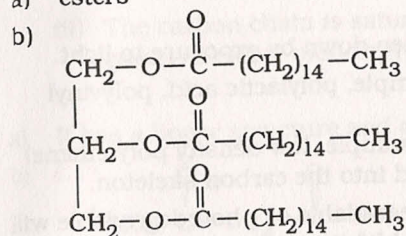


b) 1:3

4. a) esters



c) It is likely to be a fat because the carbon chains are saturated.

5. a) (enzyme) hydrolysis

b) i) saturated

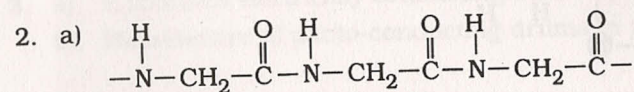
ii) glycerol (propan-1,2,3-triol)

6. a) (alkaline) hydrolysis

b) A soap molecule consists of a long hydrocarbon "tail" which is soluble in grease (hydrophobic) and an ionic head which is water soluble (hydrophilic).

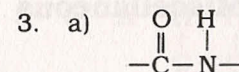
Exercise 2.18

1. a) Proteins are essential for the growth and repair of tissue.
b) amino acids
c) carbon, hydrogen, oxygen and nitrogen

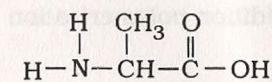
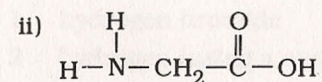


- b) condensation polymerisation
c) essential amino acids

Proteins

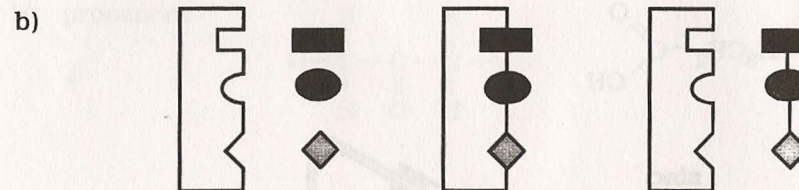


b) i) 2



iii) hydrolysis

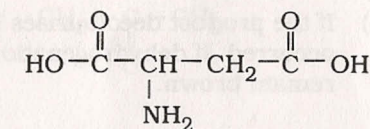
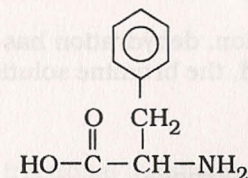
4. a) proteins



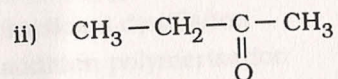
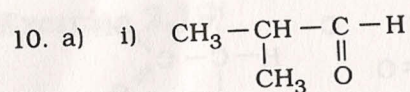
Substrate molecules adsorb onto the surface of the catalyst by a lock and key mechanism.

Reaction takes place at lower activation energy and the product desorbs from the catalyst surface.

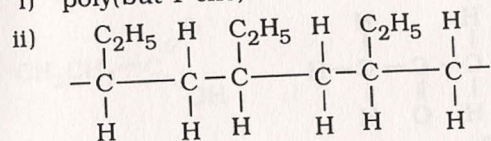
5. a)



- b) Cooking would hydrolyse aspartame and its sweetness would be lost. In cold drinks, hydrolysis is very slow, an aspartame remains unchanged.
6. a) The sucrose molecule is not the correct shape to fit the active site of maltase.
b) The change of pH causes the protein molecule to denature and the maltose molecule can no longer fit into the active site of the enzyme.
c) temperature

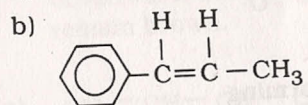


- b) **A** butanal **B** butanoic acid
 c) **C** will decolourise bromine solution rapidly in the dark. **A** will not.
 d) i) acidified potassium dichromate solution or copper(II) oxide
 ii) hot aluminium oxide
 e) i) poly(but-1-ene)



11. a) **P** propan-1-ol **Q** propan-2-ol
 b) 1 catalytic dehydration 2 oxidation
 c) $\text{CH}_3 - \text{CH}_2 - \overset{\text{O}}{\parallel}{\text{C}} - \text{H}$
 d) $-\text{NH}_2$ amine group $-\overset{\text{O}}{\parallel}{\text{C}} - \text{OH}$ carboxyl group

