ORGANIC CHEMISTRY II (P2)

1.   1990 Q28

(a) The scheme below shows several reactions starting with propanol. Study the scheme and answer the questions which follows.
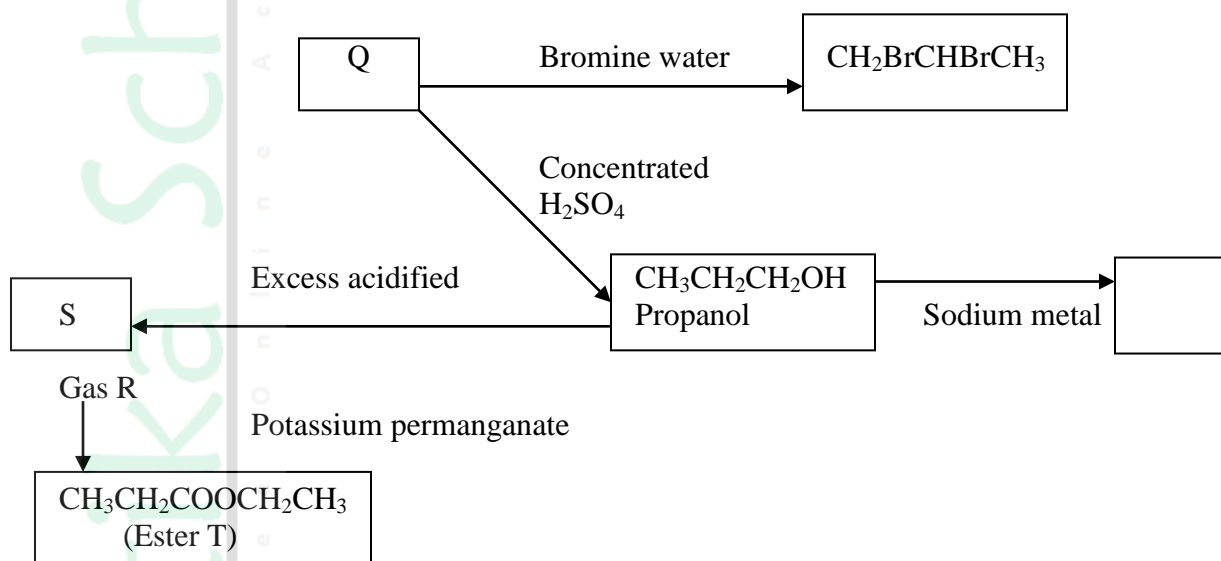
i)   Name gas R   (1 mark)

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ii)   Write the structure formulae and names of Q and S   (2 marks)

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iii)   Name the type of reaction that takes place when Q is converted to $CH_3CHBrCH_2Br$
                                                                                                                              (2 marks)

....

iv)   What reagents and conditions are necessary to convert S to T   (2 marks)

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1

(b) $RCOONa^+$ and $RCH_2OSO^{-3} Na^+$ represents two types of cleansing agents.
  (i) Name the class of cleansing agent to which each belongs.
      (ii). $RCOO Na^+$ (1 mark)

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      (iii). $RCH_2OSO^{-3} Na^+$ (1 mark)

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  (iv) Which one of the cleansing agents would be more suitable to use when washing with hard water? Explain your answer.   (2 marks)

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  (v) Which of the two cleansing agents is likely to pollute the environment? Explain your answer.   (1 mark)

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2.   1994 Q 4

The table below gives the formulae of some carboxylic acids and their boiling points.

Acid	Boiling point (^{o}C)
HCOOH	101
CH_3COOH	118
CH_3CH_2COOH	141
$CH_3CH_2 CH_2 CH_2COOH$	187
$CH_3CH_2CH_2CH_2CH_2COOH$	205

i). Give the name of the acid whose formula is $CH_3CH_2 CH_2 CH_2COOH$ (1 mark)

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ii) What is the empirical formula of the acid $CH_3CH_2 CH_2 CH_2CH_2COOH$ (1mark)

....

