OCR (A) Chemistry A-level

Topic 6.2.1 - Amines

Flashcards

Draw the structures of primary, secondary and tertiary amines and a quaternary ammonium ion.

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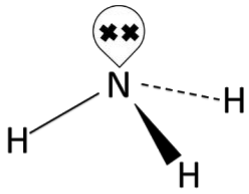
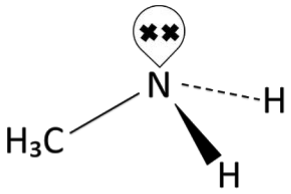
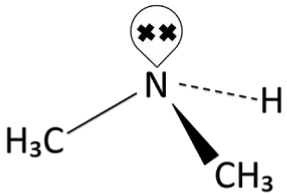


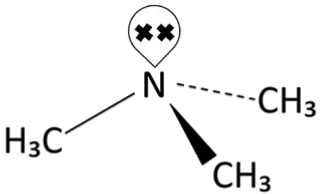
0 carbons
Ammonia (unique)



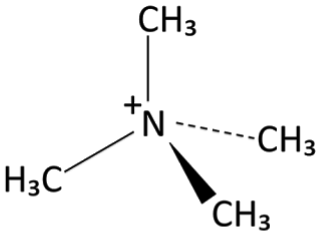
1 carbon
Primary (1^o) amine



2 carbons
Secondary (2^o) amine



3 carbons
Tertiary (3^o) amine



4 carbons
Quaternary (4^o) ammonium ion

How do you name amines?

How do you name amines?

-amine or amino-

Why are amines so reactive?

Why are amines so reactive?

The lone pair of electrons on the Nitrogen - due to polar N-H bond

What shape are amines around the N? Bond angle?

What shape are amines around the N? Bond angle?

Trigonal pyramidal, 107º due to lone pair on N

What kind of intermolecular forces do they have? Why?

What kind of intermolecular forces do they have?

Why?

Hydrogen bonding due to polar N-H bond and lone pair of electrons on N atom.

Do amines have intermolecular forces which are stronger than or weaker than alcohols? Why?

Do amines have intermolecular forces which are stronger than or weaker than alcohols? Why?

Weaker, as N has a lower electronegativity than O → weaker hydrogen bonding

How can/when do amines act as bases?

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The lone pair on the nitrogen atom accepts a proton

How can/when do amines act as nucleophiles?

How can/when do amines act as nucleophiles?

When they bond with an electron-deficient C atom (donate lone pair from N)

Draw a mechanism for the basic action of an amine with water.

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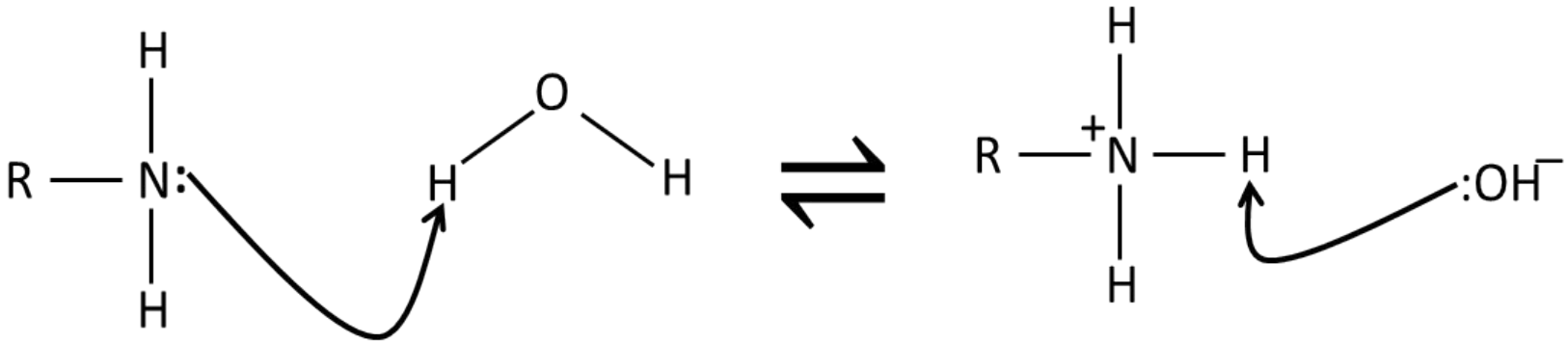

What is the product from the basic action of an amine with water?

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RNH_3^+ - ammonium ion, which forms a salt with an anion

Write an equation for methylamine reacting with HCl.

