

34.3 AMIDES

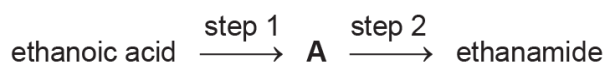
Learning outcomes

Candidates should be able to:

- recall the reactions (reagents and conditions) by which amides are produced:
 - the reaction between ammonia and an acyl chloride at room temperature
 - the reaction between a primary amine and an acyl chloride at room temperature
- describe the reactions of amides:
 - hydrolysis with aqueous alkali or aqueous acid
 - the reduction of the CO group in amides with LiAlH₄ to form an amine
- state and explain why amides are much weaker bases than amines

Preparations of amides

- Ethanamide can be made from ethanoic acid in a two-step synthesis.



- Compound A contains chlorine.

Give the structural formula and name of A.

structural formula

name

[2]

- Suggest suitable reagents for steps 1 and 2.

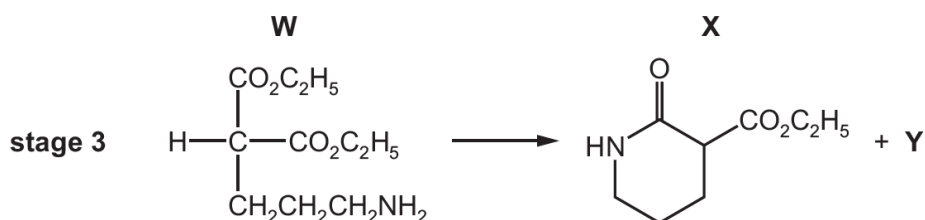
step 1

step 2

[2]

- Stage 3 takes place in the presence of an acid catalyst.

X and Y are the only products of the reaction.



- Suggest the type of reaction that occurs in stage 3.

..... [1]

- Deduce the identity of Y.

..... [1]

3. Fig. 4.1 shows two different ways to synthesise propylamine.

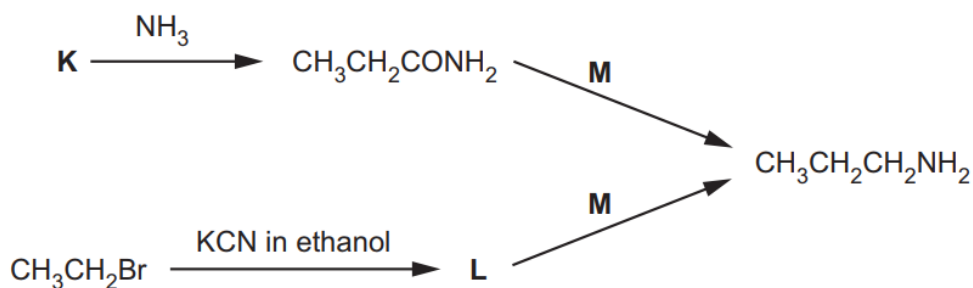


Fig. 4.1

Identify compounds K and L and reagent M from Fig. 4.1.

K

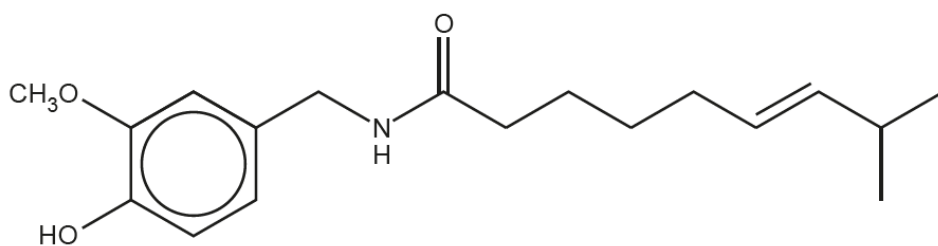
L

M

[3]

Hydrolysis of amides

4. Capsaicin is heated with an excess of hot aqueous NaOH.



- (i) Draw the structures of the two organic products H and K.

