbe's electrolytic method.

9. Convert acetone to propane.

10. Convert acetaldehyde to ethane.

Worksheet2

1. Convert methyl magnesium bromide to methane.

2. Convert ethyl magnesium bromide to ethane.

3. Give catalytic oxidation of methane.

4. Convert methane to nitromethane.

5. Convert methane to carbon tetrachloride.

6. Convert alkyl halide to alkene.

7. Convert ethyl bromide to ethene

8. Convert propyl bromide to propene

9. Convert alcohol to alkene

10. Convert primary alcohol to alkene

11. Convert secondary alcohol to alkene.

12. Convert tertiary alcohol to alkene.

13. Convert vicinal dihalides to alkene.

14. Convert 1,2-dibromobutane to 2-butene

15. Convert disodium succinate to ethene

16. Convert alkyne to cis-alkene.

17. Convert alkyne to trans-alkene.

18. Convert 3-Methyl-1-butene to iso pentane

19. Convert benzene to cyclohexane

Worksheet 3

1. Convert alkene to alkyl halide

2. Convert ethene to ethyl chloride

3. Convert propene to 2-Bromopropane

4. Convert 2-methyl-1-butene to 2-Bromo-2-methyl propane

5. Convert ethene to ethanol

6. Convert ethene to vicinal dihalide

7. Convert ethene to halohydrin

8. Convert ethene to ethylene epoxide

9. Convert propene to propylene oxide

Worksheet 4

1. Convert ethene to ethylene glycol.

2. Convert ethene to ozonide.

3. Convert ethene to formaldehyde.

4. Convert ethene to polyethylene.

5. Convert ethene to 2,2-Dichloro ethyl sulphide

6. Convert 1,2-Dihalide to alkyne

7. Convert 1,2-Dibromoethane to vinyl bromide

8. Convert 1-bromo ethene to ethyne

9. Convert tetrabromo ethane to ethyne

10. Convert potassium maleate to ethyne

11. Convert calcium carbide to ethyne

12. Convert ethyne to ethane

13. Convert ethyne to 1,2-Dichloroethane

14. Convert 1,2-Dichloroethane to 1,1,2,2- Tetrachloroethane

Worksheet 5

1. Convert ethyne to vinyl bromide

2. Convert vinyl bromide to 1,1-Dibromoethane

3. Convert ethyne to vinyl alcohol

4. Convert ethyne to acetaldehyde

5. Convert propyne to acetone

6. Convert ethyne to methyl nitrile

7. Convert ethyne to acrylonitrile

8. Convert ethyne to oxalic acid

9. Convert acetylene to divinyl acetylene

10. Convert acetylene to chloroprene

11. Convert acetylene to benzene

12. Convert alkyne to sodium alkynide

13. Convert ethyne to sodium acetylide

14. Convert ethyne to dicopper acetylide

15. Convert ethyne to disilver acetylide

16. Convert disilver acetylide to ethyne

Chapter 9

Aromatic Hydrocarbons

A. Draw structures of the compounds according to IUPAC names.

Benzene

Naphthalene

Toluene

Biphenyl

Phenol

Aniline

Benzoic acid

Benzaldehyde

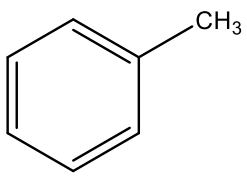
Benzene sulphonic acid

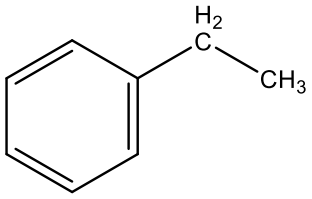
Diphenyl methane

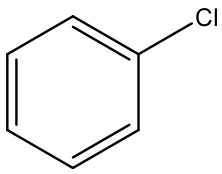
Phenanthrene

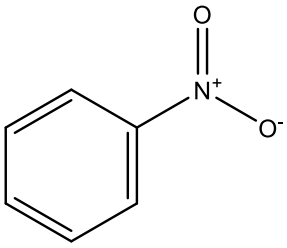
Anthracene

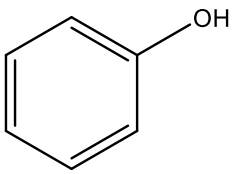
B. Give IUPAC names of the following compounds.

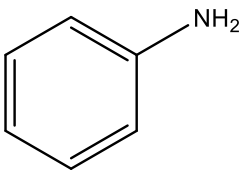


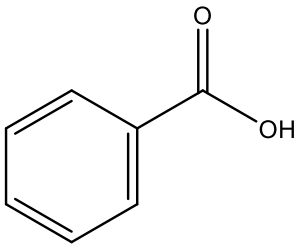


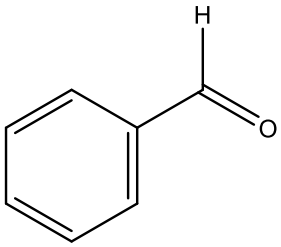


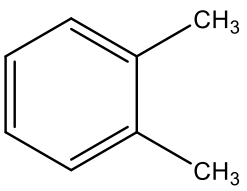


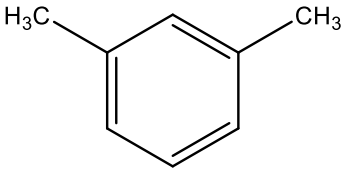


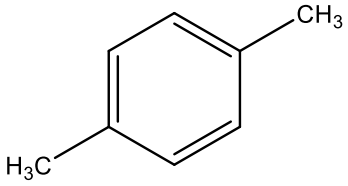


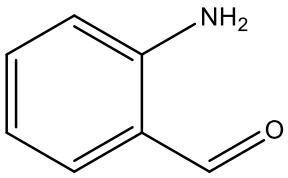


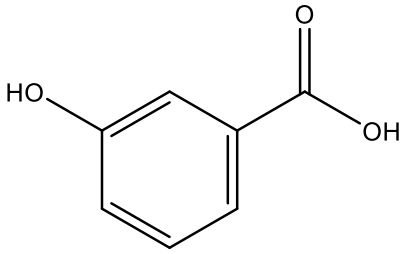


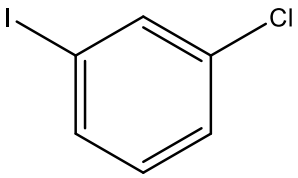


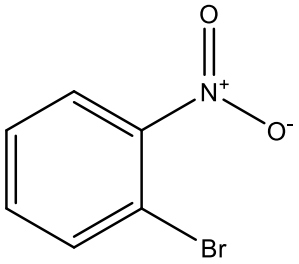


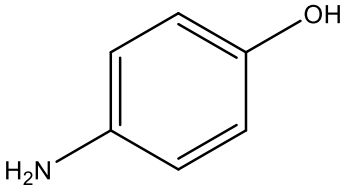


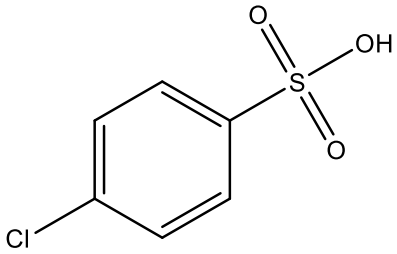


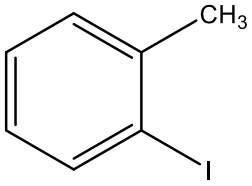












Learn the Reaction Conditions

- Dehydrogenation of cyclohexane: Pt/250 ºC
- Alkane to benzene: $Cr_2O_3+Al_2O_3+SiO_2$/500 ºC
- Benzene sulphonic acid to benzene: HCl/boil
- Halogenation of benzene: i. $FeBr_3$ with Br_2 ii. $FeCl_3$ with Cl_2
- Nitration of benzene: HNO_3/H_2SO_4 50-55 ºC

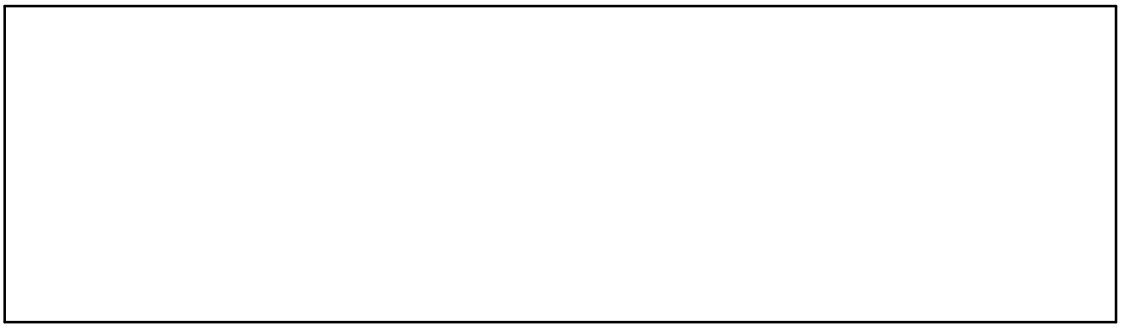
- Alkylation of benzene/Acylation of benzene: $AlCl_3$
- Halogenation of benzene: hν
- Chlorination of nitrobenzene: $FeCl_3$
- Nitration of toluene: 1) 2(HNO_3+H_2SO_4)/30-40 ºC for o-and p-products. 2(HNO_3+H_2SO_4) 60-70 ºC for 2,4 and 2,6 products. HNO_3+H_2SO_4/100 ºC 2,4,6-trinitrotoluene
- Acetylene to benzene: Organo-nickel catalyst/70 ºC
- Sodium benzoate to benzene: CaO
- Wurtz-Fittig reaction: Na/Ether
- Halogenation of alkyl benzene: hν
- Sulphonation of benzene: H_2SO_4/80 ºC, SO_3/H_2SO_4/25 ºC
- Reduction of benzene: Ni at 200 ºC or Pt/H_3O^+
- Catalytic oxidation: V_2O_5/450 ºC
- Nitration of chlorobenzene: 2(HNO_3+H_2SO_4)
- Nitrotoluene to m-nitrotoluene: HNO_3+H_2SO_4/95 ºC
- Simple hydrogenation of cyclohexene: Pt

C. Match the correct reaction condition.

Reaction	Condition
Dehydrogenation of cyclohexane	Pt
Benzene sulphonic acid to benzene	HNO_3+H_2SO_4/95 ºC
Alkane to benzene	hν
Nitration of benzene	2(HNO_3+H_2SO_4)
Halogenation of benzene	V_2O_5/450 ºC
Simple hydrogenation of cyclohexene	Ni at 200 ºC or Pt/H_3O^+
Alkylation of benzene/Acylation of benzene	H_2SO_4/80 ºC, SO_3/H_2SO_4/25 ºC
Nitrotoluene to m-nitrotoluene	Na/Ether
Nitration of chlorobenzene	Organo-nickel catalyst/70 ºC
Catalytic oxidation	CaO
Reduction of benzene	1) 2(HNO_3+H_2SO_4)/30-40 ºC for o-and p-products. 2(HNO_3+H_2SO_4) 60-70 ºC for 2,4 and 2,6 products. HNO_3+H_2SO_4/100 ºC 2,4,6-trinitrotoluene
Halogenation of alkyl benzene	$FeCl_3$
Sulphonation of benzene	hν
Halogenation of alkyl benzene	$AlCl_3$
Wurtz-Fittig reaction	HNO_3/H_2SO_4 50-55 ºC
Sodium benzoate to benzene	i. $FeBr_3$ with Br_2 ii. $FeCl_3$ with Cl_2
Acetylene to benzene	HCl/boil
Nitration of toluene	Cr_2O_3+Al_2O_3+SiO_2/500 ºC
Chlorination of nitrobenzene	Pt/250 ºC

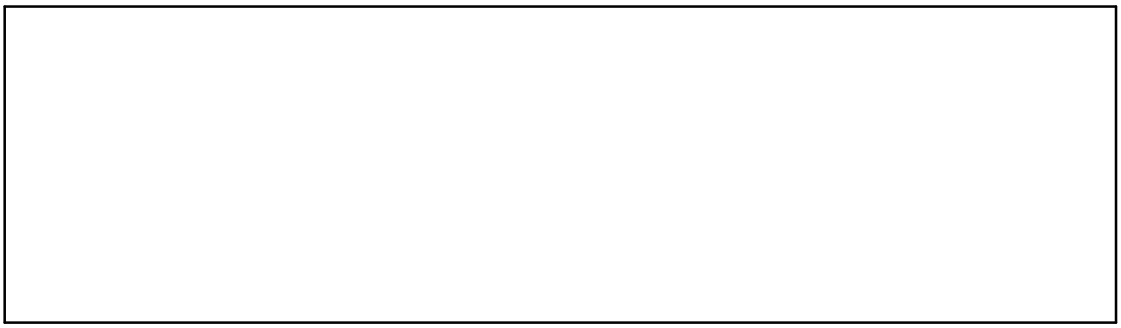
D. Structure of Benzene

- The technique used for the determination of empirical formula of benzene is_____
- Vapour density method gave molecular mass_____
- Molecular formula came out to be_____
- Benzene is highly_____compound
- Two possible straight chain structures of benzene are

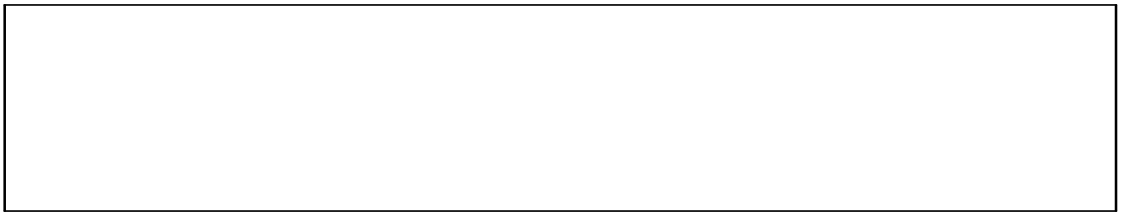


- With alkaline $KMnO_4$ the colour_____
- The addition reactions show_____
- Substitution reactions give_____
- The straight chain structures are ruled out because_____
  _____
  _____

Draw the Kekule's Structures of Benzene.



Benzene gives monosubstituted product.



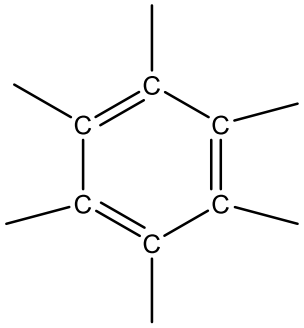
Benzene gives three disubstituted products.

Benzene adds three hydrogen molecules.

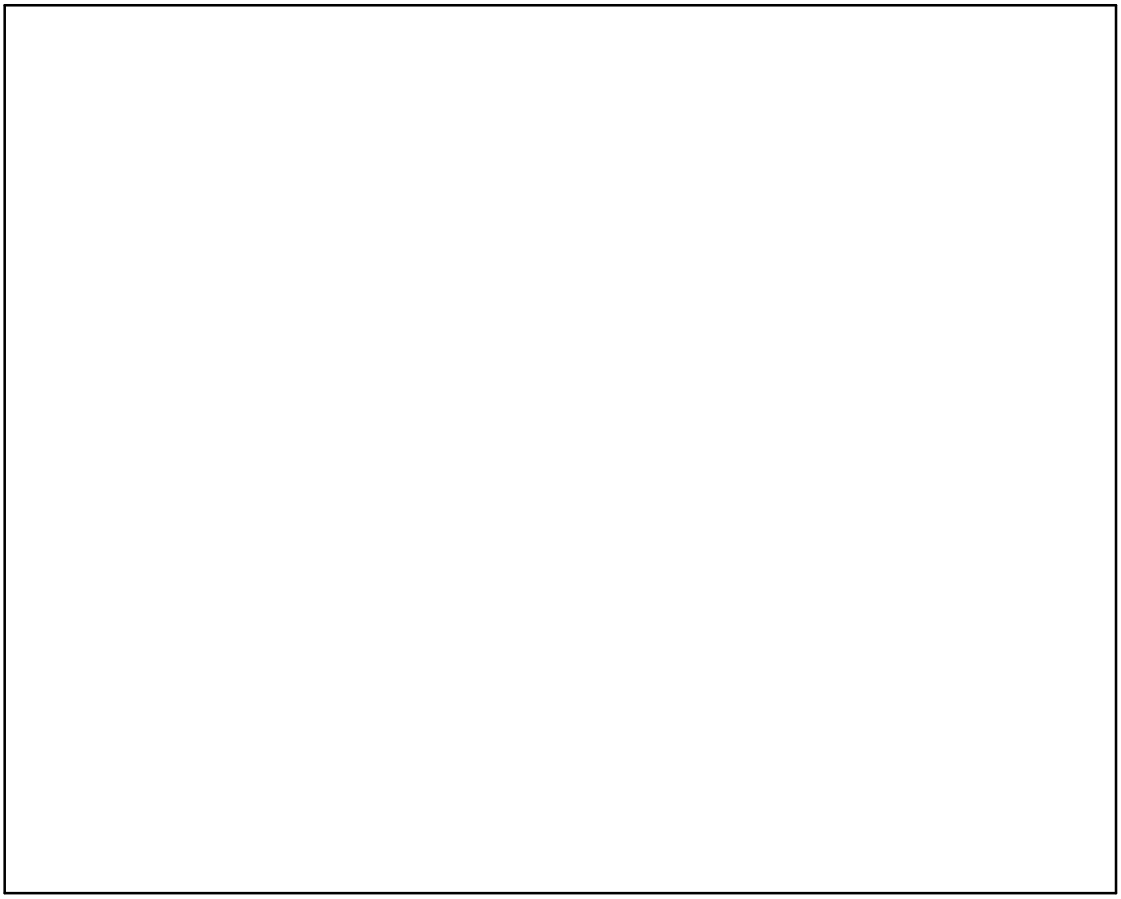
Benzene adds three halogen molecules.

X-Ray studies of benzene

Identify bond angles and bond lengths



Draw Atomic Orbital Treatment diagram of benzene

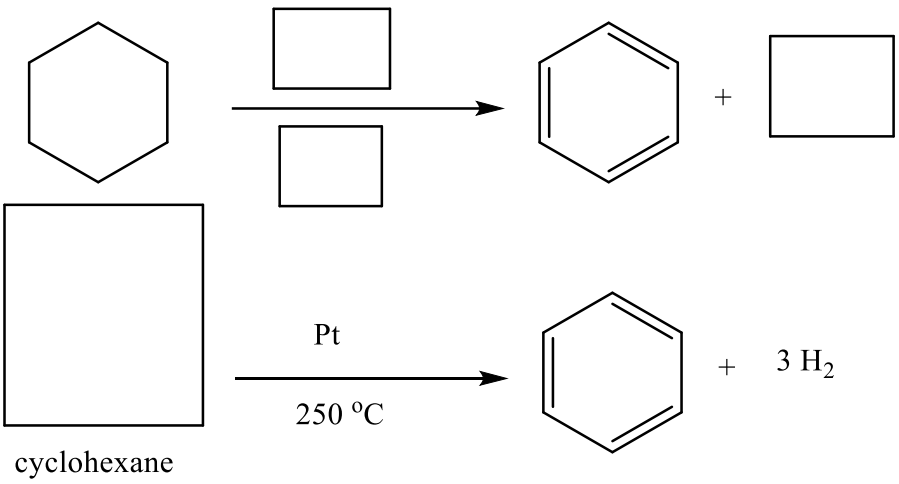


Calculate resonance energy of benzene through hydrogenation of cyclohexene, 1,3-cyclohexadiene and 1,3,5-cyclohexatriene.

Draw resonance structures of benzene. Why Dewar structures are minor contributors?

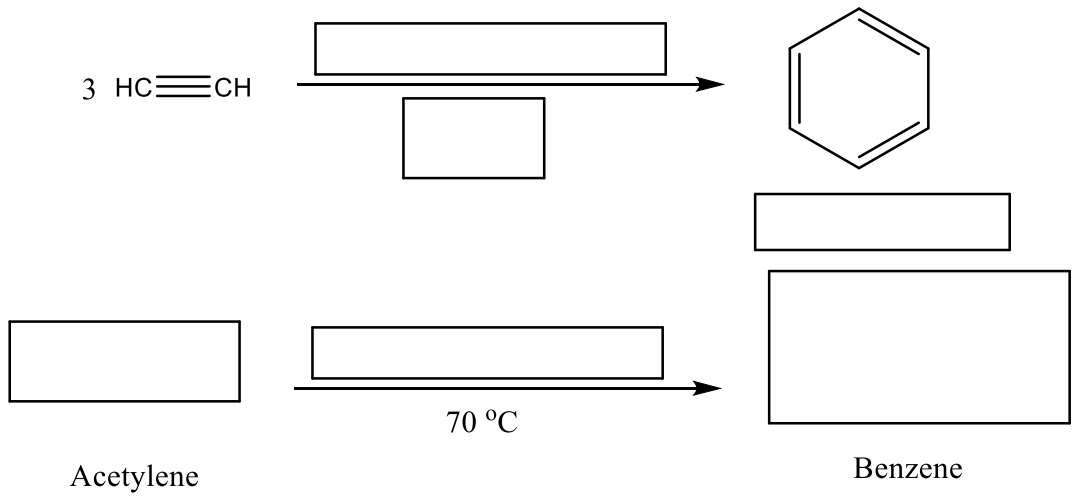
E. Learn through blanks.

