Amines JEE Main PYQ - 2

Total Time: 1 Hour : 15 Minute **Total Marks:** 120

Instructions

Instructions

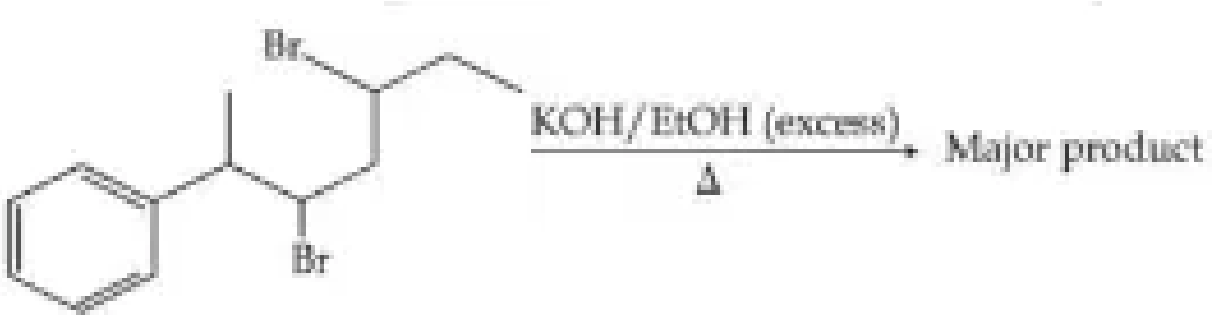
1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

Amines

1. The major product of the following reaction is: **(+4, -1)**



a. 2-Phenylhepta-2,4-diene

b. 6-Phenylhepta-3,5-diene

c. 6-Phenylhepta-2,4-diene

d. 2-Phenylhepta-2,5-diene

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2. The purification method based on the following physical transformation is: **(+4, -1)**

$$Solid \xrightarrow{Heat} Vapour \xrightarrow{Cool} Solid$$

a. Distillation

b. Sublimation

c. Crystallization

d. Extraction

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3. Consider an elementary reaction: **(+4, -1)**

$$A(g) + B(g) \rightarrow C(g) + D(g)$$

If the volume of the reaction mixture is suddenly reduced to $\frac{1}{3}$ of its initial

volume, the reaction rate will become x times of the original reaction rate. The value of x is:

a. $\frac{1}{9}$

b. 9

c. 3

d. $\frac{1}{3}$

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4. Identify correct statements: (+4, -1)

(A) Primary amines do not give diazonium salts when treated with $NaNO_2$ in acidic condition.
(B) Aliphatic and aromatic primary amines on heating with $CHCl_3$ and ethanolic KOH form carbylamines.
(C) Secondary and tertiary amines also give carbylamine test.
(D) Benzenesulfonyl chloride is known as Hinsberg's reagent.
(E) Tertiary amines react with benzenesulfonyl chloride very easily.
Choose the correct answer from the options given below:

a. (D) and (E) only

b. (B) and (D) only

c. (A) and (B) only

d. (B) and (C) only

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5. Identify the inorganic sulphides that are yellow in colour: (+4, -1)

(A) $(NH_4)_2S$
(B) PbS
(C) CuS
(D) As_2S_3
(E) As_2S_5
Choose the correct answer from the options given below:

a. (A) and (B) only

b. (A) and (C) only

c. (A), (D) and (E) only

d. (D) and (E) only

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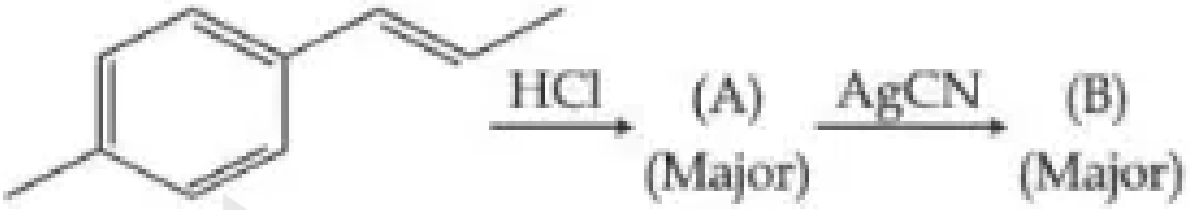
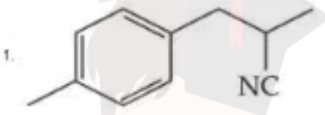
6. The product B formed in the following reaction sequence is: **(+4, -1)**

$$C_6H_5CN \xrightarrow{HCl} (A) \xrightarrow{AgCN} (B)$$



a.



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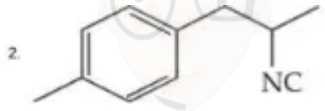

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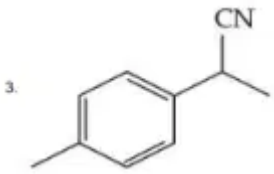

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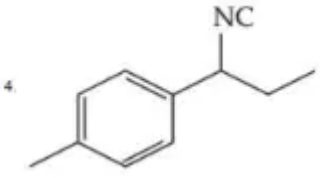

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7. Identify product [A], [B], and [C] in the following reaction sequence. **(+4, -1)**

$$CH_3 - C \equiv CH \xrightarrow[H_2]{Pd/C} [A] \xrightarrow[(ii)\ Zn,\ H_2O]{(i)\ O_3} [B] + [C]$$

a. [A] : $CH_3-CH=CH_2$, [B] : CH_3CHO, [C] : CH_3CH_2OH

b. [A] : $CH_2=CH_2$, [B] : $H_3C-\overset{\overset{O}{\|}}{C}-CH_3$, [C] : HCHO

c. [A] : $CH_3-CH=CH_2$, [B] : CH_3CHO, [C] : HCHO

d. [A] : $CH_3CH_2CH_3$, [B] : CH_3CHO, [C] : HCHO

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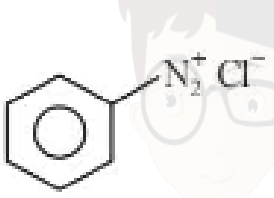
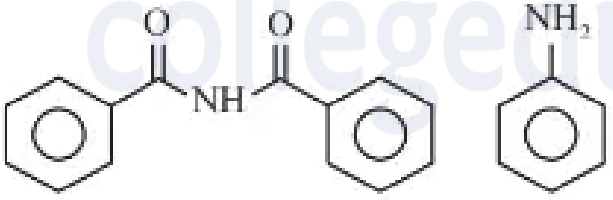
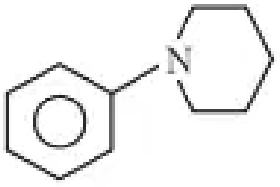
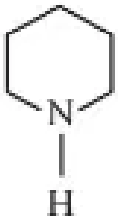
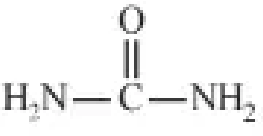
8. Number of compounds which give reaction with Hinsberg's reagent is_____. **(+4, -1)**



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9. An amine (X) is prepared by ammonolysis of benzyl chloride. On adding p-toluenesulphonyl chloride to it, the solution remains clear.Molar mass of the amine (X) formed is _____ $g\ mol^{-1}$.(Given molar mass in $g\ mol^{-1}$: $C = 12$, $H = 1$, $O = 16$, $N = 14$) **(+4, -1)**

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10. X of enthanamine was subjected to reaction with $NaNO_2/HCl$ followed by hydrolysis to liberate N_2 and HCl. The HCl generated was completely neutralised by 0.2 moles of NaOH. X is ____ g. **(+4, -1)**

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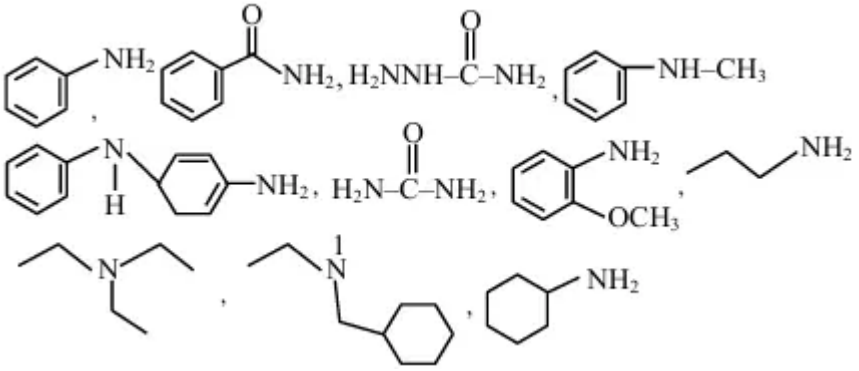
11. Number of amine compounds from the following giving solids which are soluble in NaOH upon reaction with Hinsberg's reagent is _____. **(+4, -1)**



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12. Given below are two statements: **(+4, -1)**

Statement (I) : All the following compounds react with p-toluenesulfonyl chloride.

$C_6H_5NH_2$ $(C_6H_5)_2NH$ $(C_6H_5)_3N$

Statement (II) : Their products in the above reaction are soluble in aqueous NaOH.