[2]

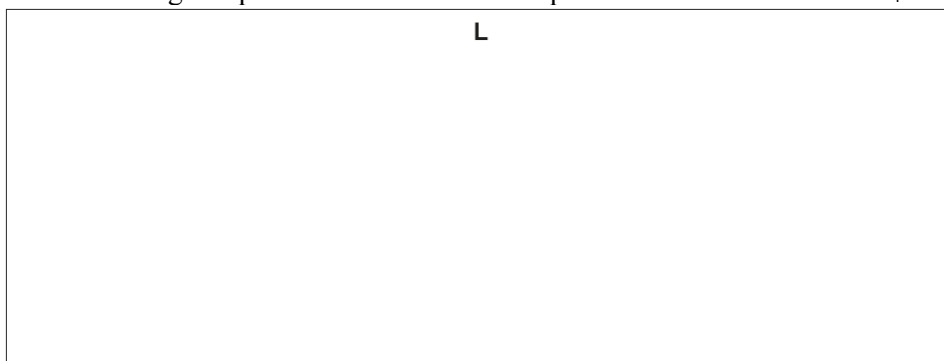
H $\text{C}_8\text{H}_{10}\text{NO}_2\text{Na}$

K $\text{C}_{10}\text{H}_{17}\text{O}_2\text{Na}$

(ii) Name the two types of reaction occurring in (i).

..... [1]

(i) Draw the structure of the organic product L formed when capsaicin is treated with LiAlH_4 in dry ether. [1]



5. Compound N is shown in Fig. 4.2.

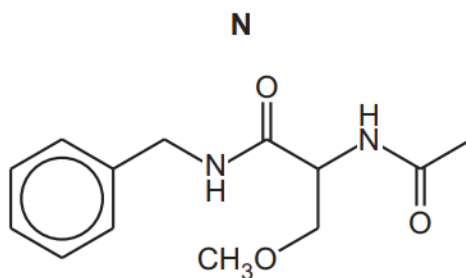
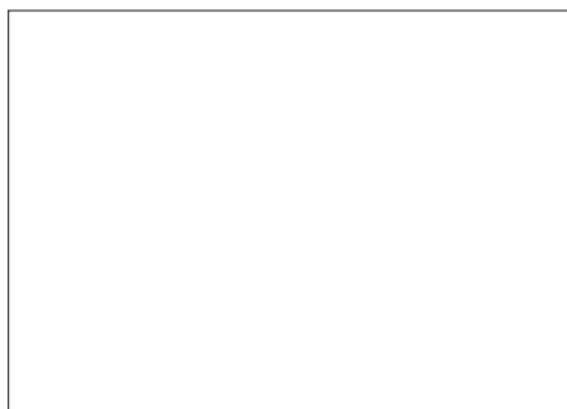
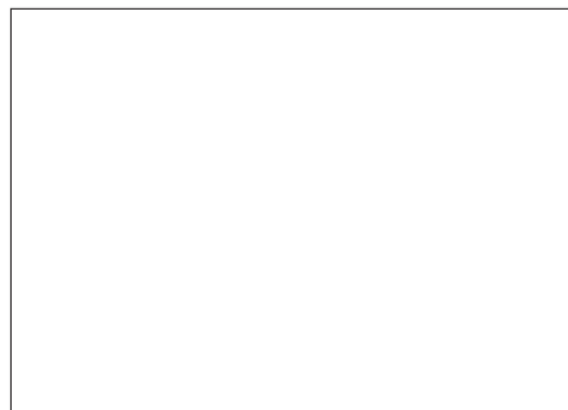
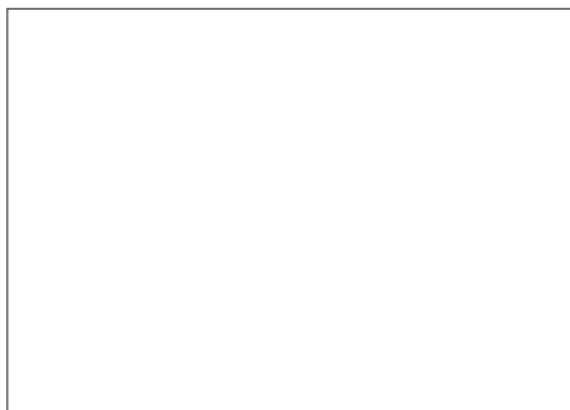
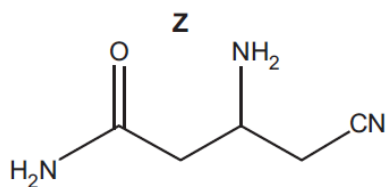


