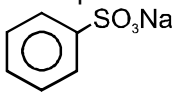
Exercise-1

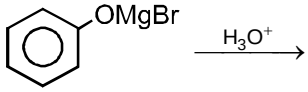
Marked questions are recommended for Revision.

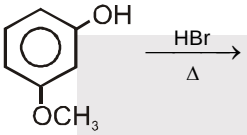
PART - I : SUBJECTIVE QUESTIONS

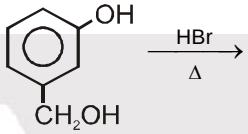
Section (A) : Phenol

A-1. Write the products of the following reactions :

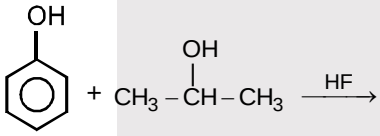
(a) 

(b) 

(c) 

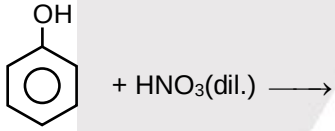
(d) 

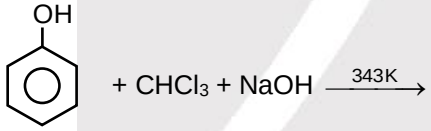
A-2. Explain why nucleophilic substitution reactions are not very common in phenols.

A-3. 

Give the products of the above reactions.

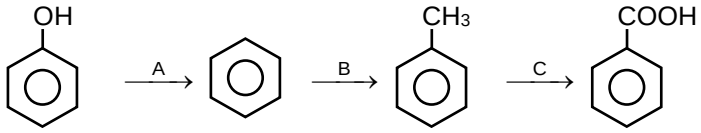
A-4. Complete the following :

(a) 

(b) 

(c) 

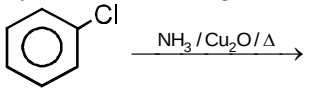
A-5. An organic compound 'A' having molecular formula C_6H_6O gives a characteristic colour with aqueous $FeCl_3$ solution. When 'A' is treated with CO_2 and NaOH at 400 K under pressure, 'B' is obtained. B on acidification gives C when C treated with CH_3COCl gives a popular pain killer D. Deduce the structures of A, B, C and D.

A-6. 

Identify A, B and C in above reaction ?

Section (B) : Nitrogen containing compounds

B-1. Complete the following reactions :

(a) 

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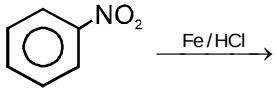
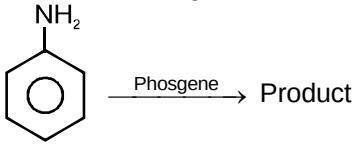
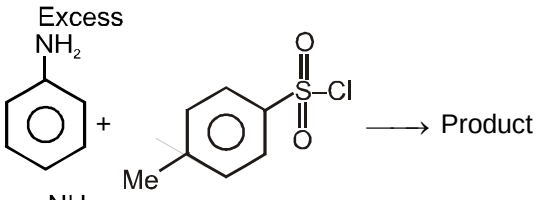
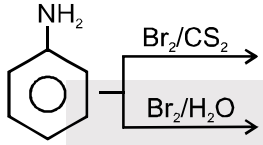
(b) 

B-2. Complete the following reaction :

(a) 

(b) 

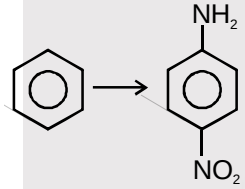
(c) 

B-3. Why does aniline soluble in aqueous HCl ?

B-4. Write following conversions :
(a) nitrobenzene ⟶ acetanilide
(b) acetanilide ⟶ *p*-nitroaniline

B-5. What is the product when $C_6H_5CH_2NH_2$ reacts with HNO_2 ?

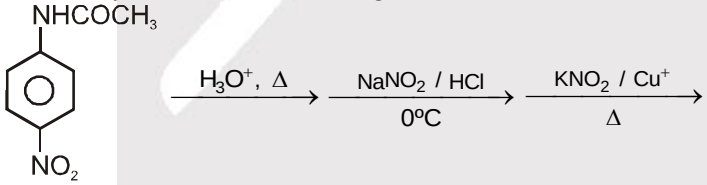
B-6. How will you carry out the following conversion ?



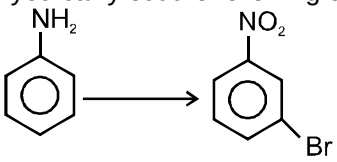
B-7. Give 3 methods to distinguish primary amine from secondary and tertiary.

Section (C) : Benzene diazonium salt & its reaction

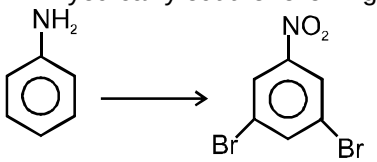
C-1. The final product of the following reaction is :

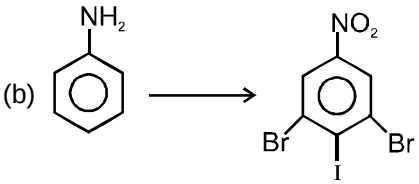


C-2. How will you carry out the following conversion ?

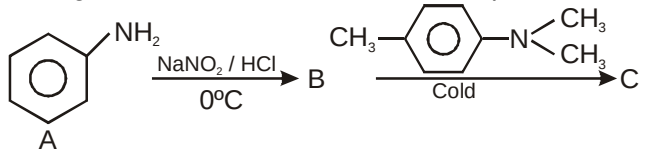


C-3. How will you carry out the following conversions ?

(a) 

(b) 

C-4. In the given reaction of aniline a coloured product C was obtained. The structure of C would be :



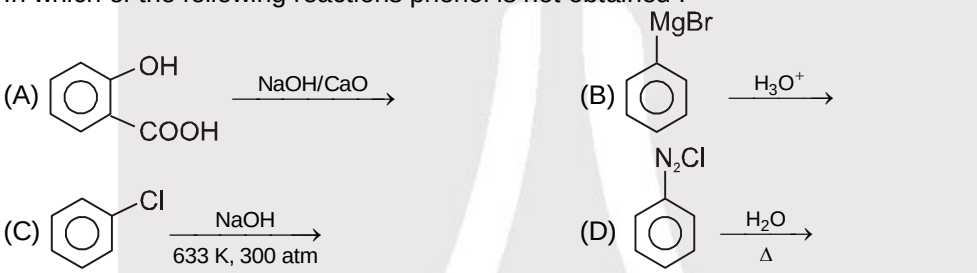
C-5. A solution contains 1 g mol. each of *p*-toluene diazonium chloride and *p*-nitrophenyl diazonium chloride. To this 1 g mol. of alkaline solution of phenol is added. Predict the major product. Explain your answer.

C-6. How will you carry out the following conversions ?
(a) toluene $\longrightarrow$ *p*-toluidine
(b) *p*-toluene diazonium chloride $\longrightarrow$ *p*-toluic acid

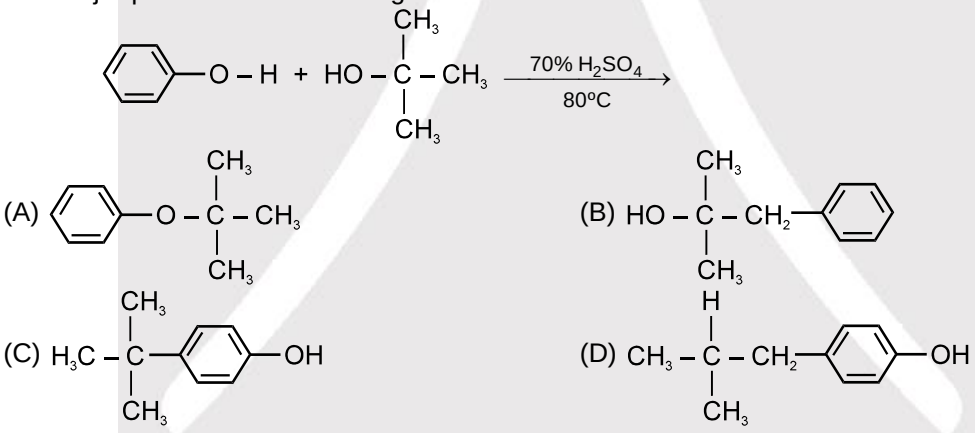
PART - II : ONLY ONE OPTION CORRECT TYPE

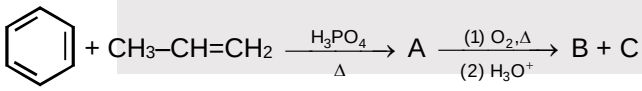
Section (A) : Phenol

A-1. In which of the following reactions phenol is not obtained :

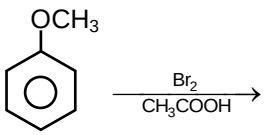


A-2. The major product of the following reaction is

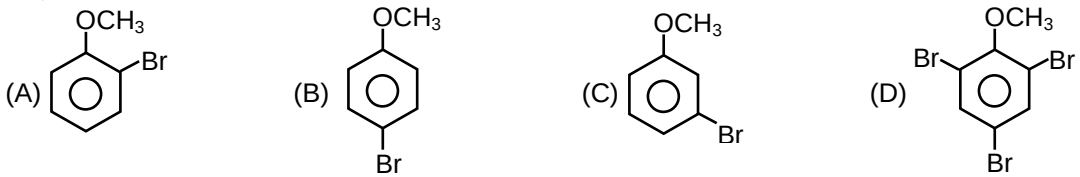


A-3. 

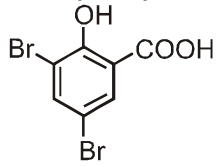
The products B & C are respectively :
(A) Phenol & acetic acid
(B) Phenol & acetaldehyde
(C) Benzoic acid & acetone
(D) Phenol & acetone

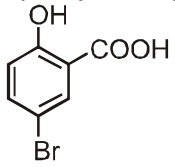
A-4. 

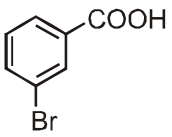
product. The major product obtained is

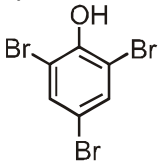


A-5. When 2-hydroxybenzoic acid (salicylic acid) is treated with bromine water, the product formed is

(A) 

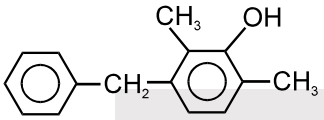
(B) 

(C) 

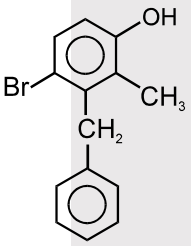
(D) 

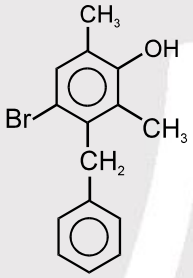
A-6. An organic compound having the molecular formulaf C_7H_8O is insoluble in $NaHCO_3$ solution but dissolves in aqueous NaOH. When treated with bromine water the compound rapidly forms a precipitate having the molecular formula $C_7H_5OBr_3$. The organic compound is

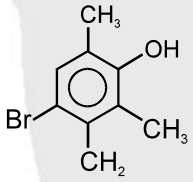
(A) o-cresol (B) m-cresol (C) p-cresol (D) anisole

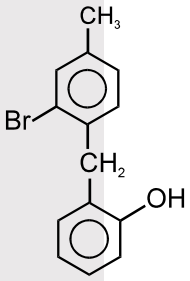
A-7. 

$\xrightarrow{Br_2/CCl_4}$, The product is :

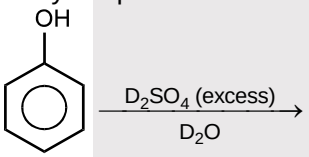
(A) 

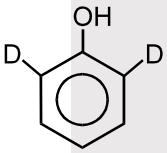
(B) 

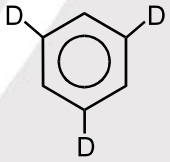
(C) 

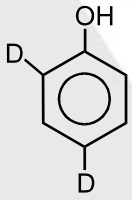
(D) 

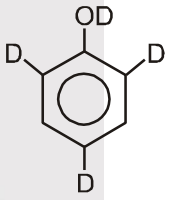
A-8. Identify the product in following reaction ?



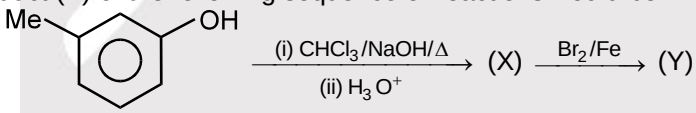
(A) 

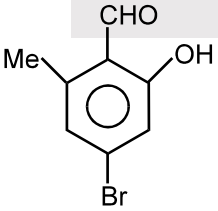
(B) 

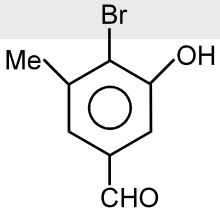
(C) 

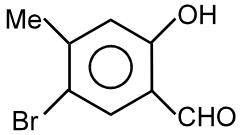
(D) 

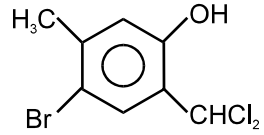
A-9. The product (Y) of the following sequence of reactions would be :

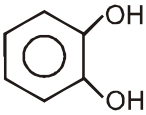


(A) 

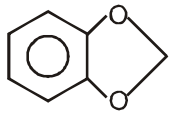
(B) 

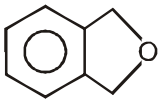
(C) 

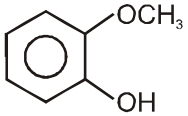
(D) 

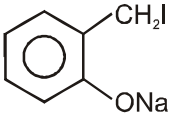
A-10. 

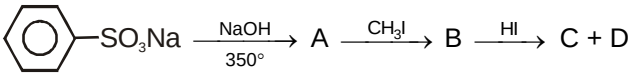
$+ CH_2I_2 + NaOH \longrightarrow$, the product is :

(A) 

(B) 

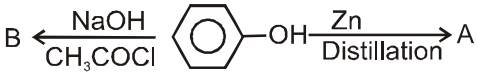
(C) 

(D) 

A-11. In the reaction sequence  A, B, C and D are given by the set :

(A) Sodium phenate, anisole, C_6H_5I, CH_3OH (B) Sodium phenate, phenitole, C_2H_5I, C_6H_5OH

(C) Sodium phenate, anisole, C_6H_5OH, CH_3I (D) Sodium phenate, phenitole, C_6H_5I, C_2H_5OH

A-12. 

The compounds A and B in the above reaction sequence are :

(A) benzene, methyl benzoate (B) benzene, phenyl acetate

(C) phenyl acetate, benzene (D) benzene, phenylacetyl chloride

Section (B) : Nitrogen containing compounds

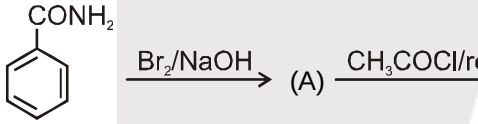
B-1. Which of the following sequence is best suited to convert benzene to 3-chloro aniline ?

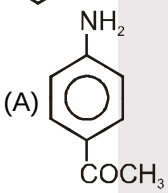
(A) nitration, reduction, chlorination

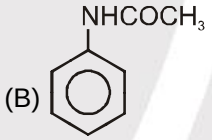
(B) chlorination, nitration, reduction

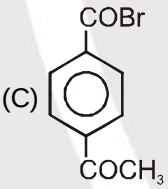
(C) nitration, chlorination, reduction

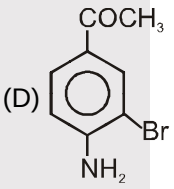
(D) nitration, reduction, acetylation, chlorination, hydrolysis

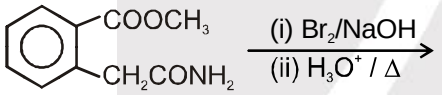
B-2.  (B), Identify the major product (B).

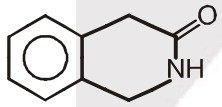
(A) 

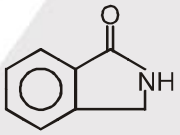
(B) 

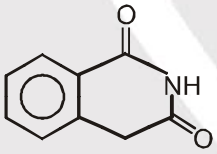
(C) 

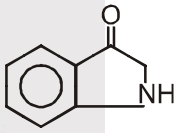
(D) 

B-3.  Product. The major product obtained is

(A) 

(B) 

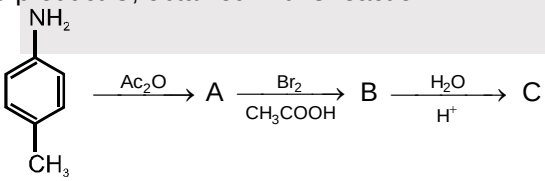
(C) 

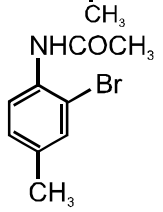
(D) 

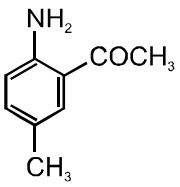
B-4. Aniline when treated with acetyl chloride in presence of alkali, the product formed is :

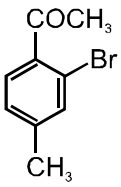
(A) acetanilide (B) benzoyl chloride (C) acetophenone (D) aniline hydrochloride

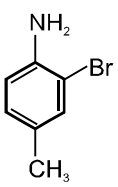
B-5. The final product C, obtained in this reaction



(A) 

(B) 

(C) 

(D) 

B-6. Chloroform when treated with aniline and alcoholic KOH, the product formed is ?