In the light of the above statements, choose the correct answer from the options given below.

a. Both Statement I and Statement II is false

b. Statement I is true but Statement II is false

c. Statement I is false but Statement II is true

d. Both Statement I and Statement II is true

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13. A compound (x) with molar mass $108\ \text{g mol}^{-1}$ undergoes acetylation to give a product with molar mass $192\ \text{g mol}^{-1}$. The number of amino groups in the compound (x) is _____. **(+4, -1)**

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14. Given below are two statements: **(+4, -1)**

Statement I: Aniline reacts with con. H_2SO_4 followed by heating at 453–473 K gives p-aminobenzene sulphonic acid, which gives blood red colour in the

'Lassaigne's test'.
Statement II: In Friedel-Craft's alkylation and acylation reactions, aniline forms salt with the $AlCl_3$ catalyst. Due to this, nitrogen of aniline acquires a positive charge and acts as a deactivating group.
In the light of the above statements, choose the correct answer from the options given below:

a. Statement I is false but Statement II is true

b. Both Statement I and Statement II are false

c. Statement I is true but Statement II is false

d. Both Statement I and Statement II are true

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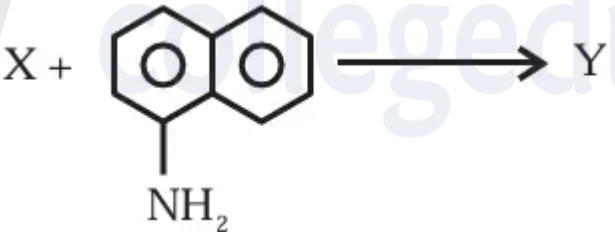
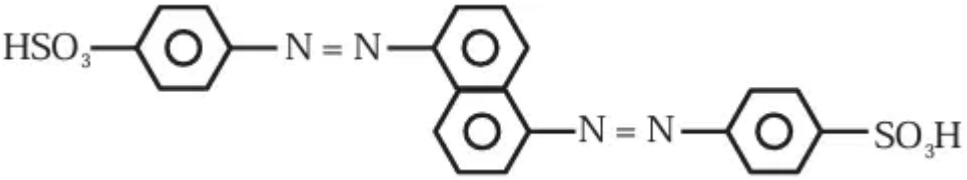
15. The azo-dye (Y) formed in the following reactions is: Sulphanilic acid + $NaNO_2$ + $CH_3COOH \rightarrow X$ **(+4, -1)**



a.



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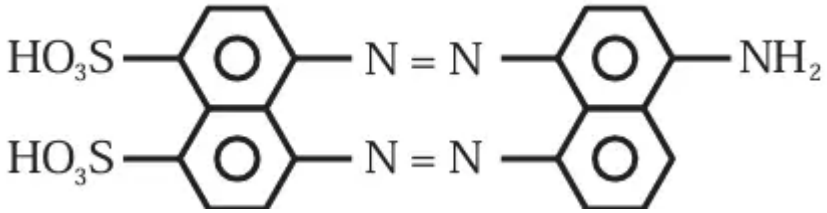

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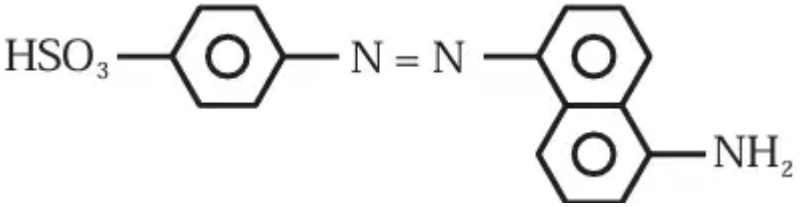
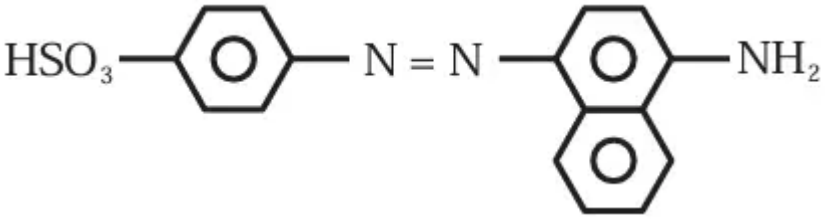


d. 

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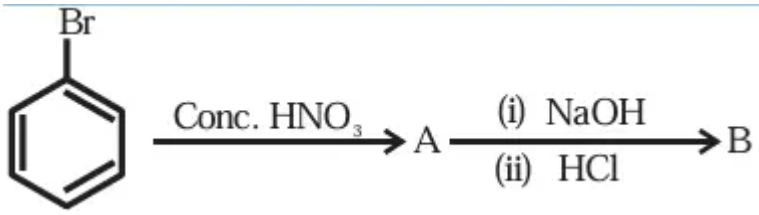
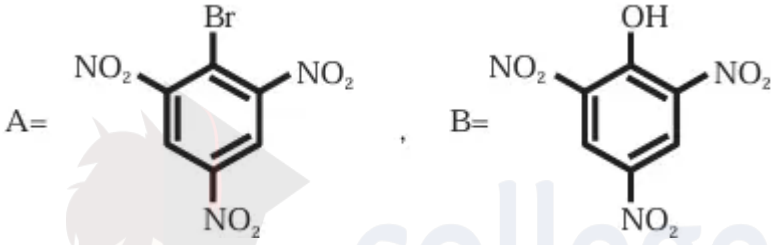
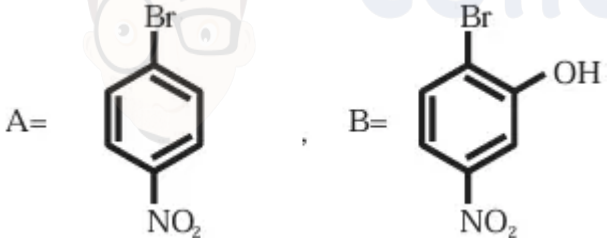
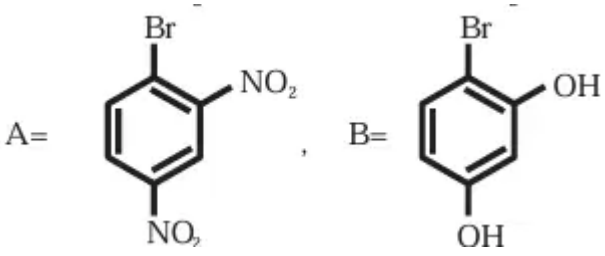
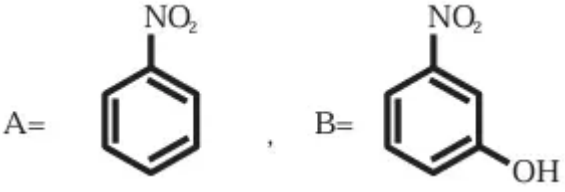
16. Identify A and B in the following reaction sequence. **(+4, -1)**



a. 

b. 

c. 

d. 

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17. Which of the following compounds will not give Hinsberg's test **(+4, -1)**

a. NH_2-NH-CO -NH_2

b. CH_3CO-NH_2

c. CH_3-CH_2-NH_2

d. CH_3-NH-CH_3

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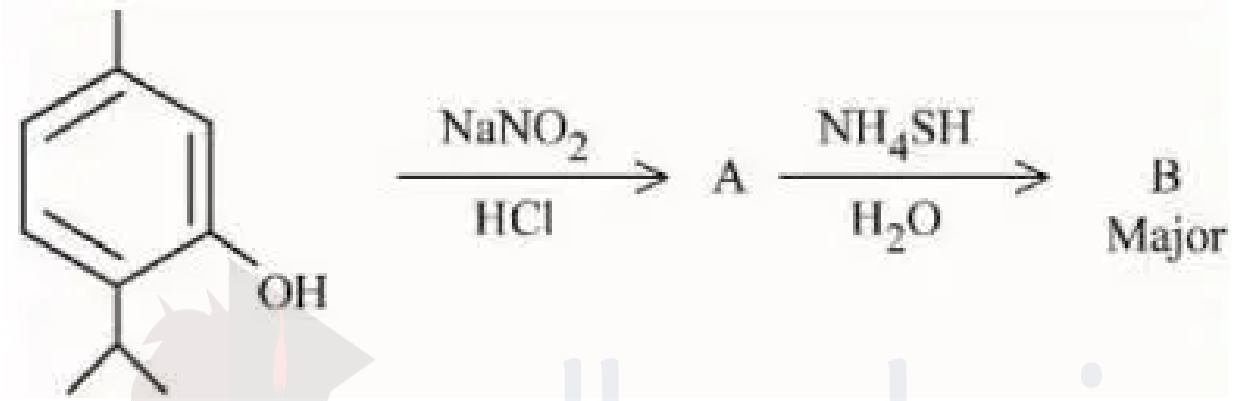
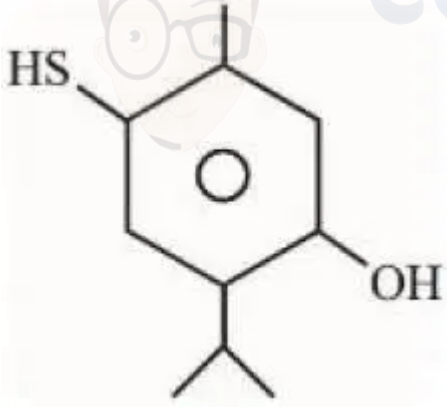
18. Compound 'B' is **(+4, -1)**



a.



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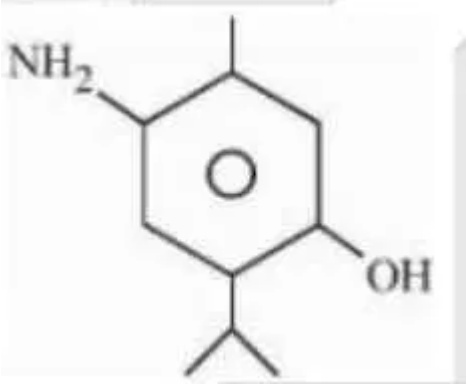
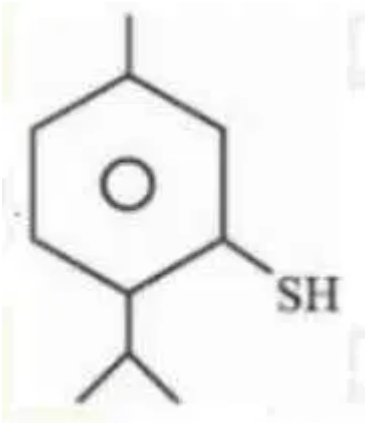
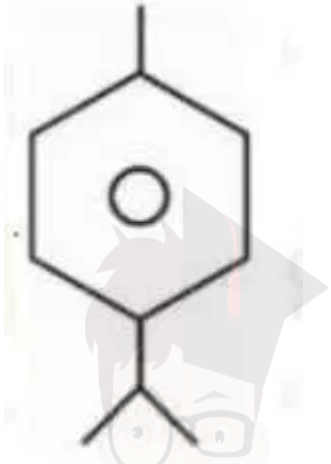


c. 

d. 