Name of Reaction:_____

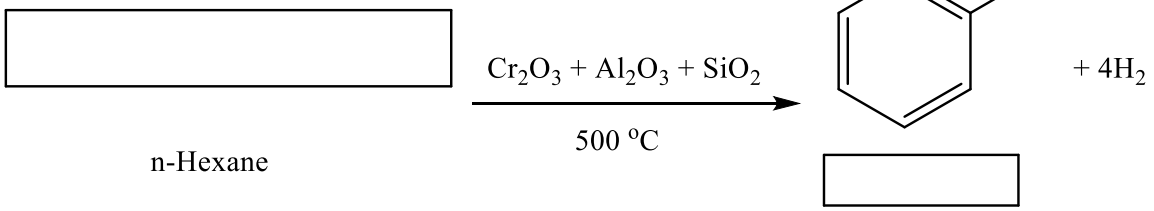


Practice Reaction

Name of Reaction:_____

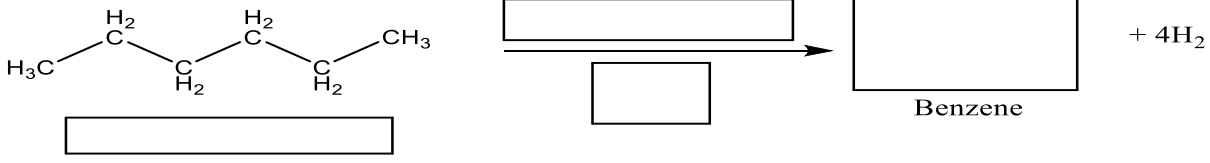


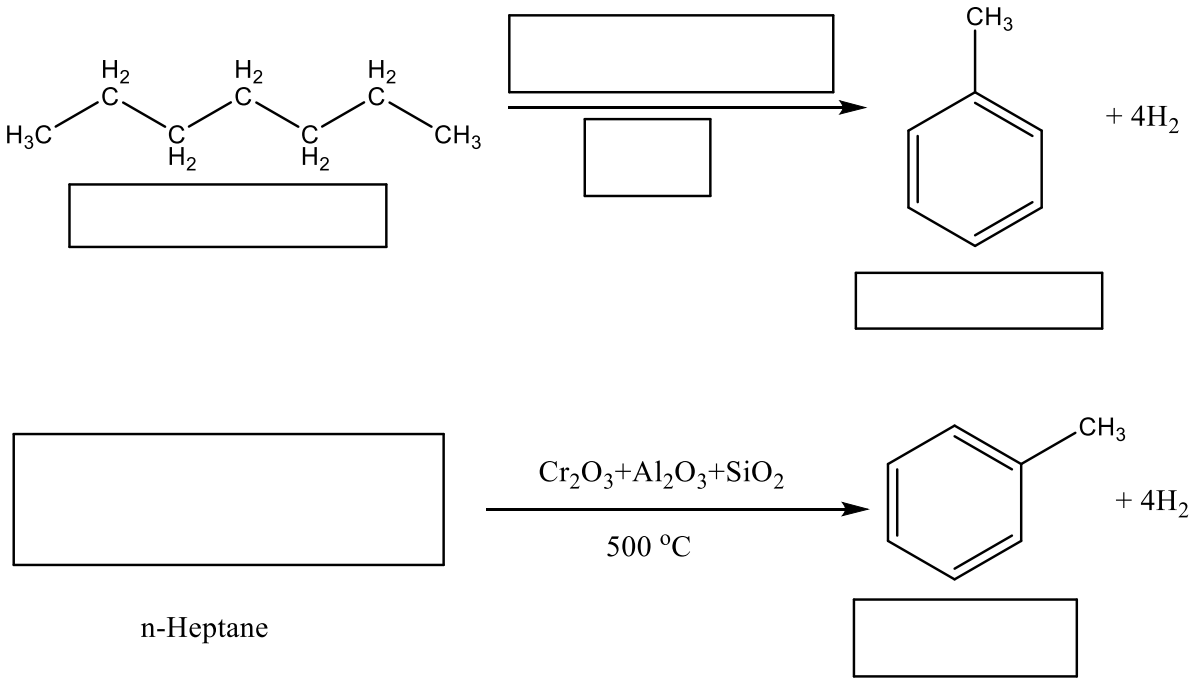
Practice Reaction



Practice Reaction

Name of Reaction: _____



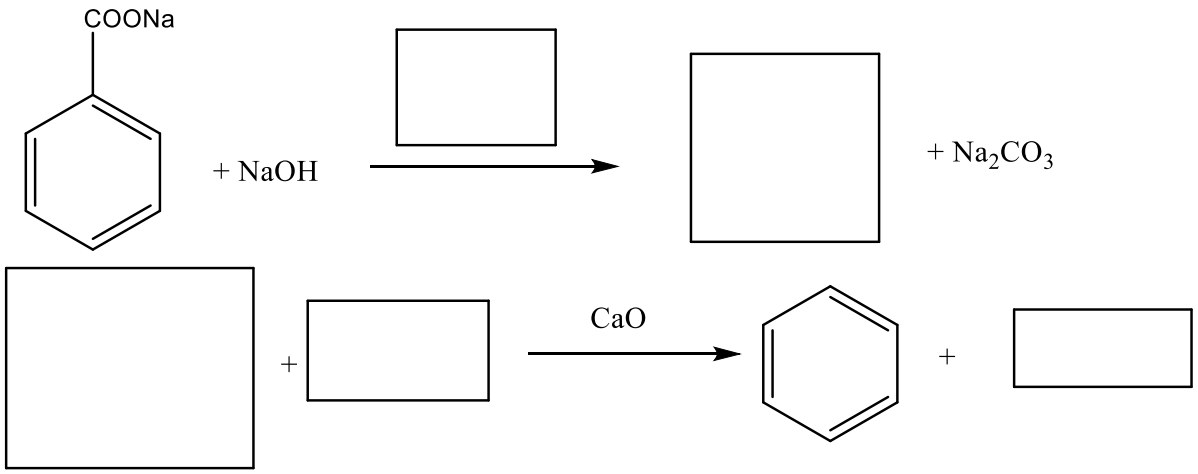


n-Heptane

Practice Reaction

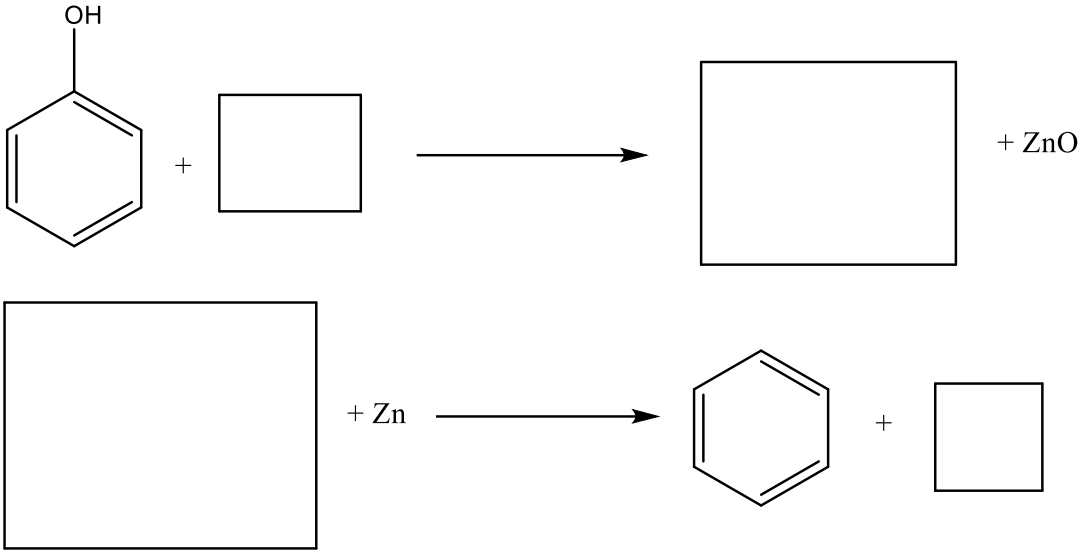
Preparation in the Laboratory

Name of Reaction: _____

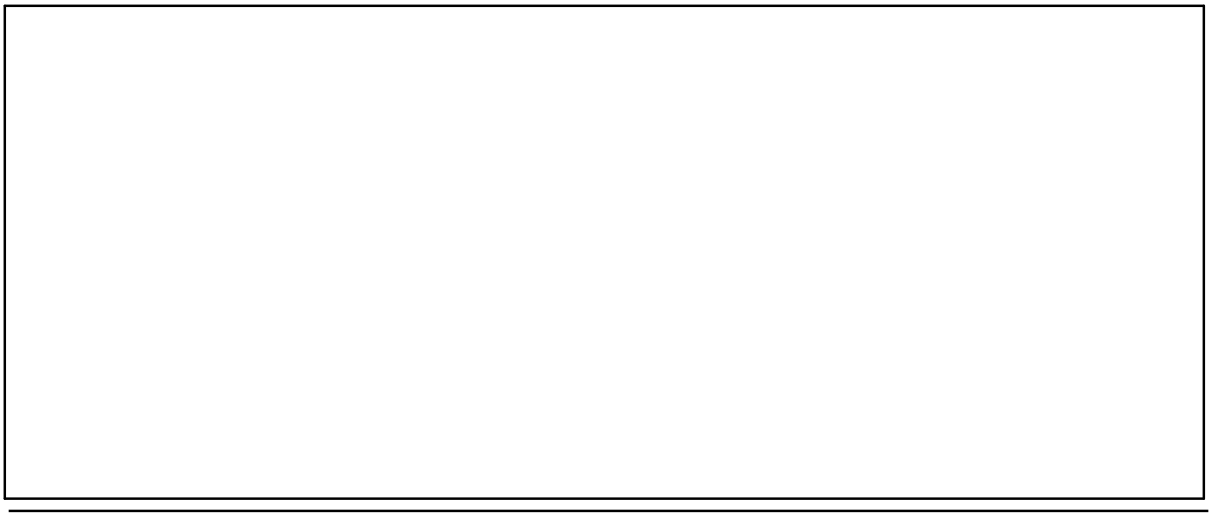


Practice Reaction

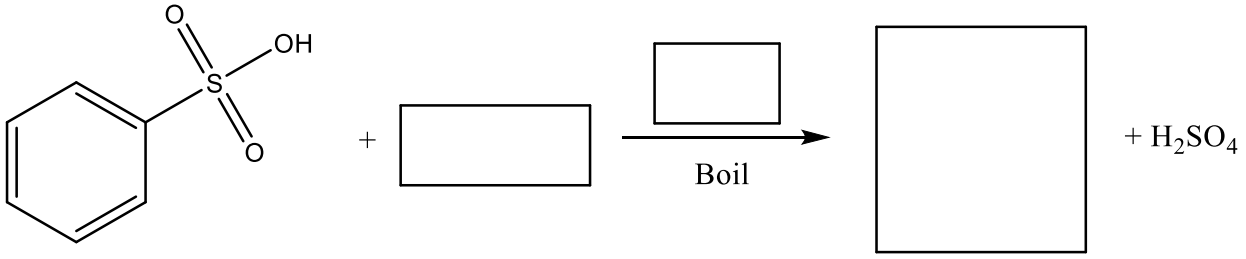
Name of Reaction: _____

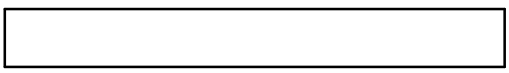


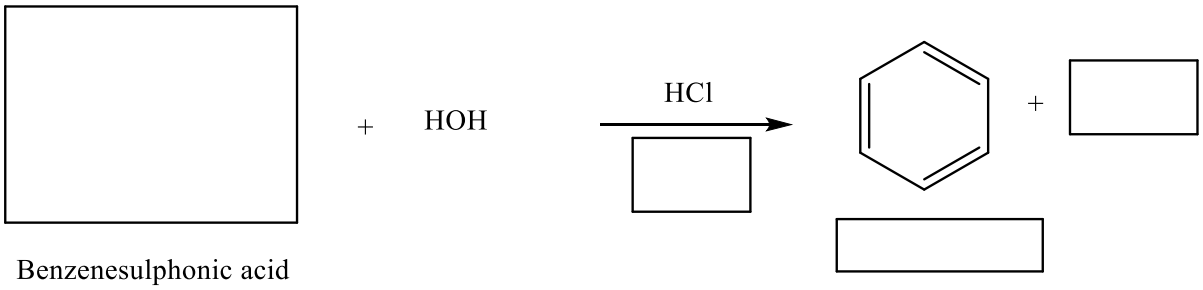
Practice Reaction



Name of Reaction: _____

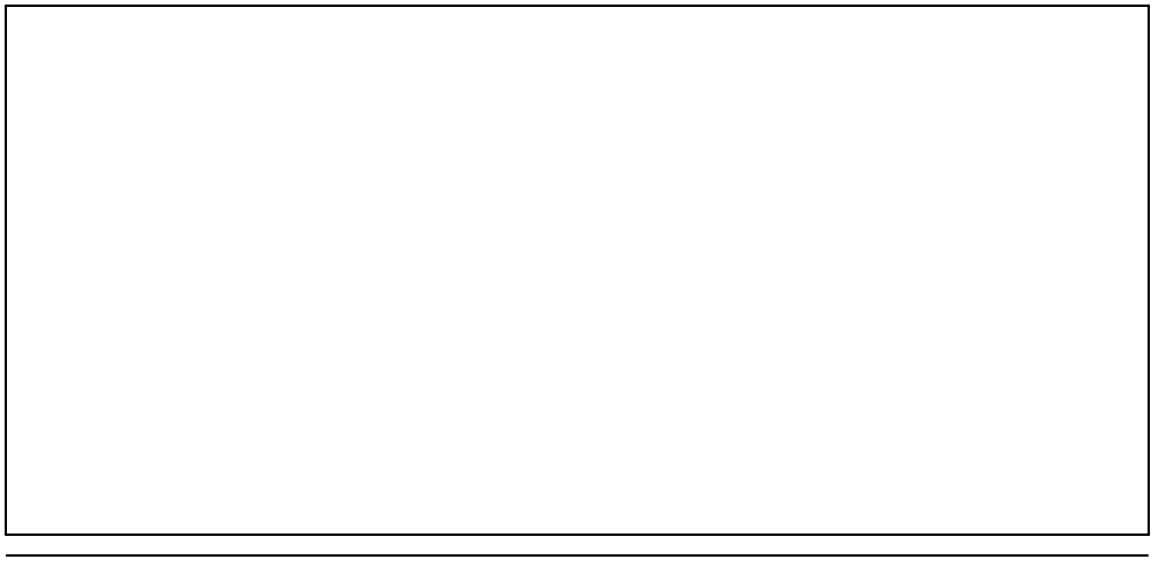




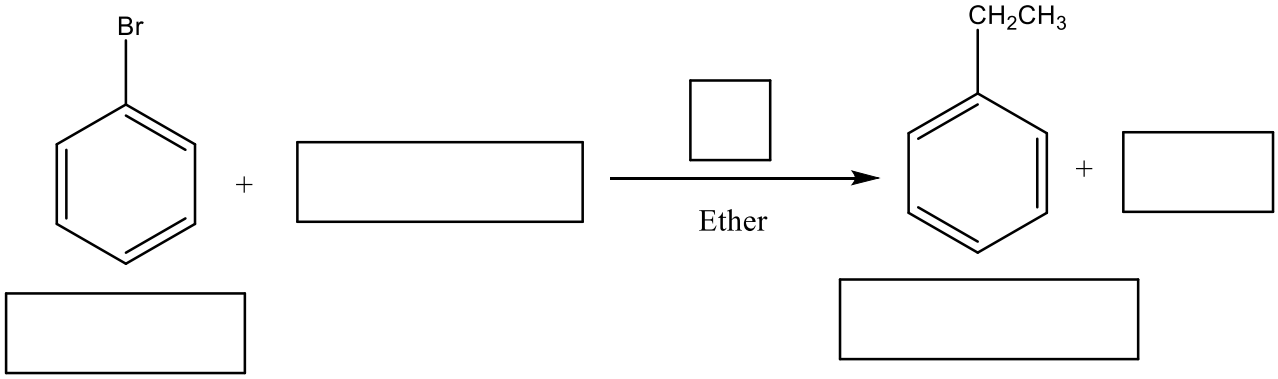


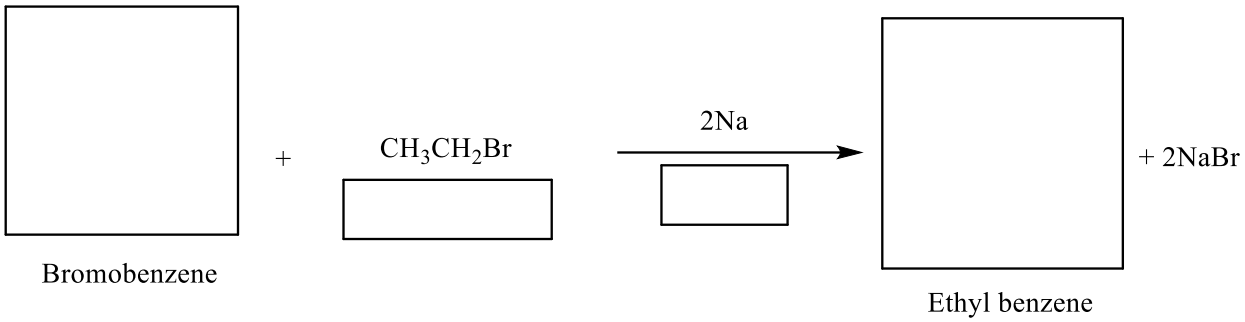
Benzenesulphonic acid

Practice Reaction

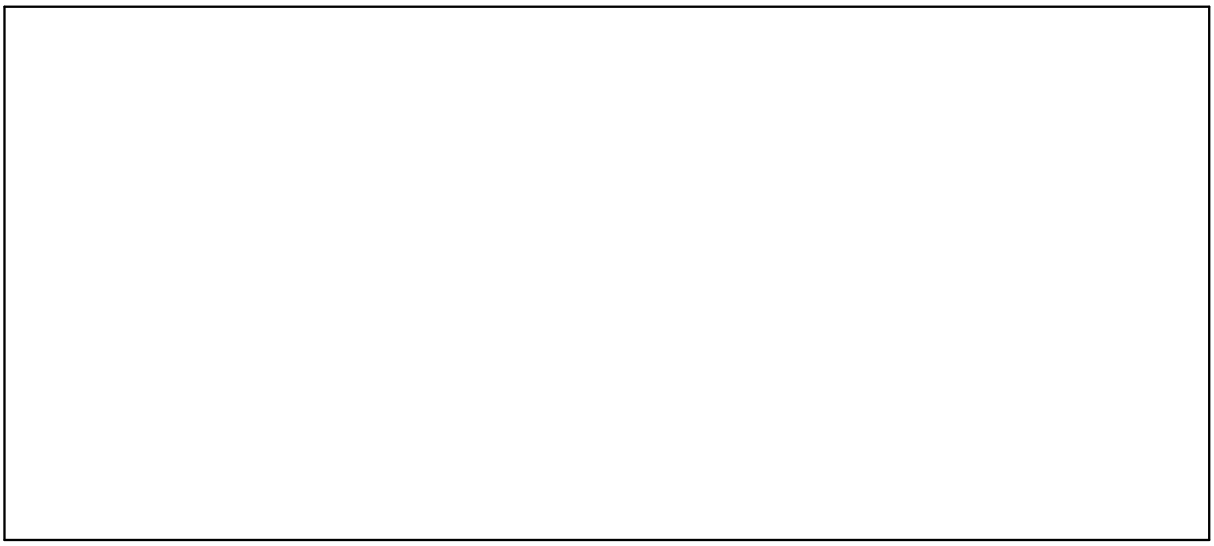


Name of Reaction:_____

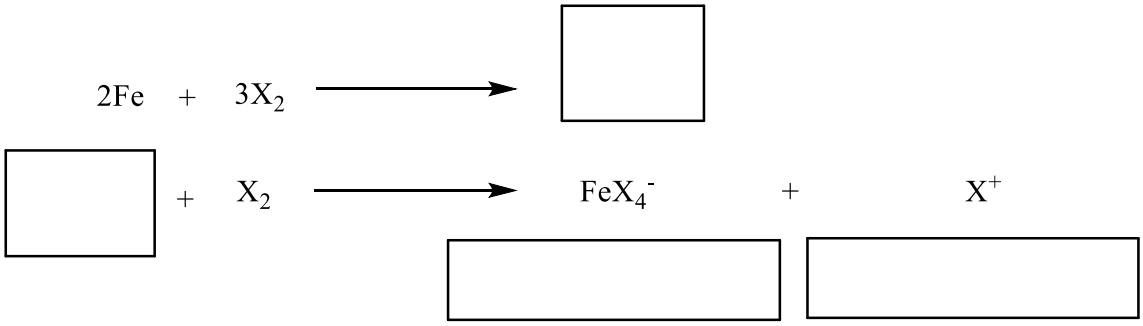


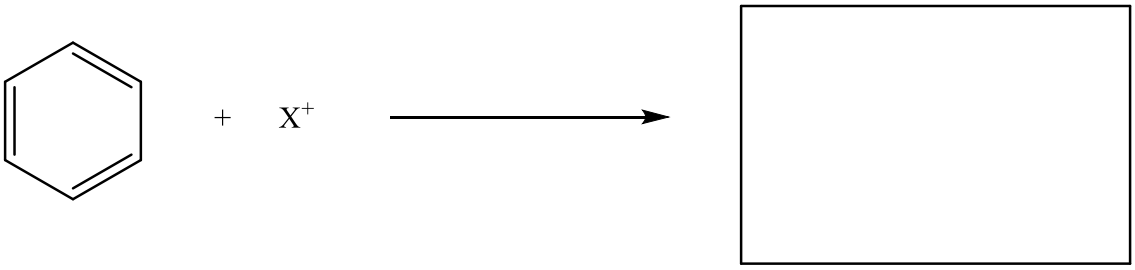


Practice Reaction

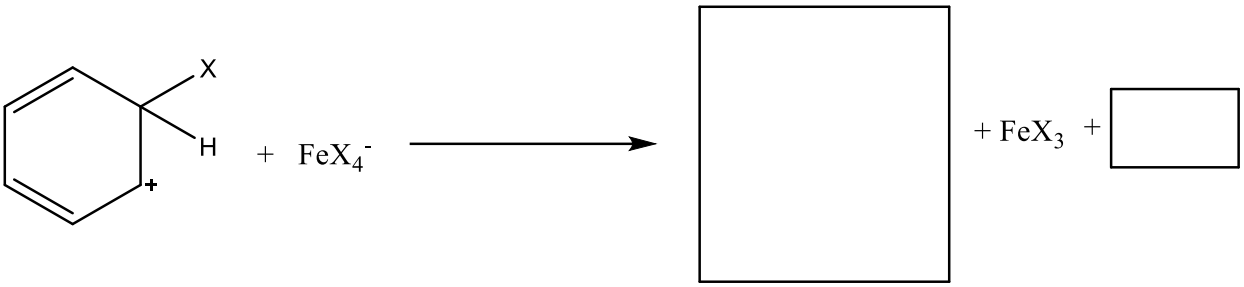


General Pattern of Reactivity of Benzene

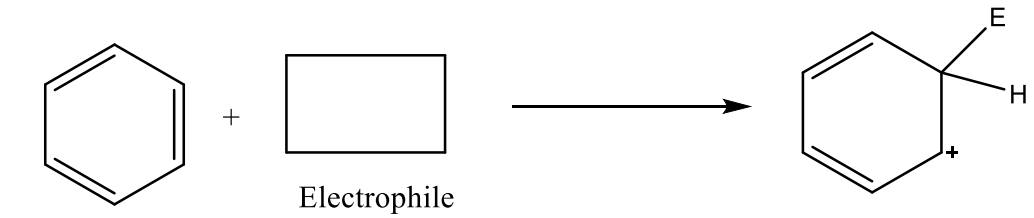


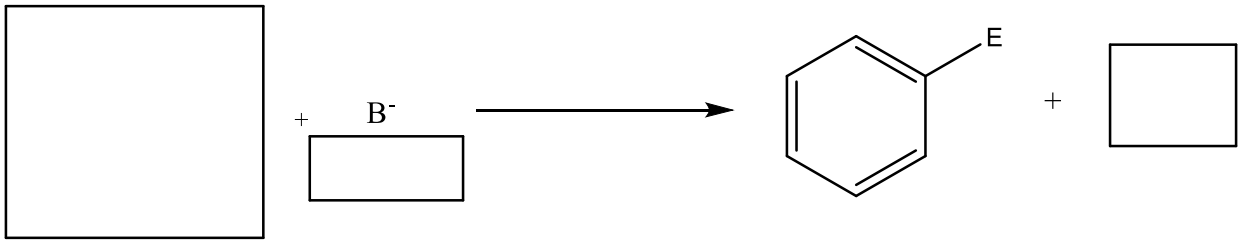


Benzenonium ion



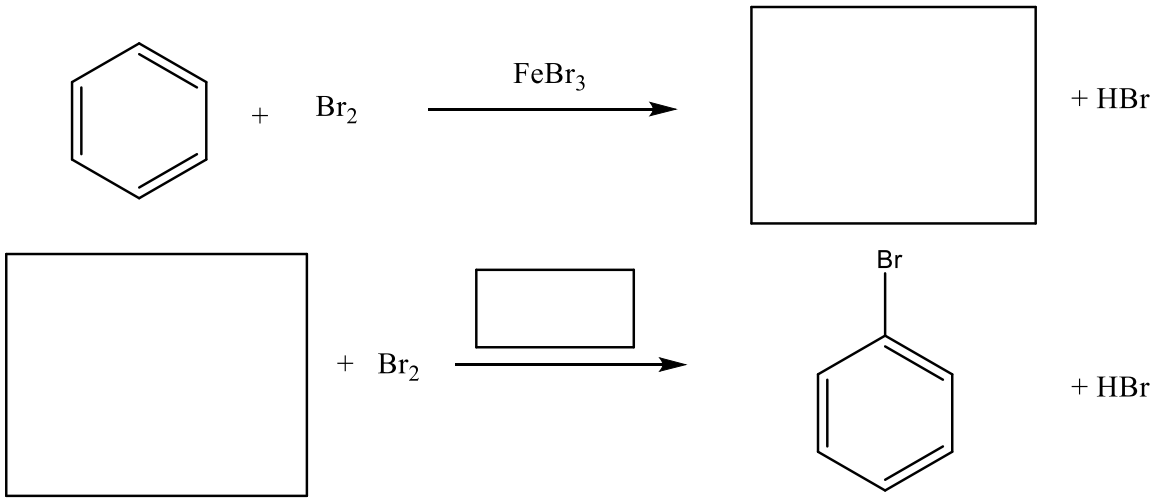
Practice Reaction



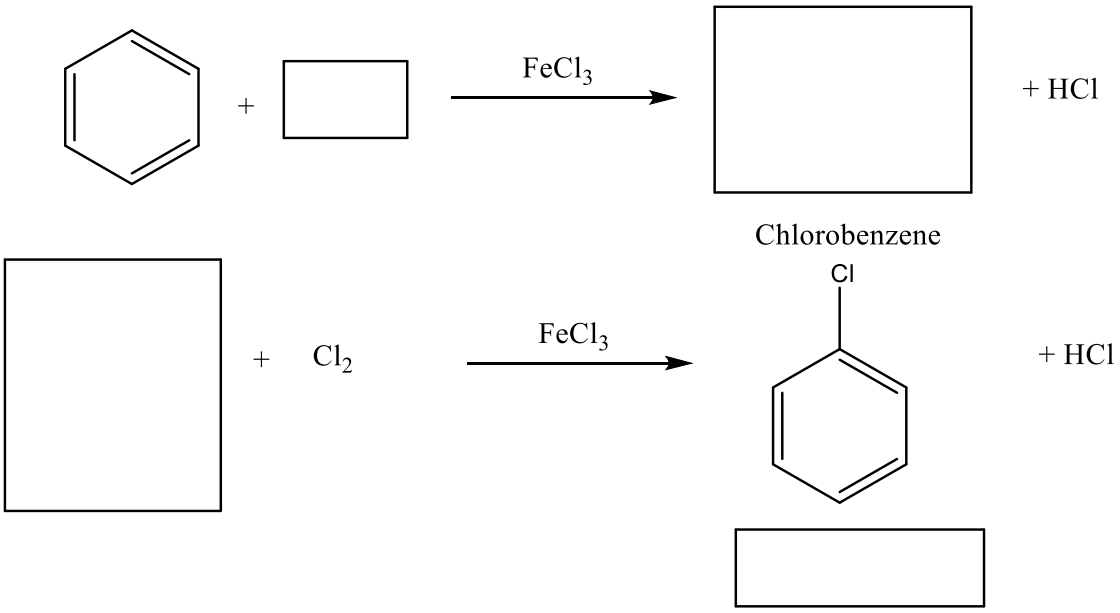


Practice Reaction

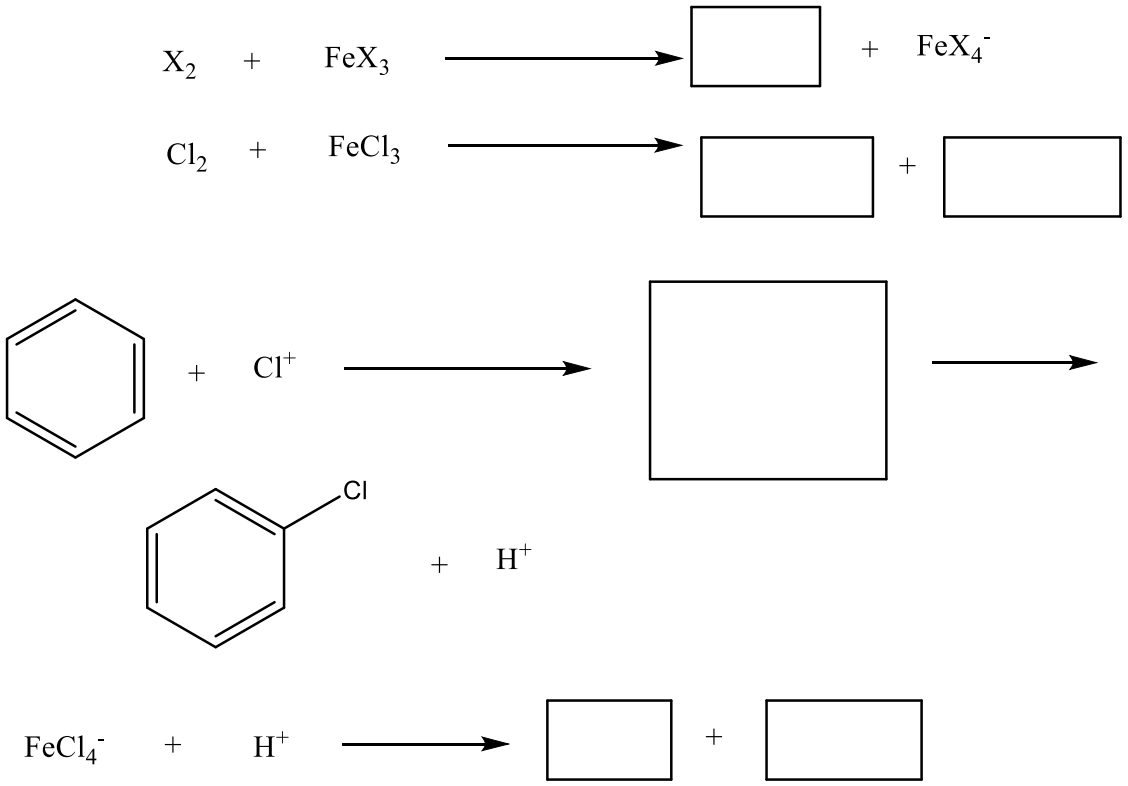
Halogenation



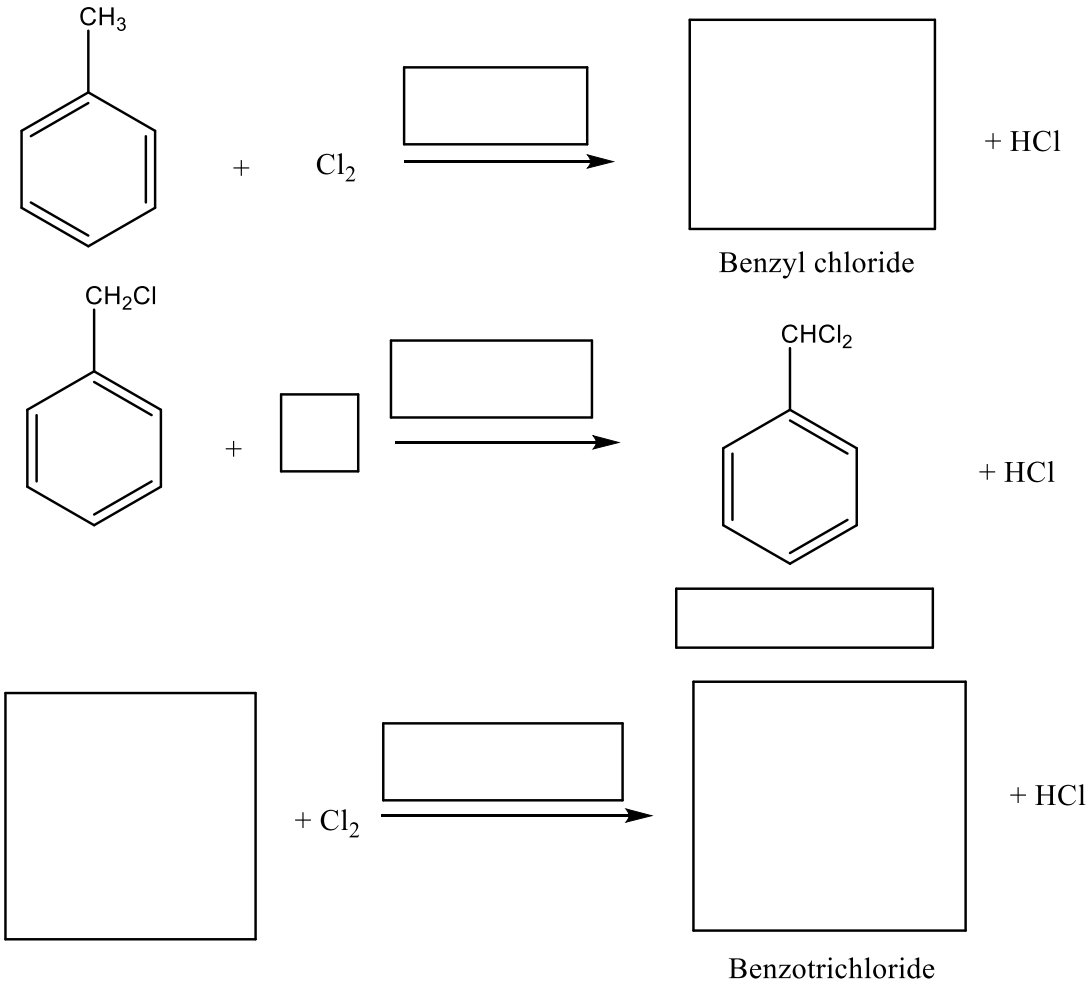
Practice Reaction



Practice Reaction

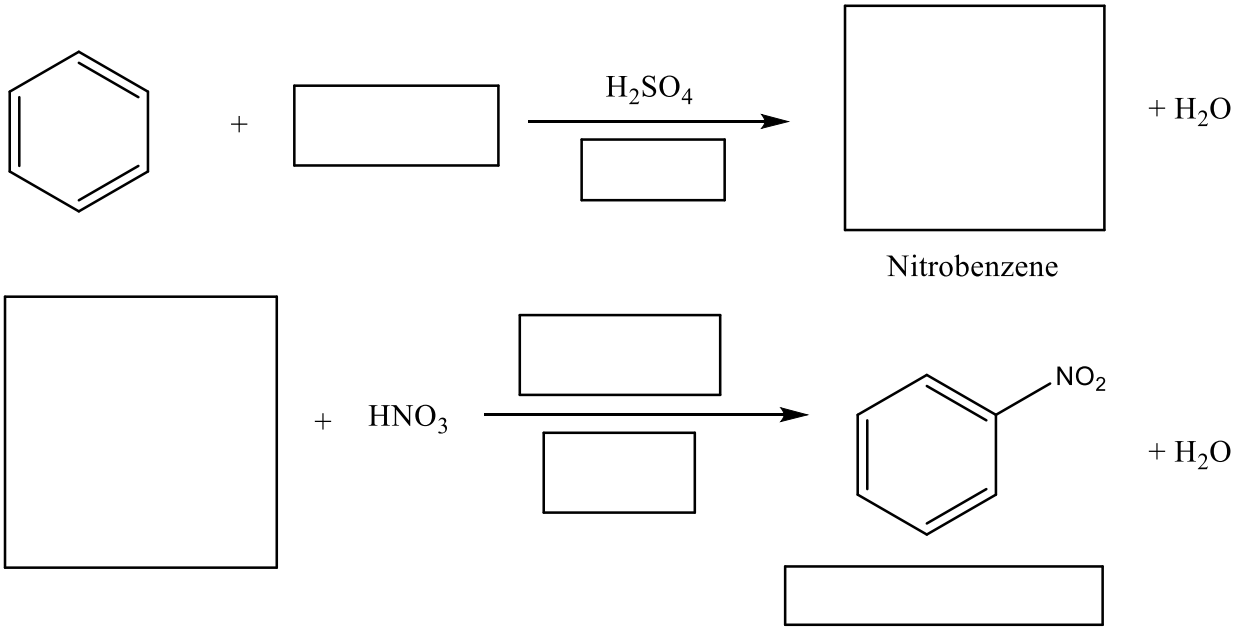


Practice Reaction

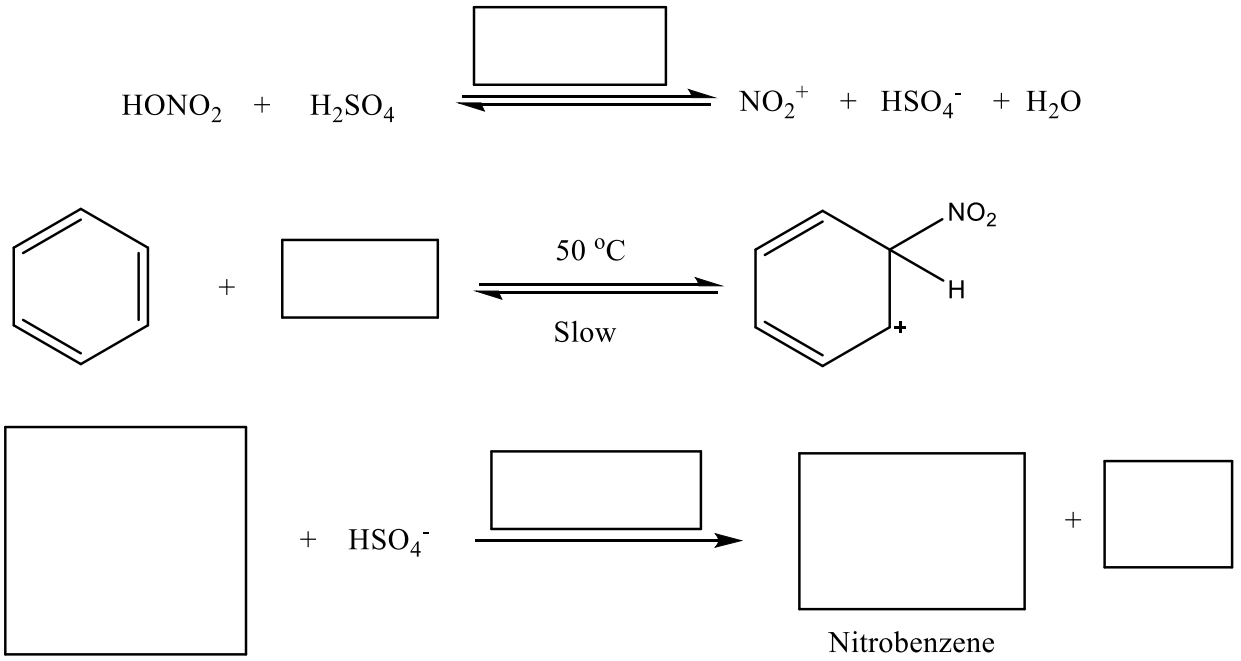


Practice Reaction

Nitration

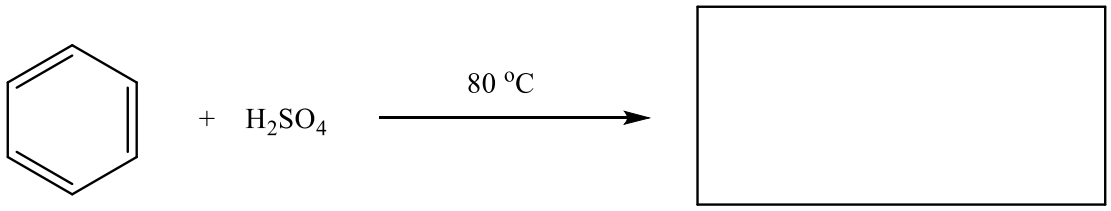


Practice Reaction

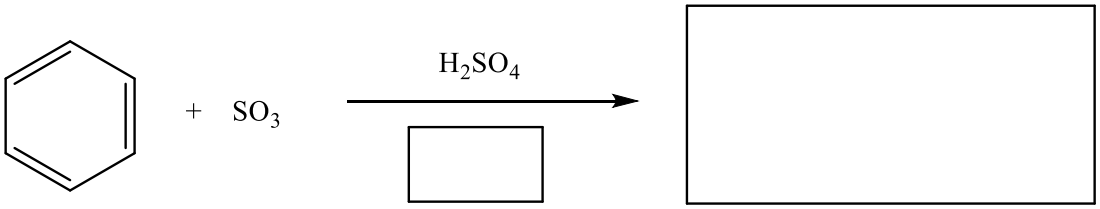


Nitrobenzene

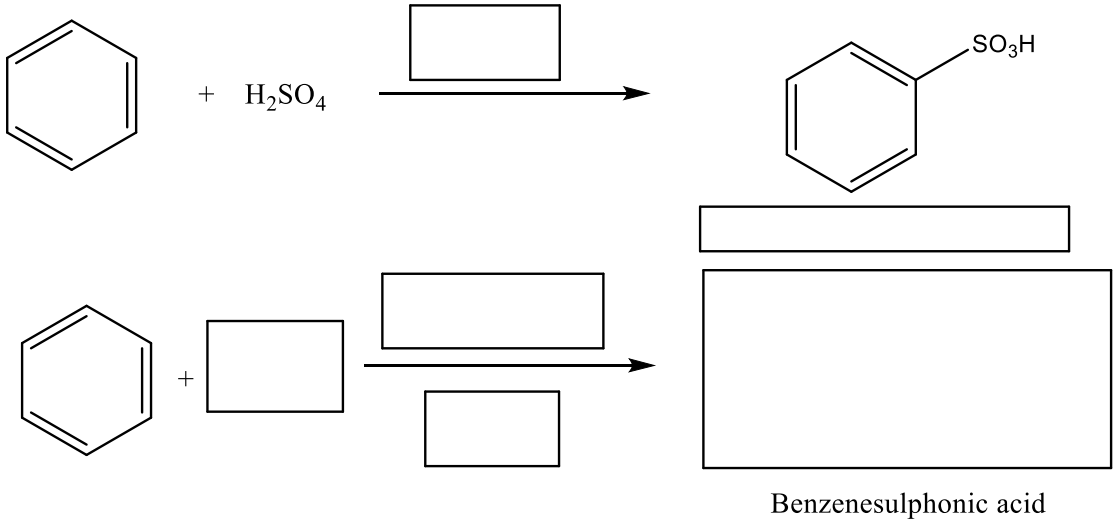
Practice Reaction



Benzenesulphonic acid

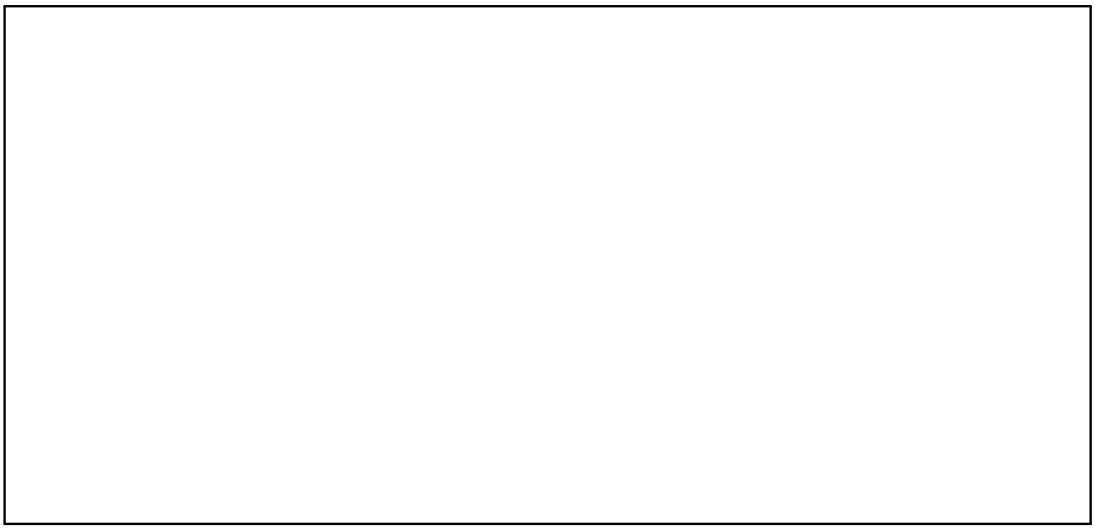


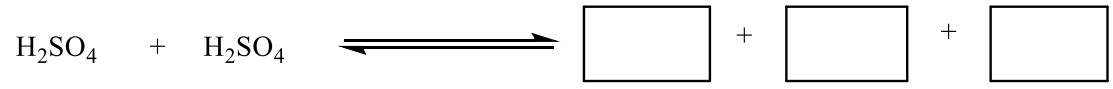
Benzenesulphonic acid

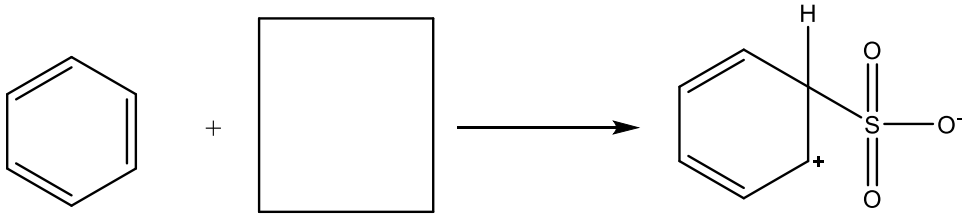


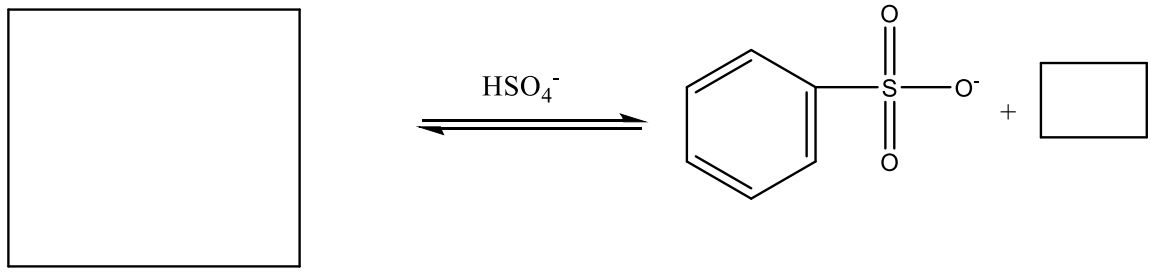
Benzenesulphonic acid

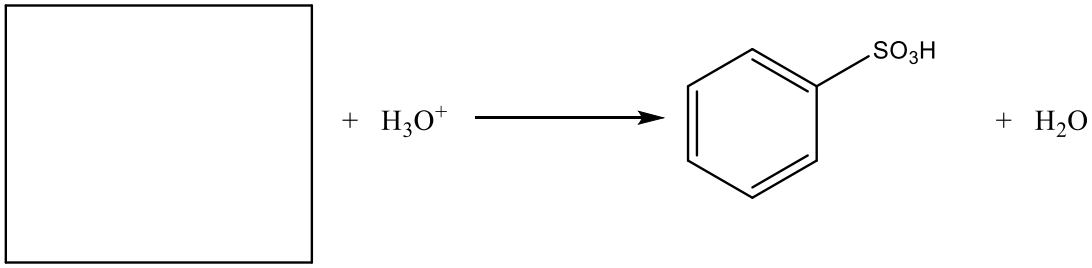
Practice Reaction







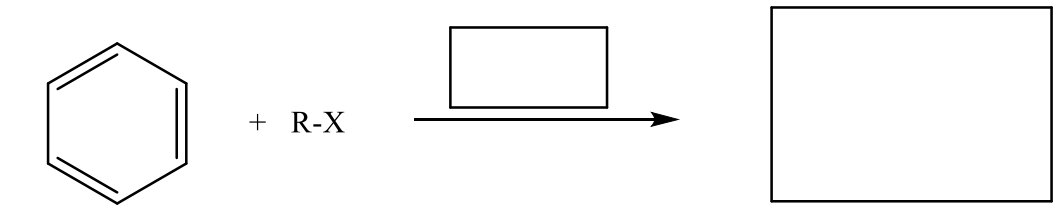


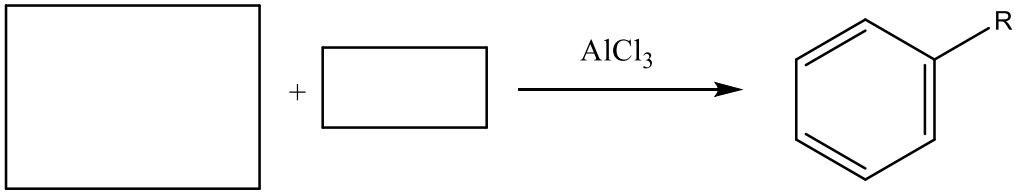


Practice Reaction

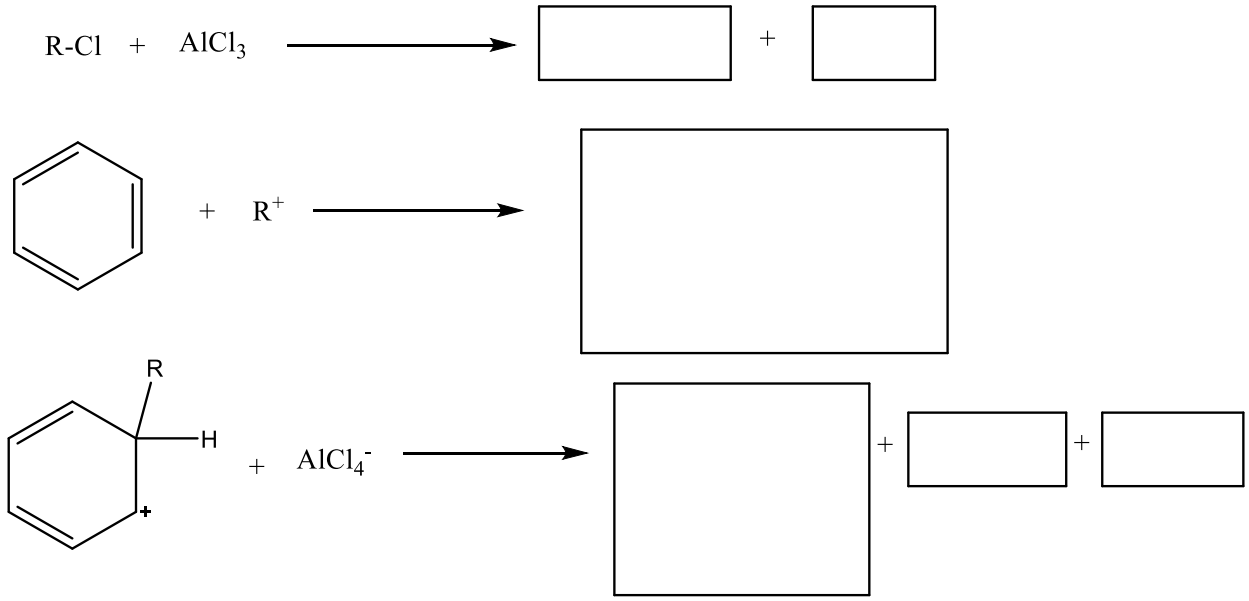
Friedel-Crafts Reactions

a) Alkylation





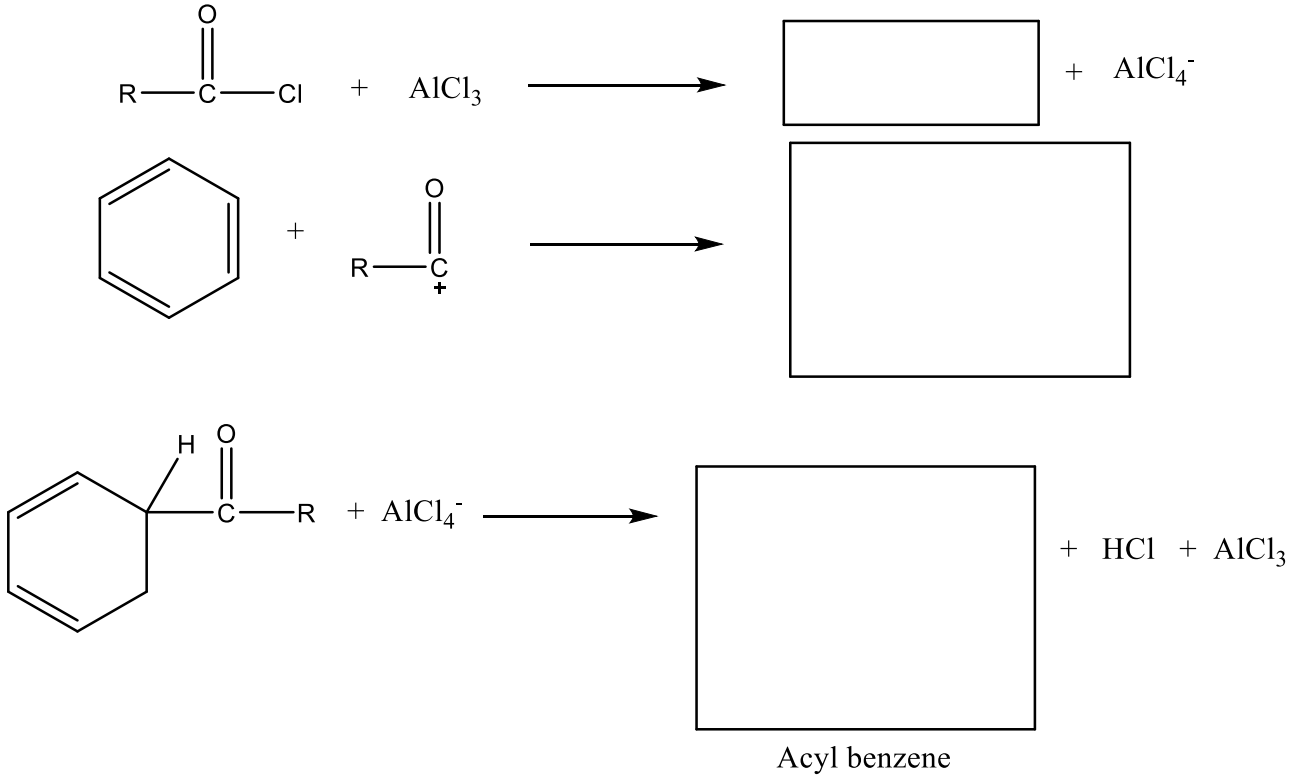
Practice Reaction



Practice Reaction

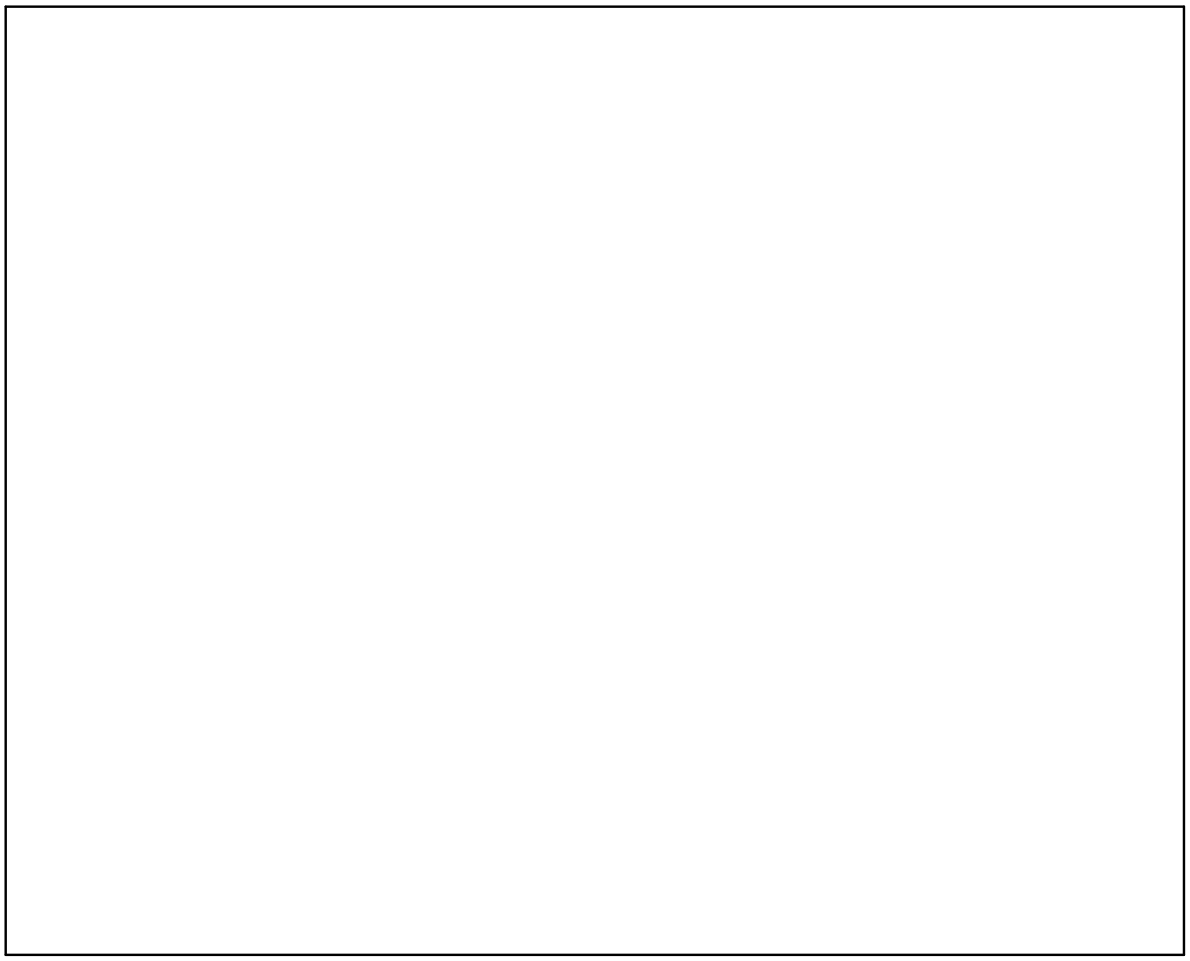
Draw mechanism for the synthesis of toluene from benzene.

b) Acylation



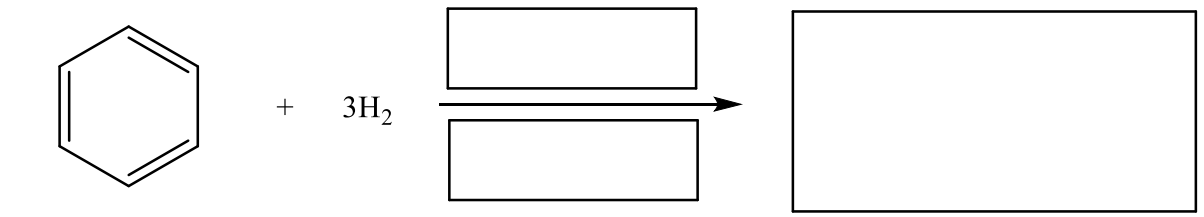
Acyl benzene

Practice Reaction

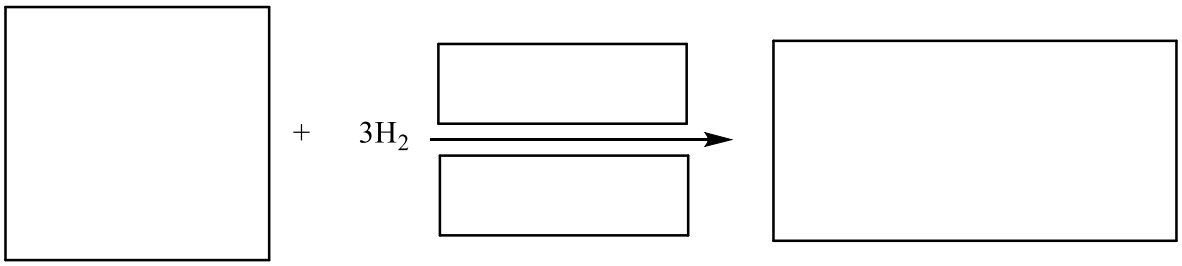


Draw mechanism for the synthesis of acetophenone from benzene.

Reduction



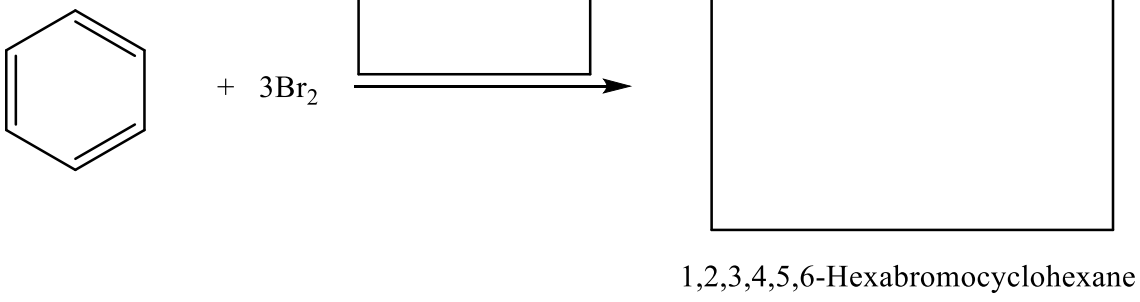
Cyclohexane



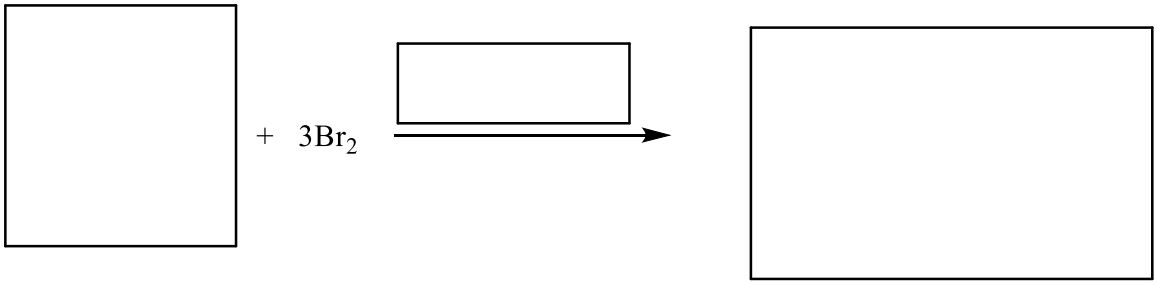
Cyclohexane

Practice Reaction

Halogenation



1,2,3,4,5,6-Hexabromocyclohexane

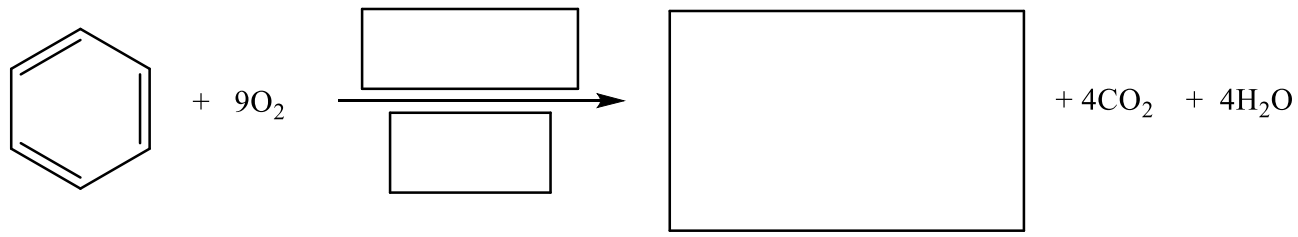


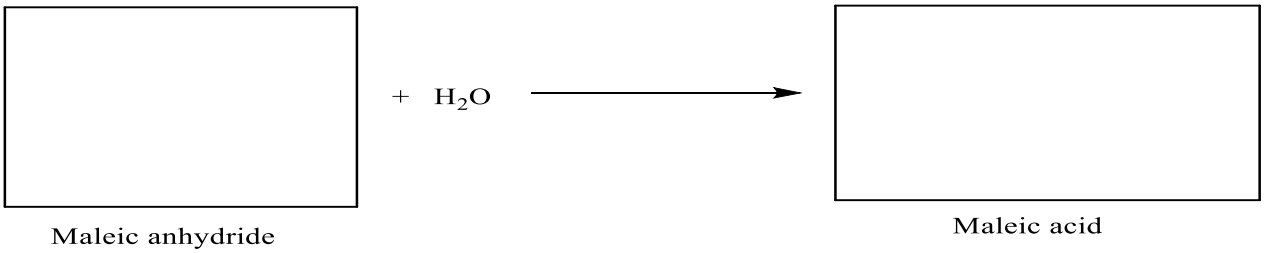
1,2,3,4,5,6-Hexabromocyclohexane

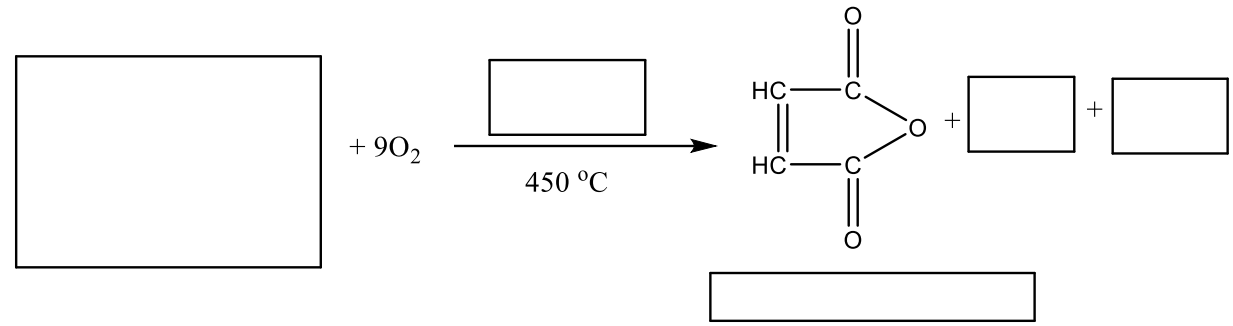
Practice Reaction

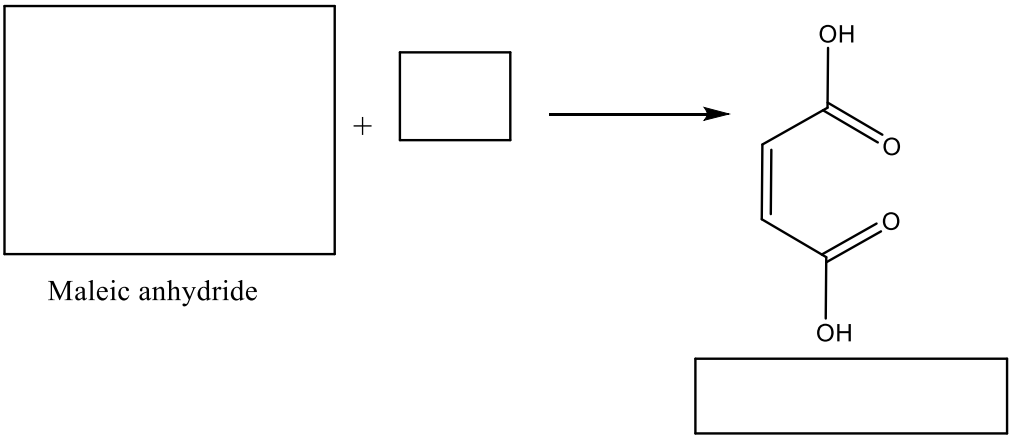
What are the products of combustion of benzene?

Catalytic Oxidation





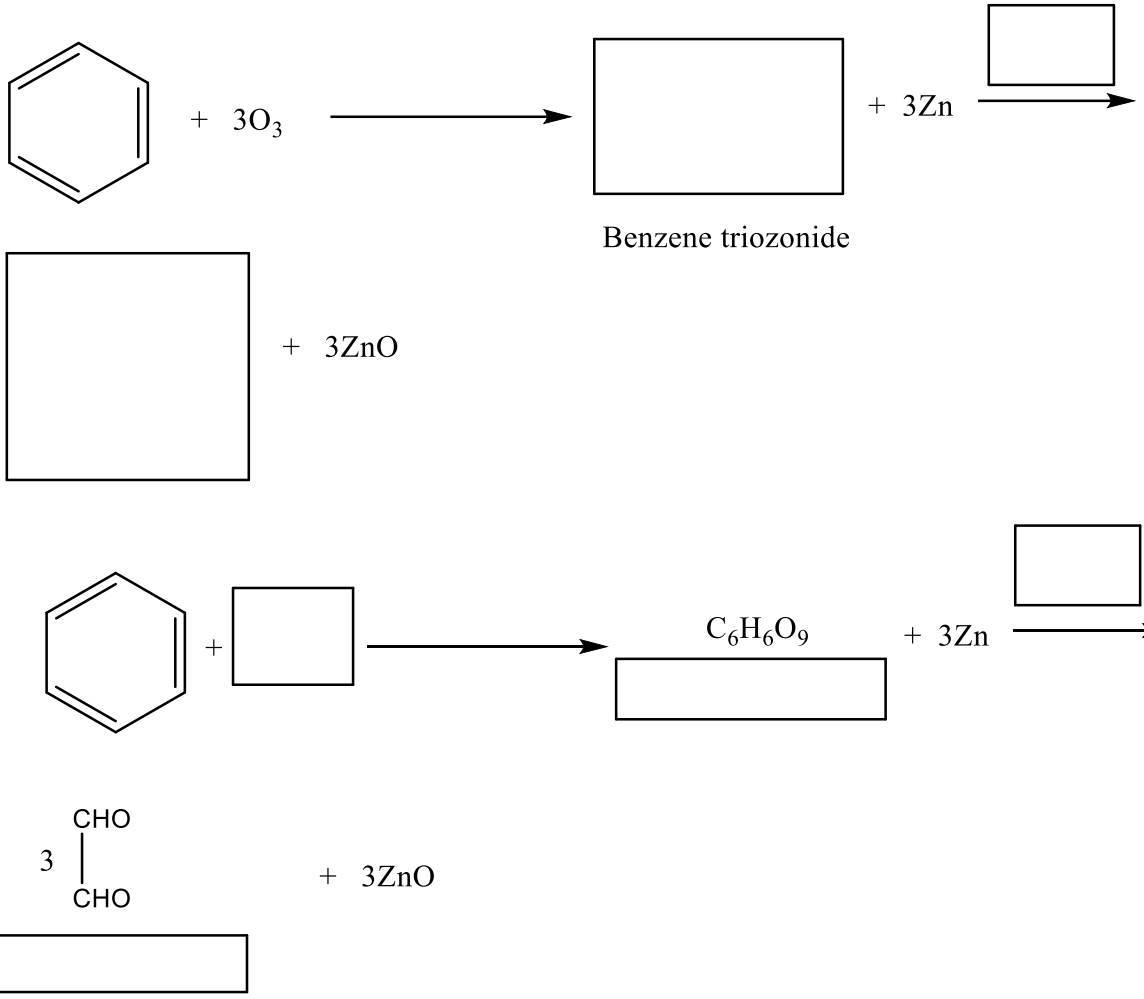




Maleic anhydride

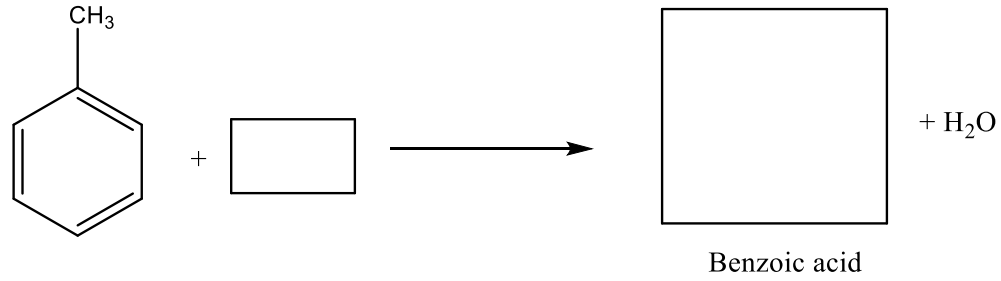
Practice Reaction

Ozonolysis

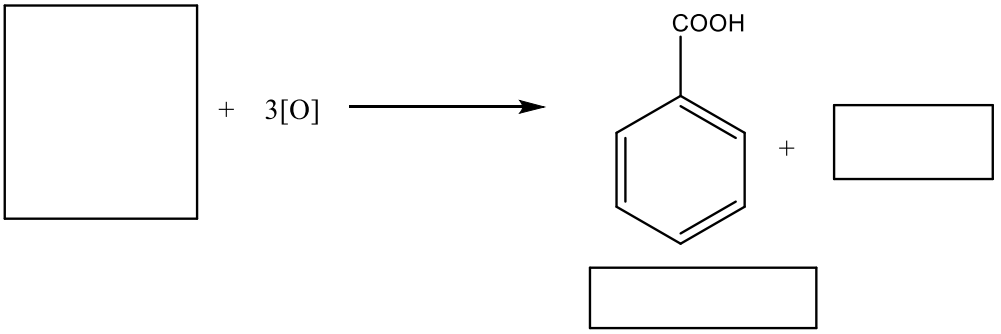


Practice Reaction

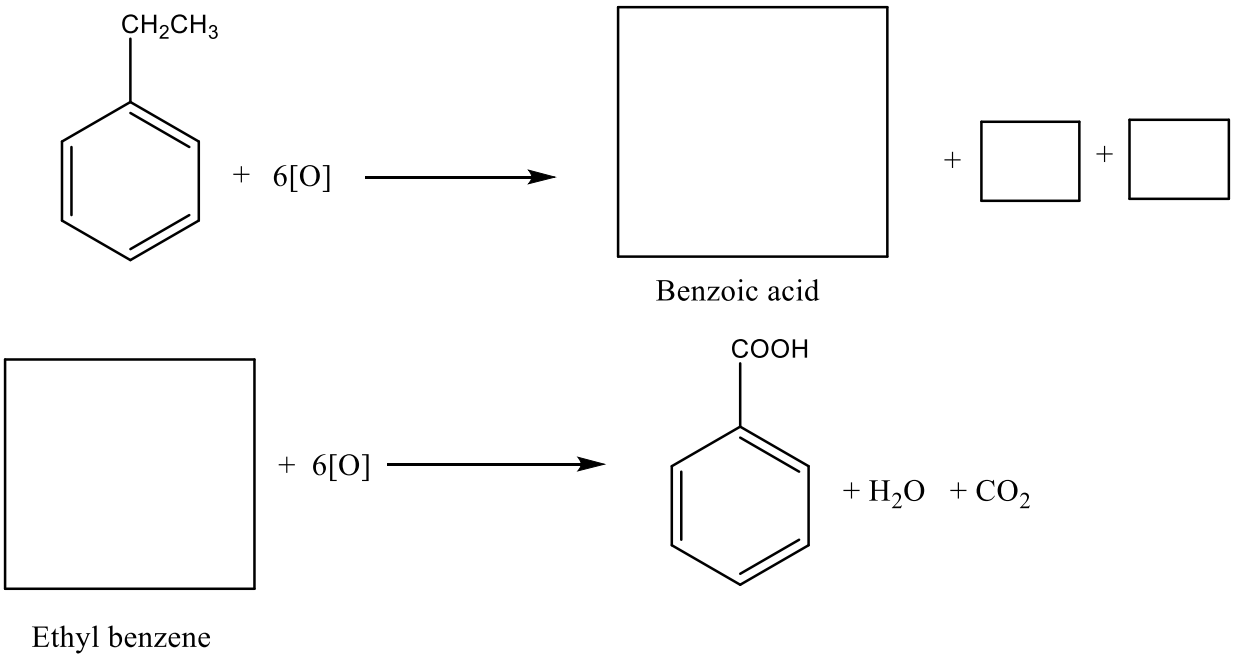
Side Chain Oxidation



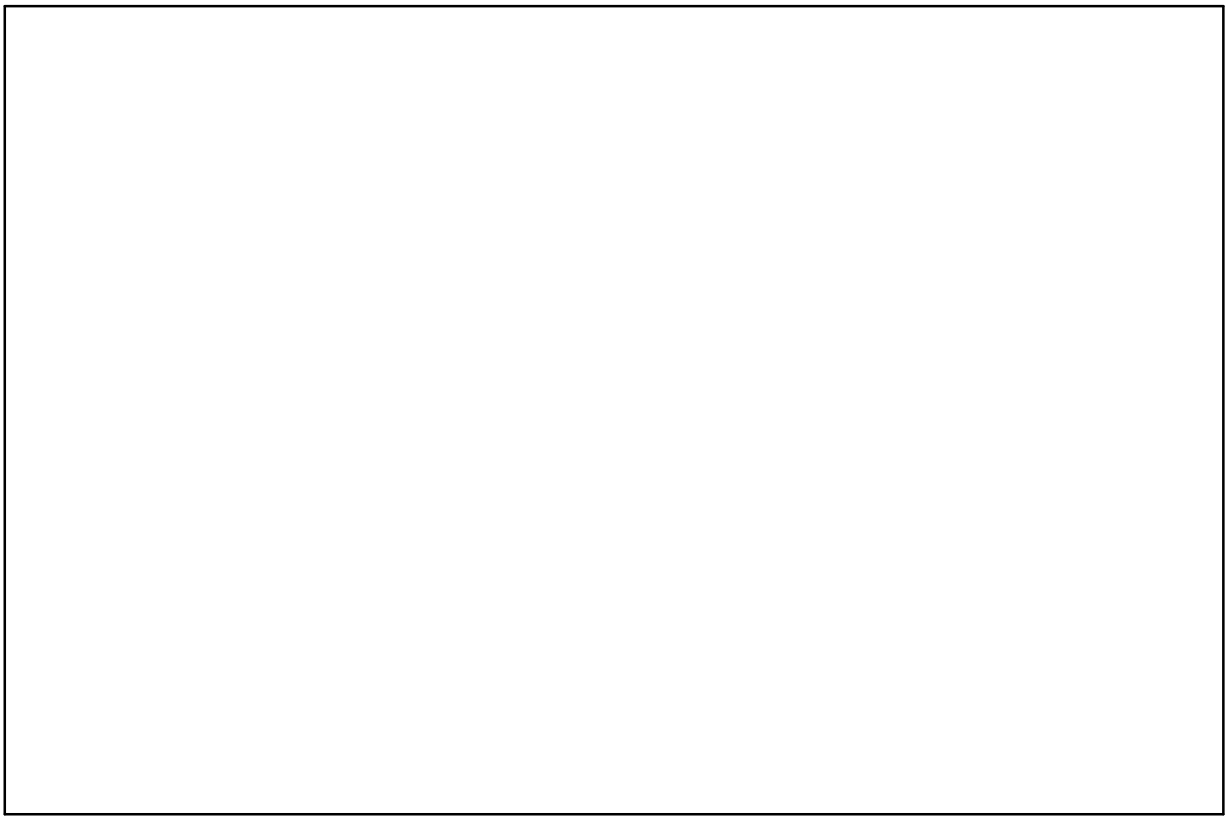
Benzoic acid



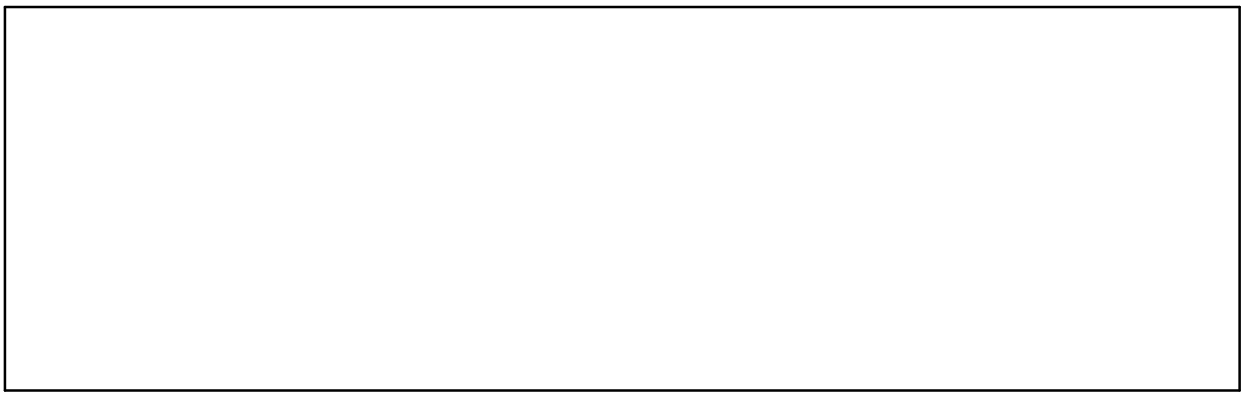
Practice Reaction

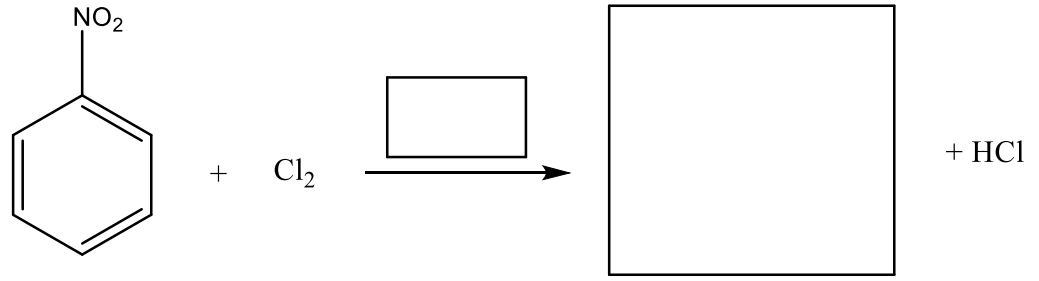


Practice Reaction

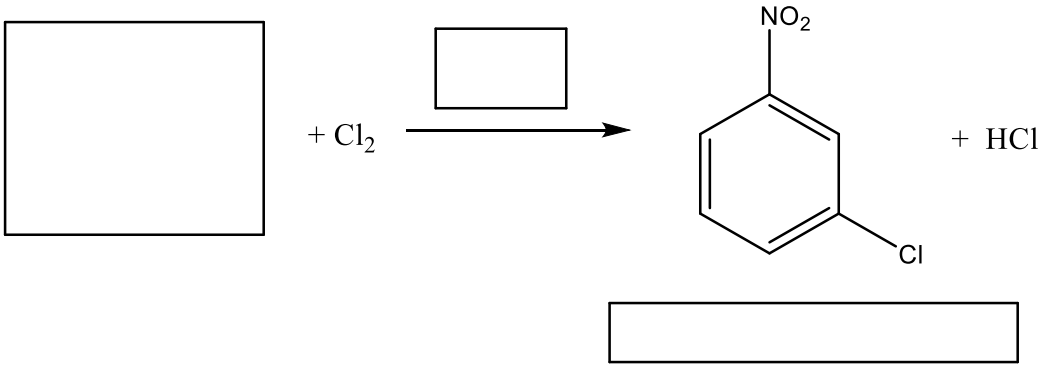


Sketch the possible orientations in electrophilic substitution reactions.

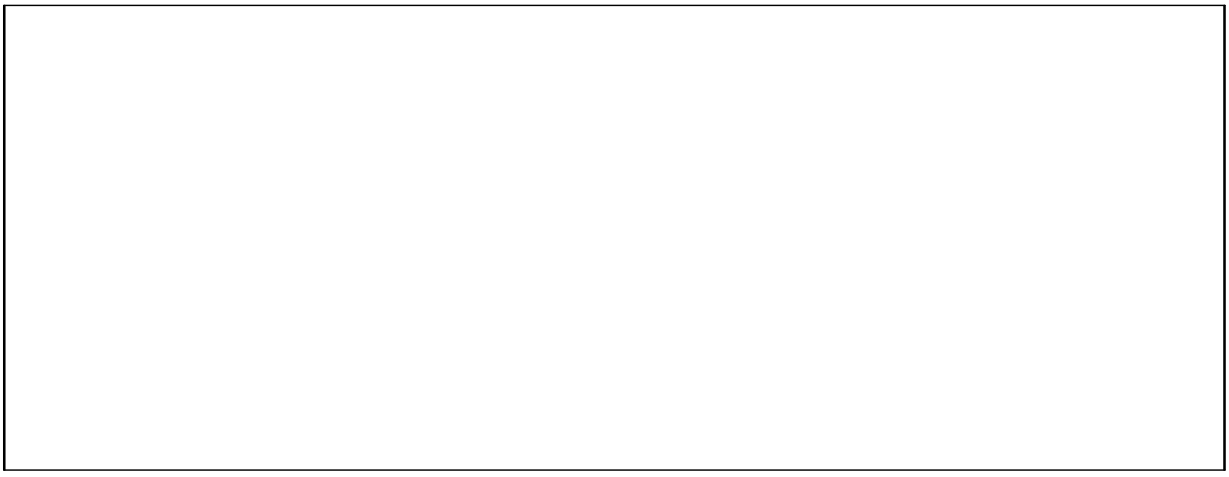


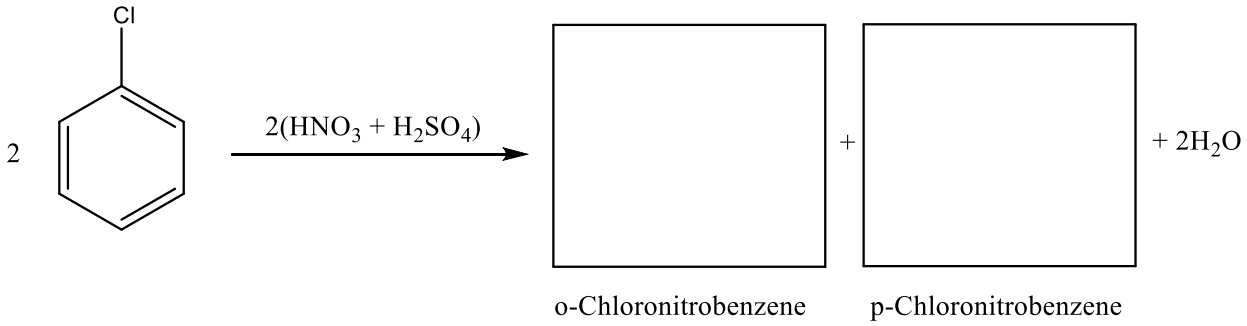


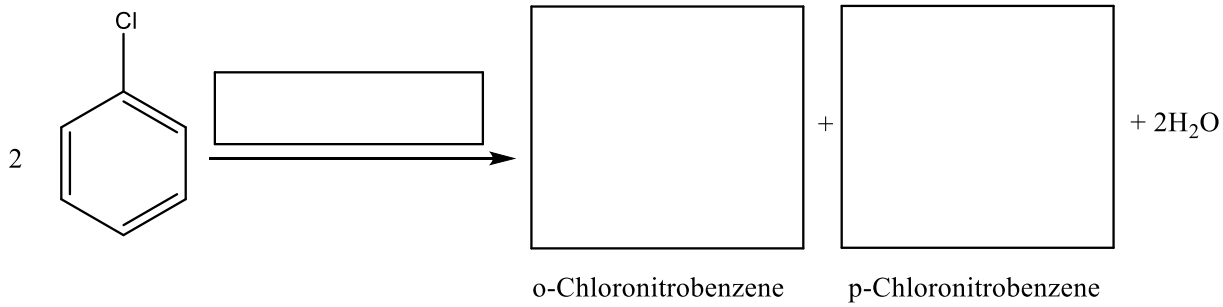
m-Chloronitrobenzene



Practice Reaction

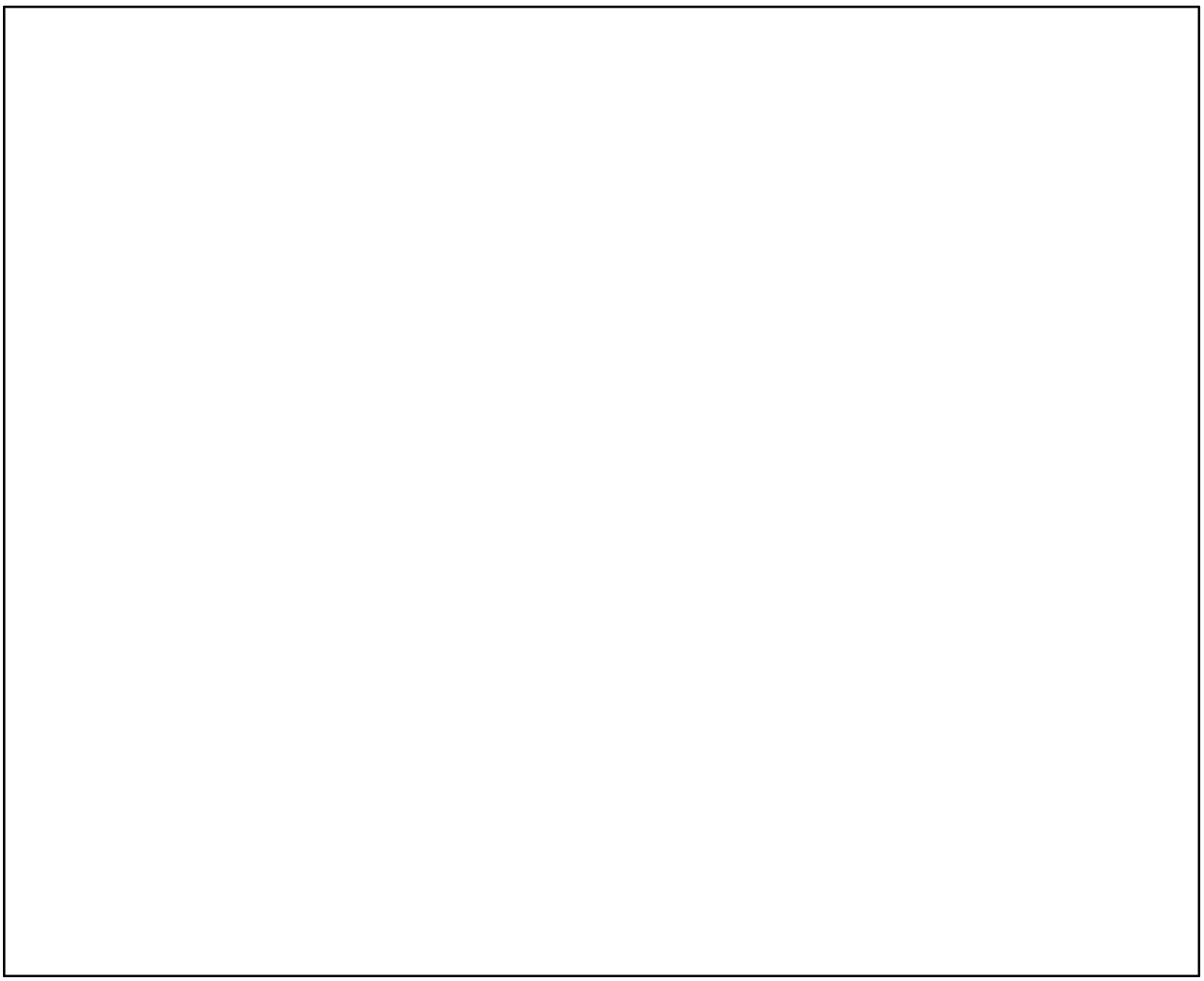


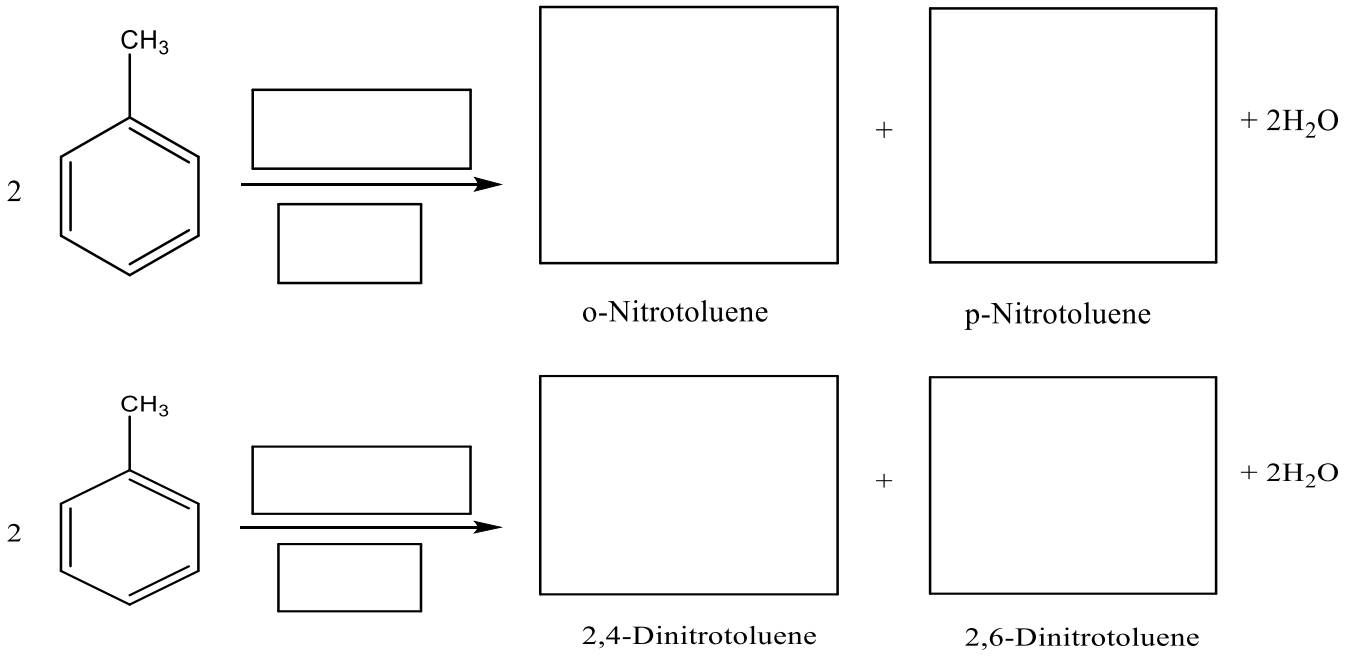


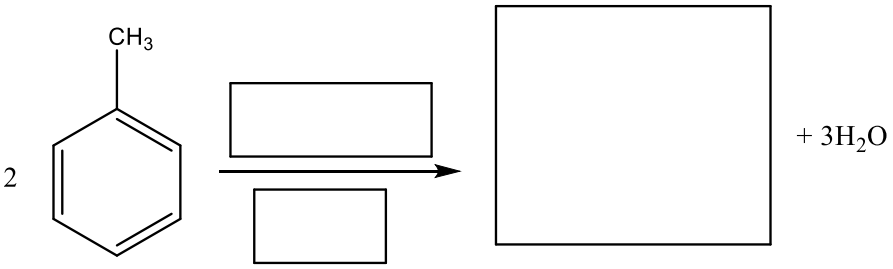


Practice Reaction

Give the products of nitration of toluene at 30-40 ºC, 60-70 ºC and 100 ºC.

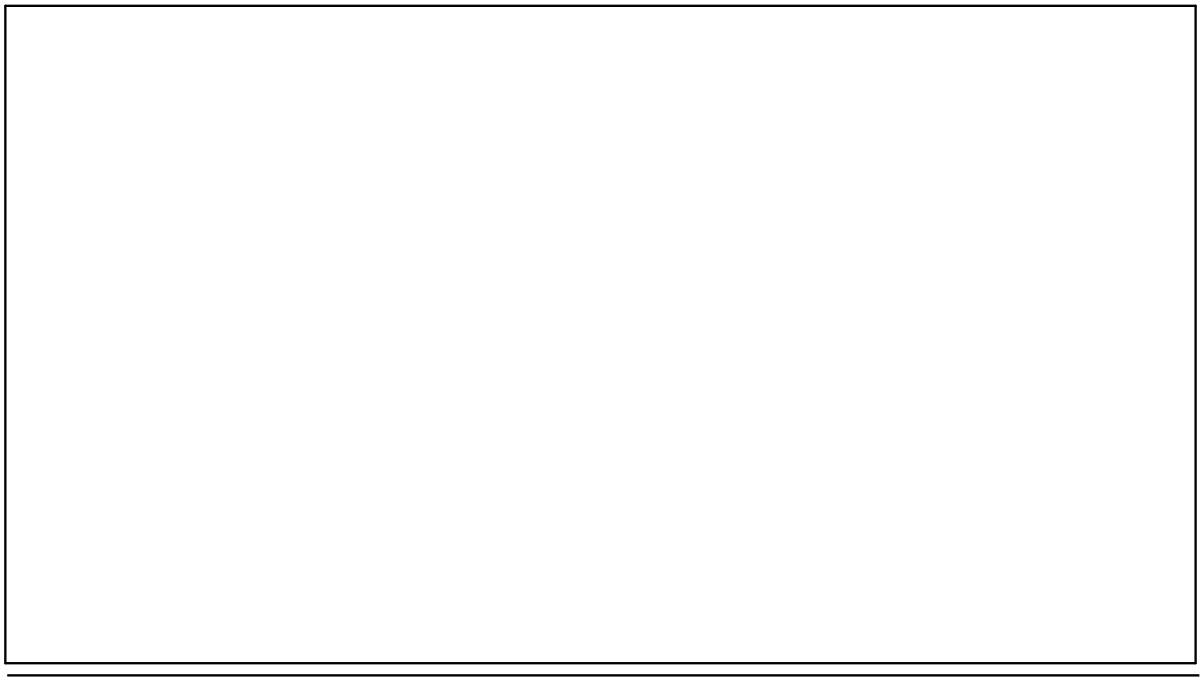


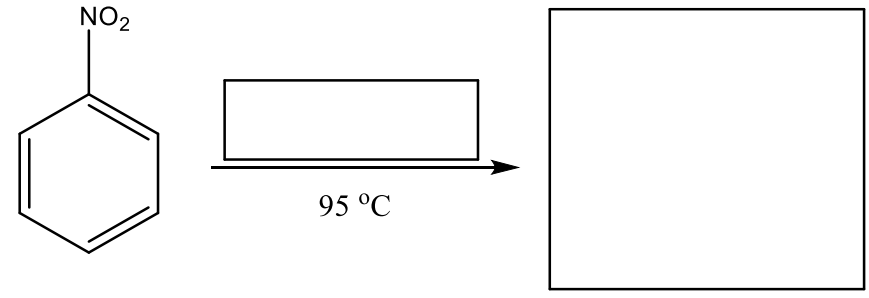

CH3
2
+
+ 2H2O
o-Nitrotoluene
p-Nitrotoluene
CH3
2
+
+ 2H2O
2,4-Dinitrotoluene
2,6-Dinitrotoluene

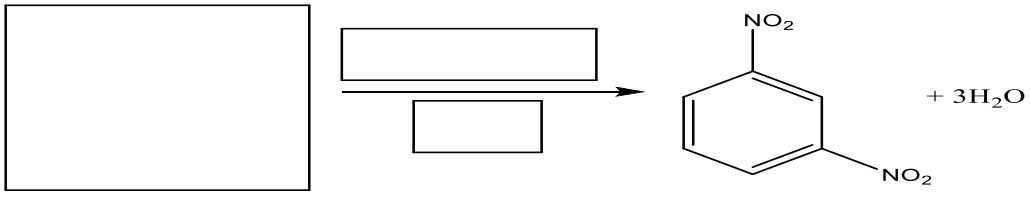


2,4,6-Trinitrotoluene

Practice Reaction

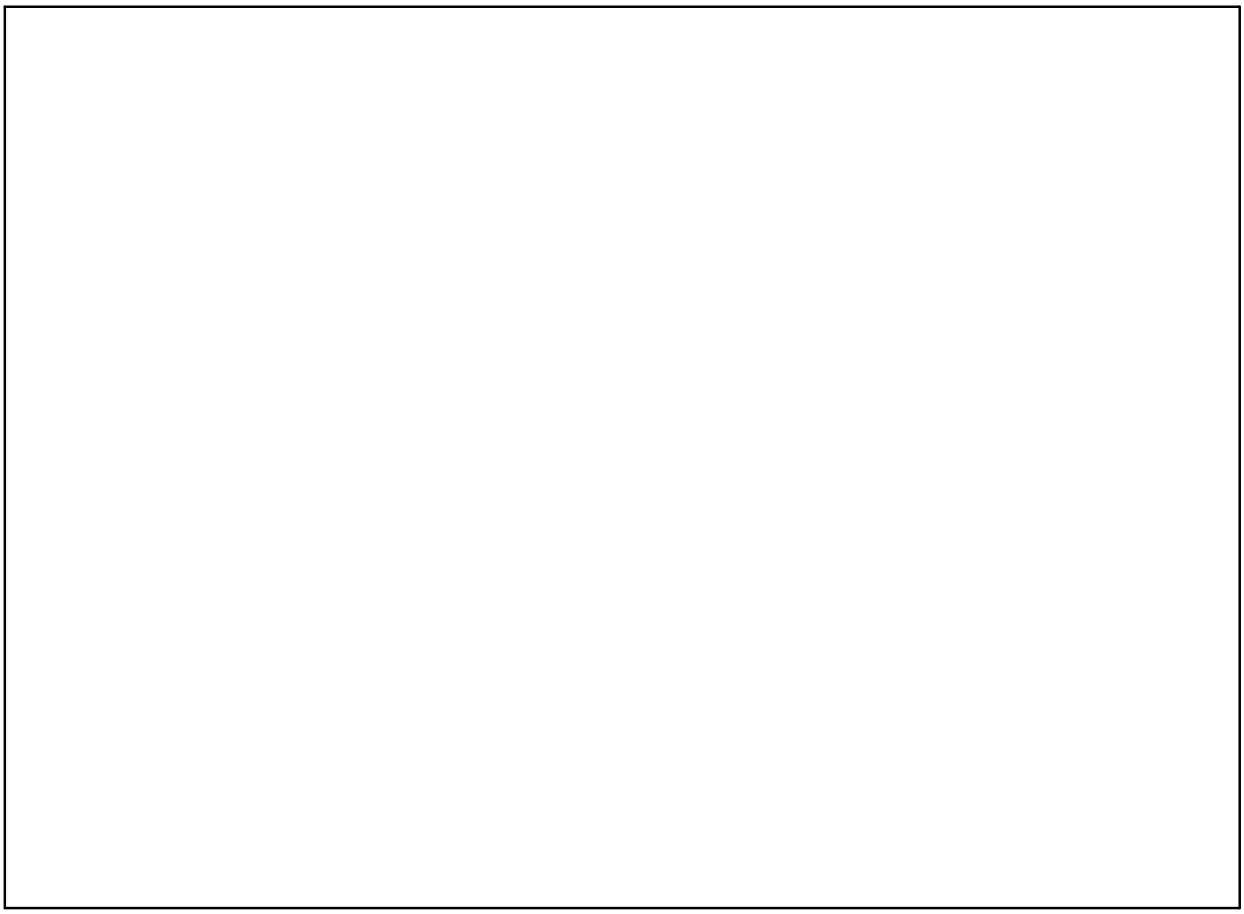






Nitrobenzene

Practice Reaction



When a substituent is ortho and para directing?

_____

_____

_____

When a substituent is meta directing?

_____

_____

_____

Identify ortho, meta and para directing substituents.

$-N(CH_3)_2$

$-\overset{+}{N}R_3$

-Cl

-Br

-I

$-NH_2$

-COOH

-CN

-OH

$-OCH_3$

-CHO

-COR

Compare reactivity of alkanes and alkenes with benzene.

_____
_____
_____
_____
_____
_____
_____
_____
_____

F. Conversion questions (according to order in book).

Worksheet 1

1. Convert benzene to benzene hexachloride

_____

2. Convert benzene to cyclohexane

3. Convert cyclohexene to cyclohexane

4. Convert 1,3-cyclohexadiene to cyclohexane

5. Convert benzene to cyclohexane

6. Convert cyclohexane to benzene

7. Convert acetylene to benzene

8. Convert n-hexane to benzene

9. Convert n-heptane to toluene

_____

_____

Worksheet 2

1. Convert sodium benzoate to benzene

_____

_____

2. Convert phenol to benzene

_____

_____

3. Convert benzenesulphonic acid to benzene

_____

_____

4. Convert bromobenzene to ethylbenzene

_____

_____

5. Give general pattern of reactivity of benzene towards electrophiles

_____

_____

6. Convert benzene to bromobenzene

_____

7. Convert benzene to chlorobenzene

8. Give mechanism of halogenations of benzene

9. Convert toluene to benzyl chloride

10. Convert toluene to benzotrichloride

Worksheet 2

1. Convert benzene to nitrobenzene

2. Give mechanism of nitration of benzene

3. Convert benzene to benzene sulphonic acid

4. Give mechanism of sulphonation of benzene

5. Give Friedel-Crafts alkylation of benzene

6. Give mechanism of Friedel-Crafts alkylation of benzene

7. Give Friedel-Crafts acylation of benzene

8. Give mechanism of Friedel-Crafts acylation of benzene

9. Convert benzene to cyclohexane

10. Convert benzene to 1,2,3,4,5,6-hexabromocyclohexane

11. Convert benzene to maleic anhydride

12. Convert benzene to maleic acid

13. Convert benzene to glyoxal

14. Convert toluene to benzoic acid

15. Convert ethyl benzene to benzoic acid

16. Convert nitrobenzene to m-chloronitrobenzene

17. Convert chlorobenzene to chloronitrobenzene

18. Convert toluene to nitrotoluene

_____

_____

19. Convert toluene to dinitrotoluene

_____

_____

20. Convert toluene to 2,4,6-trinitrotoluene

_____

_____

21. Convert nitrobenzene to 1, 3-dinitrobenzene

_____

_____

Chapter 10

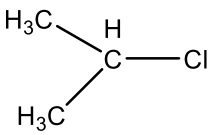
Alkyl Halides

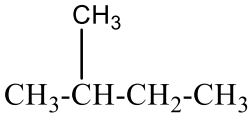
A. Give names of the following compounds.

