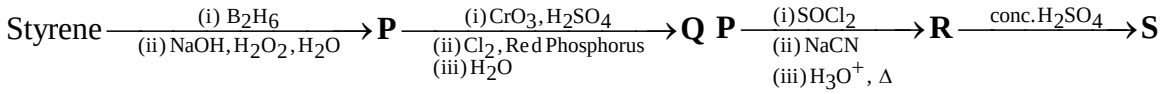
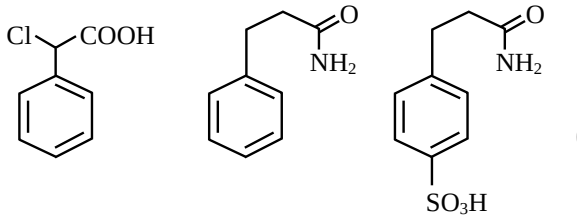
ORGANIC CHEMISTRY

AROMATIC COMPOUND

1. Consider the following reaction scheme and choose the correct option(s) for the major products **Q**, **R** and **S**. **[JEE(Advanced) 2023]**

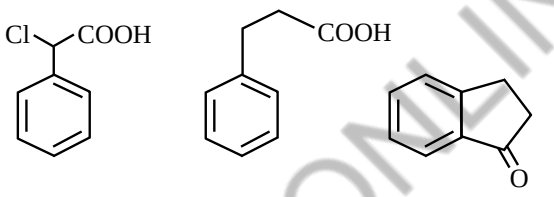


(A)



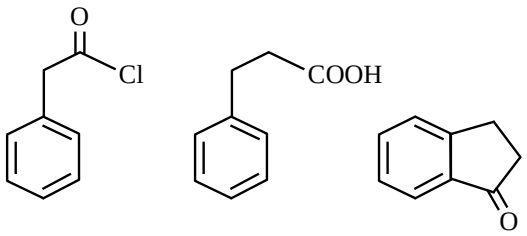
Q **R** **S**

(B)



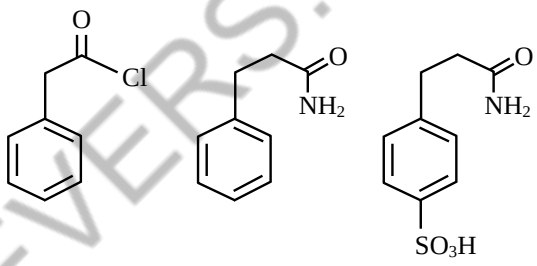
Q **R** **S**

(C)



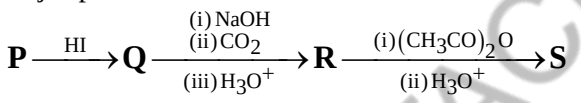
Q **R** **S**

(D)



Q **R** **S**

2. In the given reaction scheme, **P** is a phenyl alkyl ether, **Q** is an aromatic compound; **R** and **S** are the major products. **[JEE(Advanced) 2023]**



The correct statement about **S** is

(A) It primarily inhibits noradrenaline degrading enzymes.

(B) It inhibits the synthesis of prostaglandin.

(C) It is a narcotic drug.

(D) It is *ortho*-acetylbenzoic acid.

3. The major products obtained from the reactions in List-II are the reactants for the named reactions mentioned in List-I. Match List-I with List-II and choose the correct option. **[JEE(Advanced) 2023]**

List-I		**List-II**	
(P)	Etard reaction	(1)	Acetophenone $\xrightarrow{Zn-Hg,\ HCl}$
(Q)	Gattermann reaction	(2)	Toluene $\xrightarrow[(ii)\ SOCl_2]{(i)\ KMnO_4, KOH,\ \Delta}$
(R)	Gattermann-Koch reaction	(3)	Benzene $\xrightarrow[anhyd.\ AlCl_3]{CH_3Cl}$
(S)	Rosenmund reduction	(4)	Aniline $\xrightarrow[273-278\ K]{NaNO_2/HCl}$
		(5)	Phenol $\xrightarrow{Zn,\ \Delta}$

(A) P → 2; Q → 4; R → 1; S → 3

(B) P → 1; Q → 3; R → 5; S → 2

(C) P → 3; Q → 2; R → 1; S → 4

(D) P → 3; Q → 4; R → 5; S → 2

"Paragraph II" for Question No. 4

A trinitro compound, 1, 3,5 tris-(4-nitrophenyl) benzene, on complete reaction with an excess of Sn/HCl gives major product, which on treatment with an excess of $NaNO_2$/HCl at 0°C provides **P** as the product. **P**, upon treatment with excess of H_2O at room temperature, gives the product **Q.** Bromination of **Q** in aqueous medium furnishes the product **R.** The compound **P** upon treatment with an excess of phenol under basic conditions gives the product **S.**

The molar mass difference between compounds **Q** and **R** is 474 mol^{-1} and between compounds **P** and **S** is 172.5 g mol^{-1}. **[JEE(Advanced) 2023]**

4. The number of heteroatoms present in one molecule of **R** is _____.

[Use: Molar mass (in g mol^{-1}): H = 1, C = 12, N = 14, O = 16, Br = 80, Cl = 35.5

Atoms other than C and H are considered as heteroatoms]

"Paragraph II" for Question No. 5

A trinitro compound 1, 3, 5 tris-(4-nitrophenyl) benzene, on complete reaction with an excess of Sn/HCl gives major product, which on treatment with an excess of $NaNO_2$/HCl at 0°C provides **P** as the product. **P,** upon treatment with excess of H_2O at room temperature, gives the product **Q.** Bromination of **Q** in aqueous medium furnishes the product **R.** The compound **P** upon treatment with an excess of phenol under basic conditions gives the product **S.**

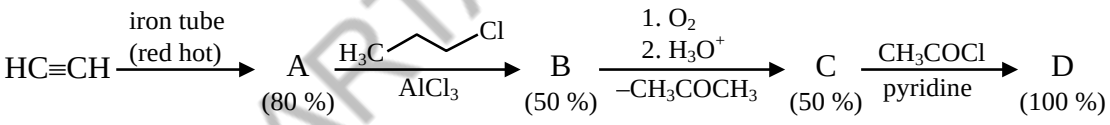
The molar mass difference between compounds **Q** and **R** is 474 mol^{-1} and between compounds **P** and **S** is 172.5 g mol^{-1}. **[JEE(Advanced) 2023]**

5. The total number of carbon atoms and heteroatoms present in one molecule of **S** is **_____.**

[Use: Molar mass in g mol^{-1}]: H = 1, C = 12, N = 14, O = 16, Br = 80, Cl = 35.5

Atoms other than C and H are considered as heteroatoms

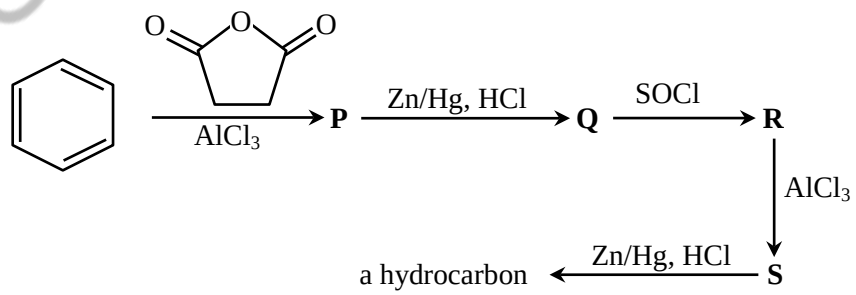
6. If the reaction sequence given below is carried out with 15 moles of acetylene, the amount of the product **D** formed (in g) is _____.