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19. Statement-I : Aniline on reaction with concentrated H_2SO_4 at 475 K gives p-amino benzene sulphonic acid. This gives blood red colour with Lassaigne's test. **(+4, -1)**
Statement-II : Aniline forms a salt with anhydrus $AlCl_3$ in Friedel Craft's reaction.

a. Both Statement-I and Statement-II are correct.

b. Both Statement-I and Statement-II are incorrect.

c. Statement-I is correct and Statement-II incorrect.

d. Statement-I is incorrect and Statement-II correct.

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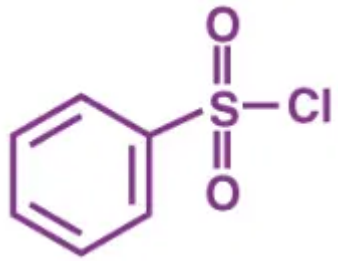
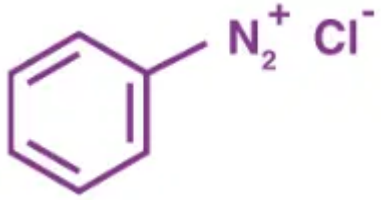
20. The Hinsberg reagent is **(+4, -1)**

a.



b.



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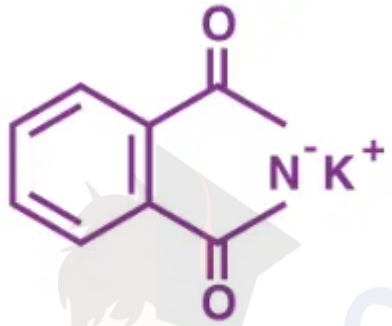
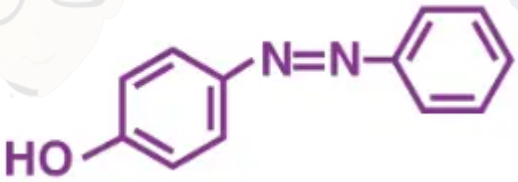


d.



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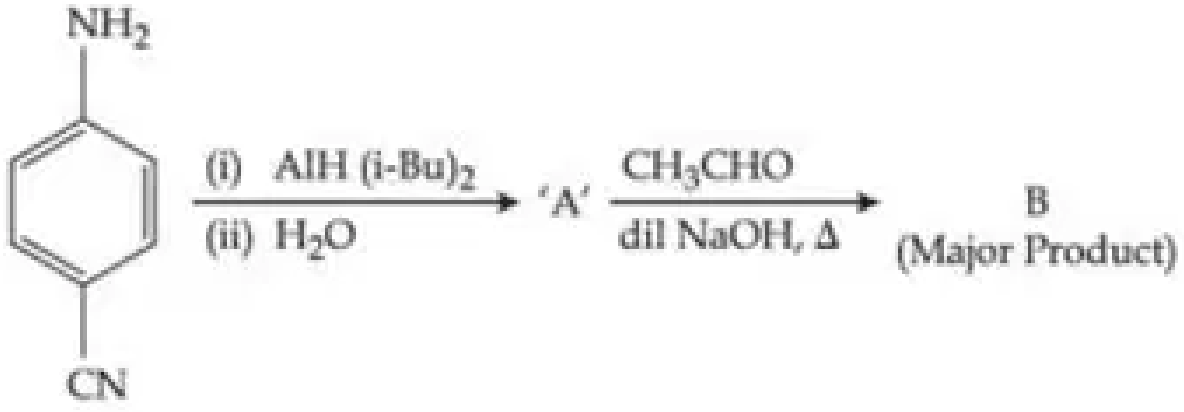
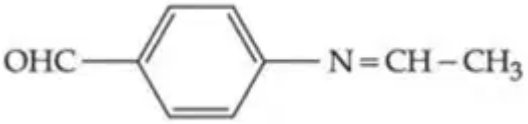
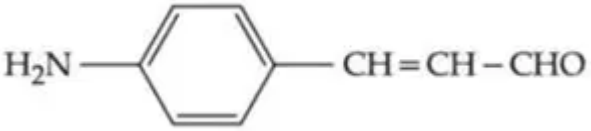
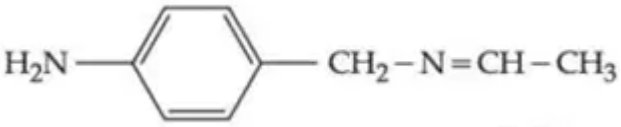
21. Consider the following reaction sequence: **(+4, -1)**

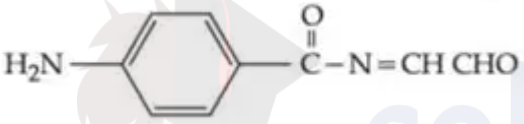


The product 'B' is:

a. 

b. 

c. 

d. 

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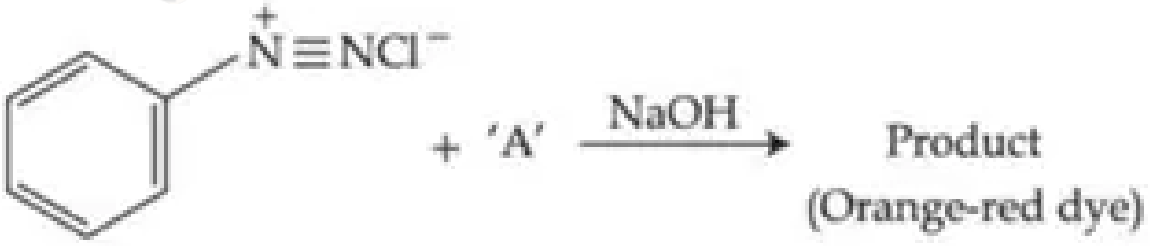
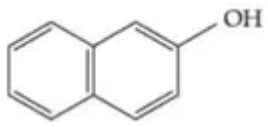
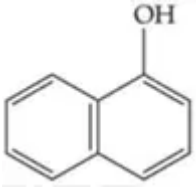
22. **(+4, -1)**



Which among the following represents reagent 'A'?

a. 

b. 

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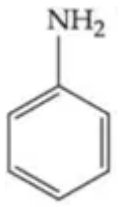
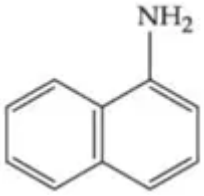


d.



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23. Consider the above reaction, the compound 'A' is : **(+4, -1)**

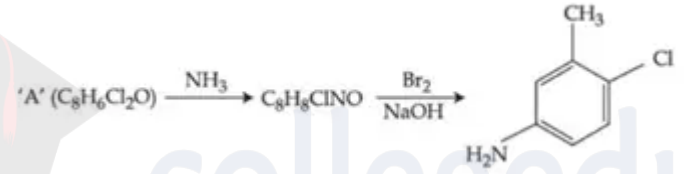
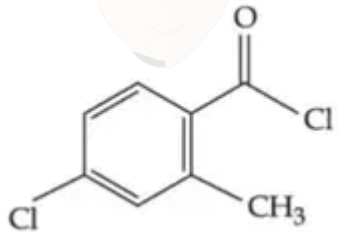


Fig.

a.



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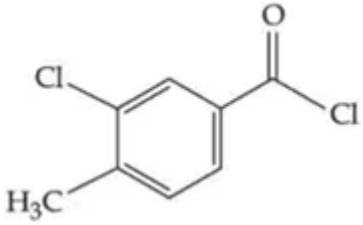
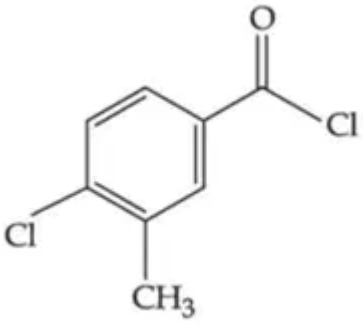
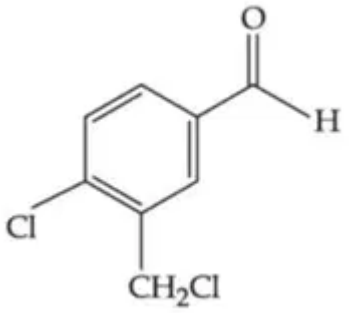


c.



d.



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24. (+4, -1)

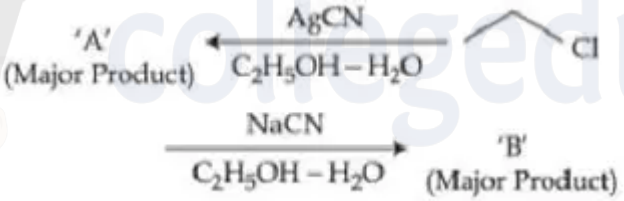
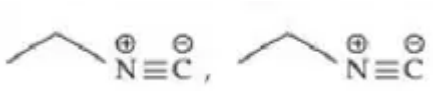
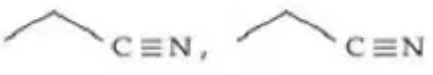
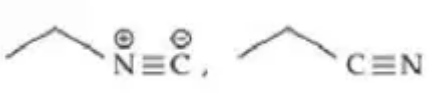


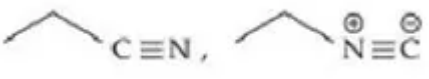
Fig.

Considering the above reactions, the compound 'A' and compound 'B' respectively are :

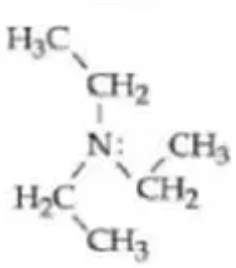
a. 