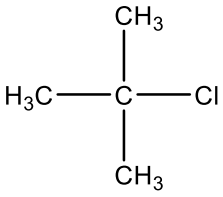
CH_3Cl

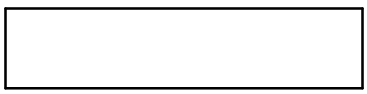
CH_3CH_2Cl

$CH_3CH_2CH_2Cl$

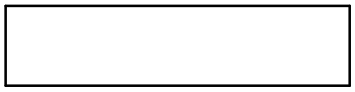


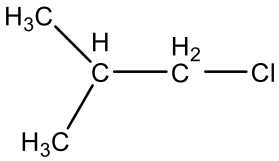


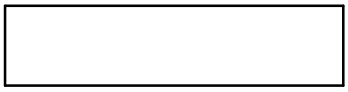




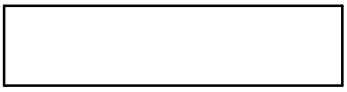
$CH_3CH_2CH_2Br$







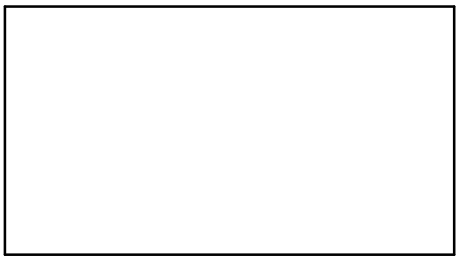
$CH_3CH_2CH_2CH_2Cl$



B. Give structures of the following compounds according to IUPAC names.

1-Chloropropane

2-Bromo-3-methylbutane



2-Chlorobutane

2,2-Dichlorobutane

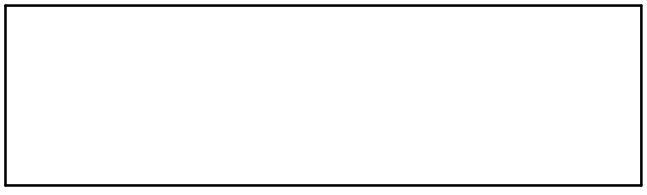
2-Chloro-4-methyl hexane

1-Chloro-2-methyl propane

2-Chloro-2-methyl propane

2-Chloro-4-methyl pentane

2-Bromo-3,4-Dimethyl pentane



Learn the Reaction Conditions

- Ethanol to ethyl halide: $ZnCl_2/H^+$
- SN1: Polar solvent

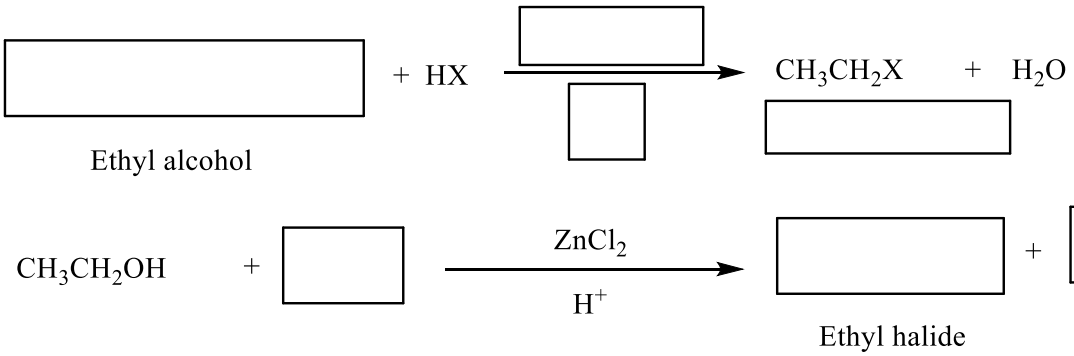
- Wurtz synthesis: Ether
- Alcohol to ethyl halide: Pyridine
- β-Elimination: Alcoholic KOH
- Grignard reagent: Ether

C. Match the correct reaction condition.

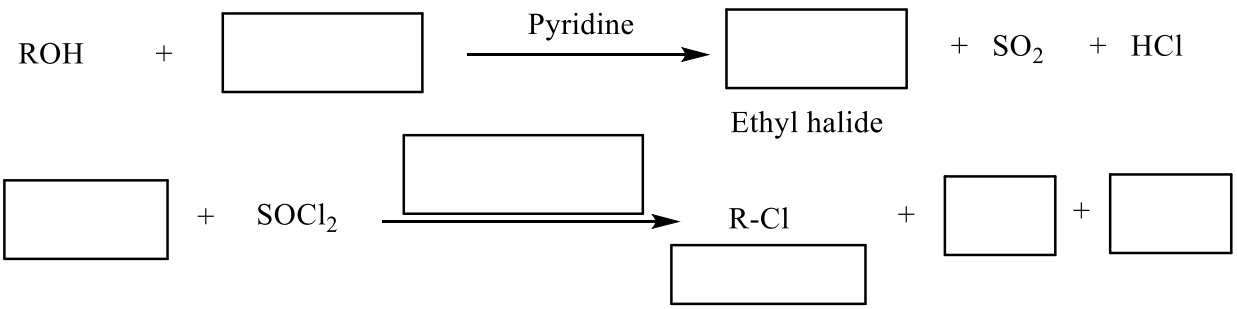
Reaction	Condition
S_N1	Ether
Wurtz synthesis	Alcoholic KOH
Alcohol to ethyl halide	Ether
Grignard reagent	Polar solvent
β-Elimination	Pyridine
Ethanol to ethyl halide	$ZnCl_2/H^+$

D. Learn through blanks.

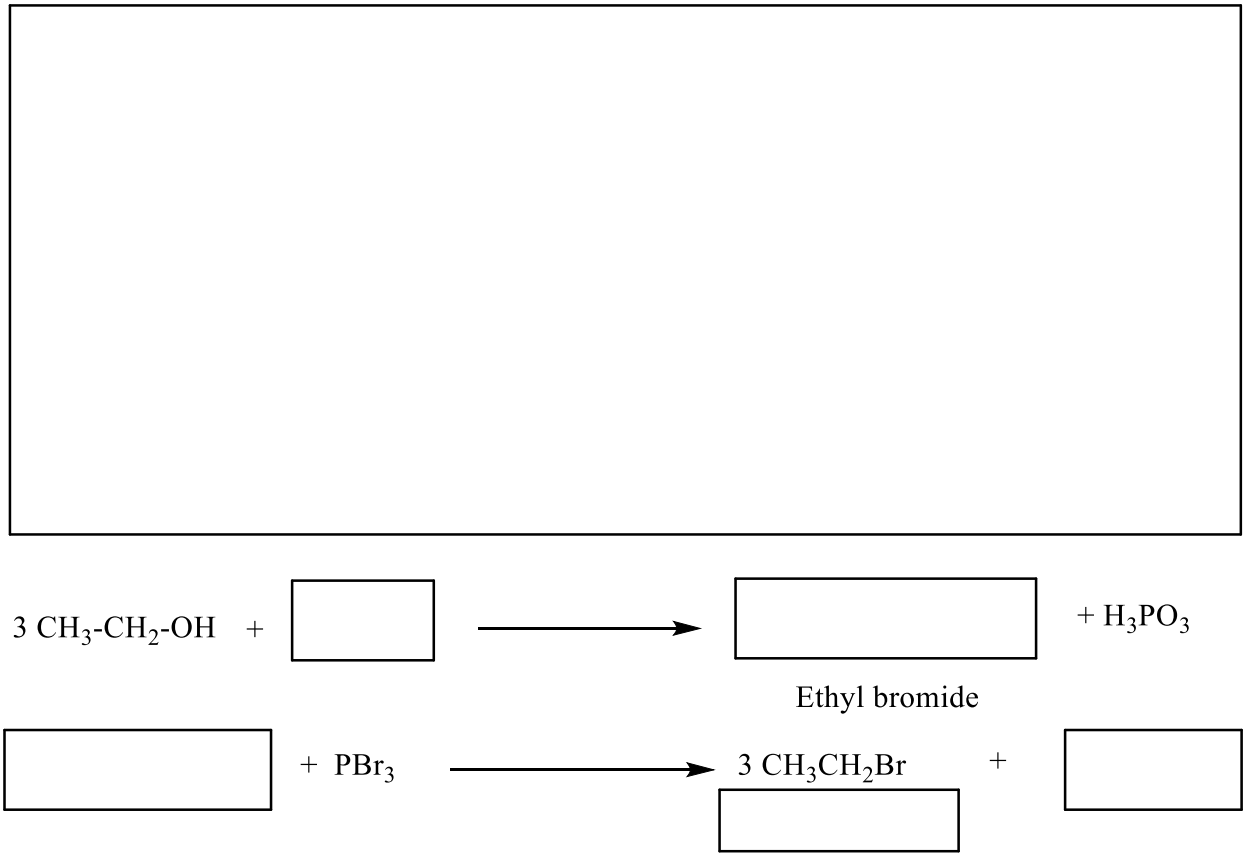
Name of Reaction:_____



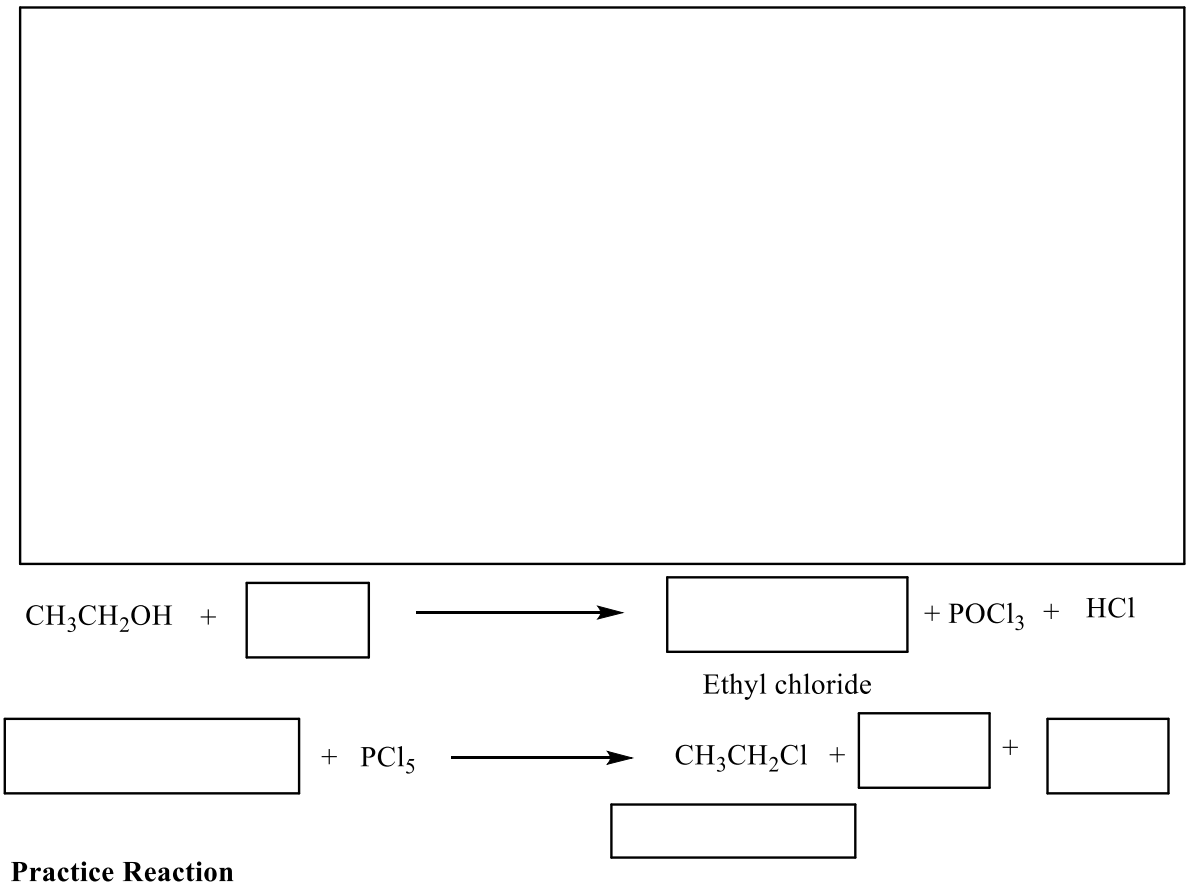
Practice Reaction



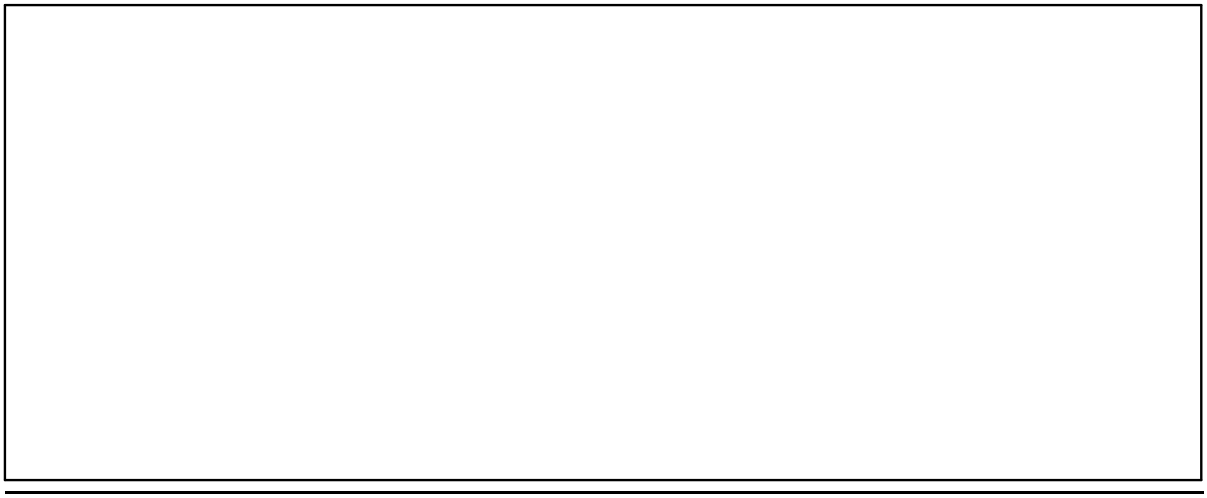
Practice Reaction



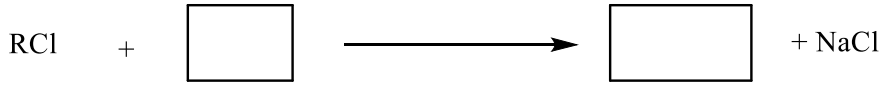
Practice Reaction

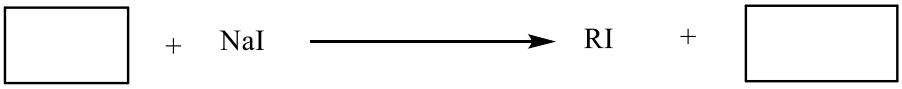


Practice Reaction

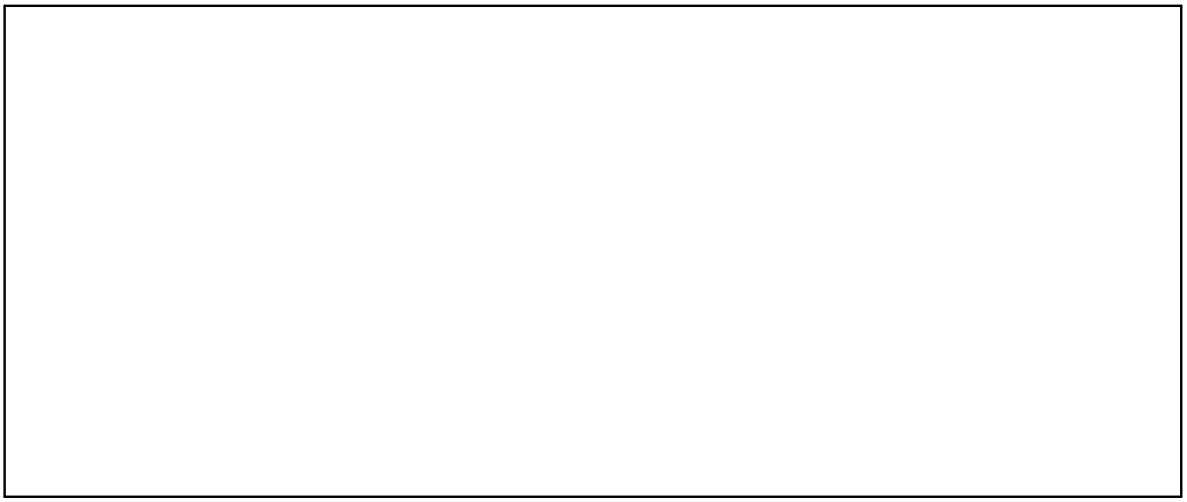


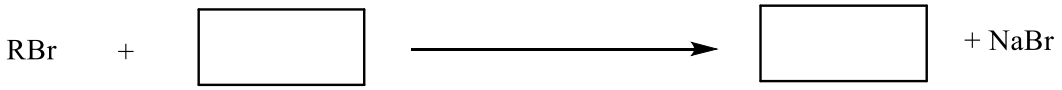
Name of Reaction:_____

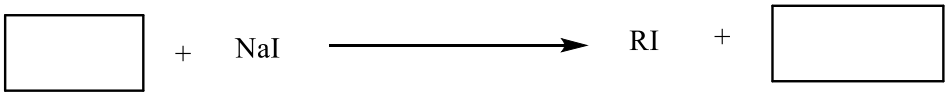




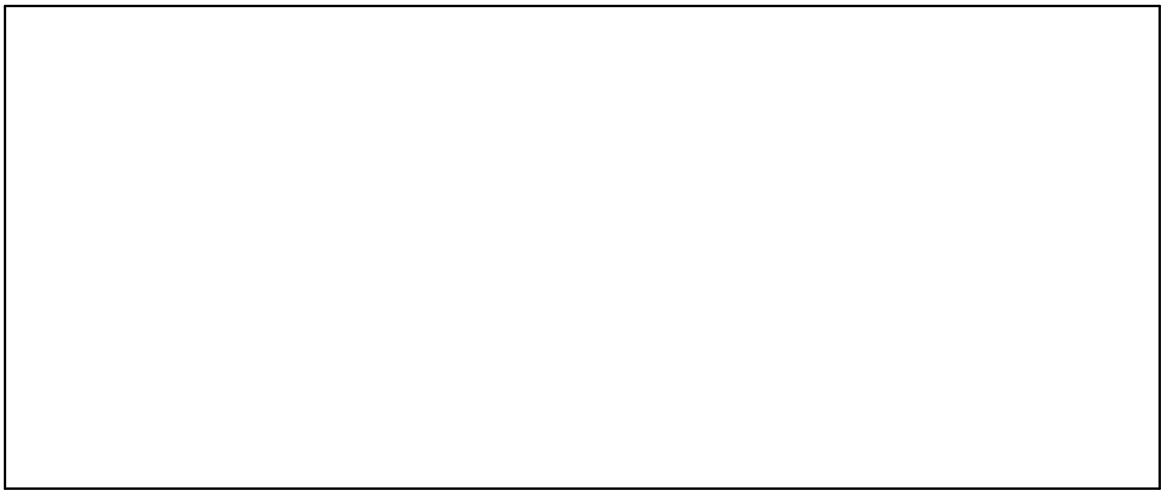
Practice Reaction







Practice Reaction



Mention the factors accounting for the reactivity of alkyl halides. Which one dominates and why?

_____
_____
_____
_____
_____

Define electrophile, nucleophile, leaving group and substrate molecule.

_____
_____
_____
_____
_____
_____
_____
_____
_____

Sr No.	S_N2	S_N1
1.	**Name** It is called nucleophilic substitution _____	**Name** It is called nucleophilic substitution _____
2.	**Number of steps** This is a _____ step mechanism	**Number of steps** This is a _____ step mechanism
3.	**Extent** The extent of bond formation is _____ the extent of bond breakage	**Extent** The extent of bond formation _____the extent of bond breakage
4.	**Mechanism**	**Mechanism**

5.	As soon as the nucleophile starts attacking the electrophilic carbon of the substrate_____	The first step is the reversible ionization of the alkyl halide in the presence of_____. This step provides a carbocation _____. In the second step _____
6.	**Direction of attack of nucleophile** Nucleophile attacks from the side _____	**Direction of attack of nucleophile** The intermediate carbocation is a planar specie allowing _____
7.	**Configuration of product** _____ inverted product	**Configuration of product** **_____** inversion of configuration and _____ retention of configuration in product
8.	**Hybridization** The substrate carbon atom changes its state of hybridization from _____	
9.	**Molecularity** Two molecules are participating in this step so it is called a_____ Molecularity= _____	**Molecularity** Only one molecule participates in the rate determining step (slow step) so it is called_____ Molecularity=_____
10.	**Rate of Reaction** _____	**Rate of Reaction** _____
11.	**Order of Reaction** _____	**Order of Reaction** _____
12.	_____ give SN2	_____ give SN1
	_____ give both SN1 and SN2 depending on conditions	

Sr No	**E1**	**E2**
1	It is _____ elimination reaction	It is _____ elimination reaction
2	It is _____	It is _____
3	It is carried out along with _____	It is carried out along with _____
4	It is given by _____	It is given by _____
	_____ give both E1 and E2	
5	**Mechanism**	**Mechanism**

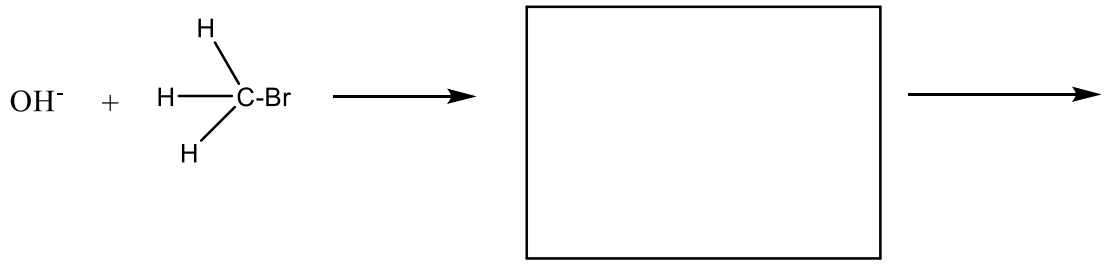
	Nature of the product in both the cases is an _____	
6	Molecularity of the reaction is _____	Molecularity of the reaction is _____
7	Rate=_____	Rate=_____
8	Order of the reaction is _____	Order of the reaction is _____

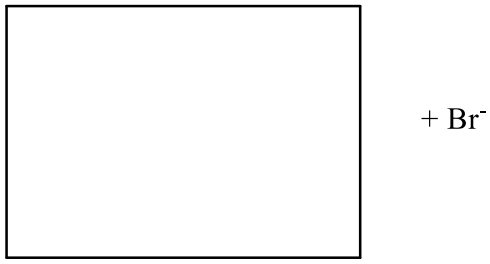
Common points between E1 and E2 reactions

- In both elimination reactions a new C-C _____ is formed and a C-H bond and a C-leaving group bond is _____.
- In both elimination reactions a species acts as a _____ to remove a proton to form the new _____.
- With increase of temperature we get _____

.

Mechanism of S_N2

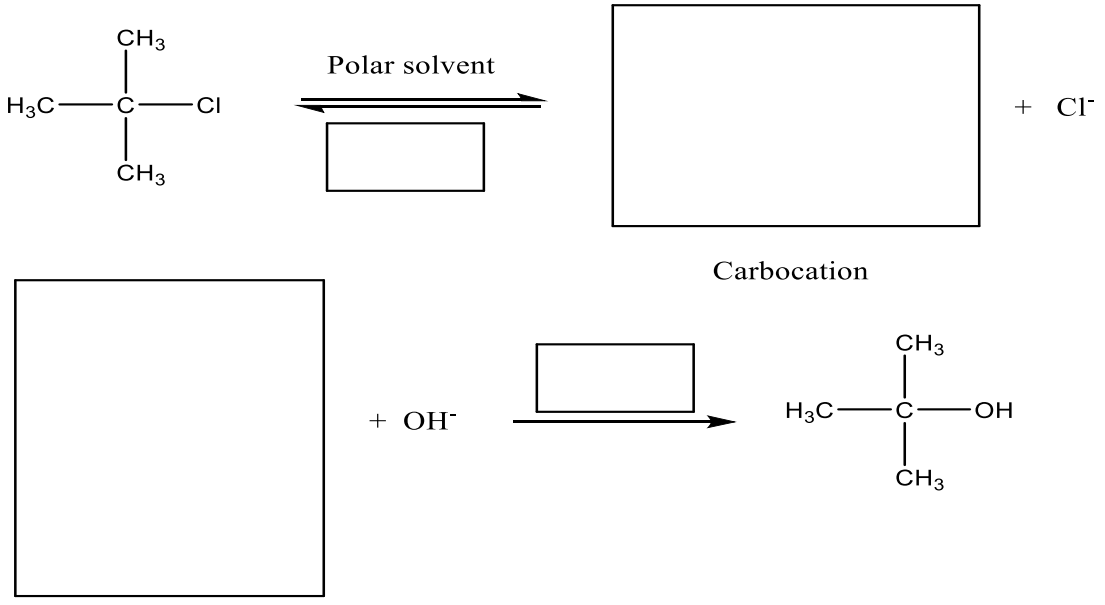




+ Br^-

Practice Reaction

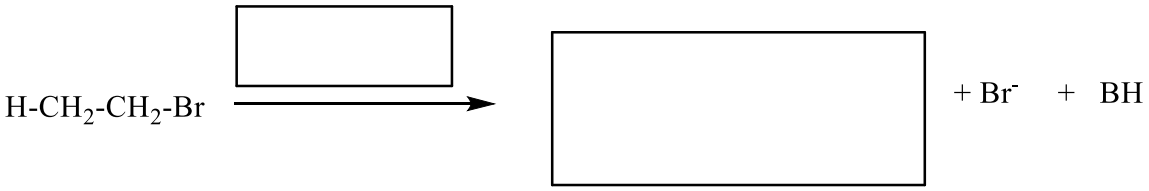
Mechanism of S_N1



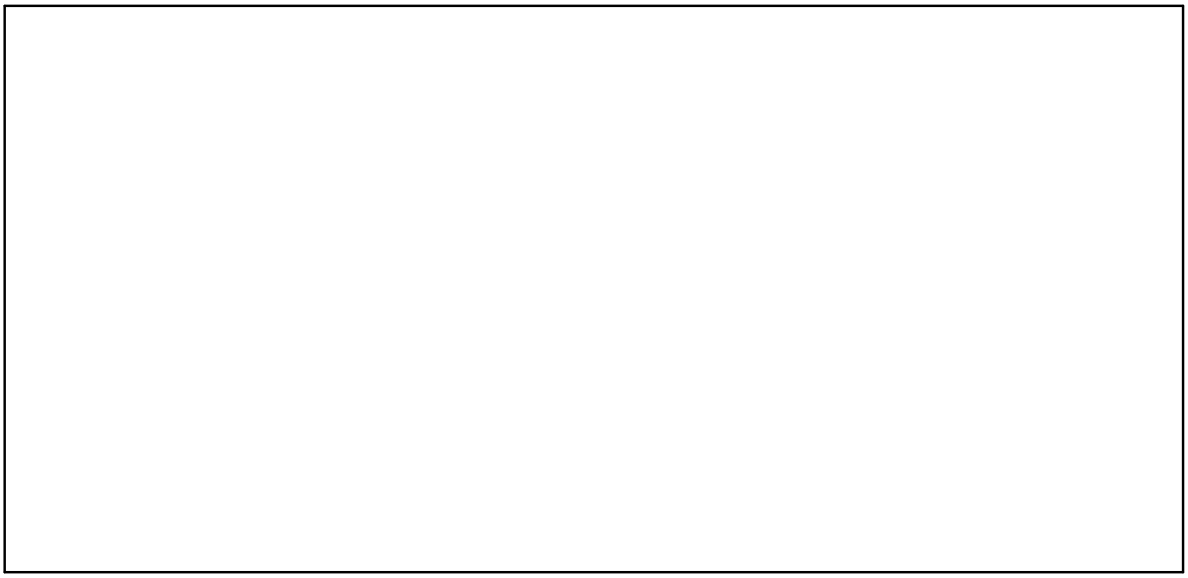
Practice Reaction

β-Elimination Reactions

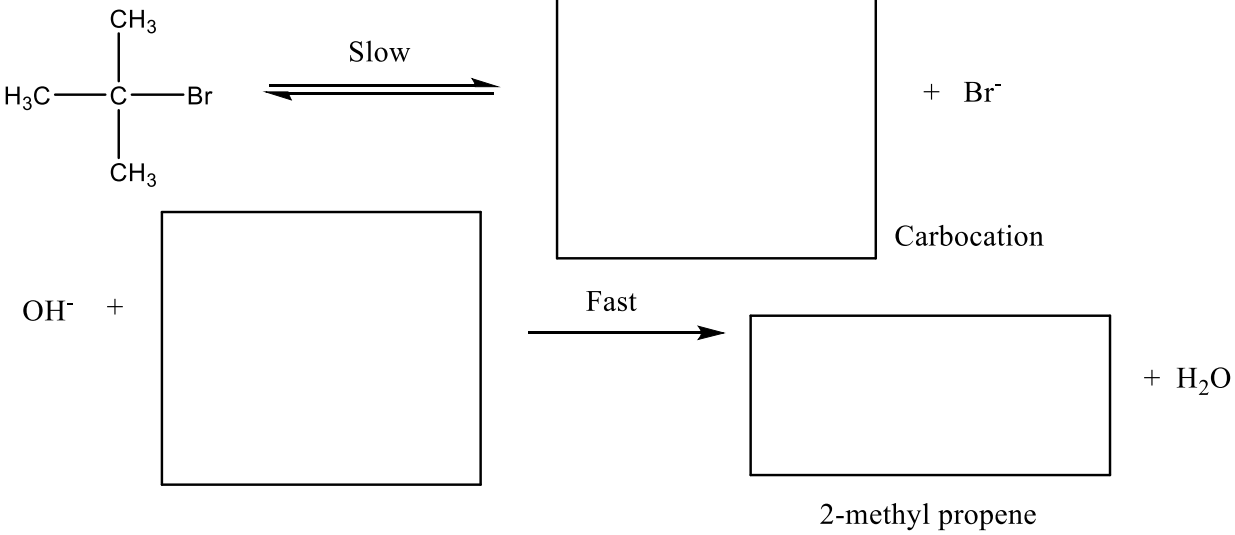
E2 mechanism



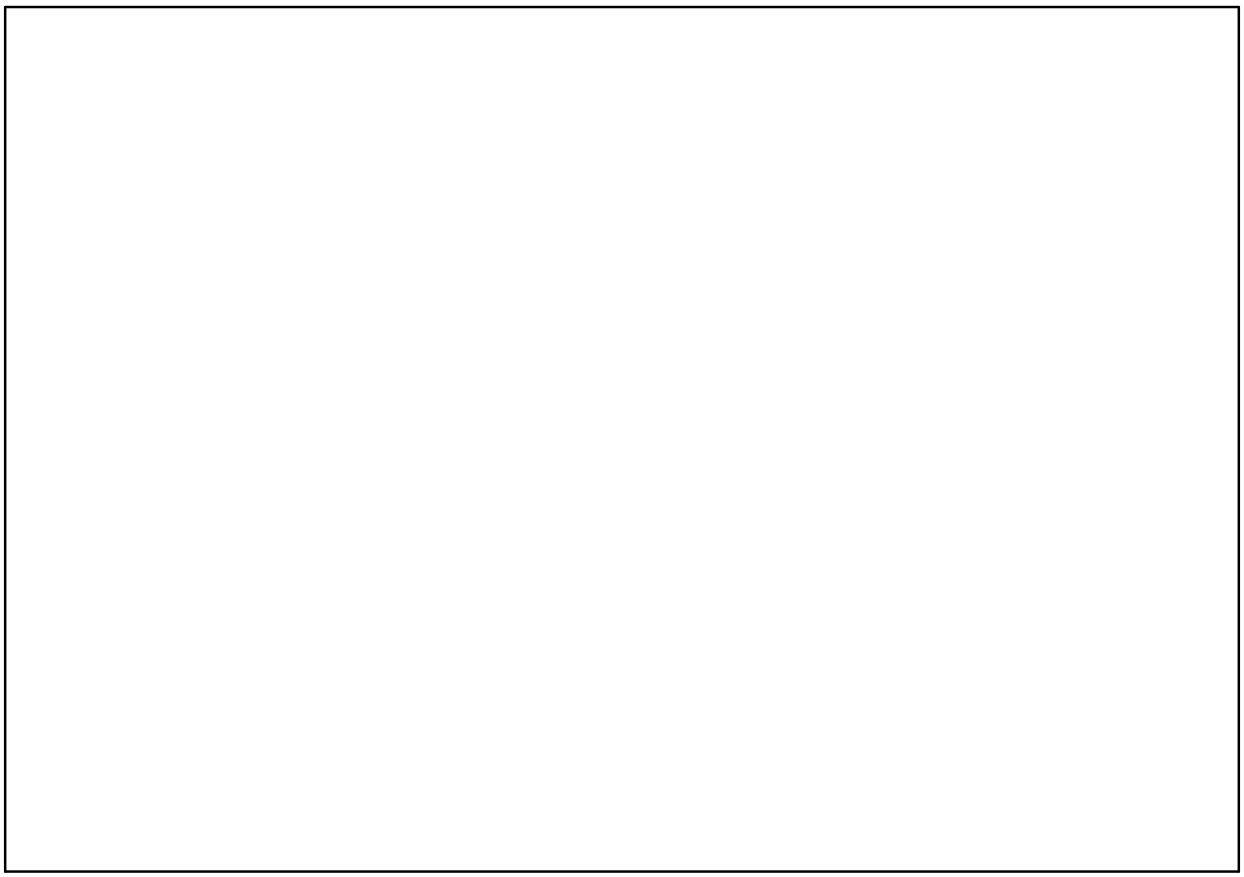
Practice Reaction

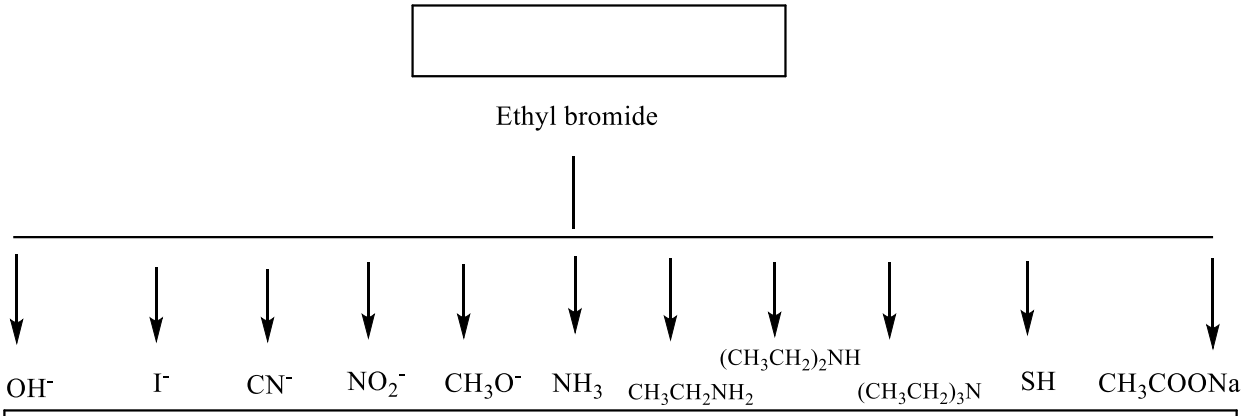


E1 mechanism



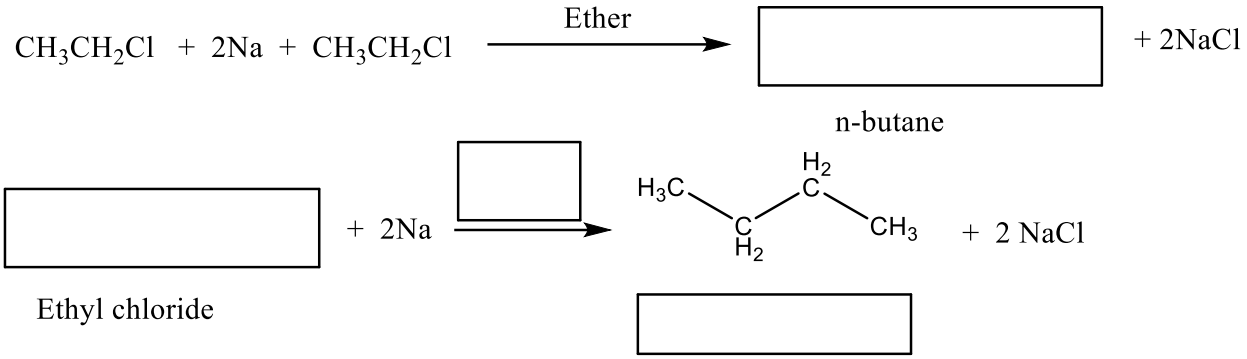
Practice Reaction





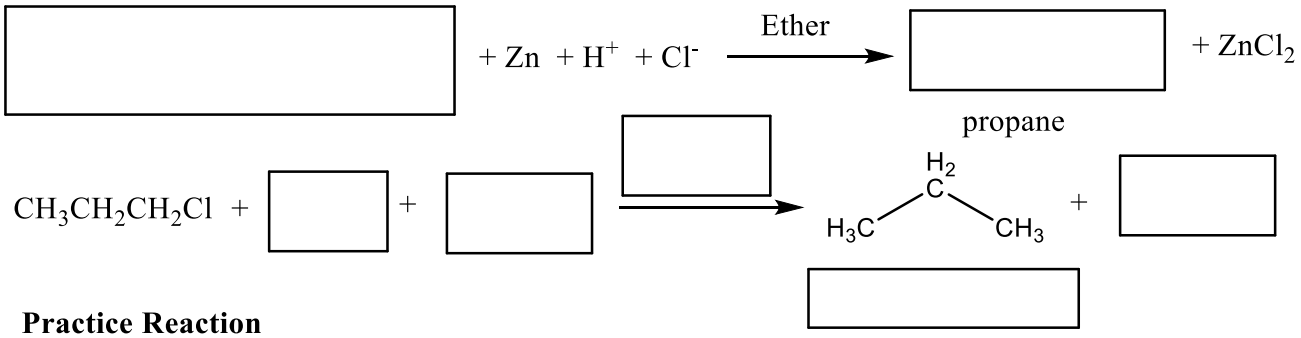
Practice Reactions

Wurtz Synthesis



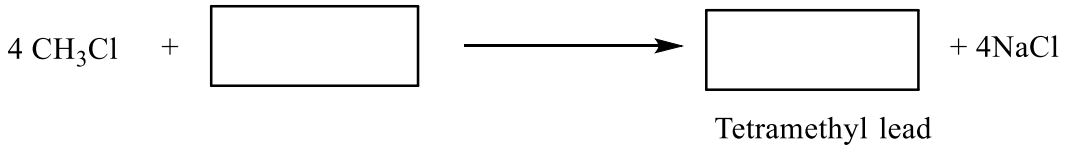
Practice Reaction

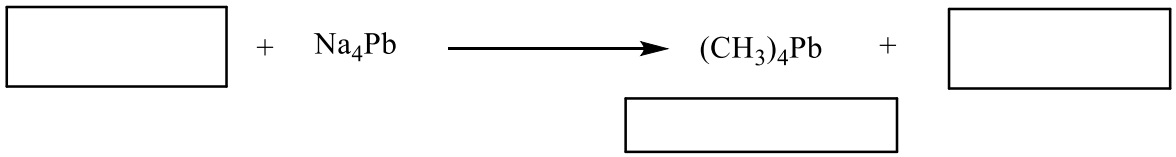
Reduction of Alkyl Halides



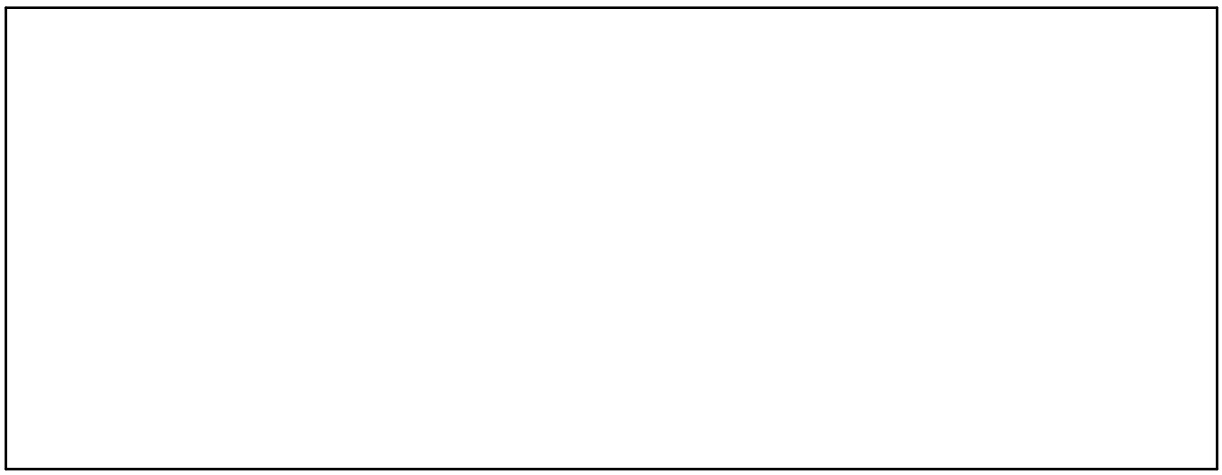
Practice Reaction

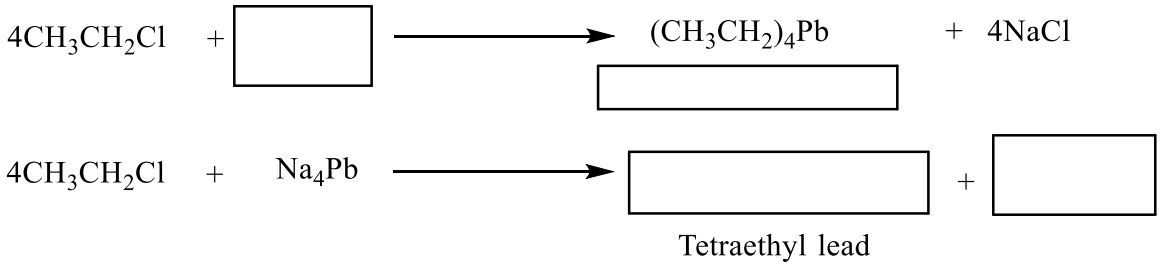
Reaction with Sodium Lead Alloy (Na_4Pb)



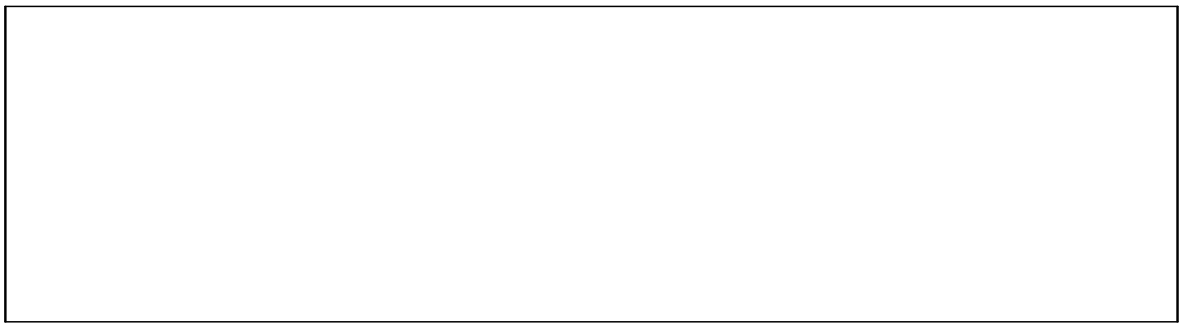


Practice Reaction

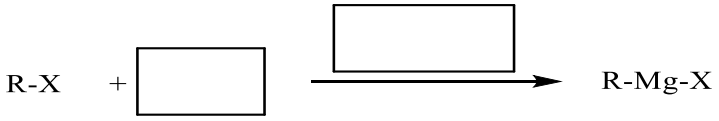


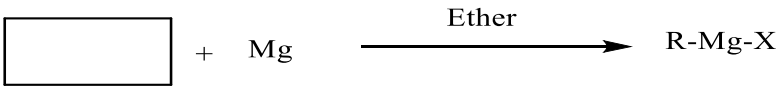


Practice Reaction

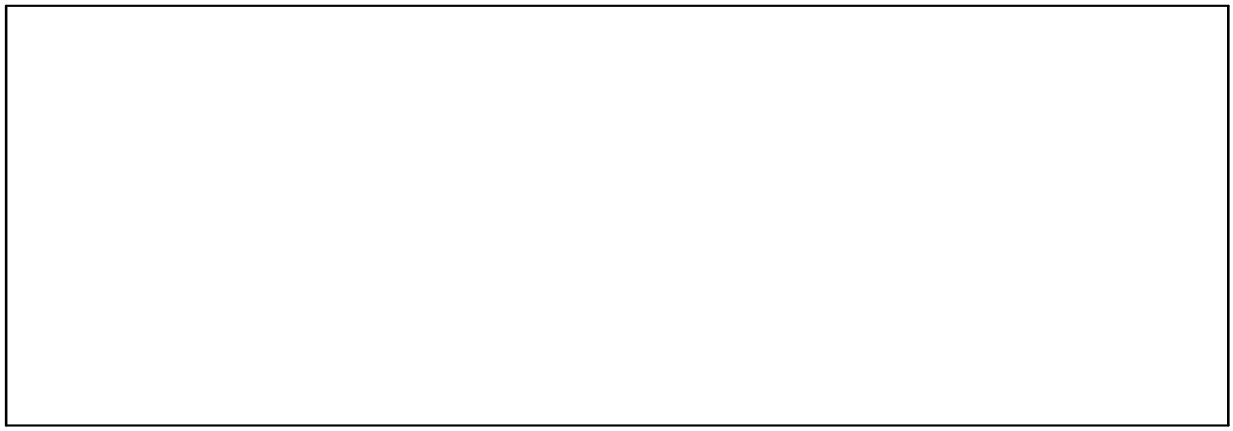


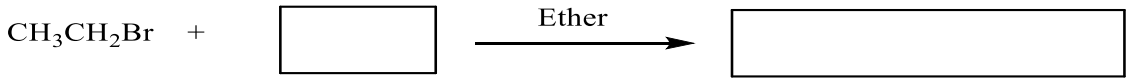
Grignard Reagent

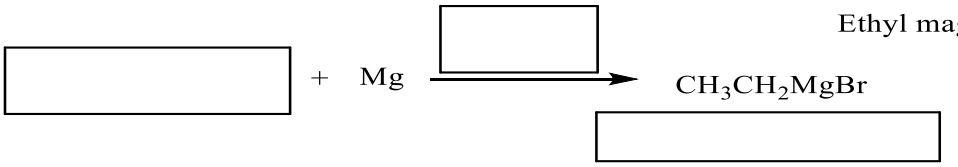




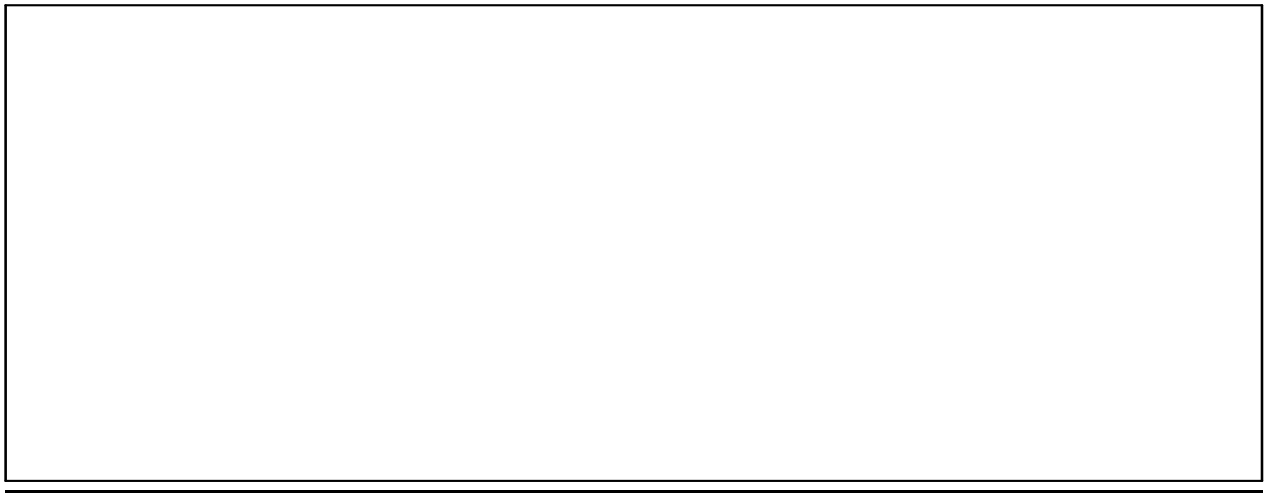
Practice Reaction



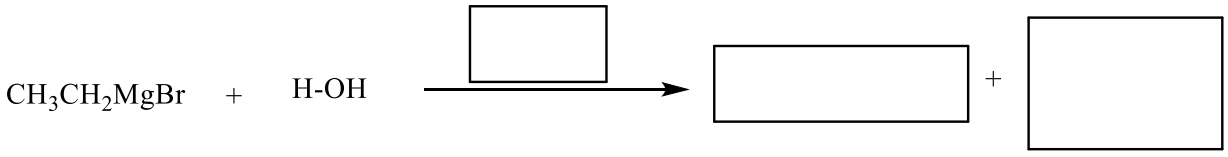




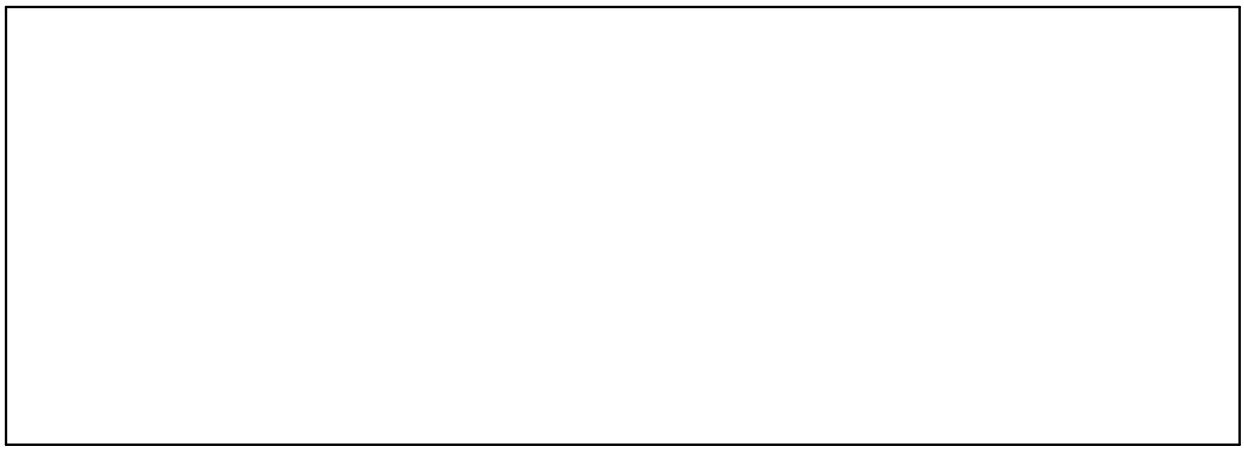
Practice Reaction

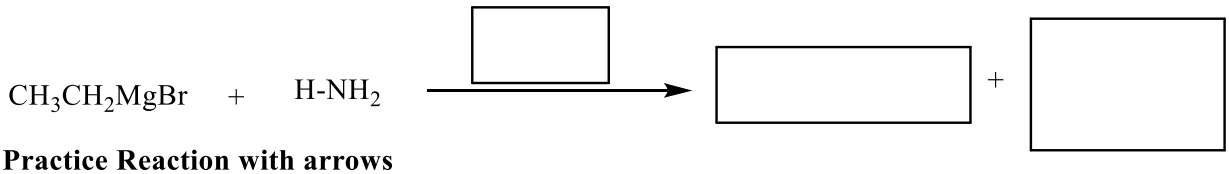


Tell briefly about reactivity of Grignard reagent.

