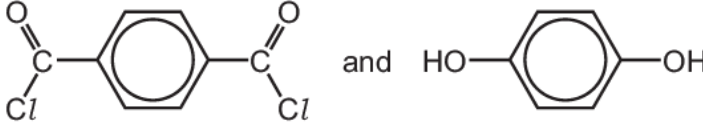


Polymerisation - 2021

1. Nov/2020/Paper_41/No.10

(a) The table shows three pairs of monomers that are capable of polymerisation.

Complete the table by identifying each type of polymerisation.

pair of monomers	type of polymerisation
$\text{HOCH}_2\text{CH}_2\text{OH}$ and $\text{HO}_2\text{CCH}_2\text{CO}_2\text{H}$	
 and $\text{HO}-\text{C}_6\text{H}_4-\text{OH}$	
CH_3CHCF_2 and CH_3CHCH_2	

[1]

(b) 2-aminopropanoic acid, $\text{CH}_3\text{CH}(\text{NH}_2)\text{CO}_2\text{H}$, can polymerise under suitable conditions. No other monomer is involved in this reaction.

(i) Draw a section of the polymer chain formed including **three** monomer residues. Clearly identify **one** repeat unit on your diagram.



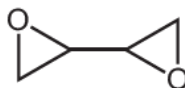
[3]

(ii) 2-aminopropanoic acid, $\text{CH}_3\text{CH}(\text{NH}_2)\text{CO}_2\text{H}$, exists as two stereoisomers.

Draw three-dimensional diagrams to show the two stereoisomers of 2-aminopropanoic acid. State the type of stereoisomerism shown.

type of stereoisomerism [2]

(c) The skeletal formula of compound **W** is shown.



When **W** is mixed with a second compound, called a hardener, a polymerisation reaction occurs, producing a non-solvent-based adhesive.

(i) Give the name of this type of non-solvent-based adhesive.

..... [1]

(ii) The hardener is a diamine. A diamine has an alkyl chain with two amine groups which are not bonded to the same carbon atom.

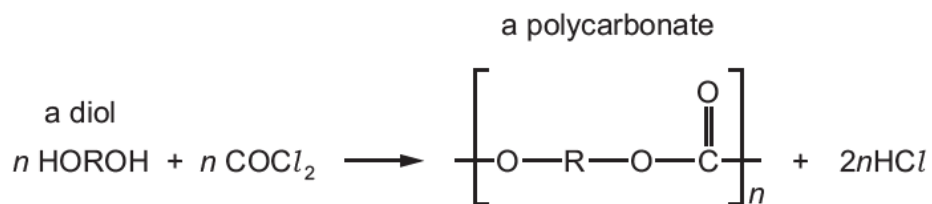
Draw the structural formula of a compound that would make a suitable hardener.



[1]

[Total: 8]

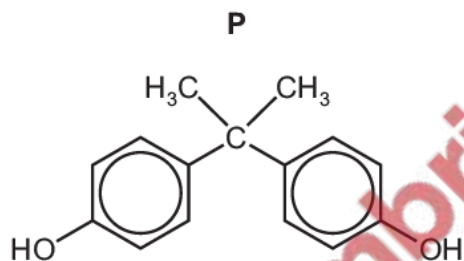
The class of polymers called polycarbonates are made by the reaction of carbonyl dichloride, COCl_2 , with a diol.



(a) (i) Deduce the *type of polymerisation* shown here.

..... [1]

Nalgene[®] is a polycarbonate formed from the diol **P** and COCl_2 .



(ii) Draw **one** repeat unit of Nalgene[®].

[1]

(iii) Nalgene[®] is a **strong** and tough polymer.

Identify **two** types of intermolecular force that are responsible for these properties of Nalgene[®].

1

2

[1]

(b) Proteins are polymers of amino acids.

Complete the table to show how the secondary and tertiary structures of proteins are stabilised.

	one intermolecular force responsible	groups involved
secondary structure		
tertiary structure		

[2]

(c) Explain the significance of hydrogen bonding in DNA in relation to the accurate replication of genetic information.

.....
.....
.....