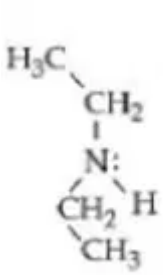
b. 

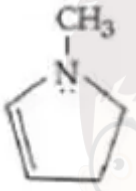
c. 

d. 

25. Which among the following is the strongest Bronsted base? **(+4, -1)**

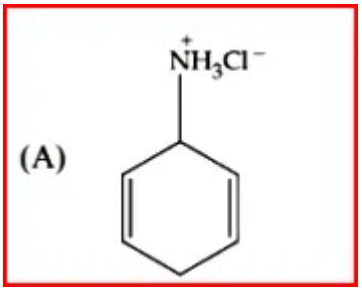
a. 

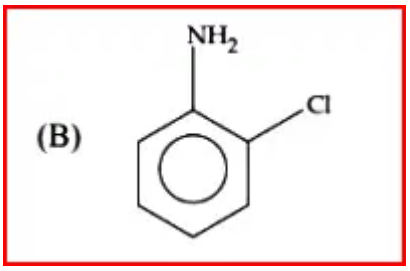
b. 

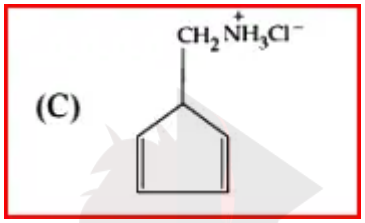
c. 

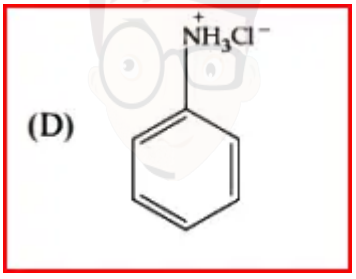
d. 

26. An organic compound 'A' contains nitrogen and chlorine. It dissolves readily in water to give a solution that turns litmus red. Titration of compound 'A' with standard base indicates that the molecular weight of 'A' IS 131±2. When a sample of 'A' is treated with aq. NaOH, a liquid separates which contains N but not Cl. Treatment of the obtained liquid with nitrous acid followed by phenol gives orange precipitate. The compound A is : **(+4, -1)**

a. 

b. 

c. 

d. 

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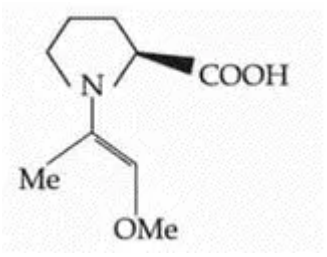
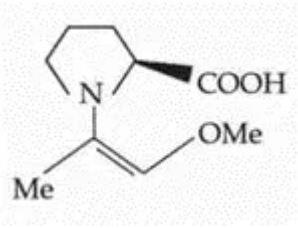
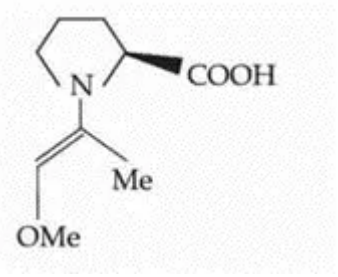
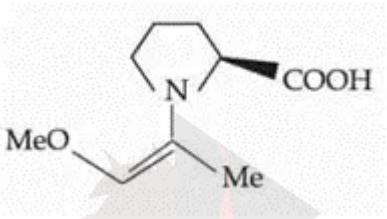
27. Among the following structures, which will show the most stable enamine formation? **(+4, -1)**
(Where Me is $-CH_3$)

a. 

b. 

c. 

d. 

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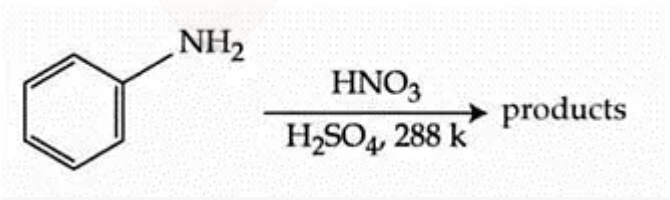
28. With respect to the following reaction, consider the given statements: **(+4, -1)**



Fig

(A) o-Nitroaniline and p-nitroaniline are the predominant products.
(B) p-Nitroaniline and m-nitroaniline are the predominant products.
(C) HNO_3 acts as an acid.
(D) H_2SO_4 acts as an acid.
Choose the correct option.

a. (A) and (C) are correct statements.

b. (A) and (D) are correct statements.

c. (B) and (D) are correct statements.

d. (B) and (C) are correct statements.

---

29. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R **(+4, -1)**

Assertion A : Aniline on nitration yields ortho, meta & para nitro derivatives of aniline.

Reason R : Nitrating mixture is a strong acidic mixture.

In the light of the above statements, choose the correct answer from the options given below.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

---

30. In Friedel-Crafts alkylation of aniline, one gets **(+4, -1)**

a. Alkylated product with ortho and para substitution.

b. Secondary amine after acidic treatment.

c. An amide product.

d. Positively charged nitrogen at benzene ring.

Answers

1. **Answer: c**

Explanation:

The given reaction involves a dehydrohalogenation process, where a halogen (Br) is eliminated in the presence of an excess base, KOH in ethanol. This reaction typically leads to the formation of alkenes by the elimination of H and Br atoms.
Since the reagent is in excess, it leads to a conjugated diene product.
The elimination occurs in such a way that the resulting product has two double bonds conjugated with the phenyl group.
The correct product formed in this reaction is 6-Phenylhepta-2,4-diene, as it has the conjugation in positions 2 and 4.

---

2. **Answer: b**

Explanation:

The process shown in the question involves heating a solid to convert it into vapour, followed by cooling the vapour back into a solid.
This is a typical example of sublimation, where a substance transitions directly from a solid to a gas and then back to a solid without passing through the liquid phase. Sublimation is commonly used to purify substances that can undergo this phase transition, such as iodine, dry ice, or camphor.
The heating provides enough energy for the molecules to overcome intermolecular forces and directly convert to vapour.
When the vapour is cooled, it condenses back into a solid, leaving impurities behind.
Thus, the correct purification method based on the described transformation is sublimation.

---

3. **Answer: b**

Explanation:

For an elementary reaction, the rate of reaction is proportional to the concentrations of the reactants. Specifically, for a reaction where the stoichiometric coefficients are 1 for both A and B, the rate law can be expressed as:

$$Rate = k[A][B]$$

Here, k is the rate constant, and $[A]$ and $[B]$ are the concentrations of reactants A and B. Now, when the volume of the reaction mixture is reduced to $\frac{1}{3}$ of its original volume, the concentration of the reactants will increase by a factor of 3, as concentration is inversely proportional to volume. Since the rate is directly proportional to the product of the concentrations of A and B, the reaction rate will increase by:

$$Newrate = k(3[A])(3[B]) = 9 \times (Originalrate)$$

Therefore, the reaction rate will become 9 times the original rate. The value of x is 9.

---

4. Answer: b

Explanation:

- Statement (A) is incorrect: Primary amines **do** give diazonium salts when treated with $NaNO_2$ in acidic conditions. This is a standard test for primary aromatic amines.
- Statement (B) is correct: The carbylamine test is a characteristic test for primary amines, where they react with chloroform ($CHCl_3$) and ethanolic KOH to form isocyanides (carbylamines) with a foul smell.
- Statement (C) is incorrect: Only **primary amines** give the carbylamine test. **Secondary and tertiary amines do not.**
- Statement (D) is correct: Benzenesulfonyl chloride is known as Hinsberg's reagent, which is used to distinguish primary, secondary, and tertiary amines.
- Statement (E) is incorrect: Tertiary amines do not react with Hinsberg's reagent under normal conditions.

---

5. Answer: d

Explanation:

- Arsenic sulphides (As_2S_3 and As_2S_5) are known to be yellow in color.
- Lead sulphide (PbS) and Copper sulphide (CuS) are typically black in appearance.
- Ammonium sulphide ($(NH_4)_2S$) is colorless or slightly yellowish but is not classified among the prominent yellow sulphides.

---

6. **Answer: c**

Explanation:

This reaction sequence involves nucleophilic substitution.
The first reaction produces an intermediate which undergoes further substitution with AgCN to form the product.

---

7. **Answer: a**

Explanation:

In this reaction sequence:
- The Pd/C reduction of the alkyne leads to an alkene [A].
- Ozone cleavage of the alkene gives an aldehyde [B], and further reduction with Zn and water forms an alcohol [C].

---

8. **Answer: 5 - 5**

Explanation:

To determine the number of compounds that react with Hinsberg's reagent, we need to identify the compounds containing primary or secondary amines. Hinsberg's reagent (benzenesulfonyl chloride) reacts with:

- **Primary amines** to form sulfonamides, which are soluble in alkali.
- **Secondary amines** to form sulfonamides, which are insoluble in alkali.
- **Tertiary amines** do not react with Hinsberg's reagent.

Let's examine the given compounds:

1. **Benzenediazonium chloride**: Not an amine.
2. **Amide (RCONH2)**: Contains an amide group, not reactive.
3. **Aniline (C6H5NH2)**: Primary amine, reactive.
4. **Pyridine**: Tertiary amine, not reactive.
5. **Piperidine**: Secondary amine, reactive.
6. **Morpholine**: Secondary amine, reactive.
7. **Methylamine (CH3NH2)**: Primary amine, reactive.
8. **Ethylenediamine**: Primary amine, reactive.
9. **Urea**: Contains an amide group, not reactive.