The yields of **A, B, C** and **D** are given in parentheses.

[Given : Atomic mass of H = 1, C = 12, O = 16, Cl = 35] **[JEE(Advanced) 2022]**

7. Considering the following reaction sequence, the correct statement(s) is(are) **[JEE(Advanced) 2022]**



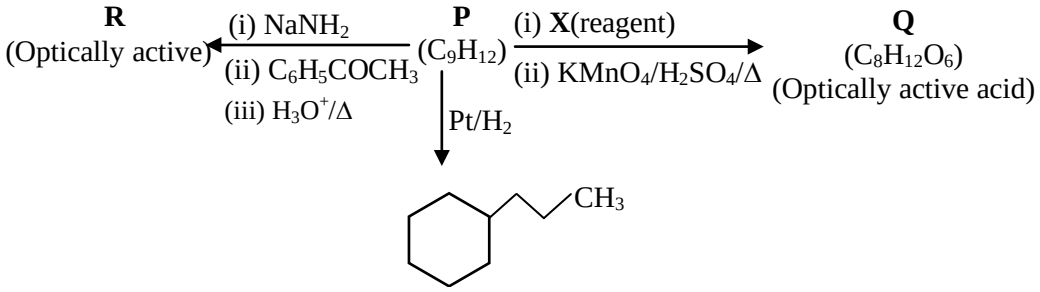
(A) Compounds **P** and **Q** are carboxylic acids.

(B) Compound **S** decolorizes bromine water.

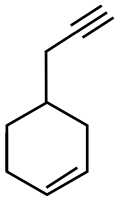
(C) Compounds **P** and **S** react with hydroxylamine to give the corresponding oximes.

(D) Compound **R** reacts with dialkylcadmium to give the corresponding tertiary alcohol.

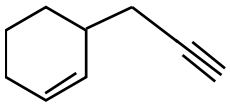
8. Consider the following transformations of a compound **P**.

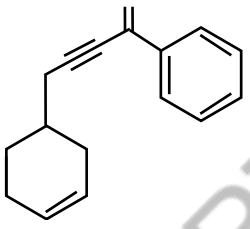


Choose the correct option(s). **[JEE(Advanced) 2020]**

(A) **P** is 

(B) **X** is Pd-C/quinoline/H_2

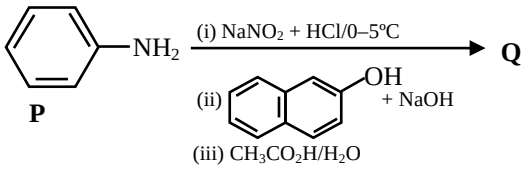
(C) **P** is 

(D) **R** is 

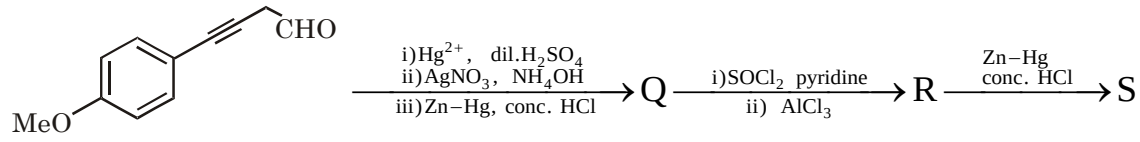
9. Consider the reaction sequence from **P** to **Q** shown below. The overall yield of the major product **Q** from **P** is 75%. What is the amount in grams of **Q** obtained from 9.3 mL of **P** ?

(Use density of **P** = 1.00 g mL^{-1}, Molar mass of C = 12.0, H = 1.0, O = 16.0 and N = 14.0 g mol^{-1})

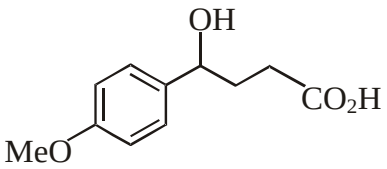
[JEE(Advanced) 2020]



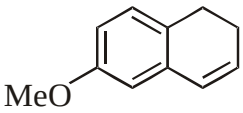
10. Choose the correct option(s) for the following reaction sequence



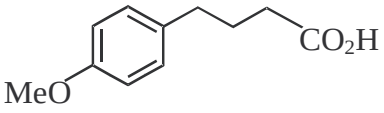
Consider Q, R and S as major products **[JEE(Advanced) 2019]**

(A) 

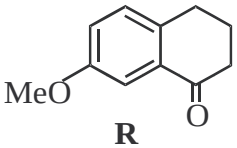
Q



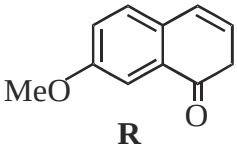
S

(B) 

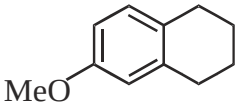
Q



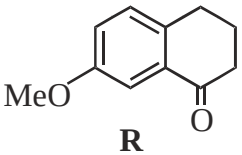
R

(C) 

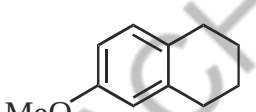
R



S

(D) 

R

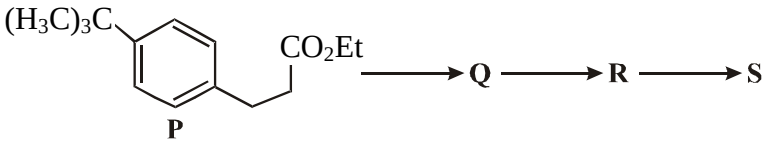


S

Paragraph for Question No. 11 & 12

The reaction of compound P with CH_3MgBr (excess) in $(C_2H_5)_2O$ followed by addition of H_2O gives **Q**, The compound **Q** on treatment with H_2SO_4 at 0^oC gives **R**. The reaction of **R** with CH_3COCl in the presence of anhydrous $AlCl_3$ in CH_2Cl_2 followed by treatment with H_2O produces compounds S.