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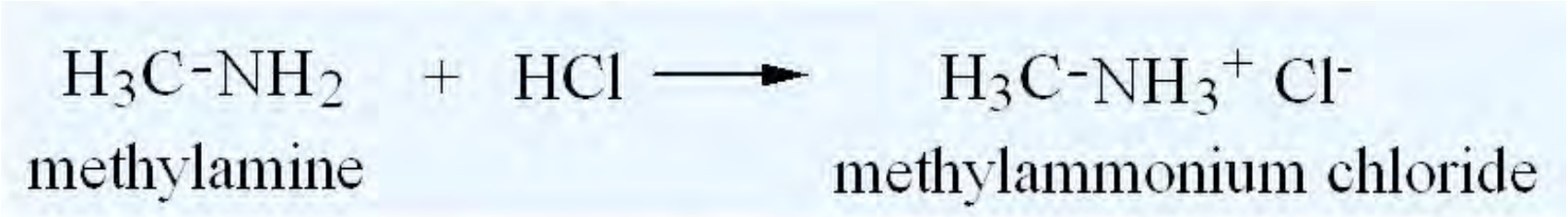

In order to be the strongest base, what must a particular amine have (out of a set of amines)?

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Greatest electron density around the N atom, making it a better electron pair donor (attracts protons more)

What effect do alkyl groups have (on electron density and base strength)?

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Positive inductive effect - increase electron density around N → stronger base

Place the following in order of base strength (in general): NH_3, 1º amine, 2º amine, phenylamine.

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2º amine > 1º amine > NH_3 > phenylamine

Draw a mechanism for the nucleophilic substitution of NH_3 with RCH_2Br to form primary amines.

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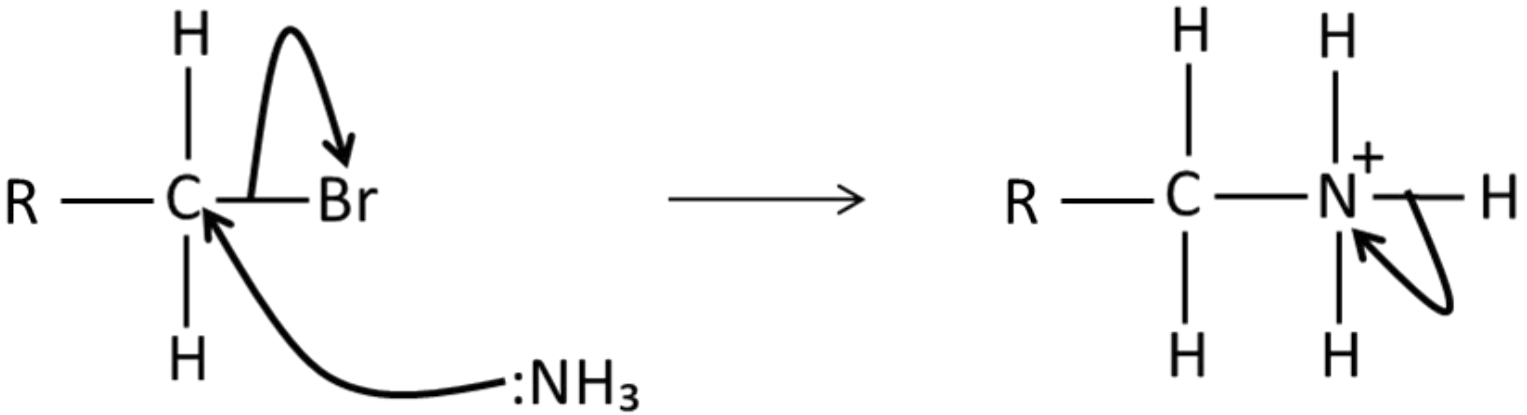

How can primary amines then form 2º, 3º amines and 4º ammonium ions?

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Multiple substitutions; primary amine is a nucleophile that attacks the original haloalkane etc

What are the problems with this method?

What are the problems with this method?

Not efficient as low yield of 1º amine due to multiple substitutions

How would you maximise the yield of the primary amine?

How would you maximise the yield of the primary amine?

Use excess ammonia

What type of mechanism is the reaction of a haloalkane with a cyanide ion?

What type of mechanism is the reaction of a haloalkane with a cyanide ion?

Nucleophilic substitution

What conditions does this reaction require? What is the product formed?

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Ethanol as a solvent

A nitrile is formed

How do you get from a nitrile to a primary amine? (name of reaction type and reagents/catalysts).

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Reduction using Nickel / Hydrogen catalyst

Why is this a purer method of synthesising amines?

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Only the primary amine can be formed

What conditions are needed to form nitrobenzene from benzene?

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Concentrated H_2SO_4 and HNO_3 to form the NO_2^+ ion for electrophilic attack.

How do you form an ammonium chloride salt from nitrobenzene? What conditions are needed?

How do you form an ammonium chloride salt from nitrobenzene? What conditions are needed?

Reduce the nitrile using Tin / HCl → forms an ammonium salt with Cl^- ions

Room temperature

Equation for the reaction of

nitrobenzene → phenylamine.

Equation for the reaction of nitrobenzene → phenylamine?

$$C_6H_5NO_2 + 6[H] \rightarrow C_6H_5NH_2 + 2H_2O$$

What mechanism is used for forming amides from acyl chlorides and amines?

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Nucleophilic addition/elimination

Draw a mechanism for the reaction of ethanoyl chloride with ethanamine.

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