(A) Phenyl cyanide (B) Phenyl isocyanide

(C) Chlorobenzene (D) Phenol

B-7. An aromatic amine (X) was treated with alcoholic potash and another compound (Y) then foul smelling gas C_6H_5NC is formed. The compound (Y) was formed by reacting compound (Z) with Cl_2 in the presence of slaked lime. The compound (Z) is :
(A) $CHCl_3$ (B) CH_3COCH_3 (C) CH_3OH (D) $C_6H_5NH_2$

B-8. p-Chloro aniline and anilinium chloride can be distinguished by
(A) Sandmayer reaction (B) Carbyl amine reaction
(C) Hinsberg's reaction (D) $AgNO_3$

B-9. The best reagent for converting 2–phenylpropanamide into 2-phenylpropanamine is _____.
(A) excess H_2 (B) Br_2 in aqueous NaOH
(C) iodine in the presence of red phosphorus (D) $LiAlH_4$ in ether

B-10. Hoffmann bromamide degradation reaction is shown by _____.
(A) $ArNH_2$ (B) $ArCONH_2$ (C) $ArNO_2$ (D) $ArCH_2NH_2$

B-11. The best reagent for converting, 2-phenylpropanamide into 1- phenylethanamine is ____.
(A) excess H_2/Pt (B) NaOH/Br_2 (C) $NaBH_4$/methanol (D) $LiAlH_4$/ether

B-12. In order to prepare a 1º amine from an alkyl halide with simultaneous addition of one CH_2 group in the carbon chain, the reagent used as source of nitrogen is _____.
(A) Sodium amide, $NaNH_2$ (B) Sodium azide, NaN_3
(C) Potassium cyanide, KCN (D) Potassium phthalimide, $C_6H_4(CO)_2N^-K^+$

B-13. Best method for preparing primary amines from alkyl halides without changing the number of carbon atoms in the chain is
(A) Hoffmann Bromamide reaction (B) Gabriel phthalimide synthesis
(C) Sandmeyer reaction (D) Reaction with NH_3

B-14. The product formed by the reaction of acetamide with Br_2 in presence of NaOH is :
(A) CH_3CN (B) CH_3CHO (C) CH_3CH_2OH (D) CH_3NH_2

Section (C) : Benzene diazonium salt & its reactions

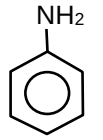
C-1. In the reaction, the product (C) is :

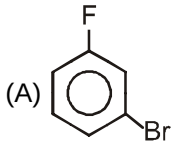
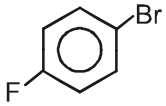
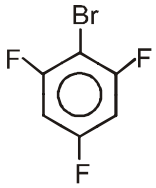
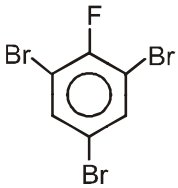
$$C_6H_5NH_2 \xrightarrow[0-5°C]{NaNO_2+HCl} (A) \xrightarrow[KCN]{CuCN} (B) \xrightarrow{H^+/H_2O} (C)$$

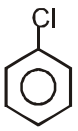
(A) $C_6H_5CH_2NH_2$ (B) C_6H_5COOH (C) C_6H_5OH (D) none of these

C-2. Benzenediazonium chloride can be converted into benzene on treatement with:
(A) H_3PO_3 (B) H_3PO_4 (C) H_3PO_2 (D) HPO_3

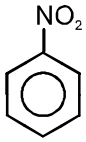
C-3. $C_6H_5NH_2 \xrightarrow[0-5°C]{NaNO_2+HCl} X \xrightarrow[\Delta]{H_2O} Y$, the product Y is :
(A) Benzenediazonium chloride (B) Nitrobenzene
(C) Phenol (D) Cresol

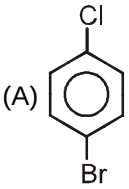
C-4.  $\xrightarrow[(ii)\ HNO_2\ (0-5°C)\ (iii)\ HBF_4/\Delta]{(i)\ Br_2/H_2O}$ (A). The major product (A) is

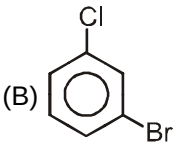
(A) 
(B) 
(C) 
(D) 

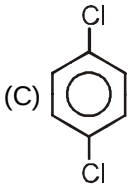
C-5. Diazonium salt + Cu + HCl $\rightarrow$  ; the reaction is known as

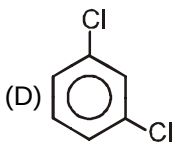
(A) Chlorination (B) Sandmeyer's reaction
(C) Perkin reaction (D) Gattermann reaction

C-6.  $\xrightarrow[(ii)\ H_2/Pt]{(i)\ Br_2/Fe}$ (A) $\xrightarrow[(ii)\ Cu_2Cl_2/HCl]{(i)\ NaNO_2/HCl\ 0-5°C}$ (B). The product (B) is

(A) 

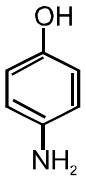
(B) 

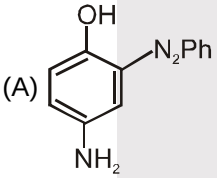
(C) 

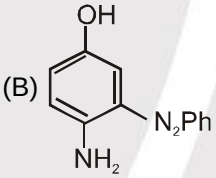
(D) 

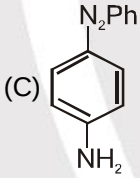
C-7. Which of the following compound will not undergo azo coupling reaction with benzene diazonium chloride.

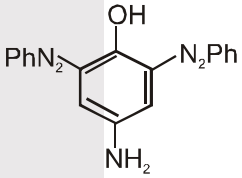
(A) Aniline (B) Phenol (C) Anisole (D) Nitrobenzene

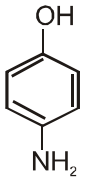
C-8.  + Ph – $\overset{+}{N}_2$ $\xrightarrow{pH = 4-6}$ X (major product) X will be -

(A) 

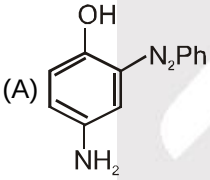
(B) 

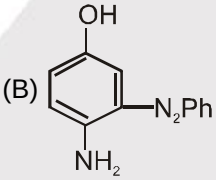
(C) 

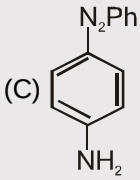
(D) 

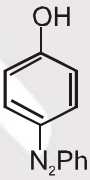
C-9.  + Ph–$\overset{+}{N}_2$ $\xrightarrow{(pH=9-11)}$ X (major product)

X will be :

(A) 

(B) 

(C) 

(D) 

PART - III : MATCH THE COLUMN

1. Match the column:

	Column-I		**Column-II**
(A)	$RNH_2 + CHCl_3 + KOH\ (alc) \xrightarrow{\Delta}$	(p)	Schotten-Baumann reaction
(B)	$C_6H_5N_2Cl \xrightarrow[\Delta]{CuBr/HBr}$	(q)	Coupling reaction
(C)	$C_6H_5NH_2 + C_6H_5COCl \xrightarrow{NaOH(aq.)}$	(r)	Carbylamine reaction
(D)	$C_6H_5N_2Cl + C_6H_5OH \xrightarrow{pH\ 9-10}$	(s)	Sandmeyer reaction

2. Match the reactions given in Column I with the statements given in Column II.

	Column-I		**Column-II**
(A)	Ammonolysis	(p)	Amine with lesser number of carbon atoms
(B)	Gabriel phthalimide synthesis	(q)	Detection test for primary amines.
(C)	Hoffmann Bromamide reaction	(r)	Reaction of phthalimide with KOH and R—X
(D)	Carbylamine reaction	(s)	Reaction of alkylhalides with NH_3

3. Match the compounds given in Column-I with the items given in Column-II.

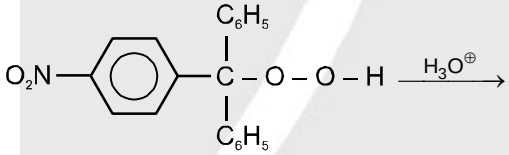
	Column-I		**Column-II**
(A)	$C_6H_6 + CH_3CH(Cl)–CH_3 \xrightarrow{\text{anhydrous } AlCl_3}$	(p)	Diazocoupling reaction.
(B)	$C_6H_5NH_2 + C_6H_5N_2Cl \xrightarrow{\text{dil.HCl}}$	(q)	Friedel-Craft reaction
(C)	$C_6H_6 + C_6H_5COCl \xrightarrow{\text{anhydrous } AlCl_3}$	(r)	Reimer-Tiemann reaction
(D)	$C_6H_5OH \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } CCl_4 / NaOH}$	(s)	Product is Isopropyl benzene
		(t)	Electrophilic substitution reaction

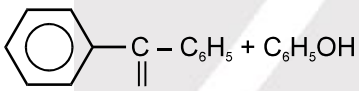
Exercise-2

Marked questions are recommended for Revision.

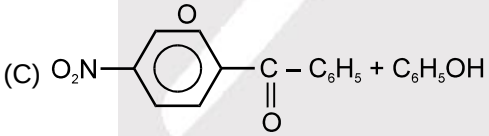
PART - I : ONLY ONE OPTION CORRECT TYPE

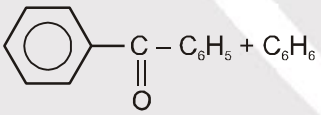
1. Identify the product in the following reaction.



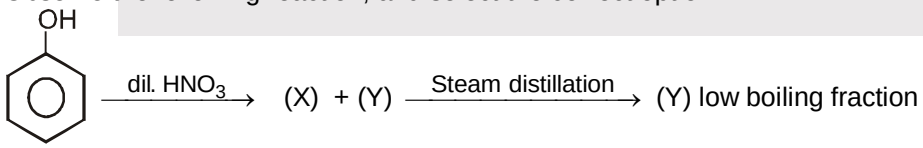
(A) 

(B) 

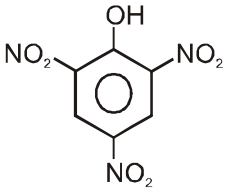
(C) 

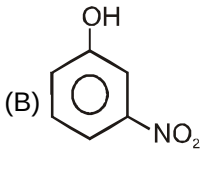
(D) 

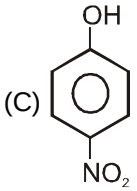
2. Observe the following reaction, and select the correct option

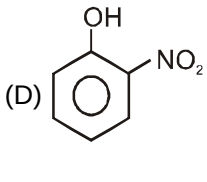


'Y' is :

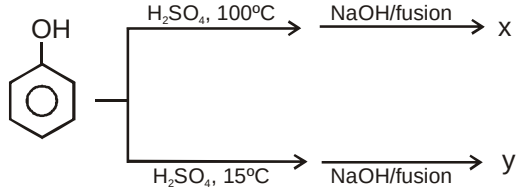
(A) 

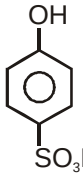
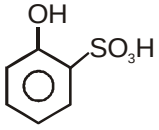
(B) 

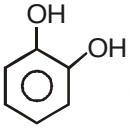
(C) 

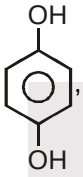
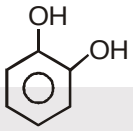
(D) 

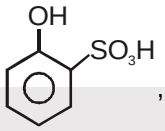
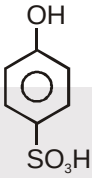
3.



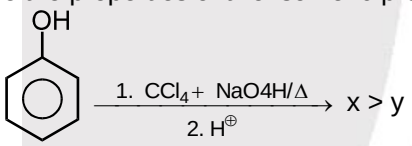
(A) x =  , y = 

(B) x =  , y = 

(C) x =  , y = 

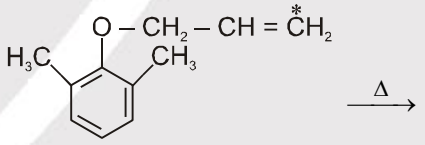
(D) x =  , y = 

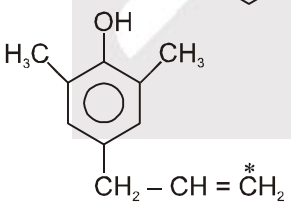
4. Compare the properties of two isomeric products x and y formed in the following reaction.

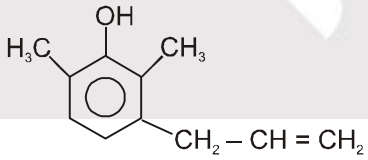


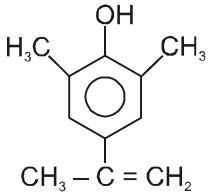
Option	Acid Strength	H_2O Solubility	Volatility	Melting Point
(A)	y > x	y > x	x > y	y > x
(B)	x > y	x > y	y > x	x > y
(C)	y > x	x > y	y > x	y > x
(D)	x > y	y > x	x > y	y > x

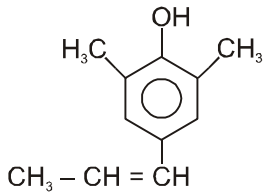
5. Give the product of the following reactions :



(A) 

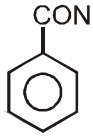
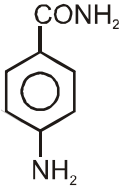
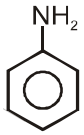
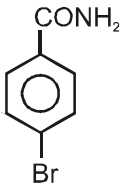
(B) 

(C) 

(D) 

6. (P) $\xrightarrow[KOH]{Br_2}$ (Q) $\xrightarrow{CH_3COCl}$ (R) $\xrightarrow[(ii)\ H_3O^+]{(i)\ Br_2/CH_3COOH}$ 

The reactant (P) is :

(A)  (B)  (C)  (D) 

7. Which of the following reduction reaction does not give an amine as product ?

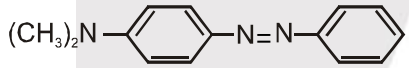
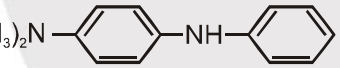
(A) $R–NO_2 \xrightarrow[Raney\,Ni]{H_2}$ (B) $R–NO_2 \xrightarrow[ether]{LiAlH_4}$

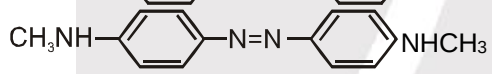
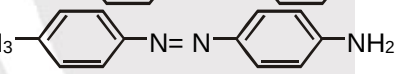
(C) $R–NO_2 \xrightarrow{Sn/HCl}$ (D) $R–NO_2 \xrightarrow[\Delta]{Zn/NH_4Cl}$

8. Para toluidine is treated with HNO_2 at ice cold conditions and then boiled with water. The final product obtained is :

(A) anthranilic acid (B) p-cresol (C) toluic acid (D) phenol

9. Aniline when diazotized in cold and then treated with dimethyl aniline gives a coloured product. Its structure would be :

(A)  (B) 

(C)  (D) 

10. In the diazotisation of aniline with sodium nitrite and hydrochloric acid, an excess of hydrochloric acid is used primarily to :

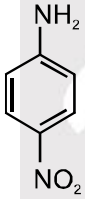
(A) suppress the concentration of free aniline available for coupling

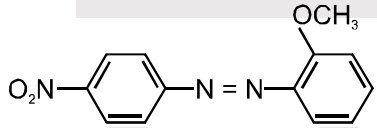
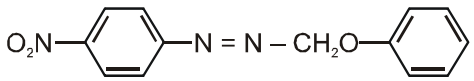
(B) suppress hydrolysis of phenol

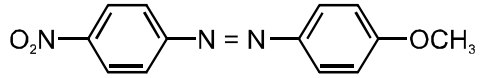
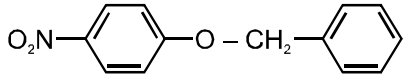
(C) insure a stoichiometric amount of nitrous acid

(D) neutralize the base liberated

11. The structure of the final product (Y) formed in the following reaction sequence is :

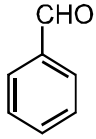
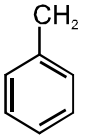
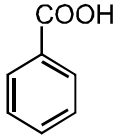
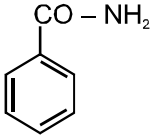
 $\xrightarrow[278\ K]{NaNO_2/HCl}$ (X) $\xrightarrow{anisole}$ (Y)

(A)  (B) 

(C)  (D) 

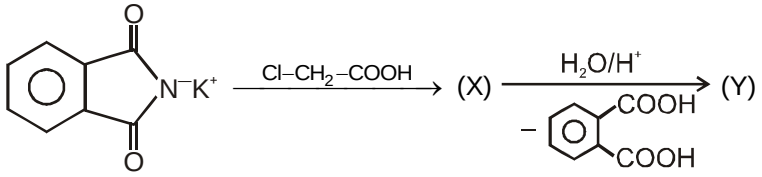
12. The major product Y in the following sequence of reaction is :

Aniline $\xrightarrow[(ii)\ CuCN/KCN]{(i)\ NaNO_2/HCl,\ 273\ K}$ (X) $\xrightarrow[(ii)\ H_2O]{(i)\ DIBAL–H}$ (Y)

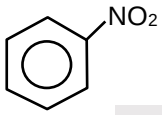
(A)  (B)  (C)  (D) 

PART - II : SINGLE OR DOUBLE INTEGER TYPE

1. Identify molecular weight of final product (Y).

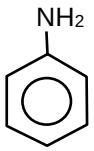


2. How many toluidines on reaction with $NaNO_2/HCl$ followed by H_3PO_2 treatment gives Toluene.

3. 