The reactive compounds are:

1. Aniline
2. Piperidine
3. Morpholine
4. Methylamine
5. Ethylenediamine

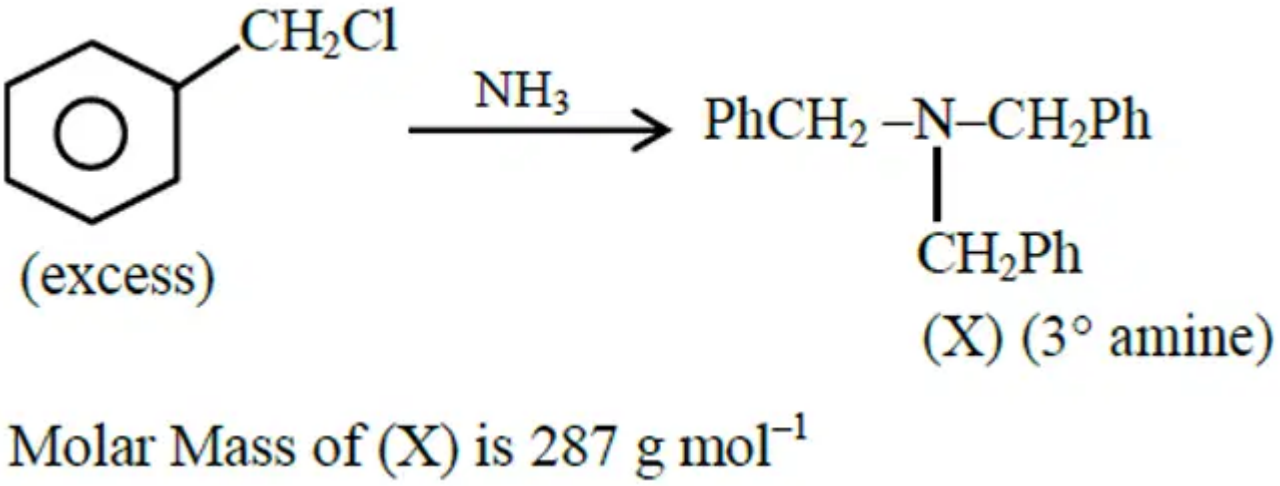
These total to **five** compounds, which fits within the given range of 5,5.

Therefore, the number of compounds that react with Hinsberg's reagent is: **5**

---

9. **Answer: 287 - 287**

Explanation:



Molar Mass of (X) is 287 g mol^{-1}

Thus the correct answer is 287 g mol^{-1}.

---

10. Answer: 9 - 9

Explanation:

The reaction sequence is as follows:
Step 1: Reaction of ethanamine with $\mathrm{NaNO_2}$ and HCl
Ethanamine ($\mathrm{CH_3CH_2NH_2}$) reacts with $\mathrm{NaNO_2}$ and HCl to form an unstable diazonium salt ($\mathrm{CH_3CH_2N_2^+Cl^-}$):

$$\mathrm{CH_3CH_2NH_2 + NaNO_2 + HCl \rightarrow CH_3CH_2N_2^+Cl^- + NaCl + H_2O.}$$

Step 2: Hydrolysis of the diazonium salt
The diazonium salt decomposes upon hydrolysis, liberating $\mathrm{N_2}$, HCl, and ethanol ($\mathrm{CH_3CH_2OH}$):

$$\mathrm{CH_3CH_2N_2^+Cl^- + H_2O \rightarrow CH_3CH_2OH + N_2 + HCl.}$$

Step 3: Calculation of the mass of ethanamine
The reaction generates 0.2 moles of HCl, which neutralizes 0.2 moles of NaOH. From the stoichiometry of the reaction, 1 mole of ethanamine produces 1 mole of HCl.
Therefore, the moles of ethanamine ($\mathrm{CH_3CH_2NH_2}$) required are 0.2 moles.
The molar mass of ethanamine is:

$$\mathrm{Molar\ mass\ of\ CH_3CH_2NH_2} = 12 + 3 + 3 + 12 + 2 + 14 + 1 = 44\,\mathrm{g/mol.}$$

The mass of ethanamine is:

$$\mathrm{Mass = Moles \times Molar\ mass} = 0.2 \times 44 = 8.8\,\mathrm{g\ (Nearest\ Integer\ to\ 9).}$$

Final Answer: $X = 9$.

---

11. Answer: 5 - 5

Explanation:

To solve the problem of identifying the number of amine compounds that form solids soluble in NaOH when reacting with Hinsberg's reagent, follow these steps:

1. **Understand Hinsberg's Test:** This test differentiates primary, secondary, and tertiary amines.
   - *Primary amines* react with Hinsberg's reagent to form sulfonamide, which is soluble in alkali such as NaOH.
   - *Secondary amines* form a sulfonamide that is usually not soluble in NaOH.
   - *Tertiary amines* do not react with Hinsberg's reagent.
2. **Identify Types of Amines:** Review the provided amine structures.
   - Analyze each structure to determine if the nitrogen atom is connected to one, two, or three carbon-containing groups.
3. **Determine Solubility in NaOH:** Focus on primary amines.
   - Structure 1 (aniline derivative) - Primary amine
   - Structure 2 (benzylamine group) - Primary amine
   - Structure 5 (aliphatic primary amine) - Primary amine
   - Structure 8 (another aniline derivative) - Primary amine
   - Structure 9 (cyclohexylamine) - Primary amine
4. **Count Primary Amines:** Total number of primary amines: 5
5. **Validate Solution:** Ensure the answer falls within the given range of 5,5.

Since the calculated number is 5, it matches the expected range.

Therefore, the number of primary amine compounds that form solids soluble in NaOH with Hinsberg's reagent is **5**.

---

12. Answer: a

Explanation:

To solve the given problem, we need to analyze the two statements provided with respect to the chemical reactivity of the compounds with p-toluenesulfonyl chloride and the solubility of the resultant products in aqueous NaOH.

Analysis of Statement I:

Statement I claims that: "All the following compounds react with p-toluenesulfonyl chloride."

The compounds listed are: $C_6H_5NH_2$ (aniline), $(C_6H_5)_2NH$ (diphenylamine), and $(C_6H_5)_3N$ (triphenylamine).

Explanation:

- Aniline ($C_6H_5NH_2$): A primary amine, reacts with p-toluenesulfonyl chloride to form a tosylamide.
- Diphenylamine ($(C_6H_5)_2NH$): A secondary amine, can react to form a tosyl derivative but typically less reactive than primary amines.
- Triphenylamine ($(C_6H_5)_3N$): A tertiary amine, which generally does not react with p-toluenesulfonyl chloride under normal conditions.

Therefore, Statement I is false because triphenylamine does not react with p-toluenesulfonyl chloride.

Analysis of Statement II:

Statement II claims that: "Their products in the above reaction are soluble in aqueous NaOH."

Explanation:

- The products of aniline and diphenylamine reacting with p-toluenesulfonyl chloride are tosylamides.
- Tosylamides are generally not soluble in aqueous NaOH as they do not possess acidic hydrogens that can result in salt formation.

Thus, Statement II is false because the products are not soluble in aqueous NaOH.

Conclusion:

The correct answer is: "Both Statement I and Statement II is false".

---

13. Answer: 2 - 2

Explanation:

To find the number of amino groups in the compound (x), we need to understand the change in molar mass due to acetylation. Acetylation involves replacing an amino hydrogen atom with an acetyl group (CH_3CO), which adds $42\,g\,mol^{-1}$ to the

molar mass per amino group modified.
1. Compute the difference in molar mass between the acetylated product and the original compound: $192\,\text{g mol}^{-1} - 108\,\text{g mol}^{-1} = 84\,\text{g mol}^{-1}$.
2. Since each acetyl group increases the molar mass by $42\,\text{g mol}^{-1}$, determine the number of acetyl groups added: $\frac{84\,\text{g mol}^{-1}}{42\,\text{g mol}^{-1}} = 2$ amino groups.
This computed value of 2 fits within the expected range of 2,2, confirming the solution is correct.

---

14. Answer: d

Explanation:

To solve this problem, let's analyze each statement individually and provide the correct reasoning behind why both statements are true.

- Statement I: Aniline reacts with concentrated H_2SO_4 followed by heating at 453–473 K to form p-aminobenzene sulphonic acid, which gives a blood red color in the 'Lassaigne's test'.

Explanation:

- In concentrated H_2SO_4, aniline undergoes sulfonation to form p-aminobenzene sulphonic acid (also known as sulphanilic acid) when heated in the range of 453–473 K.
- This compound, upon Lassaigne's test for sulphur, forms sodium thiocyanate, which reacts with ferric chloride to give a blood-red color.

This establishes that Statement I is true.

- Statement II: In Friedel-Craft's alkylation and acylation reactions, aniline forms a salt with the $AlCl_3$ catalyst. Due to this, the nitrogen of aniline acquires a positive charge and acts as a deactivating group.

Explanation:

- Aniline is a base and reacts with Lewis acids such as $AlCl_3$ to form a salt. The nitrogen atom of aniline gets protonated, acquiring a positive charge.
- This positively charged nitrogen significantly reduces the electron density of the aromatic ring, making it less reactive in the Friedel-Craft's reactions, hence acting as a deactivating group.

This confirms that Statement II is also true.

Since both statements are true, the correct option is: **Both Statement I and Statement II are true**.

---

15. Answer: d

Explanation:

To solve this question, we need to understand the formation of azo-dyes, which generally involves a diazonium salt and a coupling component. Here, sulfanilic acid undergoes a diazotization reaction followed by coupling with a nitrogen-rich compound to form an azo dye.

1. **Diazotization:** Sulfanilic acid reacts with sodium nitrite ($NaNO_2$) and acetic acid (CH_3COOH) to form the diazonium ion (X).
2. **Coupling Reaction:** The diazonium ion then reacts with another aromatic compound to form the azo-dye (Y).

The correct option involves the reaction forming an azo group (-N=N-) linked between two aromatic rings. This is typically represented by $Ar - N = N - Ar'$, where Ar and Ar' are aromatic groups.

Given the options, the correct azo-dye formed is represented in the following image:

1. **Conclusion:** The reaction of sulfanilic acid with $NaNO_2$ and CH_3COOH, followed by coupling, forms the azo dye shown in the correct answer image. This matches the typical azo-dye structure.