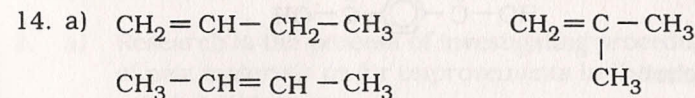
12. a) carbon-carbon double bond



- c) aromatic, aldehyde
 d) Benedict's solution or acidified potassium dichromate solution
 e) $\text{CH}_3 - \overset{\text{O}}{\parallel}{\text{C}} - \text{H}$

13. a) i) I butan-1-ol II butan-2-ol
 III methylpropan-2-ol IV methylpropan-1-ol
 ii) I and IV primary II secondary III tertiary

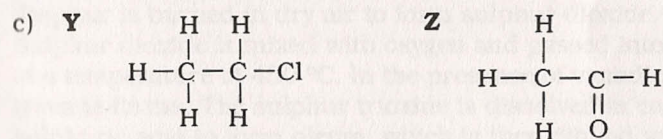
- b) i) **D** must be compound III because it is tertiary and cannot be oxidised.
 ii) **C** must be compound II because it cannot be oxidised to an acid.
 iii) If **D** is III and dehydrates to the same alkene as **A**, **A** must have a branched chain and is therefore IV. By elimination **B** is I. It can give the same alkene as **C** on dehydration.



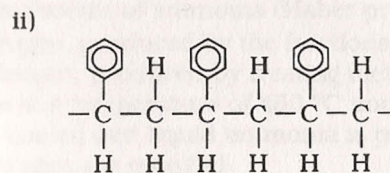
- b) i) a brick red precipitate
 ii) **Y** is an alkanal. **Z** is an alkanone.
 iii) the branched chain alkene
 iv) methylpropene
 c) i) $\text{CH}_2 - \text{CH}_2$
 $\quad | \quad \quad |$
 $\quad \text{CH}_2 - \text{CH}_2$
 ii) cyclobutane
 iii) Test with bromine solution. Cyclobutane would **not** decolourise bromine solution quickly.

15. a) cracking of ethane or naphtha

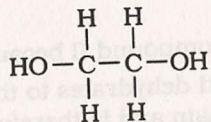
- b) **W** 1,2 dichloroethane **X** water



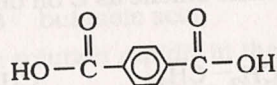
- d) i) addition polymerisation



- e) i) condensation polymerisation
 ii) ethan-1,2-diol



terephthalic acid



16. a) secondary alcohol
 b) 3 $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_3$
 2 $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_3$
 c) **A** hot aluminium oxide
B hydrogen bromide
D acidified potassium dichromate solution or copper(II) oxide
E Benedict's solution or acidified potassium dichromate solution
 d) 8 $\text{CH}_3-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$
 9 $\text{CH}_3-\text{CH}_2-\text{CH}_2-\underset{\text{H}}{\text{C}}=\text{O}$
 e) 7

Unit 3 Chemical Reactions

Exercise 3.1

The chemical industry

- The income to the UK economy from goods manufactured by the chemical industry and sold to other countries is greater than the expenditure of UK companies on chemical products manufactured abroad.
- Research is the process of investigating procedures for the synthesis of new materials or for improvements in the means of synthesising existing materials.
 - A pilot study is an investigation which attempts to produce materials on a scale larger than the small scale procedures developed during initial research.
 - Scaling up is the process where the results of the pilot study are used to develop a manufacturing process on a scale large enough to meet consumer demand at an effective cost.
 - Production is the on-going process of manufacturing consumer products or feedstocks in the most cost effective way.
 - Review is the analysis of production methods to ensure that they are as efficient as possible and minimise possible harmful effects on the environment and wellbeing of plant operators.
- For example:
 Manufacture of sulphuric acid (Contact process)
 Sulphur is burned in dry air to form sulphur dioxide.
 Sulphur dioxide is mixed with oxygen and passed into a catalyst chamber at a temperature of 450 °C. In the presence of vanadium(V) oxide, sulphur trioxide forms. The sulphur trioxide is dissolved in concentrated sulphuric acid to form oleum, which is then diluted with water to form sulphuric acid.
 Manufacture of ammonia (Haber process)
 Nitrogen, produced by the fractional distillation of liquid air, is mixed with hydrogen, produced by treating methane with steam, and passed over iron at a temperature of 450 °C under high pressure. The resulting gases are cooled and liquid ammonia is produced. Unused nitrogen and hydrogen are recycled.
- A feedstock is a substance produced from raw materials which can be further processed into consumer products.
 - cost