[Et it compounds **P** is ethyl group]



11. The reactions, **Q** to **R** and **S** to **S**, are -

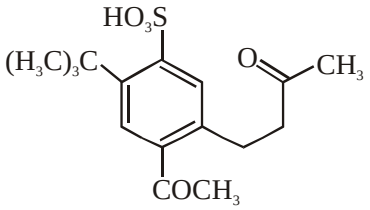
(A) Dehydration and Friedel-Crafts acylation

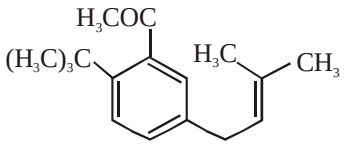
(B) Friedel-Crafts alkylation, dehydration and Friedel-Crafts acylation

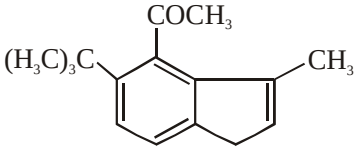
(C) Aromatic sulfonation and Friedel-Crafts acylation

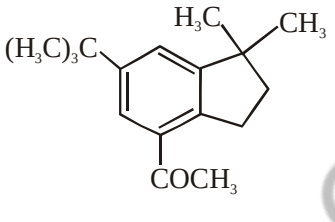
(D) Friedel-Crafts alkylation and Fridel-Crafts acylation

12. The product **S** is - **[JEE(Advanced) 2017]**

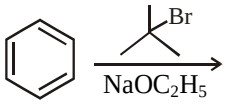
(A) 

(B) 

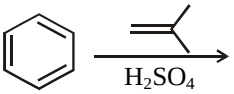
(C) 

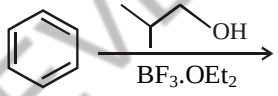
(D) 

13. Among the following reaction(s) which gives (give) tert-butyl benzene as the major product is(are) **[JEE(Advanced) 2016]**

(A) 

(B) 

(C) 

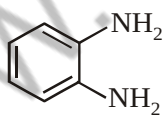
(D) 

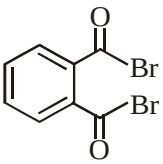
Paragraph For Q.14 & Q.15

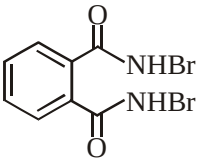
Treatment of compound **O** with $KMnO_4$ / H^+ gave **P**, which on heating with ammonia gave **Q**. The compound **Q** on treatment with Br_2 / NaOH produced **R**. On strong heating, **Q** gave **S**, which on further treatmenet with ethyl 2-bromopropanoate in the presence of KOH following by acidification, gave a compound **T**. **[JEE(Advanced) 2016]**

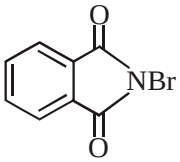
(O)

14. The compound **R** is :

(A) 

(B) 

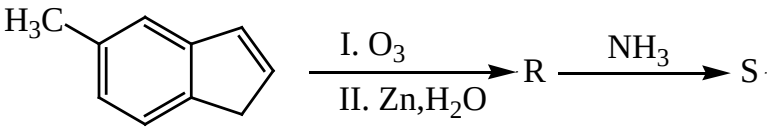
(C) 

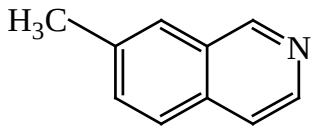
(D) 

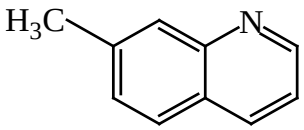
15. The compound **T** is :

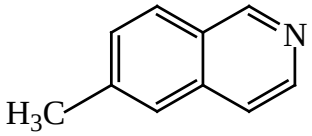
(A) Glycine (B) Alanine (C) Valine (D) Serine

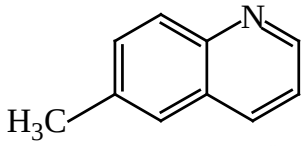
16. In the following reactions, the product S is - **[JEE(Advanced) 2015]**



(A) 

(B) 

(C) 

(D) 

17. For the identification of β-naphthol using dye test, it is necessary to use **[JEE(Advanced) 2014]**

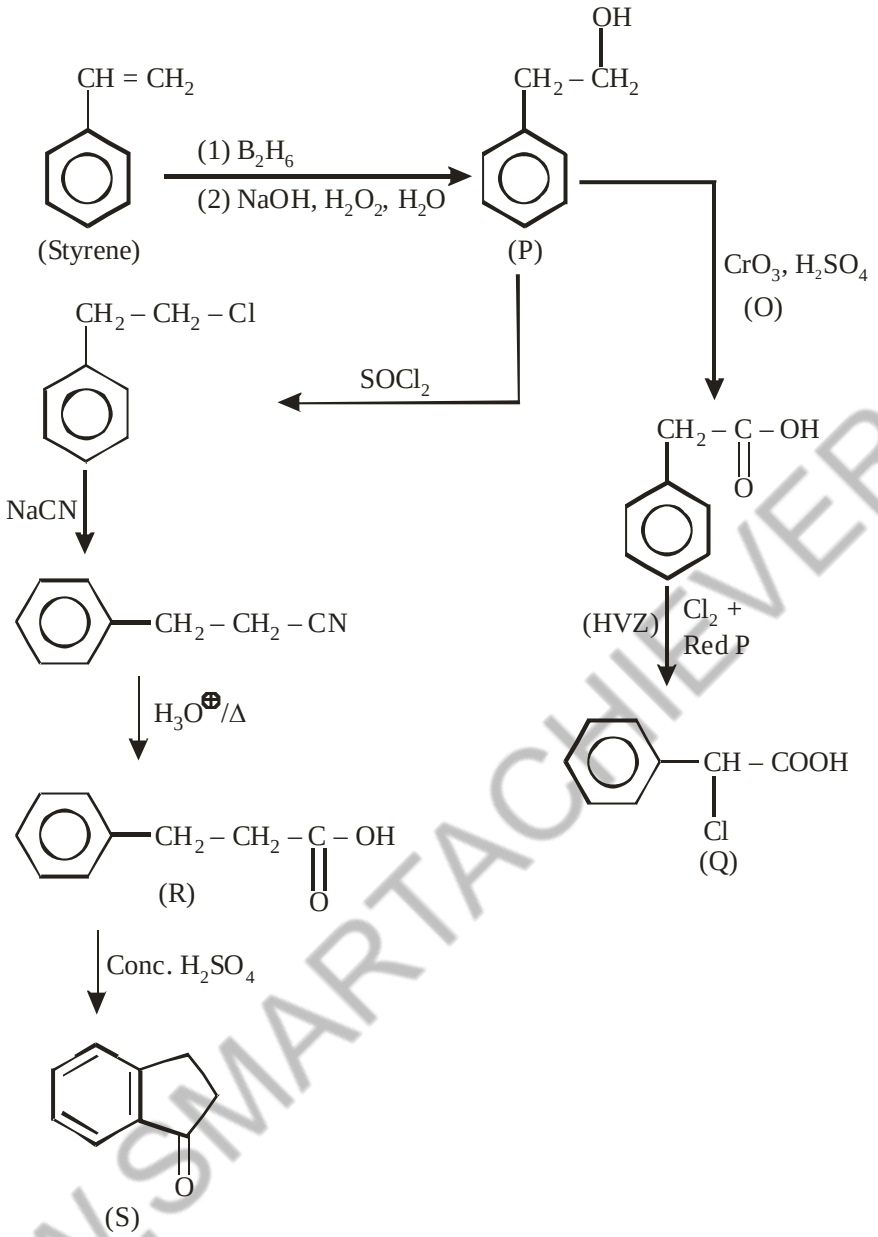
(A) dichloromethane solution of β-naphthol (B) acidic solution of β-naphthol

(C) neutral solution of β-naphthol (D) alkaline solution of β-naphthol

SOLUTIONS

1. Ans. (B)

Sol.