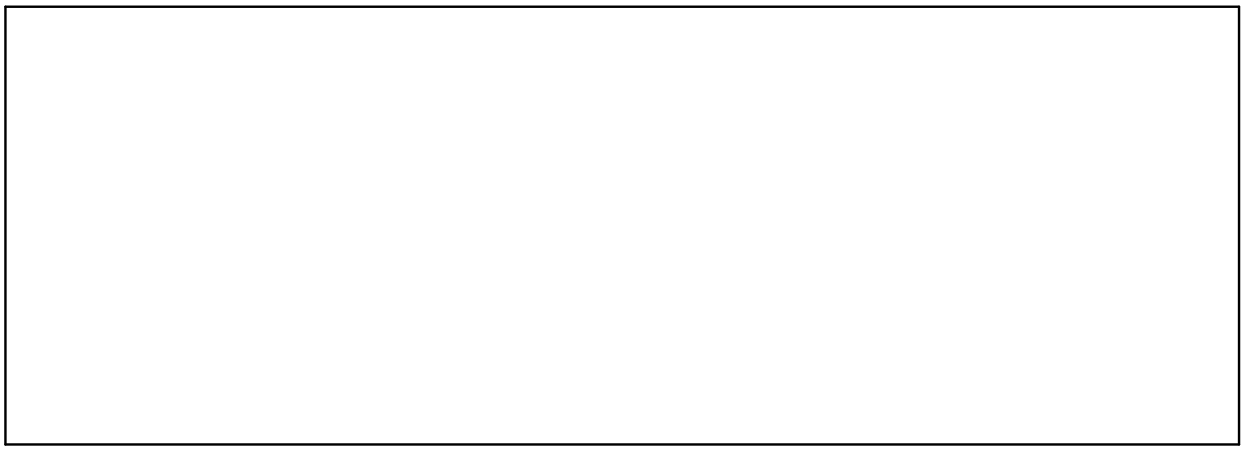


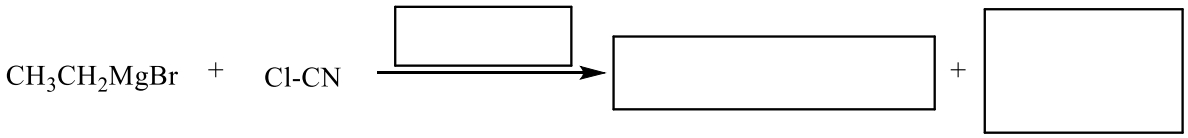
Practice Reaction with arrows



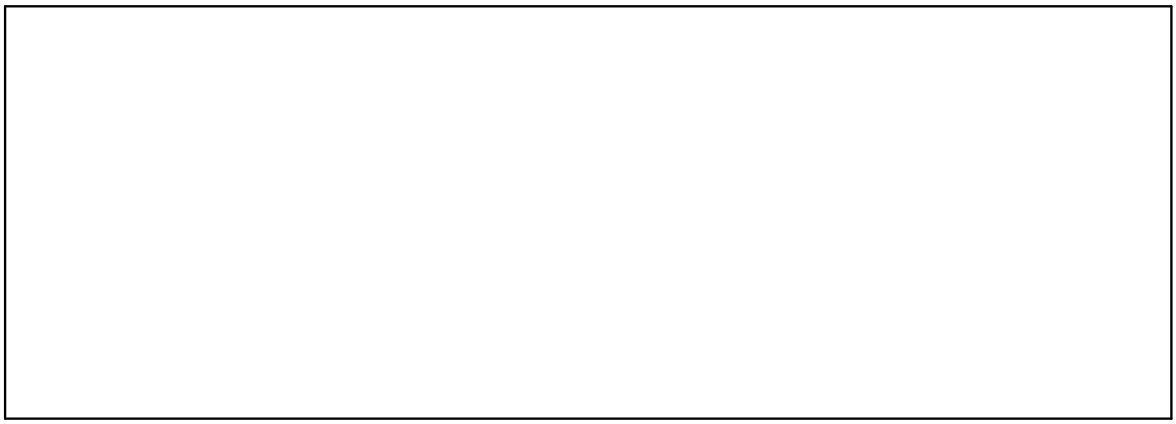


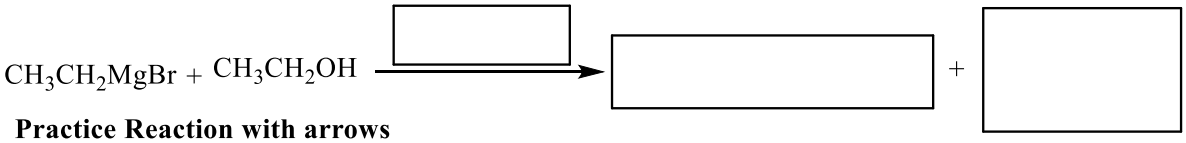
Practice Reaction with arrows



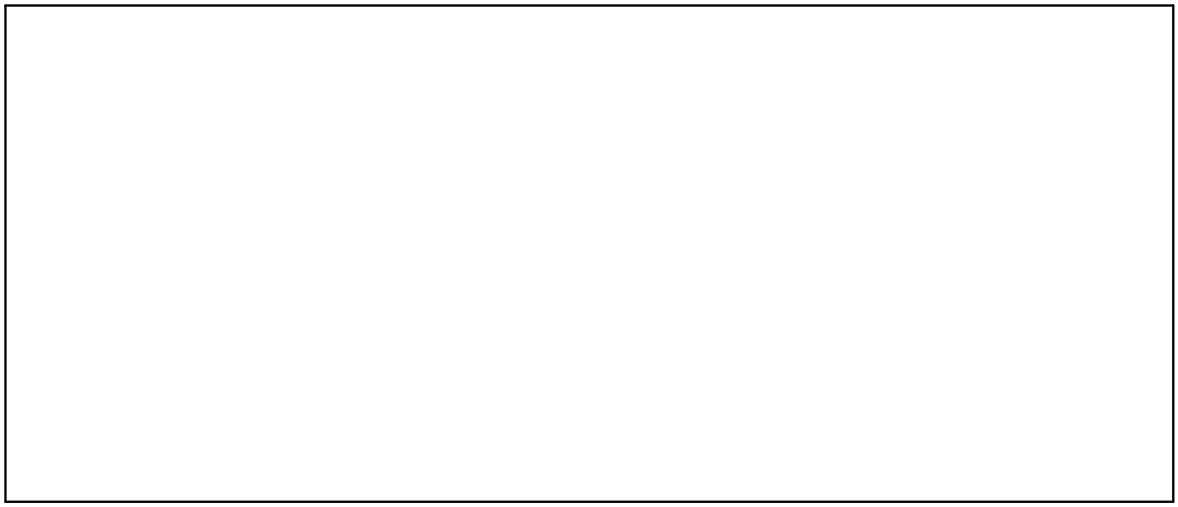


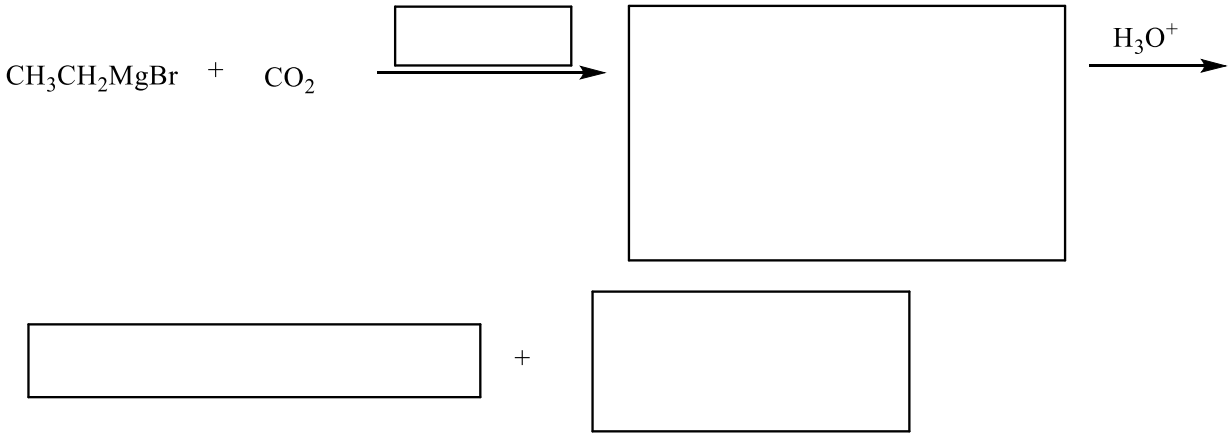
Practice Reaction with arrows



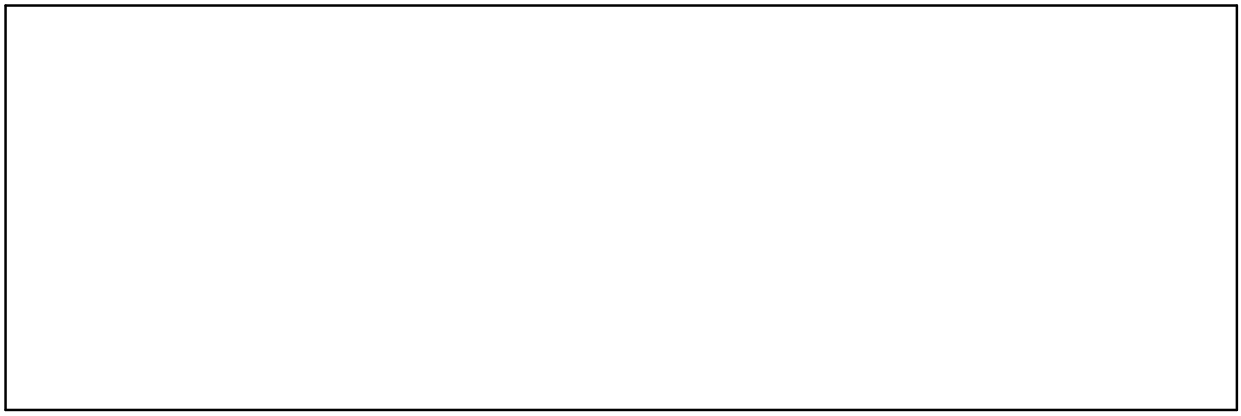


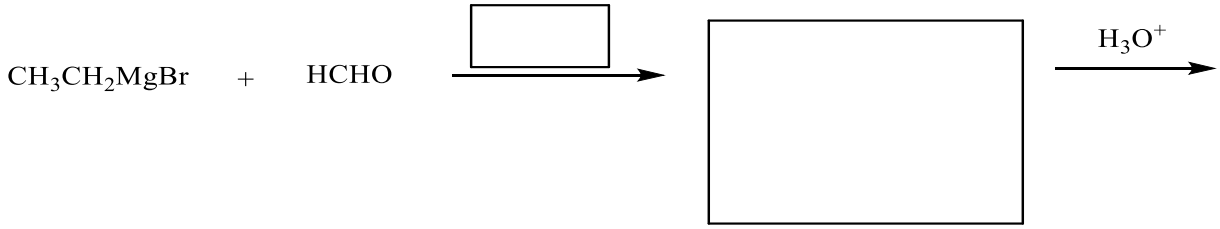
Practice Reaction with arrows

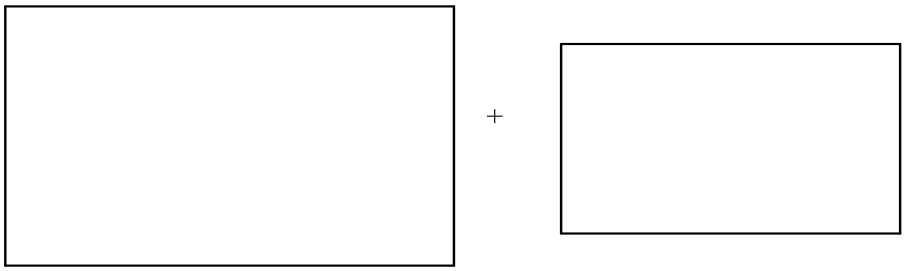




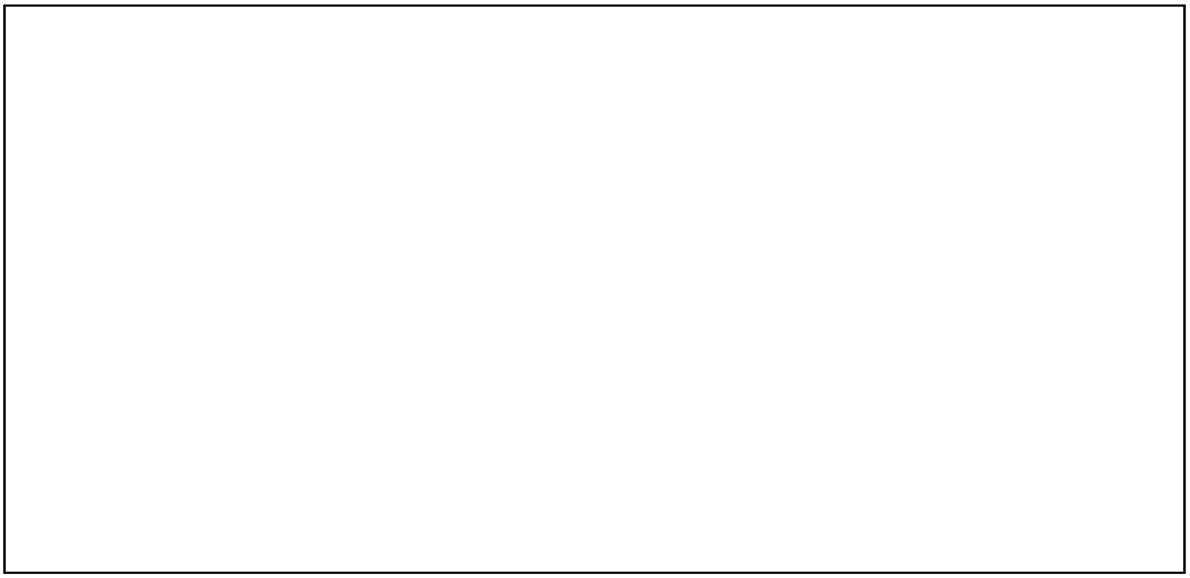
Practice Reaction with arrows

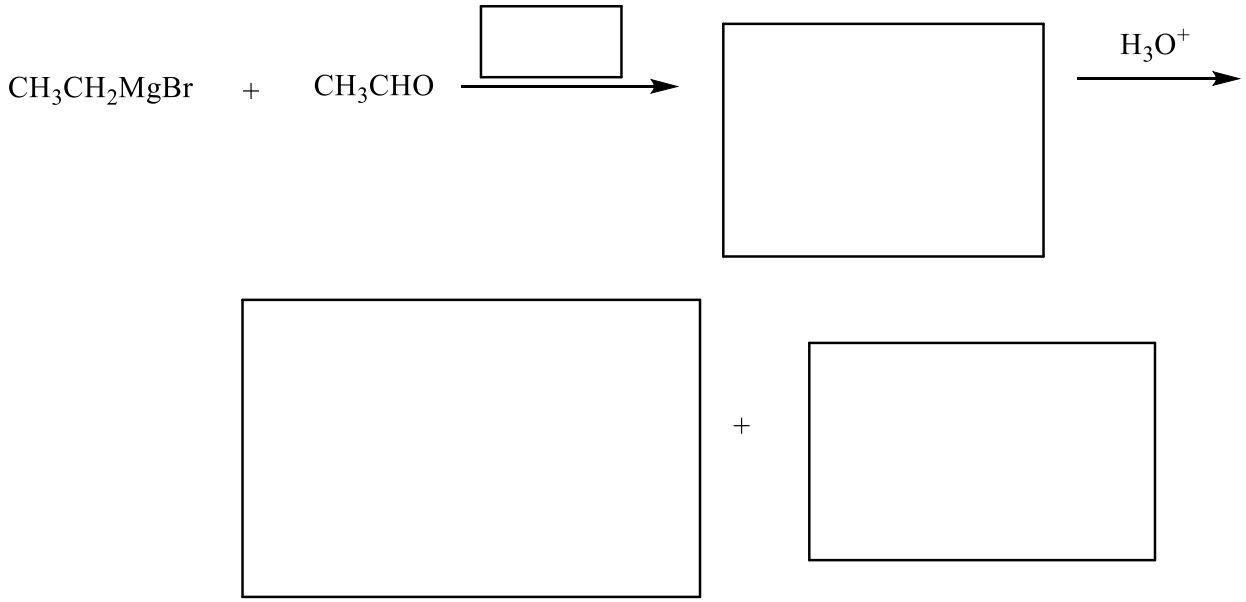




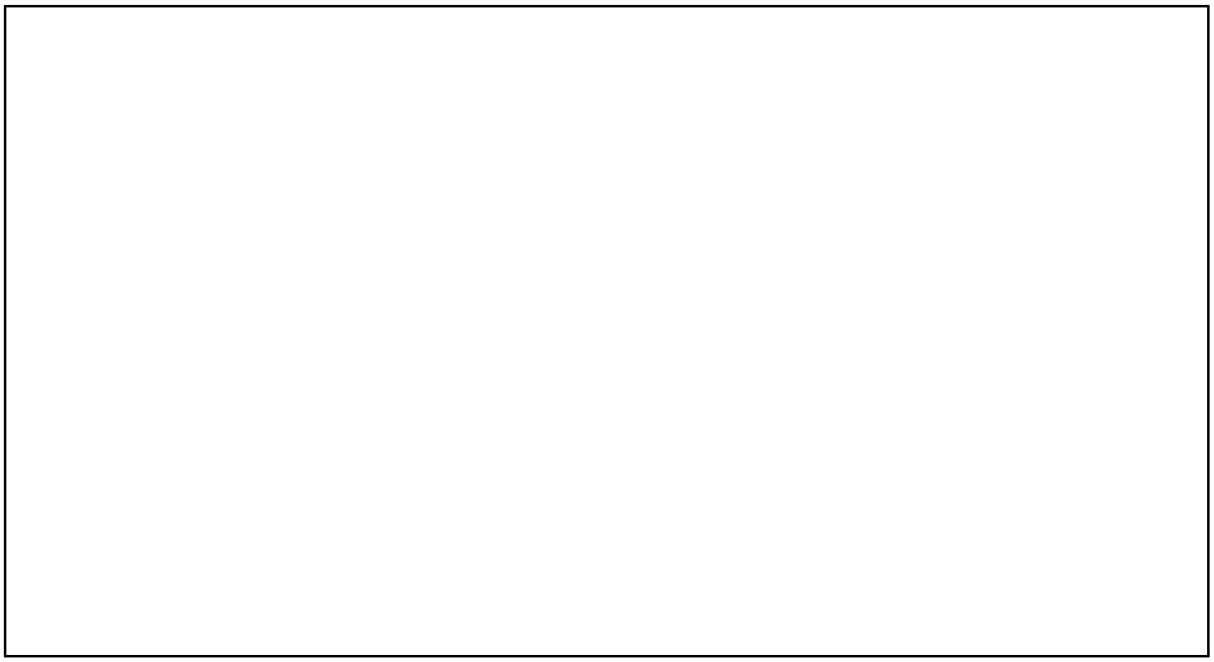


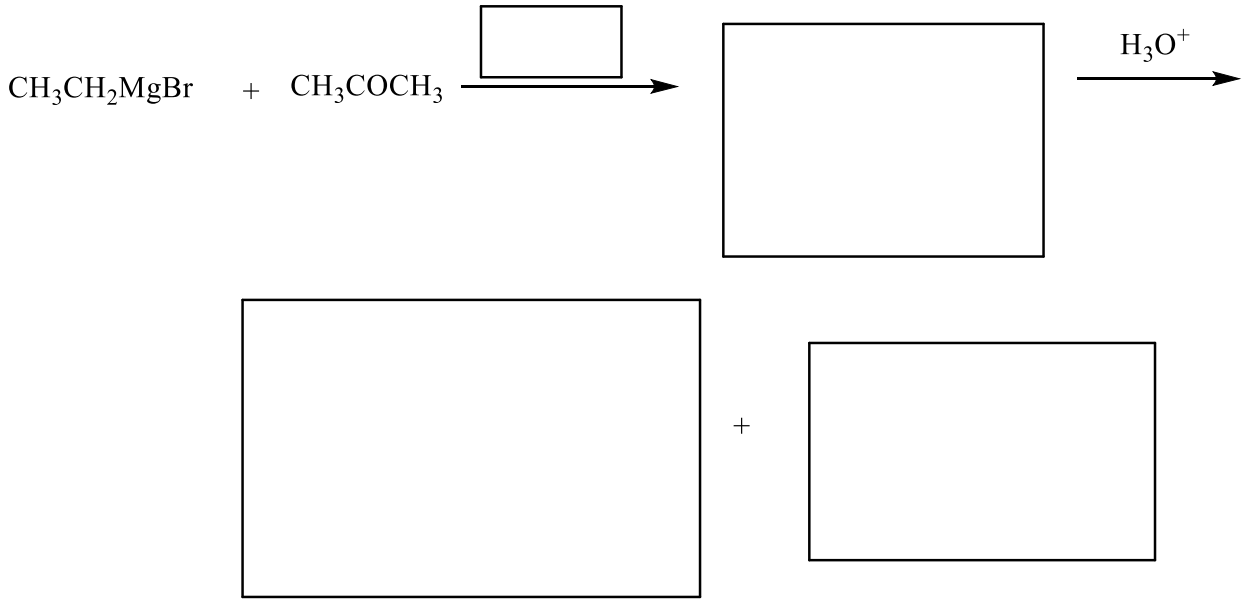
Practice Reaction with arrows



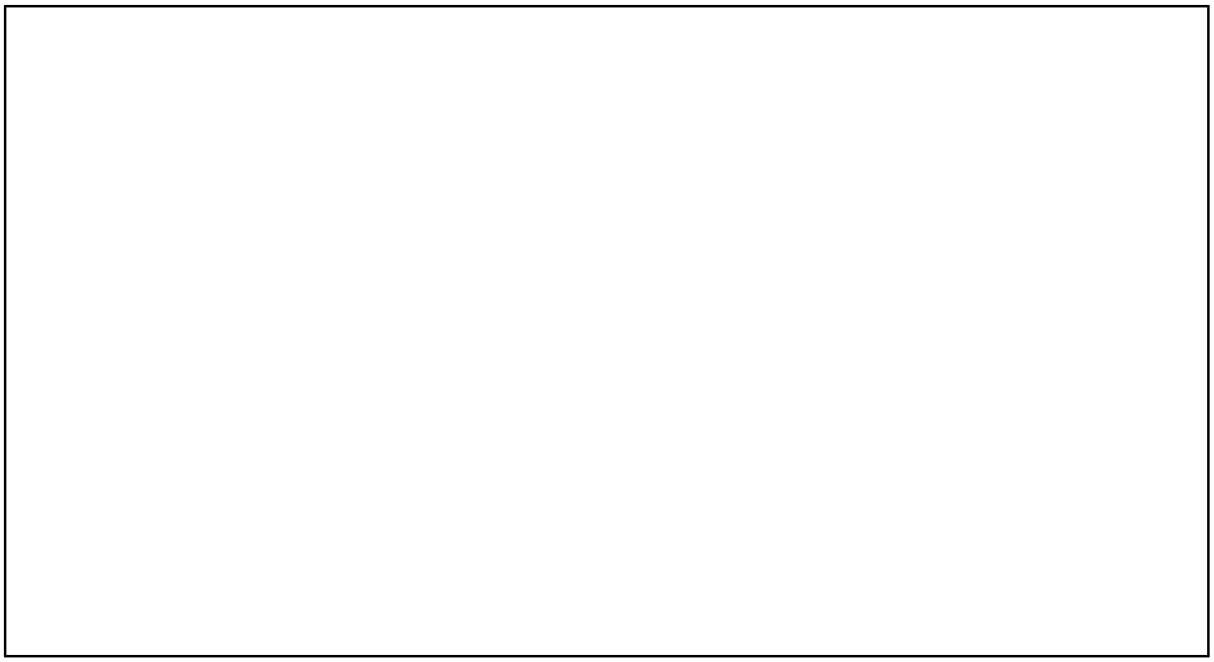


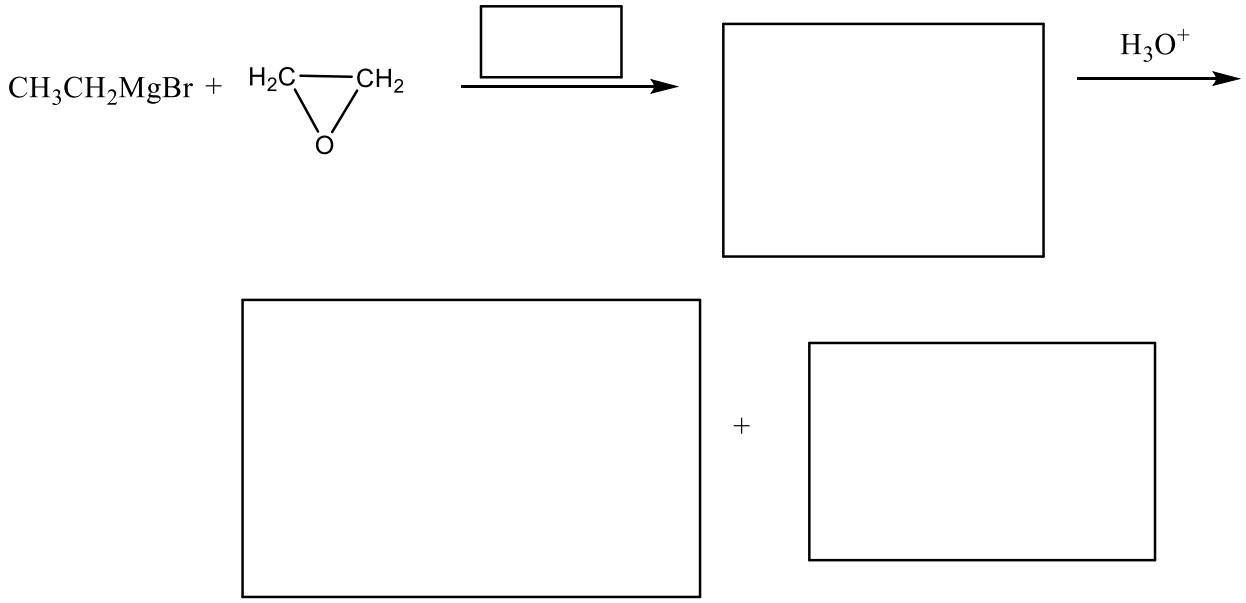
Practice Reaction with arrows



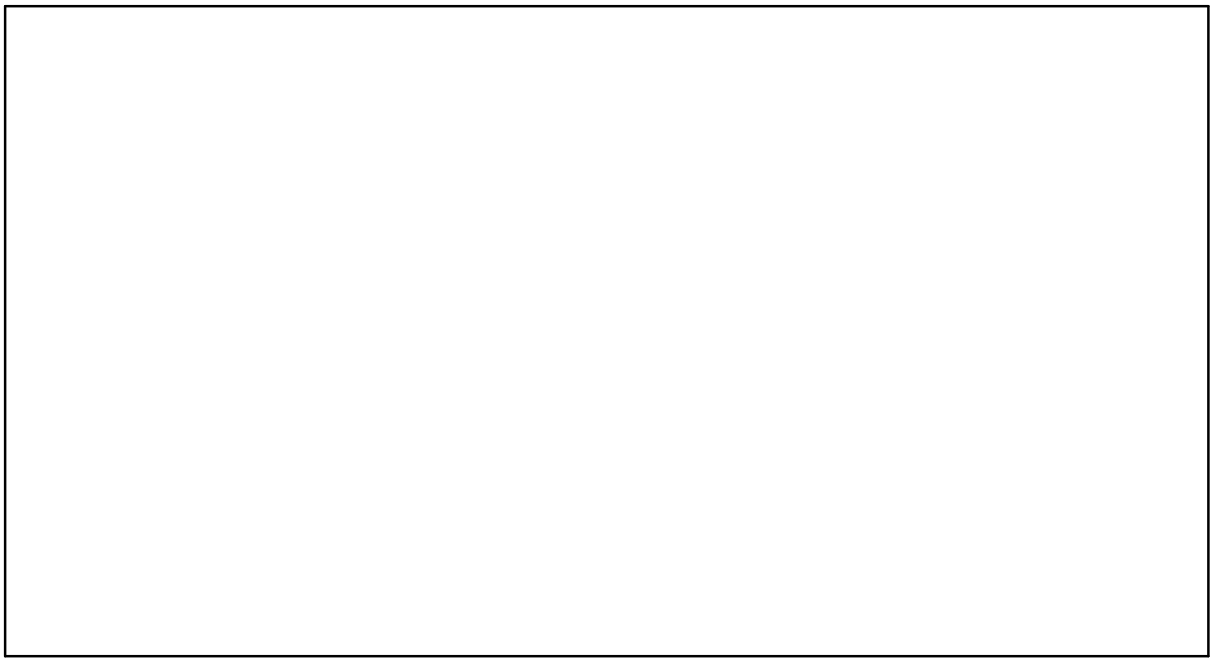


Practice Reaction with arrows





Practice Reaction with arrows



E. Conversion questions (according to order in book)

Worksheet 1

1. Convert ethanol to ethyl halide

_____

_____

2. Convert alcohol to alkyl halide

_____

_____

3. Convert ethanol to ethyl bromide

_____

_____

4. Convert ethanol to ethyl chloride

_____

_____

5. Convert alkyl halide to alkyl iodide

_____

_____

6. Give mechanism of S_N2

_____

_____

_____

_____

7. Give mechanism of S_N1

_____

_____

_____

_____

8. Give mechanism of E1

_____

_____

_____

_____

9. Give mechanism of E2

_____

_____

_____

_____

10. Convert ethyl bromide to ethyl alcohol

_____

_____

_____

_____

11. Convert ethyl bromide to ethyl iodide

_____

_____

12. Convert ethyl bromide to propane nitrile

_____

_____

13. Convert ethyl bromide to nitroethane

_____

_____

14. Convert ethyl bromide to ethyl methyl ether

_____

_____

15. Convert Ethyl bromide to ethylamine

_____

_____

Worksheet 2

1. Convert Ethyl bromide to diethyl amine

2. Convert Ethyl bromide to triethyl amine

3. Convert ethyl bromide to quaternary ethylammonium ion

4. Convert ethyl bromide to ethyl thioalcohol

5. Convert ethyl bromide to ethyl acetate

6. Convert ethyl chloride to n-butane

7. Convert n-propyl chloride to n-propane

8. Convert methyl chloride to tetramethyl lead

9. Convert ethyl chloride to tetraethyl lead

10. Convert ethyl bromide to ethyl magnesium bromide

11. Convert ethyl magnesium bromide to ethane (all possible reactions that come under it)

12. Convert ethyl magnesium bromide to ethyl cyanide

13. Convert ethyl magnesium bromide to propanoic acid

14. Convert ethyl magnesium bromide to 1-propanol

Worksheet 3

1. Convert ethyl magnesium bromide to 1-butanol or convert acetaldehyde to 1-butanol.

_____

_____

2. Convert ethyl magnesium bromide to 2-methyl-2-butanol.

_____

_____

3. Convert ethyl magnesium bromide to 1-butanol.

_____

_____

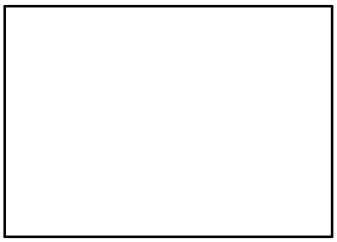
Chapter 11

Alcohols, Phenols and Ethers

A. How alcohols, phenols and ethers are related?

_____
_____
_____
_____
_____
_____

B. Draw structure of primary, secondary and tertiary alcohol.



Primary alcohol

Secondary alcohol

Tertiary alcohol

C. Give structures and names of the following compounds.

Methyl alcohol

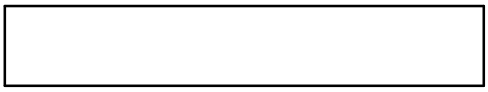
IUPAC name:_____

Ethyl alcohol

Benzyl alcohol

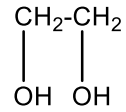
Propanol

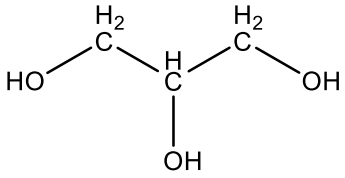
Pentanol

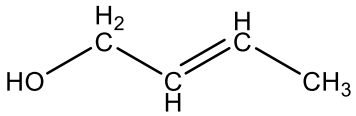


1-Butanol

2-Butanol







Tartaric acid

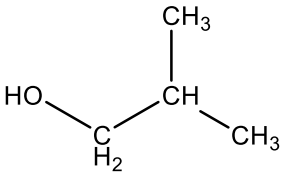
IUPAC name:_____

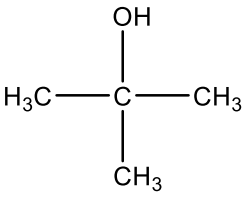
Lactic acid

IUPAC name:_____

1-Propanol

2-Propanol





Methoxy methane
Common name:_____

Methoxy ethane
Common name:_____

Methoxy benzene
Common name:_____

Ethoxy propane
Common name:_____

Ethoxy ethane
Common name:_____

Learn the Reaction Conditions

- Industrial preparation of methanol: $ZnO+Cr_2O_3$/450 °C; 200 atm
- From Molasses (Ethanol Prep.): 1) Invertase/Yeast 2)Zymase/Yeast
- From Starch: 1)Diastase/Yeast 2)Maltase/Yeast 3) Zymase/Yeast
- Ethanol to ethyl chloride: 1) Pyridine 2)$ZnCl_2$ 3) ThO_2
- Ethanol to acetaldehyde: $K_2Cr_2O_7/H_2SO_4$
- 2-Methyl-2-propanol to 2-methyl propene: $K_2Cr_2O_7/H_2SO_4$
- Propanol to propanone: $K_2Cr_2O_7/H_2SO_4$
- Dehydration of alcohols: conc.H_2SO_4/180 °C conc. H_2SO_4/140 °C
- Lucas Test: $ZnCl_2$, HCl/Heat
- Dow's method: NaOH, 360 °C/150 atm
- From sodium salt of benzene sulphonic acid: 320 °C
- Reduction with Zn: Δ
- Ether Formation: NaOH
- Nitration of phenol: 1)25 °C for o,p products 2) Δ for picric acid
- Bakelite: dil. Base
- Sulphonation of phenol: Δ
- Hydrogenation of phenol: Ni/150 °C

D. Match the correct reaction condition.

Reaction	Condition
Industrial preparation of methanol	Δ
From Molasses (Ethanol Prep.)	$ZnO+Cr_2O_3$/450 °C; 200 atm
Ethanol to acetaldehyde	1) Invertase/Yeast 2)Zymase/Yeast
From Starch	$K_2Cr_2O_7/H_2SO_4$

2-Methyl-2-propanol to 2-methyl propene	1)Diastase/Yeast 2)Maltase/Yeast 3) Zymase/Yeast
Reduction with Zn	1) Pyridine 2)$ZnCl_2$ 3) ThO_2
Ethanol to ethyl chloride	$K_2Cr_2O_7/H_2SO_4$
Propanol to propanone	$ZnCl_2$, HCl/Heat
Dehydration of alcohols	$K_2Cr_2O_7/H_2SO_4$
Lucas Test	$K_2Cr_2O_7/H_2SO_4$
Dow's method	320 °C
From sodium salt of benzene sulphonic acid	NaOH, 360 °C/150 atm
Ether Formation	1)25 °C for o,p products 2) Δ for picric acid
Sulphonation of phenol	dil. Base
Nitration of phenol	NaOH
Bakelite	Δ
Hydrogenation of phenol	Ni/150 °C

E. Learn through blanks.

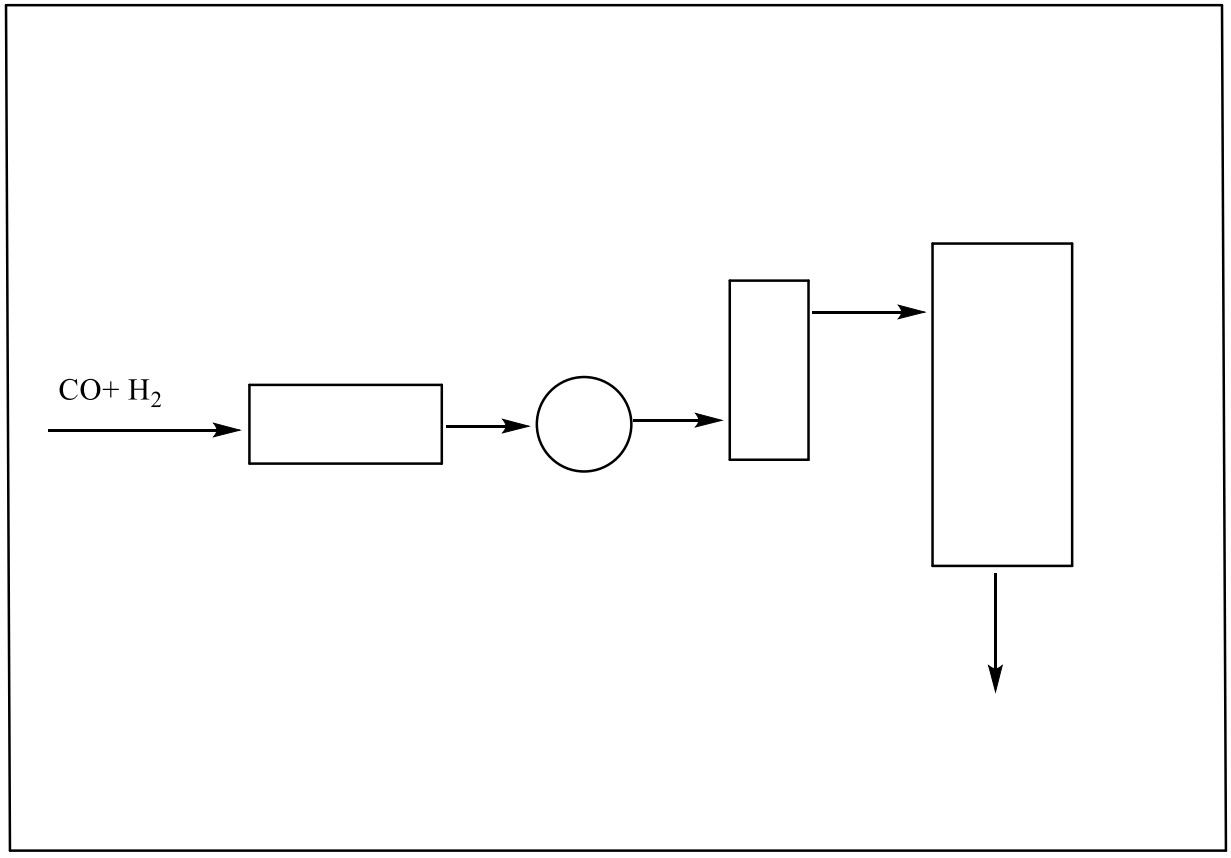
Alcohol

Name of Reaction: _____

$CO + 2H_2$ → [ ] / [ ] → [ ]

Practice Reaction

Complete the Diagram



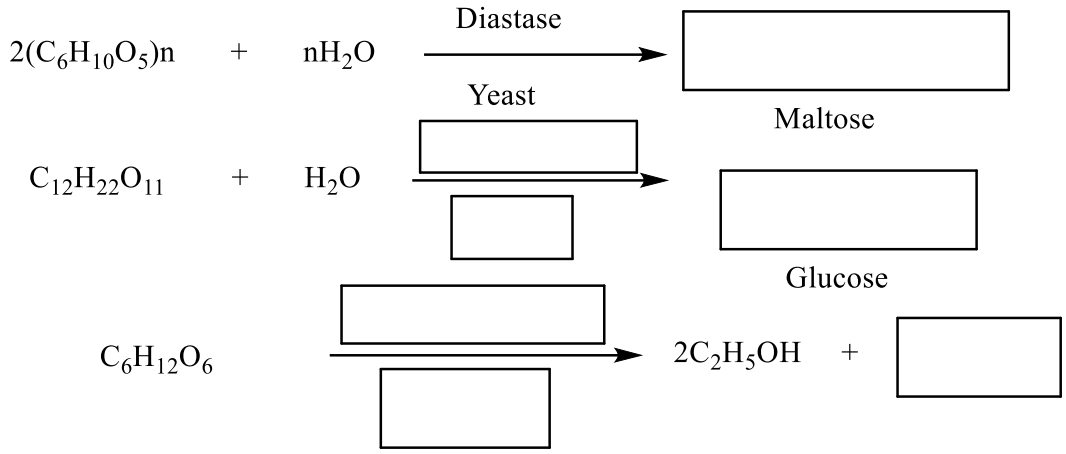
Name of Reaction:_____

$C_{12}H_{22}O_{11}$ + H_2O → [ ] → [ ] Glucose + [ ] Fructose

$C_6H_{12}O_6$ $\xrightarrow[\text{Yeast}]{\text{Zymase}}$ [ ] + $2CO_2$

Practice Reaction

Name of Reaction:_____



Practice Reaction

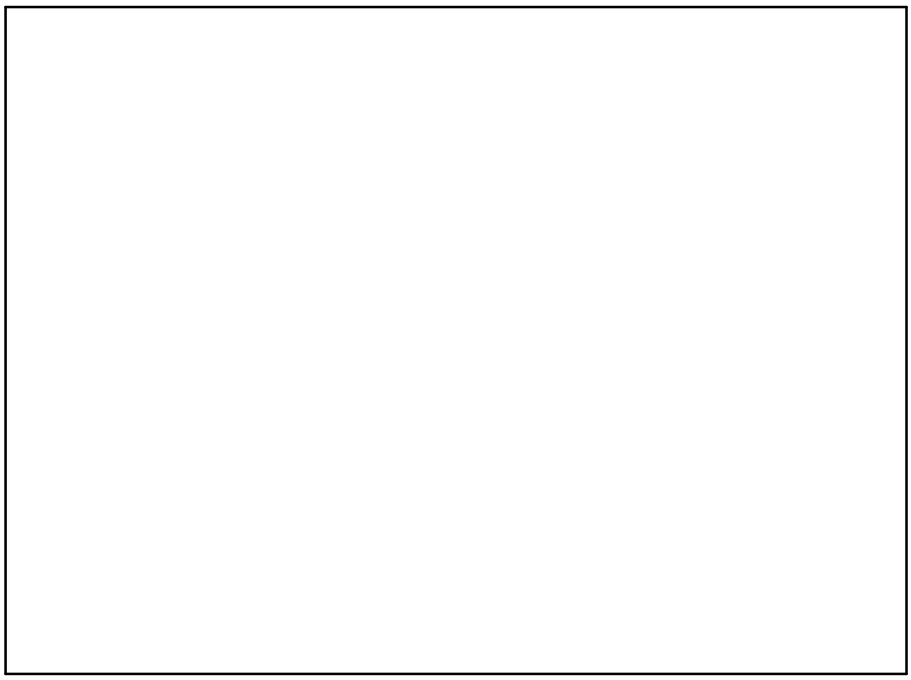
Alcohol obtained by fermentation is only up to _____% and never exceeds _____% because_____

The alcohol is distilled again and again to get_____

Absolute alcohol can be obtained by _____in the presence of _____ which absorbs moisture

Denaturing of alcohol is done to avoid_____by adding _____and _____

Sketch the hydrogen bonding of lower alcohols with water.

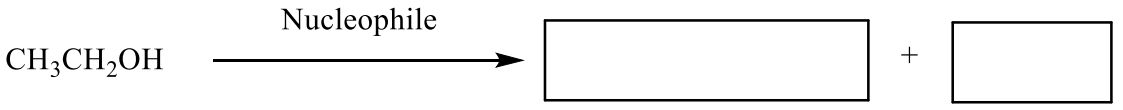


Mention any two physical properties of alcohols.

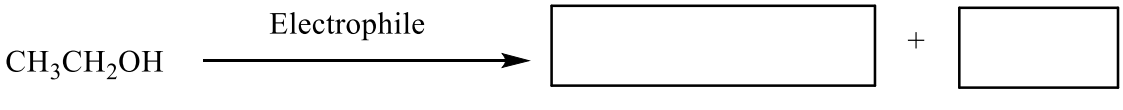
1._____

2._____

Types of Reactions of Alcohol



_____bond breaks

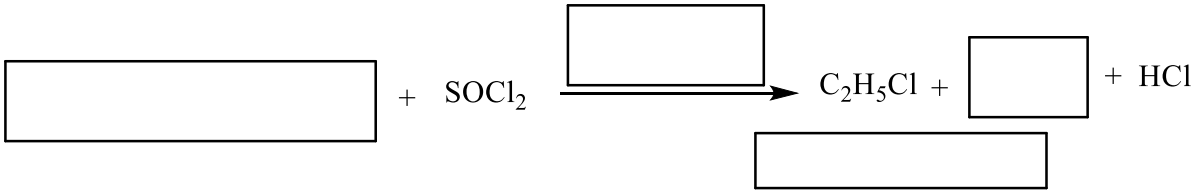


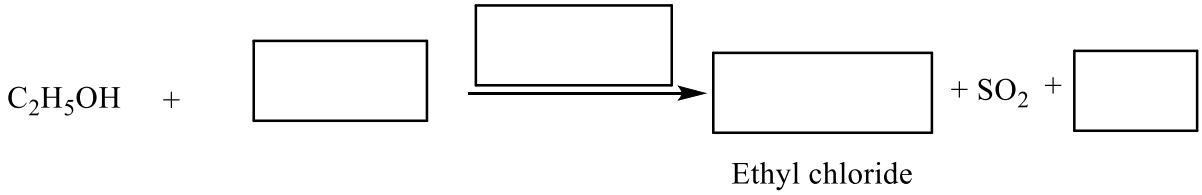
_____bond breaks

Order of reactivity of alchols when C-O breaks

Order of reactivity of alchols when O-H breaks

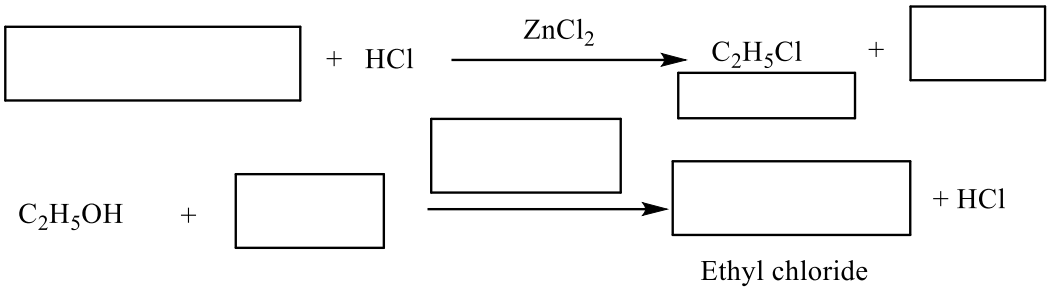
Name of Reaction:_____



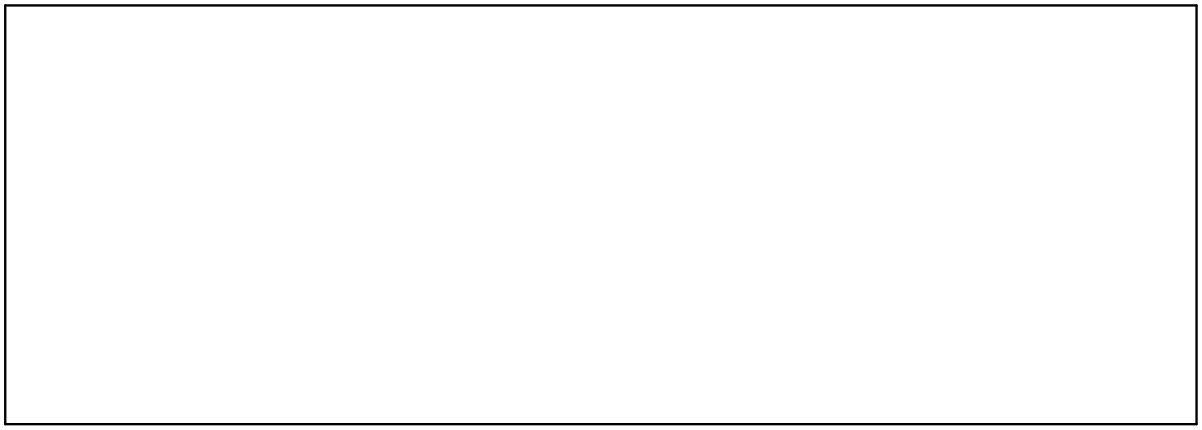


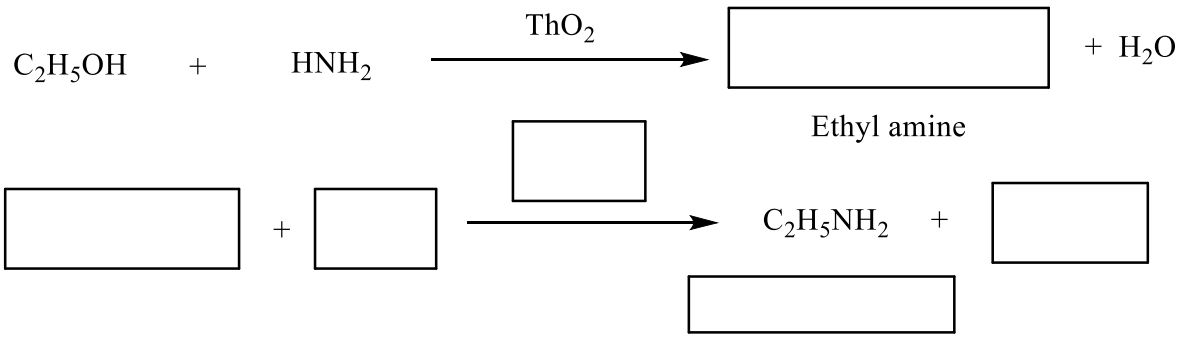
Ethyl chloride

Practice Reaction

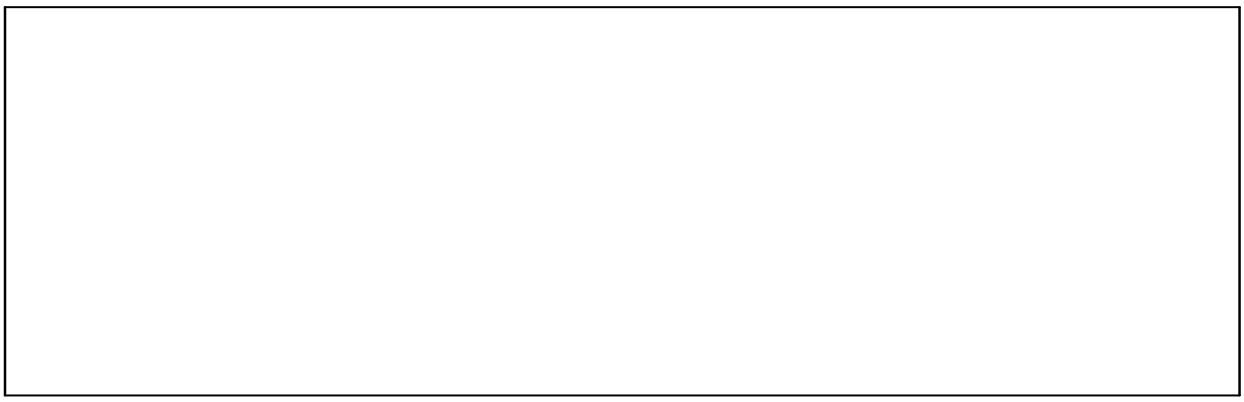


Practice Reaction

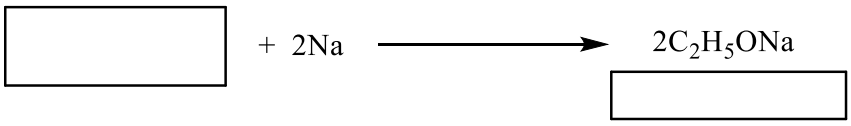




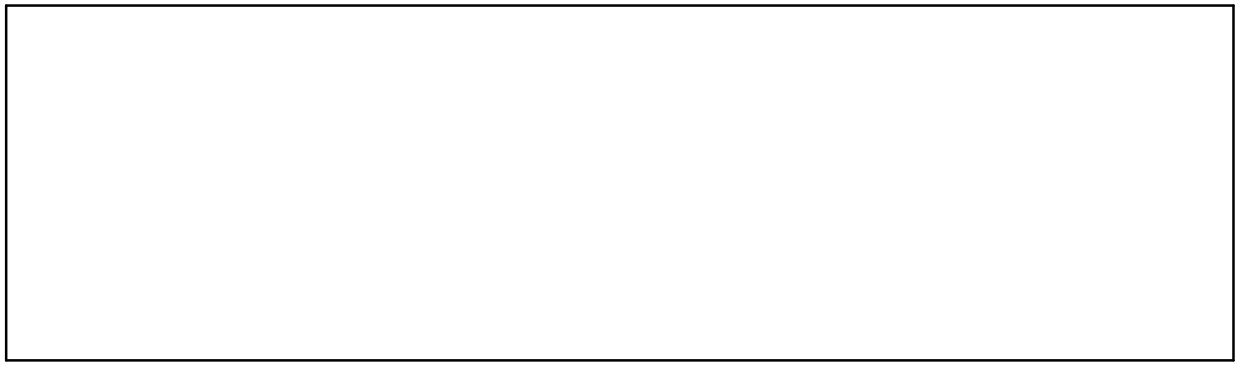
Practice Reaction

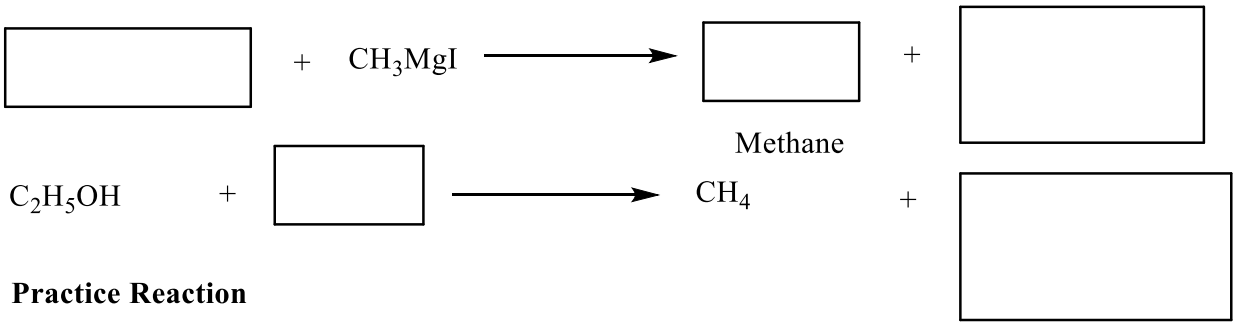


Name of Reaction: _____

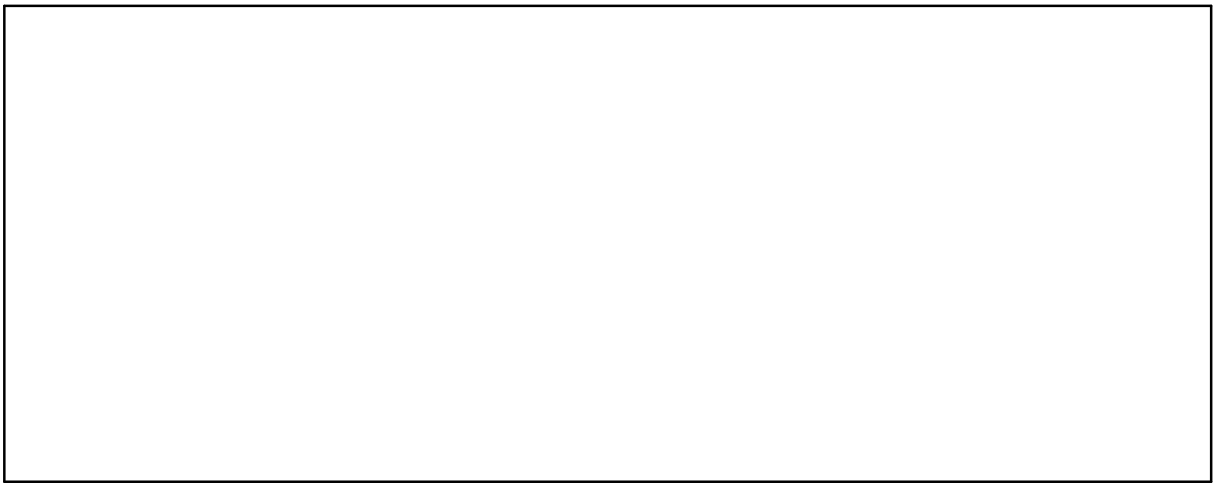


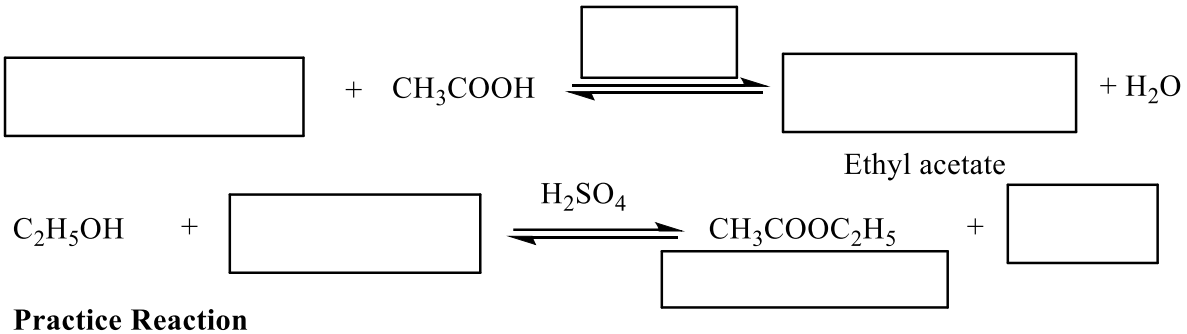
Practice Reaction





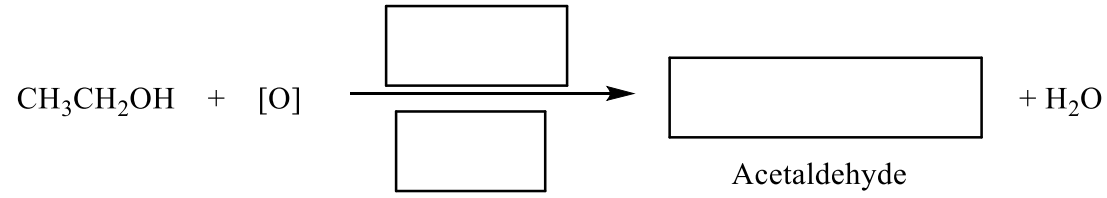
Practice Reaction

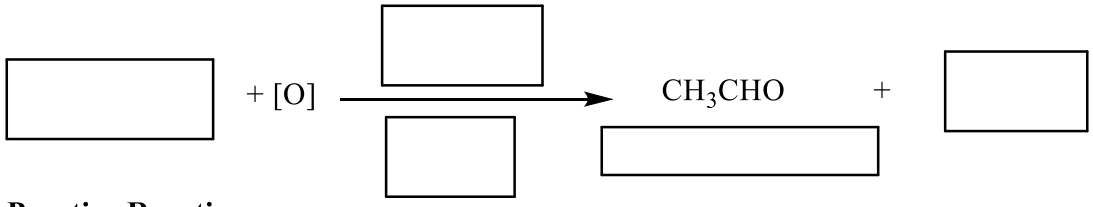




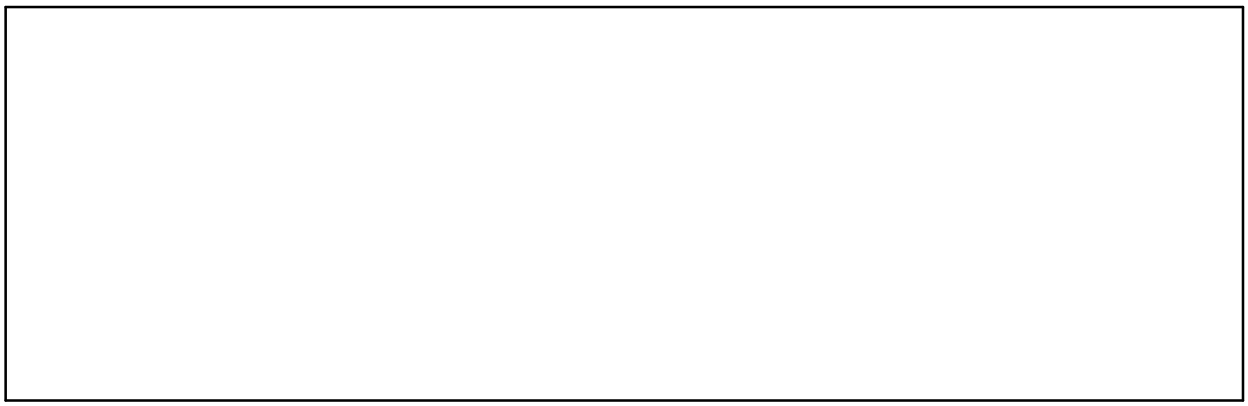
Practice Reaction

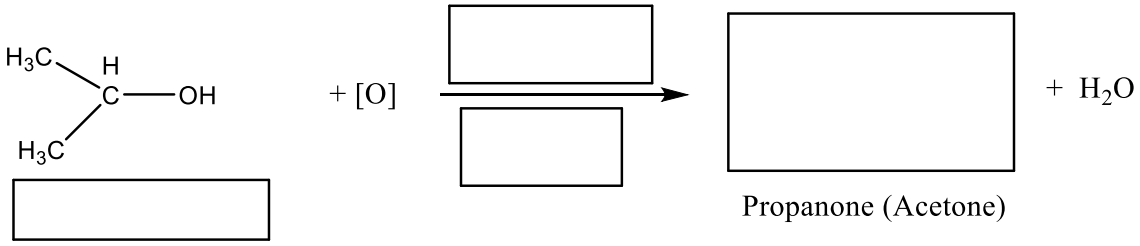
Oxidation

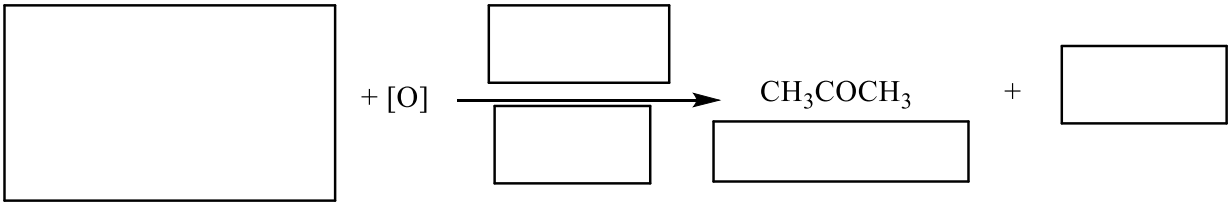




Practice Reaction

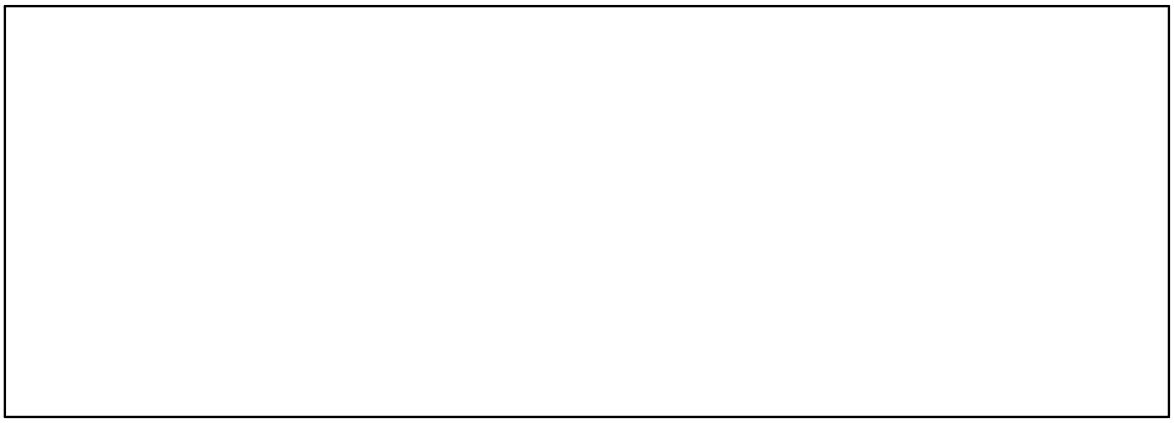


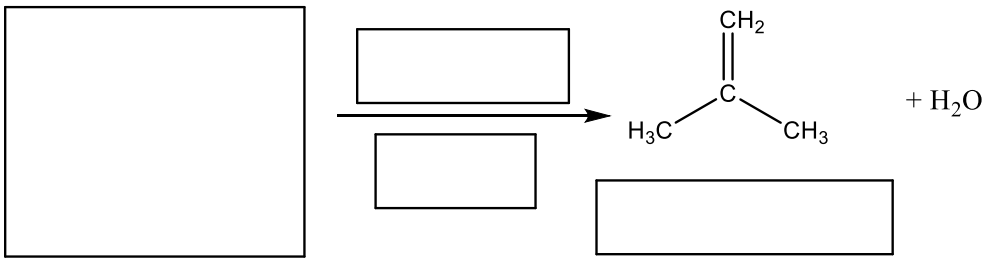




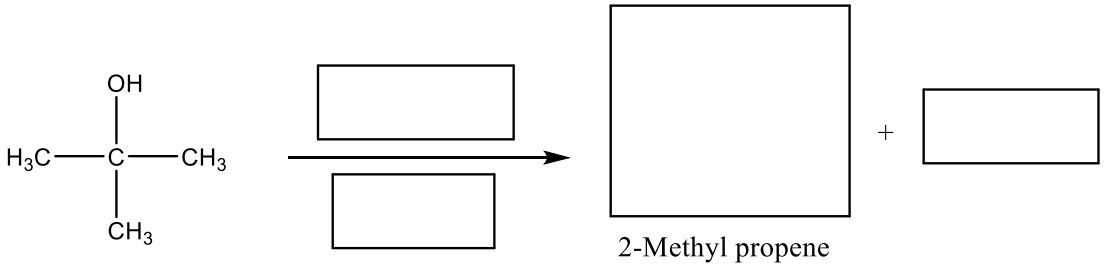
2-Propanol

Practice Reaction



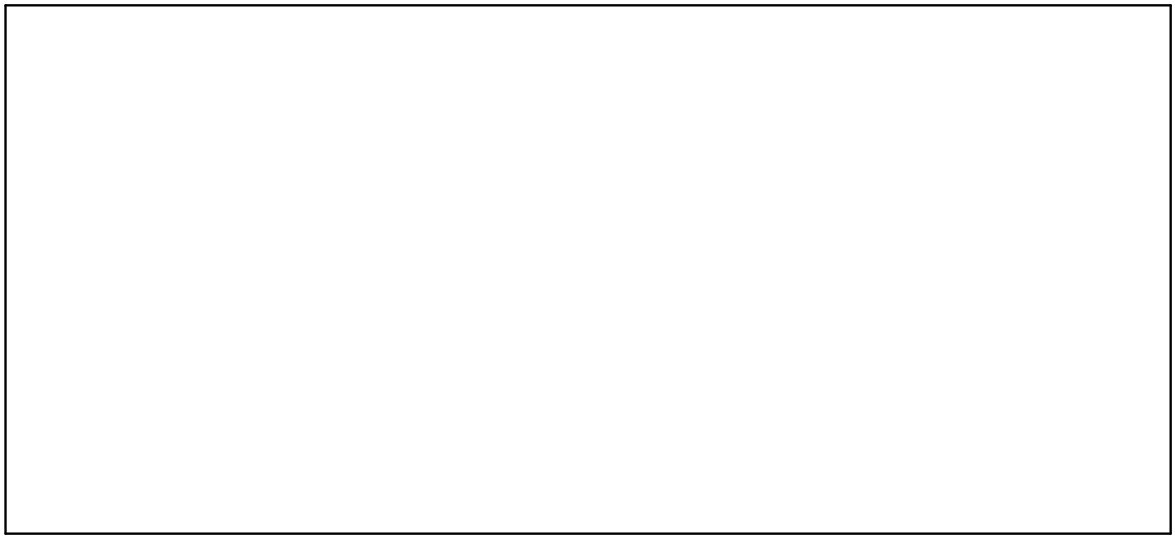


2-Methyl-2-Propanol

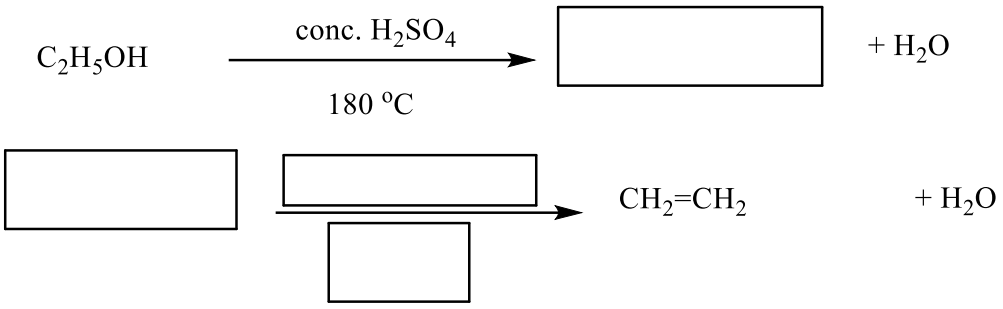


2-Methyl propene

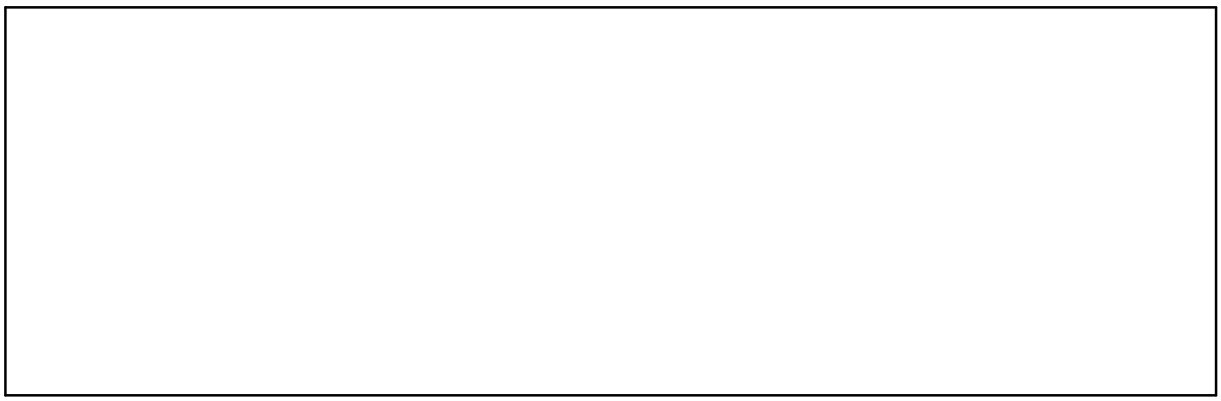
Practice Reaction

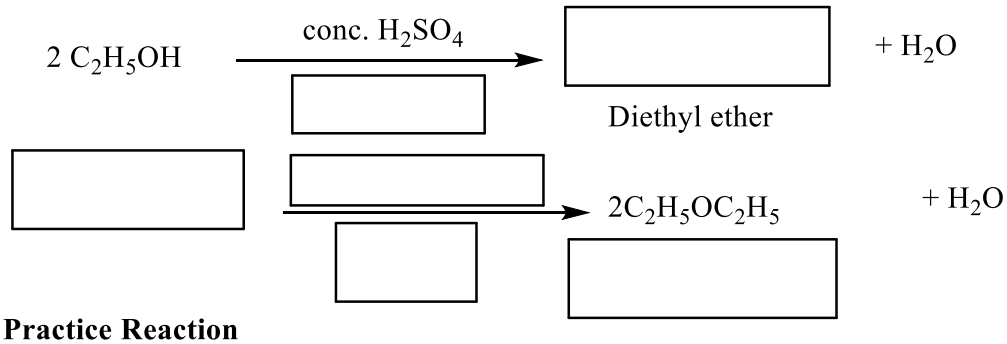


Dehydration

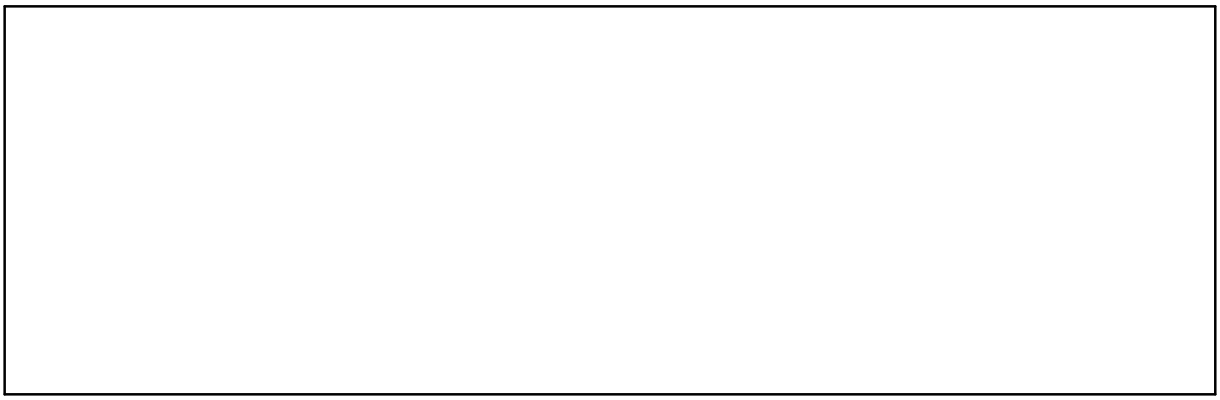


Practice Reaction





Practice Reaction



How to distinguish between primary secondary and tertiary alcohol?

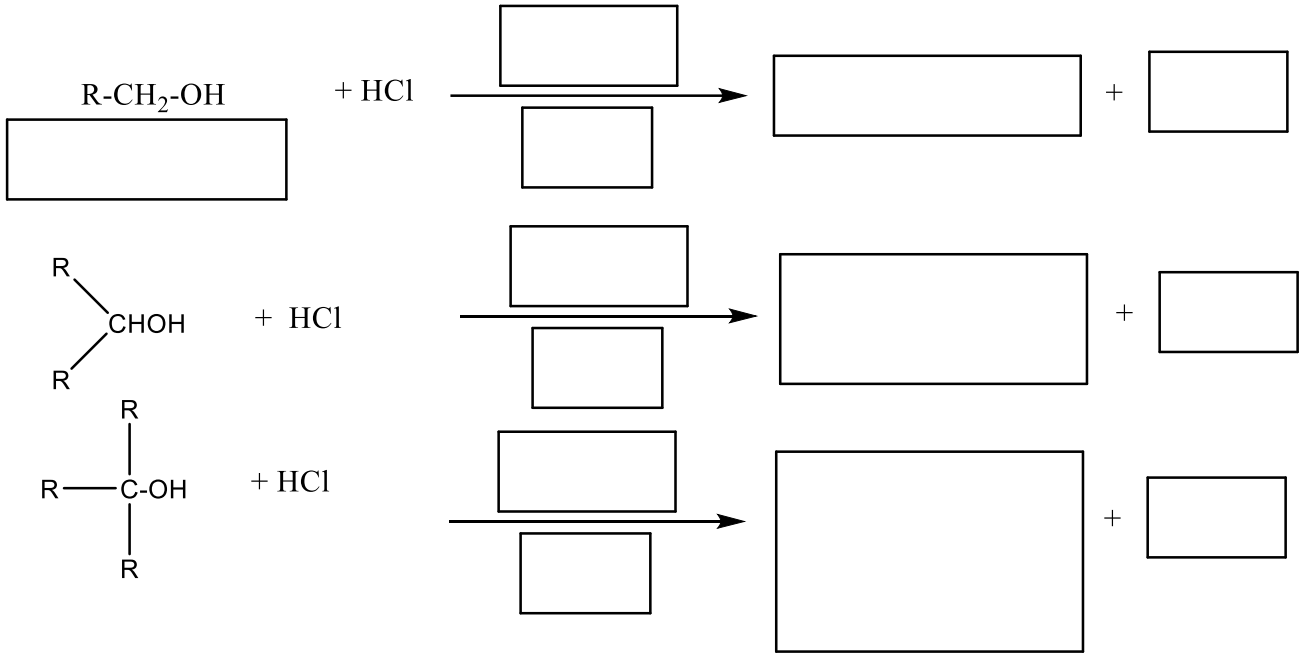
The test for distinguishing is_____

The reagent used is_____

Tertiary alcohols form an oily layer _____

Secondary alcohols form an oily layer_____

Primary alcohols form an oily layer_____



Practice Reaction

Distinguish between methanol and ethanol

$C_2H_5OH + 4I_2 + 6NaOH \longrightarrow$ [ ] + [ ] + [ ] + [ ]

[ ] + [ ] + [ ] $\longrightarrow$ No yellow ppt

Practice Reaction

[ ]

Mention any four uses of methanol and ethanol.