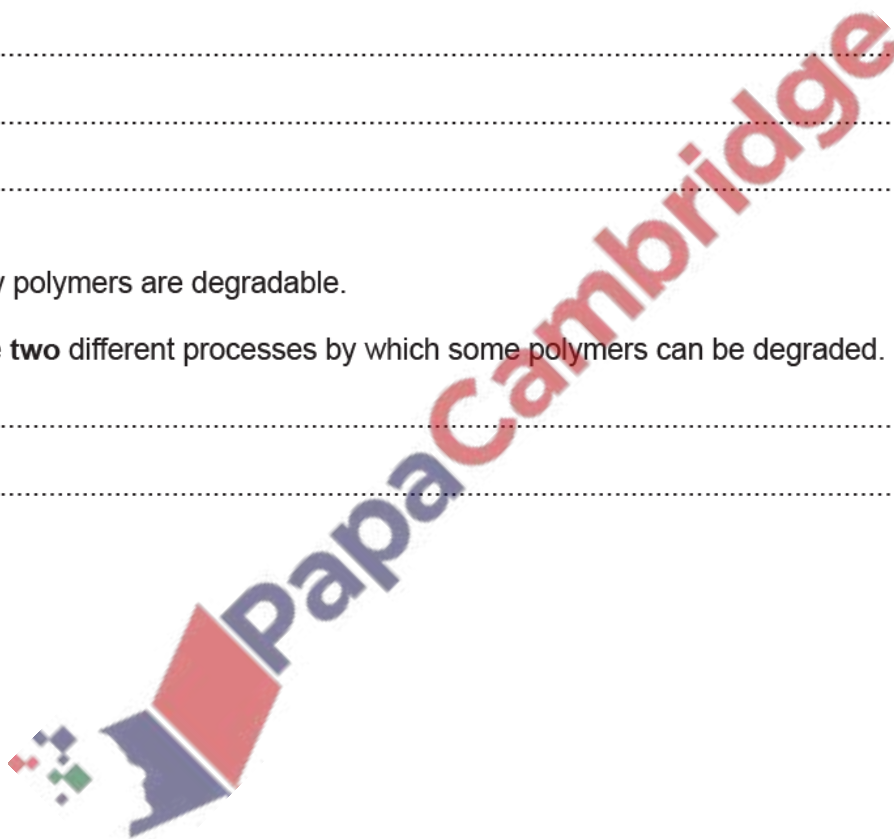
[2]

(d) Many polymers are degradable.

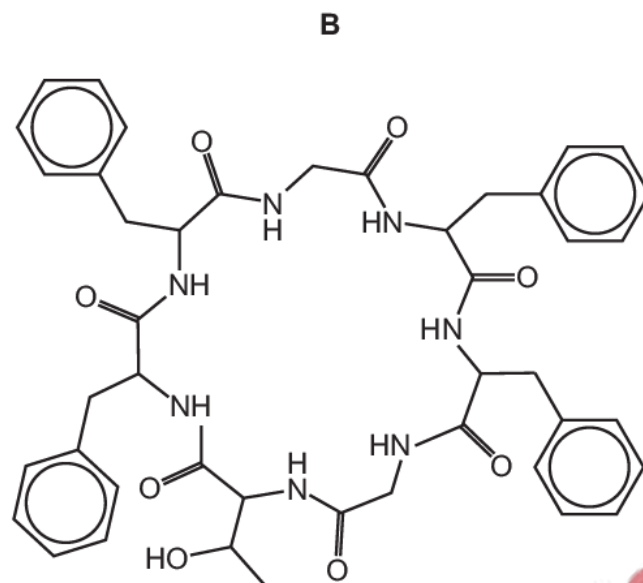
State **two** different processes by which some polymers can be degraded.

.....
.....