Therefore, the correct answer is the final option illustrated above.

---

16. Answer: a

Explanation:

To identify compounds A and B in the reaction sequence, we need to analyze each step of the given reactions.

The initial compound is bromobenzene. The reaction sequence involves two main steps:

1. **Nitration:** Bromobenzene reacts with concentrated nitric acid (HNO_3) to introduce a nitro group. The usual condition for aromatic nitration involves HNO_3 and concentrated sulfuric acid, but considering only HNO_3 here, the nitro group gets added to one of the ortho or para positions relative to the bromine due to electron-withdrawing properties.

In this mechanism, due to steric hindrance, the nitro group preferably occupies a para position. Therefore, compound A is para-bromonitrobenzene.

1. **Diazonium Formation and Sandmeyer Reaction:** The next step involves reacting with NaOH and then HCl. The combination of NaOH and HCl typically facilitates the conversion to a diazonium salt by first forming the intermediate amine which is then converted using the Sandmeyer Reaction. This conversion is also known to replace the nitro group with a hydroxyl group (saponification followed by acidification).

Thereby, compound B is phenol.

From the options, the correct answer is shown in the image below:

Thus, the compounds A and B in the reaction sequence are para-bromonitrobenzene and phenol, respectively.

---

17. Answer: b

Explanation:

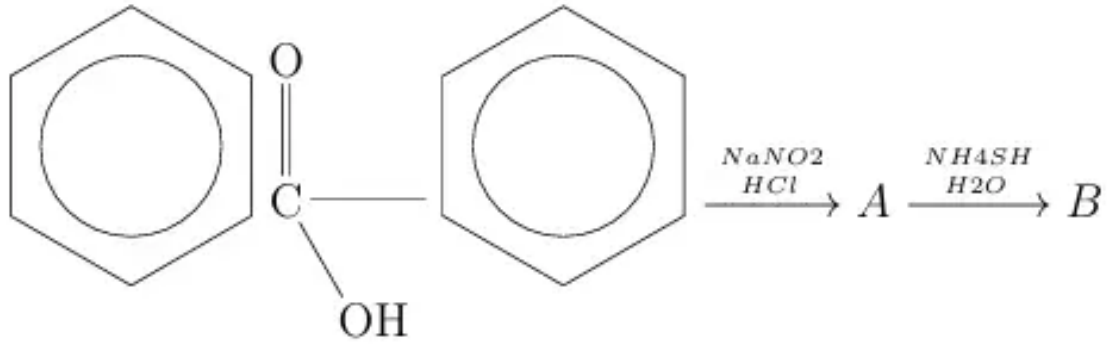
The Correct answer is option is (B) : $CH_3CO\text{-}NH_2$

---

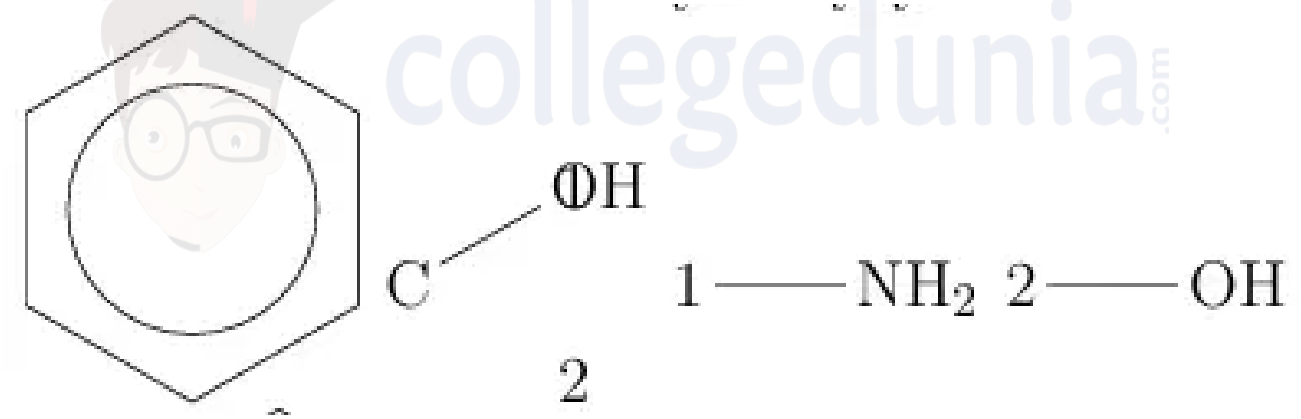
18. Answer: b

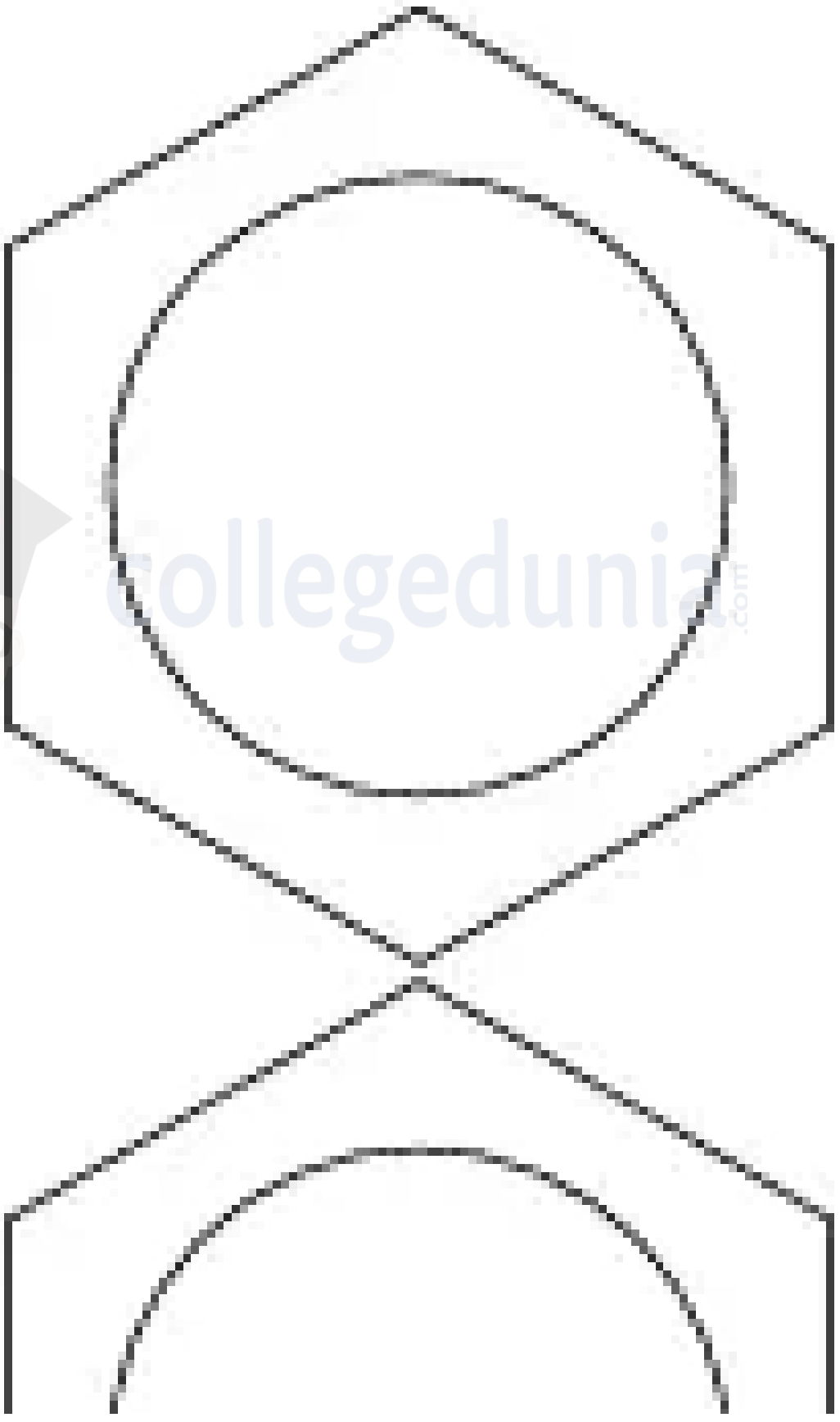
Explanation:

The given reaction sequence is;

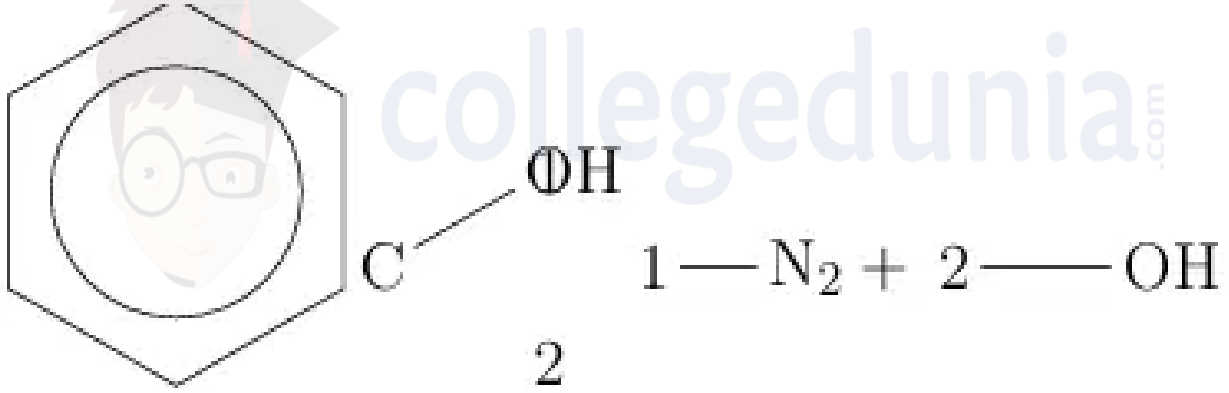


Step 1: Diazotization. The first step involves the reaction of the given compound (2-hydroxycyclohexanone) with sodium nitrite (NaNO2) and hydrochloric acid (HCl). This is a diazotization reaction, which converts the amino group (-NH2) of an aromatic amine to a diazonium salt ($-N^+ 2Cl^-$). This reaction doesn't happen with the carbonyl group. Since the starting compound shown is not an amino compound, it needs to have NH2 for diazotization reaction to happen. Hence it would be more logical if the question used a starting compound of 2-aminocyclohexanol rather than 2-hydroxycyclohexanone. Let's assume that the starting material is