Fig. 4.2

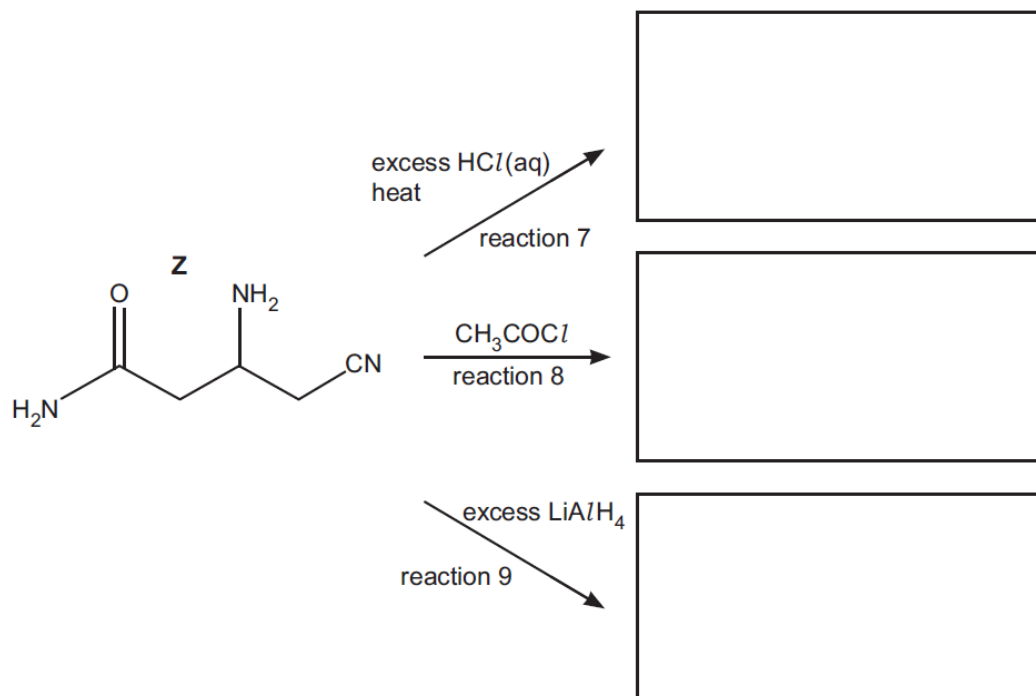
Compound N is treated with an excess of concentrated HCl(aq) .
N undergoes complete hydrolysis to form three organic products.
The products are isolated from the reaction mixture at pH 4.
Draw the structures of the three organic products at pH 4.
Assume that the $\text{CH}_3\text{O}-$ group does not react



6. Compound Z is used in organic synthesis.



Z can undergo different reactions, as shown in Fig. 6.1.

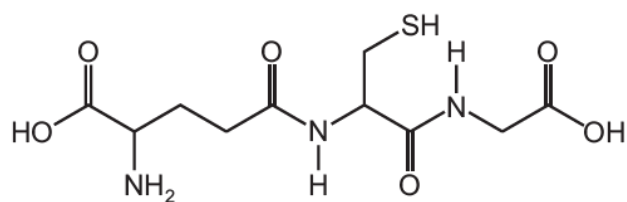


(i) Name the two types of reaction occurring in reaction 7 in Fig. 6.1.