  (i) Plot a graph of boiling point against number of atoms of the carboxylic acids.
                                                                          (3 marks)
  (ii) From the graph, determine the boiling point of the acid CH3 CH_2 CH_2COOH
                                                                          (2 marks)

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iii) Explain, giving reasons, the shape of the graph   (2 marks)

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b) Explain the observations which would be made if $NaHCO_3$ (s) is added to an aqueous solution containing HCOOH(aq). (2 marks)

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c). Calculate the volume of 0.20M sodium hydroxide solution which would be required to react completely with a solution containing 3.0g of CH_3COOH. (C=12, H=1, O=16) (3marks)

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3.   1996 Q 5

Study the table below and answer the questions that follow

Compound	Melting point (^{o}C)	Boiling point (^{o}C)
$C_2H_4O_2$	16.6	118
C_3H_6	-185	-47.7
C_3H_8O	-127	97.2
C_5H_{12}	-130	36.3
C_6H_{14}	-95.3	68.7

i)   Which of the compounds is a solid at 10.0^oC? Explain (1 mark)

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ii) Choose two compounds which are members of the same homologous series and explain the difference in their melting points. (3 marks)

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iii) The compound C_3H_8O is an alcohol. How does its solubility in water differ from

3

the solubility of C_5H_{12} in water? Explain. (2 marks)

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b). Complete combustion of one mole of a hydrocarbon produced four moles of carbon dioxide and four moles of water only

   i. Write the formula of the hydrocarbon. (1 mark)

....

   ii. Write the equation for the combustion reaction. (1 mark)

....

c). In a reaction, an alcohol J was converted to hex-l-ene

   i. Give the structural formula of the alcohol J. (1 mark)

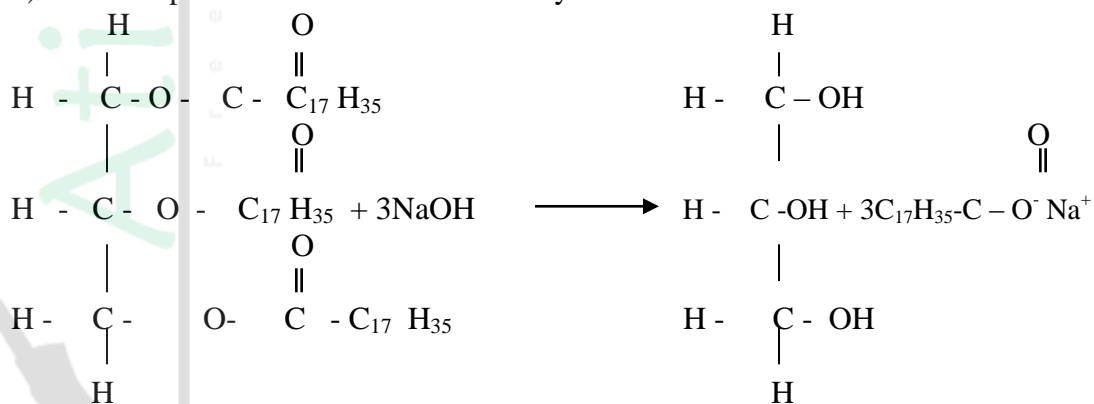..

   ii. Name the reagent and conditions necessary for the reaction in c (i) above (1 mark)

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d). Compound K reacts with sodium hydroxide as shown below

   i. What type of reaction is represented by the equation above? (1 mark)

....

   ii. To what class of organic compound does K belong? (1 mark)

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4.   1997 Que 2

   a). Give the names of the following compounds

   i. CH_3 CH_3 CH_2 CH_2 OH (1 mark)

4

....

    ii. $CH_3 CH_2 COOH$ (1 mark)

....

    iii.   O
                    ‖
    CH_3 C - $O – CH_2 CH_3$ (1 mark)

....

b). Study the information in the table below and answer the questions that follows.

| Number of carbon atoms per molecule	Relative molecular mass of hydrocarbon.
2	28
3	42
4	56

i) Write the general formula of the hydrocarbons in the table (1 mark)

....

ii). Predict relative molecular formula mass of the hydrocarbon with 5 carbon atoms.
(1 mark)

....