1._____

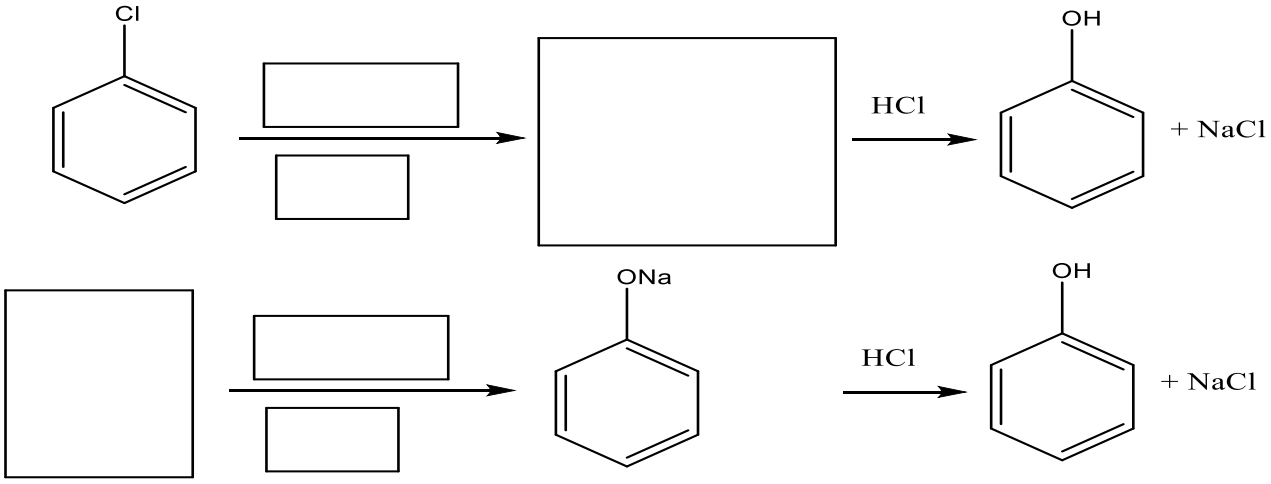
2._____

3._____

4._____

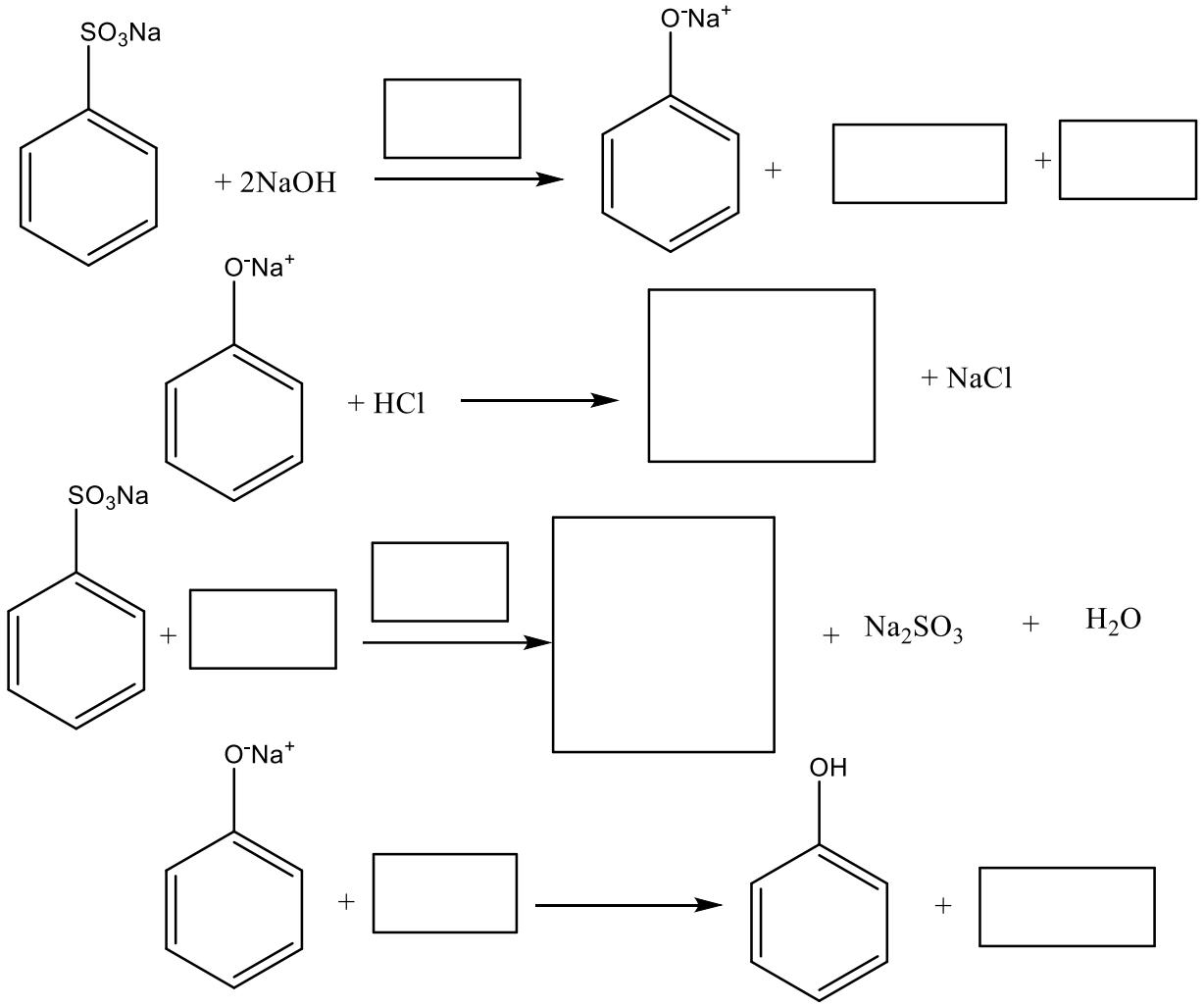
Phenol

Name of Reaction:_____

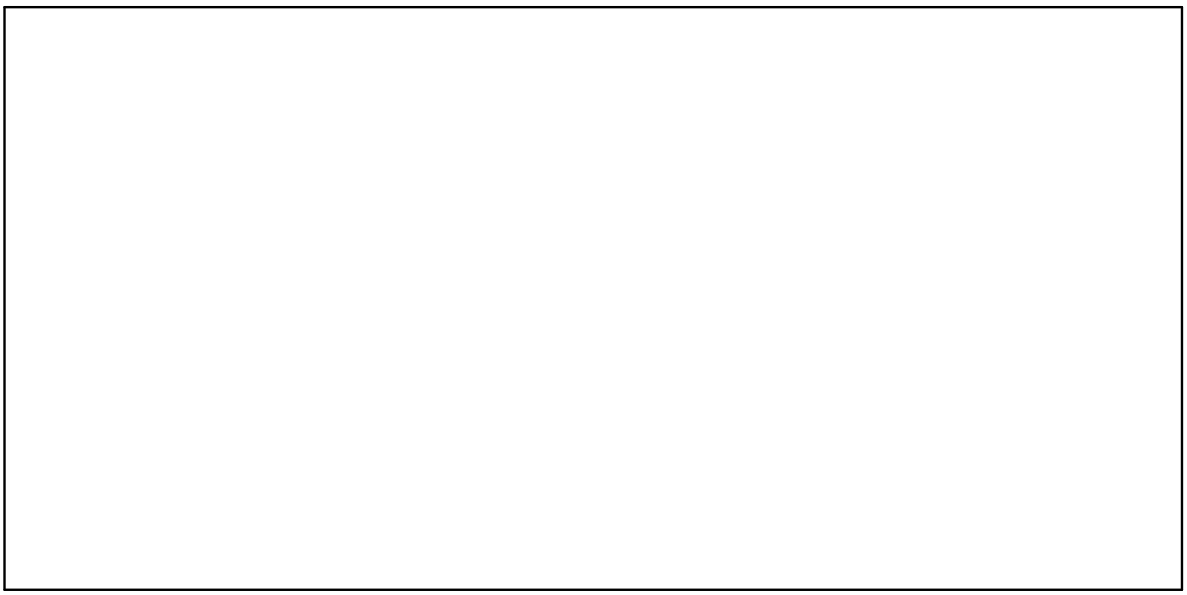


Practice Reaction

Name of Reaction: _____



Practice Reaction

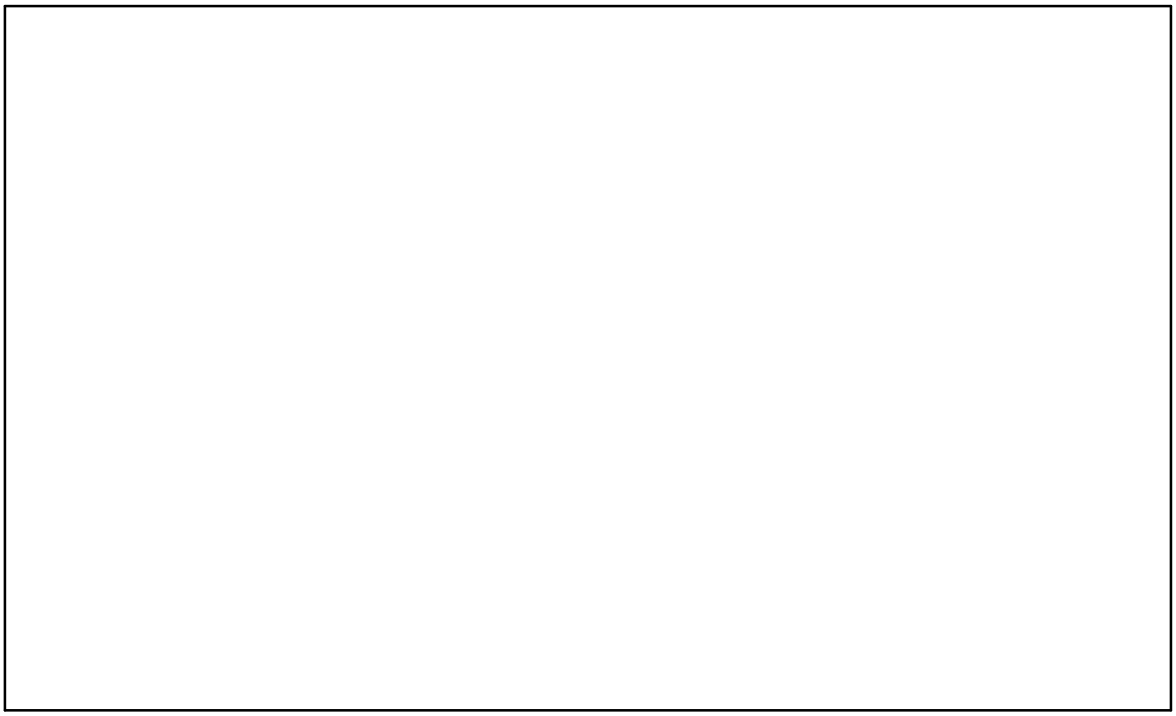


Mention any two physical properties of phenol.

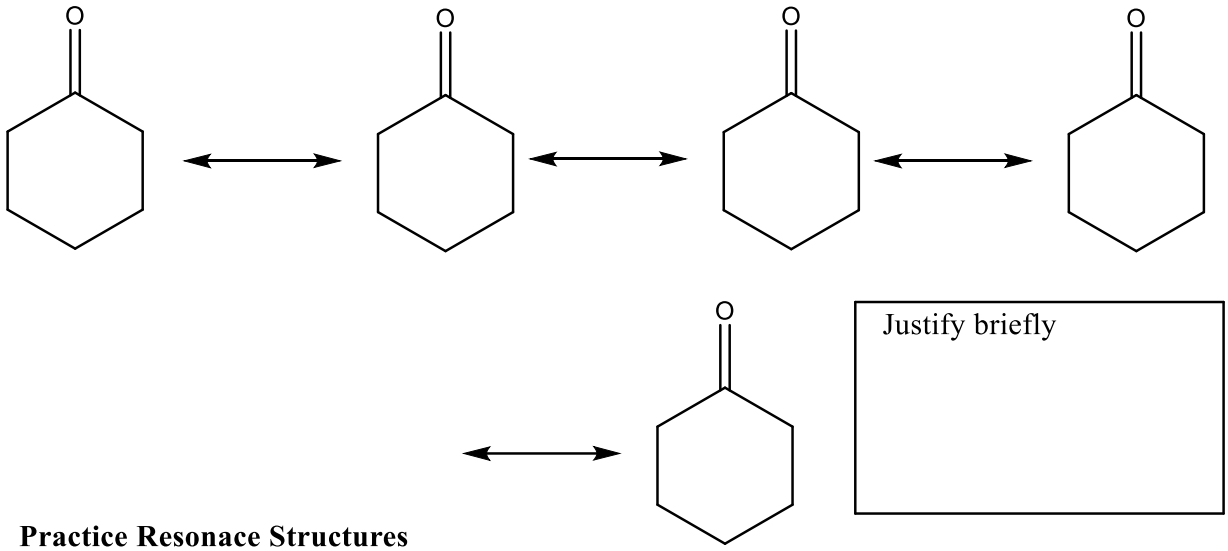
1._____

2._____

Draw the resonance structures to justify the acidic behaviour of phenol.



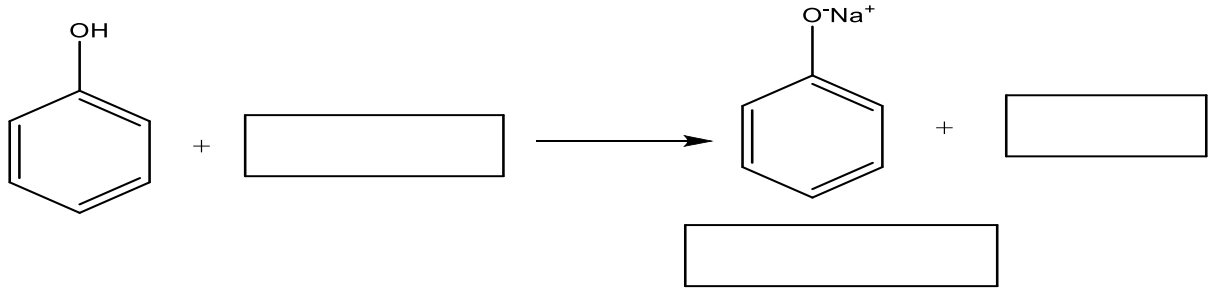
Complete through arrows

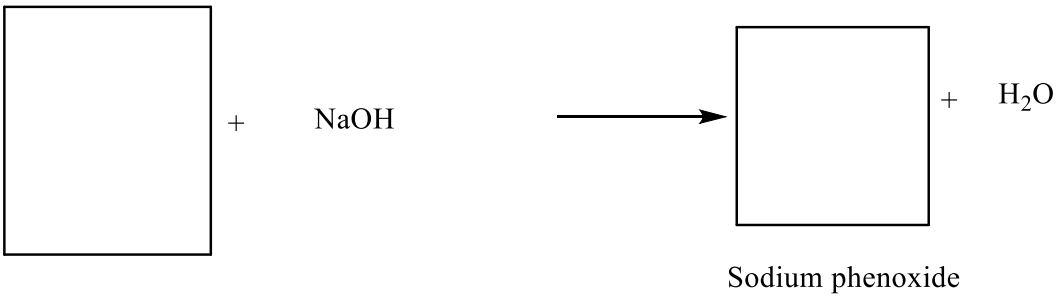


Practice Resonace Structures

Salt Formation

Reaction of phenol due to _____group

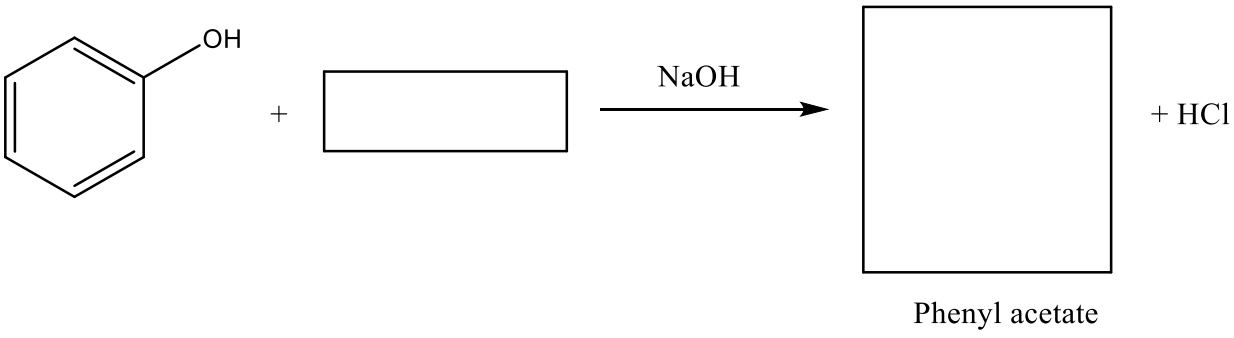


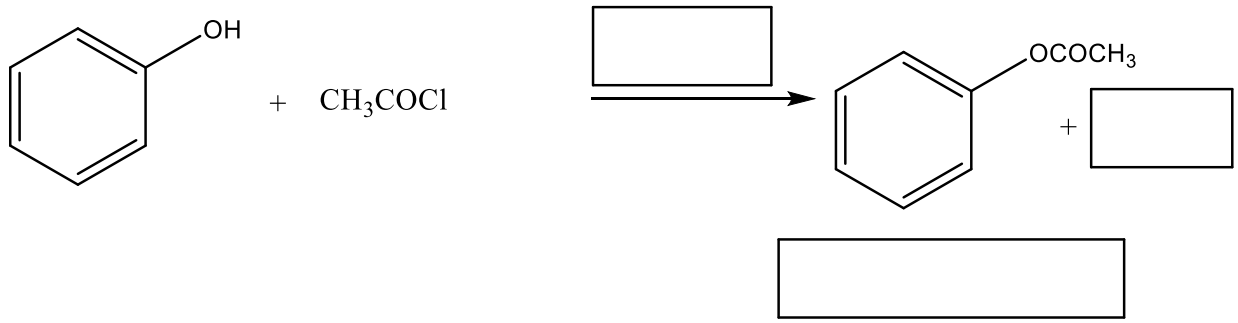


Practice Reaction

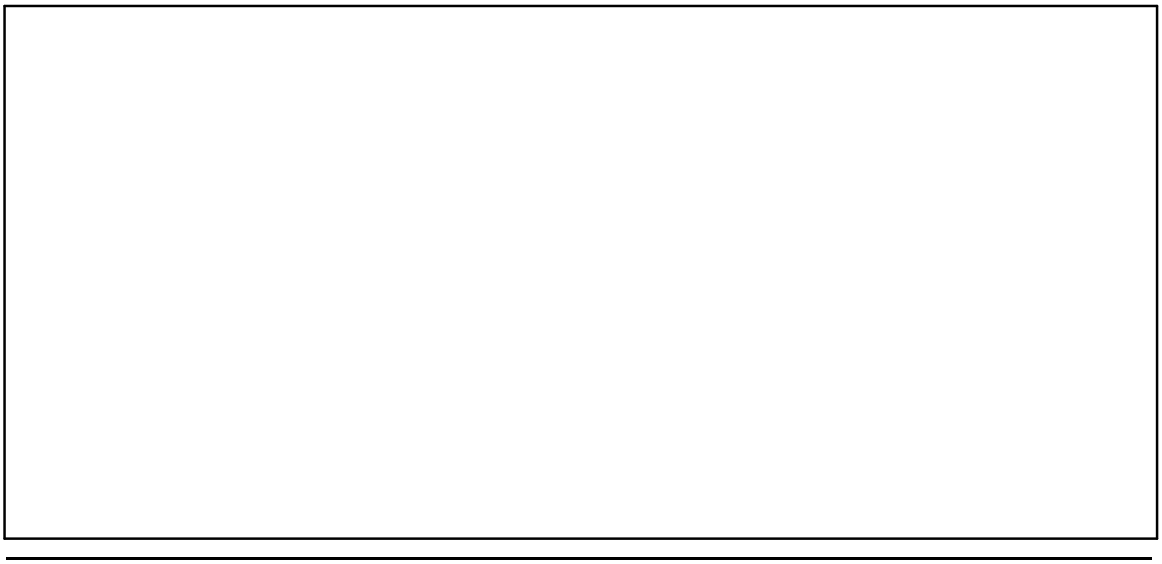
Ester Formation

Reaction of phenol due to_____group



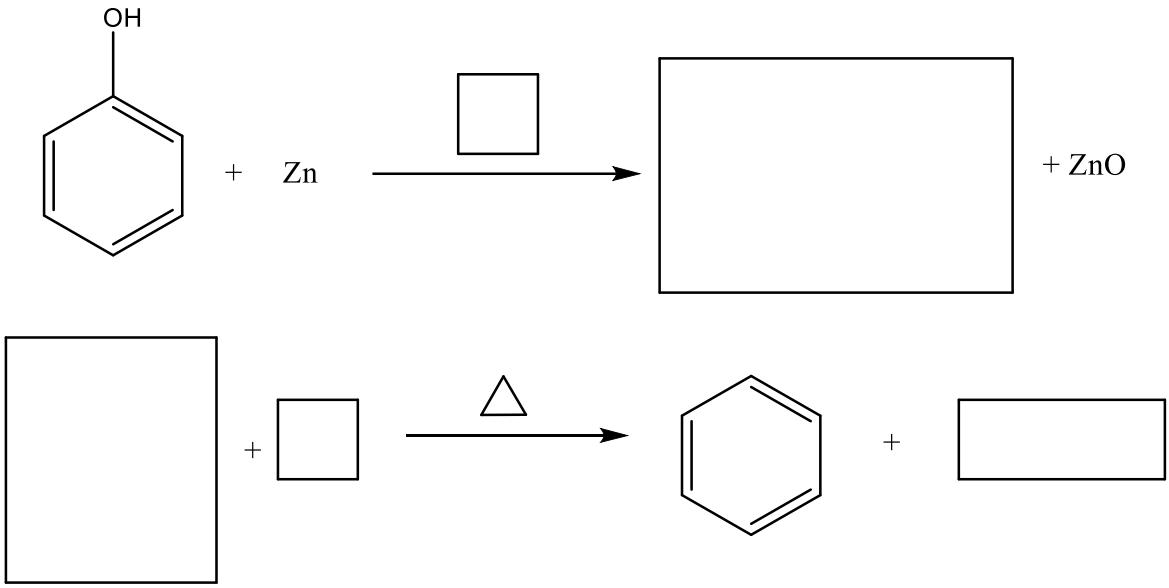


Practice Reaction

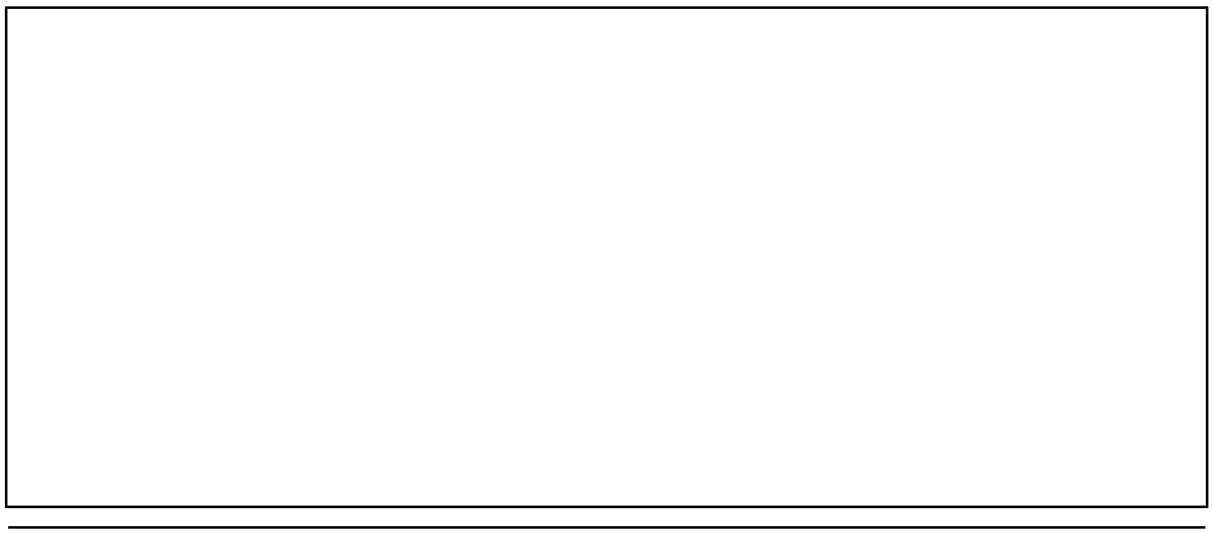


Reduction with Zn

Reaction of phenol due to_____group

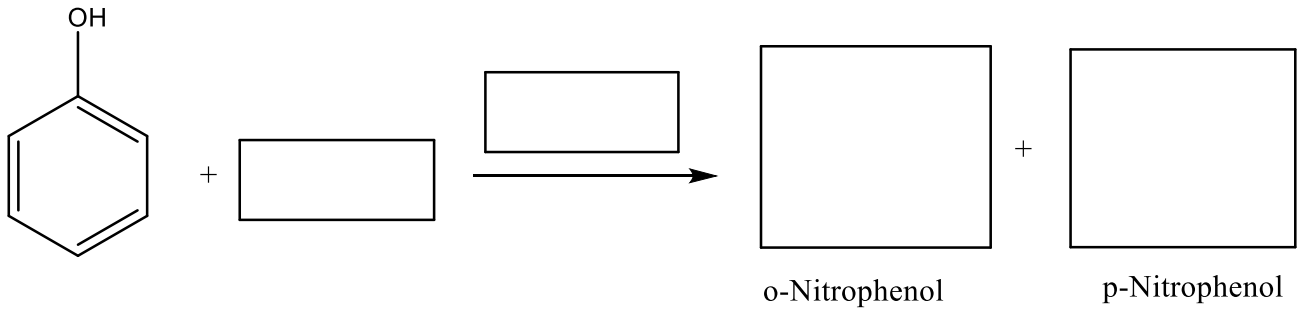


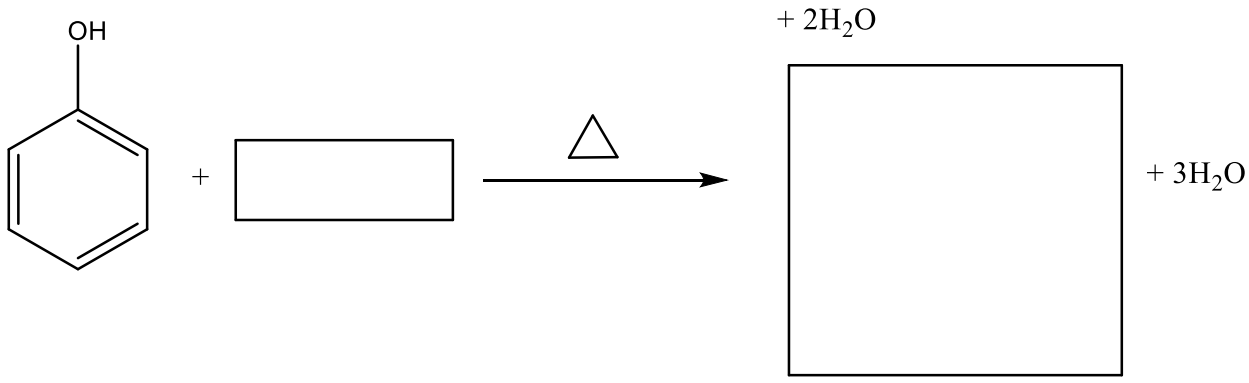
Practice Reaction



Nitration

Reaction of phenol due to _____

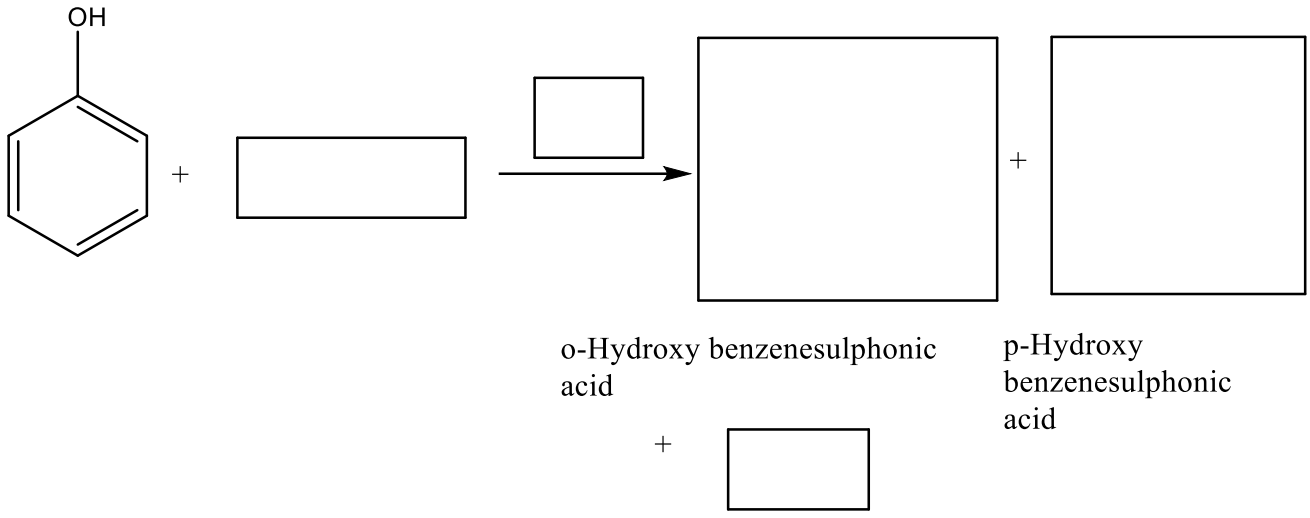




Practice Reaction

Sulphonation

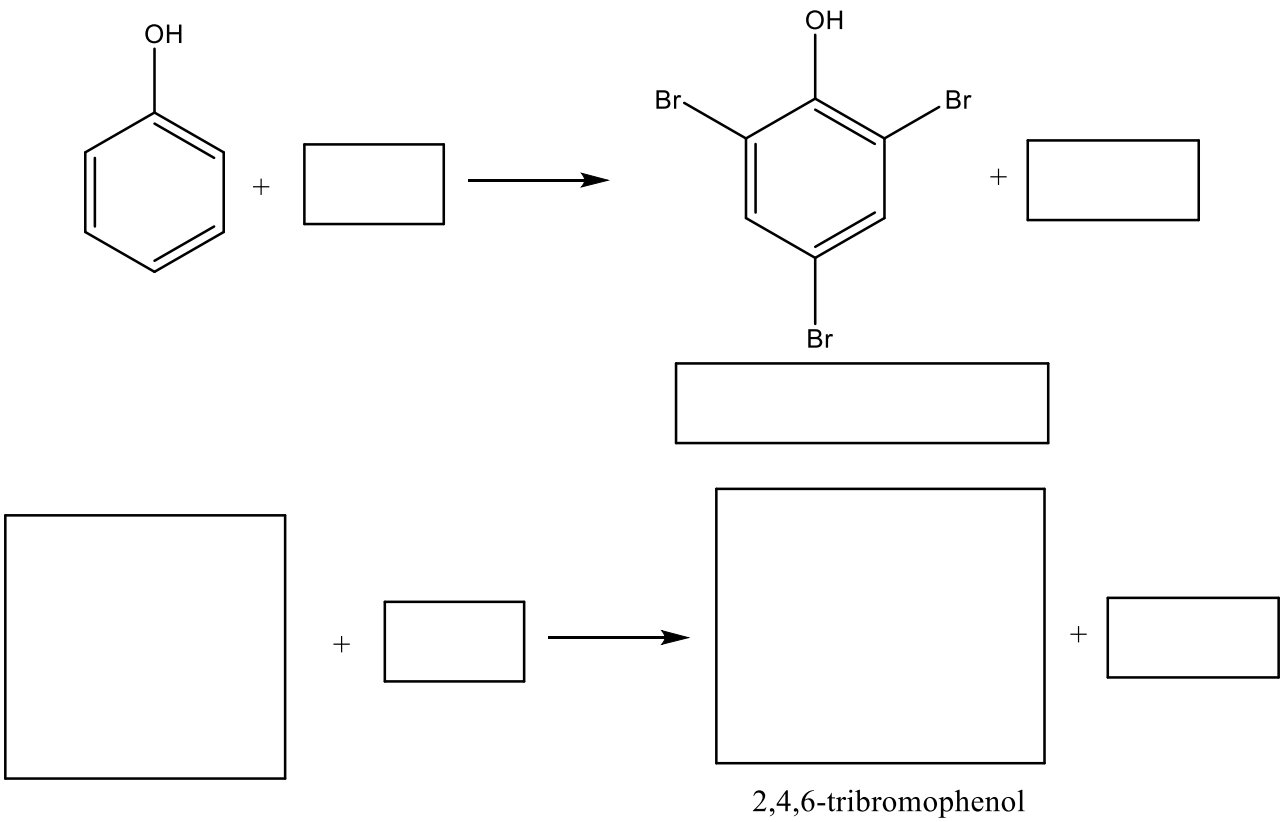
Reaction of phenol due to _____



Practice Reaction

Halogenation

Reaction of phenol due to _____

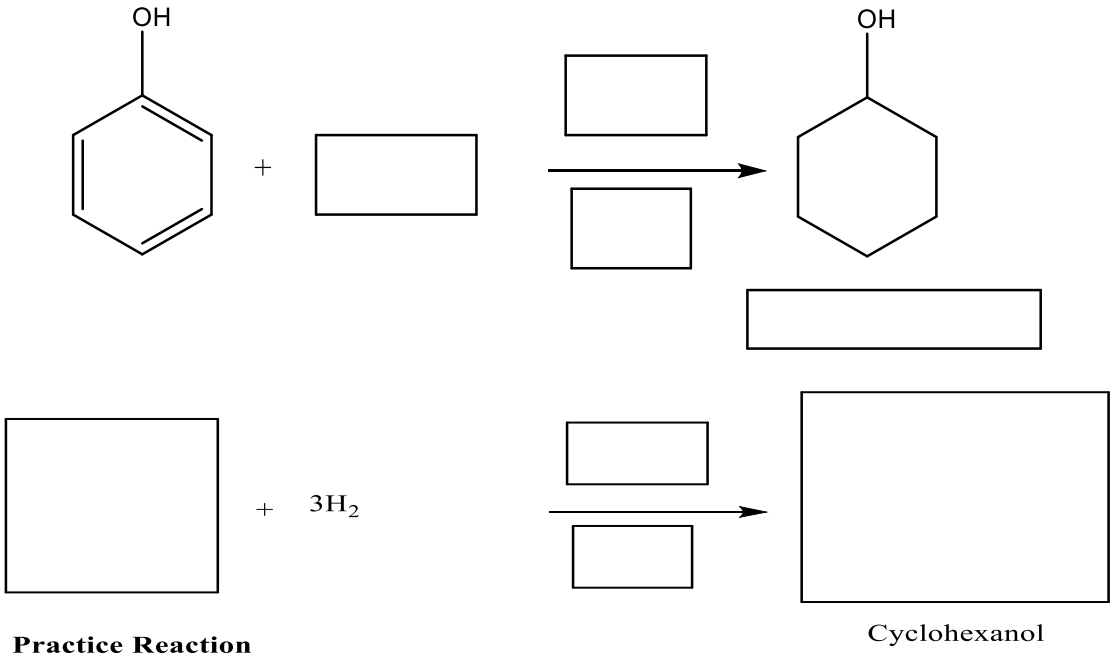


2,4,6-tribromophenol

Practice Reaction

Hydrogenation

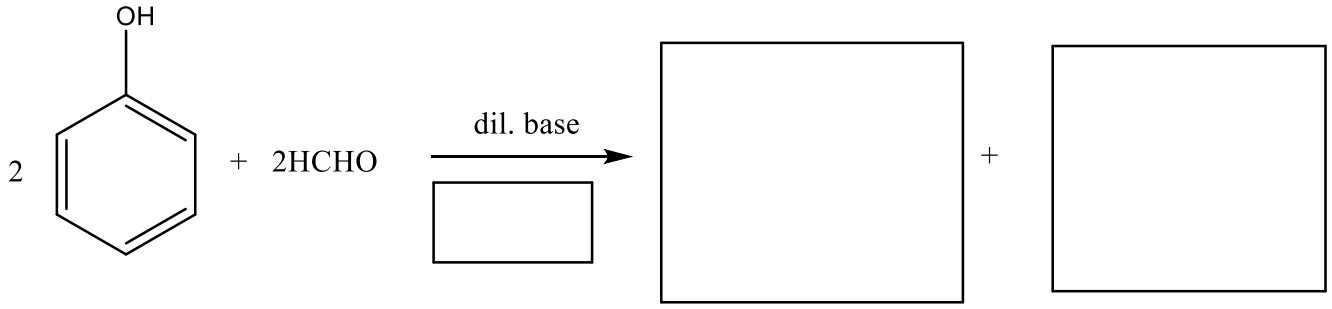
Reaction of phenol due to _____



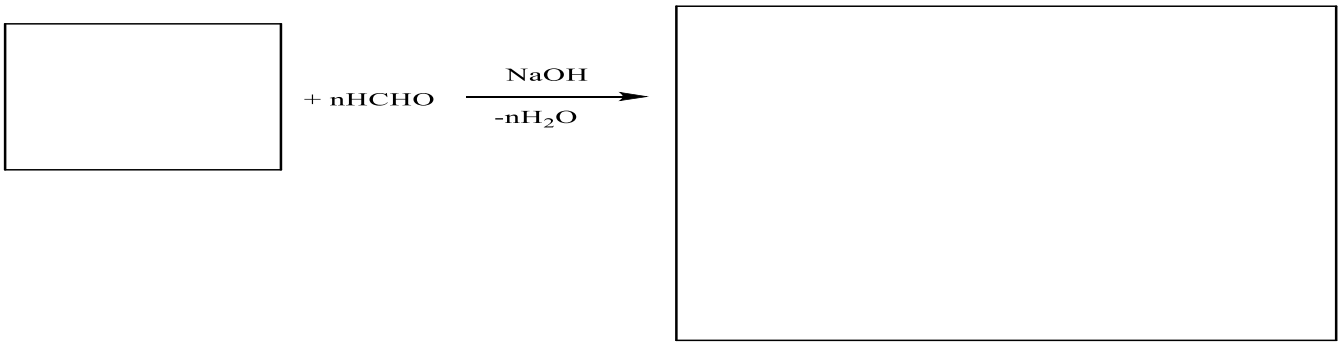
Practice Reaction

Bakelite Formation

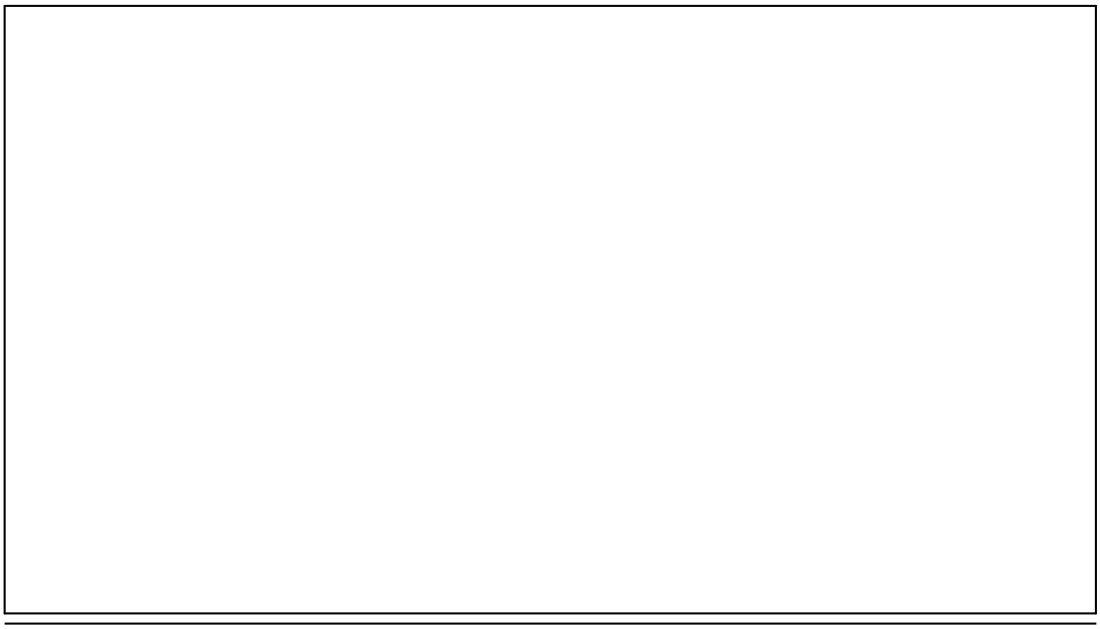
Reaction with_____



o-Hydroxybenzyl alcohol p-Hydroxybenzyl alcohol



Practice Reaction Bakelite



What is the difference between symmetrical/simple and unsymmetrical/mixed ethers?

_____

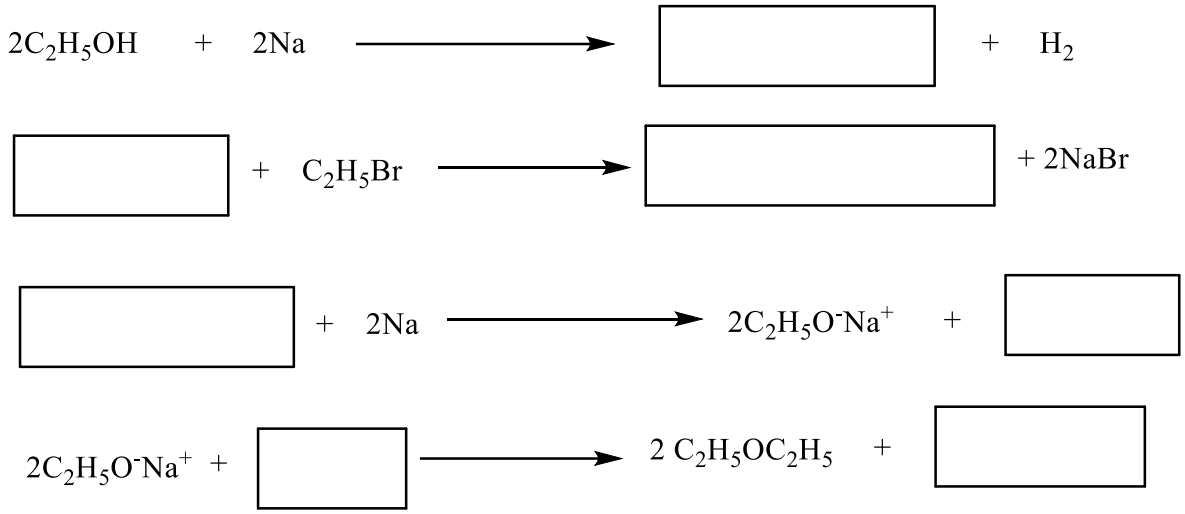
_____

_____

_____

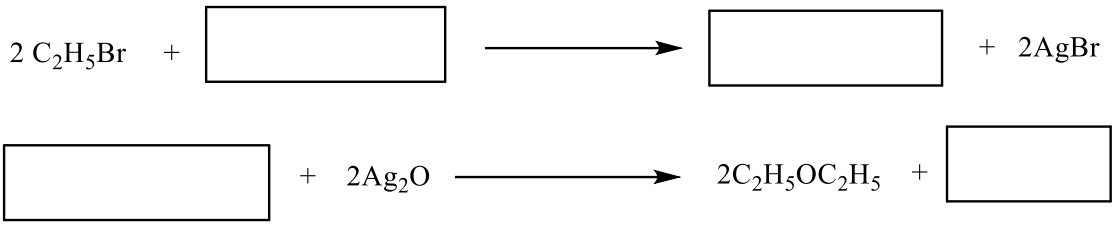
Ethers

Name of Reaction:_____



Practice Reaction

Name of Reaction:_____



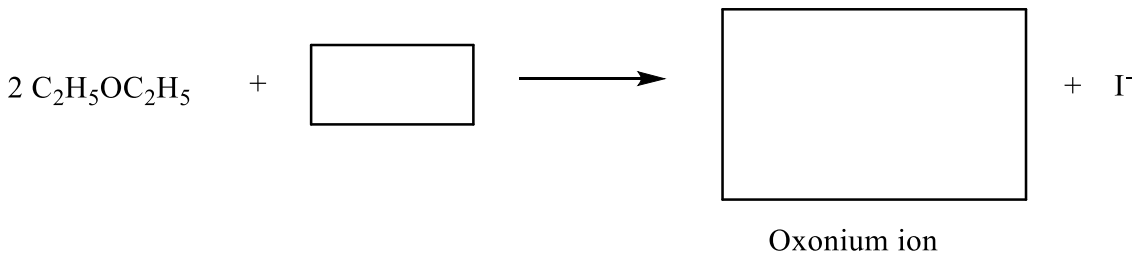
Practice Reaction

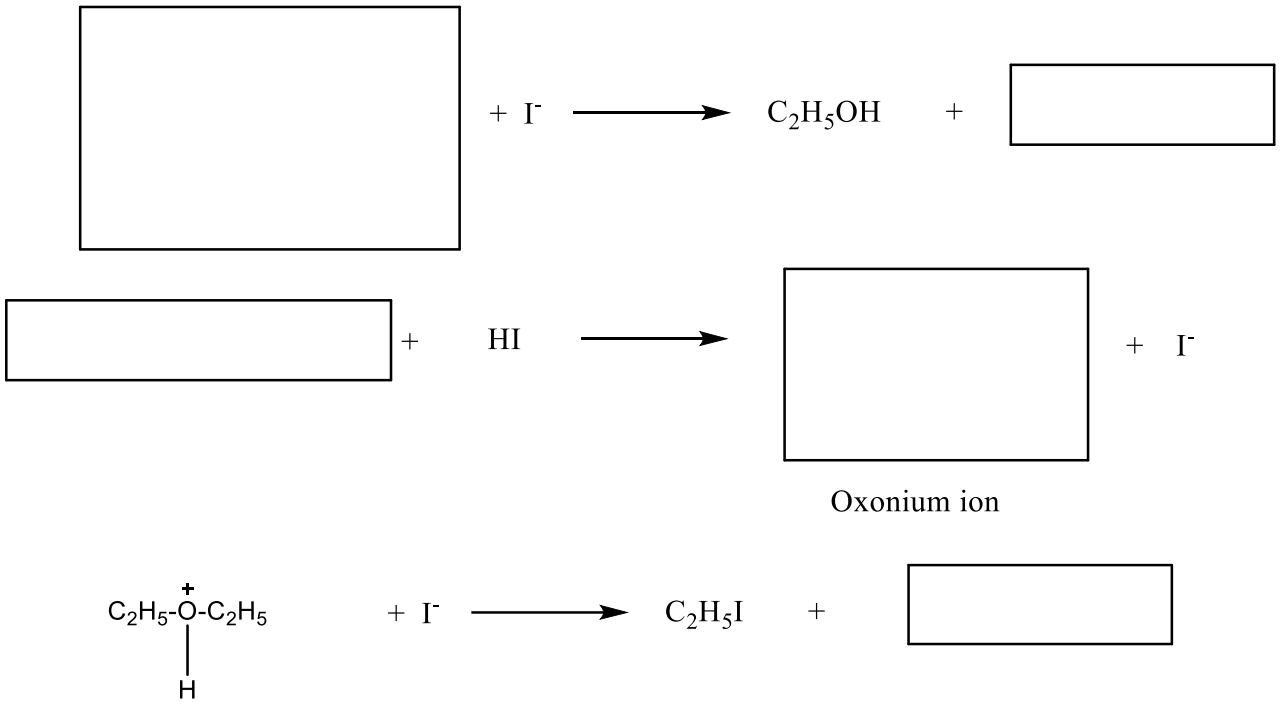
Mention any two physical properties of ethers.

1._____

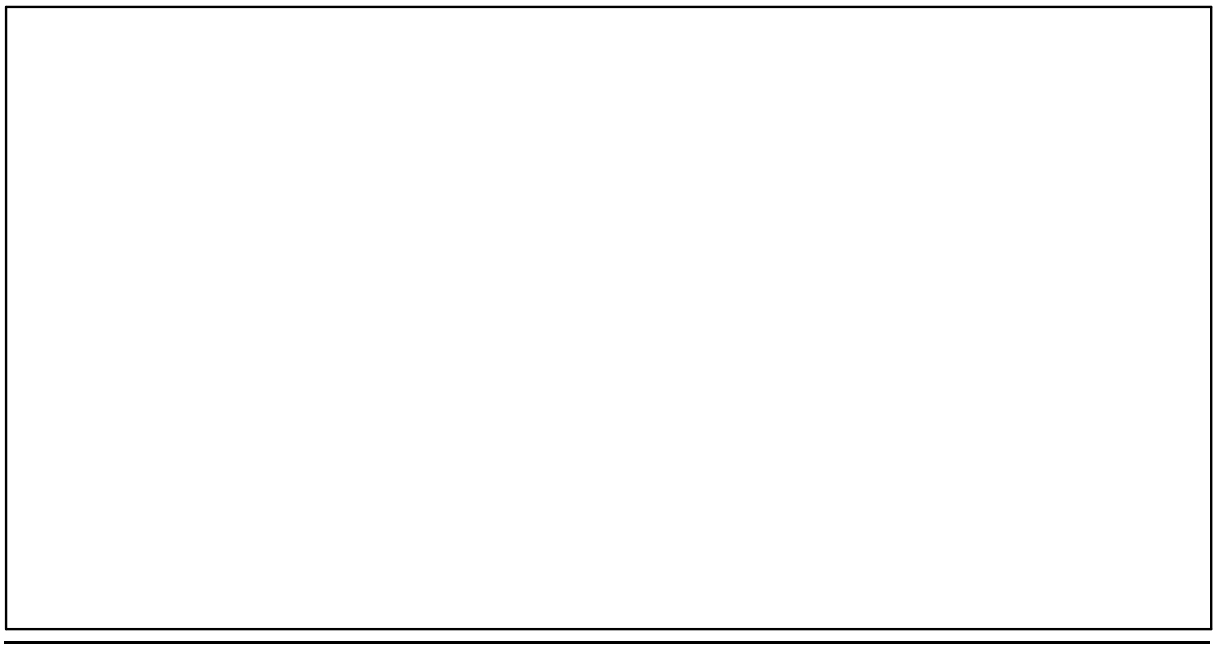
2._____

Reaction with Hydrogen Iodide

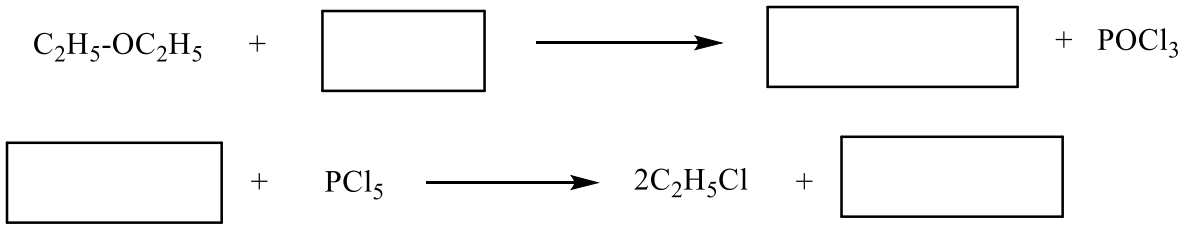




Practice Reaction



Reaction with Phosphorus pentachloride



Practice Reaction

Briefly comment on reactivity of ethers.

F. Conversion questions (according to order in book)

Worksheet 1

1. Convert molasses to ethanol

2. Convert starch to ethanol

3. Convert ethanol to ethyl chloride

4. Convert ethanol to ethyl amine

5. Convert ethanol to sodium ethoxide

6. Convert ethanol to methane

7. Convert ethanol to ethyl acetate

Worksheet 2

1. Convert ethanol to acetaldehyde

2. Convert 2-propanol to propanone (acetone)

3. Convert 2-Methyl-2-Propanol

4. Convert ethanol to ethene

5. Convert ethanol to diethyl ether.

6. Convert ethanol to ethyl chloride

Worksheet 3

1. Convert primary alcohol to primary alkyl chloride

2. Convert secondary alcohol to secondary alkyl chloride

3. Convert tertiary alcohol to tertiary alkyl chloride

4. Convert ethanol to iodoform

5. Can methanol be converted to iodoform? Give equation.

6. Convert benzyl chloride to phenol

7. Convert sodium salt of benzene sulphonic acid to phenol

8. Convert phenol to phenyl acetate

9. Convert phenol to benzene

10. Convert phenol to nitrophenol

11. Convert phenol to 2,4,6-trinitrophenol (Picric acid)

12. Convert phenol to hydroxybenzenesulphonic acid

Worksheet 4

1. Convert phenol 2,4,6-tribromophenol

2. Convert phenol to cyclohexanol

3. Convert phenol to hydroxybenzyl alcohol

4. Convert phenol to Bakelite

_____

5. Convert ethanol to sodium ethoxide

_____

_____

6. Convert ethanol to diethyl ether

_____

_____

7. Convert diethyl ether to ethanol

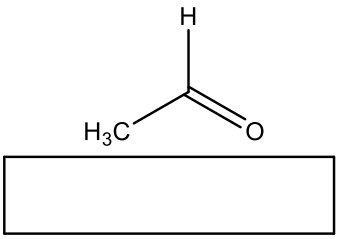
_____

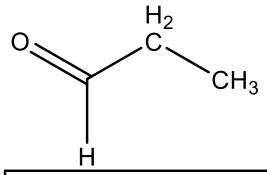
Chapter 12

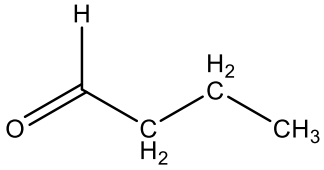
Aldehydes and Ketones

A. Give names of the following compounds.

HCHO







B. Give structures of the following compounds according to IUPAC names.

Methanal

Ethanal

Propanal

2-Chlorobutanal

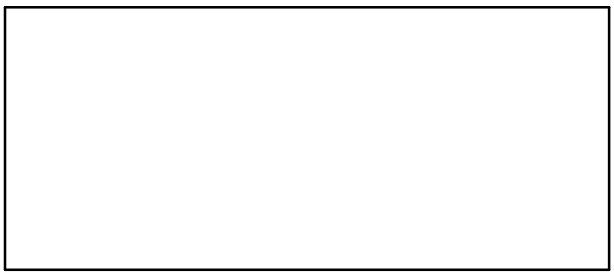
Benzaldehyde

Propanone

Common name:_____

Butanone

Common name:_____



Acetophenone

Learn the Reaction Conditions

- Methanol to formaldehyde: FeO, Mo_2O_3/500 ºC
- Dry distillation of calcium salts of acids to make acetaldehyde: Heat
- Formaldehyde to formaldehyde cyanohydrin: NaCN/HCl
- Ethanol to acetaldehyde: $Na_2Cr_2O_7/H_2SO_4/\Delta$
- Ethene to acetaldehyde: $PdCl_2/CuCl_2/H_2O$
- Formaldehyde to formaldehyde cyanohydrin: NaCN/HCl Same condition for acetaldehyde and acetone cyanohydrins
- Bisulphite addition product to acetaldehyde: Δ
- Calcium acetate to acetone: Dry distillation/heat
- Aldol condensation: dil. NaOH
- 3-Hydroxybutanal to crotonaldehyde: dil.HCl/Δ
- Cannizzaro's reaction: 50% NaOH
- Reaction of ammonia derivatives with aldehydes & ketones: H^+
- Addition of alcohols to acetaldehyde: Dry HCl
- Reduction of aldehydes & ketones: $NaBH_4/H_3O^+$
- Catalytic reduction: Pd, Pt, Ni
- Oxidation of aldehydes: $K_2Cr_2O_7/H_2SO_4$
- Oxidation of ketones: $K_2Cr_2O_7/H_2SO_4$ (NOT EASY)

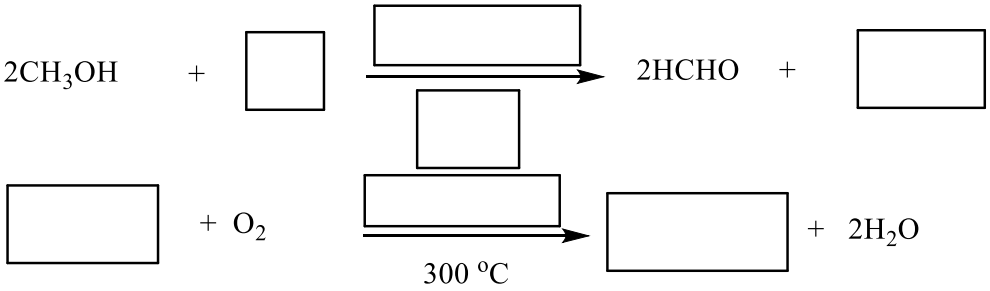
C. Match the correct reaction condition.

Reaction	Condition
Oxidation of aldehydes	Pd, Pt, Ni
Methanol to formaldehyde	$K_2Cr_2O_7/H_2SO_4$
Catalytic reduction	Dry HCl
Oxidation of ketones	H^+
Addition of alcohols to acetaldehyde	dil.HCl/Δ

Reduction of aldehydes & ketones	dil. NaOH
Ethene to acetaldehyde	FeO, Mo_2O_3/500 °C
Reaction of ammonia derivatives with aldehydes & ketones	Dry distillation/heat
Cannizzaro's reaction	50% NaOH
Bisulphite addition product to acetaldehyde	NaCN/HCl
Calcium acetate to acetone	Δ
3-Hydroxybutanal to crotonaldehyde	NaCN/HCl Same condition for acetaldehyde and acetone cyanohydrins
Formaldehyde to formaldehyde cyanohydrin	Heat
Aldol condensation	$NaBH_4/H_3O^+$
Dry distillation of calcium salts of acids to make acetaldehyde	$K_2Cr_2O_7/H_2SO_4$ (NOT EASY)
Formaldehyde to formaldehyde cyanohydrin	$Na_2Cr_2O_7/H_2SO_4/\Delta$
Ethanol to acetaldehyde	$PdCl_2/CuCl_2/H_2O$

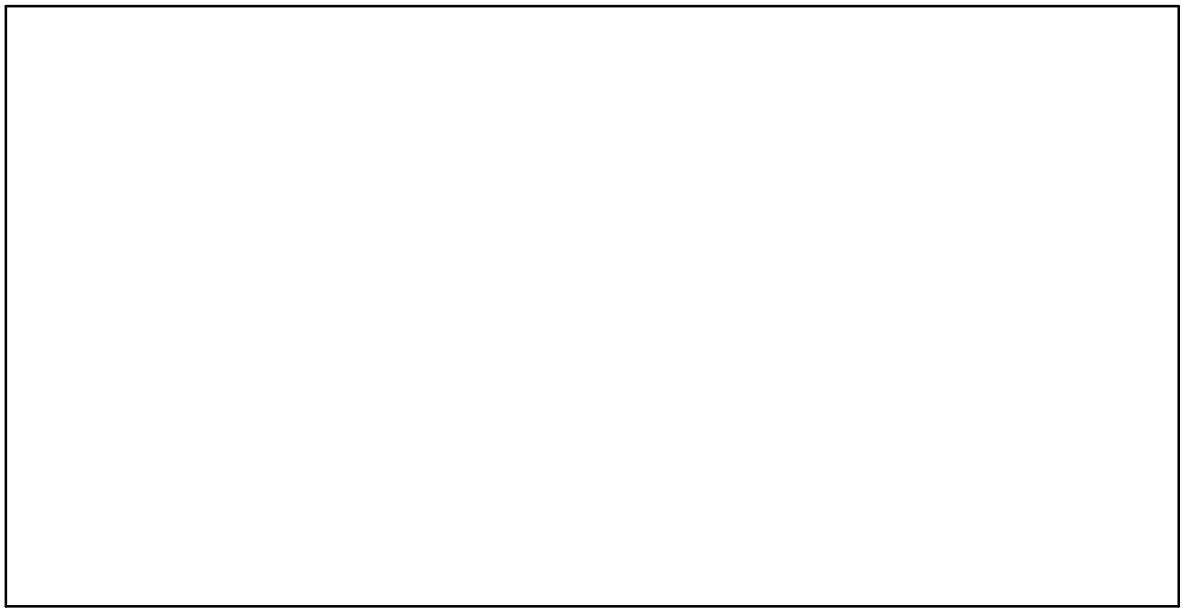
D. Learn through blanks.

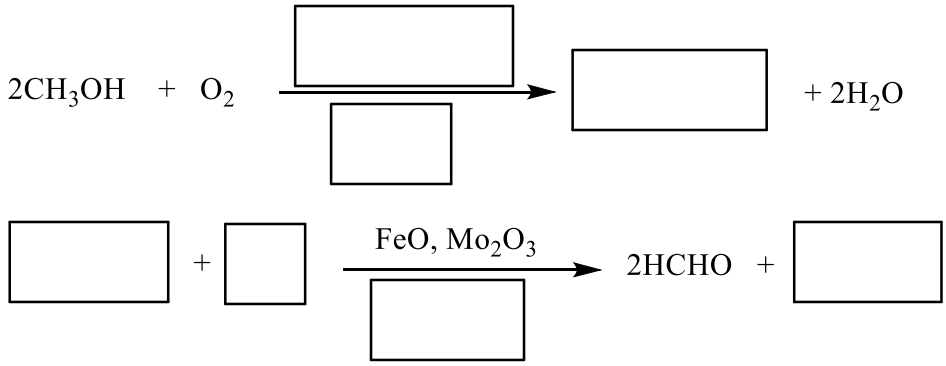
Name of Reaction:_____



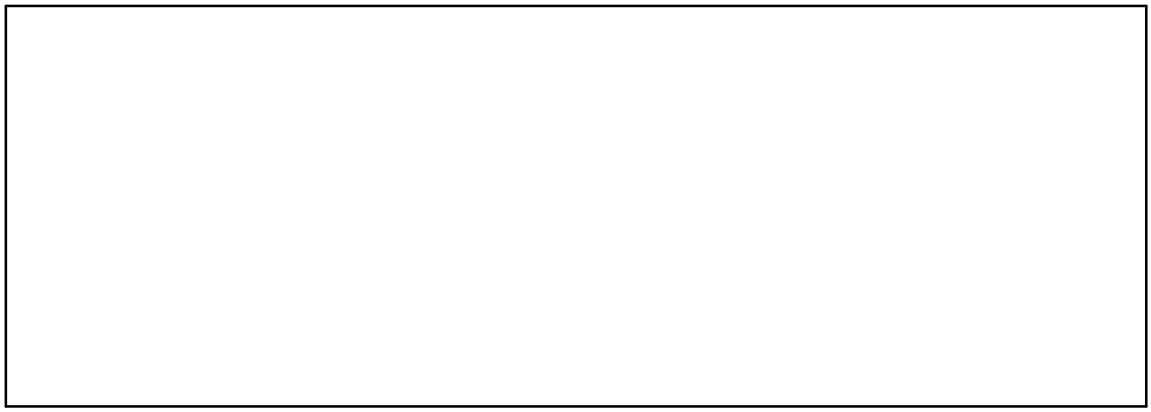
Practice Reaction

Draw a labelled diagram for laboratory preparation

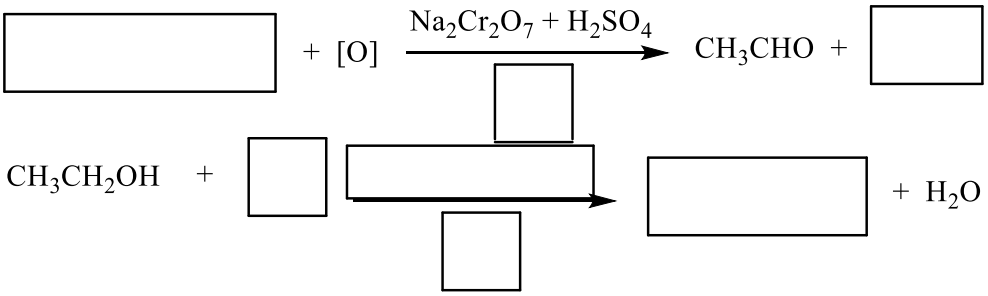




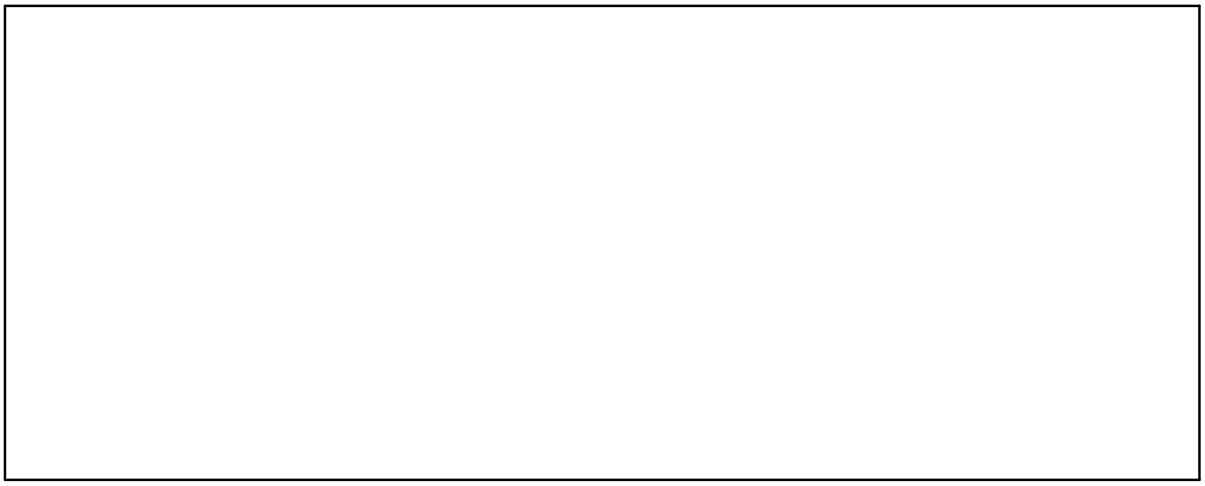
Practice Reaction



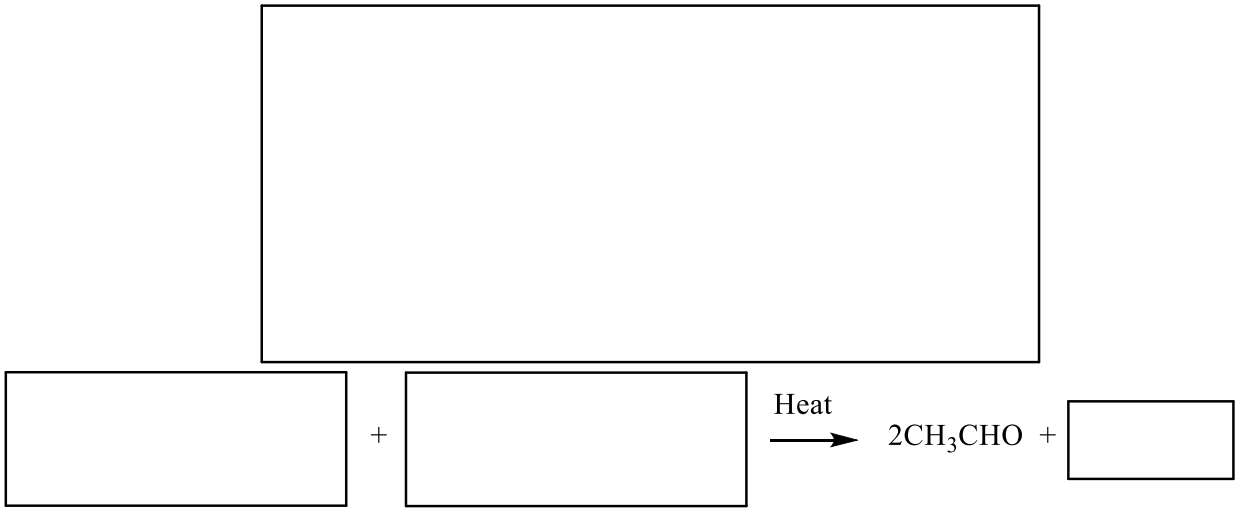
Name of Reaction: _____

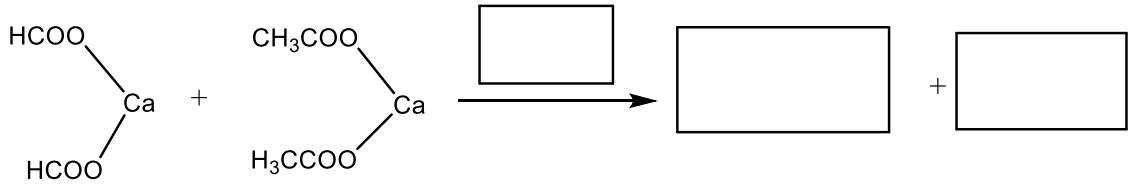


Practice Reaction



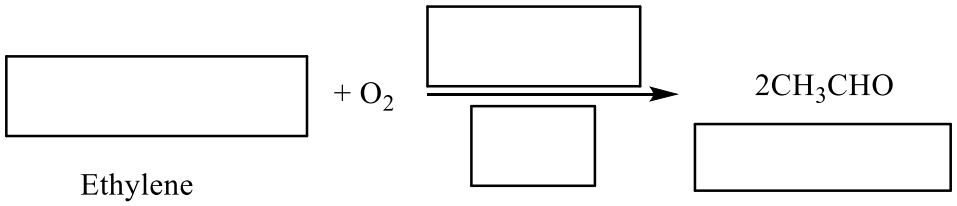
Labelled diagram for the laboratory preparation



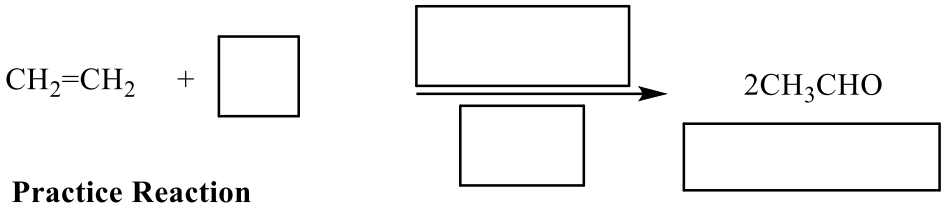


Practice Reaction

Name of Reaction: _____

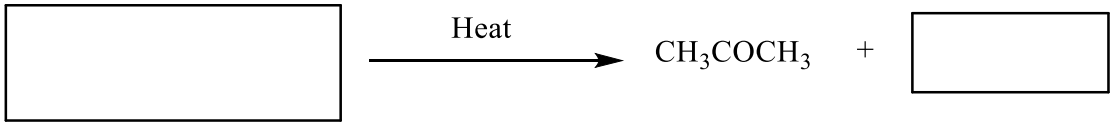


Ethylene

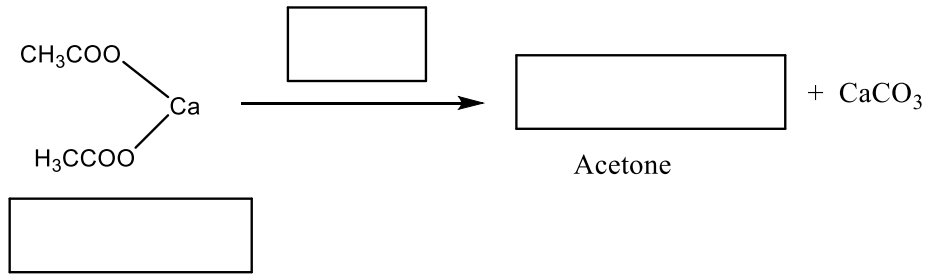


Practice Reaction

Name of Reaction: _____



Calcium acetate

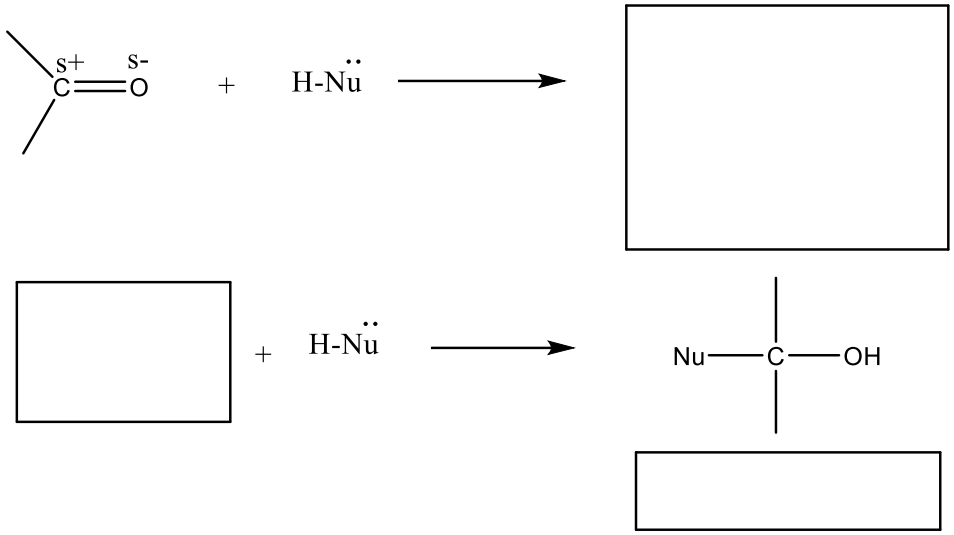


Practice Reaction

Briefly comment on the reactivity of carbonyl compounds.