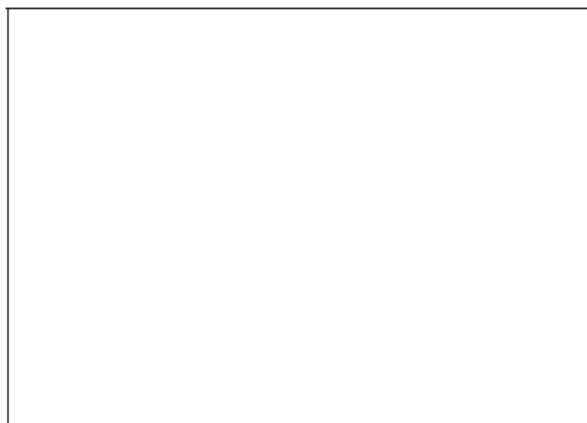
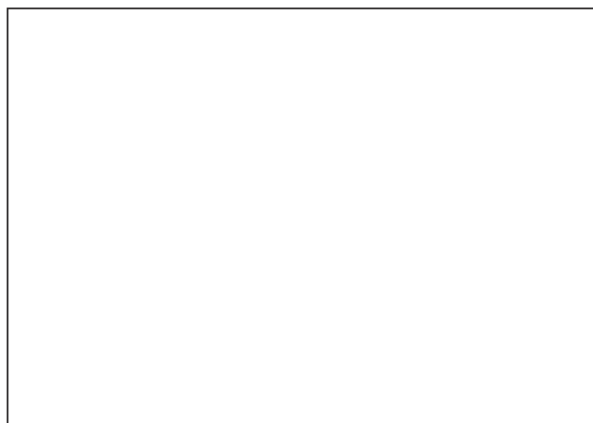
..... and [1]

(i) Draw the structures of the organic products of reactions 7, 8 and 9 in Fig. 6.1. [4]

7. Glutathione is a naturally occurring compound found in plants.



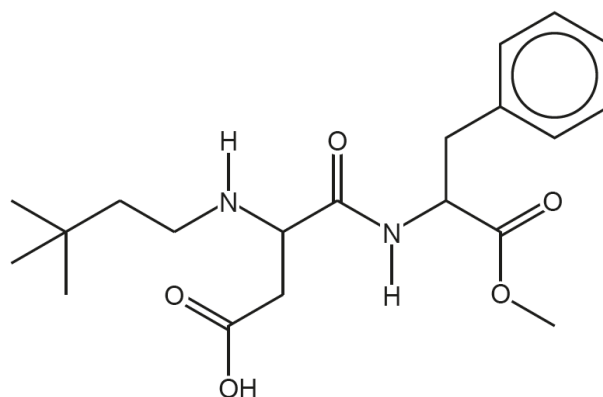
Draw the structures of the three products formed after complete acid hydrolysis of glutathione. Assume the thiol group, -SH, does not react. [2]





8. Neotame is an artificial sweetener added to some foods.

neotame



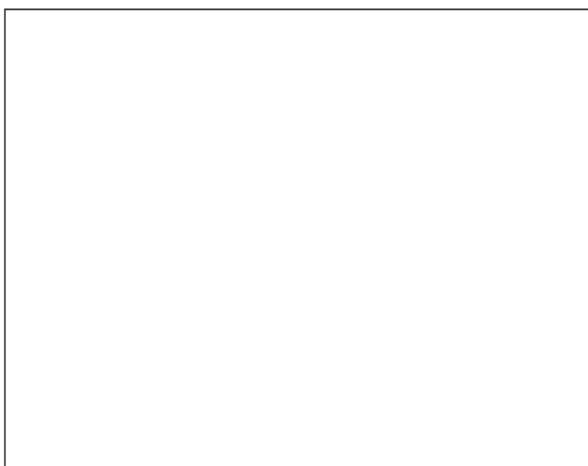
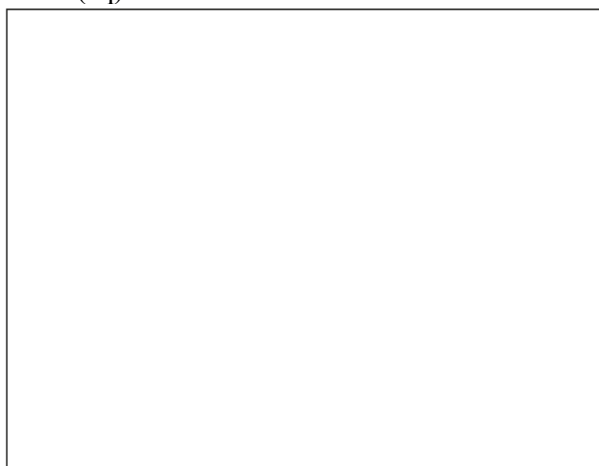
Neotame reacts with an excess of hot NaOH(aq) to form three organic products.

