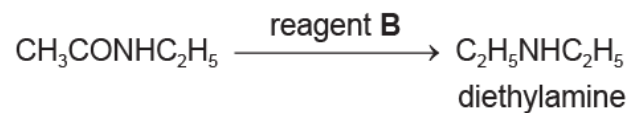


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(f) The amide undergoes the following reaction to produce diethylamine.

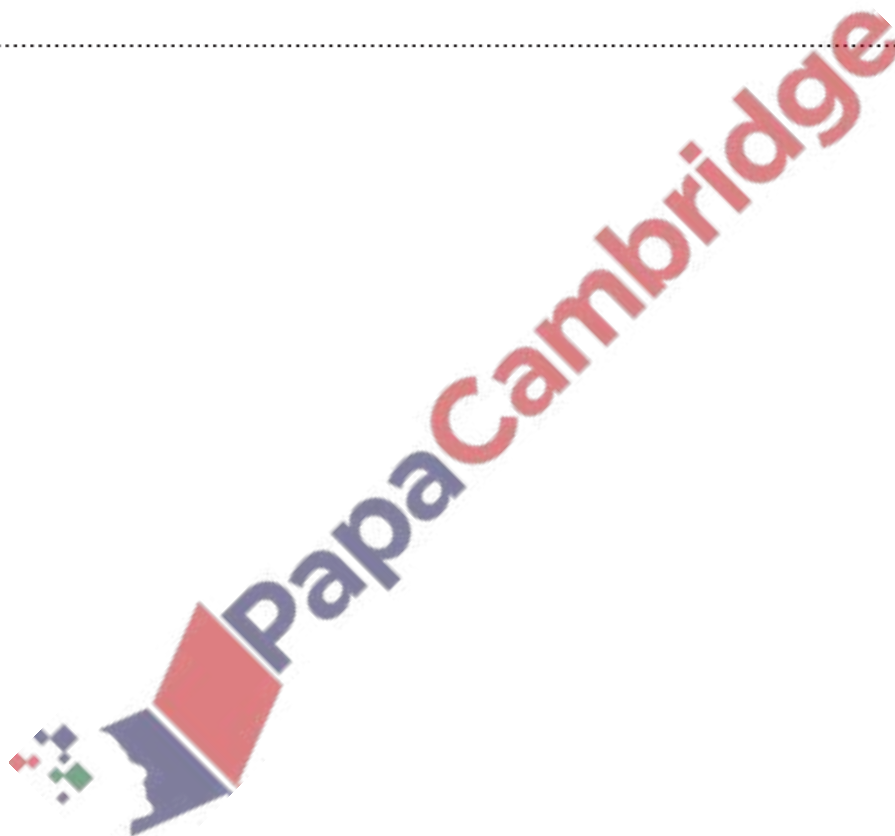


(i) Identify reagent B.

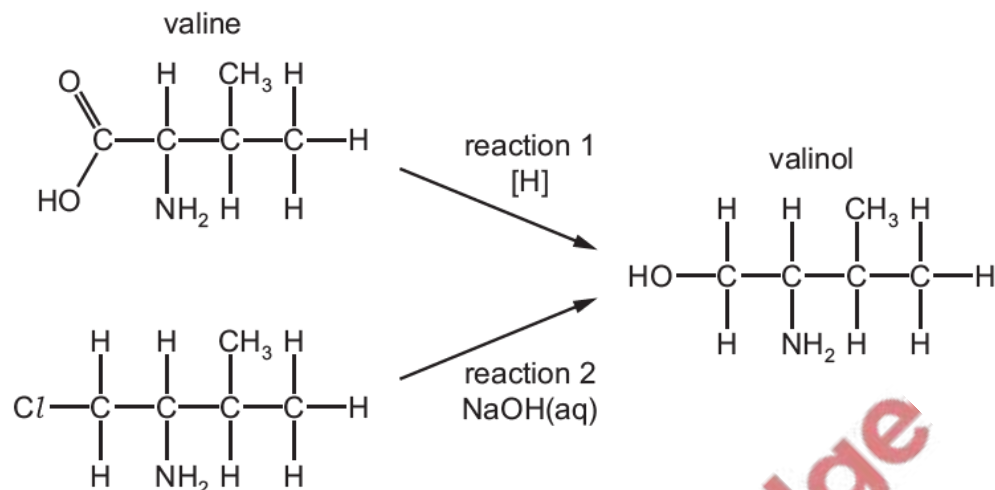
..... [1]

(ii) State the number of different absorptions in the carbon-13 NMR spectrum of diethylamine.

..... [1]



Valinol can be synthesised by the following reactions. Reaction 1 uses valine as the starting material.



(a) (i) Write an equation for reaction 1, using [H] to represent the reducing agent.

..... [1]

(ii) Suggest a suitable reagent for reaction 1.

..... [1]

(iii) Name the mechanism for reaction 2.