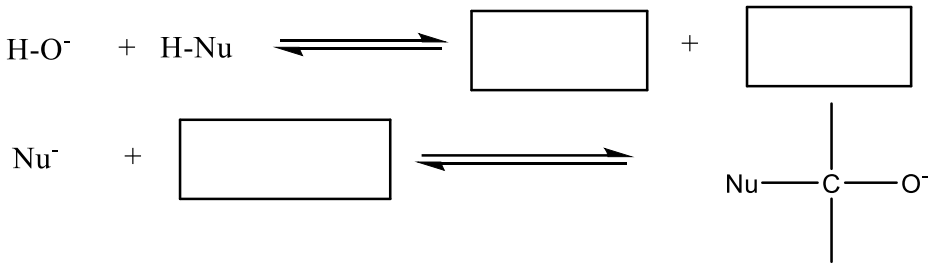
_____
_____
_____
_____

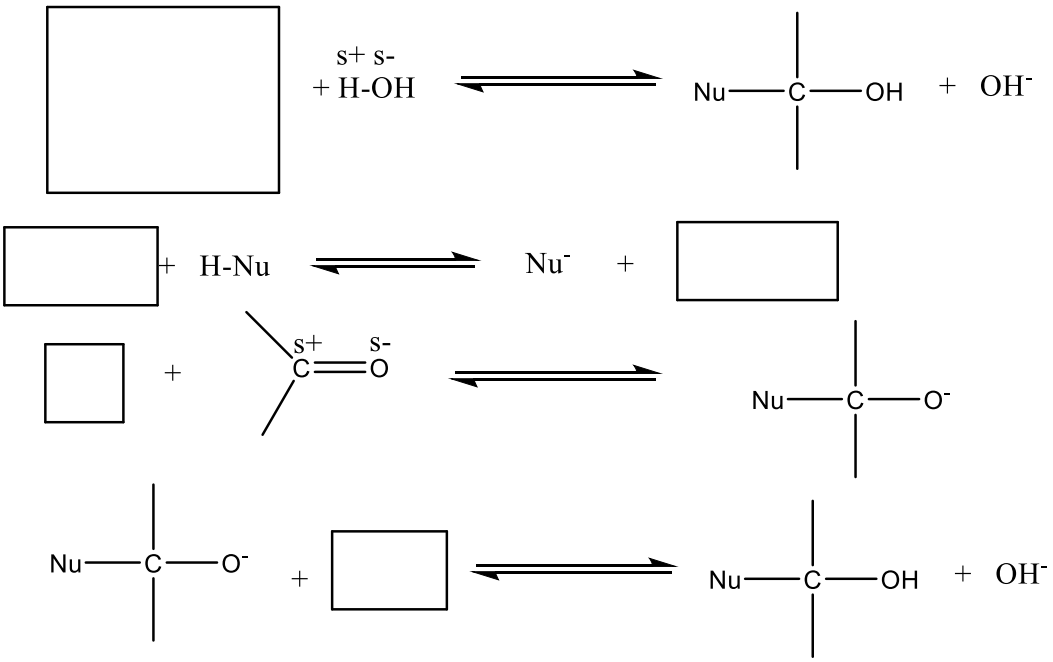
Name of Reaction: _____



Practice Reaction

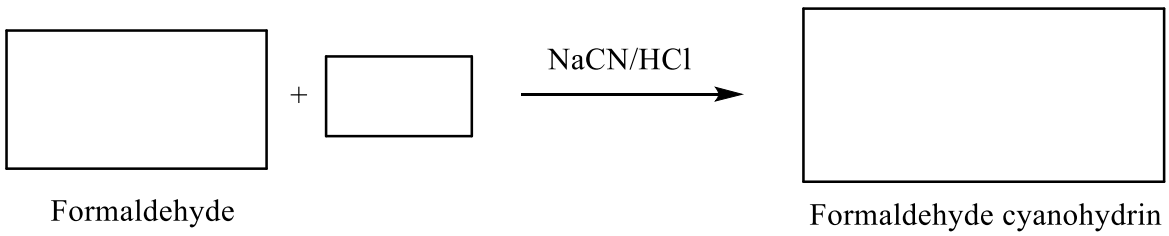
General Mechanism of Base-Catalyzed Addition Reactions

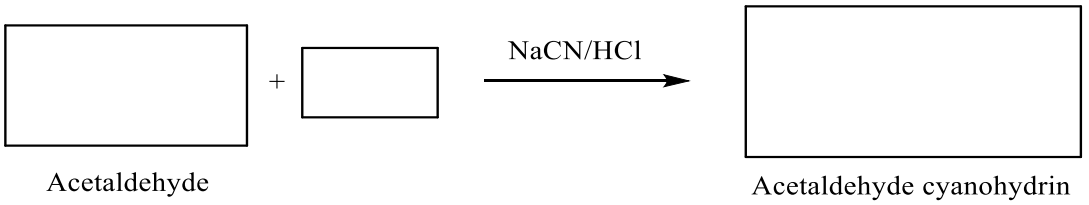


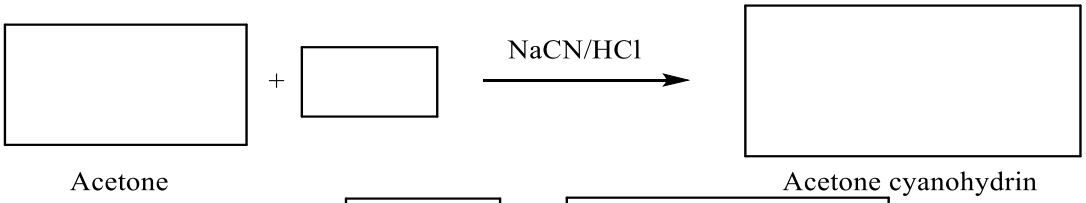


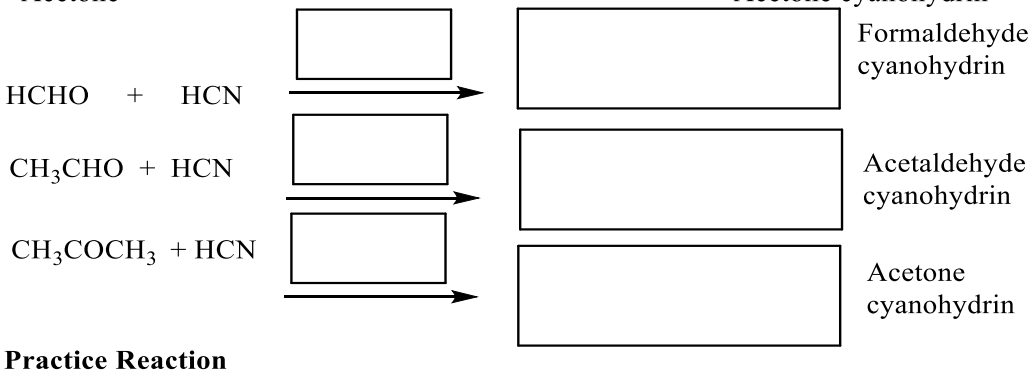
Practice Reaction

Addition of Hydrogen Cyanide

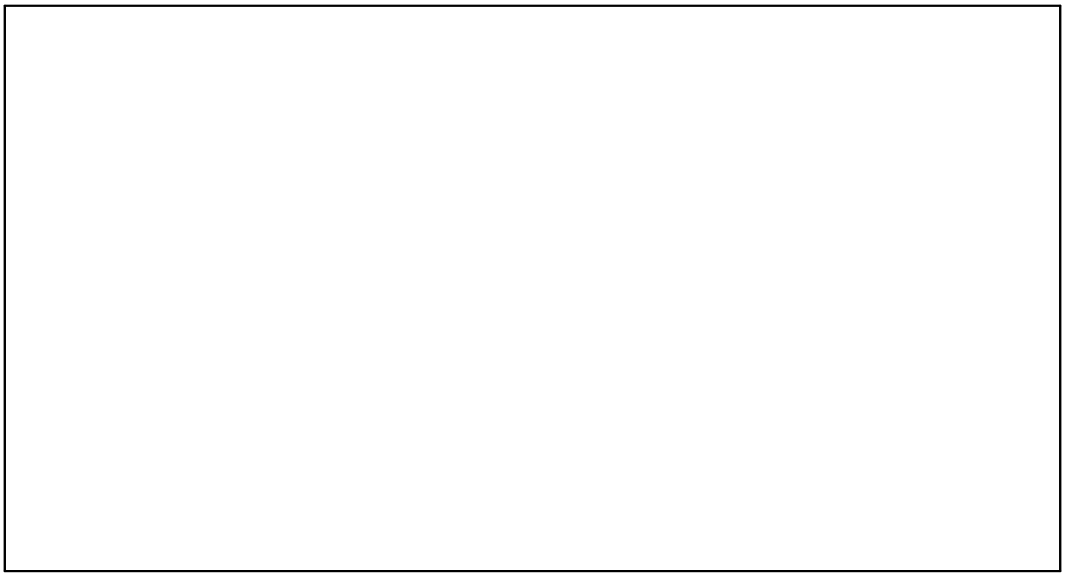


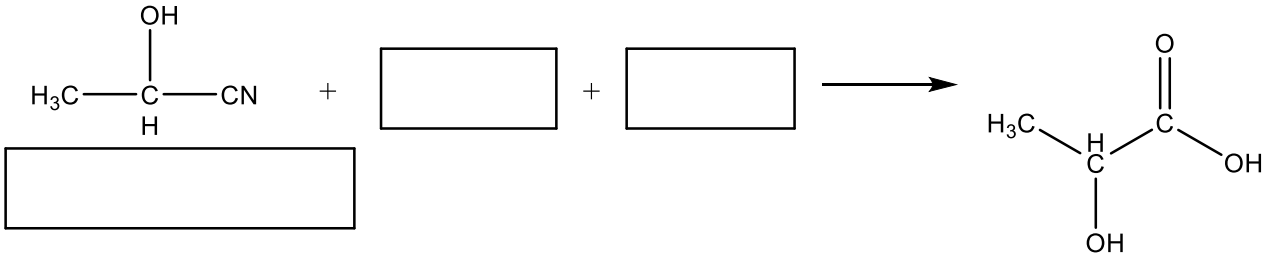


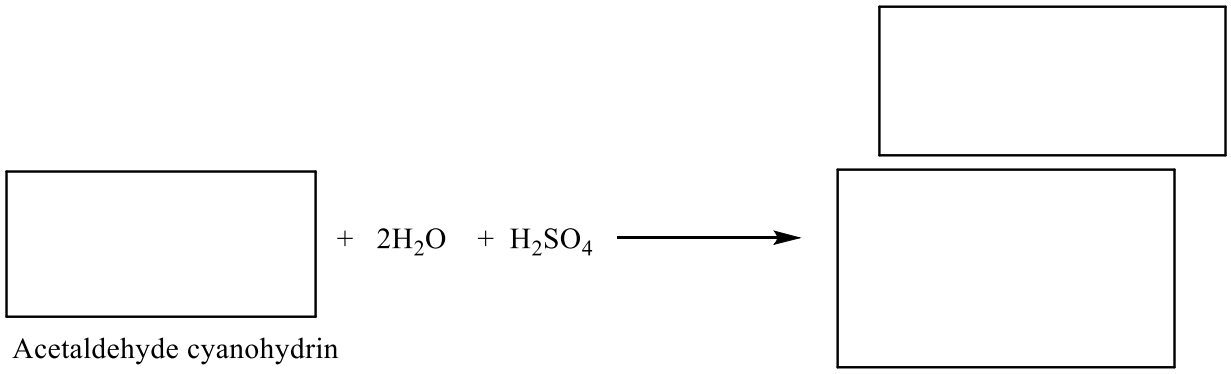




Practice Reaction



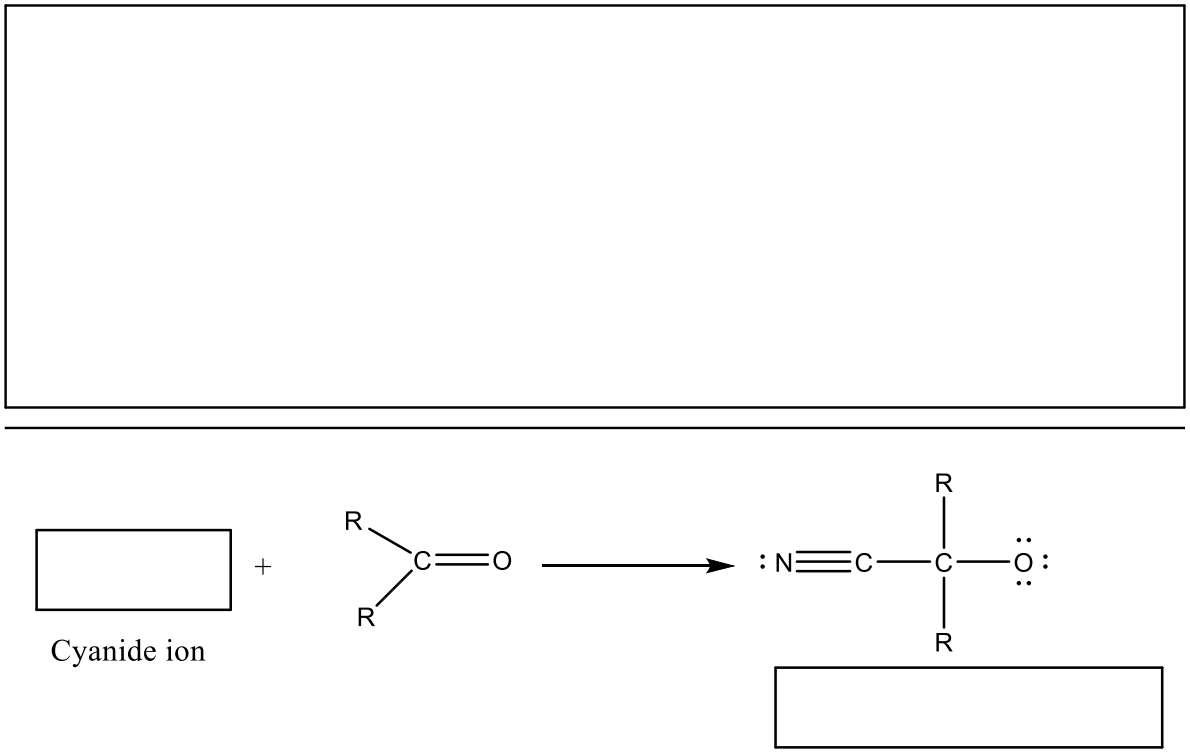




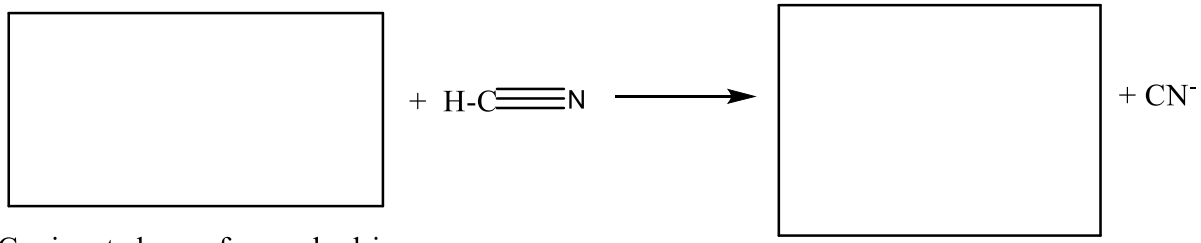
Acetaldehyde cyanohydrin

2-Hydroxypropanoic acid
(Lactic acid)

Practice Reaction

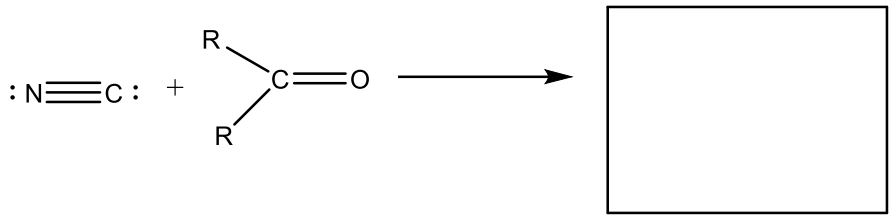


Cyanide ion

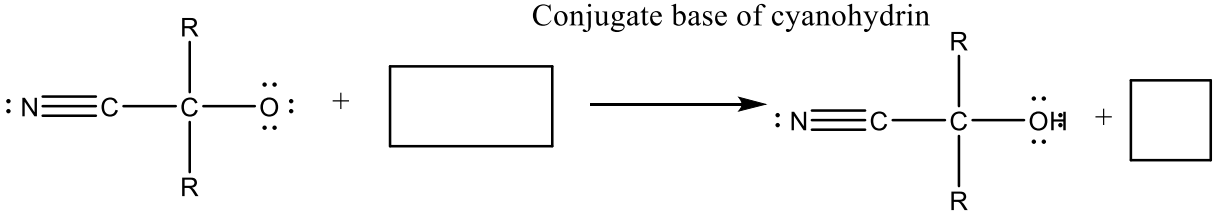


Conjugate base of cyanohydrin

Cyanohydrin

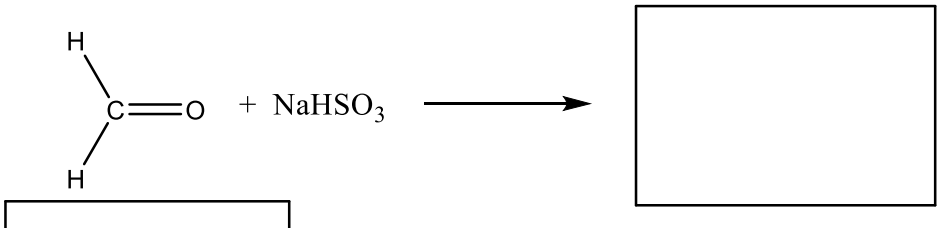


Conjugate base of cyanohydrin

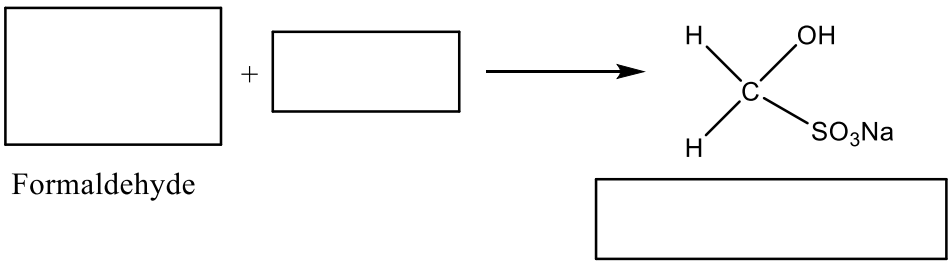


Practice Reaction

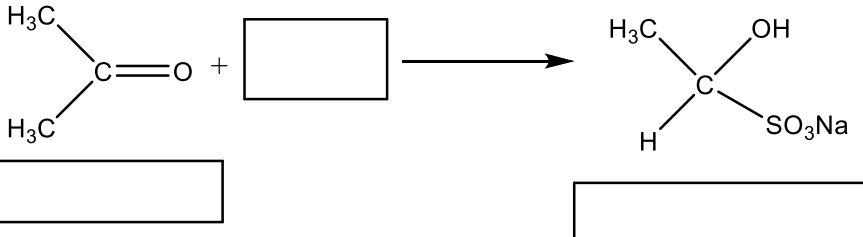
Addition of Sodium Bisulphite

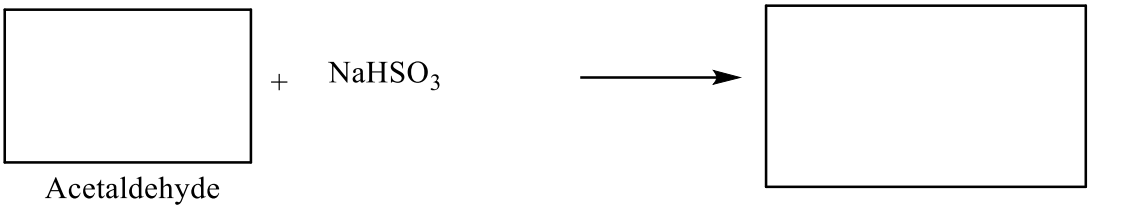


Bisulphite addition product



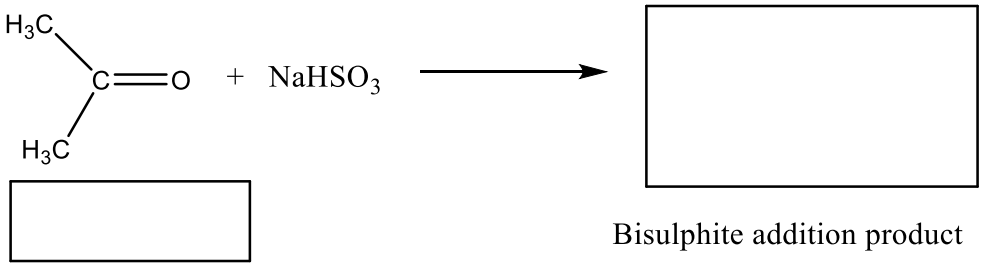
Formaldehyde



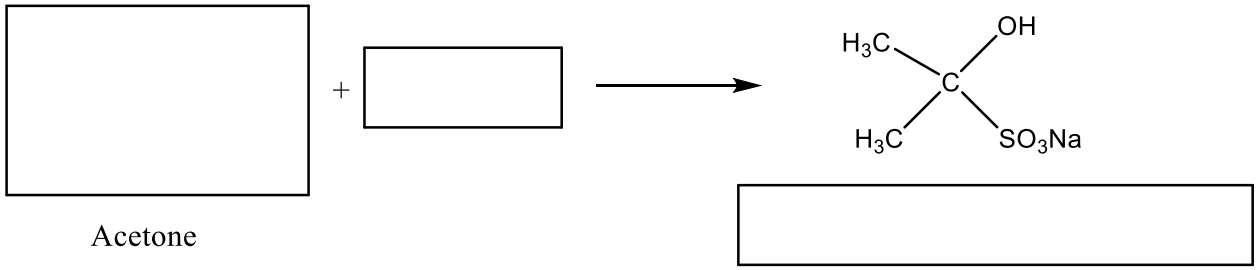


Acetaldehyde

Bisulphite addition product

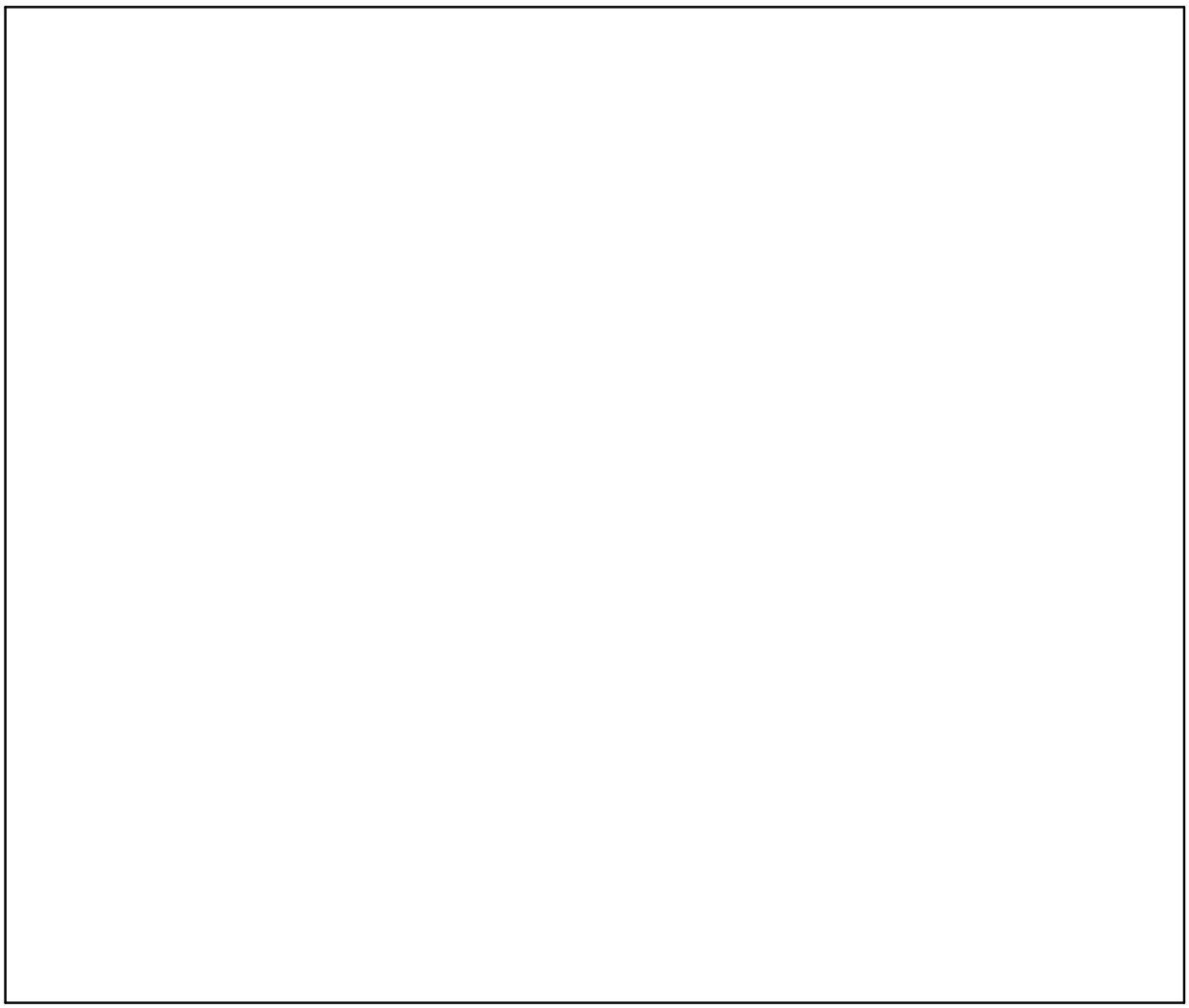


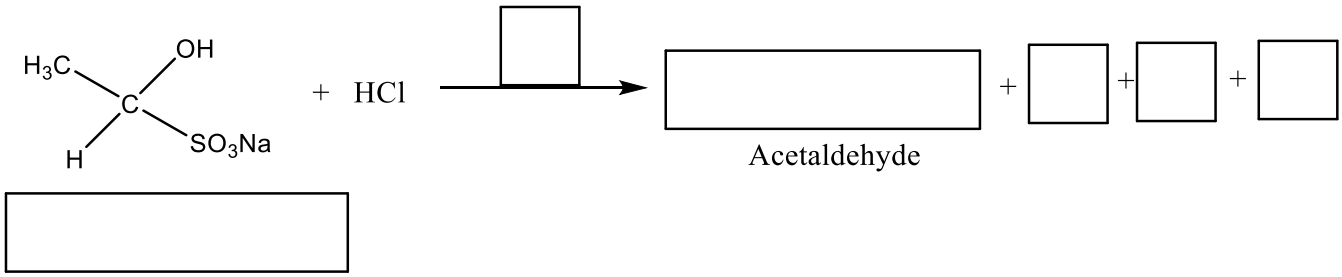
Bisulphite addition product



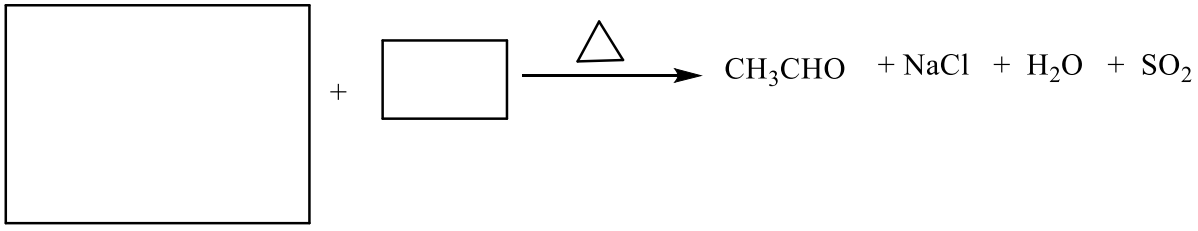
Acetone

Practice Reaction



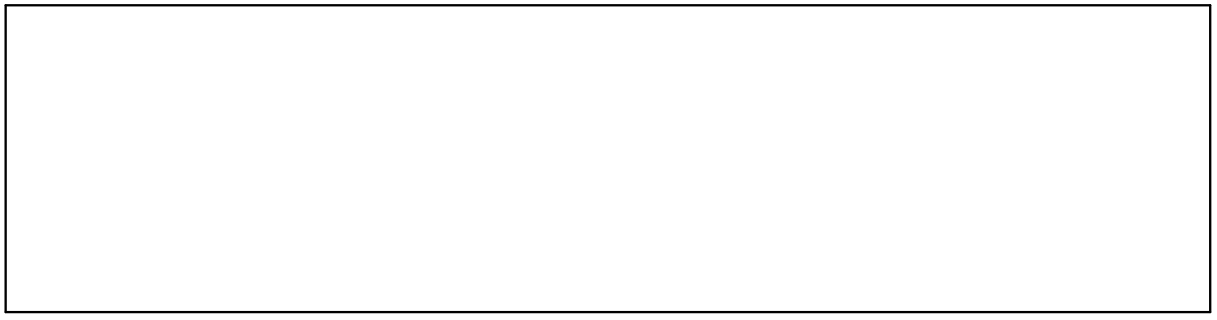


Acetaldehyde

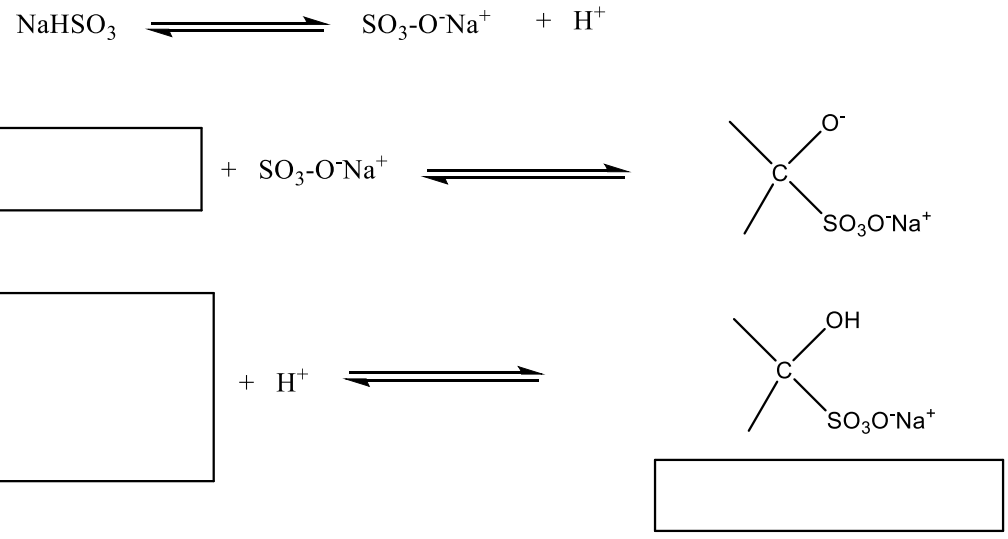


Bisulphite addition product

Practice Reaction



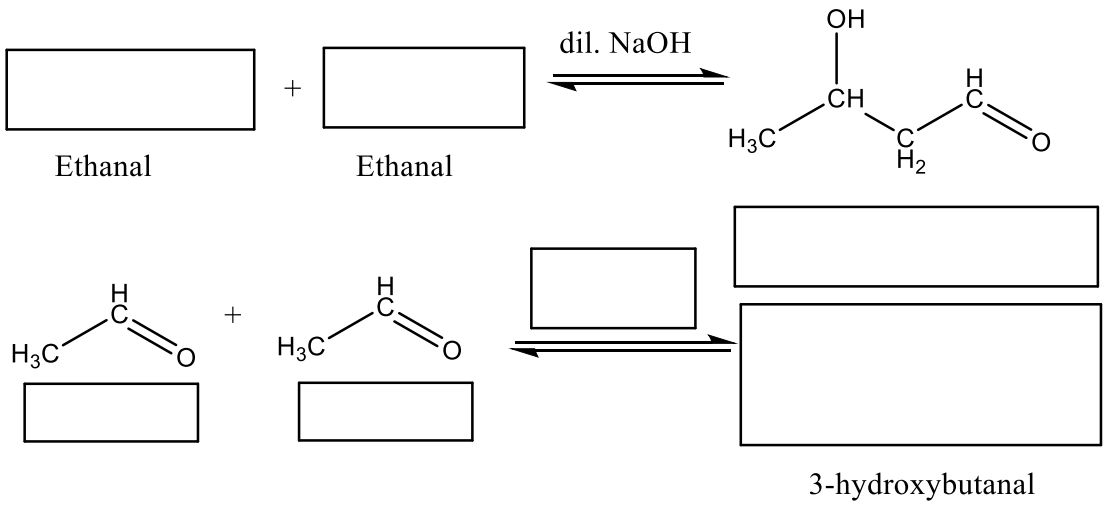
Mechanism

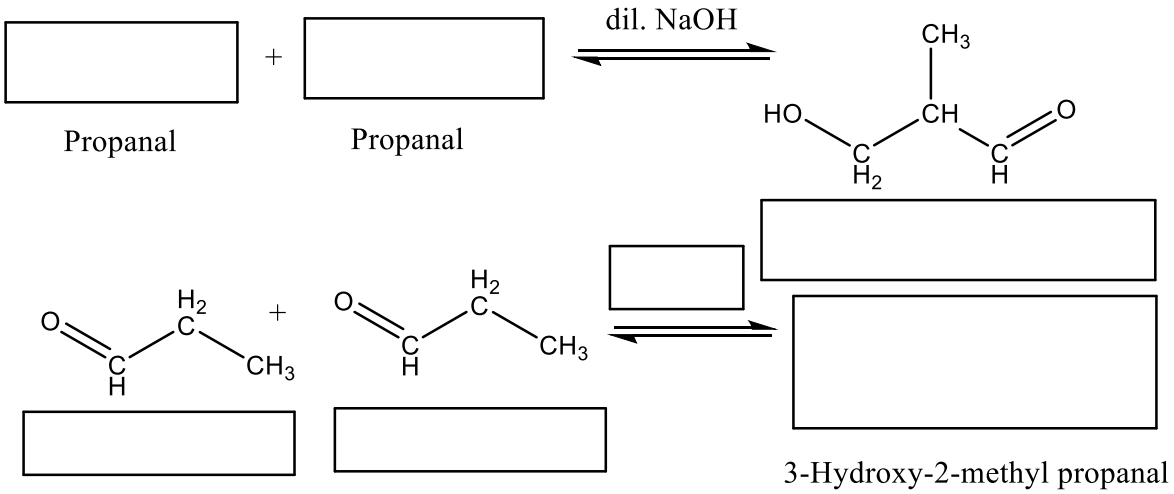


Practice Mechanism with arrows

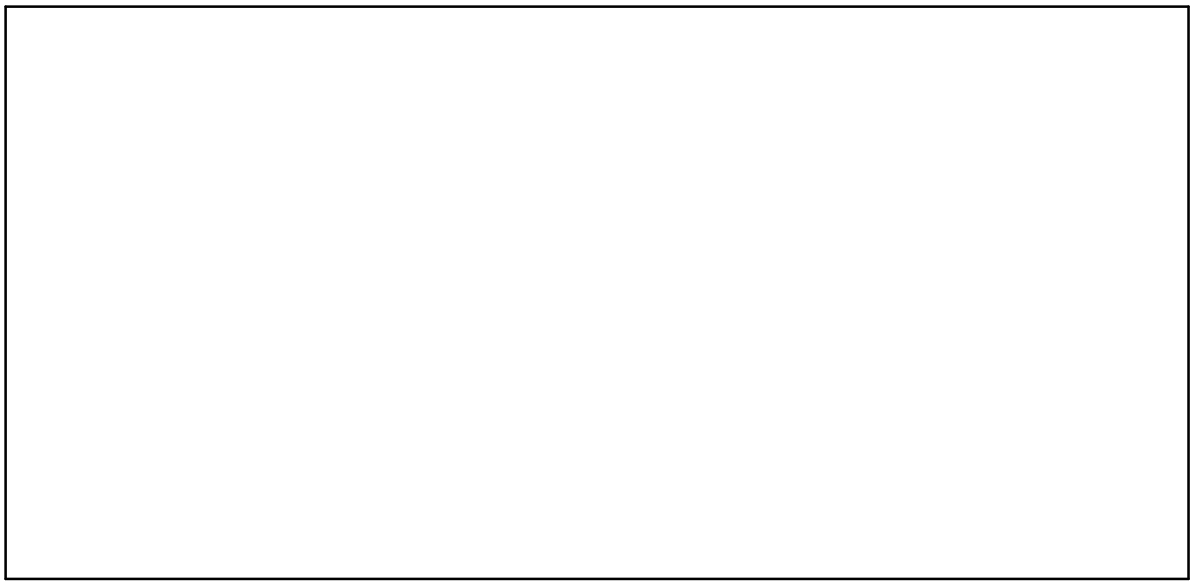
Aldol Condensation

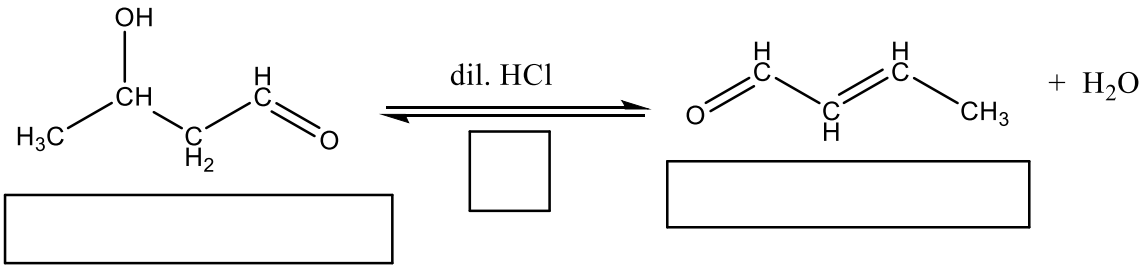
Definition



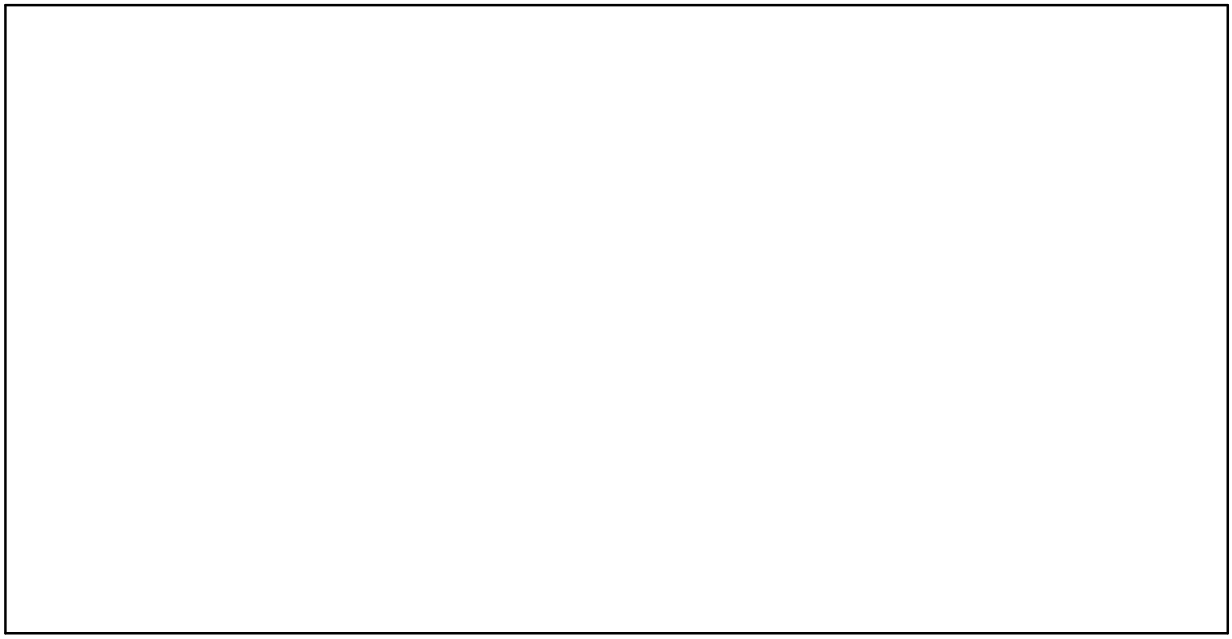


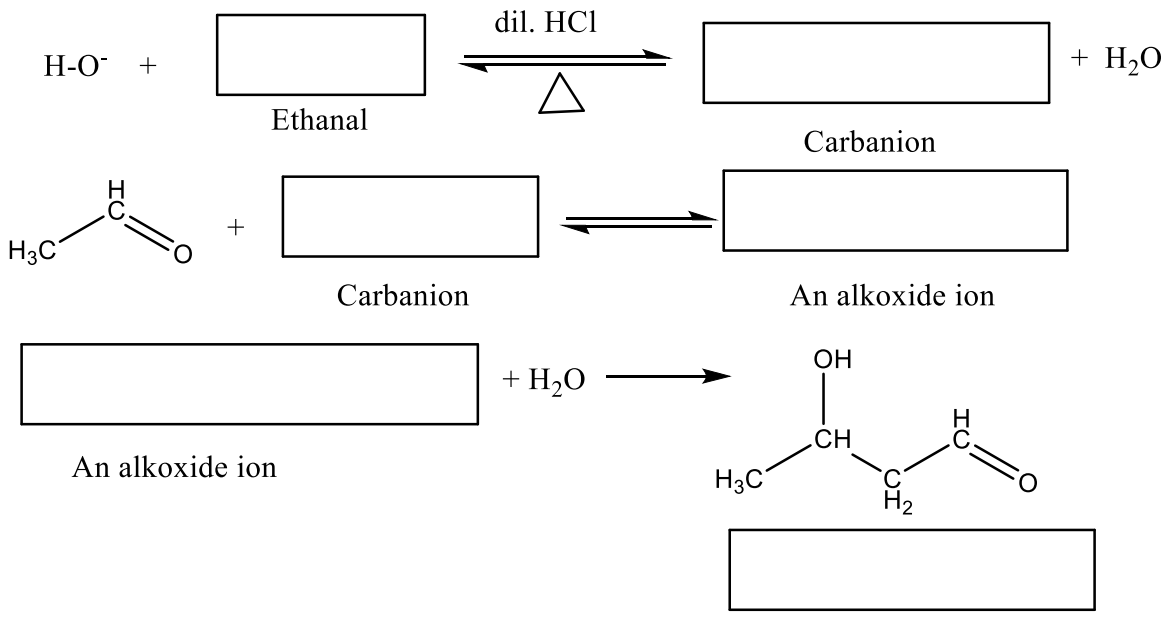
Practice Reaction



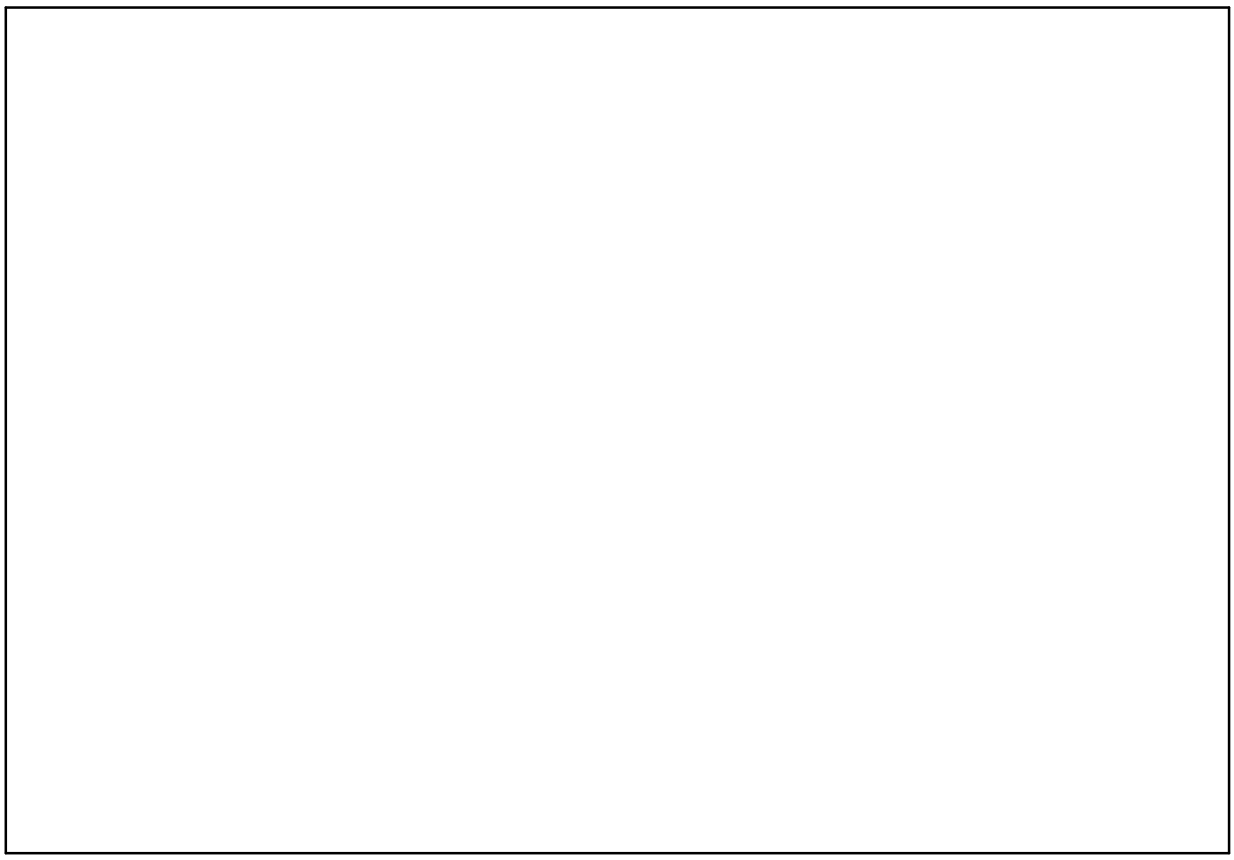


Practice Reaction





Practice Mechanism with arrows



Cannizzaro's Reaction

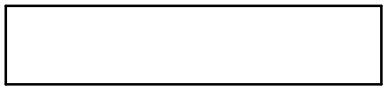
Definition

_____

_____

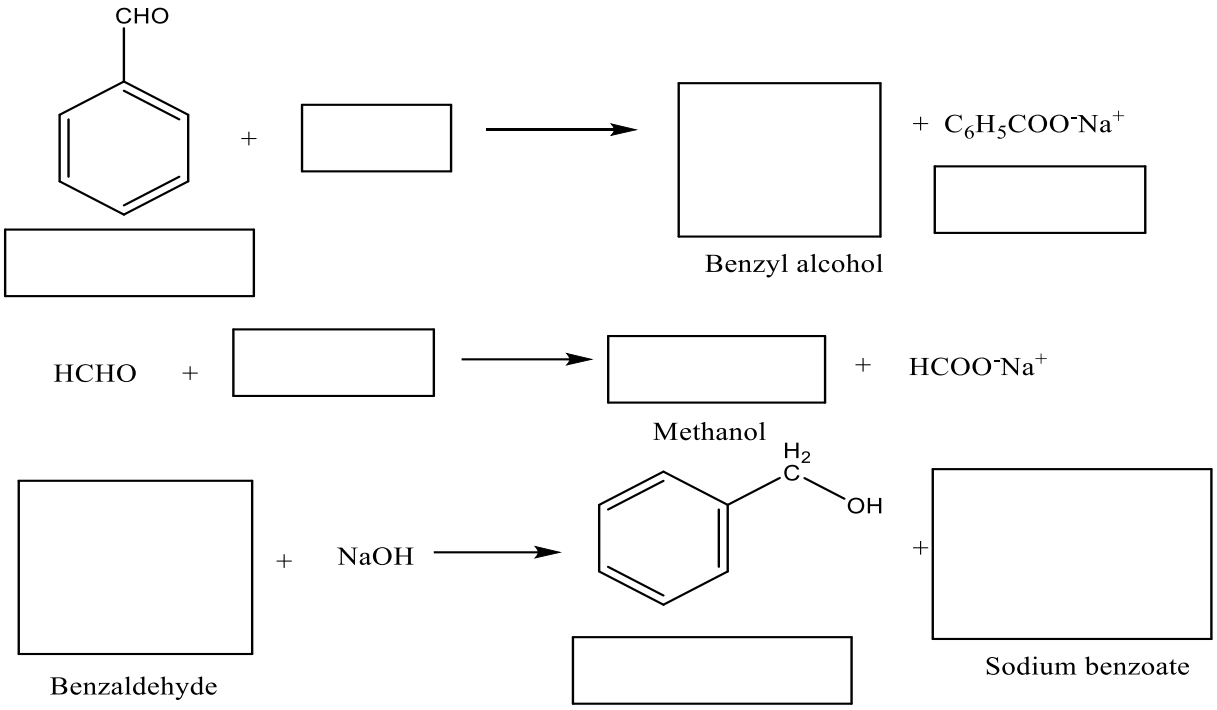
_____

_____

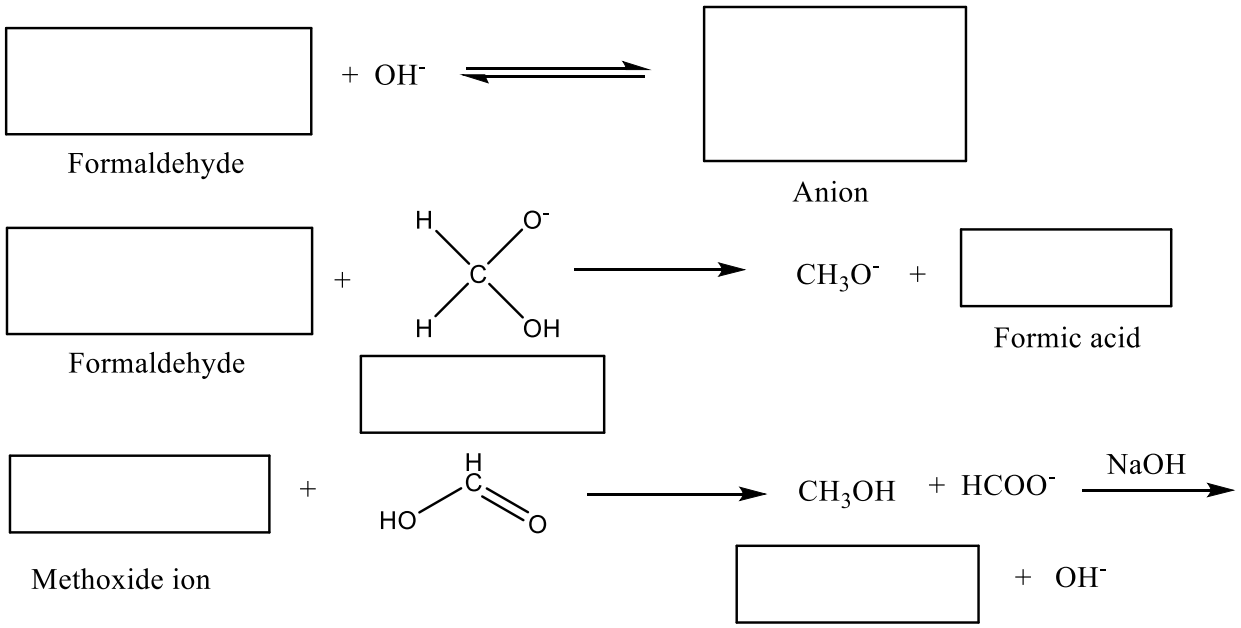


Formaldehyde

+ NaOH ⟶ CH_3OH + $HCOO^-Na^+$



Practice Reactions



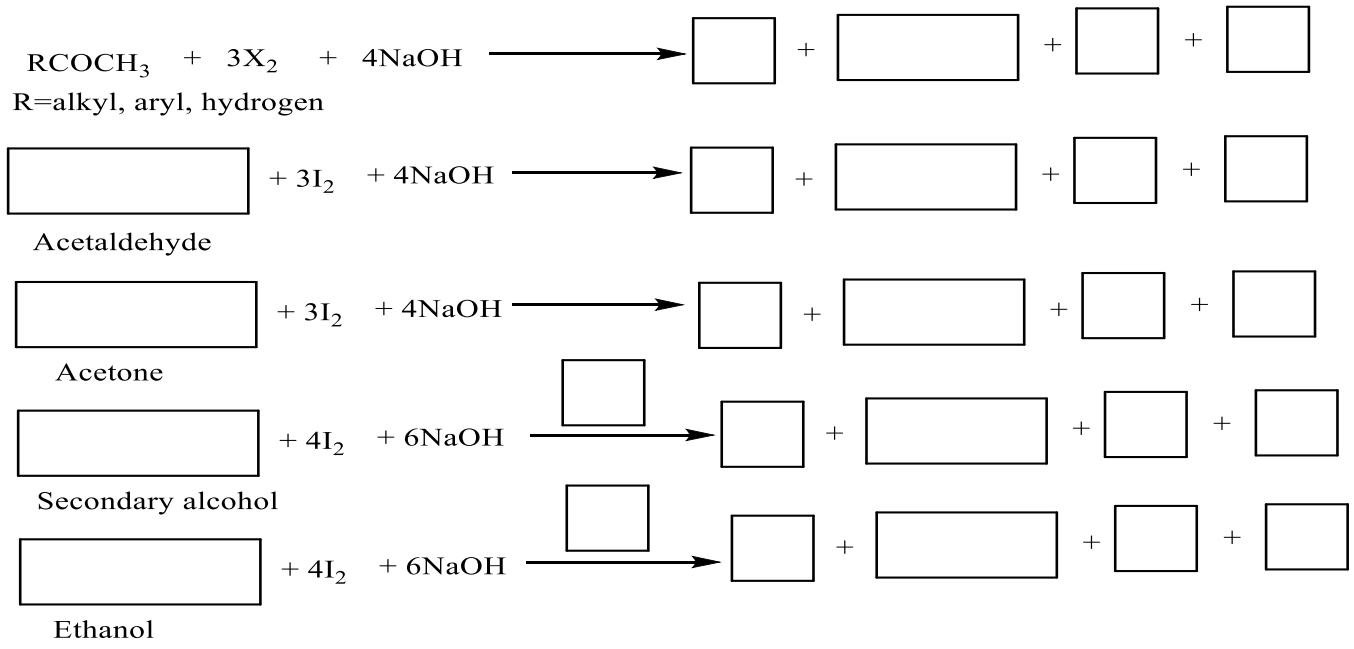
Practice Mechanism with arrows

Haloform Reaction

Definition

_____

_____



Practice Reactions

What is the significance of iodoform test?