....

iii). Determine the molecular formula of the hydrocarbon in (ii) above and draw its structural formula. (H= 1.0, C= 12.0)

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5. **1998 Que 21**

The formula give below represents a portion of polymer.
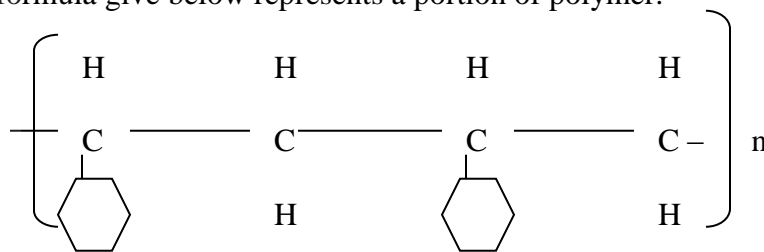
Give
    a. The name of the polymer (1 mark)

....

        b. One disadvantage of the continued use of this polymer.   (1 mark)

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6.   **1999 P1B Que 5**

    a. When an organic compound Y is reacted with aqueous sodium carbonate, it produces carbon dioxide. Y reacts with propanol to form a sweet smelling compound Z whose formula is.

$$CH_3CH_2 - \overset{\displaystyle O}{\overset{\displaystyle \|}{C}} - O - CH_2CH_2CH_3$$
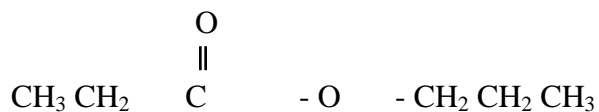
    i).   Name and draw the structural formula of compound Y.   (2 marks)

....

    ii.   What is the name of the group of compounds to which Z belongs?   (1 mark)

....

    b).   In an experiment, excess ethanol warmed with acidified potassium dichromate for about twenty minutes. State and explain the observation that was made at the end of the experiment.   (2 marks)

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    c). The scheme below was used to prepare a cleansing agent. Study it and answer the questions that follows.

| Fat | → NaOH(aq) Boil Step I → | Solution of Cleansing agent and an alcohol |

Step II ↓

| Solid cleansing agent |
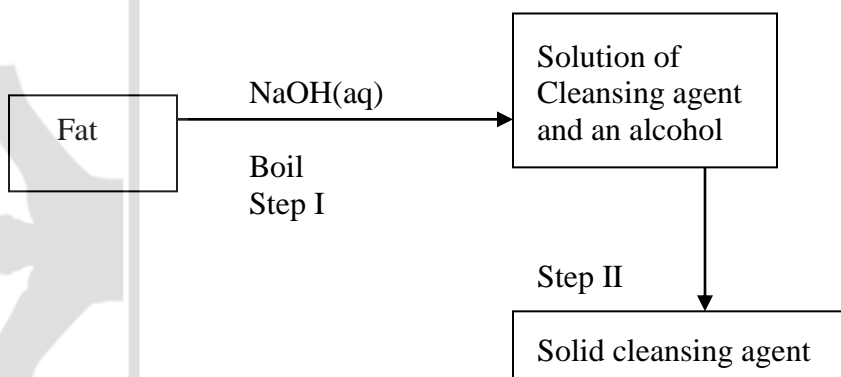
    i. What name is given to the type of cleansing agent prepared by the method shown in the scheme.   (1 mark)

....

ii). Name one chemical substance added in step II. (1 mark)

....

iii). What is the purpose of adding the chemical substance named in c (ii) above?
(1 mark)

....

....

iv). Name one other suitable substance that can be used in step I. (1 mark)

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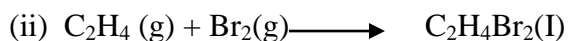
v). Explain how an aqueous solution of the cleansing agent removes oil from
utensils during washing. (2 marks)

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7. **2000 Que 5**

(a) Give the names of the following compounds. (2 marks)

i). $CH_3CH = CH\ CH2\ CH_3$

....

$$\begin{array}{c} O \\ \parallel \end{array}$$

ii). $CH_3CH_2CH_2\ C - OH$

....
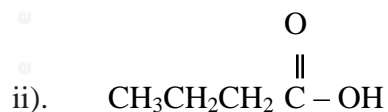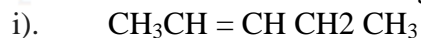
b). Ethane and Ethene react with bromine according to the equations given below.