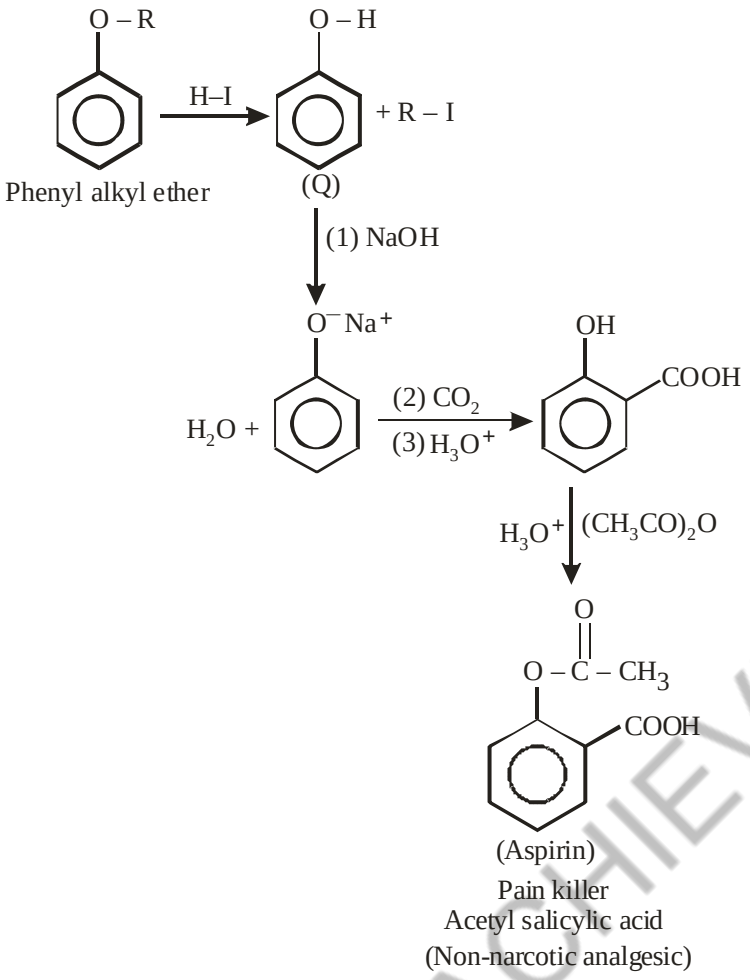
2. Ans. (B)

Sol. P is phenyl alkyl ether

Q is aromatic compound

R and S are the major product

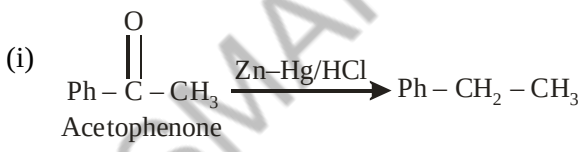
i.e.

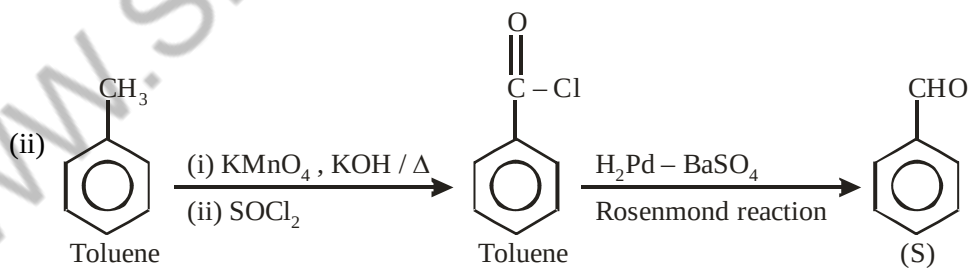


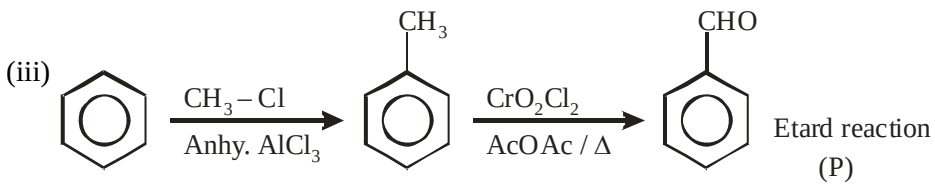
Aspirin inhibits the synthesis of chemicals known as prostaglandin's.

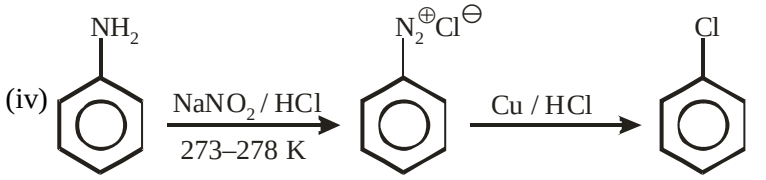
3. Ans. (D)

Sol. P → 3, Q → 4, R → 5, S → 2

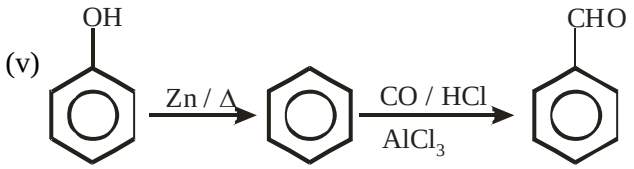






(iv) 

Gattermann reaction
(Q)

