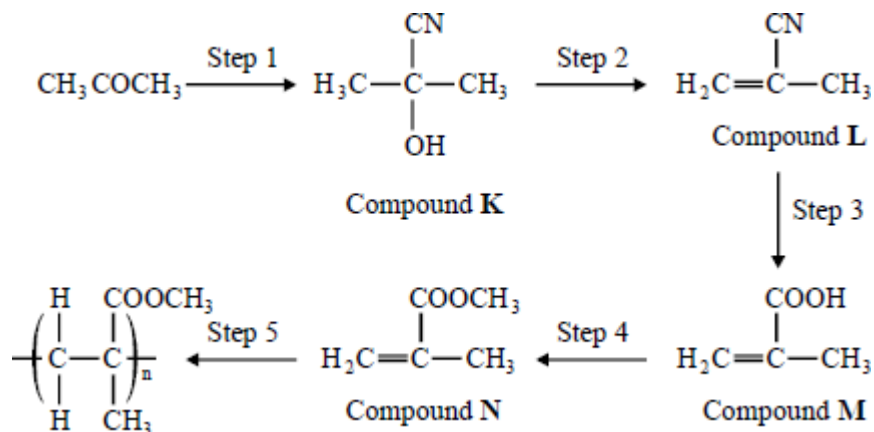


**Q1.** This question concerns the preparation of the plastic poly(methyl 2-methylpropenoate) (*Perspex*), starting from propanone.



Which one of the following sets of reagents is **not** suitable for the step indicated?

- A** Step 1 HCN (NaCN then dilute HCl)
- B** Step 2 hot ethanolic KOH
- C** Step 3 warm aqueous H<sub>2</sub>SO<sub>4</sub>
- D** Step 4 CH<sub>3</sub>OH with an acid catalyst

(Total 1 mark)

**Q2.** Use the data given on the back of the Periodic Table (PT) to help you answer this question.

Compounds **A** to **G** are all isomers with the molecular formula C<sub>6</sub>H<sub>12</sub>O<sub>2</sub>

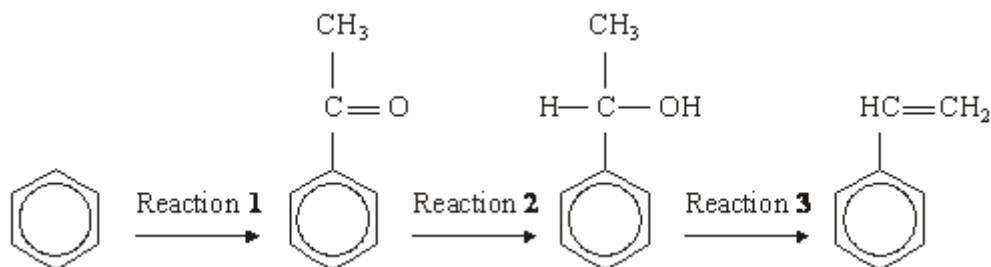
- (a) Isomer **A**, C<sub>6</sub>H<sub>12</sub>O<sub>2</sub>, is a neutral compound and is formed by the reaction between compounds **X** and **Y** in the presence of a small amount of concentrated sulphuric acid.  
**X** and **Y** can both be formed from propanal by different redox reactions.  
**X** has an absorption in its infra-red spectrum at 1750 cm<sup>-1</sup>.  
 Deduce the structural formulae of **A**, **X** and **Y**. Give suitable reagents, in each case, for the formation of **X** and **Y** from propanal and state the role of concentrated sulphuric acid in the formation of **A**.

(7)

- (b) Isomers **B**, **C**, **D** and **E** all react with aqueous sodium carbonate to produce carbon dioxide.  
 Deduce the structural formulae of the three isomers that contain an asymmetric carbon atom.  
 The fourth isomer has only three singlet peaks in its proton n.m.r. spectrum. Deduce



**Q4.** A possible synthesis of phenylethene (*styrene*) is outlined below.



(a) In Reaction 1, ethanoyl chloride and aluminium chloride are used to form a reactive species which then reacts with benzene.

Write an equation to show the formation of the reactive species.

Name and outline the mechanism by which this reactive species reacts with benzene.

(6)

(b)  $\text{NaBH}_4$  is a possible reagent for Reaction 2.

Name and outline the mechanism for the reaction with  $\text{NaBH}_4$  in Reaction 2.

Name the product of Reaction 2.

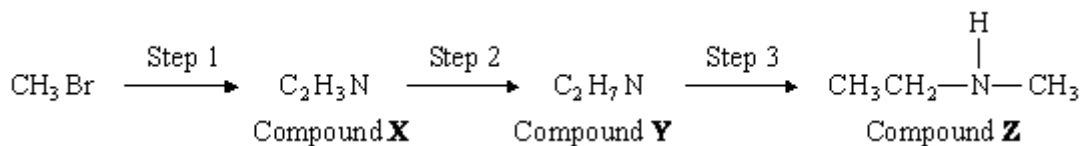
(6)

(c) Name the type of reaction involved in Reaction 3 and give a reagent for the reaction.

(2)

(Total 14 marks)

**Q5.** Compound **Z** can be formed via compounds **X** and **Y** in the three step synthesis shown below.



Identify compounds **X** and **Y** and give reagents and conditions for Steps 1 and 2.

State the **type** of compound of which **Z** is an example.

Compound **Z** reacts with a large excess of bromomethane to form a solid product. Draw

the structure of this product and name the type of mechanism for this reaction.

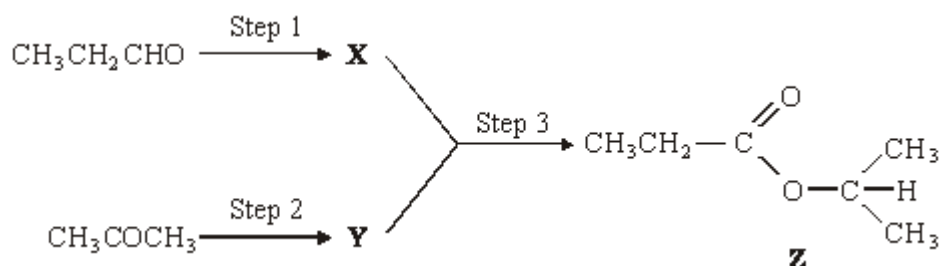
(Total 9 marks)

**Q6.** (a) Describe how propanal,  $\text{CH}_3\text{CH}_2\text{CHO}$ , and propanone,  $\text{CH}_3\text{COCH}_3$ , can be distinguished using

- (i) a chemical test and
- (ii) the number of peaks in their proton n.m.r. spectra.

(5)

(b) Compound **Z** can be produced by the reaction of compound **X** with compound **Y** as shown in the synthesis outlined below.



Identify compounds **X** and **Y**.

For each of the three steps in the synthesis, name the type of reaction involved and give reagents and conditions. Equations are **not** required.

(10)

(Total 15 marks)