(i) $C_2H_6\ (g) + Br_2\ (g) \longrightarrow C_2H_5Br\ (l) + HBr\ (g)$

(ii) $C_2H_4\ (g) + Br_2(g) \longrightarrow C_2H_4Br_2(l)$
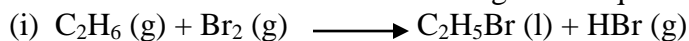
Name the type of bromination reaction that takes place in i and ii (2 marks)

....

c). Study the diagram below and answer the questions that follows

Gas L to pump

Ice / salt mixture

Flame
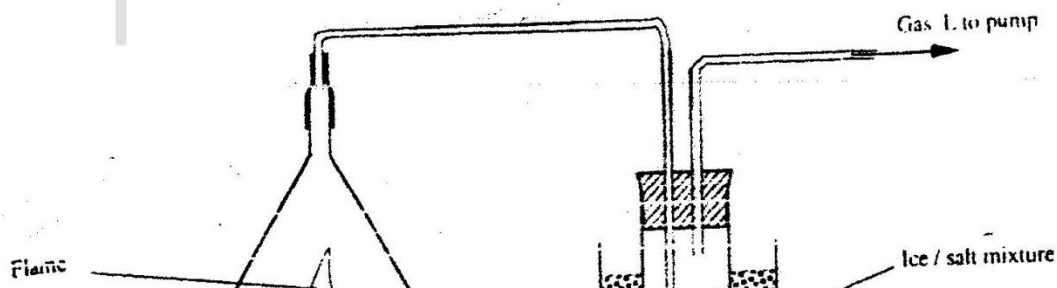
i. Write the equation for the combustion of butane   (1 mark)

....

ii) The Ph of substance K was found to be less than 7. Explain this observation
                                                                                              (2 marks)

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d). The polymerization of tetrafloureoethene (C_2F_4) is similar to that of ethane (C_2H_4)
   i. What is meant by the term polymerization?   (1 mark)

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ii. Draw the structural formula of a portion of the polymer obtained from the
      monomer C_2F_4.   (1 mark)

e). State any two advantages that synthetic polymers have over natural polymers.   (2 marks)

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8.   **2001 Q2**
   (a) In which homologous series do the following compounds belong?
      (i) CH_3CCH

....

   (ii) CH_3CH_2COOH

....
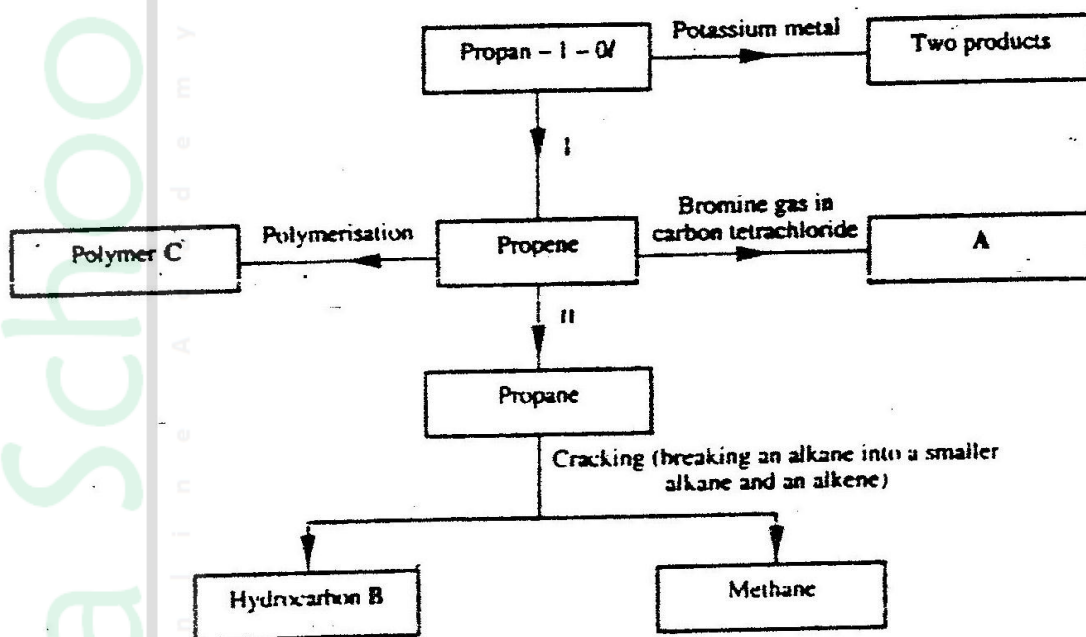
   (b) Raw rubber is heated with Sulphur in the manufacture of natural rubber
        (i) What name is given to the process?