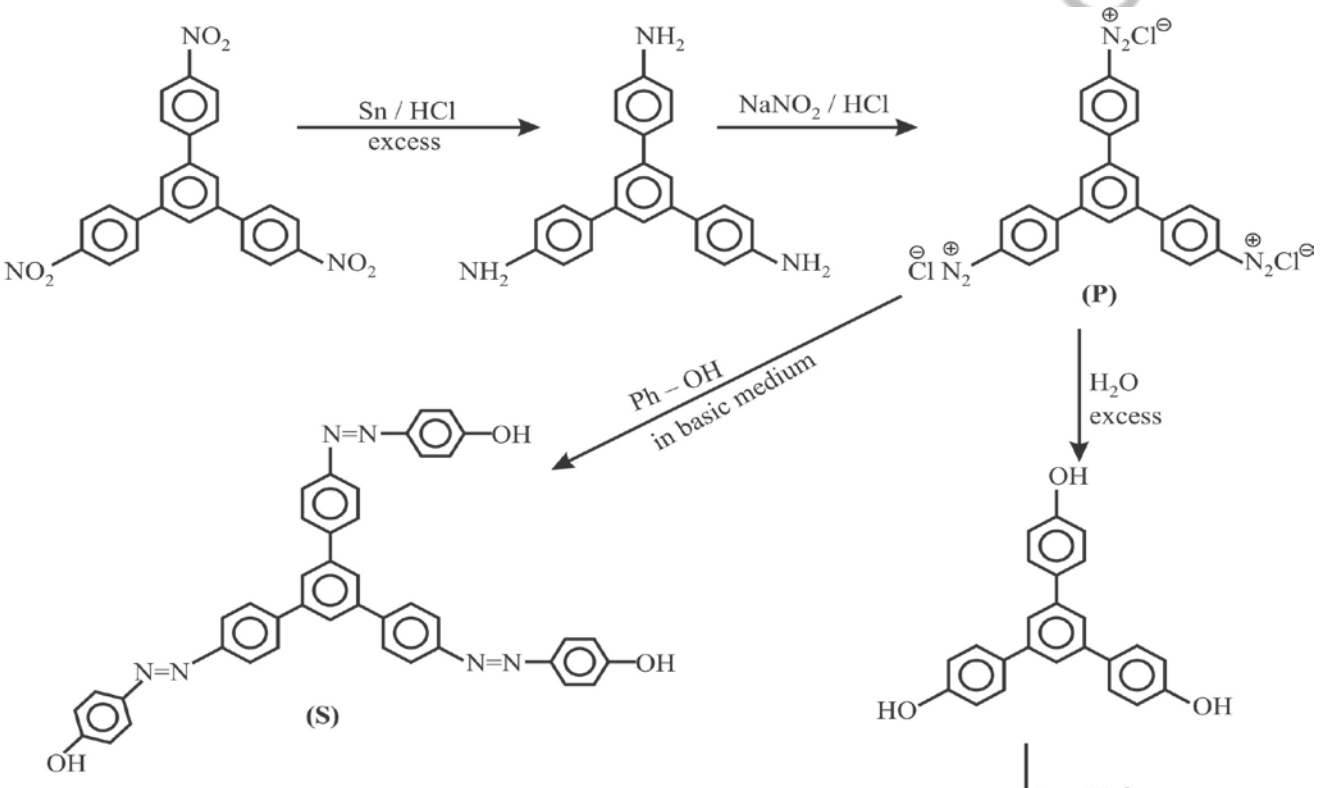
(v) 

Gattermann Koch reaction
(R)

4. Ans. (9.00)

5. Ans. (51.00)

Sol. Common solution for Q.No. 4 and 5



Number of carbons = 42

Number of heteroatoms = 09

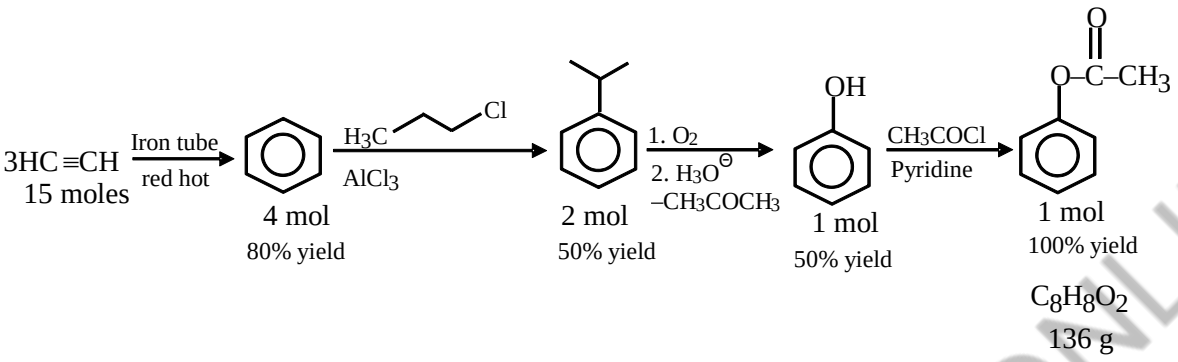
Total = 51

(R)

Number of hetero atoms in R is 9

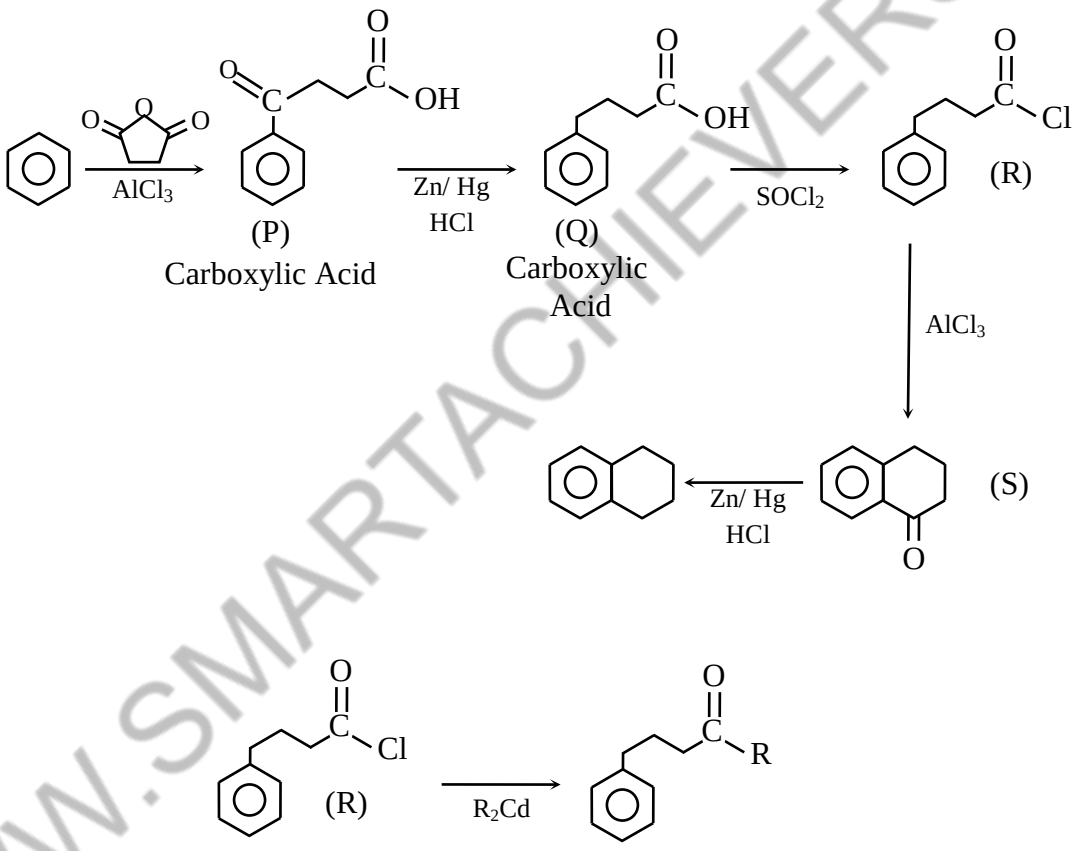
6. Ans. (135.80 - 136.20)

Sol.