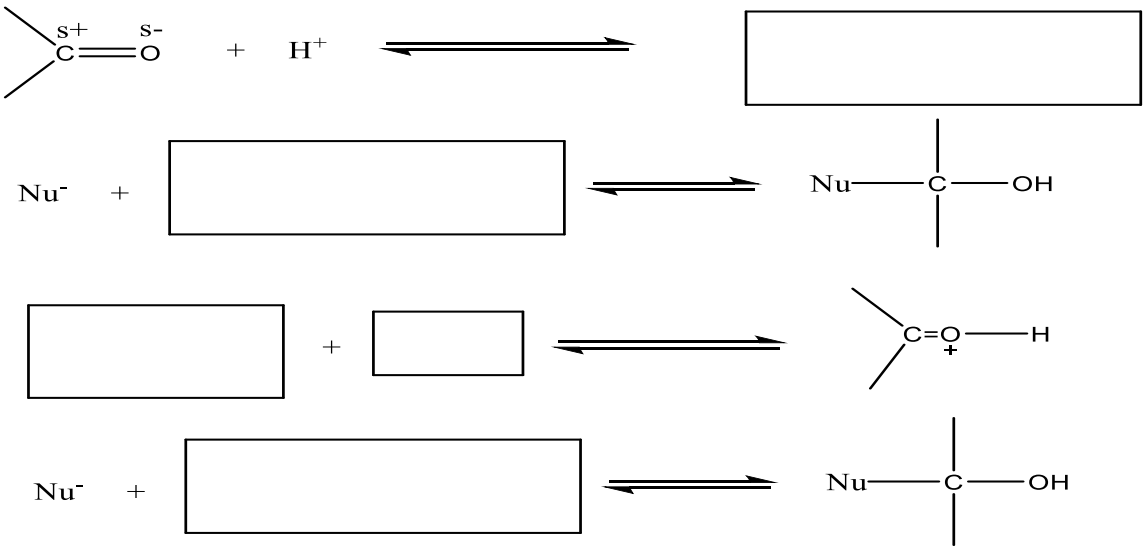
It produces_____which is water_____ and of_____colour

It distinguishes _____ketones from other_____

It distinguishes ethanol from_____

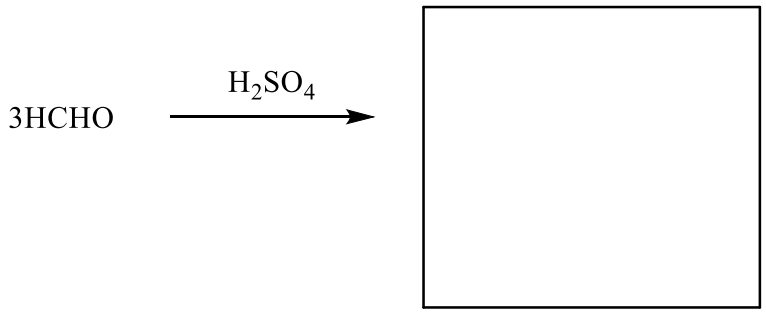
It distinguishes acetaldehyde from_____

Acid-Catalysed Addition Reactions

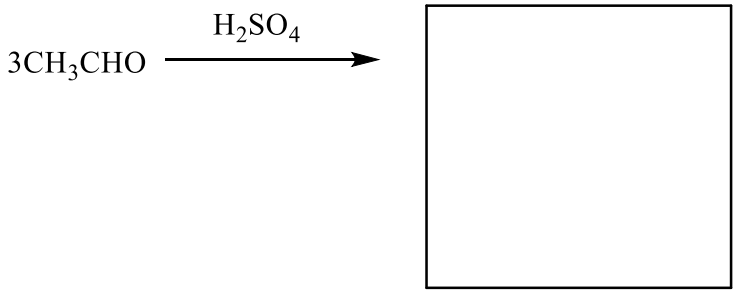


Practice Mechanism with arrows

Polymerization



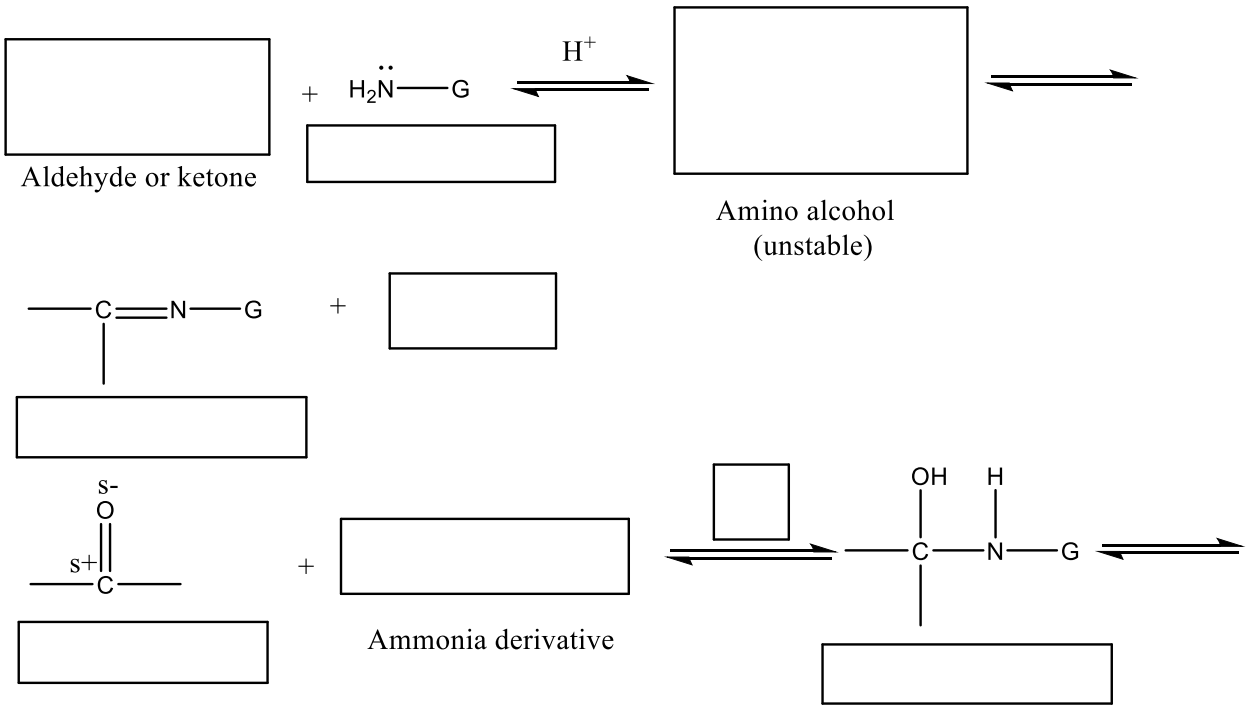
Metaformaldehyde



Paraldehyde

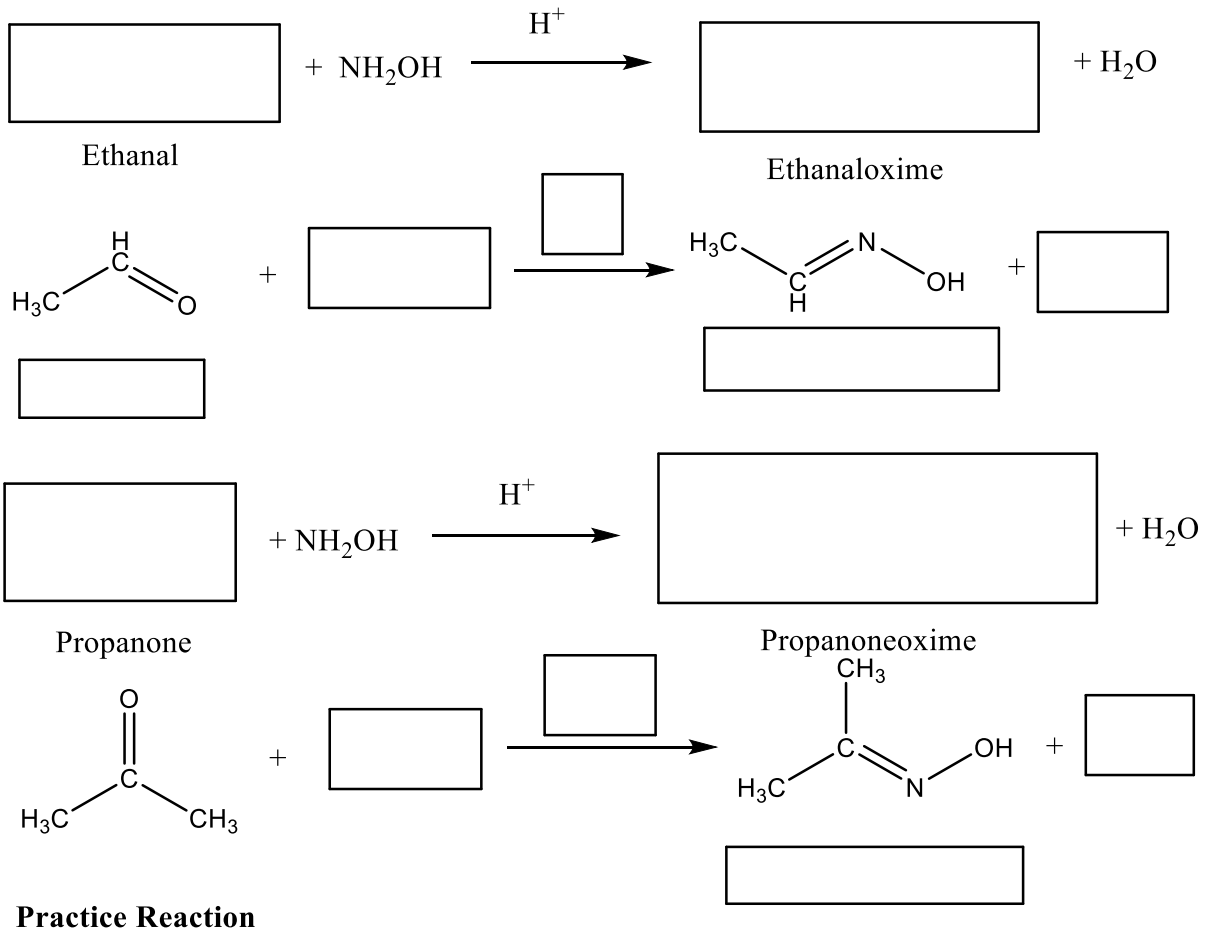
Practice Reaction

Reactions of Ammonia Derivatives



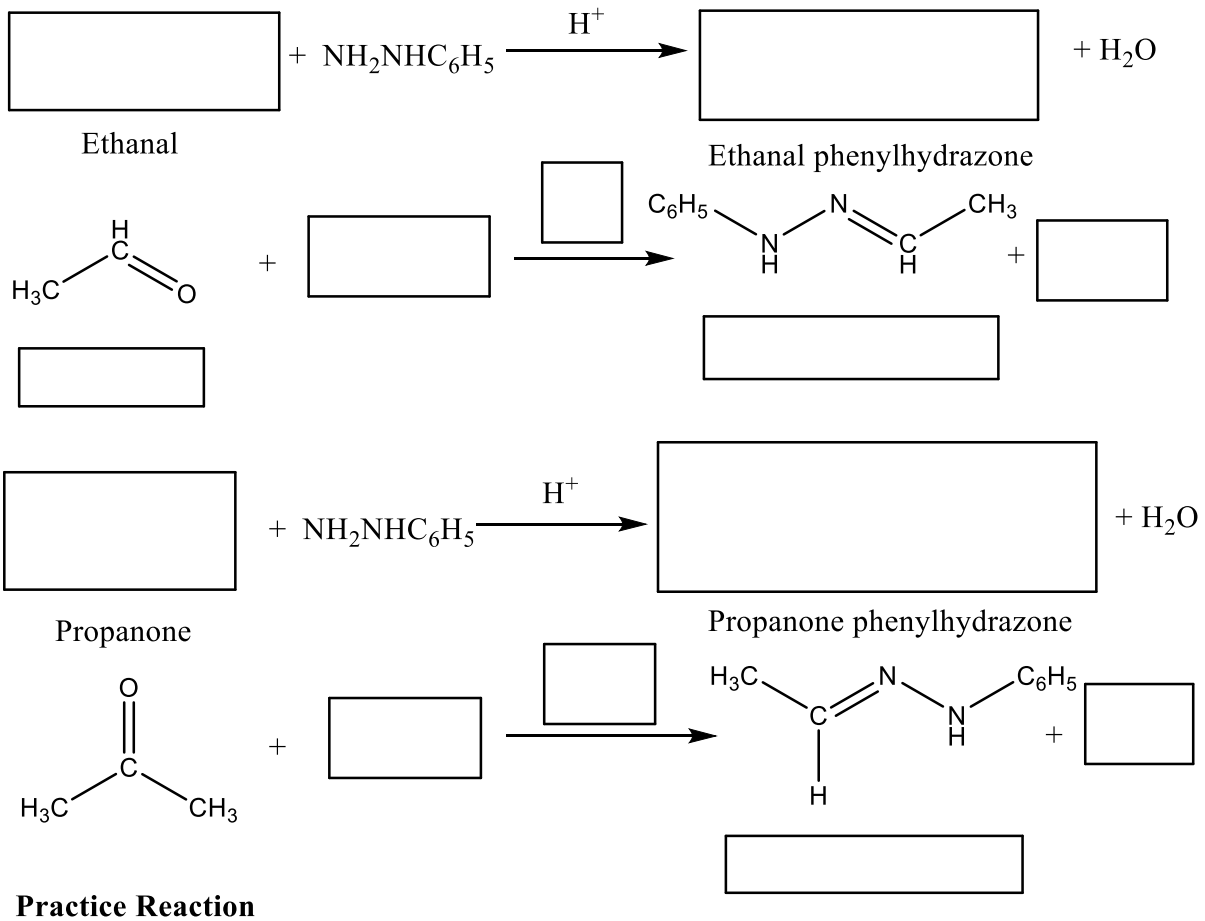
Practice Mechanism with arrows

Reaction with Hydroxylamine

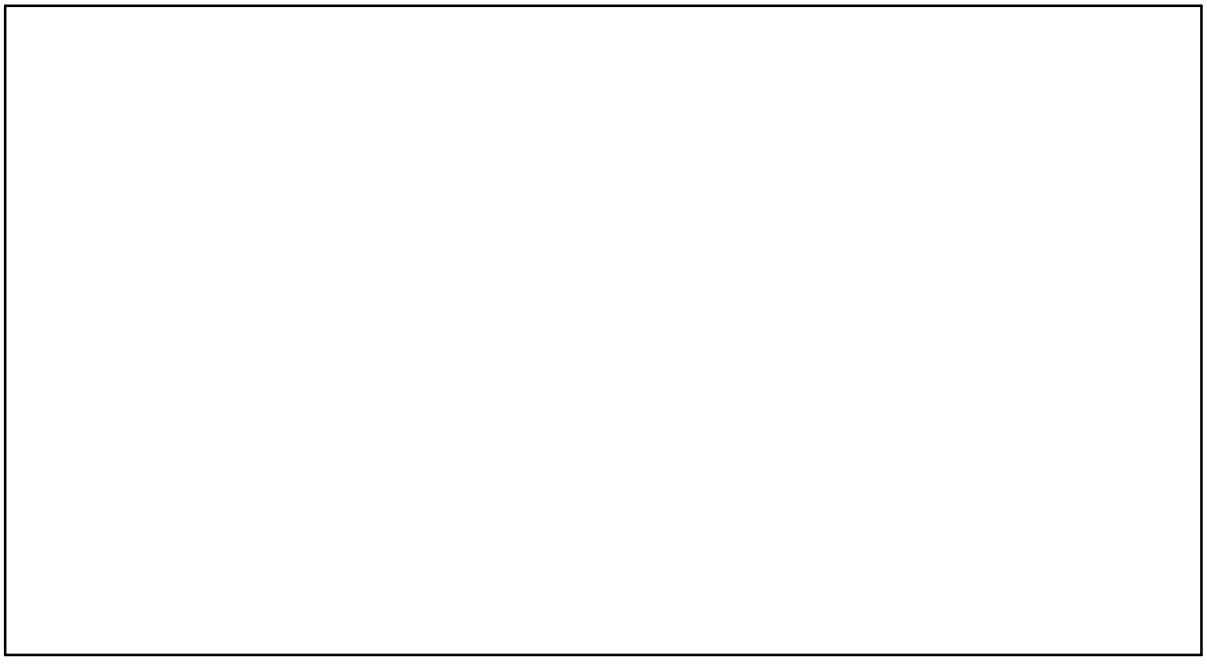


Practice Reaction

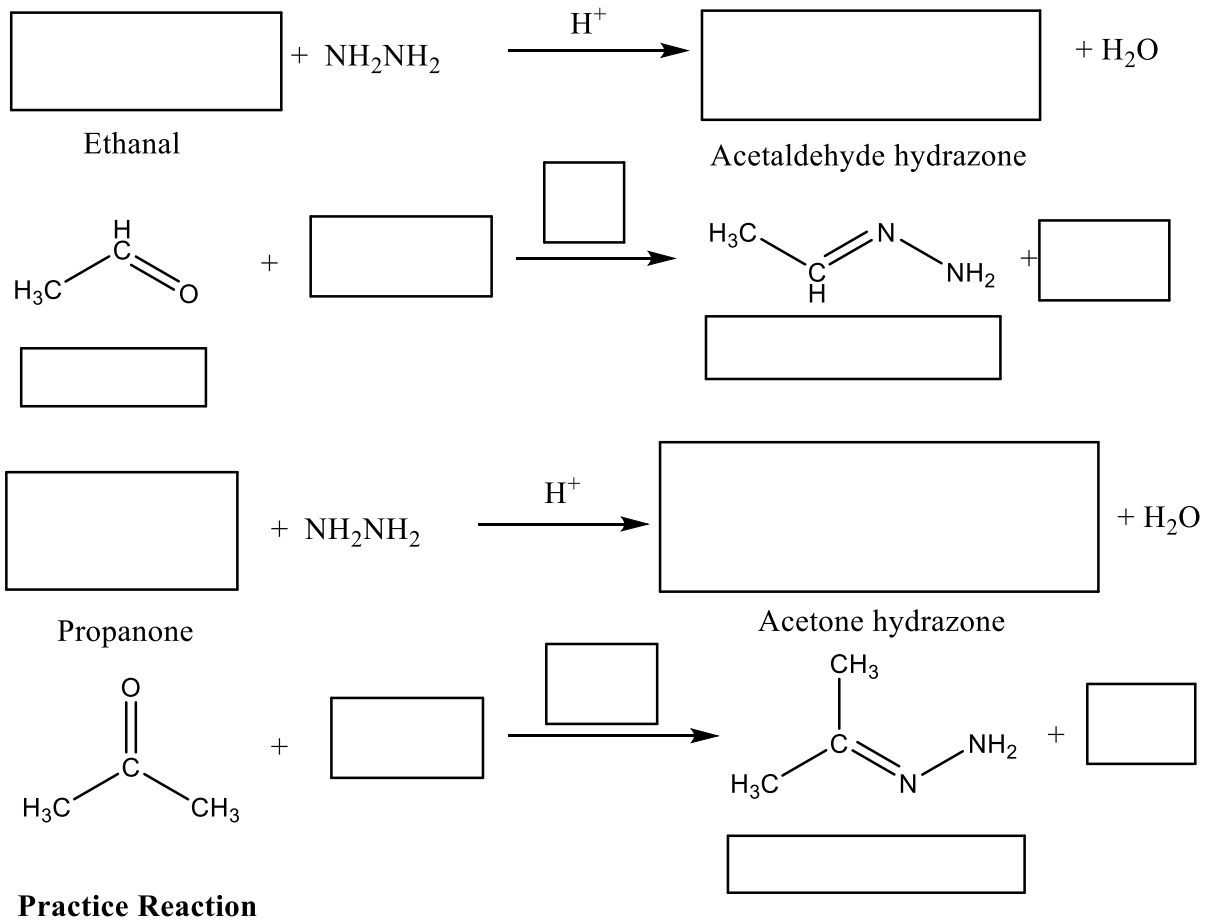
Reaction with Phenylhydrazine



Practice Reaction

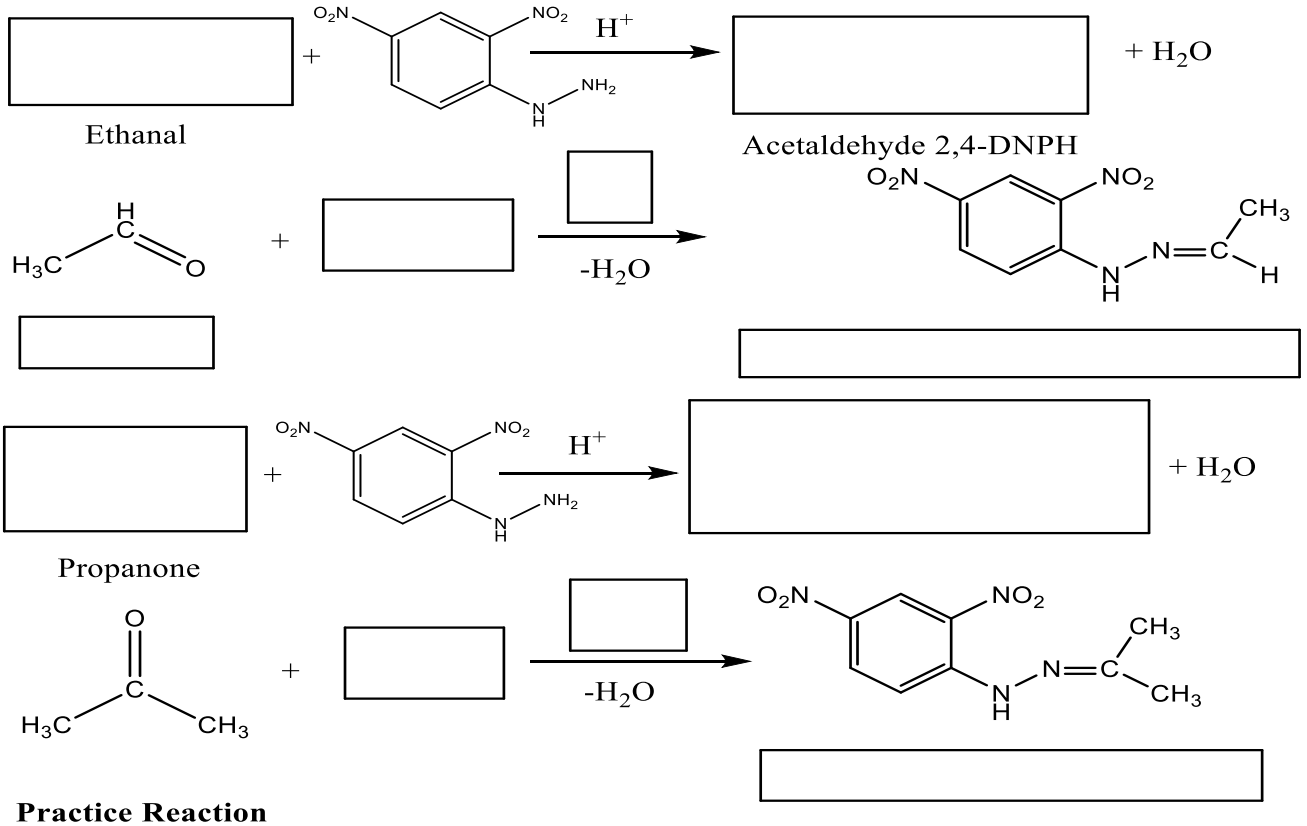


Reaction with Hydrazine



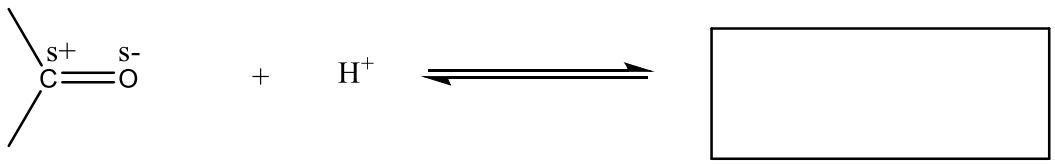
Practice Reaction

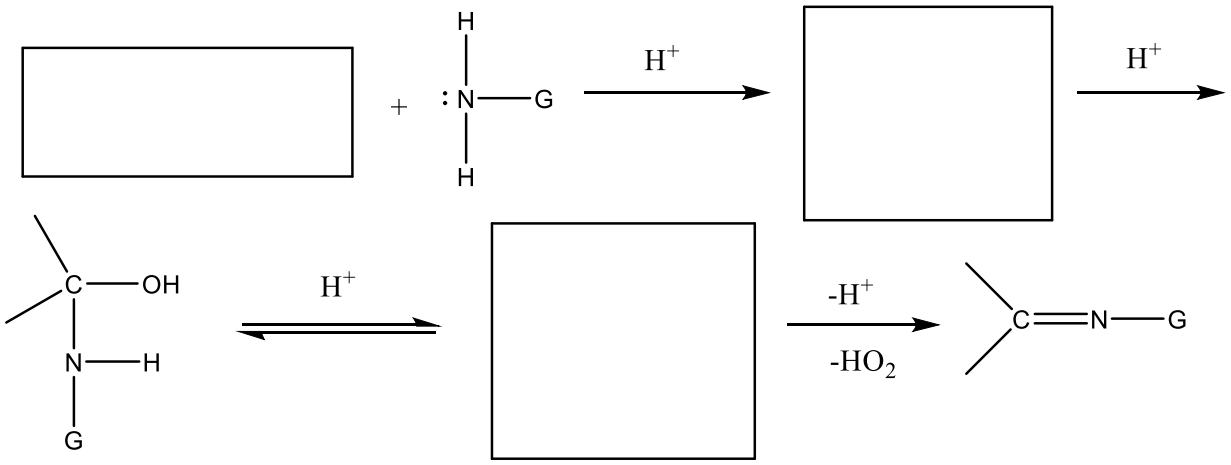
Reaction with 2,4-Dinitrophenylhydrazine [2,4-DNPH]



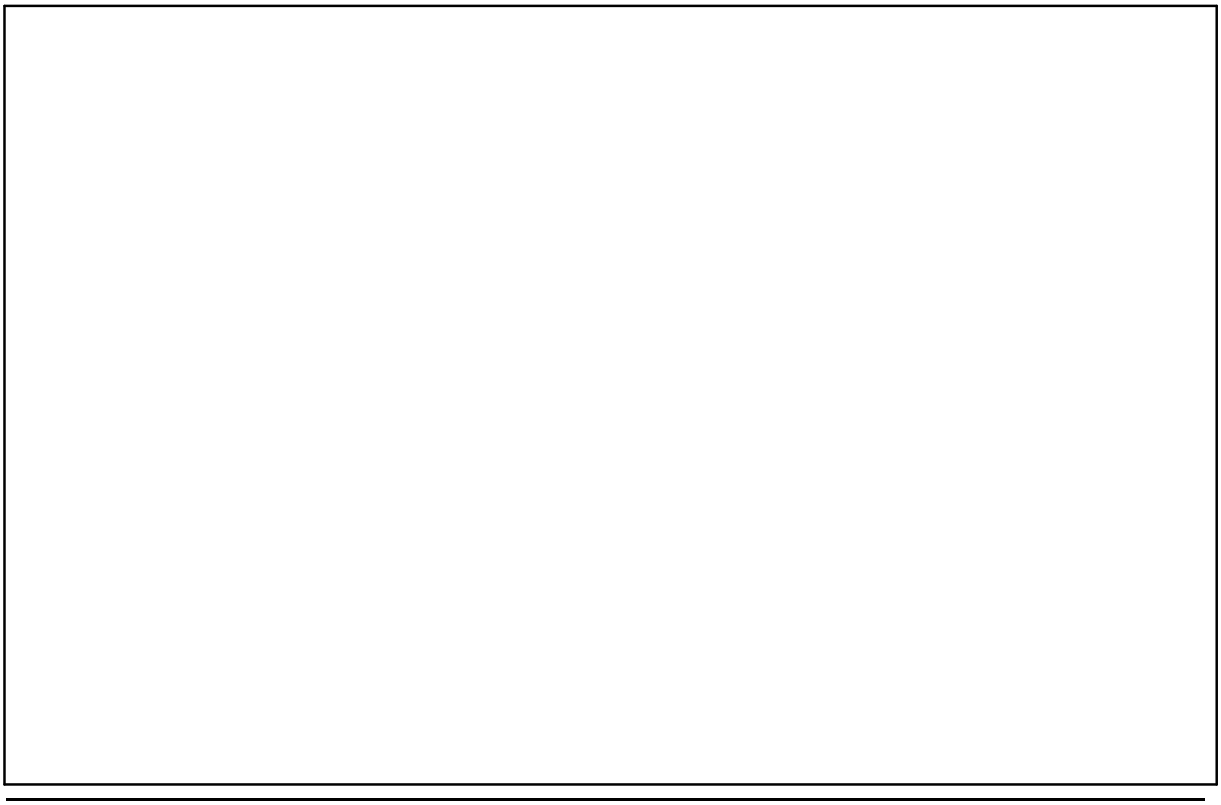
Practice Reaction

Mechanism of the Reactions of Ammonia Derivatives

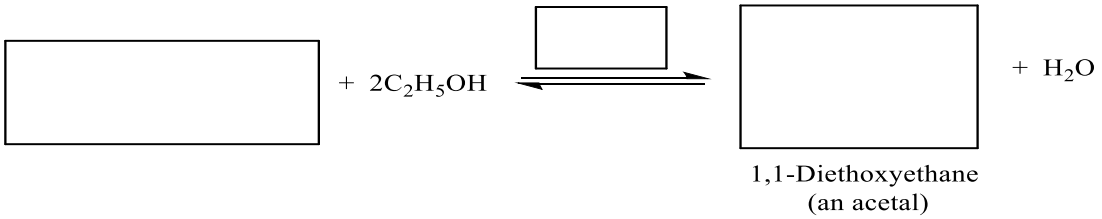


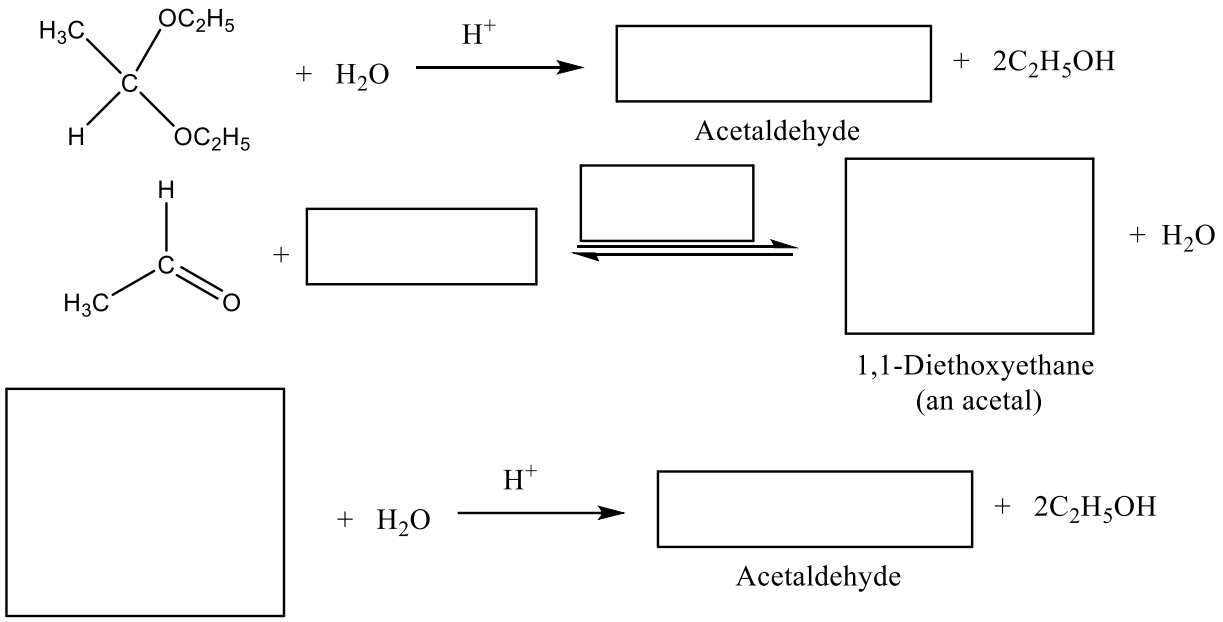


Practice Mechanism with arrows

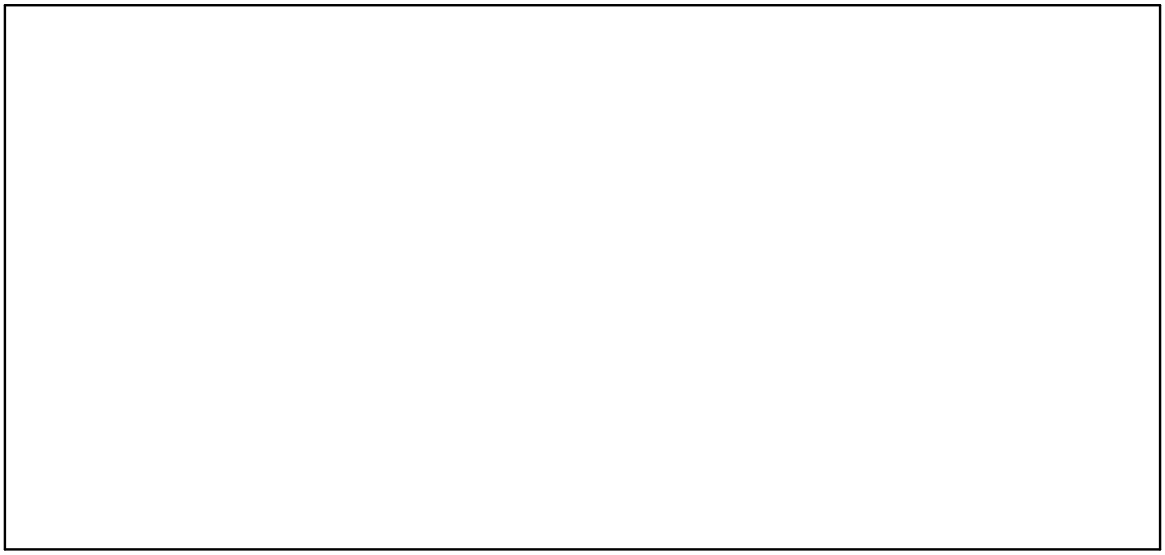


Addition of Alcohols

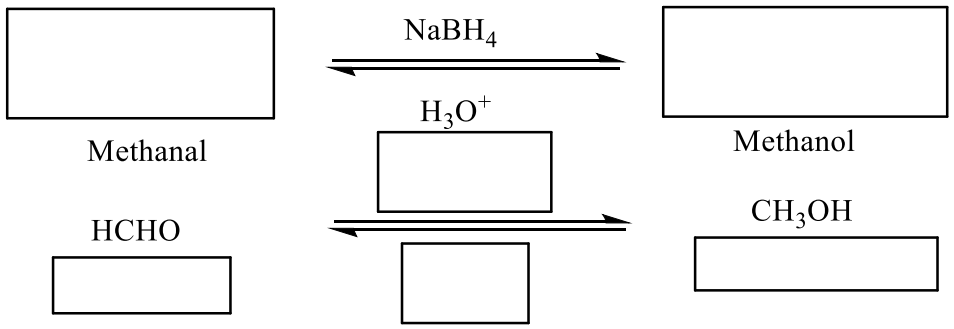


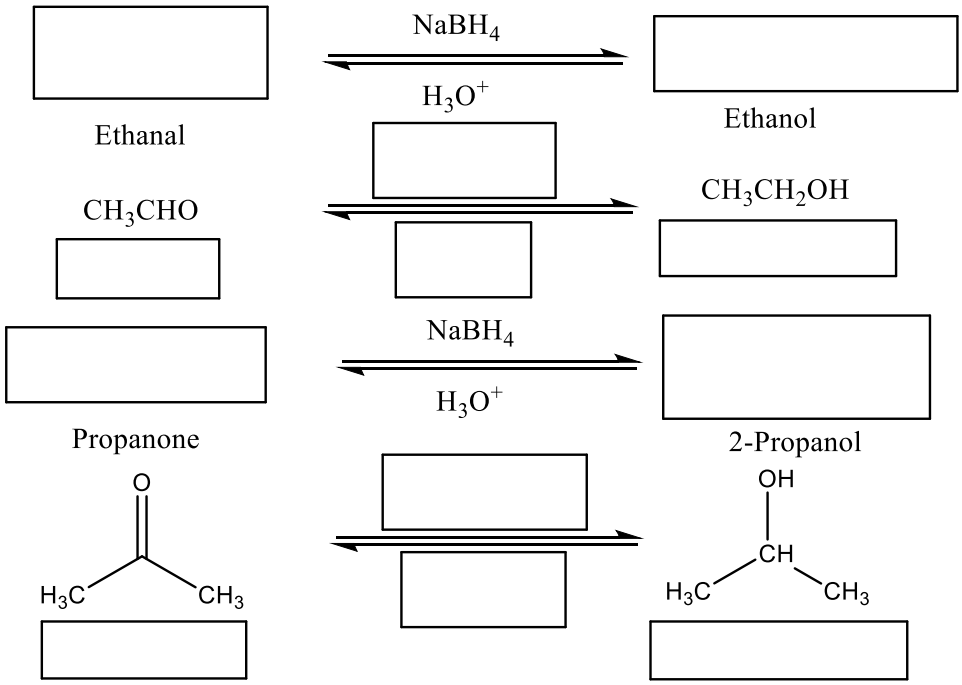


Practice Reaction



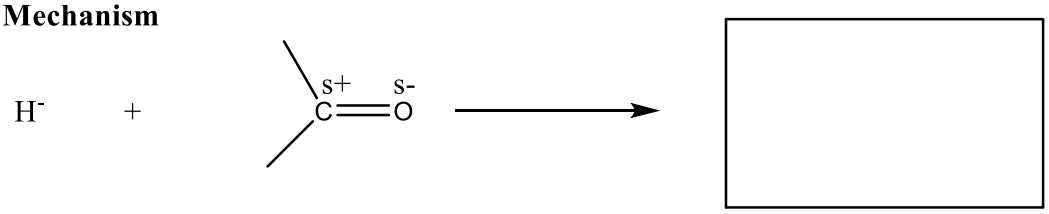
Reduction with Sodium Borohydride

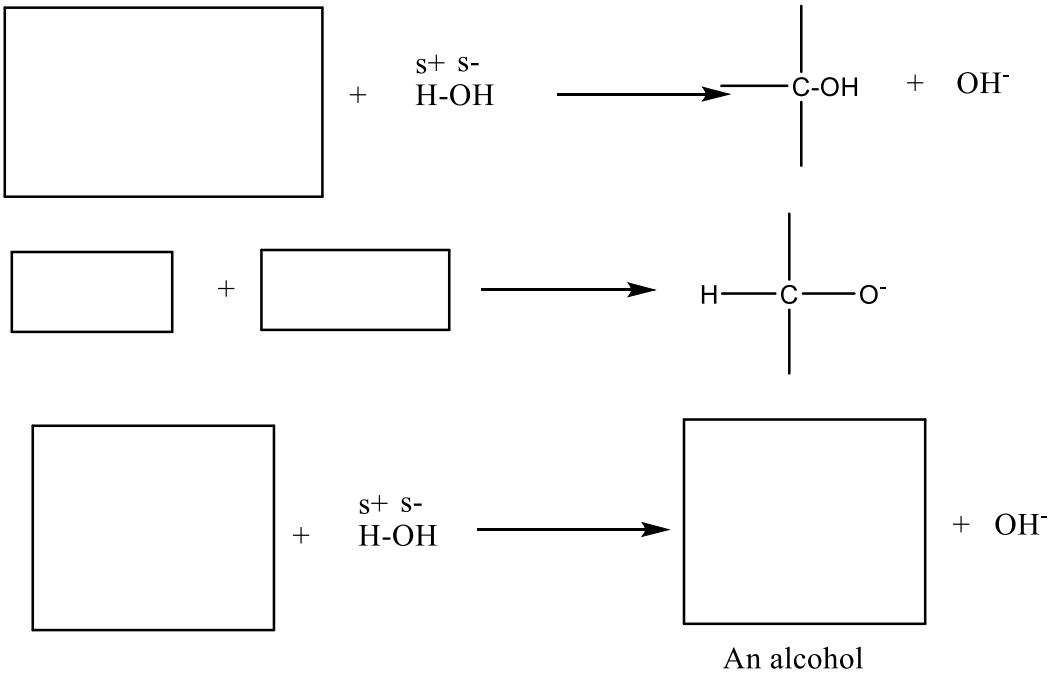




Practice Reaction

Mechanism

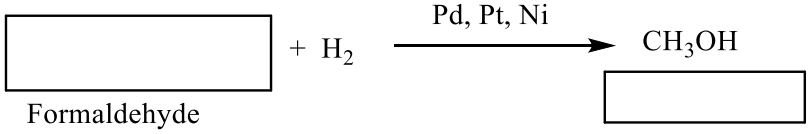




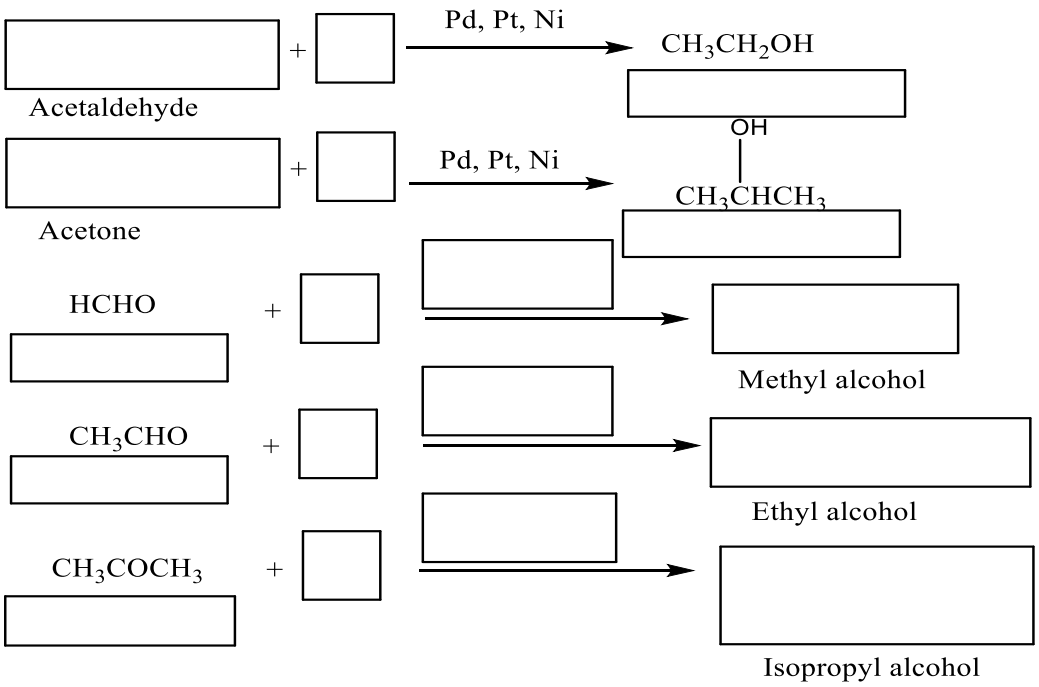
An alcohol

Practice Reaction

Catalytic Reduction

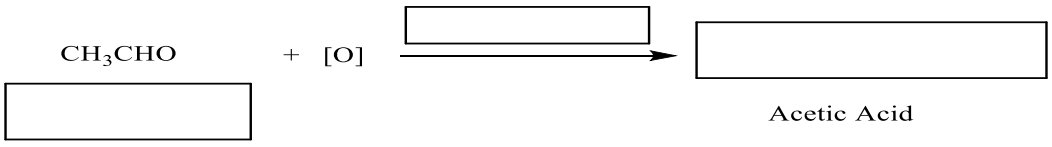


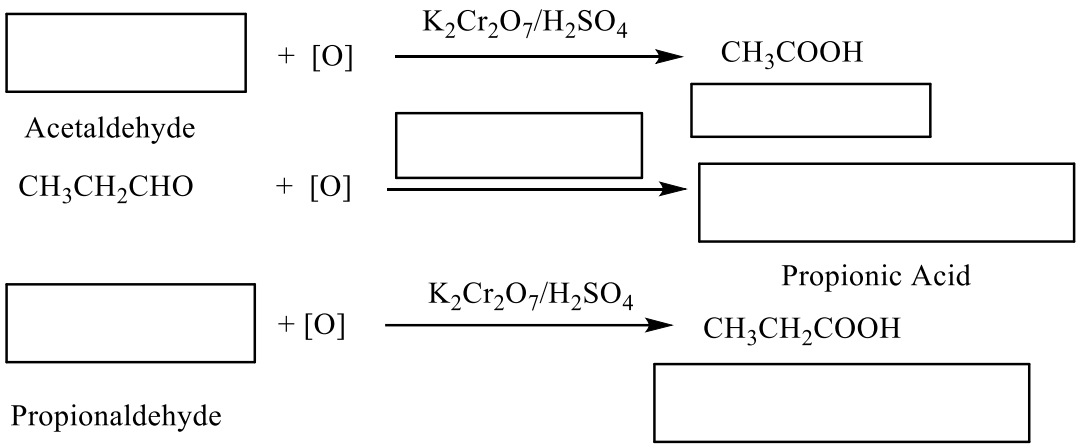
Formaldehyde



Practice Reaction

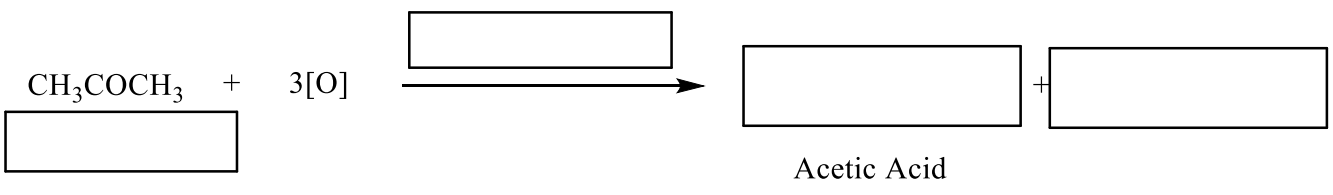
Oxidation of Aldehydes

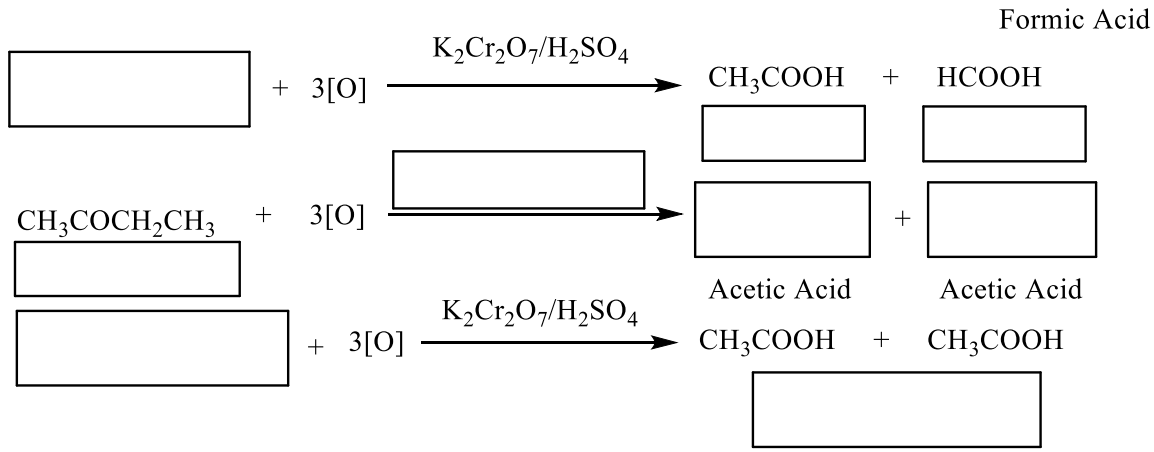




Practice Reaction

Oxidation of Ketones





Practice Reaction

Identification of Carbonyl Compounds

Aldehydes and ketones give_____precipitates with DNPH

_____and_____form a crystalline white precipitate with _____

_____give silver mirror test the procedure of which is_____ _____

$AgNO_3 + 3NH_4OH \longrightarrow$ [ ] + [ ] $+ 2H_2O$

$R\text{-}CHO + 2[Ag(NH_3)_2]OH \longrightarrow R\text{-}COONH_4 +$ [ ] + [ ] + [ ]

Practice Reaction

[ ]

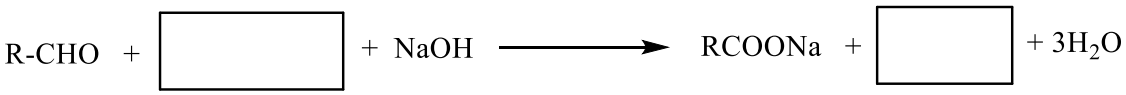
_____form a brick red precipitate with _____procedure of which is_____
_____
_____

$R\text{-}CHO +$ [ ] $+ NaOH \longrightarrow RCOONa +$ [ ] $+ 3H_2O$

Practice Reaction

[ ]

_____form a brick red precipitate with _____procedure of which is_____
_____
_____



Practice Reaction

Mention any four uses of formaldehyde

1._____

2._____

3._____

4._____

Mention any four uses of acetaldehyde

1._____

2._____

3._____

4._____

E. Conversion questions (according to order in book)

Worksheet 1

1. Convert methanol to formaldehyde

_____

2. Convert ethanol to acetaldehyde

3. Convert sodium salts of formic and acetic acid to acetaldehyde

4. Convert ethylene to acetaldehyde

5. Convert calcium acetate to acetone

6. Convert formaldehyde to formaldehyde cyanohydrin

7. Convert acetaldehyde to acetaldehyde cyanohydrin

Worksheet 2

1. Convert acetone to acetone cyanohydrin

2. Convert acetaldehyde cyanohydrin to 2-hydroxypropanoic acid (Lactic acid)

3. Convert formaldehyde to bisulphate addition product

4. Convert acetaldehyde to bisulphite addition product

5. Convert acetone to bisulphite addition product

6. Convert acetone to acetaldehyde

7. Write mechanism to add sodium bisulphite to aldehydes and ketones

8. Convert ethanal to 3-hydroxybutanal

9. Convert propanal 3-hydroxy-2-methyl pentanal

10. Convert propanone to 4-hydroxy-4-methyl-2-pentanone

11. Convert 3-hydroxybutanal to crotonaldehyde

Worksheet 3

1. Give mechanism of aldol condensation

2. Convert formaldehyde to methanol and sodium salt of formic acid

3. Give mechanism of Cannizzaro's reaction

4. Give general reaction for haloform reaction

5. Convert acetaldehyde to iodoform

6. Convert acetone to iodoform

7. Convert formaldehyde to metaformaldehyde and paraldehyde

Worksheet 4

1. Give general reaction of conversion of aldehyde and ketone to condensation product

2. Convert ethanal to ethanaloxime

3. Convert propanone to propanone oxime

4. Convert ethanal to ethanal phenylhydrazone

5. Convert propanone to propanone phenylhydrazone

6. Convert acetaldehyde to acetaldehyde hydrazone

7. Convert acetone to acetone hydrazone

Worksheet 5

1. Convert acetaldehyde to acetaldehyde-2,4-DNPH

2. Convert acetone to acetone-2,4-DNPH

3. Give mechanism of the reaction of ammonia derivatives

4. Convert methanal to methanol

5. Convert ethanal to ethanol

6. Convert propanone to 2-propanol

Worksheet 6

1. Give mechanism of the reduction of aldehydes and ketones with sodium borohydride

2. Convert formaldehyde to methyl alcohol

3. Convert acetaldehyde to ethyl alcohol

4. Convert acetone to isopropyl alcohol

5. Convert acetaldehyde to acetic acid

6. Convert propionaldehyde to propionic acid

7. Convert acetone to acetic acid

Worksheet 7

1. Convert butanone to acetic acid

2. Give chemistry of silver mirror test

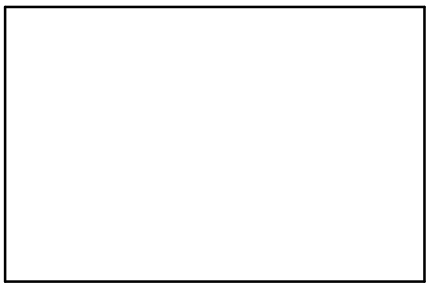
3. Give chemistry of Fehling's solution test

4. Give chemistry of Benedict's test

Chapter 13

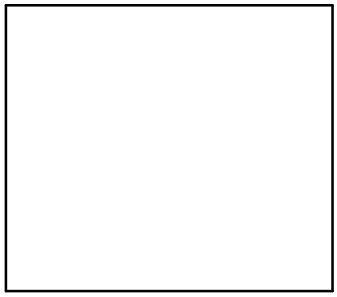
Carboxylic Acid

A. Give structures of the following compounds.

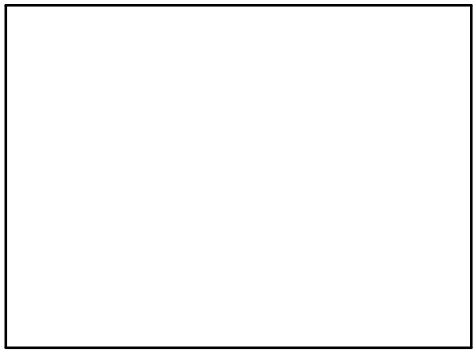


Formic acid

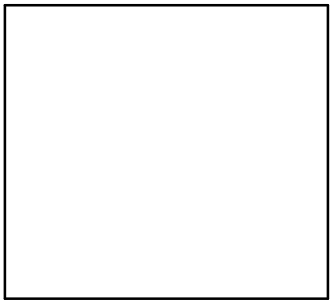
Acetic acid



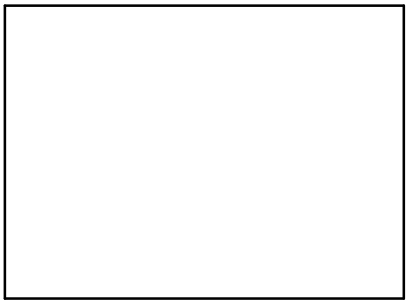
Oxalic acid



Malonic acid



Benzoic acid

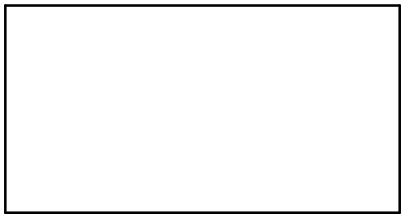


Phthalic acid

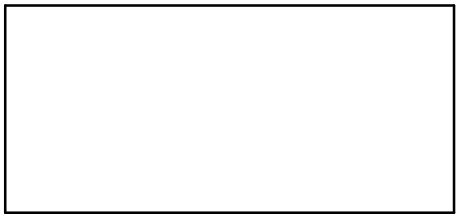
B. Give structures of the following compounds according to IUPAC names.

Methanoic acid

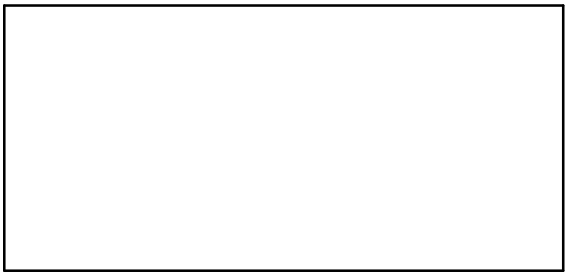
Ethanoic acid



Propanoic acid



Butanoic acid



2-Methyl propanoic acid

Learn the Reaction Conditions

- Alcohol to carboxylic acid: $K_2Cr_2O_7/H_2SO_4$
- Alkyl halide to alkanenitrile: Alcohol
- Oxidative cleavage of alkenes: $KMnO_4/OH^-$
- Amide formation: Heat
- Partial reduction of carboxyl group to alcohol: $LiAlH_4$
- Alcohol to carboxylic acid: $K_2Cr_2O_7/H_2SO_4$
- Acetylene to carboxylic acid: 1) $H_2SO_4/HgSO_4$ 2) V_2O_5
- α-bromoacid to amino acid: P
- Alkanenitrile to carboxylic acid: H^+ or OH^-
- Grignard reagent to carboxylic acid: Dry ether/H^+
- Carboxylic acid to ester: H_2SO_4
- Formation of acid anhydride: P_2O_5
- Reduction of carboxylic acid to alkane: P

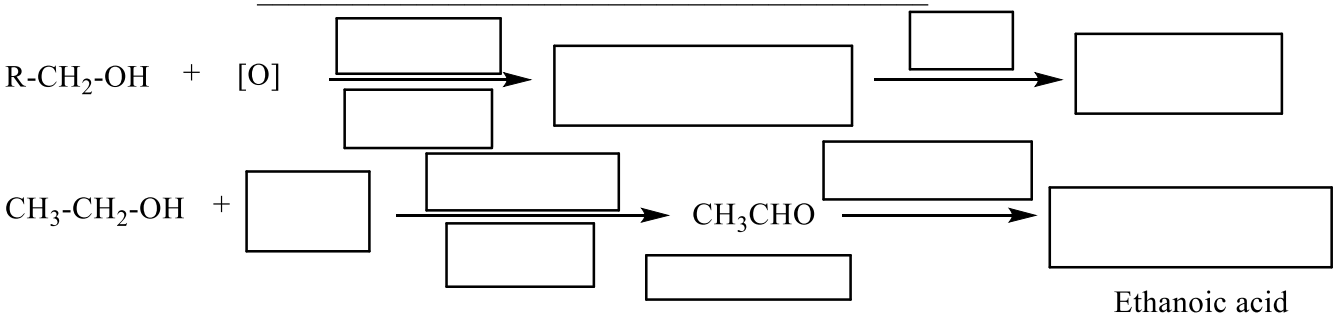
- Hydrolysis of methyl cyanide to carboxylic acid: H_2O/H^+
- Alcohol to carboxylic acid: $K_2Cr_2O_7/H_2SO_4$
- Strecker synthesis: H_3O^+
- Amino acid to α-hydroxy carboxylic acid: $NaNO_2/HCl$

C. Match the correct reaction condition.

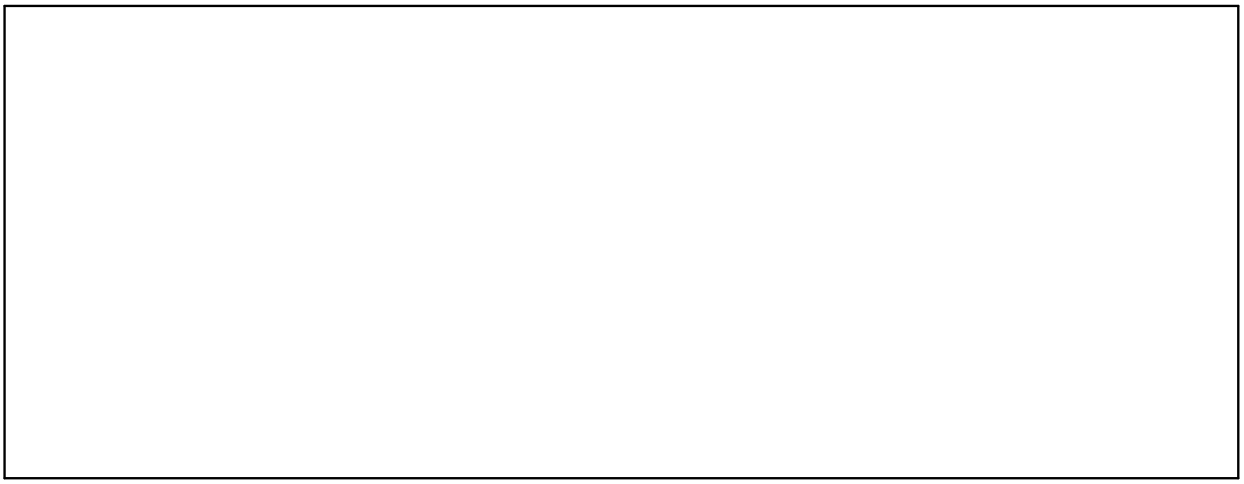
Reaction	Condition
Alcohol to carboxylic acid	$NaNO_2/HCl$
Reduction of carboxylic acid to alkane	$K_2Cr_2O_7/H_2SO_4$
Amide formation	H_3O^+
Alcohol to carboxylic acid	H_2O/H^+
α-bromoacid to amino acid	P
Partial reduction of carboxyl group to alcohol	P_2O_5
Oxidative cleavage of alkenes	H_2SO_4
Grignard reagent to carboxylic acid	Dry ether/H^+
Acetylene to carboxylic acid	H^+ or OH^-
Alkyl halide to alkanenitrile	P
Alkanenitrile to carboxylic acid	1) $H_2SO_4/HgSO_4$ 2) V_2O_5
Carboxylic acid to ester	$K_2Cr_2O_7/H_2SO_4$
Hydrolysis of methyl cyanide to carboxylic acid	Heat
Strecker synthesis	$LiAlH_4$
Amino acid to α-hydroxy carboxylic acid	$K_2Cr_2O_7/H_2SO_4$
Formation of acid anhydride	Alcohol
Alcohol to carboxylic acid	$KMnO_4$/OH-

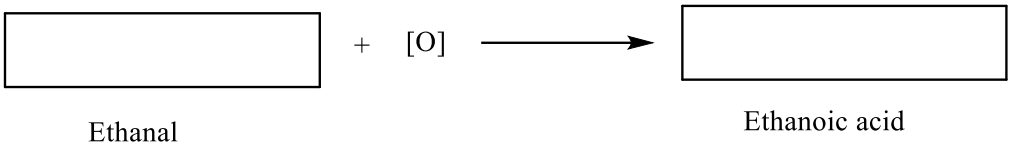
D. Learn through blanks.

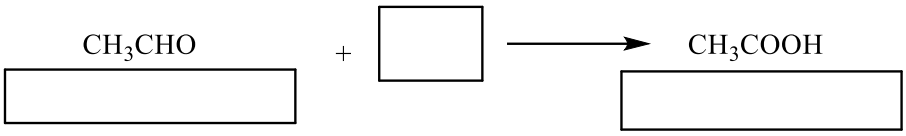
Name of Reaction: _____



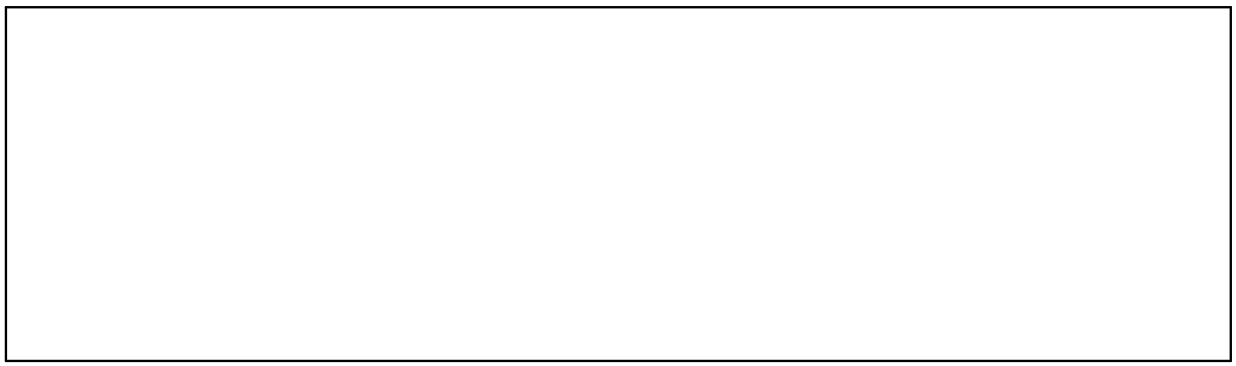
Practice Reaction



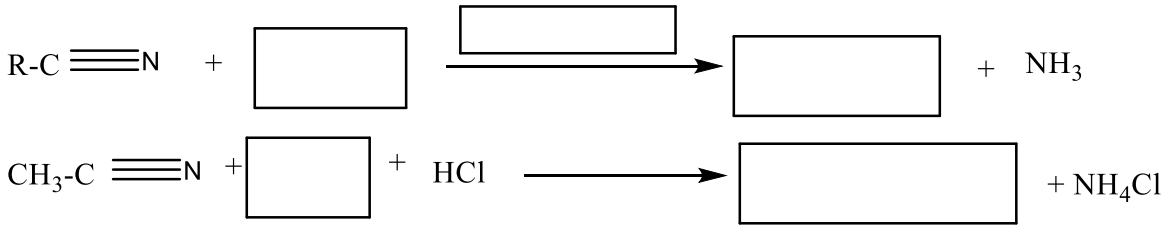




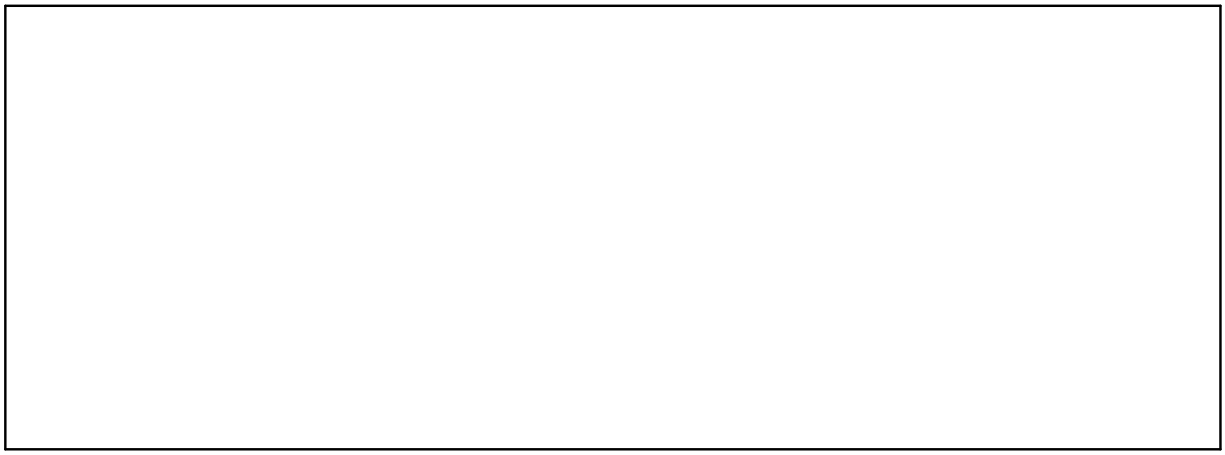
Practice Reaction

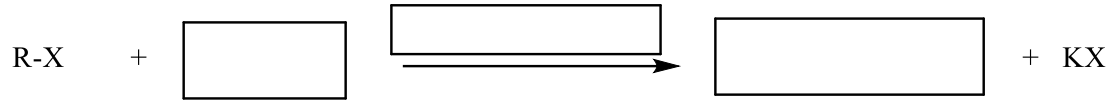


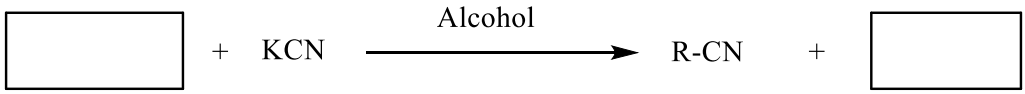
Name of Reaction: _____



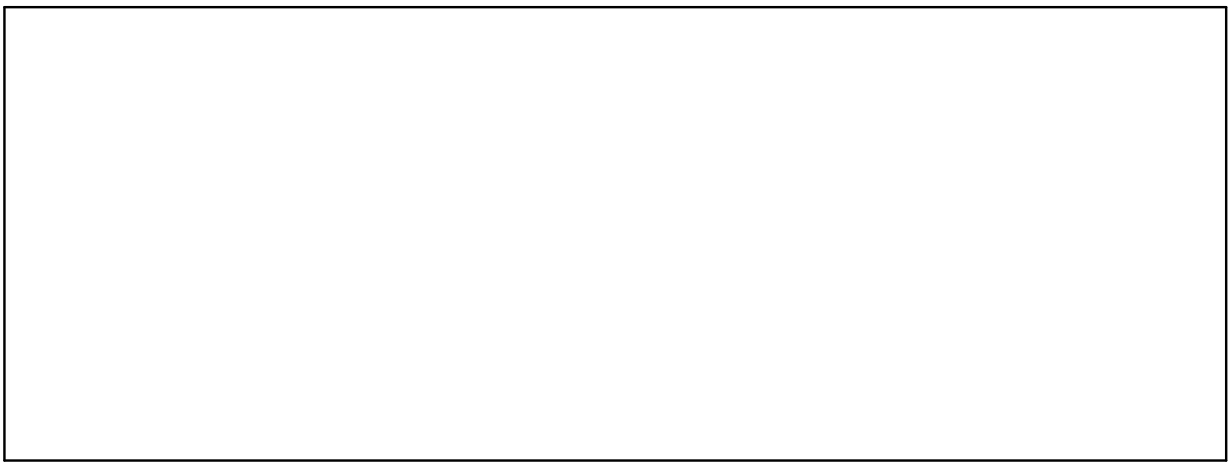
Practice Reaction



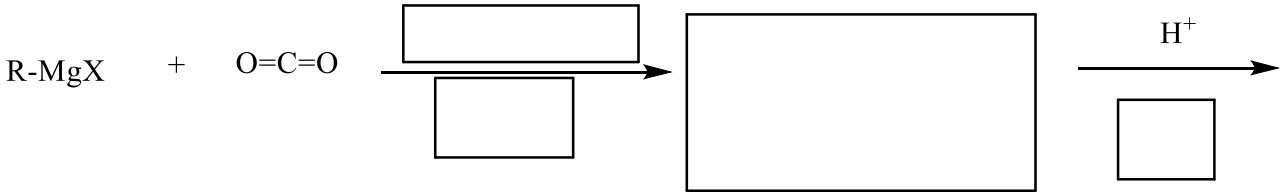


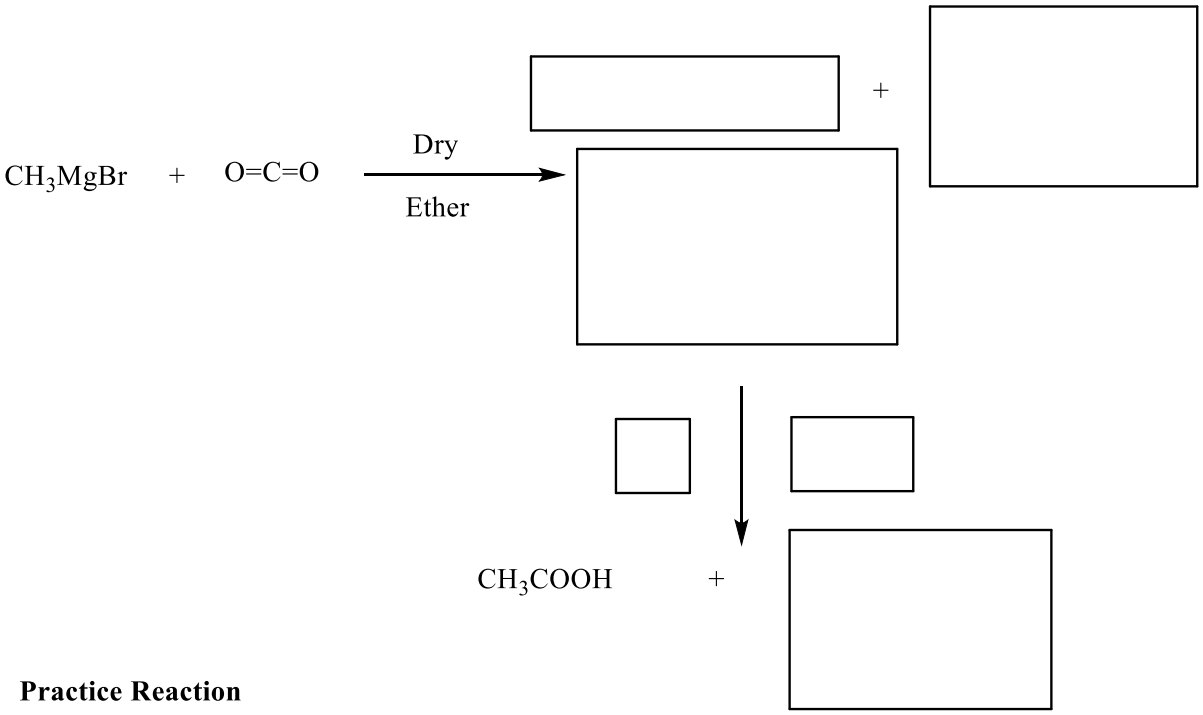


Practice Reaction



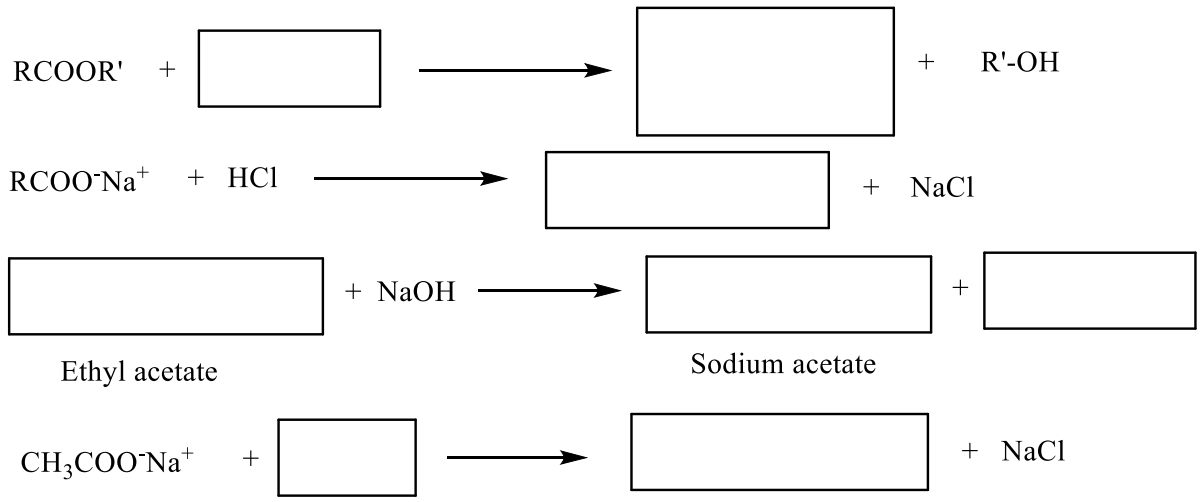
Name of Reaction:_____





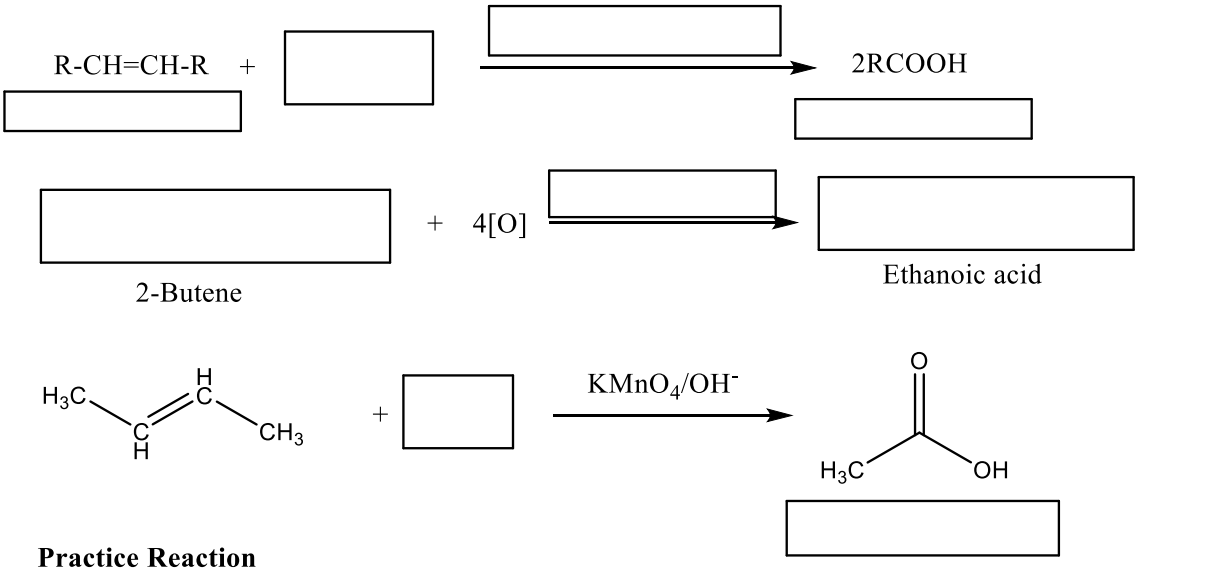
Practice Reaction

Name of Reaction: _____



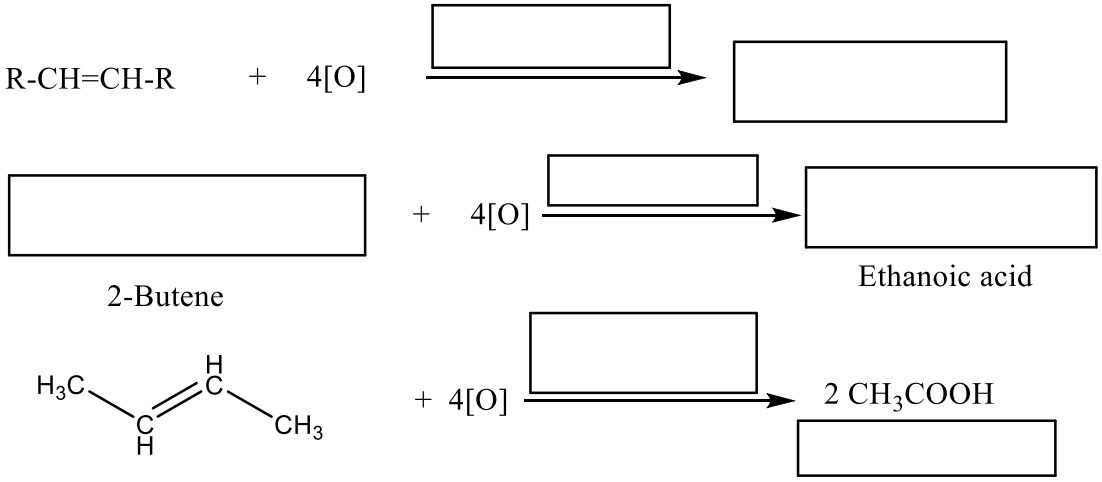
Practice Reaction

Name of Reaction: _____



Practice Reaction

Name of Reaction:_____



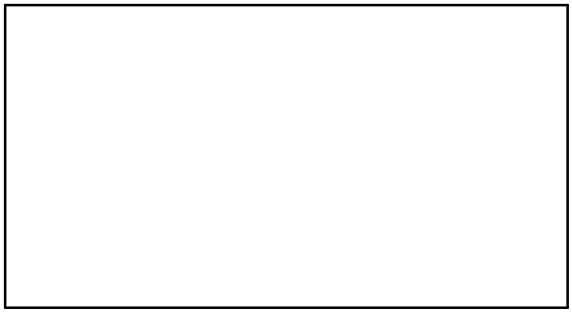
Practice Reaction

Mention any two physical properties of carboxylic acids.