....

(ii) Why is the process necessary

....

....

(c) Study the scheme given below and answer the questions that follow.

(i) Write an equation for the reaction between propan–1-ol and potassium metal

....

....

(ii) Name process I and II

....

....

(iii) Identify the products A and B

....

....

(iv) Name ONE catalyst used in process II

....

(v) Draw the structural formula of the repeating unit in the polymer C

9

(d) State **TWO** industrial uses of methane

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9. 2002 Que 7

a). Write the structural formulae of:

    i). Methanol   (1 mark)

....

    ii). Methanol acid.   (1 mark)

....

b). Write the equation for the reaction between methanoic acid and aqueous sodium hydroxide.   (1 mark)

....

c). i) Name the product formed when methanol reacts with methanoic acid   (1 mark)

....

    ii) State one condition necessary for the reaction in (c) (i) above to take place
                                                  (1 mark)

....

(d) i) Describe one chemical test that can be used to distinguish between hexane and hexene.   (2 marks)

        ....

        ....

        ....

    ii) State one use of hexane.   (1 mark)

   ....

iii) Hydrogen gas reacts with hexene to form hexane. Calculate the volume of hydrogen gas required to convert 42 g of hexene to hexane at S.T.P.
(C= 12.0, H= 1.0, mole gas volume at S.T.P. is = 22.4 litres)   (4 marks)

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10.   2003 Q7

a) State how burning can be used to distinguish between ethane and ethyne. Explain your answer.   (3marks)

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b) Draw the structural formula of the third member of the homologous series of ethyne.

c) The flow chart below shows a series of reactions starting with ethanol. Study it and answer the questions that follow.
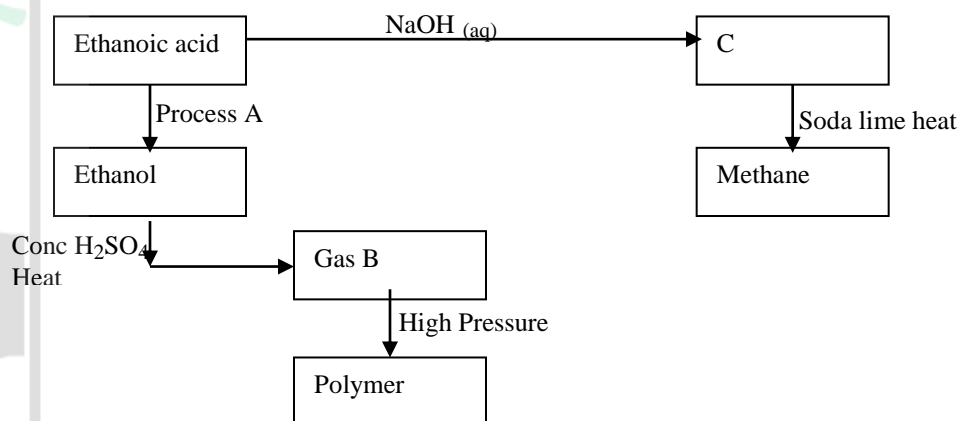
i) Name:
   I.   Process A   ....
   II. Substances B and C

B ....