(i) State the two types of reaction that occur when neotame reacts with hot NaOH(aq) .

1

2 [2]

(ii) Draw the structures of the three organic products formed from the reaction of neotame with an excess of hot NaOH(aq) . [3]





9. Perindopril is a drug used to treat heart disease.

perindopril

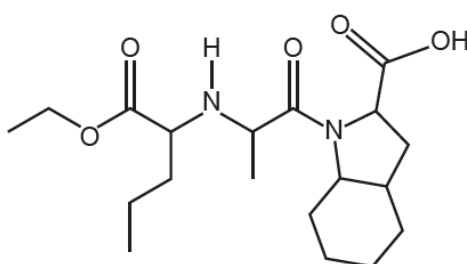


Fig. 6.1

A sample of perindopril is hydrolysed with hot aqueous acid.

Draw the structures of the **three** organic products of the **complete** acid hydrolysis of perindopril.

[3]



10. Compound **H** can be prepared from the reaction of **J** with an excess of hot aqueous acid.

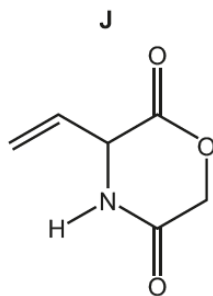


Fig. 6.1

Complete Fig. 6.2 to show the equation for this reaction.

[1]

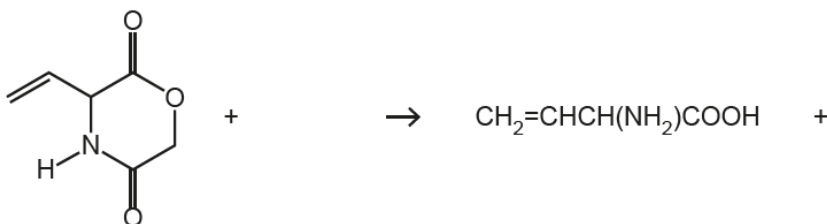
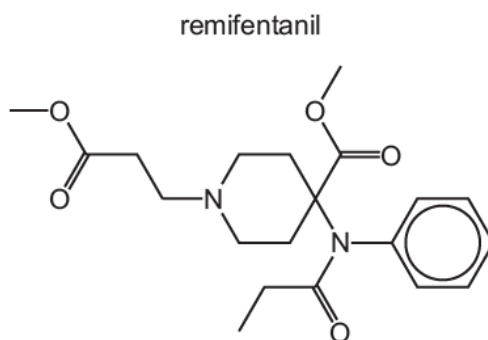


Fig. 6.2

11. The drug remifentanyl is shown.



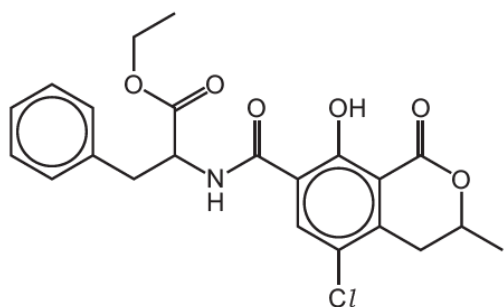
Remifentanyl is **completely** hydrolysed under acidic conditions. Three different organic compounds are formed. Draw the structures for these organic compounds in the boxes.

[3]

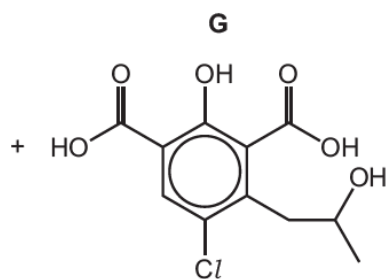


12. **F** can be hydrolysed by heating with an excess of dilute hydrochloric acid, as shown. Three products are formed: **G** and two others.

F



+



Draw the structures of the other products of the reaction in the boxes provided.

[3]

Reduction of amides

13. Amino acids are molecules that contain —NH_2 and —COOH functional groups. Glycine, $\text{H}_2\text{NCH}_2\text{COOH}$, is the simplest stable amino acid. Fig. 6.1 shows two syntheses starting with glycine.

