

FACTFILE: GCE CHEMISTRY

A2 5.8 AMIDES



Amides

Learning Outcomes

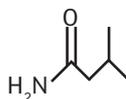
- 5.8.1 recall the preparation of amides via the reaction of carboxylic acids with ammonia and the reaction of amines with acyl chlorides;
- 5.8.2 recall the hydrolysis of amides with acids and alkalis;
- 5.8.3 recall the dehydration of amides with phosphorus pentoxide to form nitriles; and
- 5.8.4 explain the basicity of amides relative to amines by referring to the delocalisation of the lone pair on the nitrogen atom.

Amides

Amides contain the functional group $-\text{CONH}_2$
Some examples of amides are:

- Methanamide HCONH_2
- Ethanamide CH_3CONH_2

- 3-methylbutanamide

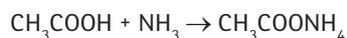


- N-methylethanamide $\text{CH}_3\text{C}(=\text{O})\text{NHCH}_3$

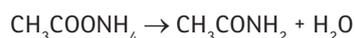
Preparation of amides

1. From carboxylic acids.

The carboxylic acid is first converted into an ammonium salt



When the reaction is complete, the mixture is heated and the ammonium salt dehydrates producing ethanamide.



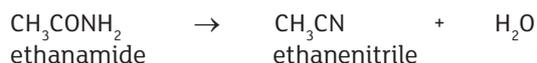
2. from amines by reaction with acyl chlorides

The N-substituted amide is formed (see notes on amines)

Reactions

1. Dehydration of amides to form nitriles

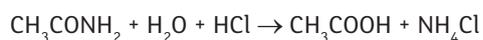
Dehydration of an amide is a reaction which involves the elimination of water from the amide.



Conditions: heat with phosphorus(V) oxide, P_4O_{10} , as the dehydrating agent

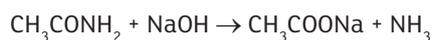
2. Hydrolysis of amides with acids and alkalis

Acid hydrolysis produces a carboxylic acid and the ammonium salt



Conditions: heat

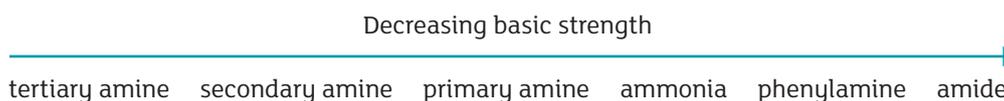
Base hydrolysis produces the carboxylic acid salt and ammonia gas



Conditions: heat

Basicity of amides

Amides are less basic than ammonia and phenylamine. They have a C=O which like any double bond has a sigma bond and a pi bond. The lone pair on the nitrogen overlaps with the pi bond and becomes delocalised and so is less available for donation to a hydrogen ion.





Revision Questions

1 Which one of the following statements about propanamide is **not** correct?

- A It produces an M+1 peak at 73 in its mass spectrum.
- B It can be dehydrated to form propanenitrile.
- C It has the molecular formula C₃H₇NO.
- D It is a weaker base than ammonia.

2 a) Ethanoic acid can be converted to ethanamide via the thermal decomposition of the ammonium salt.

i) Write the equation for the reaction of ethanoic acid with ammonia.

..... [1]

ii) Write the equation for the thermal decomposition of ammonium ethanoate.

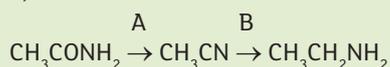
..... [1]

iii) Ethanamide is hydrolysed by either hydrochloric acid or sodium hydroxide solution to form different organic products. State the formula of the organic product in each case.

hydrochloric acid [1]

sodium hydroxide [1]

b) Ethanamide can be converted to an amine in the following sequence.



i) Give the formula of reagents in reactions A and B.

A
B [2]

ii) Write the equation for the reaction of an unknown amine, RNH₂, with ethanoyl chloride.

..... [1]

iii) Describe how you would identify the unknown amine using the pure N-substituted amide. Include relevant practical steps.

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..... [4]