$\xrightarrow{Sn/HCl} \xrightarrow[HCl\ \ 0-5°C]{NaNO_2} \xrightarrow{H_2O,\ \Delta}$ Product Z

Find the molecular weight of Z.

4. 

$\xrightarrow[0^oC \text{ to } 5^oC]{NaNO_2+HCl}$ P $\xrightarrow[\Delta]{CuCN}$ Q $\xrightarrow[\text{hydrolysis}]{\text{Complete}}$ R + S

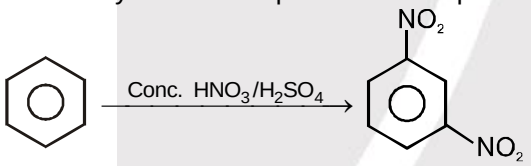
Efferevesce of CO_2 ↑ $NaHCO_3$

Δ ↓ NaOH + CaO

T

Molecular weight of T will be :

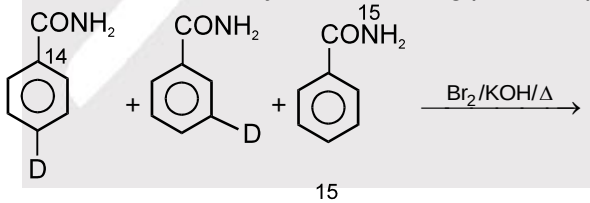
5. How many N atom are present in final product

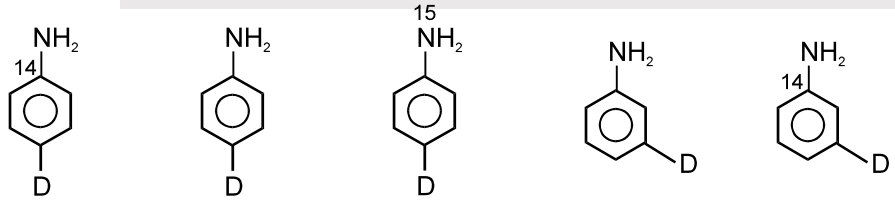


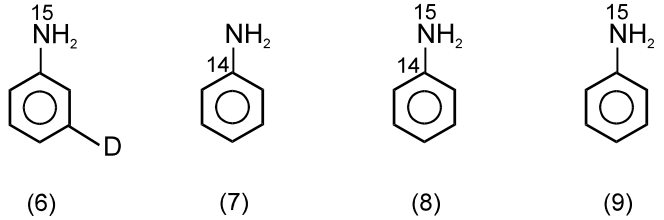
6. Ph-NO_2 $\xrightarrow{Sn/HCl}$ $\xrightarrow[HCl,\ 0°C-5°C]{NaNO_2}$ $\xrightarrow[Ph-OH]{\text{Basic medium}}$ Product Y

Find the molecular weight of Y report your answer as $\frac{\text{Molecular weight}}{2}$.

7. In the given reaction how many of the following products (1 – 9) can be formed.

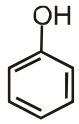
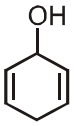
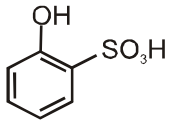
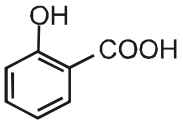




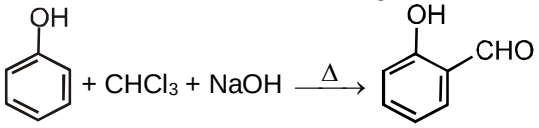


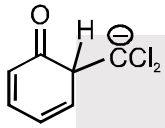
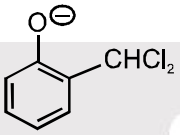
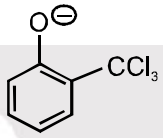
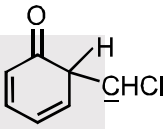
PART - III : ONE OR MORE THAN ONE OPTION CORRECT TYPE

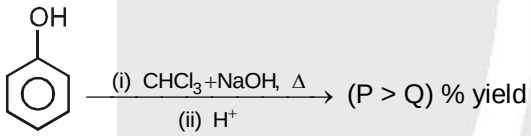
1. Which of the following can decolourise bromine water solution?

(A) 
(B) 
(C) 
(D) 

2. Identify the intermediates of the following reaction.

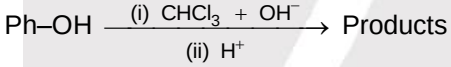


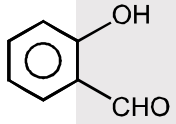
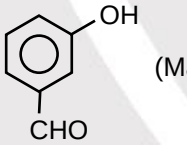
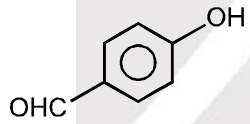
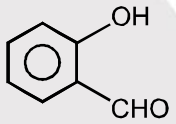
(A) 
(B) 
(C) 
(D) 

3. 

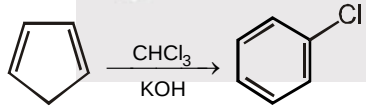
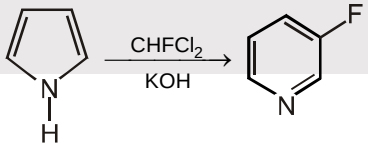
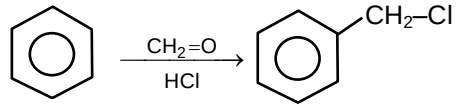
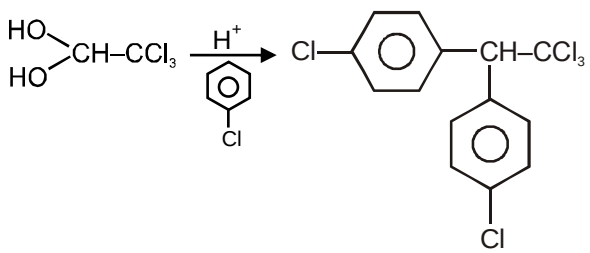
Select the correct options :
(A) Boiling point, (P > Q)
(B) Melting point, (Q > P)
(C) Water solubility, (P < Q)
(D) Acid Strength, (Q < P)

4. Correct options for the given below reaction :

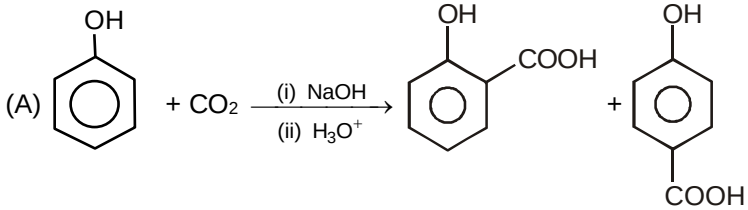


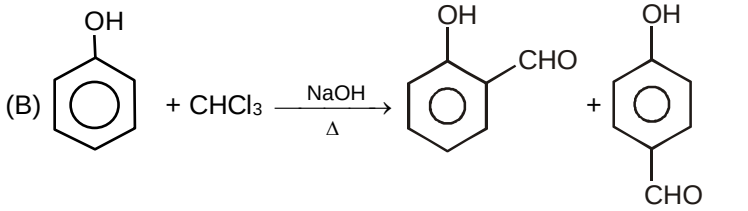
(A)  (Major)
(B)  (Major)
(C)  (Minor)
(D)  (Minor)

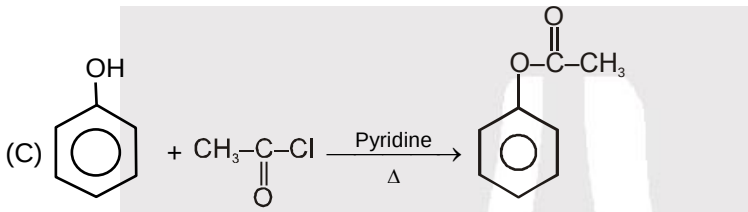
5. Which of the following reaction is/are correct

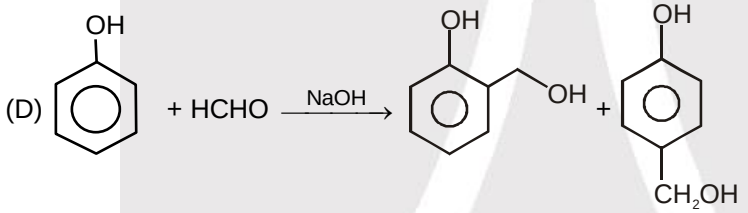
(A) 
(B) 
(C) 
(D) 

6. Which of the following reaction is/are correct :

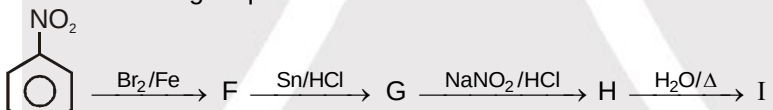
(A) 

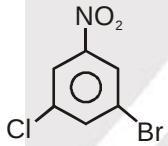
(B) 

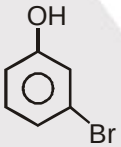
(C) 

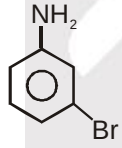
(D) 

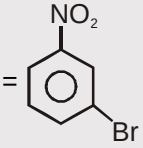
7. The products of following sequence of reactions are

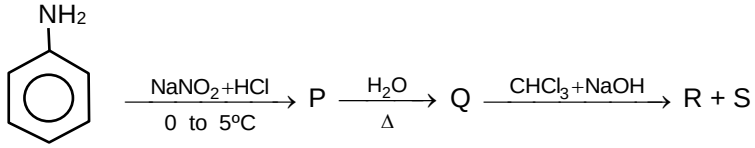


(A) H = 

(B) I = 

(C) G = 

(D) F = 

8. 

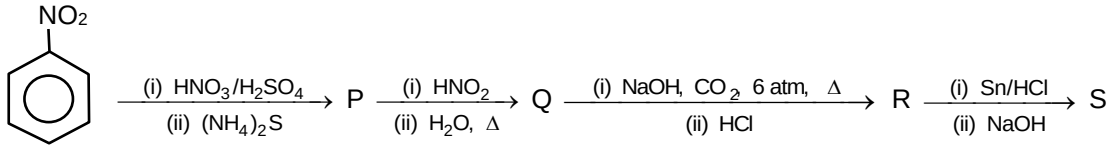
Which of the following statement is/are correct :

(A) P is benzene diazonioum chloride

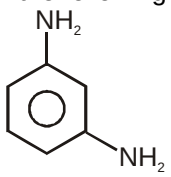
(B) Q can not give bromine water test

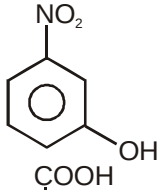
(C) R and S are position isomers

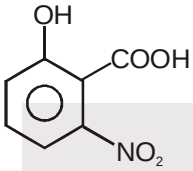
(D) During the formation of R and S from Q, formation of a new C–C bond will takes place.

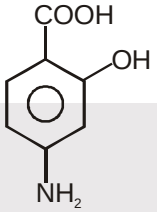
9. 

Which of the following statement(s) for the above sequence of reactions is/are correct

(A) P = 

(B) Q = 

(C) R = 

(D) S = 

10. Coupling reaction takes place when benzene diazonium chloride is treated with :

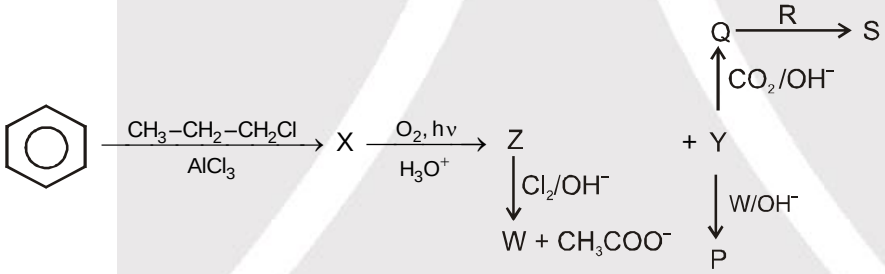
(A) Benzaldehyde (B) α-naphthol

(C) N,N-dimethyl aniline (D) Phenol

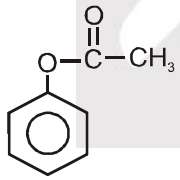
PART - IV : COMPREHENSION

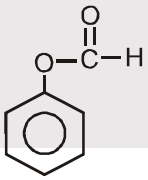
Read the following passage carefully and answer the questions.

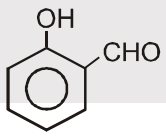
Comprehension # 1

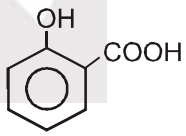


1. Which of the following compound is 'P' ?

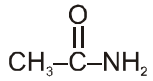
(A) 

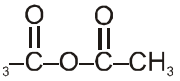
(B) 

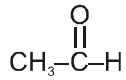
(C) 

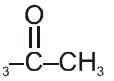
(D) 

2. S is a well known pain killer which of the following is 'R' ?

(A) 

(B) 

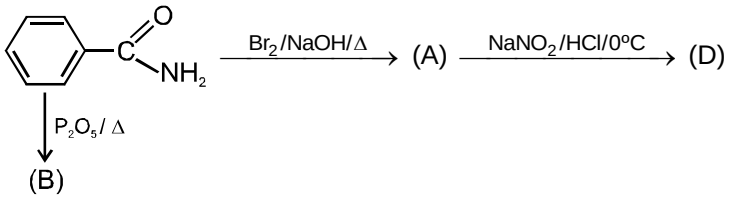
(C) 

(D) 

3. Which of the following is attacking species in conversion Y to P ?

(A) $:CCl_2$ (B) :CHCl (C) $:CH_2$ (D) CH_2Cl

Comprehension # 2



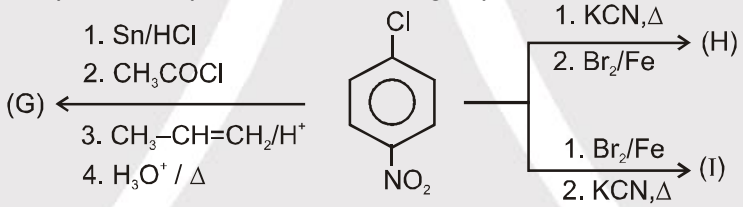
4. The intermediates which are involved in the conversion from benzamide to (A) are :
(A) N-bromamide (B) carbocation (C) carbene (D) isocyanide

5. (B) on treatment with Zn/HCl gives :
(A) aniline (B) benzylamine
(C) phenylisocyanide (D) N-methylaniline

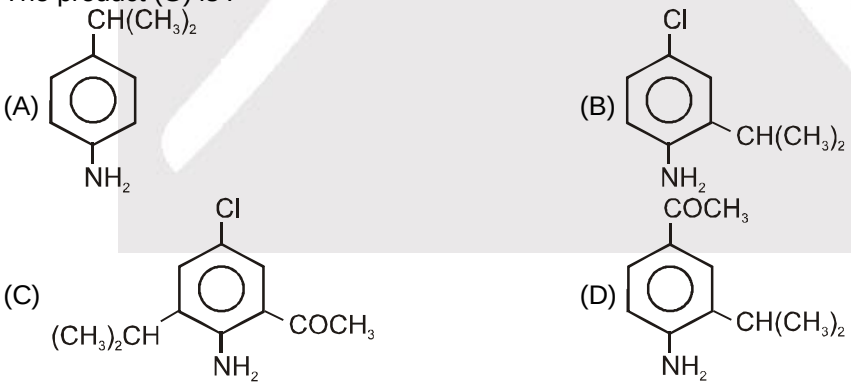
6. (D) on reaction with phenol under alkaline conditions gives :
(A) diazobenzene (B) hydrazobenzene
(C) benzidine (D) para hydroxy azobenzene

Comprehension # 3

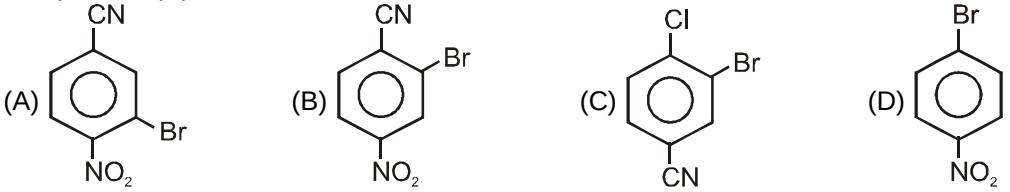
The $-NO_2$ group in an aromatic ring deactivates the ortho and para positions for an electrophilic attack. When $-NO_2$ group is present at ortho or para positions of a leaving group (Nucleofuge) it activates the ring for nucleophilic attack. The reduction of $-NO_2$ group by metal in acid causes its reduction to $-NH_2$ group and then the ring becomes strongly activated for a electrophilic attack. The strong activation of $-NH_2$ group is moderated by its acylation with CH_3COCl to –NHAc group. Deacylation is carried out by hydrolysis with H_3O^+ or OH^-. The ring alkylation by using RX/AlX_3 is not possible in presence of $-NO_2$ or $-NH_2$ group but is possible in presence of –NHAc group.