C ....

   ii)   Write the equation for the combustion of ethanol   (1mark)

....

   iii)   Explain why it is necessary to use high pressure to change gas B into the polymer

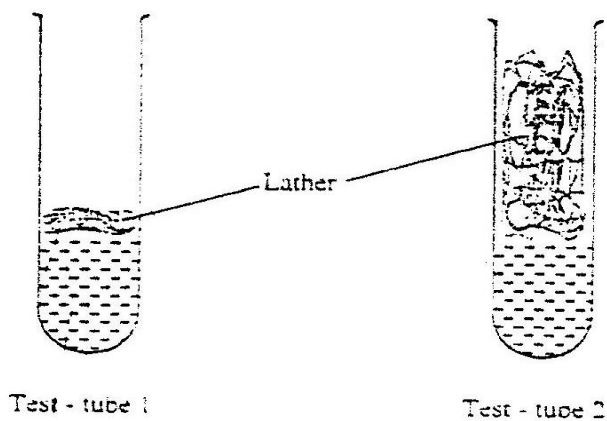   (1mark)

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   iv)   State one use of methane   (1mark)

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11.   **2004 Q13, 23 (P1)**

   13. a) What is the name given to the smallest repeating unit of a polymer.   (1mark)

....

   b) Draw the structure of the smallest repeating unit of a polyvinyl chloride   (1mark)
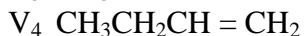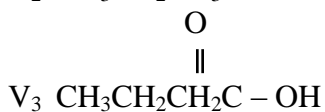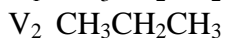
   23. $1cm^3$ of soap was added to two test – tubes each containing water obtained from different sources. The lather produced in each test tube is represented as shown in the diagram below.

Test - tube 1   Test - tube 2

Explain why there is more lather in test – tube 2 than in test – tube 1.   (3marks)

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12.   2005 Q6

(a) The list below shows the formulae of some organic compounds. Use it to answer the questions that follow.

V_1 $HC_3CH_2CH_2OH$

V_2 $CH_3CH_2CH_3$

$$
V_3 \quad CH_3CH_2CH_2\overset{\overset{\displaystyle O}{\parallel}}{C} - OH
$$

V_4 $CH_3CH_2CH = CH_2$

V_5 $CH_3\ CH_2CH_2CH_3$

(i)   Select two compounds which

I   are not hydrocarbons   (1mark)

....

II   Belong to the same homologous series   (1 mark)

....

(ii) Identify the compound that is likely to undergo polymerization. Give a reason for your answer.   (2 marks)

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a.   The structures below represents two cleansing agents:

$R – COO^-\ Na^+$

$R – OSO_3^-\ Na^+$

In the table below, give one advantage and one disadvantage of using each one of them

	Advantage	Disadvantage
$R – COO\text{-}\ Na^+$		
$R\ \text{-}\ OSO_3 – Na^+$		

b. Under certain conditions, ethanoic acid ($C_2H_4O_2$) and ethanol (C_2H_5OH) react to form a sweet smelling compound.

(i) What is the general name of compound to which the sweet smelling compound belong? (1mark)

....

(ii) Write the formula of the sweet smelling compound (1 mark)

....

(iii) Give one use of ethanoic acid other the formation of the sweet smelling compounds (1 mark)

....

(iv) Write the equation for the reaction dilute ethanoic acid and solid potassium carbonate (1mark)

....

c. Fibres are either synthetic or natural. Give one:

(i) Example of a natural fibre (1 mark)

....

(ii) Advantage of synthetic fibres have over natural fibres (1 mark)

....

13. 2006 Q7

A group of compounds called chlorofluorocarbons have a wide range of uses but they also have harmful effects on the environment.

State one:

a) Use of chlorofluorocarbons (1 mark)

....

b) Harmful effect of chlorofluorocarbons on the environments. (1 mark)

....

14. 2006 Q11

a) Water from a town in Kenya is suspected to contain chloride ions but not sulphate ions. Describe how the presence of the chloride ions in the water can be shown. (1 mark)

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....

b) State one advantage of drinking hard water rather than soft water. (1 mark)

....