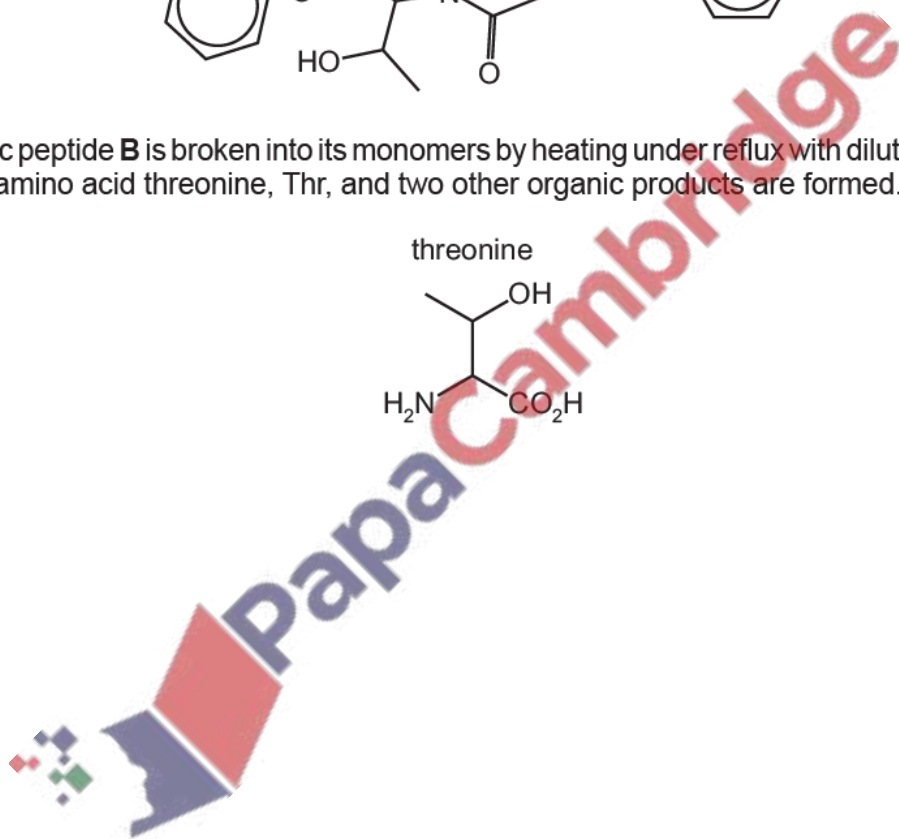
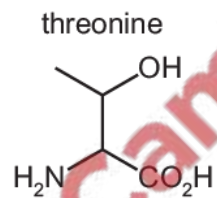
[1]



(e) The cyclic peptide **B** is shown.



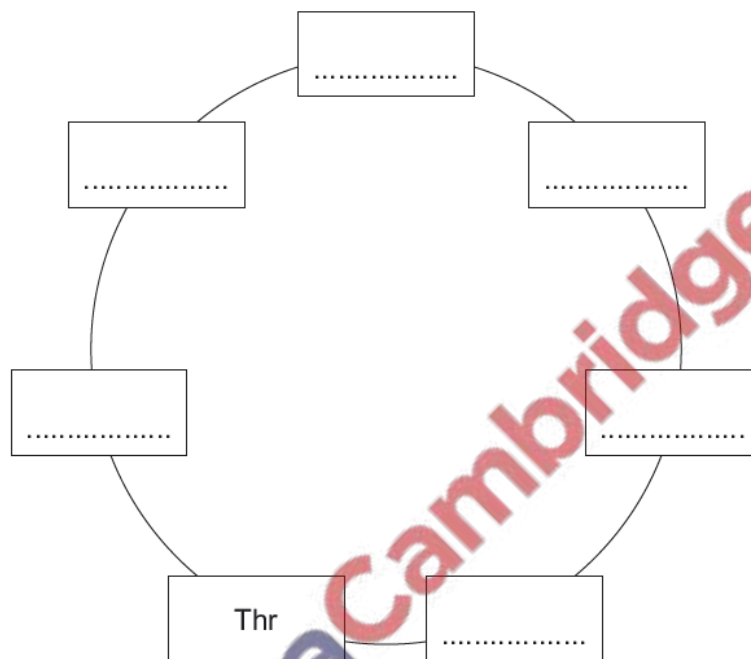
Cyclic peptide **B** is broken into its monomers by heating under reflux with dilute hydrochloric acid. The amino acid threonine, Thr, and two other organic products are formed.



(i) Draw the structures of the two other organic products formed.

[2]

(ii) Using the 3-letter abbreviations for the amino acids as given in the *Data Booklet*, complete the sequence for the cyclic peptide, **B**.



[1]

(iii) Name **two** analytical techniques that could be used to separate these amino acids.

..... and [1]

[Total: 12]