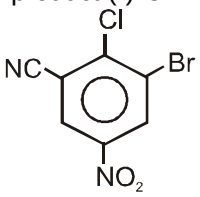
7. The product (G) is :

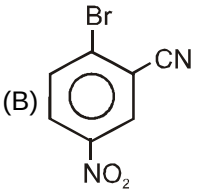


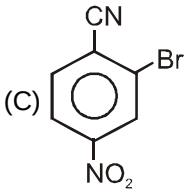
8. The product (H) is :

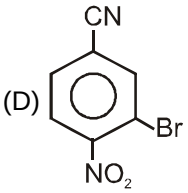


9. The product (I) is :

(A) 

(B) 

(C) 

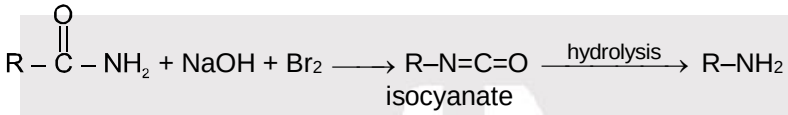
(D) 

Comprehension # 4

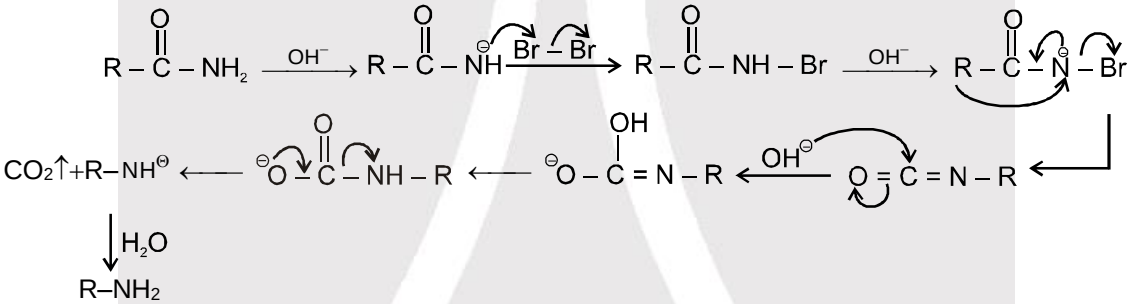
Hofmann rearrangement

In the Hofmann rearrangement an unsubstituted amide is treated with sodium hydroxide and bromine to give a primary amine that has one carbon lesser than starting amide.

General reaction :

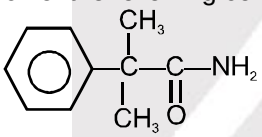


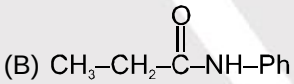
Mechanism :

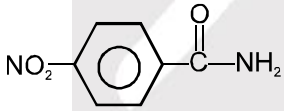


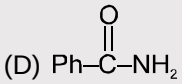
If the migrating group is chiral then its cofiguration is retained. Electron releasing effects in the migrating group increases reactivity of Hofmann rearrangement.

10. Which of the following compound(s) cannot give Hofmann rearrangement :

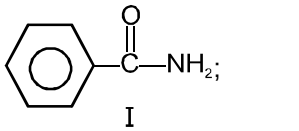
(A) 

(B) 

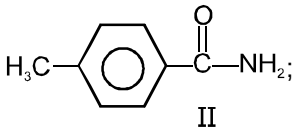
(C) 

(D) 

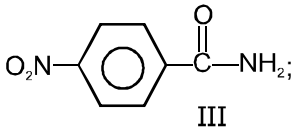
11. Arrange the following amides according to their relative reactivity when reacted with Br_2 in excess of strong base :



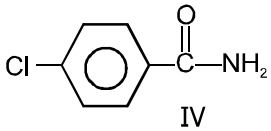
I



II



III



IV

(A) IV > I > II > III (B) II > I > III > IV (C) II > IV > III > I (D) II > I > IV > III

Comprehension # 5

Q.12, Q.13 and Q.14 by appropriately matching the information given in the three columns of the following table.

Column-I, 2 and 3 contain starting materials, reaction conditions and type of reactions respectively.		
Column 1	**Column 2**	**Column 3**
(I) p-Fluoro nitrobenzene	(i) NaOH + heat	(P) Nucleophilic substitution
(II) Ethyl benzene carboxylate	(ii) Br_2 + U.V	(Q) Free radical substitution
(III) 1-Bromo-1-phenyl ethane	(iii) $Br_2 + A\ell$	(R) Electrophilic substitution
(IV) Ethyl benzene	(iv) Conc. HNO_3 + conc. H_2SO_4	(S) Hydrolysis

12. Match the correct combination?
(A) (IV) (iii) (R) (B) (I) (i) (R) (C) (III) (iv) (P) (D) (II) (ii) (R)

13. In which amongs the following product is formed by free radical mechanism?
(A) (I) (ii) (P) (B) (IV) (ii) (Q) (C) (II) (iii) (Q) (D) (III) (iii) (P)

14. In which amongs the following more than one products are not formed?
(A) (IV) (iv) (R) (B) (III) (ii) (Q) (C) (II) (iii) (R) (D) (I) (i) (P)

Exercise-3

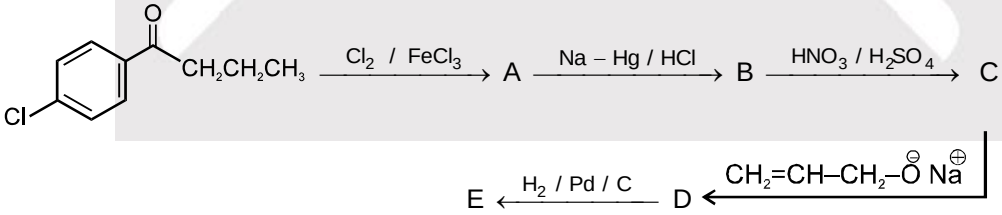
*** Marked Questions may have more than one correct option.**

PART - I : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

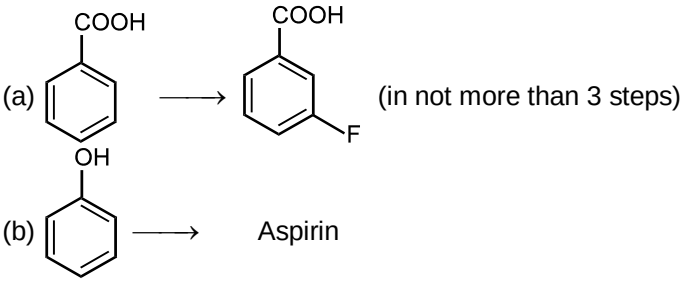
1. **Assertion :** In strongly acidic solutions, aniline becomes more reactive towards electrophilic reagents.
Reason : The amino group being completely protonated in strongly acidic solution, the lone pair of electrons on the nitrogen is no longer available for resonance. **[IIT-JEE 2001(S), 1/35]**
(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(B) Both Assertion and Reason are true but Reason is not correct explanation of Assertion.
(C) Assertion is true but Reason is false.
(D) Assertion is false but Reason is true.

2. How would you synthesised 4-methoxyphenol from bromobenzene in NOT more than five steps ? State clearly the reagents used in each step and show the structure of the intermediate compounds in your synthetic scheme. **[IIT-JEE 2001(M), 5/100]**

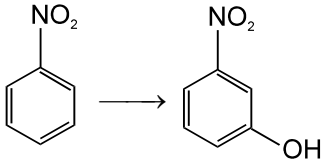
3. Write structures of the products A, B, C, D and E in the following scheme. **[IIT-JEE 2002(M), 5/60]**



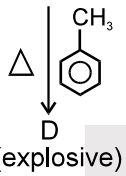
4. Convert **[IIT-JEE 2003(M), 4/60]**



5. How would you carry out the following conversion efficiently using NOT more than four steps ? Give the appropriate reagent(s) and reaction condition(s) employed in each step. **[IIT-JEE 2004(M), 4/60]**

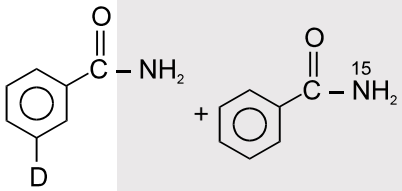


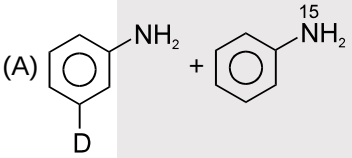
6. C (intermediate) $\xleftarrow{\text{conc. } HNO_3}$ A $\xrightarrow{NaBr + MnO_2}$ B (brown coloured gas with pungent odour)

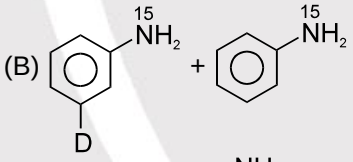


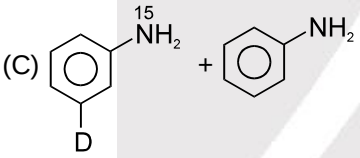
(explosive)

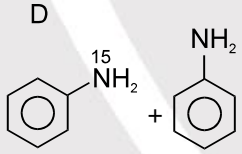
Identify A, B, C, D and write the balanced chemical equation of formation of A to B and A to C.
[IIT-JEE-2005(M), 4/60]

7.  under Hofmann conditions will give : **[JEE 2006, 5/184]**

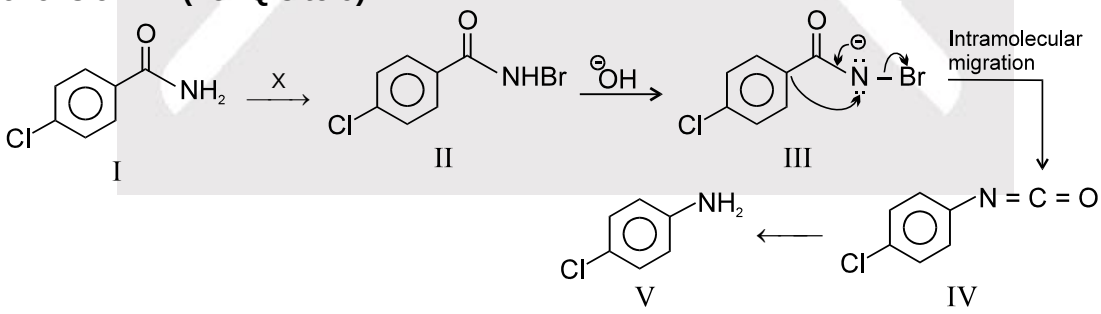
(A) 

(B) 

(C) 

(D) 

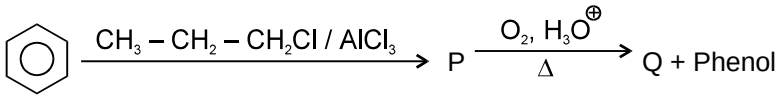
Comprehension # 1 (For Q.8 to 9)



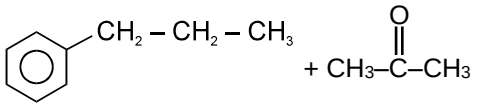
8. Which reagent (X) is used to convert I to II **[IIT-JEE 2006, 5/184]**
(A) KBr / NaOH (B) Br_2 / NaOH (C) $NaHCO_3$ (D) N-Bromo succinamide

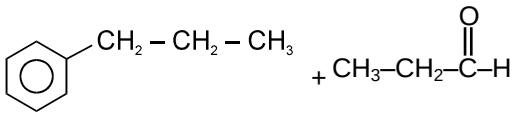
9. Which step is rate determining step **[IIT-JEE 2006, 5/184]**
(A) Formation of II (B) Formation of III (C) Formation of V (D) Formation of IV

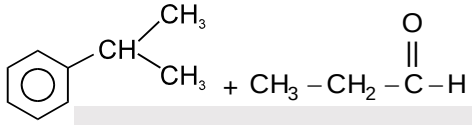
10. $CH_3NH_2 + CHCl_3 + KOH \rightarrow$ Nitrogen containing compound + KCl + H_2O.
Nitrogen containing compound is : **[IIT-JEE 2006, 3/184]**
(A) $CH_3–C\equiv N$ (B) $CH_3–NH–CH_3$ (C) $CH_3–N^-\equiv C^+$ (D) $CH_3–N^+\equiv C^-$

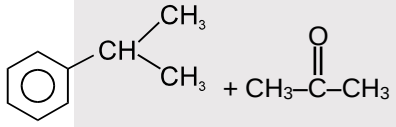
11. 

What are P & Q. **[IIT-JEE-2006, 5/184]**

(A) 

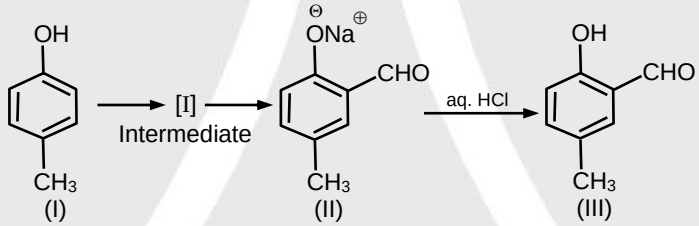
(B) 

(C) 

(D) 

Comprehension # 2 (For Q.12 to 14)

Riemer-Tiemann reaction introduces an aldehyde group, on to the aromatic ring of phenol, ortho to the hydroxyl group. This reaction involves electrophilic aromatic substitution. This is a general method for the synthesis of substituted salicylaldehydes as depicted below.