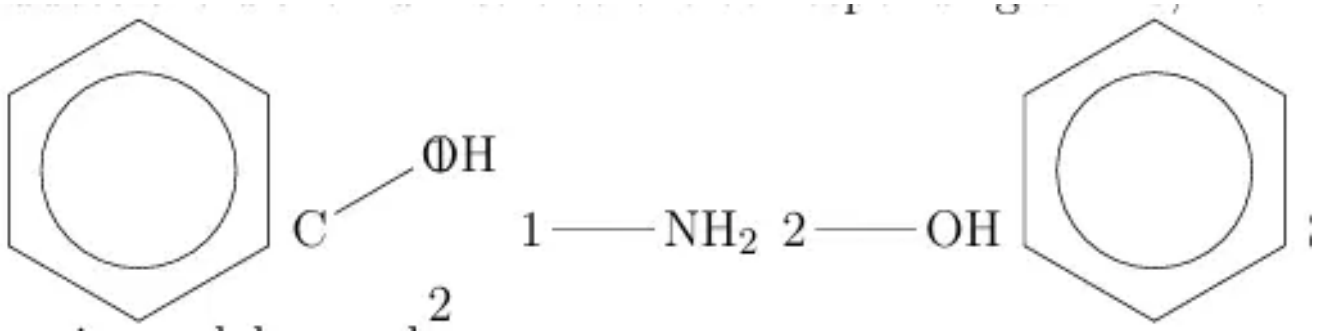




Then the diazonium salt is formed



Step 2: Reduction of Diazonium salt. The second step involves the reaction of the diazonium salt (A) with ammonium hydrosulfide (NH4SH) in water. This re duces the diazonium salt to the corresponding amine, with nitrogen gas as a byproduct.



So the final product B is 2-aminocyclohexanol.

19. **Answer: a**

Explanation:

The correct option is (A): Both Statement-I and Statement-II are correct.

Concepts:

1. Amines - Chemical Properties:

There are many chemical properties of amines.

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On account of the ability to form hydrogen bonds, the amines have tendencies of high solubility in water. The amine molecules such as Ethyl, diethyl, triethyl, and Methyl are gaseous in nature. Whereas, higher weight amines have a solid structure and alkyl amines have a liquid structure. There is an ammonia smell to gaseous amines and a fishy smell to liquid amines. The solubility of amines entirely depends upon the number of carbon atoms in the molecule.

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20. **Answer: a**

Explanation:

The Hinsberg reagent is a chemical used to distinguish primary, secondary, and tertiary amines. It typically consists of benzene sulfonyl chloride. When primary amines react with the Hinsberg reagent, they form a sulfonamide that is soluble in

alkali. Secondary amines form a compound that is insoluble in alkali, while tertiary amines do not react with the Hinsberg reagent.

In the question provided, we have four images as options for identifying the Hinsberg reagent. Let's examine each option:

Correct option: Benzene sulfonyl chloride (Hinsberg reagent)

From the above analysis, the correct option is the benzene sulfonyl chloride, which is represented by the first image:

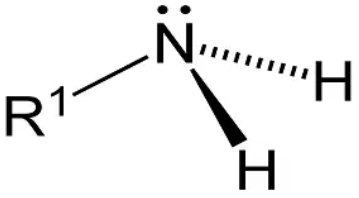
- The first image corresponds to the chemical structure of benzene sulfonyl chloride.
- The other images represent different chemical structures that are not used as the Hinsberg reagent.

Therefore, the correct answer is the first image, which depicts the Hinsberg reagent.

Concepts:

1. Structure of Amines:

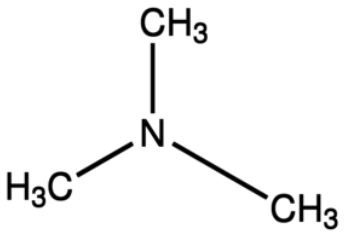
The structure of Amines is shown below:



Alkyl Amines:

Alkylamines consist of tetrahedral nitrogen centers where the C-N-H and C-N-C bond angle is 109°. The distance between C-N bonds is smaller in comparison to the C-C range. The amines can also display a chiral property wherein the center of the nitrogen atom holds for replacements which creates solo pairs.

The bond angle in the case of trimethylamine is 108° which results in the Pyramidal structure of trimethylamine-



Aromatic Amine:

Due to the mixture of the solo pair with the aryl substituent, nitrogen nearly has a planar structure in aromatic amines. The C-N range is very short. In aniline, the distance between C-N bonds is similar to the distance between C-C bonds.

Read More: Structure of Amines

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21. Answer: b

Explanation:

To determine the product 'B', we need to analyze the given reaction sequence step-by-step:

The first step involves the reduction of the cyano group (-CN) using diisobutylaluminium hydride (DIBAL-H) followed by hydrolysis.

This transforms the -CN group into an aldehyde group.

Thus, compound 'A' is formed by converting the nitrile to an aldehyde.

In the second step, compound 'A' reacts with acetaldehyde (CH_3CHO) under aldol condensation conditions (presence of dilute NaOH and heat).

Aldol condensation occurs when enolate ions, formed from aldehydes or ketones in basic conditions, react with another aldehyde or ketone. Here, the enolate form of acetaldehyde will add to the aldehyde formed from the initial reduction.

This reaction leads to the formation of a β-hydroxy ketone or aldehyde, which can further undergo dehydration to form an α,β-unsaturated carbonyl compound.

Therefore, the major product 'B' is the unsaturated carbonyl compound formed through the aldol condensation reaction.

The correct option representing product 'B' is:

Concepts:

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22. Answer: a

Explanation:

The question involves identifying a reagent that reacts with a given compound to form an orange-red dye. The reaction shown in the image is a typical diazo coupling reaction, which involves an aromatic amine.

The specific reaction here suggests the use of aniline or a derivative suitable for diazo coupling.

In diazo coupling reactions, an aniline derivative reacts with a diazonium salt to form colored azo dyes. The presence of NaOH in the reaction indicates that the compound has to be an aromatic amine that forms diazonium salts under basic conditions.

Option A is correct as it depicts aniline ($C_6H_5NH_2$), which is commonly used in diazo coupling reactions to form azo dyes. The diazonium ion ($C_6H_5N_2^+$) reacts with the nitrogen of aniline to form the azo compound responsible for the orange-red dye.

Conclusion: Thus, reagent 'A' is aniline, which undergoes diazo coupling to produce the indicated product.

Concepts:

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23. Answer: c

Explanation:

The given reaction involves two steps. Let's analyze each step:

Step 1: Acid Chloride Reaction with Ammonia

The first reaction involves compound 'A' ($C_6H_5Cl_2O$) reacting with ammonia (NH_3). This step typically forms an amide. Since compound 'A' is described as having the

formula $C_6H_5Cl_2O$, it can be inferred to be an acyl chloride. The general reaction with ammonia forms an amide:

1. Formation of an amide should clarify the intermediate product

Therefore, the intermediate compound formed is $C_6H_5ClNH_2O$, matching the description given as C_6H_5ClNO.

Step 2: Hoffmann Bromamide Degradation

In the presence of Br_2 and NaOH, the amide undergoes Hoffmann Bromamide Degradation. This reaction removes a carbonyl group, ultimately forming an amine while decreasing the carbon count by one:

The final product has an amino group (NH_2) in the para position relative to the chloro group, and a methyl group (CH_3). This corresponds to 4-Chloro-3-methylaniline.

Following these steps, you can verify that the correct compound 'A' aligns with the initial reactant that leads to this product.

Correct structure of compound 'A' (Acyl Chloride)

Thus, the correct answer is the third option, as it matches with the starting acyl chloride structure required for this reaction sequence.

Concepts:

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24. Answer: c

Explanation:

To determine the compounds 'A' and 'B', we need to understand the reactions shown.

The given reaction involves the conversion of an alkyl halide to different compounds using different reagents: AgCN and NaCN. These reagents differ in their behavior due to the difference in the nature of the cyanide ion attachment to silver and sodium.

Reaction with AgCN:

- Silver cyanide (AgCN) has a covalent cyanide ion. This nature leads to the formation of isocyanide when reacting with alkyl halides.
- Thus, when the alkyl chloride reacts with AgCN, the major product formed is an isocyanide, i.e., R-NC (alkyl isocyanide).

Reaction with NaCN:

- Sodium cyanide (NaCN), on the other hand, has an ionic cyanide ion, which can easily donate the cyanide ion.
- When the alkyl chloride reacts with NaCN, the major product formed is a nitrile, i.e., R-CN (alkyl cyanide).

Based on the reactions, the compounds can be identified as follows:

Fig. Correct structures of 'A' and 'B'.

Therefore, for the given question, the correct compounds 'A' and 'B' are alkyl isocyanide and alkyl cyanide, respectively.

Concepts:

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25. Answer: d

Explanation:

The correct answer is (D) :

is the strongest base among the given compounds due to the maximum +I effect and the lone pair of N is not in dynamic state so it can be donated easily.

Concepts:

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26. Answer: d

Explanation:

To solve this problem, we need to identify the organic compound 'A' based on the given properties and reactions it undergoes. Let's analyze the details step-by-step:

- **Compound Properties:** The compound 'A' contains nitrogen and chlorine and is acidic in nature, as it turns litmus red.
- **Molecular Weight:** The given molecular weight of 'A' is around 131±2.
- **Reaction with NaOH:** When treated with aqueous NaOH, a liquid separates that contains nitrogen but not chlorine. This suggests the formation of a compound that has nitrogen but has removed the chlorine, likely as a gaseous product like HCl.
- **Diazotization:** The liquid obtained after treatment with NaOH, when reacted with nitrous acid and phenol, gives an orange precipitate. This indicates the presence of a primary aromatic amine, as diazotization followed by coupling with phenol yields azo dyes.