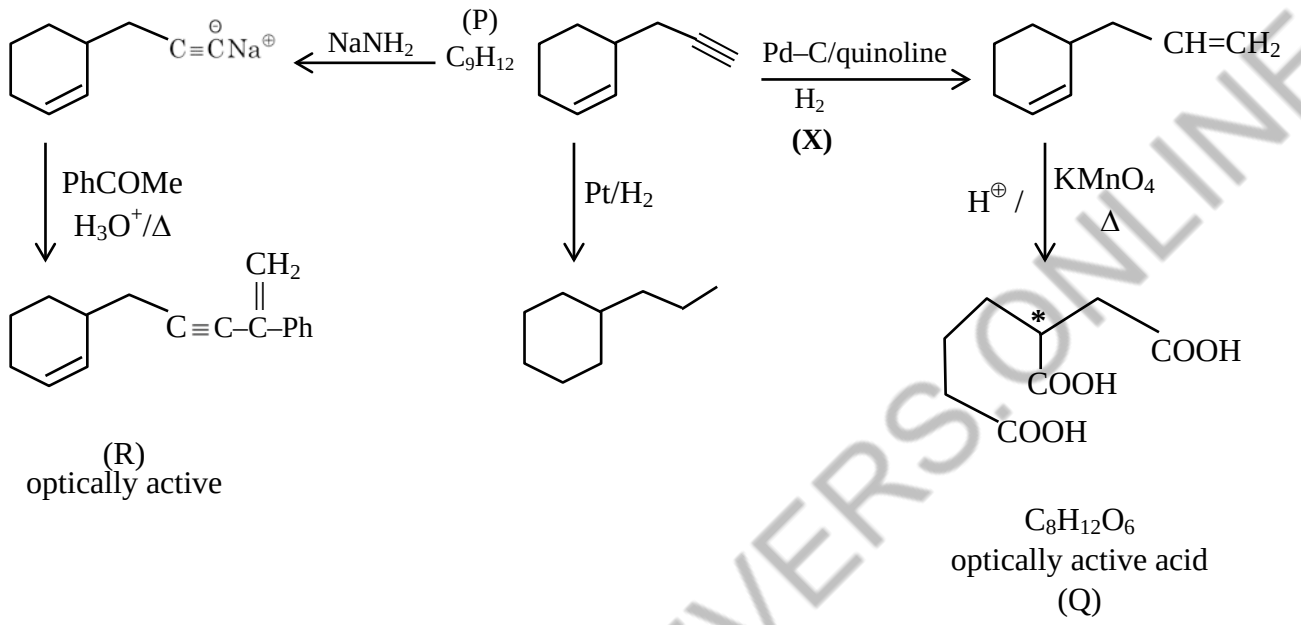
7. Ans. (A, B, C or A, C)

Sol.



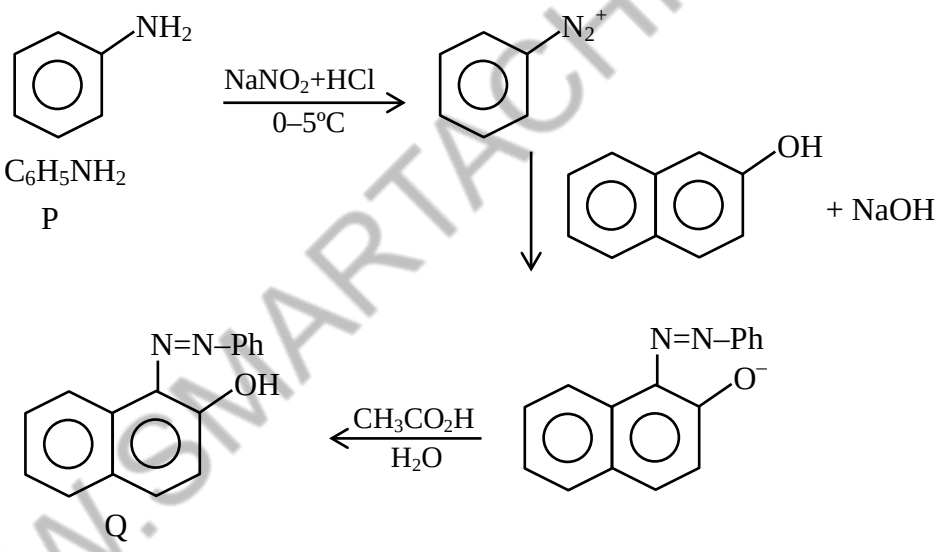
8. Ans. (B, C)

Sol.



9. Ans. (18.60)

Sol.



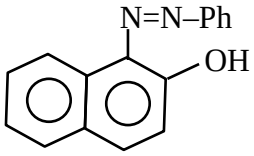
Molecular weight of aniline = M.wt. of C_6NH_7

$= 72 + 7 + 14 = 93$

density of P = 1 gm ml^{-1}

9.3 ml of P = 9.3 gm P

$= \frac{9.3}{9.3} = 0.1\,\text{mole P}$

The mole ratio $PhNH_2 : PhN_2^+ :$ 

= 1 : 1 : 1

so the mole of Q formed will be 0.1 mole and extent of reaction is 100% but if it is 75% yield.