12. Which one of the following reagents is used in the above reaction ? **[IIT-JEE 2007, 4/162]**

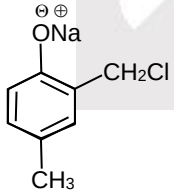
(A) aq. NaOH + CH_3Cl (B) aq. NaOH + CH_2Cl_2

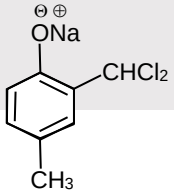
(C) aq. NaOH + $CHCl_3$ (D) aq. NaOH + CCl_4

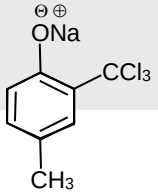
13. The electrophile in this reaction is : **[IIT-JEE 2007, 4/162]**

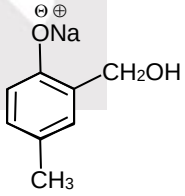
(A) :CHCl (B) $^+CHCl_2$ (C) $:CCl_2$ (D) $^\bullet CCl_3$

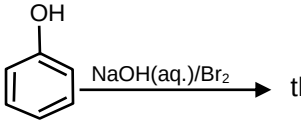
14. The structure of the intermediate **I** is : **[IIT-JEE 2007, 4/162]**

(A) 

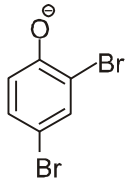
(B) 

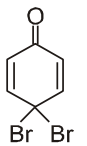
(C) 

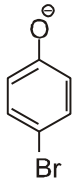
(D) 

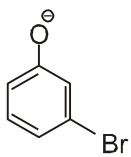
15. In the reaction 

the intermediate (s) is (are) : **[IIT-JEE-2010, 3/163]**

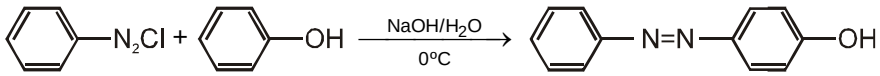
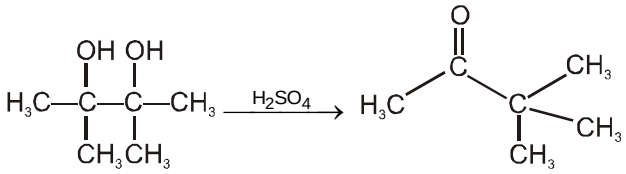
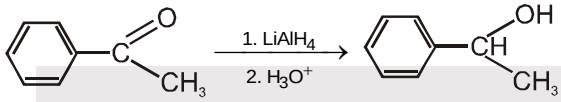
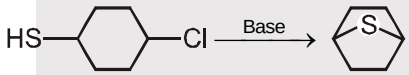
(A) 

(B) 

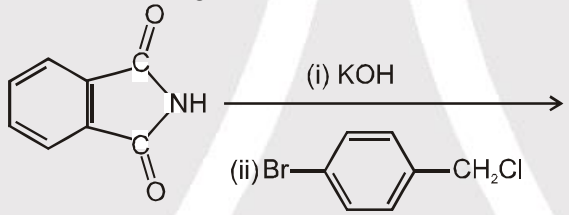
(C) 

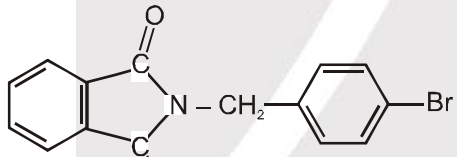
(D) 

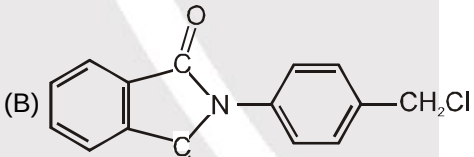
16. Match the reactions in **Column I** with appropriate options in **Column II**. **[IIT-JEE 2010, 8/163]**

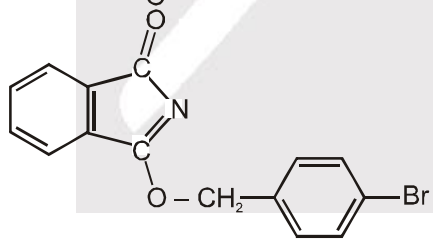
	Column-I		**Column-II**
(A)		(p)	Racemic mixture
(B)		(q)	Addition reaction
(C)		(r)	Substitution reaction
(D)		(s)	Coupling reaction
		(t)	Carbocation intermediate

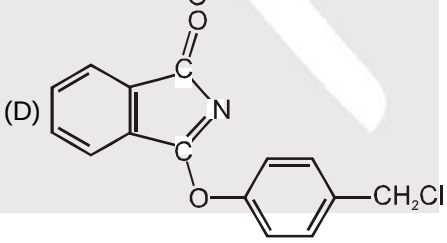
17. The major product of the following reaction is : **[JEE-2011, 3/160]**



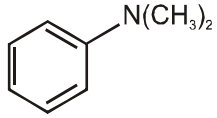
(A) 

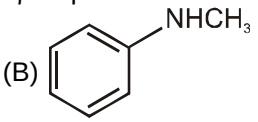
(B) 

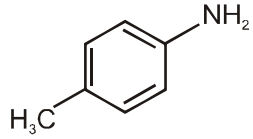
(C) 

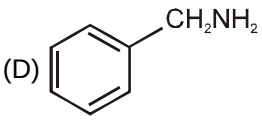
(D) 

18. Amongst the compounds given, the one that would form a brilliant colored dye on treatment with $NaNO_2$ in dilute HCl followed by addition to an alkaline solution of β-naphthol is : **[JEE-2011, 3/160]**

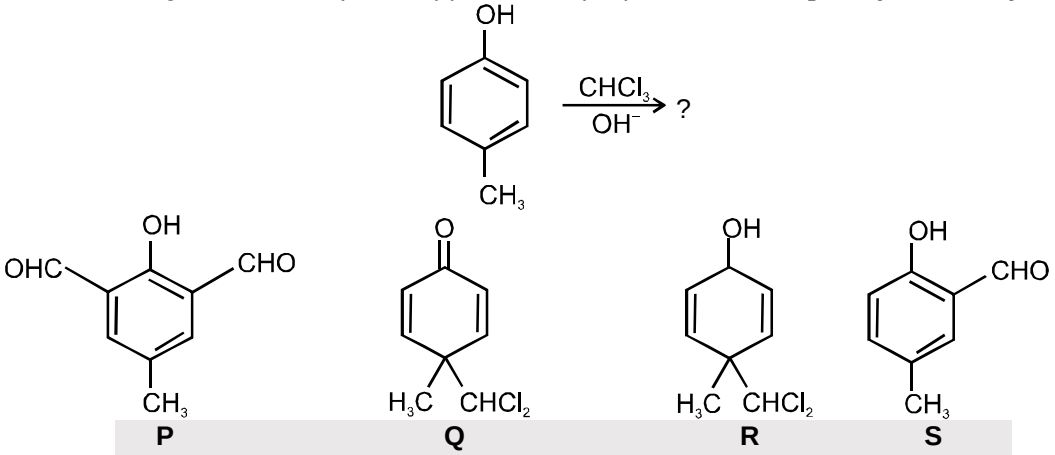
(A) 

(B) 

(C) 

(D) 

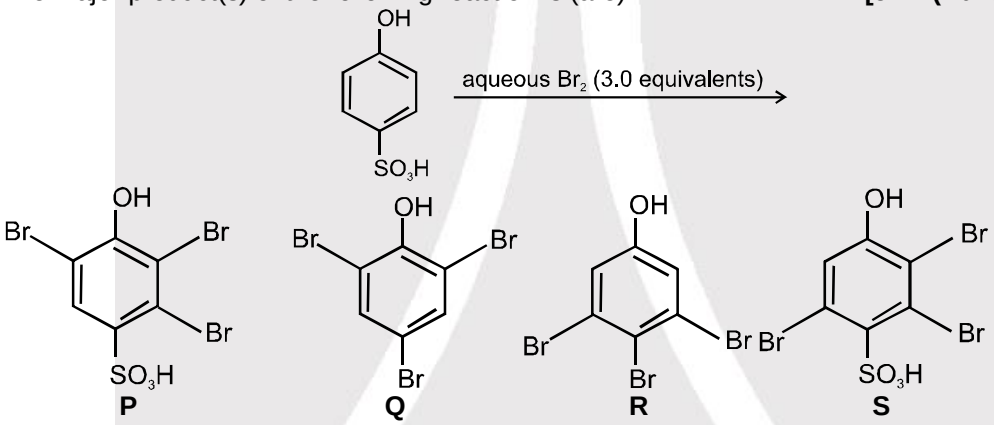
19.* In the following reaction, the product(s) formed is(are) **[JEE (Advanced)-2013, 3/120]**



P **Q** **R** **S**

(A) **P** (major) (B) **Q** (minor) (C) **R** (minor) (D) **S** (major)

20. The major product(s) of the following reaction is (are) **[JEE (Advance)-2013, 3/120]**



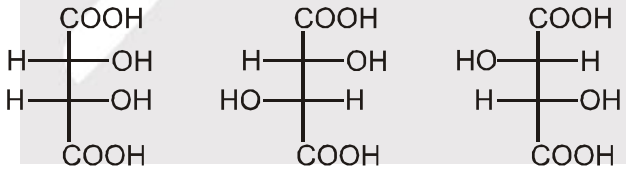
P **Q** **R** **S**

(A) **P** (B) **Q** (C) **R** (D) **S**

Comprehension # 3 (Q.21 to 22)

P and **Q** are isomers of dicarboxylic acid $C_4H_4O_4$. Both decolorize Br_2/H_2O. On heating, **P** forms the cyclic anhydride.

Upon treatment with dilute alkaline $KMnO_4$, **P** as well as **Q** could produce one or more than one from **S, T** and **U**.

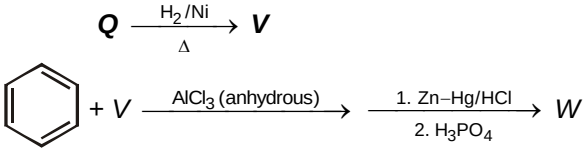


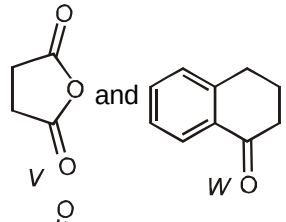
S **T** **U**

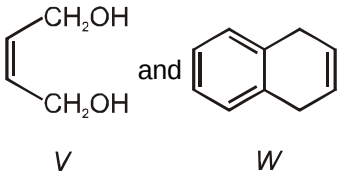
21. Compounds formed form **P** and **Q** are, respectively : **[JEE (Advance)-2013, 3/120]**

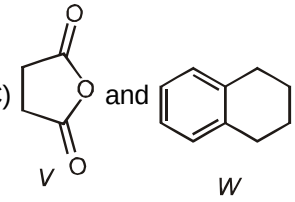
(A) Optically active **S** and optically active pair **(T, U)**
(B) Optically inactive **S** and optically inactive pair **(T, U)**
(C) Optically active pair **(T, U)** and optically active **S**
(D) Optically inactive pair **(T, U)** and optically inactive **S**

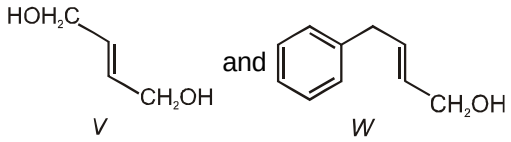
22. In the following reaction sequences **V** and **W** are respectively :



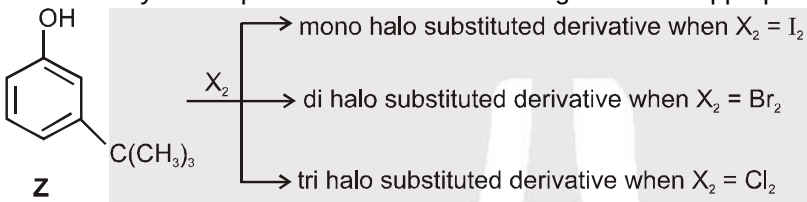
(A)  and

(B)  and

(C)  and

(D) 

23.* The reactivity of compound **Z** with different halogens under appropriate conditions is given below :



Z

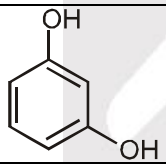
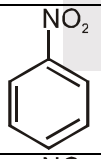
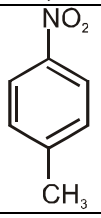
The observed pattern of electrophilic substitution can be explained by **[JEE(Advanced)-2014, 3/120]**

(A) the steric effect of the halogen
(B) the steric effect of the *tert-butyl* group
(C) the electronic effect of the phenolic group
(D) the electronic effect of the *tert-butyl* group

24. For the identification of β-naphthol using dye test, it is necesary to use : **[JEE(Advanced)-2014, 3/120]**

(A) dichloromethane solution of β-naphthol.
(B) acidic solution of β-naphthol.
(C) neutral solution of β-naphthol.
(D) alkaline solution of β-naphthol.

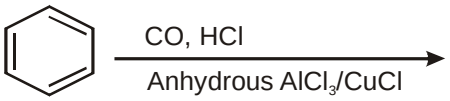
25. Match the four starting materials **(P, Q, R, S)** given in **List-I** with the corresponding reaction schemes **(I, II, III, IV)** provided in List II and select the correct answer using the code given below the lists.

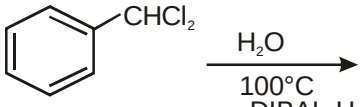
	List-I		**List-II**
P.		1.	Scheme I (i) $KMnO_4$, $HO^{\ominus}$, heat (ii) $H^{\oplus}$, H_2O (iii) $SOCl_2$, (iv) NH_3 ? ⟶ $C_7H_6N_2O_3$
Q.		2.	Scheme II (i) Sn/HCl (ii) CH_3COCl (iii) conc. H_2SO_4 (iv) HNO_3 (v) dil. H_2SO_4, heat (vi) $HO^{\ominus}$? ⟶ $C_6H_6N_2O_2$
R.		3.	Scheme III (i) red hot iron, 873 K (ii) fuming HNO_3, H_2SO_4, heat (iii) $H_2S.NH_3$ (iv) $NaNO_2$, H_2SO_4 (v) hydrolysis ? ⟶ $C_6H_5NO_3$
S.		4.	Scheme IV (i) conc. H_2SO_4, 60°C (ii) conc. HNO_3, conc. H_2SO_4 (iii) dil. H_2SO_4, heat ? ⟶ $C_6H_5NO_4$

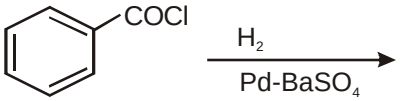
Code : **[JEE(Advanced)-2014, 3/120]**

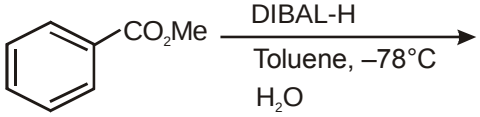
	P	Q	R	S		P	Q	R	S
(A)	1	4	2	3	(B)	3	1	4	2
(C)	3	4	2	1	(D)	4	1	3	2

26. Among the following the number of reaction(s) that produce(s) benzaldehyde is **[JEE(Advanced)-2015, 4/168]**

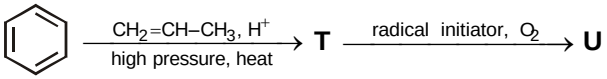
I. 

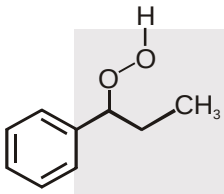
II. 

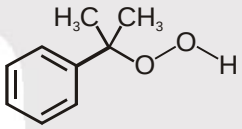
III. 

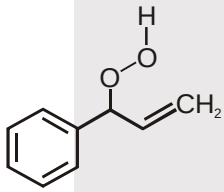
IV. 