..... [1]

(b) Valine and glycine, $\text{H}_2\text{NCH}_2\text{COOH}$, form the tripeptide Gly-Val-Gly.

Draw the structure of this tripeptide. Show the peptide bonds fully displayed.

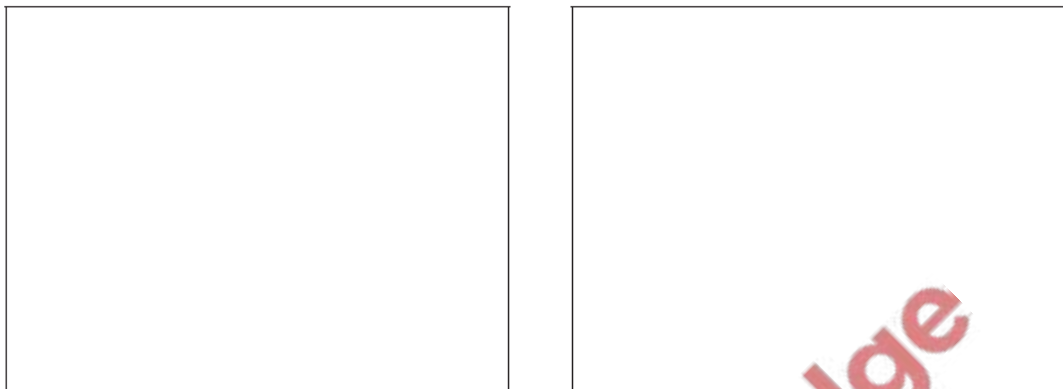


[2]

(c) (i) Valine exists as two stereoisomers.

Draw three-dimensional diagrams to show the two stereoisomers of valine. In your diagrams, the $-\text{CH}(\text{CH}_3)_2$ group can be represented by $-\text{R}$.

State the type of stereoisomerism shown.



type of stereoisomerism [2]

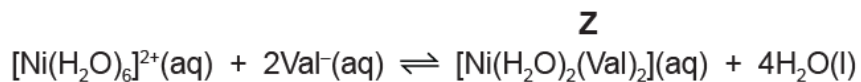
(ii) Valine is an amino acid.

Draw the zwitterion of valine.



[1]

- (iii) Valinate, Val⁻, is the anion of valine. It takes part in a ligand substitution reaction with hexaaquanickel(II) ions. Complex **Z** is formed.



Write an expression for K_{stab} for this equilibrium.

$K_{\text{stab}} =$

[1]

- (iv) At room temperature, the numerical value of K_{stab} is 2.34×10^5 .

Explain what this value indicates about the equilibrium and the stability of complex **Z**.

.....
.....
..... [1]

- (v) **Z** is an octahedral complex with formula $[\text{Ni}(\text{H}_2\text{O})_2(\text{Val})_2]$.

Use this information to state the type of ligand that the valinate ion is acting as in this complex.

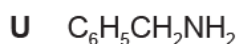
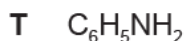
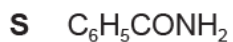
..... [1]

[Total: 11]



3. June/2020/Paper_41/No.4

(a) The molecular formulae of three nitrogen-containing compounds are given.



Describe and explain the relative basicities of **S**, **T** and **U**.

..... > >

most basic least basic

.....

.....

.....

.....

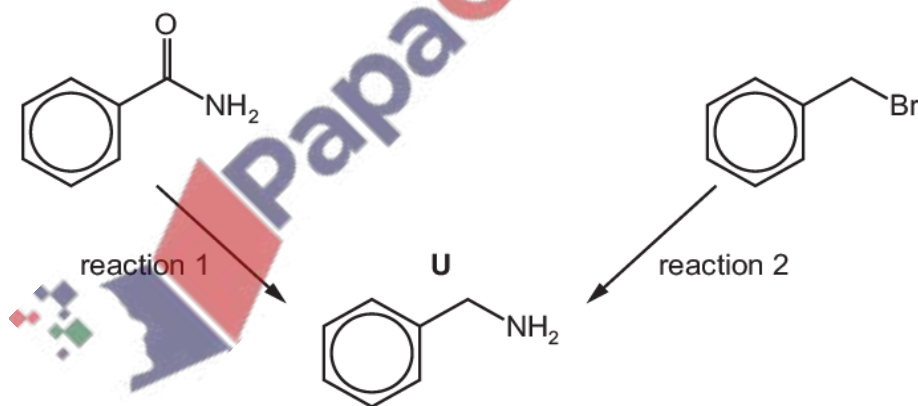
.....

.....

.....

[3]

(b) Compound **U** can be prepared by two different methods as shown.



(i) Suggest reagents and conditions for reaction 1 and for reaction 2.

reaction 1

reaction 2

[2]

(ii) State the type of reaction in reaction 1 and name the mechanism in reaction 2.

type of reaction in reaction 1

mechanism of reaction 2

[2]