Then amount of Q = $0.1 \times \frac{75}{100}$ = 0.075 mol

The molecular formula of Q = $C_{16}H_{12}ON_2$

so M.wt. of Q = $16 \times 12 + 12 \times 1 + 16 + 2 \times 14$

= 192 + 12 + 16 + 28

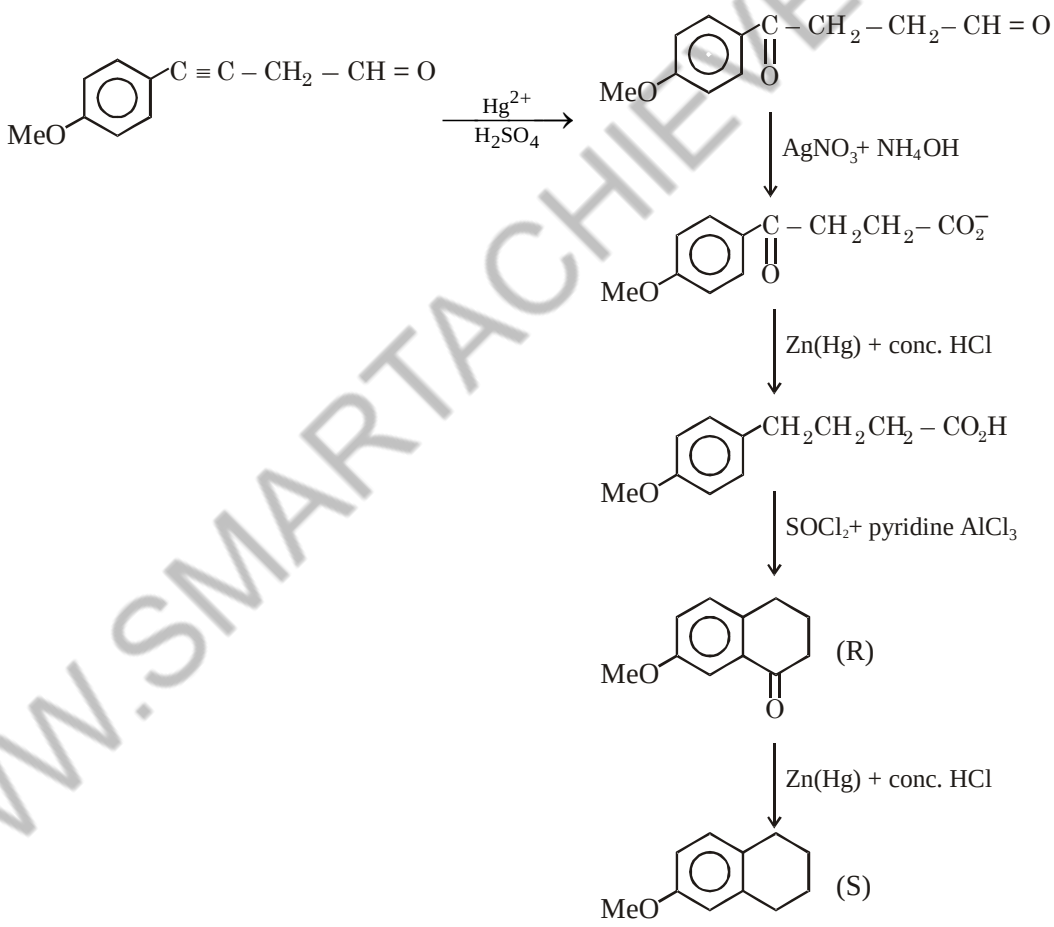
= 248 gm

so amount of Q = 248×0.075

= 18.6 gm

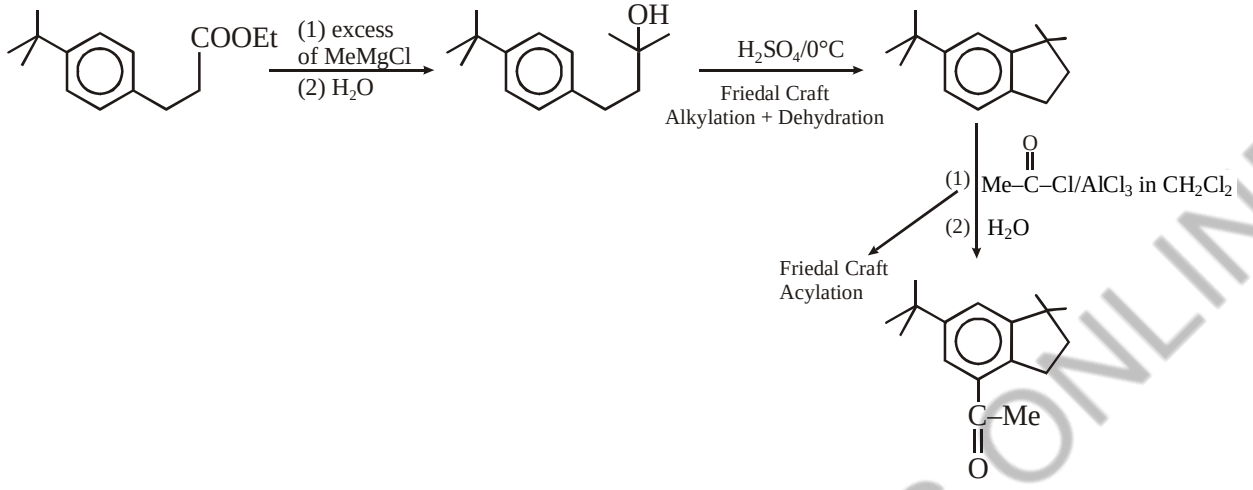
10. Ans. (B, D)

Sol.



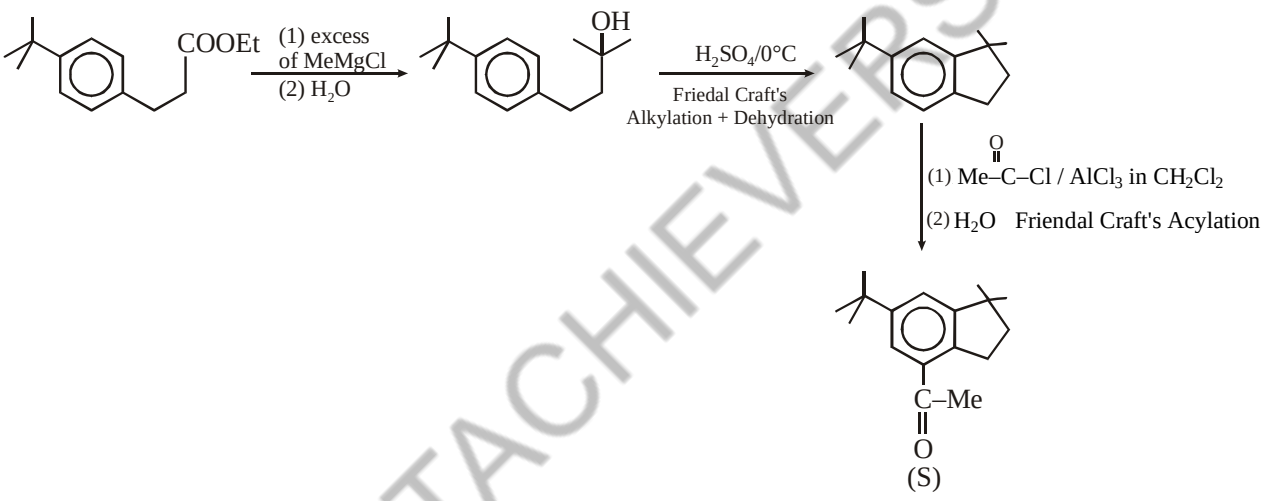
11. Ans.(B)

Sol.



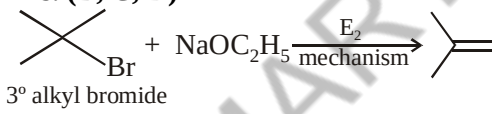
12. Ans. (D)

Sol.