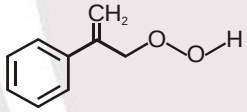
27.* The major product **U** in the following reactions is **[JEE(Advanced)-2015, 4/168]**



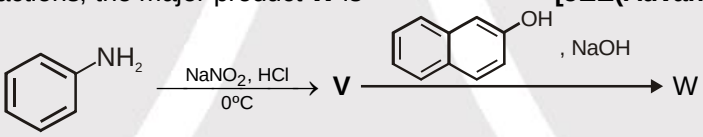
(A) 

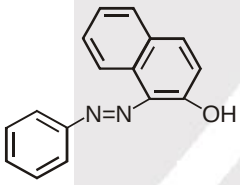
(B) 

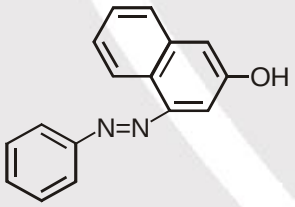
(C) 

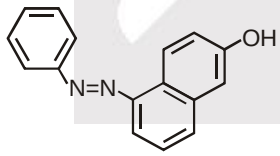
(D) 

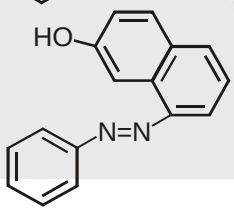
28. In the following reactions, the major product **W** is **[JEE(Advanced)-2015, 4/168]**



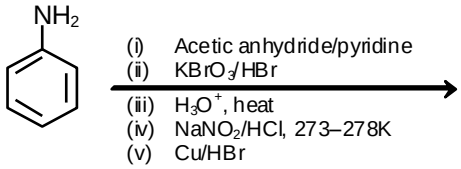
(A) 

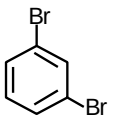
(B) 

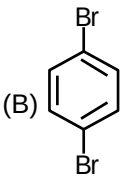
(C) 

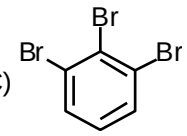
(D) 

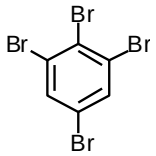
29.* The product(s) of the following reaction sequence is(are) **[JEE(Advanced)-2016, 4/124]**



(A) 

(B) 

(C) 

(D) 

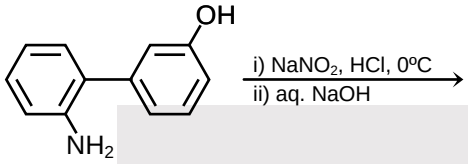
30.* The correct statement(s) about the following reaction sequence is(are) **[JEE(Advanced)-2016, 4/124]**

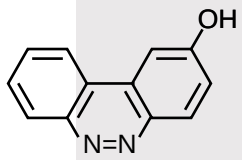
Cumene (C_9H_{12}) $\xrightarrow[(ii)\ H_3O^+]{(i)\ O_2}$ **P** $\xrightarrow{CHCl_3/NaOH}$ **Q** (major) + **R** (minor)

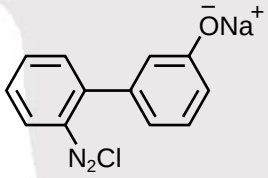
Q $\xrightarrow[PhCH_2Br]{NaOH}$ **S**

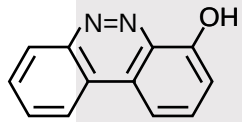
(A) **R** is steam volatile
(B) **Q** gives dark violet coloration with 1% aqueous $FeCl_3$ solution
(C) **S** gives yellow precipitate with 2, 4-dinitrophenylhydrazine
(D) **S** gives dark violet coloration with 1% aqueous $FeCl_3$ solution

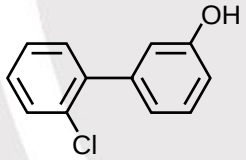
31. The major product of the following reaction is **[JEE(Advanced)-2017, 3/122]**



(A) 

(B) 

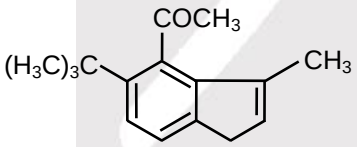
(C) 

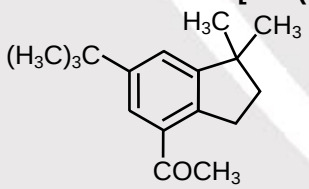
(D) 

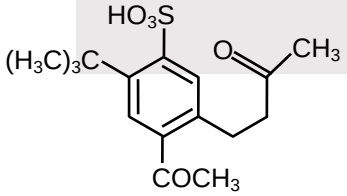
Comprehension # 4 (Q.32 to 33)

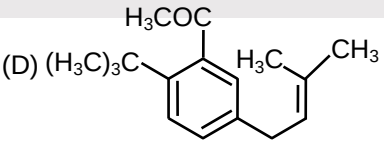
The reaction of compound **P** with CH_3MgBr (excess) in $(C_2H_5)_2O$ followed by addition of H_2O gives **Q**. The compound **Q** on treatment with H_2SO_4 at 0ºC gives **R**. The reaction of **R** with CH_3COCl in the presence of anhydrous $AlCl_3$ in CH_2Cl_2 followed by treatment with H_2O produces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

32. The product **S** is **[JEE(Advanced)-2017, 3/122]**

(A) 

(B) 

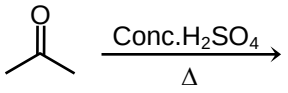
(C) 

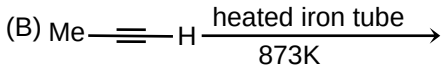
(D) 

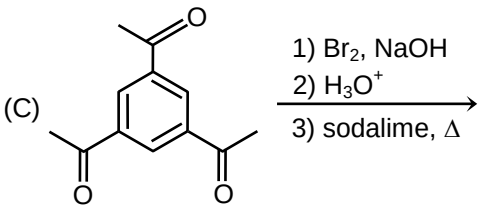
33. The reactions, **Q** to **R** and **R** to **S**, are **[JEE(Advanced)-2017, 3/122]**

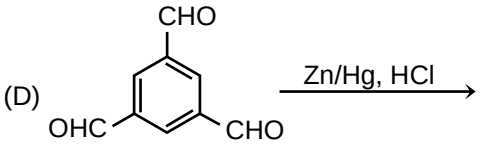
(A) Aromatic sulfonation and Friedel-Crafts acylation
(B) Friedel-Crafts alkylation and Friedel-Crafts acylation
(C) Friedel-Crafts alkylation, dehydration and Friedel-Crafts acylation
(D) Dehydration and Friedel-Crafts acylation

34.* The reaction(s) leading to the formation of 1,3,5-trimethylbenzene is (are) **[JEE(Advanced)-2018, 4/120]**

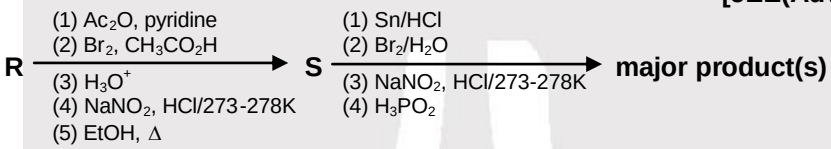
(A) 

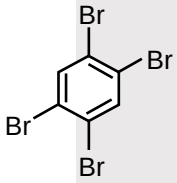
(B) 

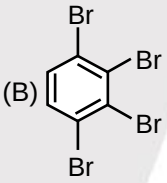
(C) 

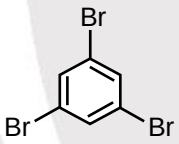
(D) 

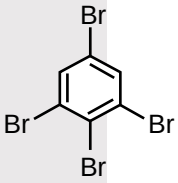
35.* Aniline reacts with mixed acid (conc. HNO_3 and conc. H_2SO_4) at 288 K to give **P** (51%), **Q** (47%) and R (2%). The major product(s) of the following reaction sequence is (are) **[JEE(Advanced)-2018, 4/120]**



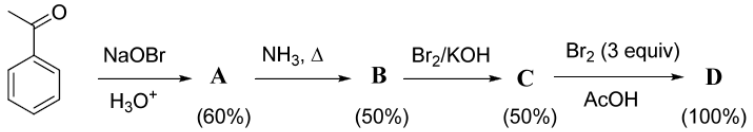
(A) 

(B) 

(C) 

(D) 

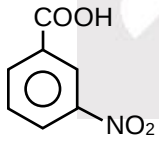
36. In the following reaction sequence, the amount of D (in g) formed from 10 moles of acetophenone is……. (Atomic weights in g mol^{-1} : H = 1, C = 12, N = 14, O = 16, Br = 80. The yield (%) corresponding to the product in each step is given in the parenthesis) **[JEE(Advanced)-2018, 3/120]**

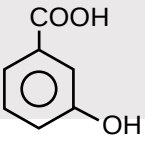


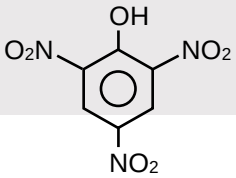
PART - II : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

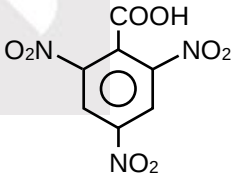
JEE(MAIN) OFFLINE PROBLEM

1. Picric acid is **[AIEEE-2002, 3/225]**

(1) 

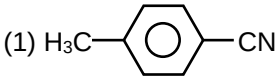
(2) 

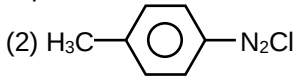
(3) 

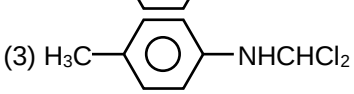
(4) 

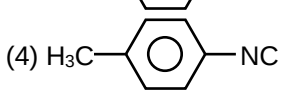
2. When primary amine reacts with chloroform in ethanolic KOH then the product is: **[AIEEE-2002, 3/225]**
(1) an isocyanide. (2) an aldehyde. (3) a cyanide. (4) an alcohol.

3. The reaction of chloroform with alcoholic KOH and p-toluidine forms : **[AIEEE-2003, 3/225]**

(1) 

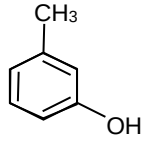
(2) 

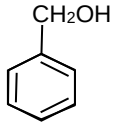
(3) 

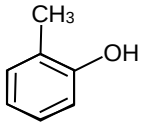
(4) 

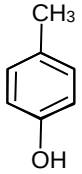
4. Fluorobenzene (C_6H_5F) can be synthesized in the laboratory **[AIEEE-2006, 3/165]**
(1) from aniline by diazotisation followed by heating the diazonium salt with HBF_4.
(2) by direct fluorination of benzene with F_2 gas.
(3) by reacting bromobenzene with NaF solution.
(4) by heating phenol with HF and KF.

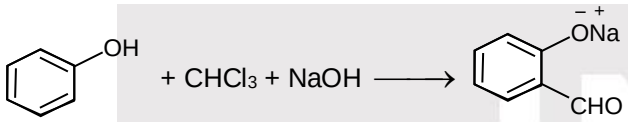
5. The structure of the compound that gives a tribromo derivative on treatment with bromine water is : **[AIEEE-2006, 3/165]**

(1) 

(2) 

(3) 

(4) 

6. 

The electrophile involved in the above reaction is : **[AIEEE-2006, 3/165]**
(1) Dichloromethyl cation ($\overset{\oplus}{C}HCl_2$) (2) Dichlorocarbene ($:CCl_2$)
(3) Trichloromethyl anion ($\overset{\ominus}{C}Cl_3$) (4) Formyl cation ($\overset{\oplus}{C}HO$)

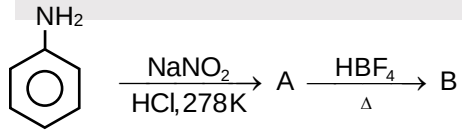
7. In the chemical reaction, $CH_3CH_2NH_2 + CHCl_3 + 3KOH \rightarrow (A) + (B) + 3H_2O$, the compounds (A) and (B) are respectively, **[AIEEE-2007, 3/120]**
(1) C_2H_5NC and K_2CO_3 (2) C_2H_5NC and 3KCl
(3) C_2H_5CN and 3KCl (4) $CH_3CH_2CONH_2$ and 3KCl

8. Phenol, when it first reacts with concentrated sulphuric acid and then with concentrated nitric acid, gives **[AIEEE-2008, 3/105]**
(1) o-nitrophenol (2) p-nitrophenol (3) nitrobenzene (4) 2,4,6-rinitrobenzene

9. Toluene is nitrated and the resulting product is reduced with tin and hydrochloric acid. The product so obtained is diazotised and then heated with cuprous bromide. The reaction mixture so formed contains : **[AIEEE-2008, 3/105]**
(1) mixture of o- and p-dibromobenzenes (2) mixture of o- and p-bromoanilines
(3) mixture of o- and m-bromotoluenes (4) mixture of o- and p-bromotoluenes

10. The major product obtained on interaction of phenol with sodium hydroxide and carbon dioxide is : **[AIEEE-2009, 4/144]**
(1) salicylaldehyde (2) salicylic acid (3) phthalic acid (4) benzoic acid

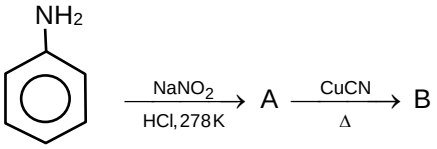
11. In the chemical reactions the compounds 'A" and 'B' respectively are : **[AIEEE-2010, 4/144]**



(1) nitrobenzene and fluorobenzene
(2) phenol and benzene
(3) benzene diazonium chloride and fluorobenzene
(4) nitrobenzene and chlorobenzene

12. Phenol is heated with a solution of mixture of KBr and $KBrO_3$. The major product obtained in the above reaction is : **[AIEEE-2011, 4/144]**
(1) 2-Bromophenol (2) 3-Bromophenol
(3) 4-Bromophenol (4) 2,4,6-Tribromophenol

13. In the following chemical reactions, the compounds A and B are respectively : **[AIEEE-2011, 4/144]**

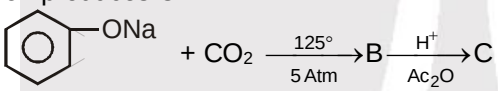


(1) Benzene diazonium chloride and benzonitrile
(2) Nitrobenzene and chlorobenzene
(3) Phenol and bromobenzene
(4) Fluorobenzene and phenol

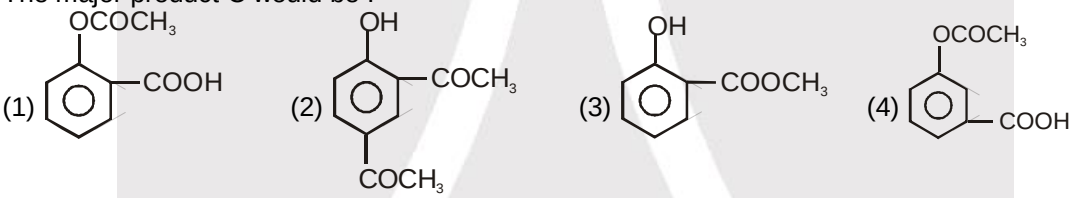
14. An organic compound A upon reacting with NH_3 gives B. On heating B gives C. C in presence of KOH reacts with Br_2 to given $CH_3CH_2NH_2$. A is : **[JEE (Main) 2013, 4/120]**

(1) CH_3COOH
(2) $CH_3CH_2CH_2COOH$
(3) $CH_3-CH(CH_3)-COOH$
(4) CH_3CH_2COOH

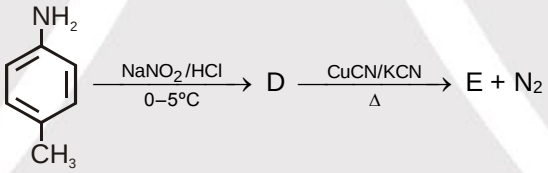
15. Sodium phenoxide when heated with CO_2 under pressure at 125°C yields a product which on acetylation produces C. **[JEE(Main)-2014, 4/120]**



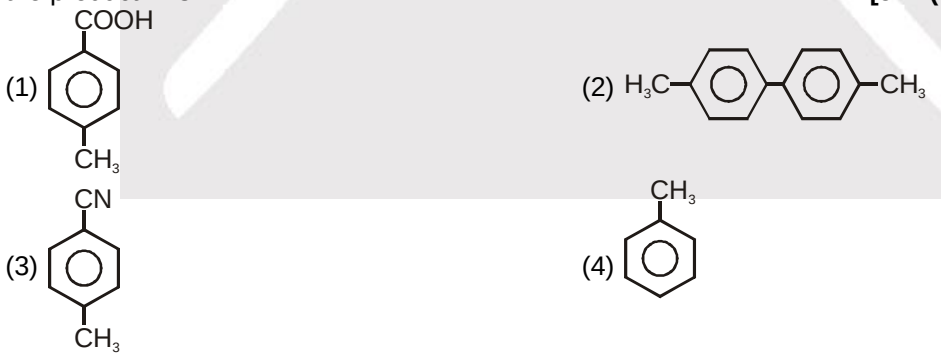
The major product C would be :



16. In the reaction



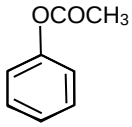
the product E is : **[JEE(Main)-2015, 4/120]**

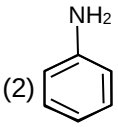


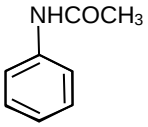
17. In the Hofmann bromamide degradation reaction, the number of moles of NaOH and Br_2 used per mole of amine produced are : **[JEE(Main)-2016, 4/120]**

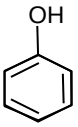
(1) Four moles of NaOH and two moles of Br_2
(2) Two moles of NaOH and two moles of Br_2
(3) Four moles of NaOH and one mole of Br_2
(4) One mole of NaOH and one mole of Br_2

18. Which of the following compounds will form significant amount of *meta* product during mono-nitration reaction ? **[JEE(Main)-2017, 4/120]**

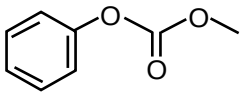
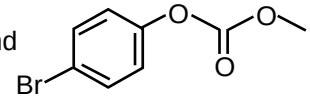
(1) 

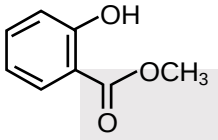
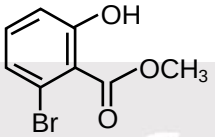
(2) 

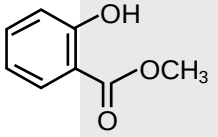
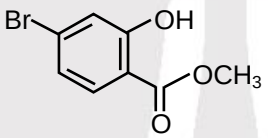
(3) 

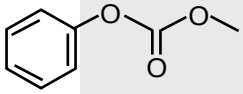
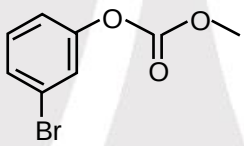
(4) 

19. Phenol reacts with methyl chloroformate in the presence of NaOH to form product A. A react with Br_2 to form product B. A and B are respectively : **[JEE(Main)-2018, 4/120]**