Based on these observations, the compound 'A' is likely to be an aromatic amine with a hydrochloride form, as aromatic amines can undergo diazotization and azo coupling reactions.

Let's consider the options provided and their structures:

The compound depicted in the image corresponds to a hydrochloride salt of an aromatic amine. It fits all the conditions:

- Dissolves in water to form an acidic solution (due to HCl present).
- Has a molecular weight close to 131 g/mol.
- Reacts with NaOH to release HCl and form a free amine.
- Undergoes diazotization and coupling with phenol to form an azo dye, indicating it is a primary aromatic amine.

Concepts:

1. Amines:

Amine is a type of compound which is derived from ammonia (NH_3). According to Organic chemistry, they are basically classified as the functional groups of the organic nitrogen compounds that contain nitrogen atoms with a lone pair.

Amine - Types

Primary Amines:

It is formed when one hydrogen atom in ammonia is substituted by an alkyl or aromatic group. Amino acids and methyl amine are the best examples that why aromatic amines include aniline.

Secondary Amines:

Amines that have two organic substitutes either alkyl or aryl ones or both and are bound to the nitrogen together with one hydrogen are termed as secondary amines. For Example, Dimethylamine.

Tertiary Amines:

Tertiary Amines are the amines where the nitrogen consists of three organic substitutes. For example, Trimethylamine and EDTA.

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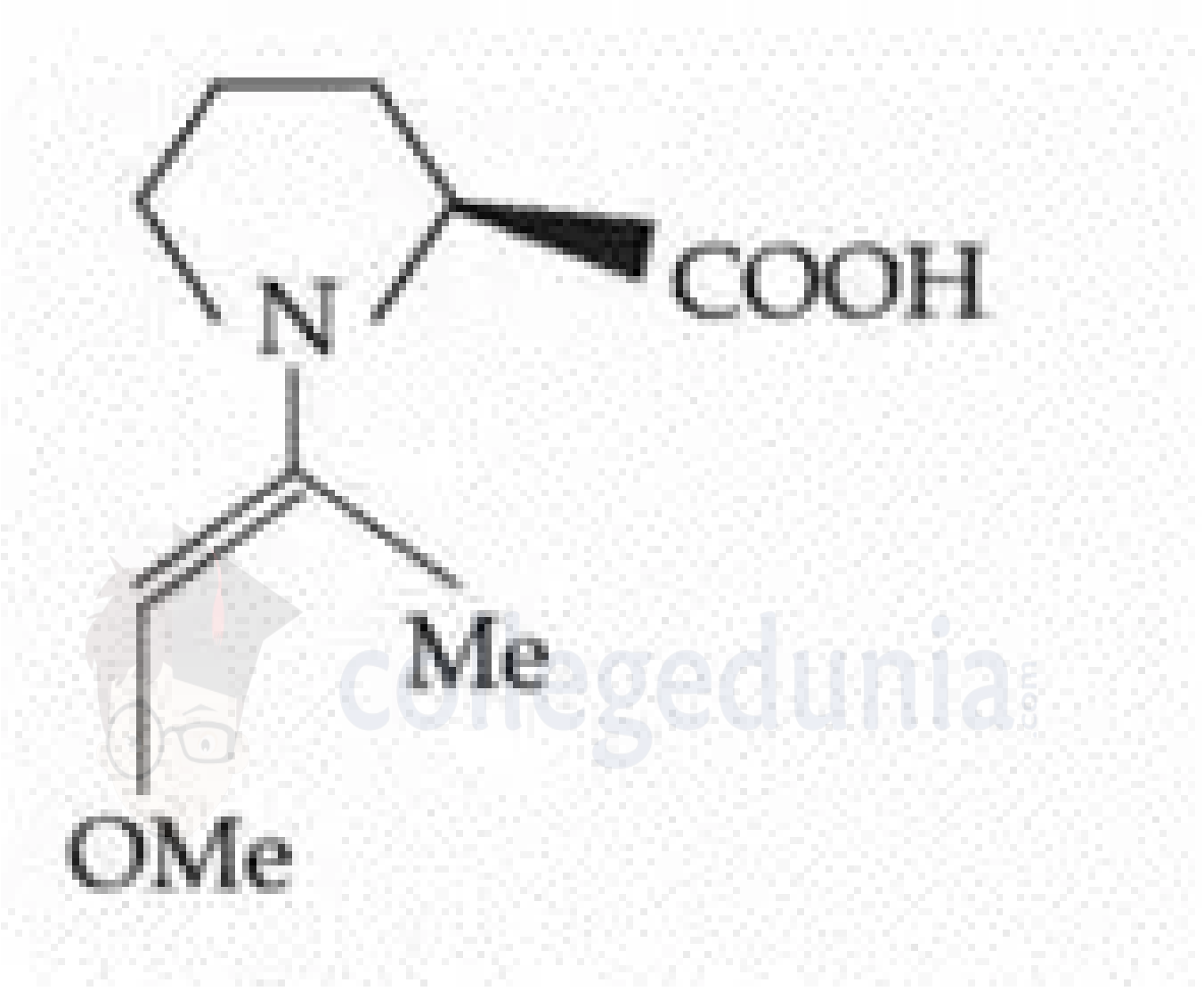
27. Answer: c

Explanation:

The correct answer is (C) :



The most appropriate option is (C) as one group is far enough from –COOH group

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---

28. Answer: c

Explanation:

The correct answer is (C) : (B) and (D) are correct statements.

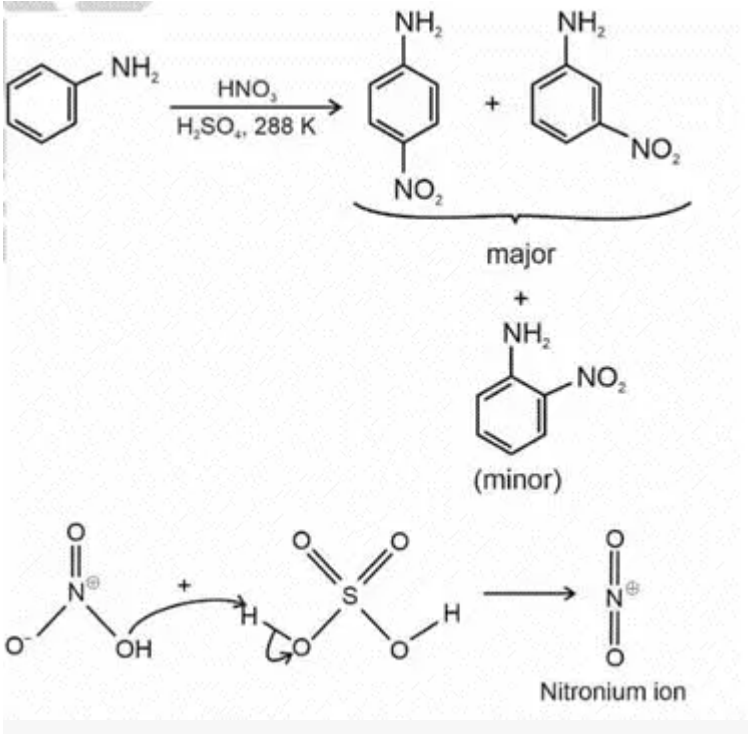

Fig.

Hence, H_2SO_4acts as an acid.

Concepts:

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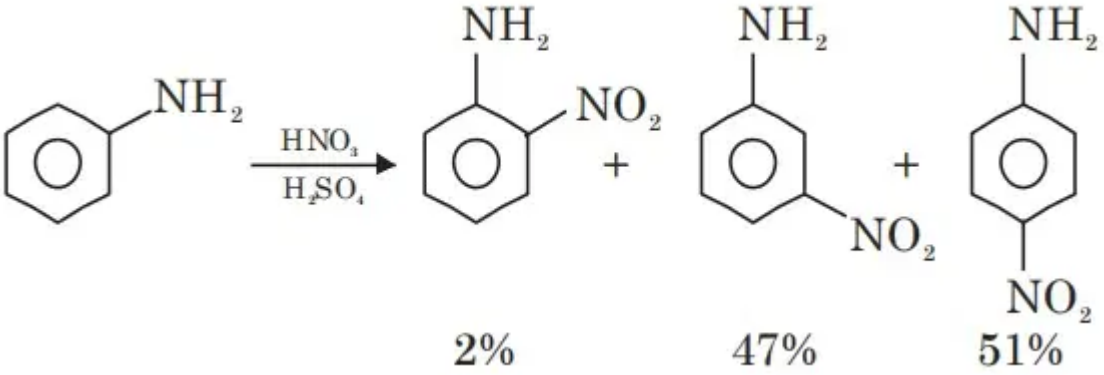
29. Answer: a

Explanation:

Due to formation of anilinium ion in acidic medium meta product is also obtained in significant amount



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Tertiary Amines:

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30. **Answer: d**

Explanation:

The correct answer is (D) : Positively charged nitrogen at benzene ring.

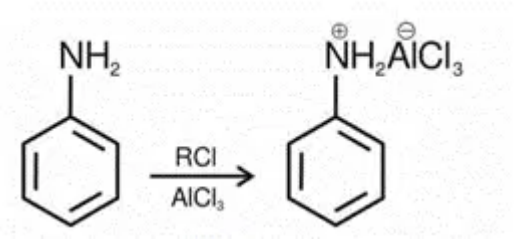

Fig.

Lewis acids are electron deficient species and nitrogen atom of aniline has a lone pair of electron. When Lewis acid reacts with aniline, then a salt forms in which nitrogen acquires a positive reaction and further reaction is not possible.

Concepts:

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