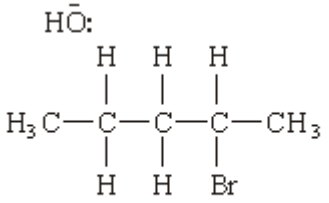
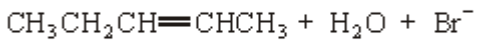
Q1. (a) Complete the mechanism below by drawing appropriate curly arrows.



2-bromopentane



pent-2-ene

(3)

(b) Draw and name the geometrical E-Z isomers of pent-2-ene.

Isomer 1 *Isomer 2*

Name ..... *Name* .....

(2)

(c) Pent-1-ene reacts with hydrogen bromide to produce 2-bromopentane as the major product.

(i) Outline the mechanism for this reaction.

(ii) Identify the minor product formed in this reaction.

.....

(iii) Explain why 2-bromopentane is the major product of this reaction.

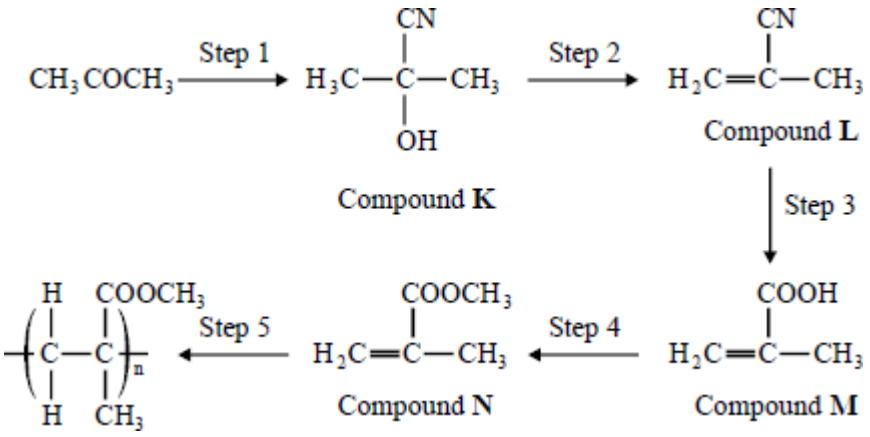
.....

.....

.....

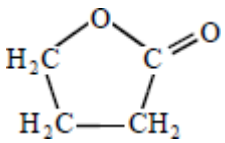
(7)
(Total 12 marks)

Q2. This question concerns the preparation of the plastic poly(methyl 2-methylpropenoate) (*Perspex*), starting from propanone.

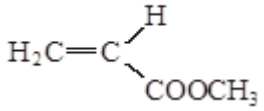


Which one of the following is **not** a structural isomer of Compound **M**?

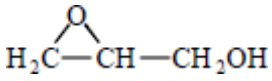
A



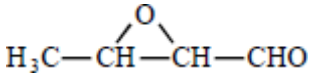
B



C



D



(Total 1 mark)

Q3. (a) **P**, **Q** and **R** have the molecular formula C_6H_{12}

All three are branched-chain molecules and none is cyclic.
P can represent a pair of optical isomers.
Q can represent a pair of geometrical isomers.
R can represent another pair of geometrical isomers different from **Q**.

Draw one possible structure for one of the isomers of each of **P**, **Q** and **R**.

*Structure of **P***

*Structure of **Q***

*Structure of **R***

(3)

(b) Butanone reacts with reagent **S** to form compound **T** which exists as a racemic mixture. Dehydration of **T** forms **U**, C_5H_7N, which can represent a pair of geometrical isomers.

(i) State the meaning of the term *racemic mixture* and suggest why such a

mixture is formed in this reaction.

Racemic mixture .....

.....

Explanation.....

.....

.....

(ii) Identify reagent **S**, and draw a structural formula for each of **T** and **U**.

*Reagent **S*** .....

*Compound **T***

*Compound **U***

(6)
(Total 9 marks)

Q4. The alkanes form an homologous series of hydrocarbons. The first four straight-chain alkanes are shown below.

methane	CH_4
ethane	CH_3CH_3
propane	$CH_3CH_2CH_3$
butane	$CH_3CH_2CH_2CH_3$

(a) (i) State what is meant by the term *hydrocarbon.*

.....

.....

(ii) Give the general formula for the alkanes.

.....

(iii) Give the molecular formula for hexane, the sixth member of the series.

.....

(3)

(b) Each homologous series has its own general formula. State **two** other characteristics of an homologous series.

.....

.....

.....

(2)

(c) Branched-chain structural isomers are possible for alkanes which have more than three carbon atoms.

(i) State what is meant by the term *structural isomers.*

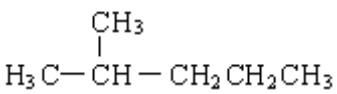
.....

.....

.....

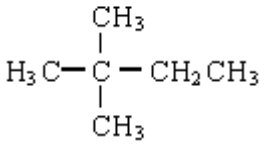
(ii) Name the **two** isomers of hexane shown below.

Isomer 1



Name .....

Isomer 2



Name .....

(iii) Give the structures of **two** other branched-chain isomers of hexane.

Isomer 3 *Isomer 4*

(6)

(d) A hydrocarbon, **W,** contains 92.3% carbon by mass. The relative molecular mass of
W is 78.0

(i) Calculate the empirical formula of **W**.

.....

.....

.....

.....

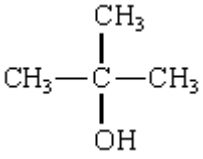
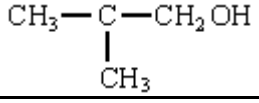
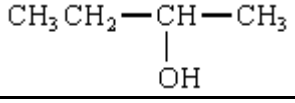
(ii) Calculate the molecular formula of **W**.

.....

.....

(4)
(Total 15 marks)

Q5. Four isomers with the formula C_4H_9OH are given below.

Isomer	Name
$CH_3CH_2CH_2CH_2OH$	butan-1-ol
	2-methylpropan-2-ol
	
	

(i) Complete the naming of the isomers in the table above.

(ii) Name the type of isomerism shown by these four isomers.

.....

(Total 3 marks)

Q6. Each of the parts (a) to (e) below concerns a different pair of isomers.

Draw one possible structure for each of the species **A** to **J**, using Table 2 on the Data Sheet where appropriate.

(a) Compounds **A** and **B** have the molecular formula C_5H_{10}
A decolourises bromine water but **B** does not.

A **B**

(2)

(b) Compounds **C** and **D** have the molecular formula $C_2H_4O_2$

Each has an absorption in its infra-red spectrum at about 1700 cm^{-1} but only **D** has a broad absorption at 3350 cm^{-1}

C **D**

(2)

(c) Compounds **E** and **F** are esters with the molecular formula $C_5H_{10}O_2$

The proton n.m.r. spectrum of **E** consists of two singlets only whereas that of **F** consists of two quartets and two triplets.

E **F**

(2)

(d) Compounds **G** and **H** have the molecular formula $C_3H_6C_{l2}$ **G** shows optical activity but **H** does not.

G **H**

(2)

(e) Compounds **I** and **J** have the molecular formula C_6H_{12}

Each has an absorption in its infra-red spectrum at about 1650 cm^{-1} and neither shows geometrical isomerism. The proton n.m.r. spectrum of **I** consists of a singlet only whereas that of **J** consists of a singlet, a triplet and a quartet.

I **J**

(2)
(Total 10 marks)