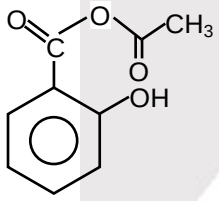
(1)  and 

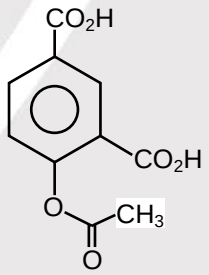
(2)  and 

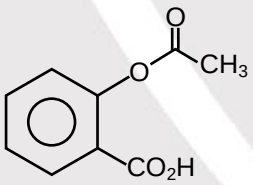
(3)  and 

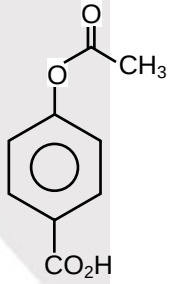
(4)  and 

20. Phenol on treatment with CO_2 in the presence of NaOH followed by acidification produces compound X as the major product. X on treatment with $(CH_3CO)_2O$ in the presence of catalytic amount of H_2SO_4 produces : **[JEE(Main)-2018, 4/120]**

(1) 

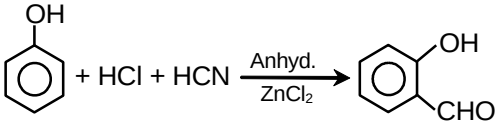
(2) 

(3) 

(4) 

JEE(MAIN) ONLINE PROBLEM

1. The following reaction



is known as : **[JEE(Main) 2014 Online (11-04-14), 4/120]**

(1) Perkin reaction
(2) Gattermann-Koch formylation
(3) Kolbe's reaction
(4) Gattermann reaction

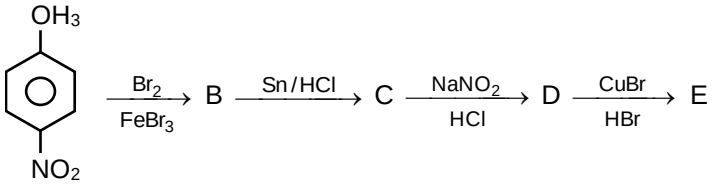
2. Complete reduction of benzene-diazonium chloride with Zn/HCl gives : **[JEE(Main) 2014 Online (11-04-14), 4/120]**

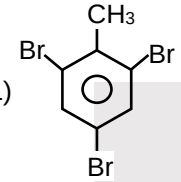
(1) Aniline
(2) Phenylhydrazine
(3) Azobenzene
(4) Hydrazobenzene

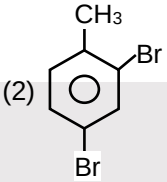
3. Conversion of benzene diazonium chloride to chloro benzene is an example of which of the following reactions? **[JEE(Main) 2014 Online (12-04-14), 4/120]**

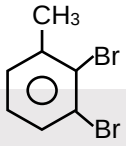
(1) Claisen (2) Friedel-craft (3) Sandmeyer (4) Wurtz

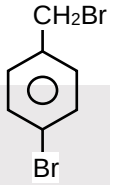
4. In a set of reactions p-nitrotoluene yielded a product E. The product E would be : **[JEE(Main) 2014 Online (19-04-14), 4/120]**



(1) 

(2) 

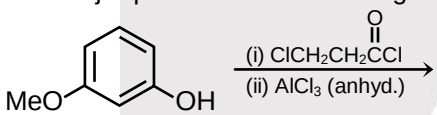
(3) 

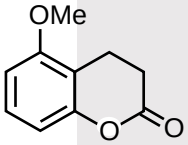
(4) 

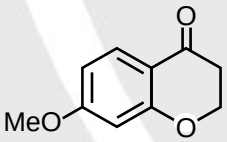
5. Fluorination of an aromatic ring is easily accomplished by treating a diazonium salt with HBF_4. Which of the following conditions is correct about this reaction? **[JEE(Main) 2016 Online (10-04-16), 4/120]**

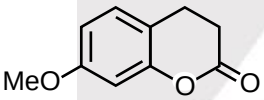
(1) Only heat (2) $NaNO_2/Cu$ (3) Cu_2O/H_2O (4) NaF/Cu

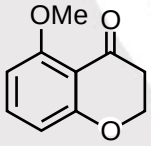
6. The major product of the following reaction is : **[JEE(Main) 2018 Online (15-04-18), 4/120]**



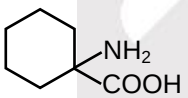
(1) 

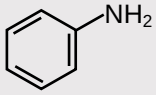
(2) 

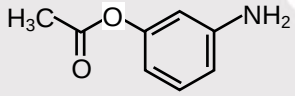
(3) 

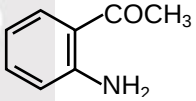
(4) 

7. The increasing order of diazotization of the following compound is : **[JEE(Main) 2018 Online (15-04-18), 4/120]**

(a) 

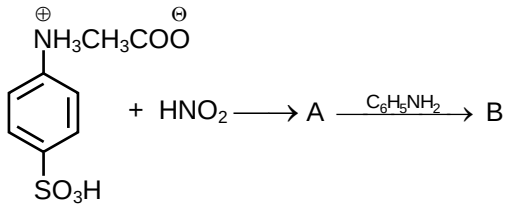
(b) 

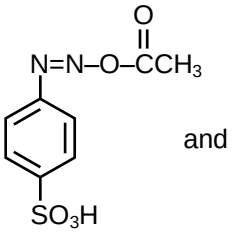
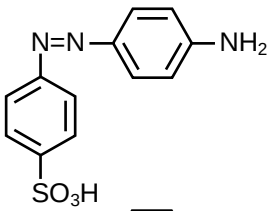
(c) 

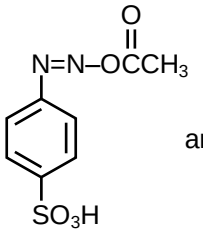
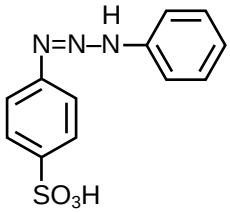
(d) 

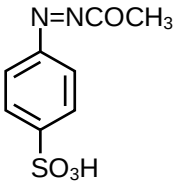
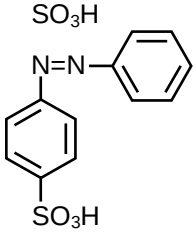
(1) (a) < (b) < (c) < (d) (2) (a) < (d) < (b) < (c) (3) (a) < (d) < (c) < (b) (4) (d) < (c) < (b) < (a)

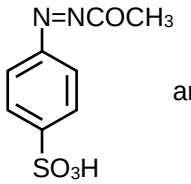
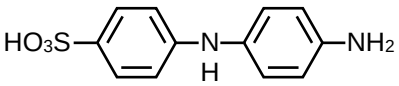
8. Products A and B formed in the following reactions are respectively : **[JEE(Main) 2018 Online (16-04-18), 4/120]**



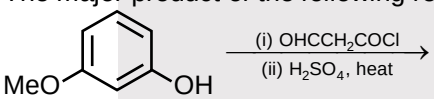
(1)  and 

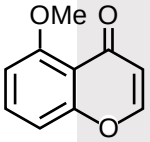
(2)  and 

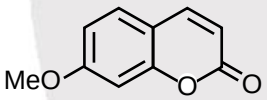
(3)  and 

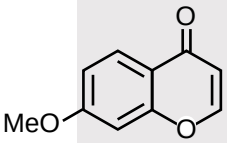
(4)  and 

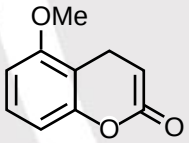
9. The major product of the following reaction is : **[JEE(Main) 2018 Online (16-04-18), 4/120]**



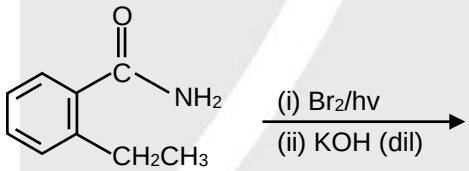
(1) 

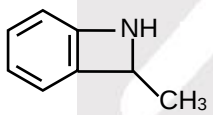
(2) 

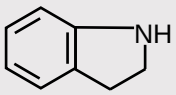
(3) 

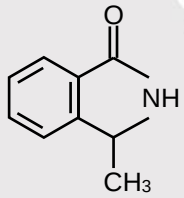
(4) 

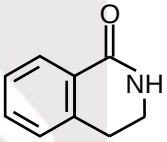
10. The major product of the following reaction is : **[JEE(Main) 2019 Online (09-01-19), 4/120]**



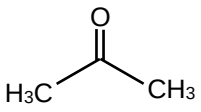
(1) 

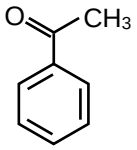
(2) 

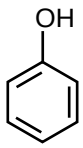
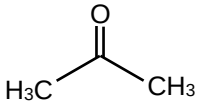
(3) 

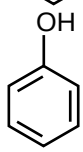
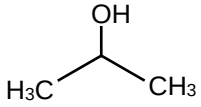
(4) 

11. The products formed in the reaction of cumene with O_2 followed by treatment with dil. HCl are:
[JEE(Main) 2019 Online (09-01-19), 4/120]

(1)  and 

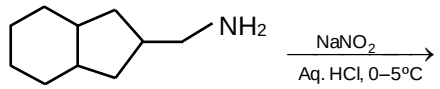
(2)  and CH_3–OH

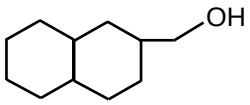
(3)  and 

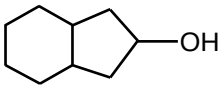
(4)  and 

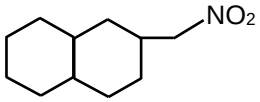
12. The major product formed in the reaction given below will be :

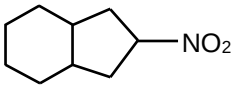
[JEE(Main) 2019 Online (10-01-19), 4/120]



(1) 

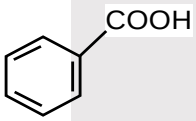
(2) 

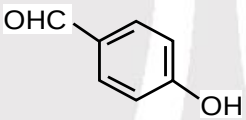
(3) 

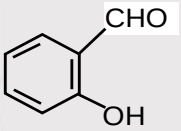
(4) 

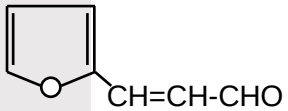
13. An aromatic compound 'A' having molecular formula $C_7H_6O_2$ on treating with aqueous ammonia and heating forms compounds 'B'. The compound B on reaction with molecular bromine and potassium hydroxide provides compound 'C' having molecular formula C_6H_7N. The structure of 'A' is:

[JEE(Main) 2019 Online (10-01-19), 4/120]

(1) 

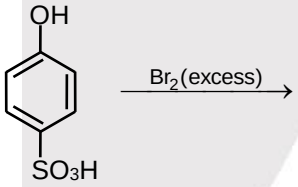
(2) 

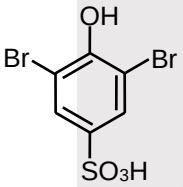
(3) 

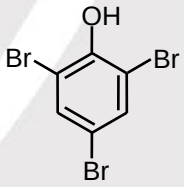
(4) 

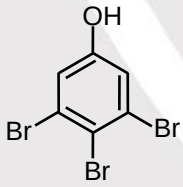
14. The major product of the following reaction is:

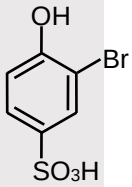
[JEE(Main) 2019 Online (11-01-19), 4/120]



(1) 

(2) 

(3) 

(4) 

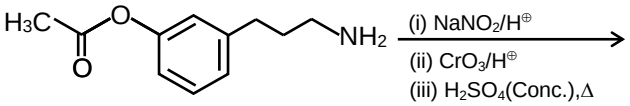
15. A compound 'X' on treatment with Br_2/NaOH, provided C_3H_9N, which gives positive cabylamine test. Compound 'X' is :

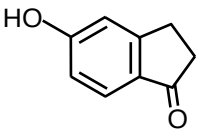
[JEE(Main) 2019 Online (11-01-19), 4/120]

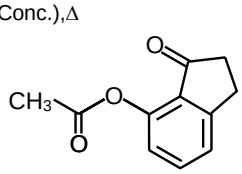
(1) $CH_3COCH_2NHCH_3$
(2) $CH_3CON(CH_3)_2$
(3) $CH_3CH_2COCH_2NH_2$
(4) $CH_3CH_2CH_2CONH_2$

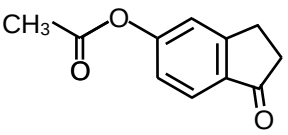
16. The major product of the following reaction is:

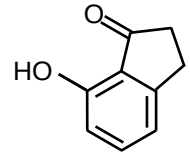
[JEE(Main) 2019 Online (12-01-19), 4/120]



(1) 

(2) 

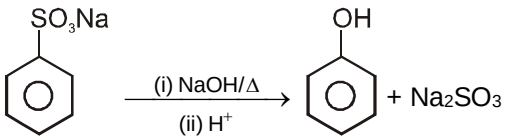
(3) 

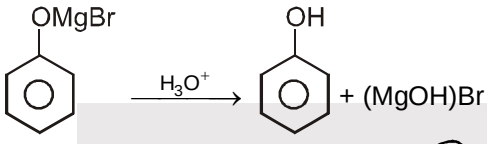
(4) 

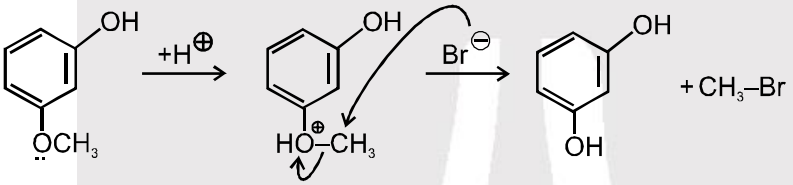
Answers

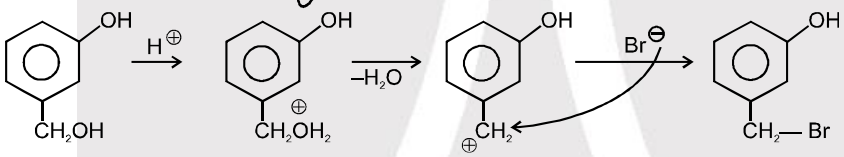
EXERCISE - 1

PART – I

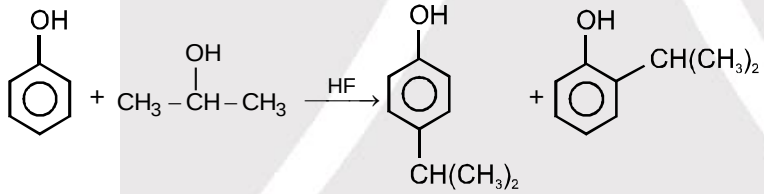
A-1. (a) 

(b) 

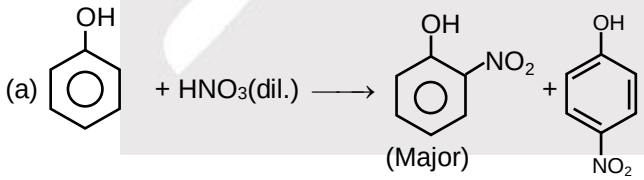
(c) 

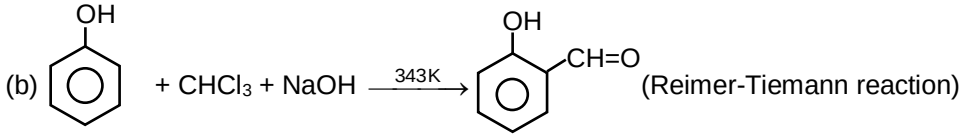
(d) 

A-2. In phenol, aromatic ring is highly electron rich due to +M of –OH group. So nucleophile does not easily attack on the ring.

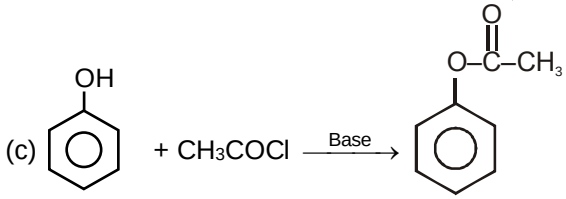
A-3. 

Phenols are highly reactive. Phenols are usually alkylated or acylated using relatively weak Friedel Crafts catalysts (such as HF) to avoid overalkylation.