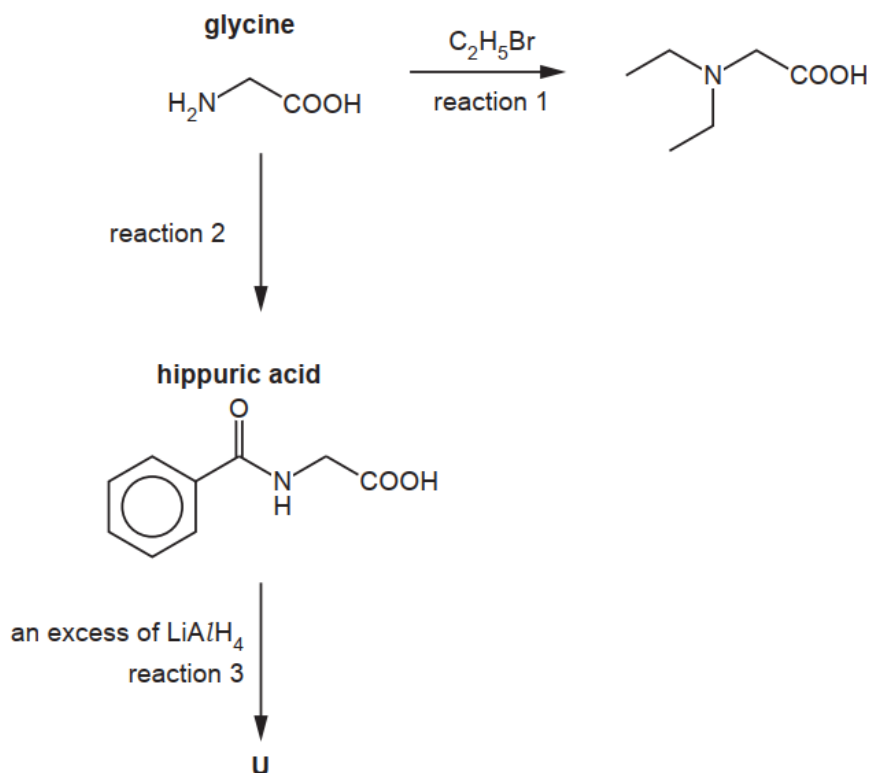


Fig. 6.1

- (i) State the essential conditions for reaction 1.

..... [1]

- (ii) Identify the reagent used in reaction 2.

..... [1]

- (iii) Draw the structure of the organic product U that forms when hippuric acid reacts with an excess of LiAlH_4 in reaction 3. [2]

14. A group of drugs known as statins are used to lower cholesterol in the blood. A commonly used statin is atorvastatin.

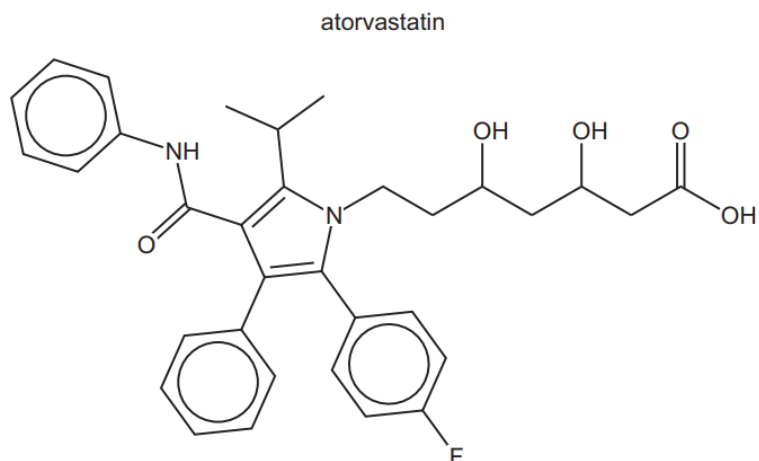


Fig. 5.1

Atorvastatin reacts with an excess of LiAlH_4 .

Name all the functional groups in atorvastatin that react with LiAlH_4 .

Name the new functional group that would be formed in each case.

names of functional groups in atorvastatin that react

.....

names of the new functional groups formed

..... [2]

*****This is not a complete note. It is to guide you. It is recommended to study the prescribed textbooks along with this material. *****