



Practical 5.14 The reactions of amines



Purpose

To describe and carry out reactions, where appropriate, using butylamine and phenylamine to investigate the typical behaviour of primary amines [5.4.2b]



Safety

Wear eye protection. Butylamine is highly flammable and corrosive – it needs to be used with care. The quantity available should be restricted and it should be dispensed in a fume cupboard. 2 M hydrochloric acid is an irritant. Phenylamine (aniline) is toxic and volatile so it is better to use ethyl 4-aminobenzoate which is an irritant. Ethanoyl chloride is highly flammable, corrosive and violently reactive and the teacher may prefer to demonstrate the reactions with it. Asthmatics should be warned to be cautious of smelling amines.

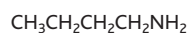
Background

In these experiments, you will be looking at the reactions of ammonia, butylamine and an aryl amine. The simplest aryl amine, phenylamine, is toxic, so is better to use ethyl 4-aminobenzoate, which is the anaesthetic benzocaine.

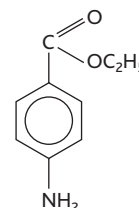
Before starting the experiments, make sure that you are familiar with the formulae of the three compounds and the shapes of their molecules, if possible by building models.



ammonia



butylamine



ethyl 4-aminobenzoate

Each group of students will need:

Eye protection
Test tubes and rack
Dropping pipette

Access to:

Fume cupboard
Butylamine HIGHLY FLAMMABLE, CORROSIVE

Ethyl 4-aminobenzoate IRRITANT
or Phenylamine TOXIC
Ethanoyl chloride HIGHLY FLAMMABLE, CORROSIVE
2 M ammonia
2 M hydrochloric acid
0.1 M copper(II) sulfate
Full-range indicator solution

Method

1 Smell, solubility and pH

Make dilute aqueous solutions of the three amine compounds, warming if necessary. Cautiously smell each one, and then add drops of full-range indicator.

- a** What kind of smell do they have?



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- b** Are the compounds readily soluble or only sparingly soluble? What type of molecular interaction will be helping them to dissolve?

- c** Are the compounds acidic or basic, strong or weak?

2 Formation of salts

Add small quantities of the three compounds, warming the ethyl 4-aminobenzoate, to separate portions of 2 M hydrochloric acid.

- d** Are the amines more soluble in hydrochloric acid than in water?

- e** Could they be reacting with the hydrochloric acid? Write down equations representing any reactions which you consider to be taking place.

- f** How might you recover the butylamine or the aryl amine from their mixture with 2 M hydrochloric acid? Test your suggestion experimentally, checking with your teacher first.

3 Reaction with transition metal ions

Add small quantities of the three amine compounds, warming the ethyl 4-aminobenzoate, to separate portions of 0.1 M copper(II) sulfate solution until present in excess.

- g** Are somewhat similar results obtained with all three amines?

- h** What type of reaction do you think is taking place?

4 Nucleophilic reactions of amines with acid derivatives

This reaction with ethanoyl chloride may be demonstrated by your teacher.

Carefully place 0.2 cm³ of ethanoyl chloride (take care) and 0.2 cm³ of the amine in separate test tubes, in a fume cupboard, and then mix. A solid compound should be obtained, whose melting temperature is characteristic of the original amine.



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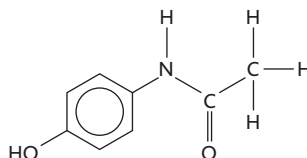
i Write an equation for the reaction.

j Which electrophilic centre is attacked?

k Which bond breaks?

Questions

1 Paracetamol has the following structure:



Write the structure of the amine and the acid chloride that paracetamol could be made from.