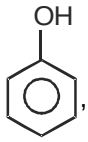
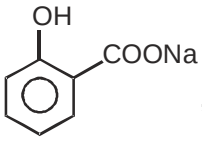
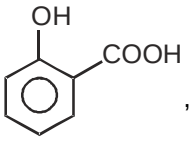
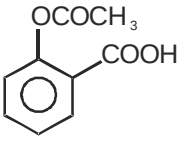
A-4. (a) 

(b) 

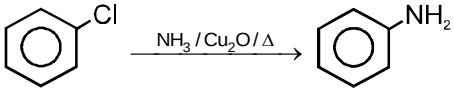
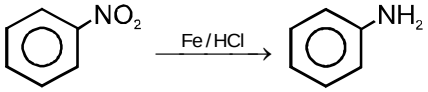
(Reimer-Tiemann reaction)

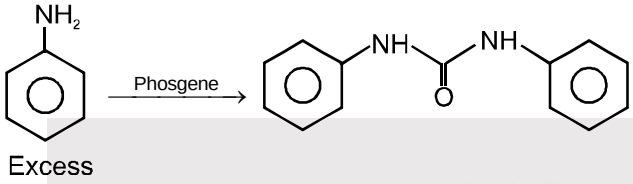
(c) 

(Phenyl acetate) + HCl

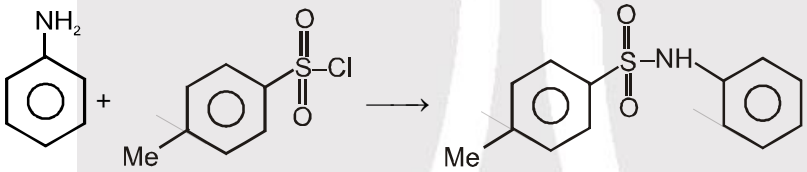
A-5. A →  , B →  , C →  , D → 

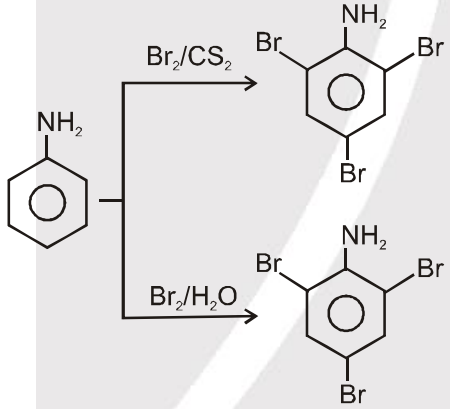
A-6. A → Zn, B → CH_3Cl / $FeCl_3$ and C → Strong oxidising reagent

B-1. (a)  ; (b) 

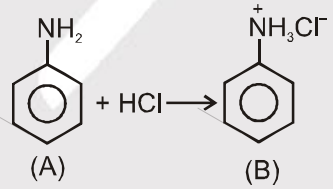
B-2. (a) 

Excess

(b) 

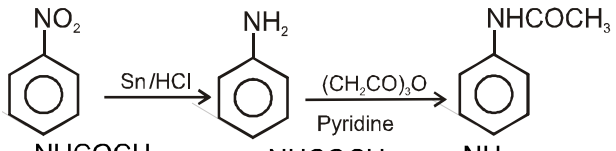
(c) 

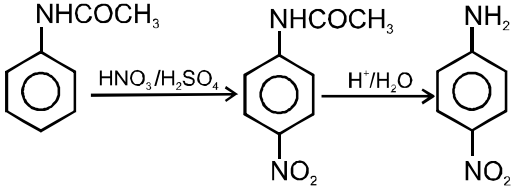
B-3. Aniline forms the salt anilinium chloride which is water soluble.



(A) Aniline (Colourless liquid. Sparingly soluble in water)

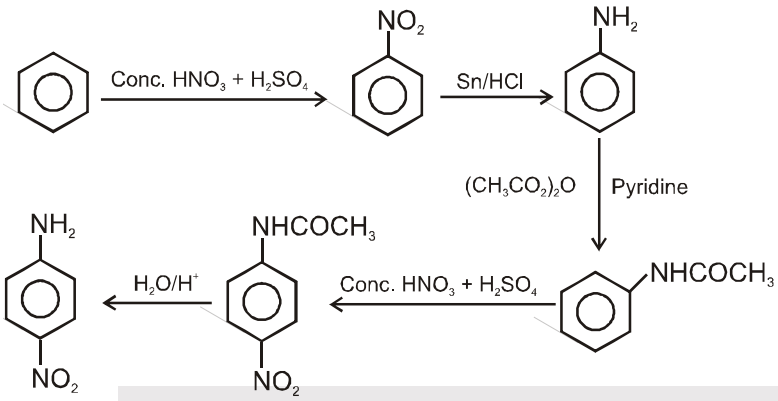
(B) Anilinium chloride (water soluble salt)

B-4. (a) 

(b) 

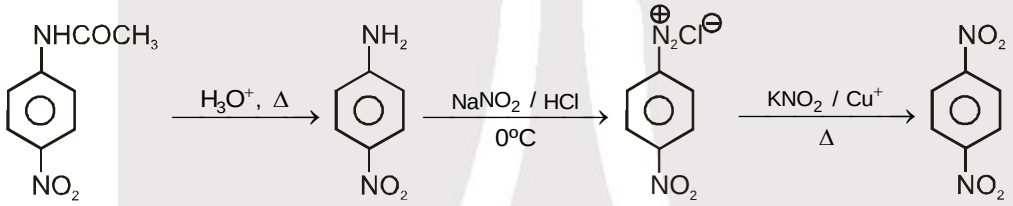
B-5. $C_6H_5CH_2NH_2 \xrightarrow{HNO_2} C_6H_5CH_2OH + N_2\uparrow$

B-6.

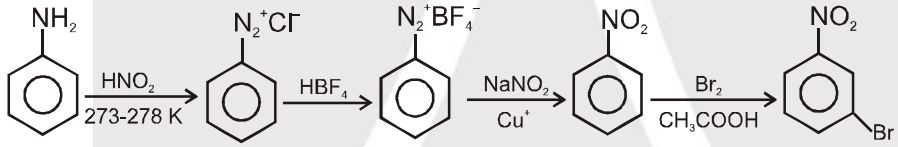


B-7. (i) Isocyanide test (ii) Hinsberg test (iii) $NaNO_2$ + HCl test

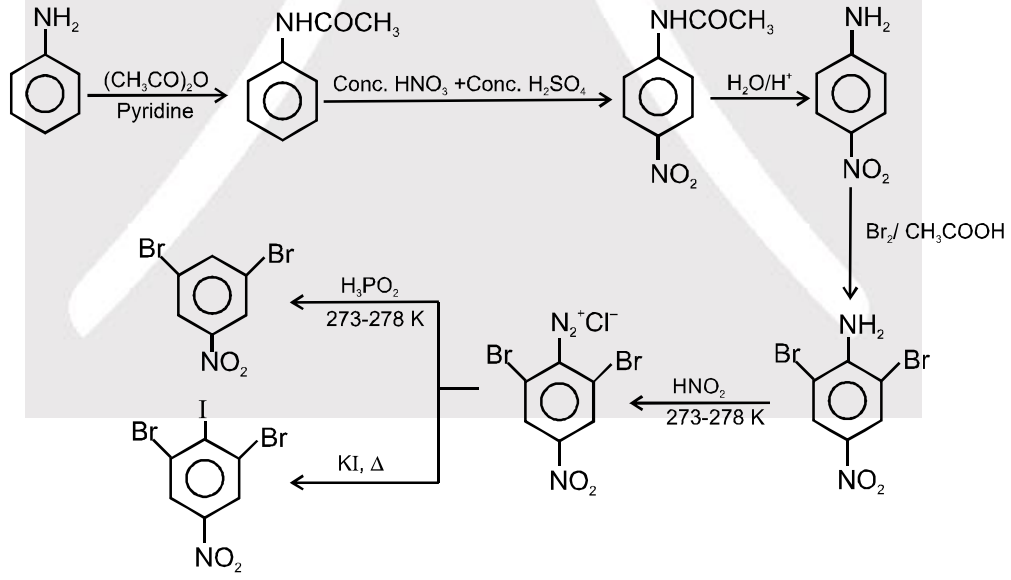
C-1.



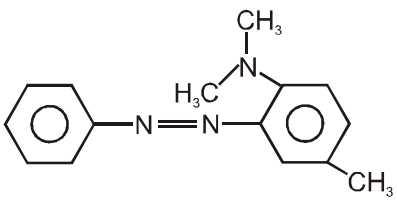
C-2.



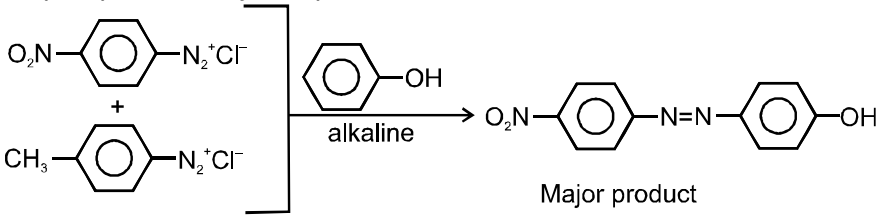
C-3. (a & b)



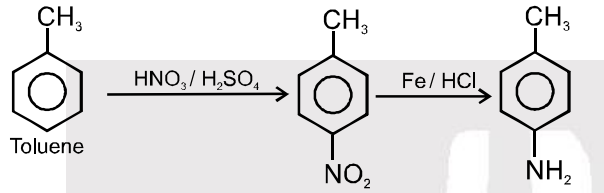
C-4.



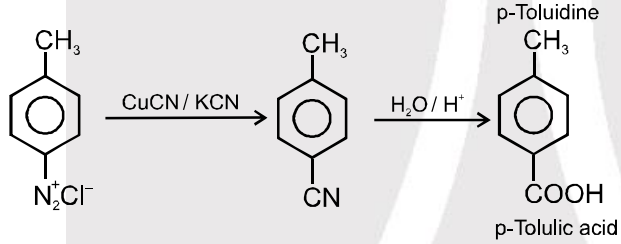
C-5. This reaction is an example of electrophilic aromatic substitution. In alkaline medium, phenol generates phenoxide ion which is more electron rich than phenol and hence more reactive for electrophilic attack. The electrophile in this reaction is aryldiazonium cation. Stronger the electrophile faster is the reaction. *p* Nitrophenyldiazonium cation is a stronger electrophile than *p*-toluene diazonium cation. Therefore, it couples preferentially with phenol.



C-6. (a)



(b)



PART – II

A-1.	(B)	**A-2.**	(C)	**A-3.**	(D)	**A-4.**	(B)	**A-5.**	(D)
A-6.	(B)	**A-7.**	(B)	**A-8.**	(D)	**A-9.**	(C)	**A-10.**	(A)
A-11.	(C)	**A-12.**	(B)	**B-1.**	(C)	**B-2.**	(B)	**B-3.**	(B)
B-4.	(A)	**B-5.**	(D)	**B-6.**	(B)	**B-7.**	(B)	**B-8.**	(D)
B-9.	(D)	**B-10.**	(B)	**B-11.**	(B)	**B-12.**	(C)	**B-13.**	(B)
B-14.	(D)	**C-1.**	(B)	**C-2.**	(C)	**C-3.**	(C)	**C-4.**	(D)
C-5.	(D)	**C-6.**	(B)	**C-7.**	(D)	**C-8.**	(B)	**C-9.**	(A)

PART – III

1. (A - r) ; (B - s) ; (C - p) ; (D - q)

2. (A - s) ; (B - r) ; (C - p) ; (D - q)

3. (A - q,s,t) ; (B - p, t) ; (C - q,t) ; (D - r,t)

EXERCISE – 2

PART – I

1.	(C)	**2.**	(D)	**3.**	(C)	**4.**	(D)	**5.**	(A)
6.	(A)	**7.**	(D)	**8.**	(B)	**9.**	(A)	**10.**	(A)
11.	(C)	**12.**	(A)						

PART – II

1.	75	**2.**	03	**3.**	94	**4.**	78	**5.**	Zero (0).
6.	99	**7.**	3 (1, 4, 9)						

PART – III

1.	(ABCD)	**2.**	(AB)	**3.**	(BC)	**4.**	(AC)	**5.**	(ABCD)
6.	(ABCD)	**7.**	(BCD)	**8.**	(ACD)	**9.**	(BD)	**10.**	(BCD)

PART – IV

1.	(C)	**2.**	(B)	**3.**	(A)	**4.**	(A)	**5.**	(B)
6.	(D)	**7.**	(B)	**8.**	(B)	**9.**	(C)	**10.**	(B)
11.	(D)	**12.**	(A)	**13.**	(B)	**14.**	(D)		

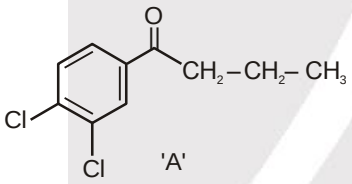
EXERCISE – 3

PART – I

1. (D)

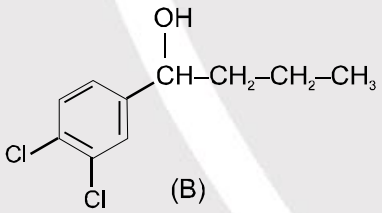
2. Reagents are (1) NaOH / high temperature and pressure (2) Me_2SO_4 (3) conc. H_2SO_4 (4) Fusion with NaOH (5) H_3O^+

3. A =



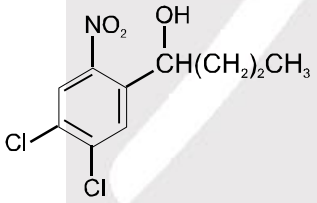
'A'

B =



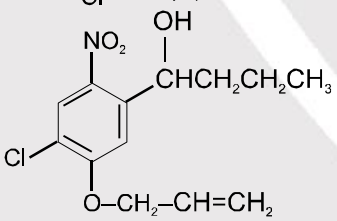
(B)

C =



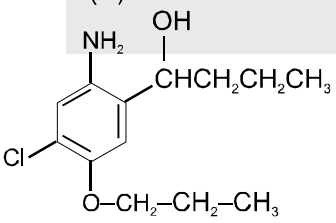
(C)

D =



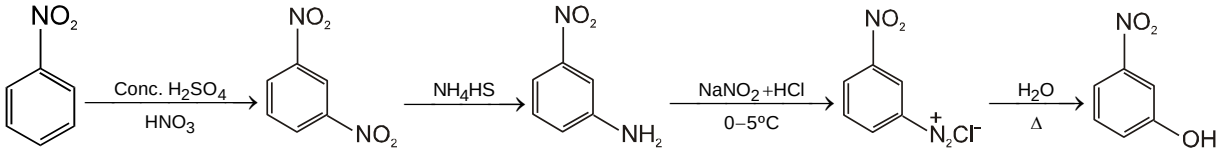
(D)

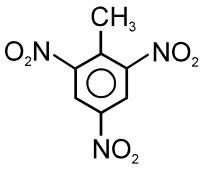
E =



(E)

4. **(a)** (i) Conc. H_2SO_4 (ii) KHF_2/Δ
or (i) conc. HNO_3/H_2SO_4 (ii) Sn + HCl (iii) $NaNO_2$ + HCl & HBF_4/Δ
(b) (i) NaOH + CO_2 (ii) $H^{\oplus}$ (iii) $(CH_3CO)_2O$

5. 

6. (A) H_2SO_4 (conc.), (B) Br_2, (C) $NO_2^{\oplus}$, (D)  (T.N.T. = Trinitrotoluene)

7.	(A)	**8.**	(B)	**9.**	(D)	**10.**	(D)	**11.**	(D)
12.	(C)	**13.**	(C)	**14.**	(B)	**15.**	(AC)		
16.	(A) - r,s ; (B) - t ; (C) - p, q ; (D) – r			**17.**	(A)	**18.**	(C)	**19.**	(BD)
20.	(B)	**21.**	(B)	**22.**	(A)	**23.**	(ABC)	**24.**	(D)
25.	(C)	**26.**	4	**27.**	(B)	**28.**	(A)	**29.**	(B)
30.	(BC)	**31.**	(A)	**32.**	(B)	**33.**	(B)	**34.***	(ABD)
35.*	(D)	**36.**	495						

PART – II

JEE(MAIN) OFFLINE PROBLEM

1.	(3)	**2.**	(1)	**3.**	(4)	**4.**	(1)	**5.**	(1)
6.	(2)	**7.**	(2)	**8.**	(1)	**9.**	(4)	**10.**	(2)
11.	(3)	**12.**	(4)	**13.**	(1)	**14.**	(4)	**15.**	(1)
16.	(3)	**17.**	(3)	**18.**	(2)	**19.**	(1)	**20.**	(3)

JEE(MAIN) ONLINE PROBLEM

1.	(4)	**2.**	(1)	**3.**	(3)	**4.**	(2)	**5.**	(1)
6.	(3)	**7.**	(3)	**8.**	(1)	**9.**	(2)	**10.**	(3)
11.	(3)	**12.**	(Bonus)	**13.**	(1)	**14.**	(2)	**15.**	(4)
16.	(1)								