

# OCR (A) Chemistry A-level

## Topic 6.2.1 - Amines

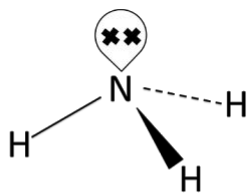
### Flashcards



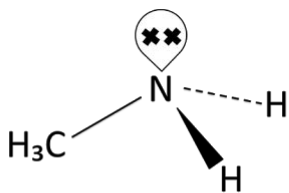
Draw the structures of  
primary, secondary and  
tertiary amines and a  
quaternary ammonium ion.



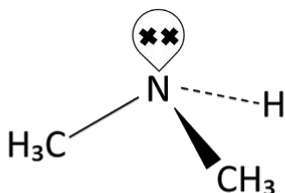
Draw the structures of primary, secondary and tertiary amines and a quaternary ammonium ion.



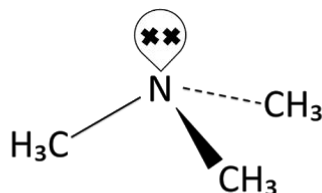
**0 carbons**  
 Ammonia  
 (unique)



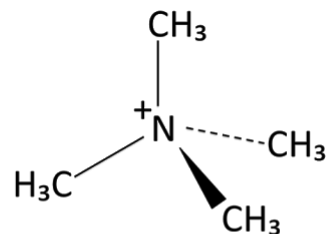
**1 carbon**  
 Primary (1°)  
 amine



**2 carbons**  
 Secondary (2°)  
 amine



**3 carbons**  
 Tertiary (3°)  
 amine



**4 carbons**  
 Quaternary (4°)  
 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,  $107^\circ$  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?



# How can/when do amines act as bases?

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?

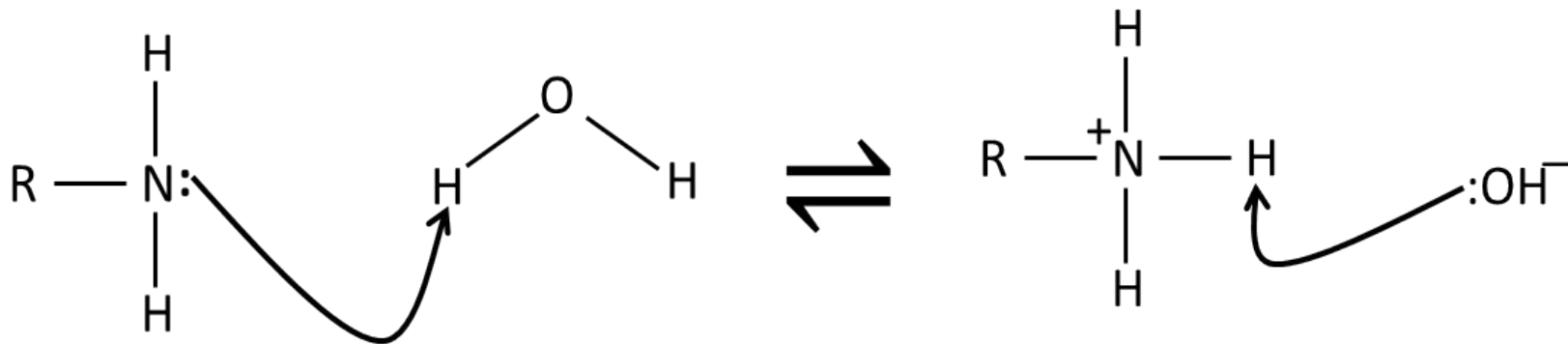
When they bond with an electron-deficient C atom (donate lone pair from N)



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



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



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



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

$\text{RNH}_3^+$  - ammonium ion, which forms a salt with an anion



Write an equation for  
methylamine reacting with  
HCl.



Write an equation for methylamine reacting with HCl.



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





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

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)?



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

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



Place the following in order of base strength (in general):  $\text{NH}_3$ ,  $1^\circ$  amine,  $2^\circ$  amine, phenylamine.



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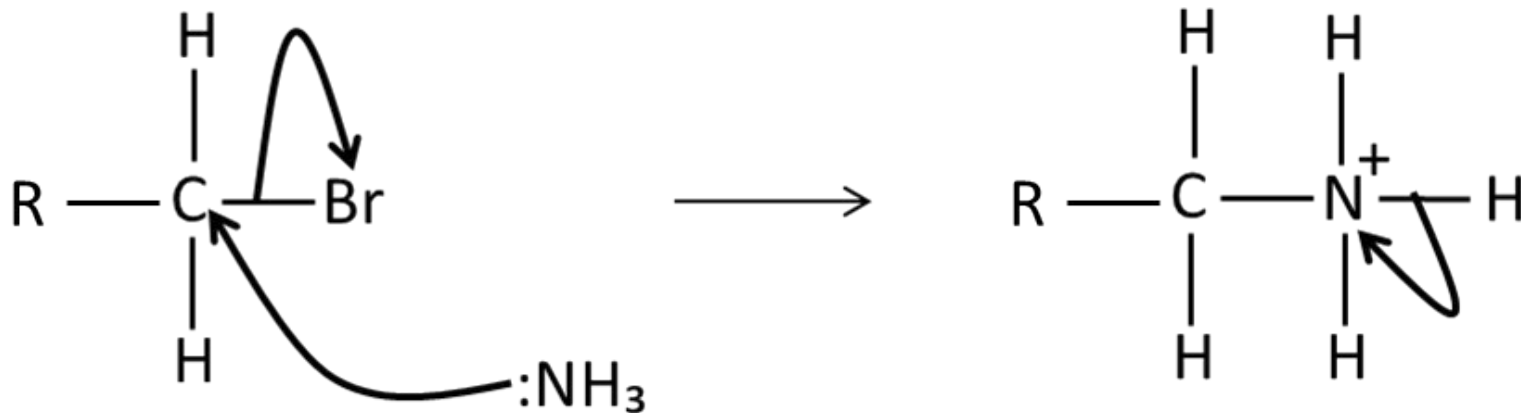
$2^\circ$  amine >  $1^\circ$  amine >  $\text{NH}_3$  > phenylamine



Draw a mechanism for the nucleophilic substitution of  $\text{NH}_3$  with  $\text{RCH}_2\text{Br}$  to form primary amines.



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How can primary amines  
then form 2<sup>o</sup>, 3<sup>o</sup> amines and  
4<sup>o</sup> ammonium ions?





How can primary amines then form 2<sup>o</sup>, 3<sup>o</sup> amines and 4<sup>o</sup> ammonium ions?

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  $1^\circ$  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?





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

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).



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

Reduction using Nickel / Hydrogen catalyst



# Why is this a purer method of synthesising amines?



Why is this a purer method of synthesising amines?

Only the primary amine can be formed



What conditions are needed to form nitrobenzene from benzene?



What conditions are needed to form nitrobenzene from benzene?

Concentrated  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$  to form the  $\text{NO}_2^+$  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<sup>-</sup> ions

Room temperature



Equation for the reaction of  
nitrobenzene  $\rightarrow$  phenylamine.



Equation for the reaction of nitrobenzene →  
phenylamine?



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



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

Nucleophilic addition/elimination



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



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