15 2007 Q2

15.0cm^3 of ethanoic acid (CH$_3$COOH) was dissolved in water to make 500cm^3 of solution. Calculate the concentration of the solution in moles per litre.

(C=12.0;H=1.0;O=16.0; density of ethanoic acid is 1.05 g/cm^3)   (3marks)

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16.   2007 Q15

a) Explain why permanent hardness in water cannot be removed by boiling.   (2marks)

....

....

....

b) Name two methods that can be used to remove permanent hardness from water.   (1mark)

....

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17.   2007 Q2 P2

(a) Give the systematic names of the following compounds

(i)   CH$_2$ = C − CH$_3$

$\quad\quad\quad\quad$ |

$\quad\quad\quad$ CH$_3$ .... (1 mark)

(ii)   CH$_3$CH$_2$CH$_2$C ≡CH   .... (1 mark)

(b) State the observations made when Propan−1-ol reacts with:

(i) Acidified potassium dichromate (VI) Solution   (1 mark)

....

....

(ii) Sodium metal   (1 mark)

....

....

(c)   Ethanol obtained from glucose can be converted to ethane as shown below

15

$$C_6H_{12}O_6 \xrightarrow{\text{Step 1}} C_2H_5OH \xrightarrow{\text{Step II}} CH_2 \equiv CH_2$$

Name and describe the process that takes place in steps I and II

Step I .... (1 ½ marks)

Step II .... (1 ½ marks)

(d) Compounds A and B have the same molecular formula $C_3H_6O_2$. Compound A liberates carbon (IV) oxide on addition of aqueous sodium carbonate while compound B does not. Compound B has a sweet smell. Draw the possible structures of:
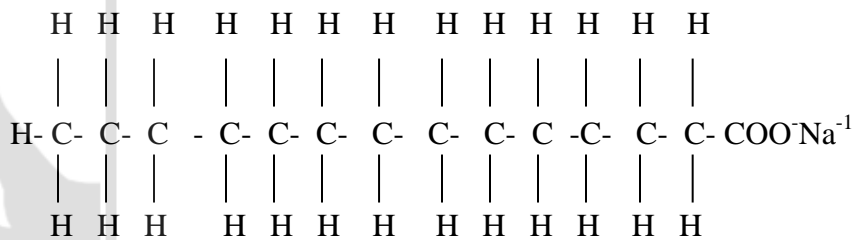(i) Compound A (1 mark)

(ii) Compound B (1 mark)

(e) Give two reasons why the disposal of polymers such as polychloroethane by burning pollutes the environment. (2 marks)

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18. **2008 Q4**
The structure of a detergent is

