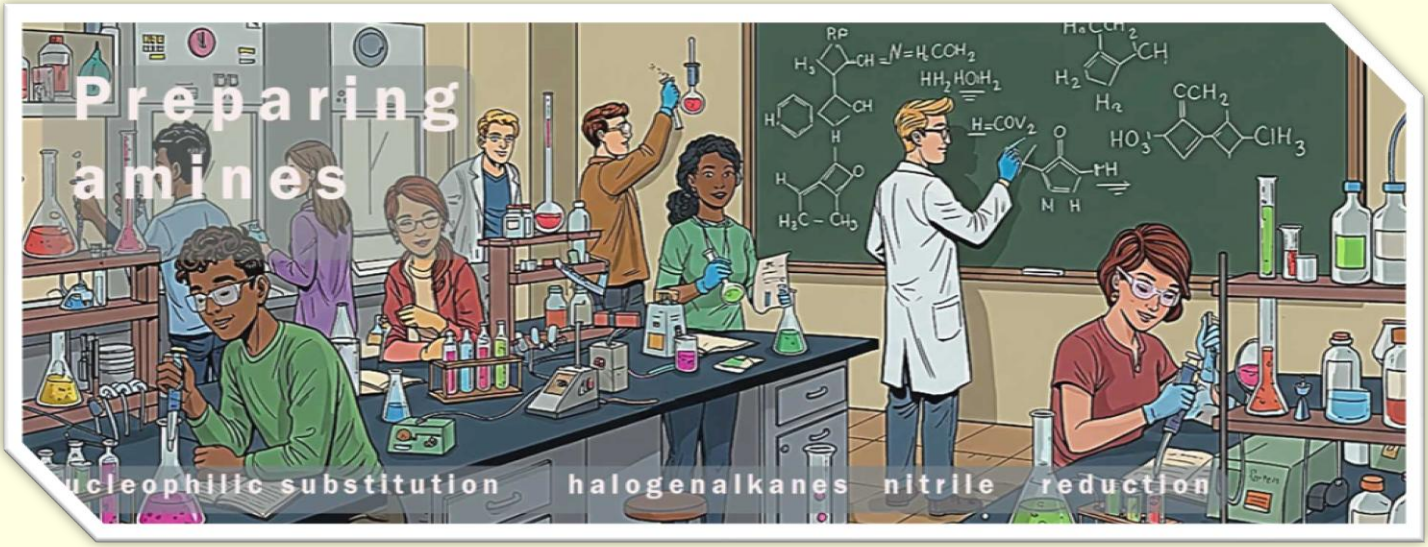


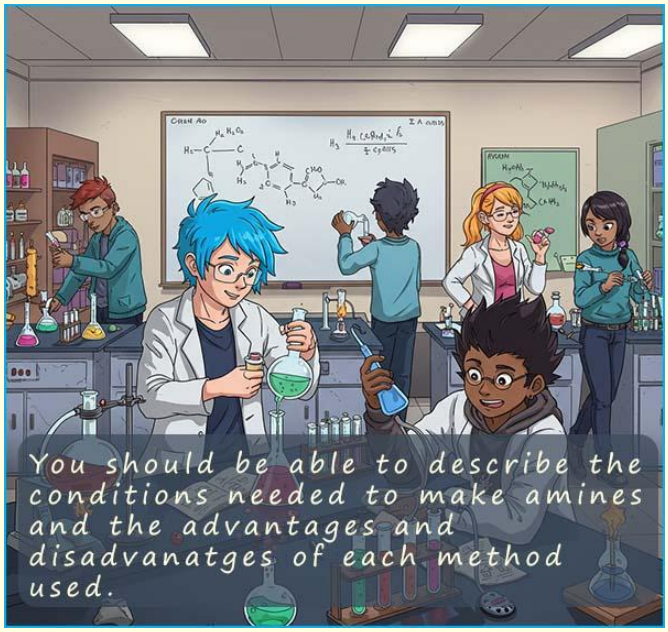
Answer all the questions below as fully as you can then check your answer

1. Which of the following is NOT a method for preparing aliphatic amines mentioned in the text?

(a) Reaction of halogenalkanes with ammonia (b) Reduction of nitriles

(c) Oxidation of alcohols (d) Catalytic reduction of nitriles

2. Why is the reaction of halogenalkanes with ammonia often considered an unsatisfactory method for preparing pure amines?



Fill in the Blank:

3. The reducing agent used in the reduction of nitriles to amines using lithium aluminium hydride is represented as _____.

True or False:

4. The reduction of a nitro group attached to an aromatic ring requires a mixture of tin or iron in dilute hydrochloric acid.

5. Explain why an excess of ammonia is used when reacting a halogenalkane with ammonia to try and produce primarily a primary amine.

6. Draw the mechanism for the reaction between bromoethane and ammonia, showing the formation of ethylamine.

7. Compare and contrast the two methods of reducing nitriles to primary amines, highlighting the advantages and disadvantages of each.

Answer:

8. Write a reaction pathway to show the production of ethylamine from chloroethane. Include all reagents and conditions.

9. Discuss the challenges associated with preparing pure primary aliphatic amines using the reaction between halogenalkanes and ammonia. Explain how these challenges can be partially overcome, and propose an alternative method that provides a more efficient synthesis.

b. 10.0g of nitrobenzene is reacted with excess tin and concentrated hydrochloric acid, followed by the addition of sodium hydroxide. Calculate the theoretical mass of aniline produced.