1._____

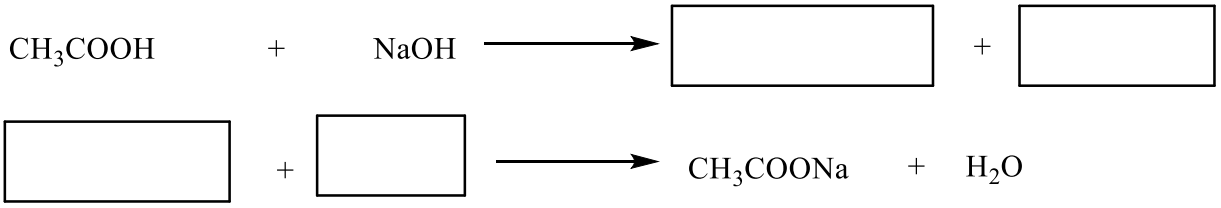
2._____

Draw a dimer of the carboxylic acid.

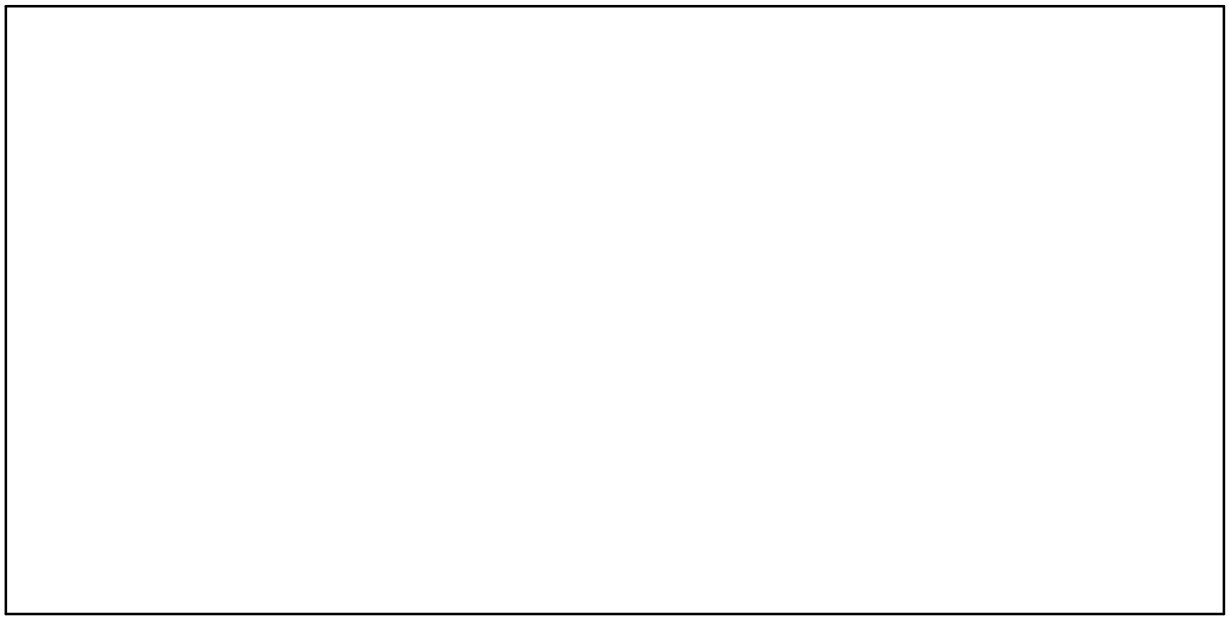


Reactions with Bases

Reactions involving_____of the carboxyl group

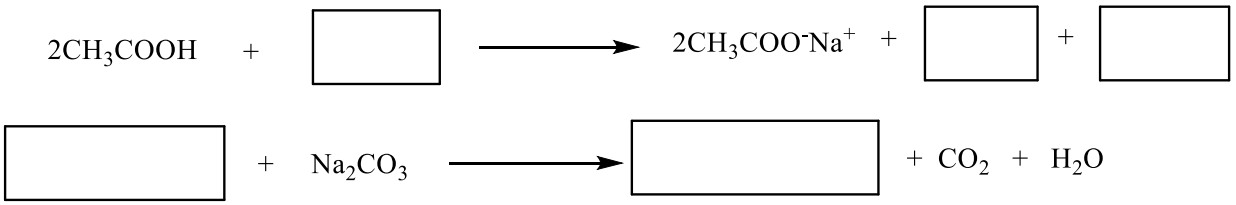


Practice Reaction



Reactions with Carbonates and Bicarbonates

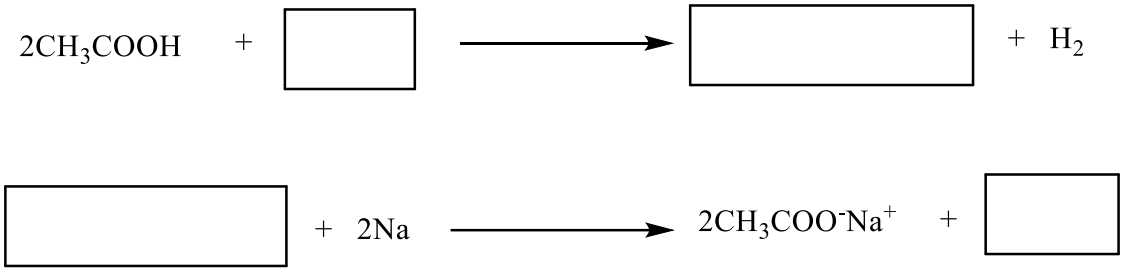
Reactions involving_____of the carboxyl group



Practice Reaction

Reactions with Metals

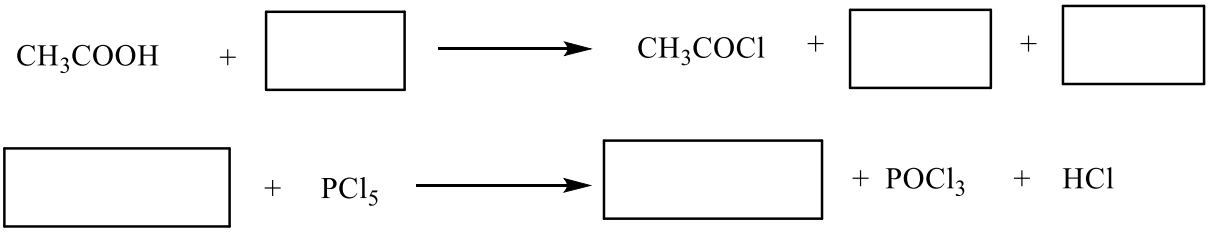
Reactions involving_____of the carboxyl group



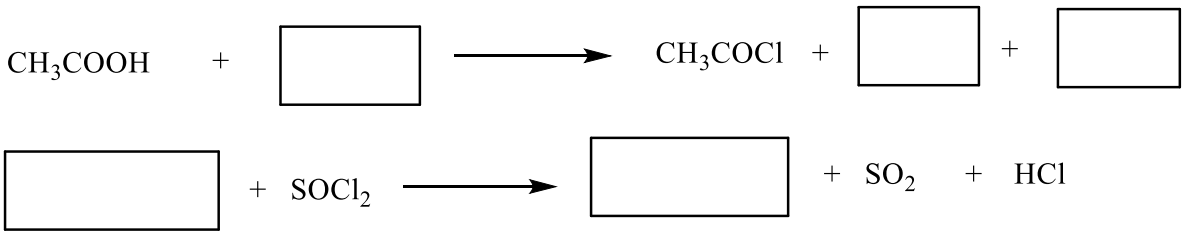
Practice Reaction

Reaction with PCl_5 and $SOCl_2$

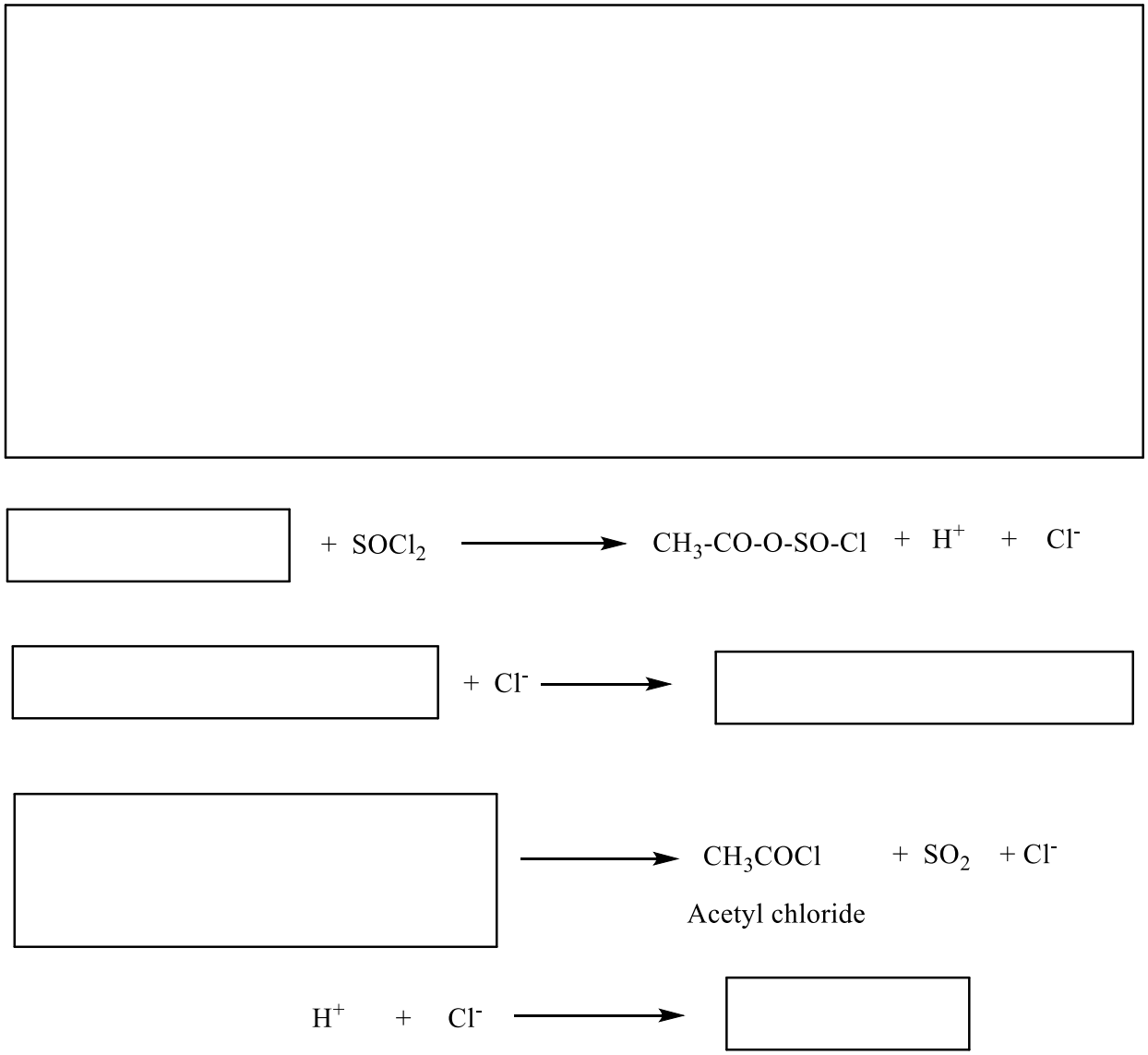
Reactions involving_____of the carboxyl group



Practice Reaction



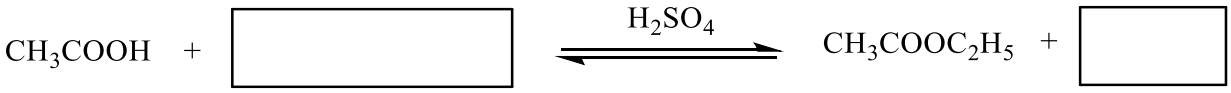
Practice Reaction



Practice Reaction

Formation of an Ester

Reactions involving_____of the carboxyl group

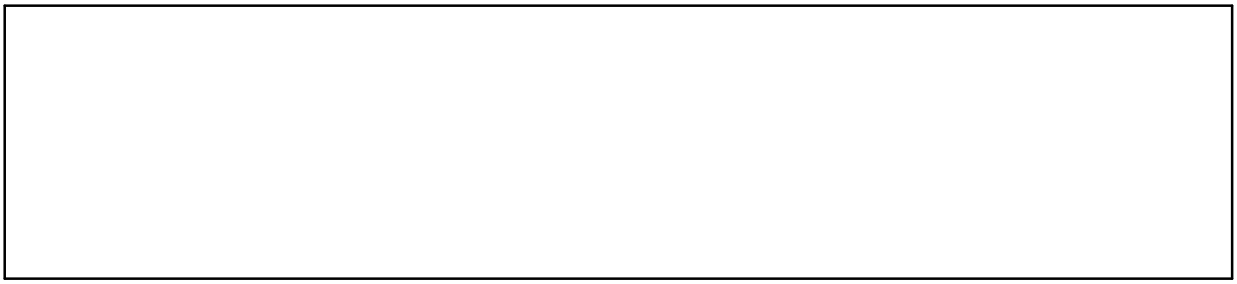


Mechanism

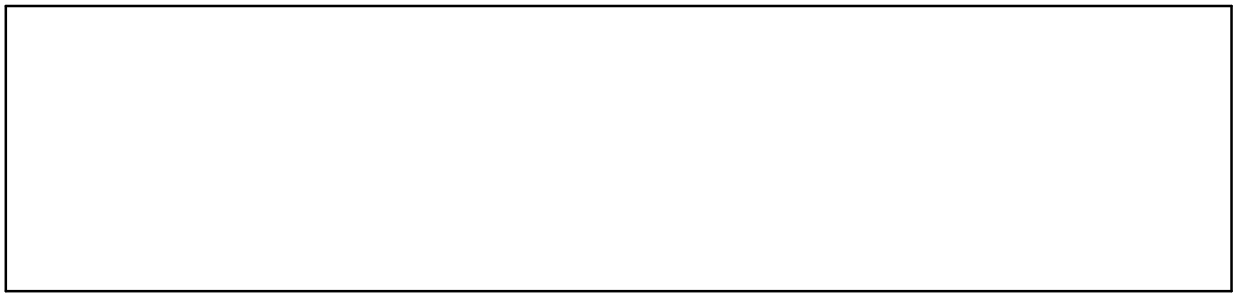
(i) Protonation of Carboxylic Acid

(ii) Attack of CH_3CH_2OH

(iii) Hydrogen Ion Transfer



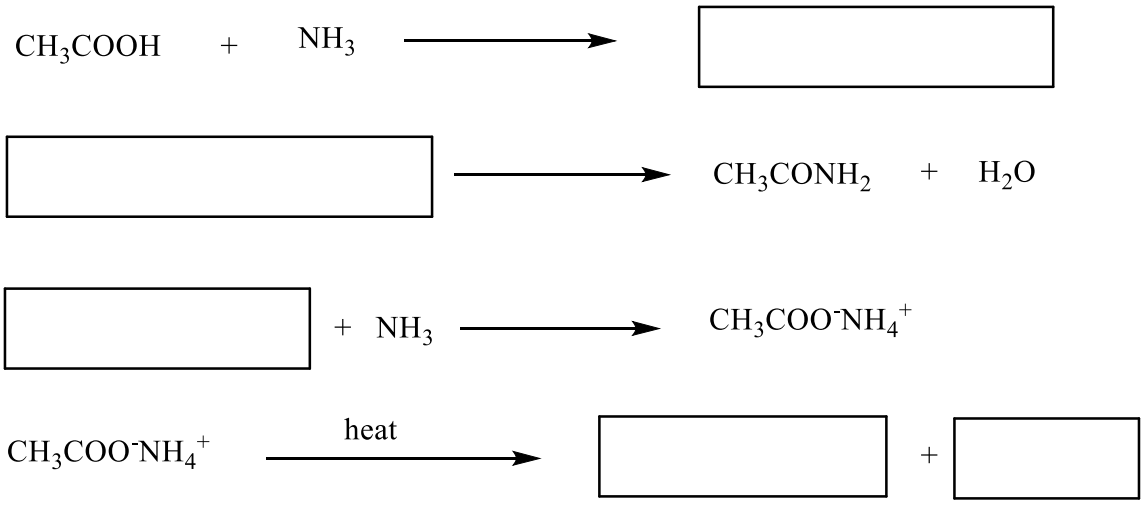
(iv) Elimination of Water and H^+



Practice Reaction

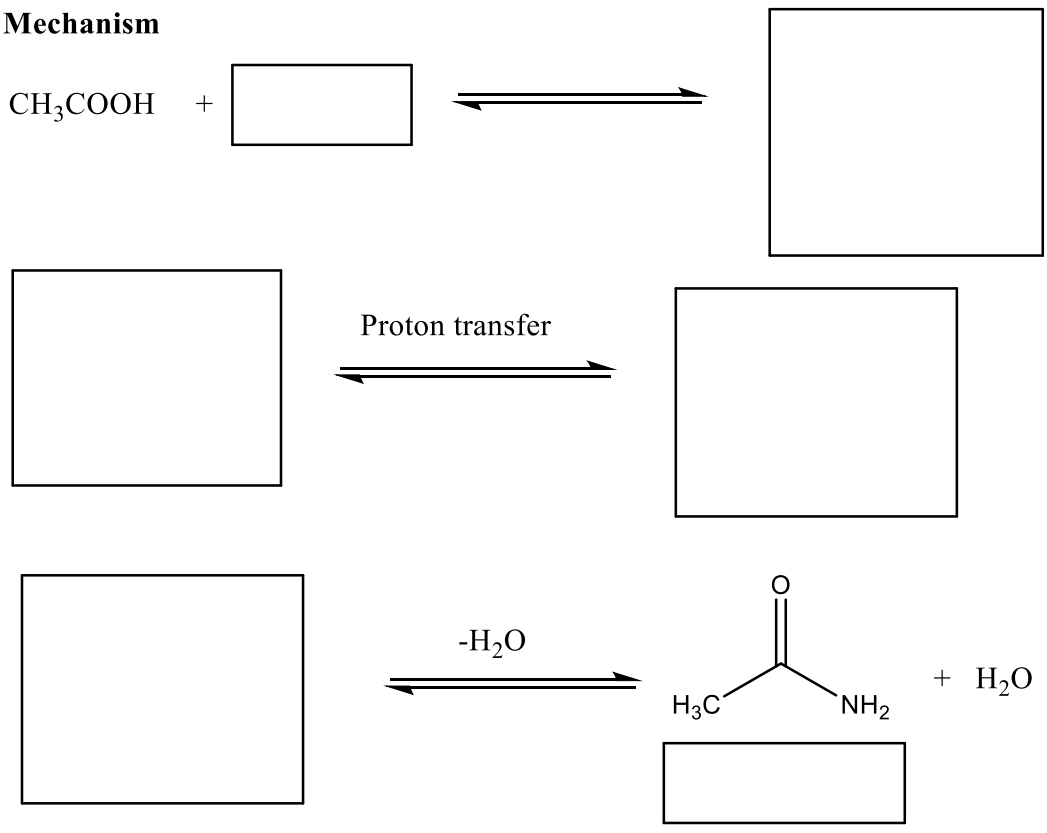
Formation of Amide

Reactions involving_____of the carboxyl group



Practice Mechanism with arrows

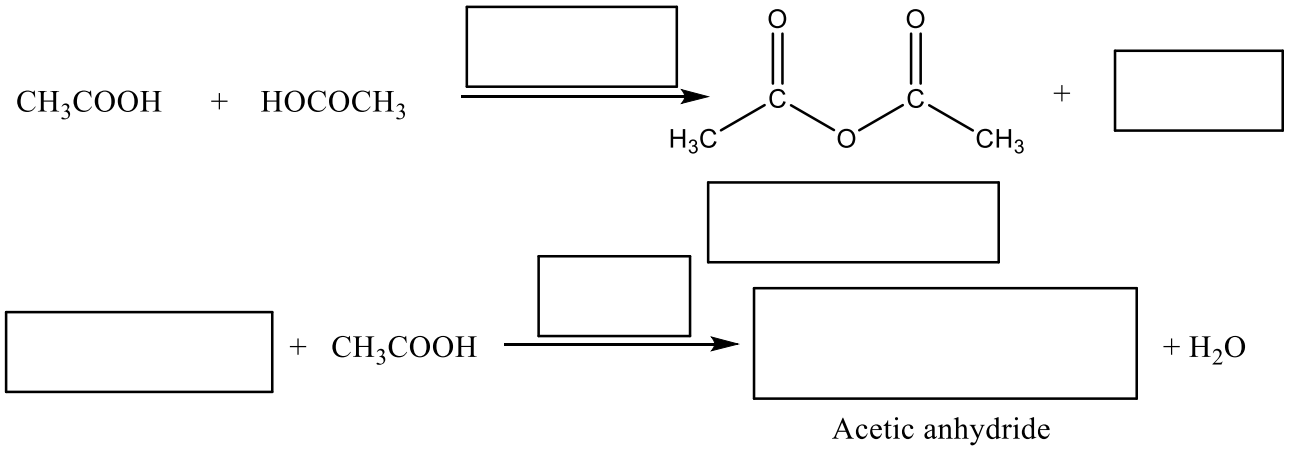
Mechanism



Practice Mechanism with arrows

Formation of Acid Anhydride

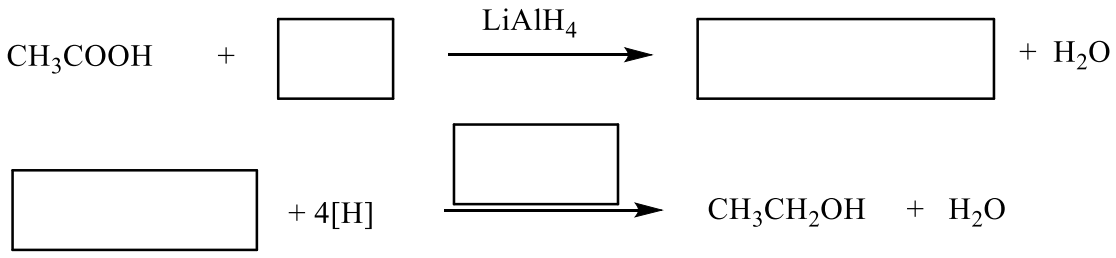
Reactions involving_____of the carboxyl group



Practice Reaction

Partial Reduction to Alcohols

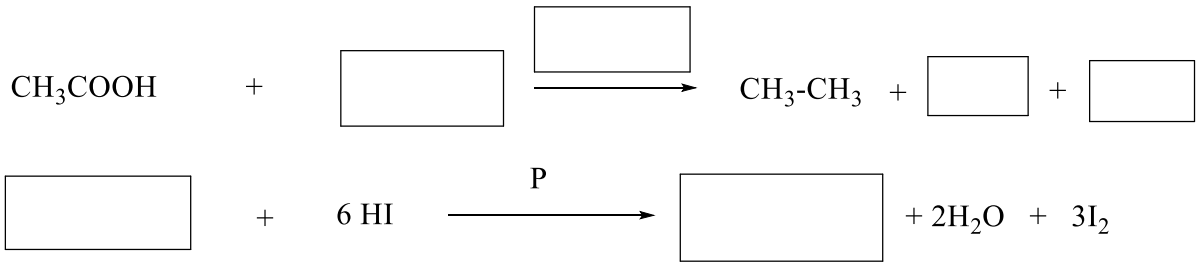
Reactions involving_____group



Practice Reaction

Complete Reduction to Alkanes

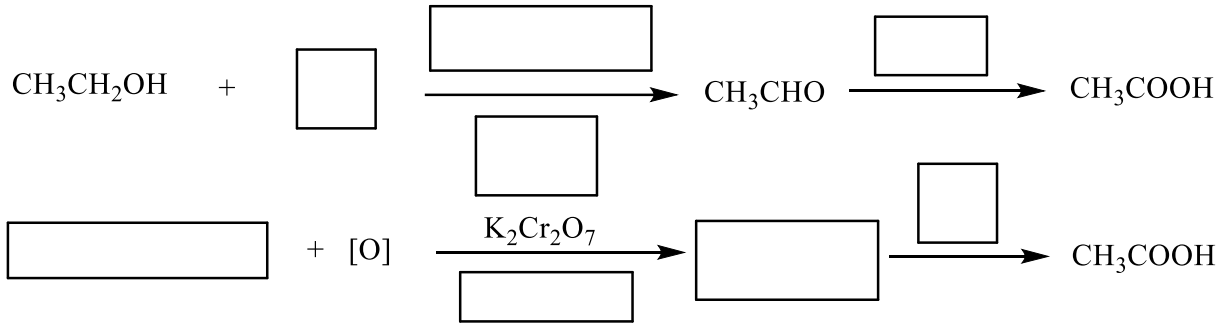
Reactions involving_____group



Practice Reaction

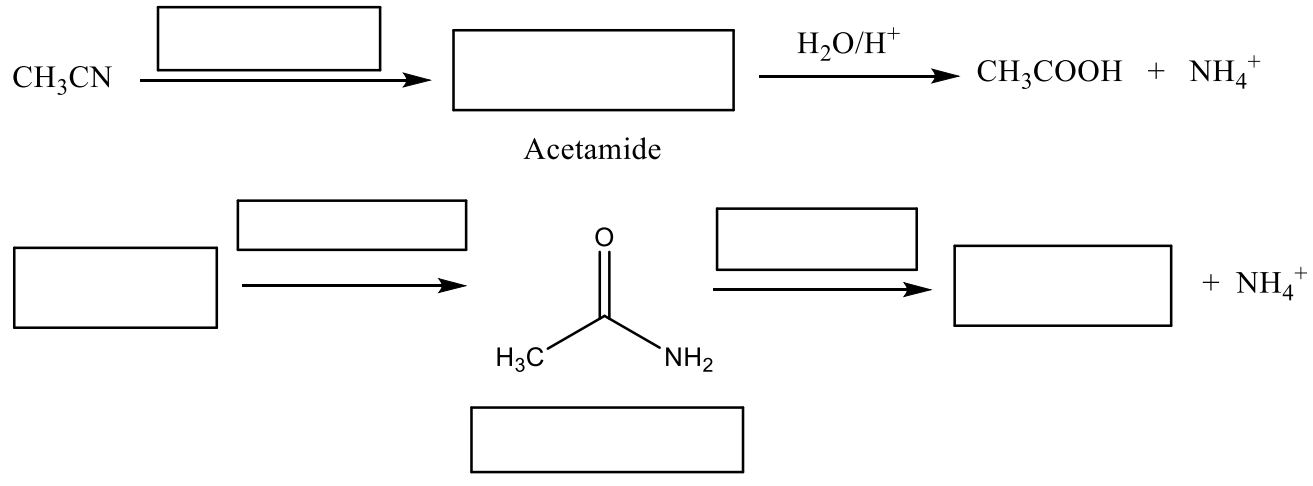
Acetic Acid

Name of Reaction:_____



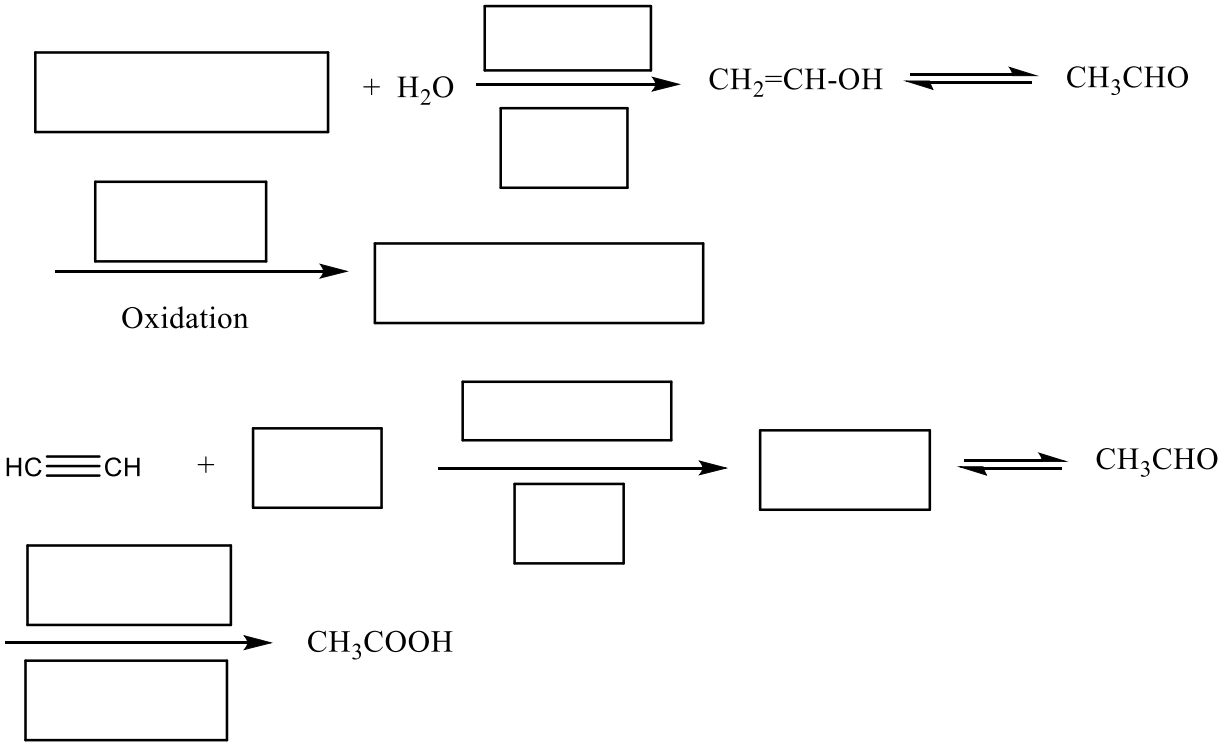
Practice Reaction

Name of Reaction:_____

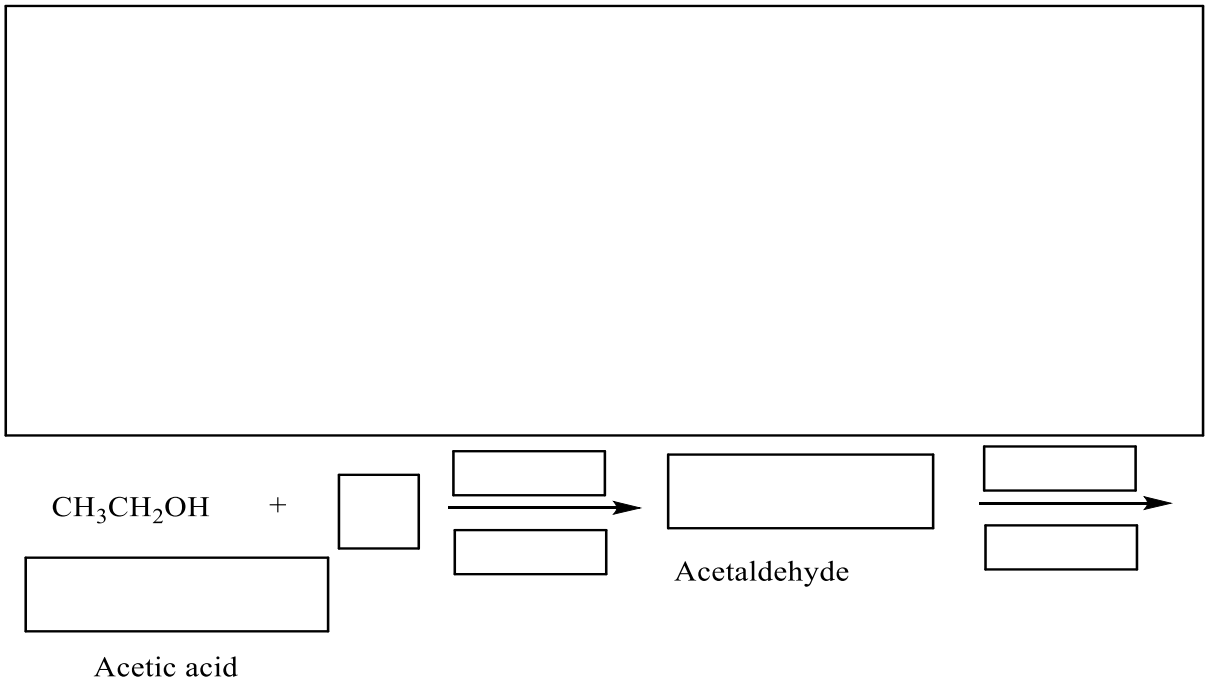


Practice Reaction

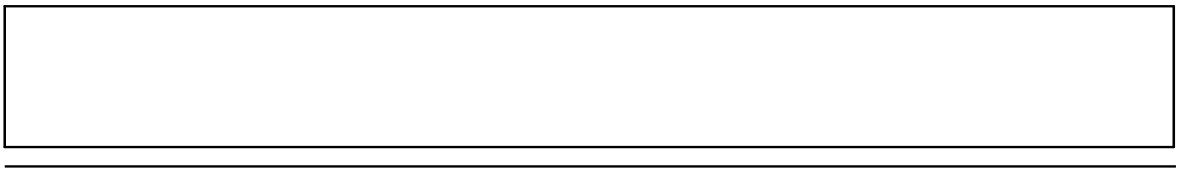
Name of Reaction: _____



Practice Reaction



Practice Reaction



Mention two physical characteristics of acetic acid.

1._____

2._____

Mention any four uses of acetic acid.

1._____

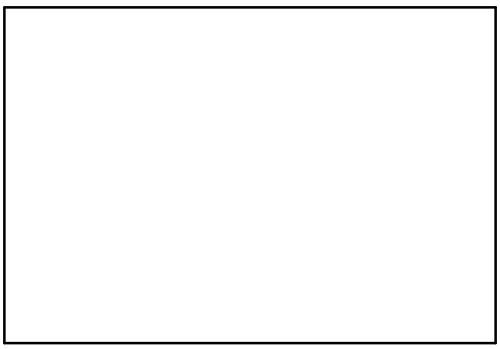
2._____

3._____

4._____

Amino Acids

General formula



The major difference between essential and non-essential amino acids is_____
_____
_____

The difference between acidic and basic amino acid is_____
_____
_____

Identify acidic, basic and neutral amino acid.

Glycine_____

Alanine_____

Valine_____

Proline_____

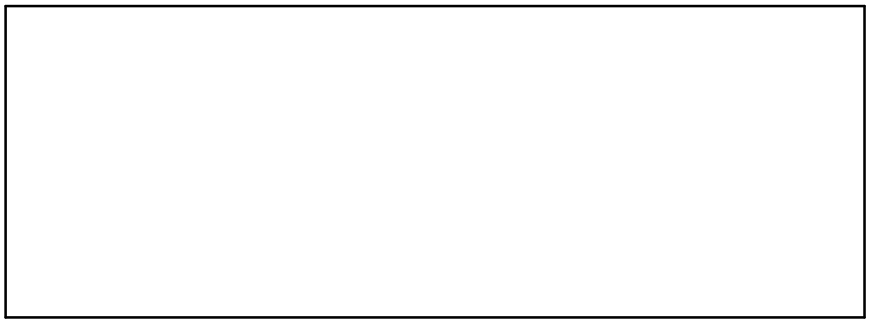
Aspartic acid_____

Glutamic acid_____

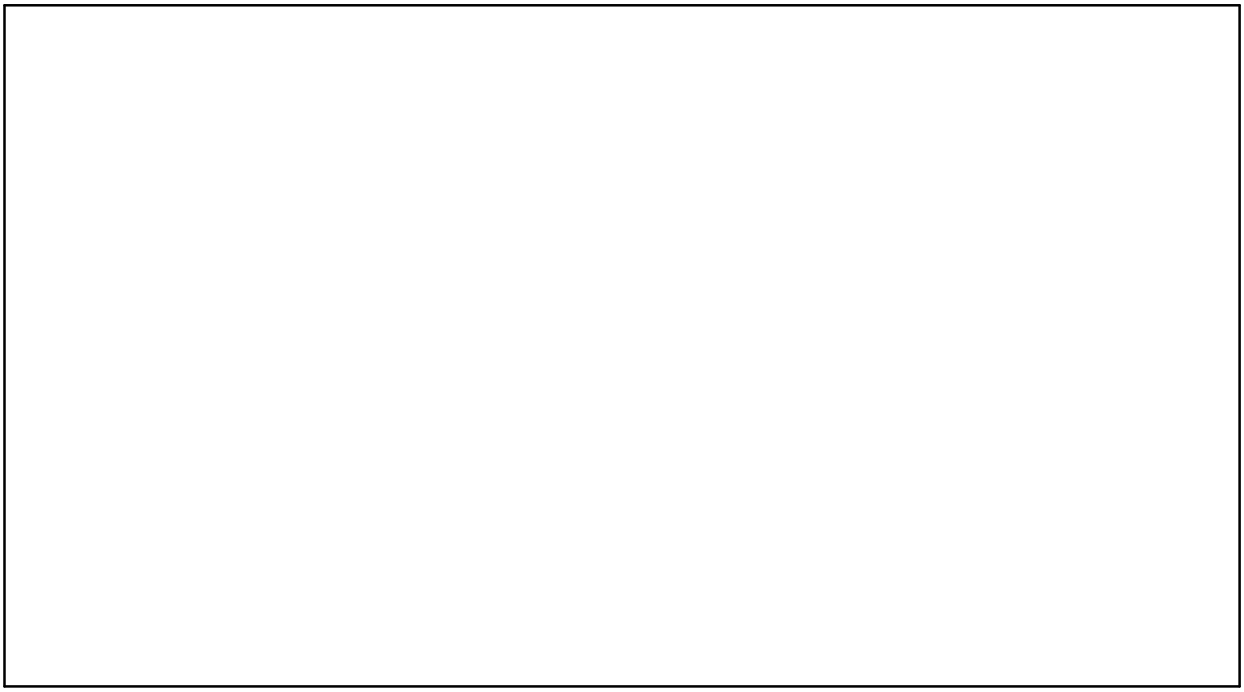
Lysine_____

Histidine_____

Give zwitter ionic structure of amino acids.



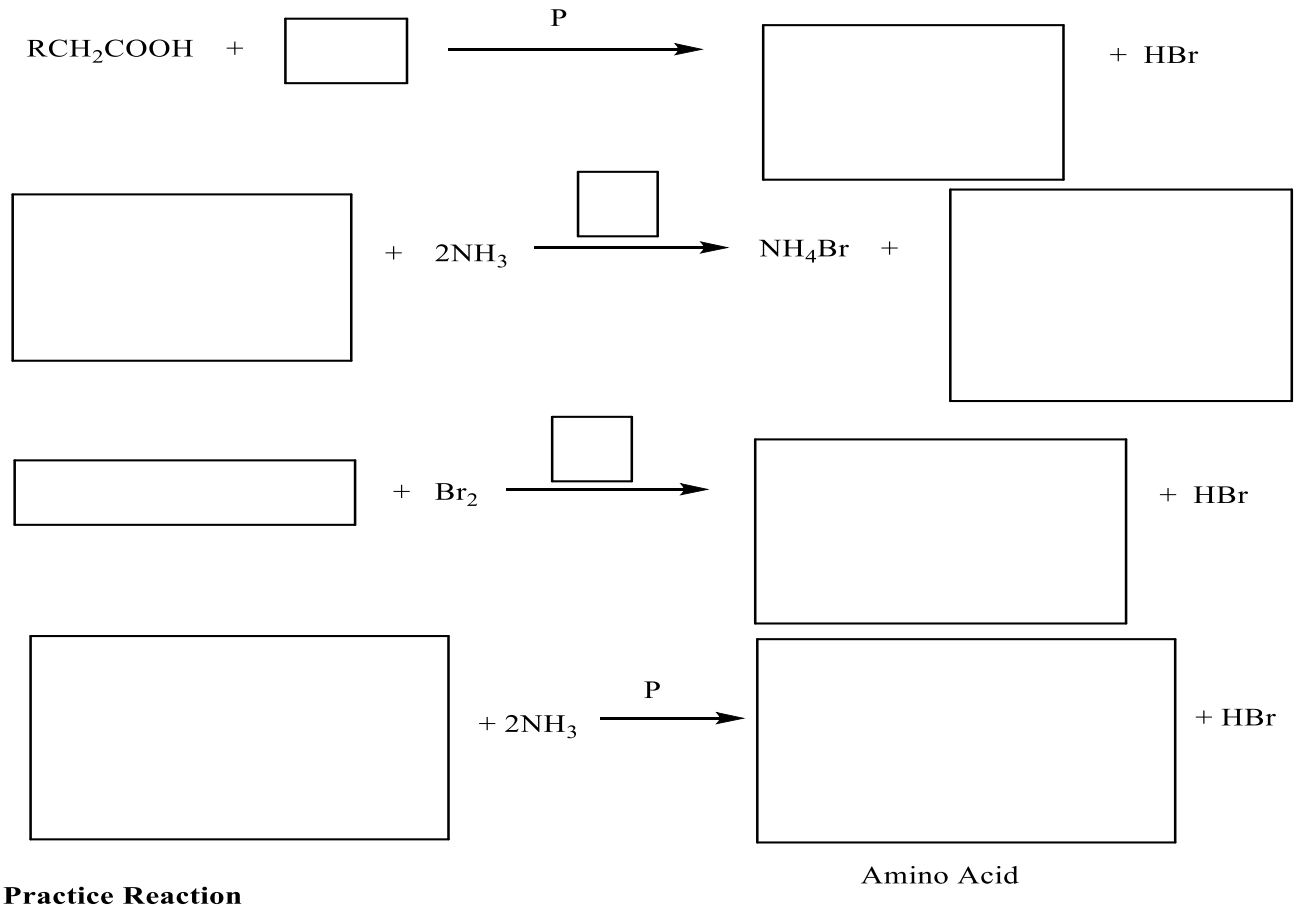
Give reactions of amino acids with acid and base.



The _____part accepts proton in reaction with acid.

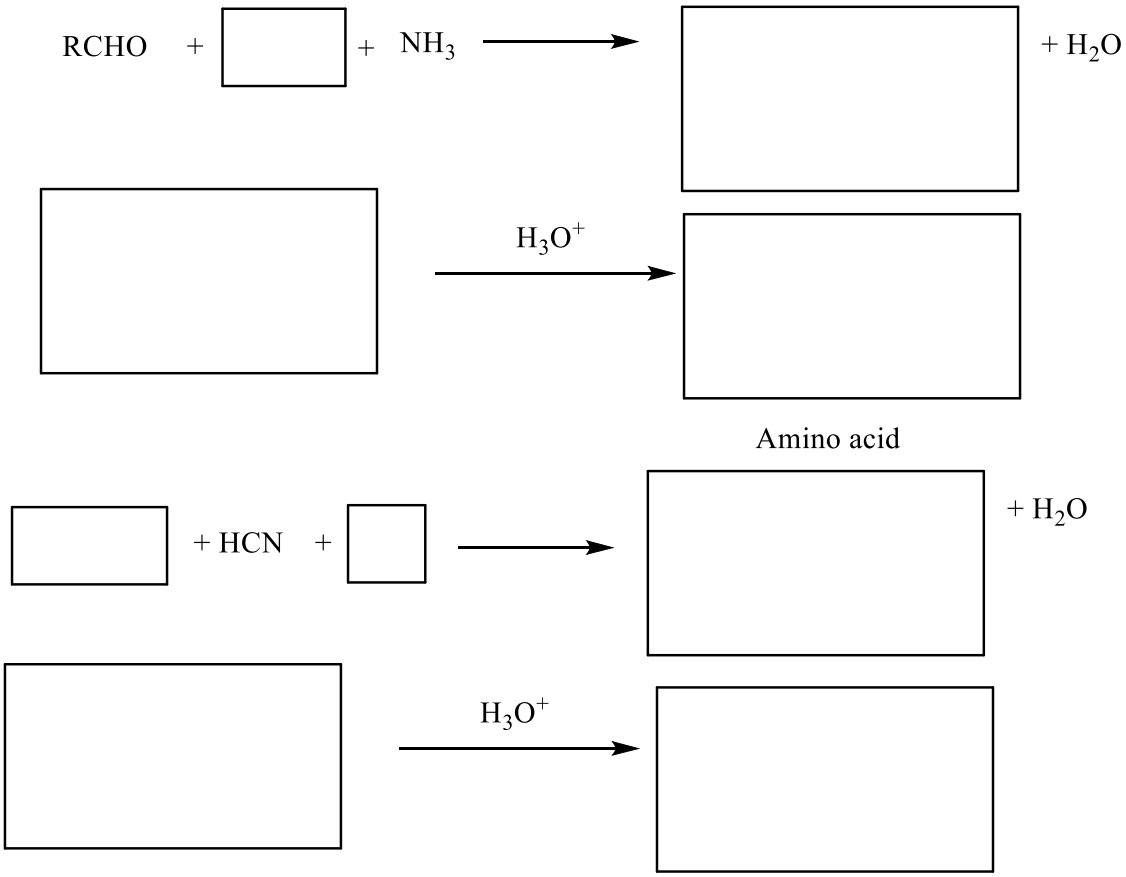
The_____part releases proton in reaction with base.

Name of Reaction:_____



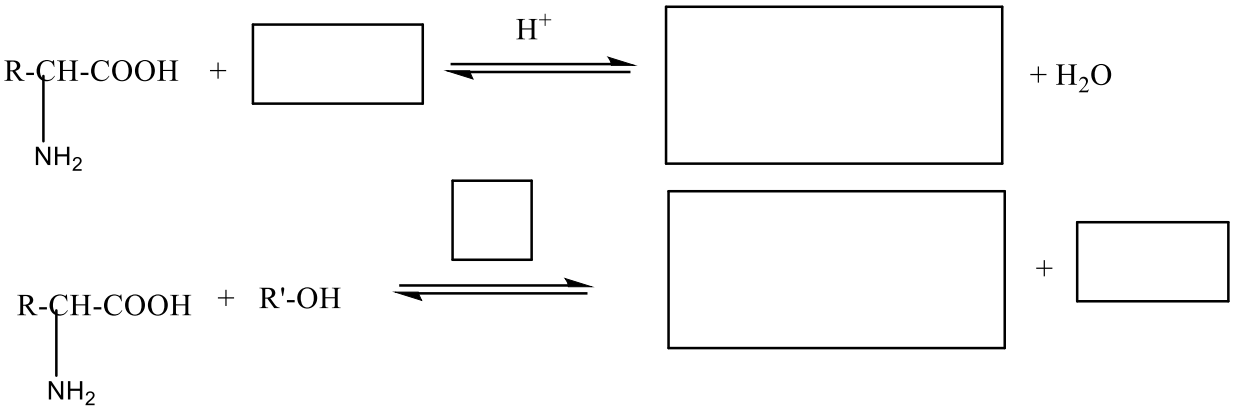
Practice Reaction

Name of Reaction:_____

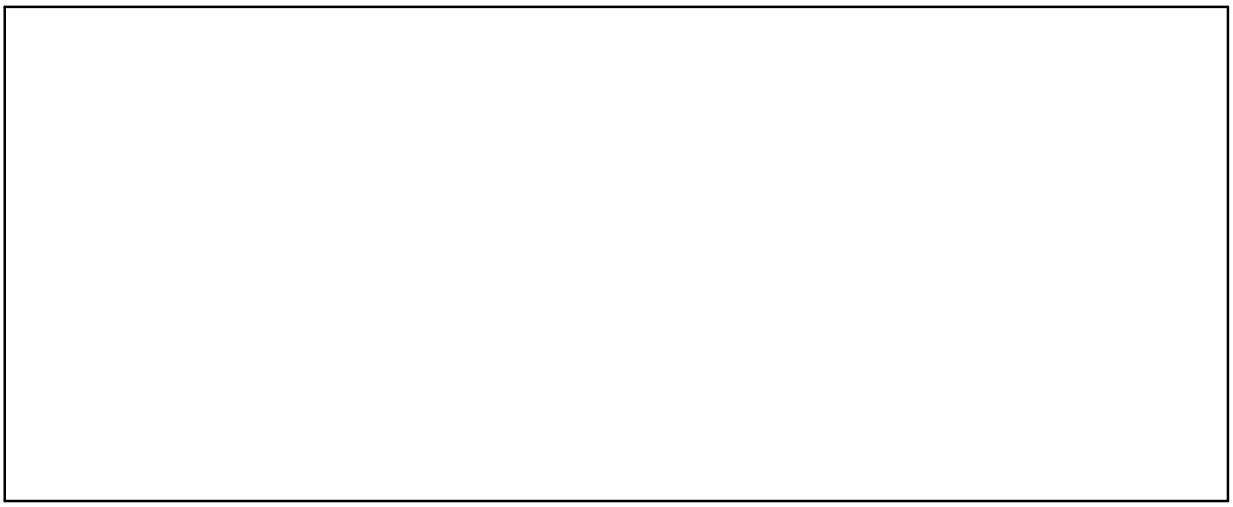


Practice Reaction

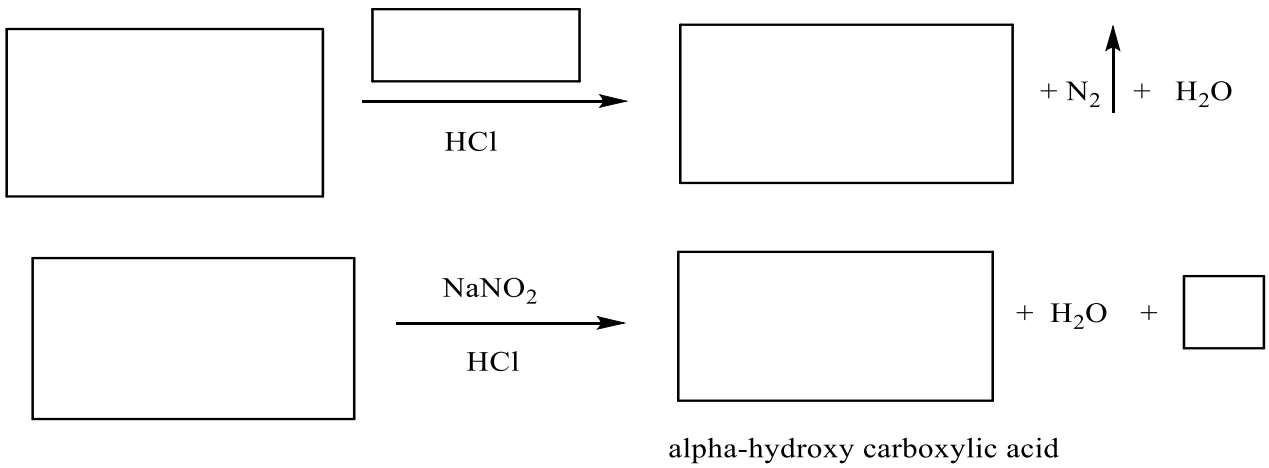
Esterification



Practice Reaction

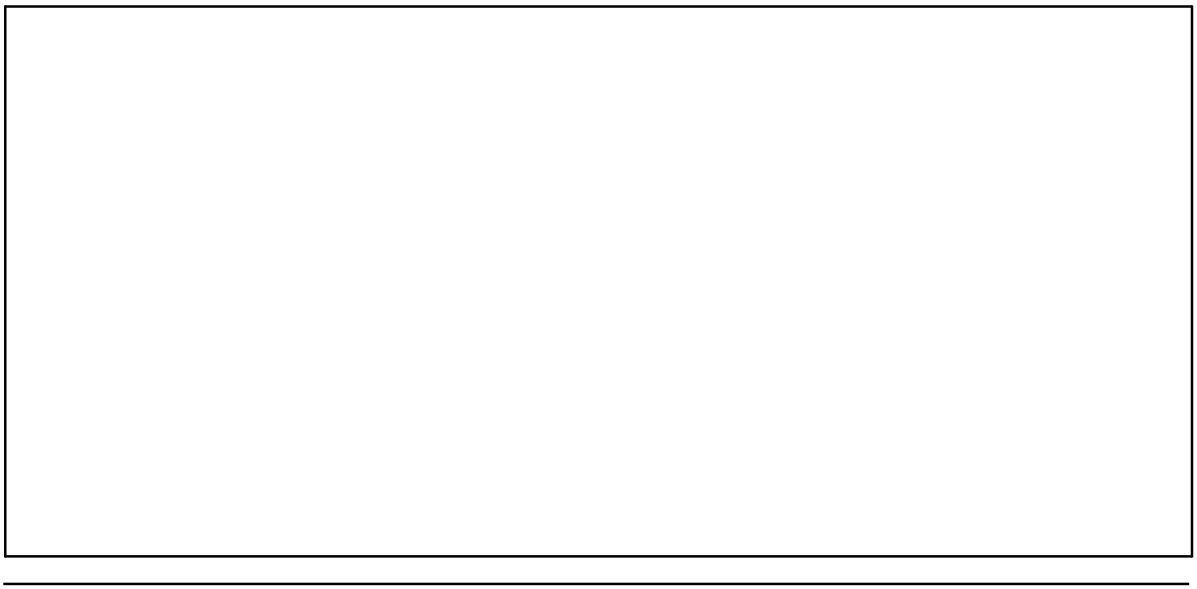


Name of Reaction:_____



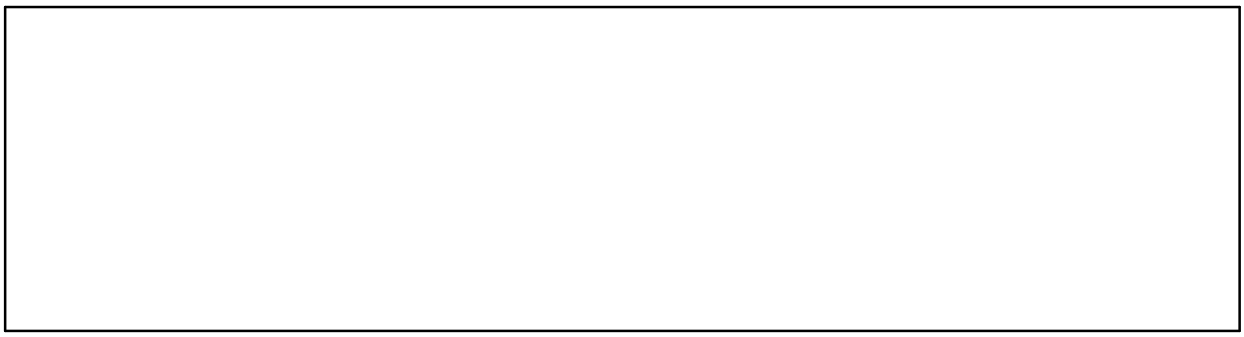
alpha-hydroxy carboxylic acid

Practice Reaction



With _____reagent the amino acids are visualized on _____chromatography as _____spots

Give reaction for the formation of a peptide bond.



A peptide having molecular mass up to _____is called a polypeptide and with molecular mass_____is called a protein

E. Conversion questions (according to order in book)

Worksheet 1

1. Convert primary alcohol to carboxylic acid

2. Convert ethanol to ethanoic acid

3. Give general reaction of conversion of alkanenitrile to carboxylic acid

4. Convert methyl cyanide to acetic acid

5. Convert alkyl halide to alkyl cyanide

6. Convert general reaction for the conversion of alkyl magnesium halide to carboxylic acid

7. Convert methyl magnesium bromide to acetic acid

Worksheet 2

1. Convert ester to sodium salt of acetic acid

2. Convert ethyl acetate to sodium acetate

3. Convert sodium salt of acetic acid to acetic acid

4. Convert symmetrical alkene to carboxylic acid

5. Convert 2-butene to ethanoic acid

6. Convert acetic acid to sodium acetate (write all possible reactions)

7. Convert acetic acid to acetyl chloride

8. Give mechanism of conversion of acetic acid to acetyl chloride

9. Convert acetic acid to ethyl acetate

10. Give mechanism of ester formation

11. Convert acetic acid to acetamide

12. Give mechanism of acetamide formation

13. Convert acetic acid to acetic anhydride

14. Convert acetic acid to ethanol

Worksheet 3

1. Convert acetic acid to ethanol

2. Convert acetic acid to ethane

3. Convert ethanol to acetic acid

4. Convert methyl cyanide to acetic acid

5. Convert acetylene to acetic acid

6. Convert ethanol to acetaldehyde

7. Convert acetaldehyde to acetic acid

8. Prove the acidic and basic character of amino acids

9. Convert carboxylic acid to amino acid

10. Convert aldehyde to α-amino acid

11. Mention Strecker synthesis

12. Convert amino acid to amino ester

13. Convert amino acid to α-hydroxy carboxylic acid

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14. Convert amino acid to protein

Exams Prayer before Studies and for Success

Lord, I will step out in faith, confident of excellence as the exam date approaches, for You never gave me a spirit of fear.

I am also confident that my hard work will definitely pay off. Faith without works is dead and the just shall reap rewards.

I proclaim and declare victory, for life and death is at the power of the tongue.