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  H  H  H   H  H  H  H   H  H  H  H   H  H
  |  |  |   |  |  |  |   |  |  |  |   |  |
H-C- C- C - C- C- C- C- C- C- C -C- C- C- COO⁻Na⁻¹
  |  |  |   |  |  |  |   |  |  |  |   |  |
  H  H  H   H  H  H  H   H  H  H  H   H  H
```

a) Write the molecular formula of the detergent. (1mark)

....

b) What type of detergent is represented by the formula? (1 mark)

16

....

c) When this type of detergent is used to wash linen in hard water, spots (marks) are left on the linen. Write the formula of the substance responsible for the spots (1 mark)

....

19.   2008 Q1c

c) Carbon (IV) oxide, methane, nitrogen (I) oxide and trichlorofluoromethane are green-house gases.

(i) State one effect of an increased level of these gases to the environment. (1mark)

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(ii) Give one source from which each of the following gases is released to the environment;

I   Nitrogen (i) oxide (1 mark)

....

II   Trichlorofluoromethane. (1 mark)

....

20.   2009 Q2

Hardness of water may be removed by either boiling or addition of chemicals.

(a) Write an equation to show how boiling removes hardness of water. (1 mark)

....

(b) Name two chemical that are used to remove hardness of water (2 marks)

....
....

21.   2009 Q25

For each of the following reactions, state the observation and write the formula of the compound responsible for the observation

(a) Bromide water is added to aqueous potassium iodine (1 ½ marks)

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....

22.   2010 Q13

Some animal and vegetable oils are used to make margarine and soap. Give the reagents and conditions necessary for converting the oils into:

   a) Margarine   (2 marks)

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

   b) Soap   (1 mark)

   ....
   ....

23.   2010 Q21

The use of CFCs has been linked to depletion of the ozone layer.

   a) What does CFC stand for?   (1 mark)

   ....

   b) Explain the problem associated with the depletion of the ozone layer   (1 mark)

   ....
   ....

   c) State another environment problem caused by CFCs   (1 mark)

   ....
   ....

24.   2010 Q25

A sample of river water was divided into three portions. The table below shows the test carried out on the portions and the observations made.

Test	Observation	Inference
To the first portion, $1cm^3$ of soap solution was added	No lather formed	
The second portion was boiled, cooled and $1cm^3$ of soap solution was added	No lather formed	
To the third portion, $3cm^3$ of aqueous sodium carbonate was added, the mixture filtered and $1cm^3$ of soap solution added to the filtrate.	Lather formed immediately	

Complete the table by filling in the inferences.   (3 marks)

25.   2011 Q15

Soap dissolves in water according to the equation below;

NaSt (aq) $\longrightarrow$ Na (aq)$^+$ + St$^-$ where St$^-$ is the stearate ion
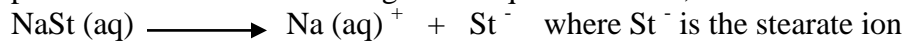
a) Write the formula of the scum formed when soap is used in hard water (1mark)

....

b) Write the ionic equation for the reaction that occurs when sodium carbonate is used to remove in hardness in water. (1mark)

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26. 2012 Q10 P1

(a) Name **two** cations that are present in hard water. (1 mark)

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(b) Explain how the ion exchange resin softens hard water (2 marks)

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....

27. 2012 Q21 P1

Give **two** uses of the polymer polystrene. (1 mark)

....
....

28. 2012 Q1 P2

(a) Draw the structural formula for all the isomers of $C_2H_3CL_3$ (2 marks)

(b) Describe **two** chemical tests that can be used to distinguish between ethene and ethane. (4 marks)

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(c) The following scheme represents various reactions starting with propanol-1-ol. Use it to answer the questions that follow.
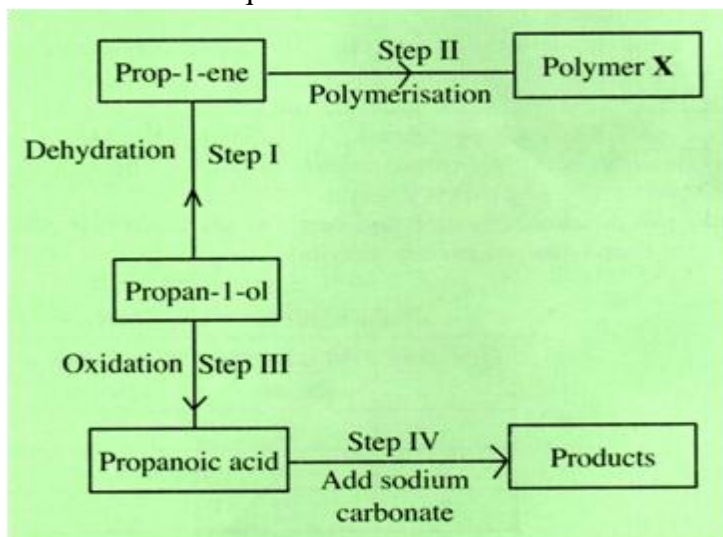
(i)   Name one substance that can be used in step 1   (1 mark)

....

(ii) Give the general formula of **X**   (1 mark)

....

(iii) Write the equation for the reaction in step IV   (1 mark)

....

(iv) Calculate the mass of propanol-1-ol which when burnt completely in air at room

temperature and pressure would produce 18dm^3 of gas.

(C = 12.0; O = 16.0; H = 1.0; Molar gas volume = 24dm^3)   (2 marks)

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