(Molar masses: Nitrobenzene = 123 g/mol, Aniline = 93 g/mol)

10. Explain the following statement.

"The lone pair of electrons on the Nitrogen atom of an amine, is what makes it a good nucleophile, and a good base."

Answers

1. Which of the following is NOT a method for preparing aliphatic amines mentioned in the text?

(a) Reaction of halogenalkanes with ammonia (b) Reduction of nitriles

(c) Oxidation of alcohols (d) Catalytic reduction of nitriles

Answer: (c) Oxidation of alcohols

2. Why is the reaction of halogenalkanes with ammonia often considered an unsatisfactory method for preparing pure amines?

Answer: Because it produces a mixture of primary, secondary, tertiary amines, and quaternary ammonium salts.

Fill in the Blank:

3. The reducing agent used in the reduction of nitriles to amines using lithium aluminium hydride is represented as _____.

Answer: $LiAlH_4$

True or False:

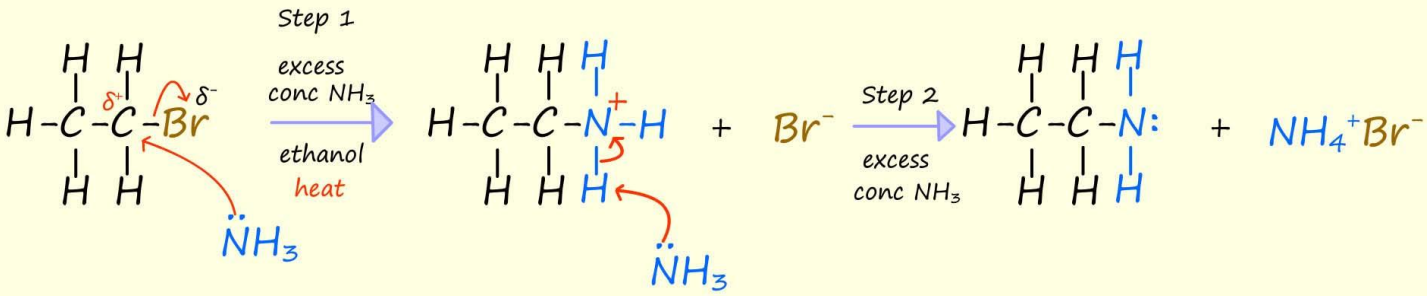
4. The reduction of a nitro group attached to an aromatic ring requires a mixture of tin or iron in dilute hydrochloric acid.

Answer: False. It requires concentrated hydrochloric acid.

5. Explain why an excess of ammonia is used when reacting a halogenalkane with ammonia to try and produce primarily a primary amine.

Answer: An excess of ammonia is used to increase its concentration, making it more likely to act as a nucleophile and base, thus minimising the chances of the formed primary amine reacting further to form secondary and tertiary amines. The high concentration of ammonia blocks, as much as possible, the other amines from reacting.

6. Draw the mechanism for the reaction between bromoethane and ammonia, showing the formation of ethylamine.



7. Compare and contrast the two methods of reducing nitriles to primary amines, highlighting the advantages and disadvantages of each.

Answer:

Catalytic Reduction (H2/Ni or Pt):

Advantages: Simpler set up, uses readily available hydrogen gas.

Disadvantages: Requires high pressure and temperature, specific catalysts.

LiAlH4 Reduction:

Advantages: Powerful reducing agent, effective at room temperature.

Disadvantages: Highly reactive (reacts violently with water), requires dry ether as a solvent, more expensive.

8. Write a reaction pathway to show the production of ethylamine from chloroethane. Include all reagents and conditions.

Answer:

Chloroethane + KCN (in ethanol, reflux) → propanenitrile

propanenitrile + LiAlH4 (in dry ether) followed by dilute acid → ethylamine.

Or

propanenitrile + H2 (Ni or Pt catalyst) -> ethylamine.

9. Discuss the challenges associated with preparing pure primary aliphatic amines using the reaction between halogenalkanes and ammonia. Explain how these challenges can be partially overcome, and propose an alternative method that provides a more efficient synthesis.

Answer: Students should discuss the formation of multiple products, the role of excess ammonia, and explain the nitrile reduction method, including reagents, conditions, and mechanisms.

b. 10.0g of nitrobenzene is reacted with excess tin and concentrated hydrochloric acid, followed by the addition of sodium hydroxide. Calculate the theoretical mass of aniline produced.

(Molar masses: Nitrobenzene = 123 g/mol, Aniline = 93 g/mol)

Answer:

Moles of nitrobenzene = 10.0g / 123 g/mol = 0.0813 mol

Moles of aniline = 0.0813 mol (1:1 ratio)

Mass of aniline = 0.0813 mol * 93 g/mol = 7.56 g

10. Explain the following statement.

"The lone pair of electrons on the Nitrogen atom of an amine, is what makes it a good nucleophile, and a good base."

Answer: The lone pair of electrons on the nitrogen atom of an amine is readily available for donation. This availability allows the nitrogen atom to form a coordinate (dative covalent) bond with a positively charged or electron-deficient species. When acting as a nucleophile, the lone pair attacks an electrophilic carbon atom. When acting as a base, the lone pair accepts a proton (H^+).