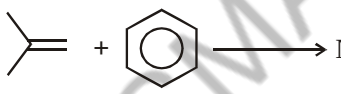


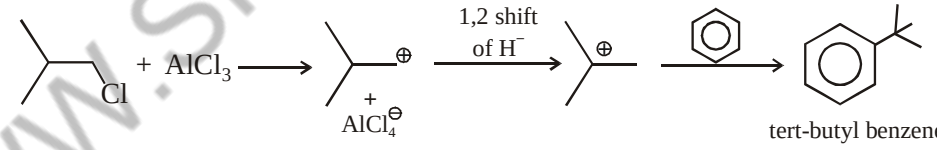
13. Ans. (B, C, D)

Sol.

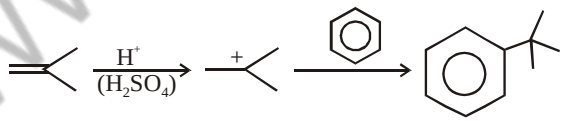


3° alkyl bromide



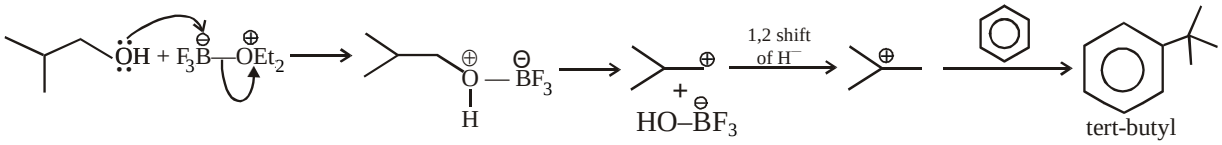


tert-butyl benzene



tert-butyl benzene

(D)

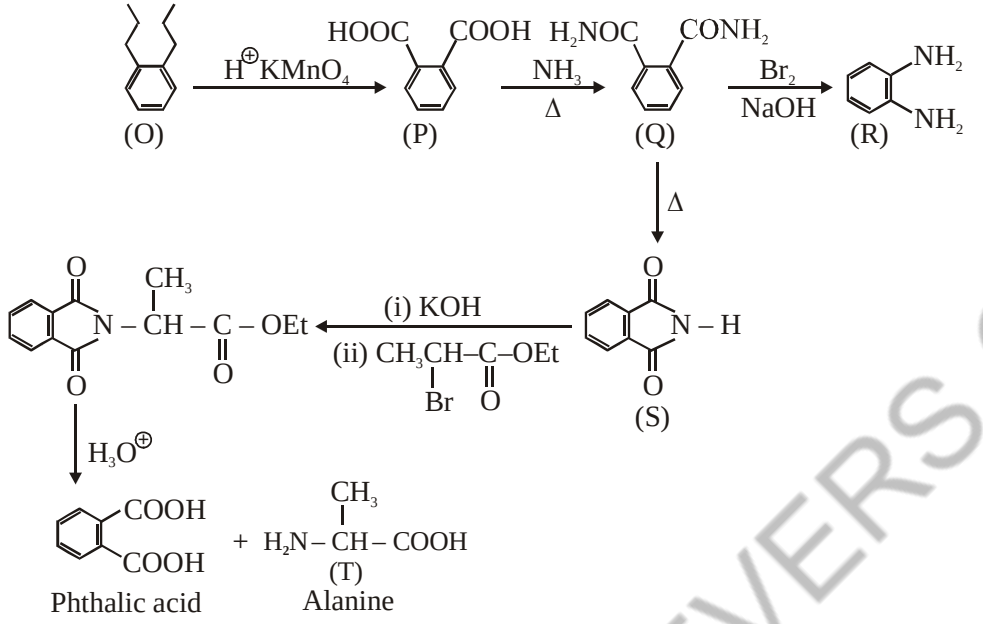


tert-butyl benzene

14. Ans. (A)

15. Ans. (B)

Solution for Q.14 & 15

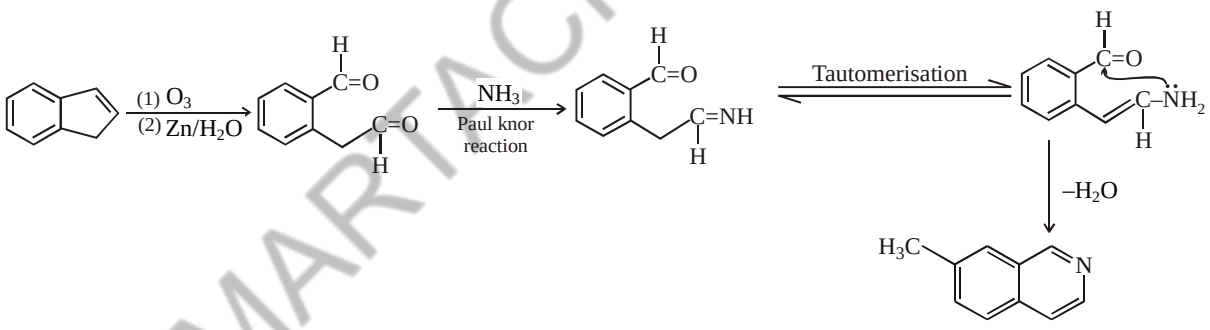


Q to R is Hoffmann's bromamide degradation reaction

S to T is Gabriel's phthalimide sysnthesis

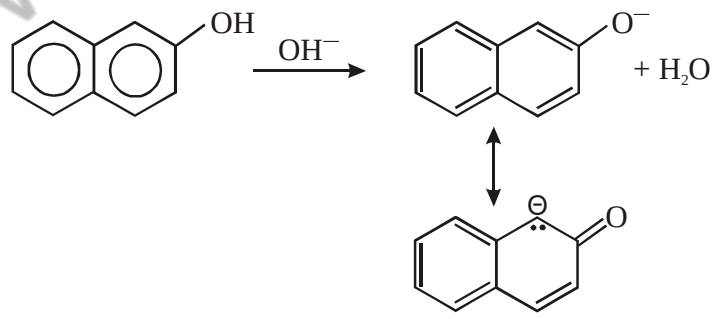
16. Ans. (A)

Sol.



17. Ans. (D)

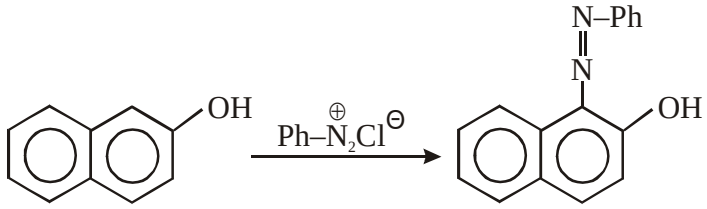
Sol. In alkaline medium the activating nature of –OH group increases and the rate of electrophilic substitution (Coupling Reaction) increases on aromatic ring.



–OH group converts to $-O^{\ominus}$

Electron releasing nature of $-O^{\ominus}$ is more than –OH

Nucleophilicity of β-napthol increases in basic medium



(Coloured dye)