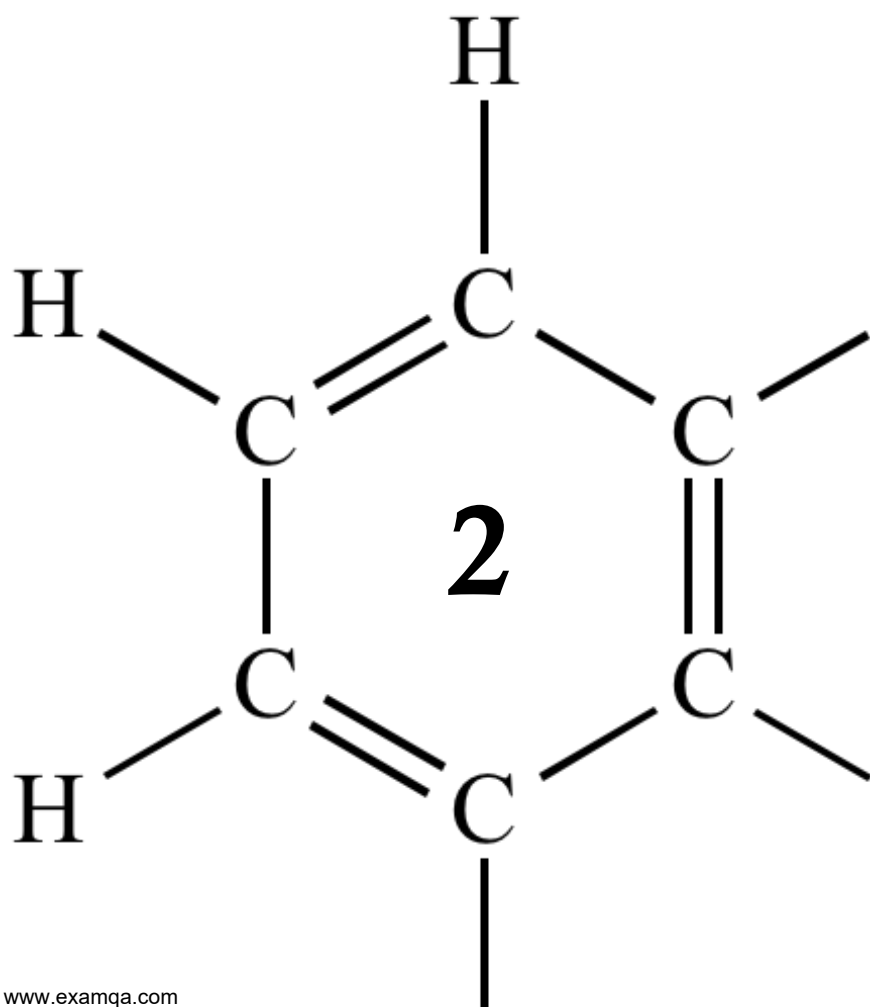


OCR A2 CHEMISTRY

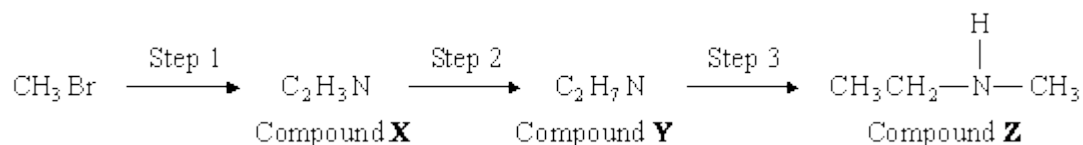
# MODULE 6.3

ORGANIC SYNTHESIS  
PRACTICALS



**1**

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.

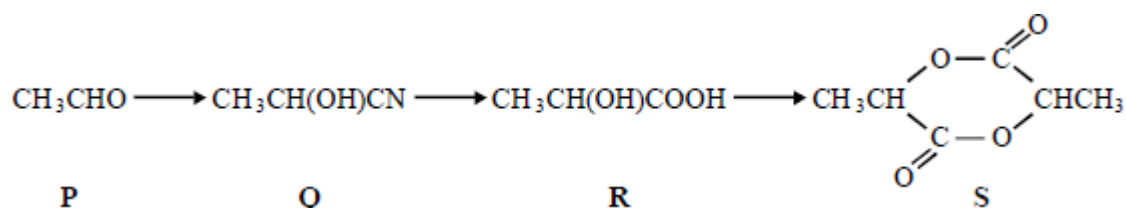
State the **type** of compound of which **Z** is an example.

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)**

**2**

This question refers to the reaction sequence below.



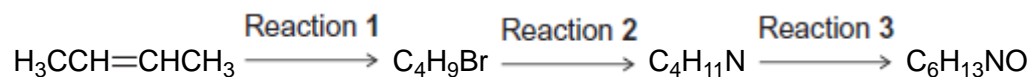
Which one of the following is **not** involved in the reaction sequence?

- A** esterification
- B** hydrolysis
- C** nucleophilic addition
- D** reduction

**(Total 1 mark)**

**3**

The N-substituted amide  $C_6H_{13}NO$  can be formed from but-2-ene in a three-step synthesis.



For each reaction

- state a reagent
- give the structure of the product
- name the mechanism of the reaction.

Detailed mechanisms are **not** required.

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**(Total 9 marks)**

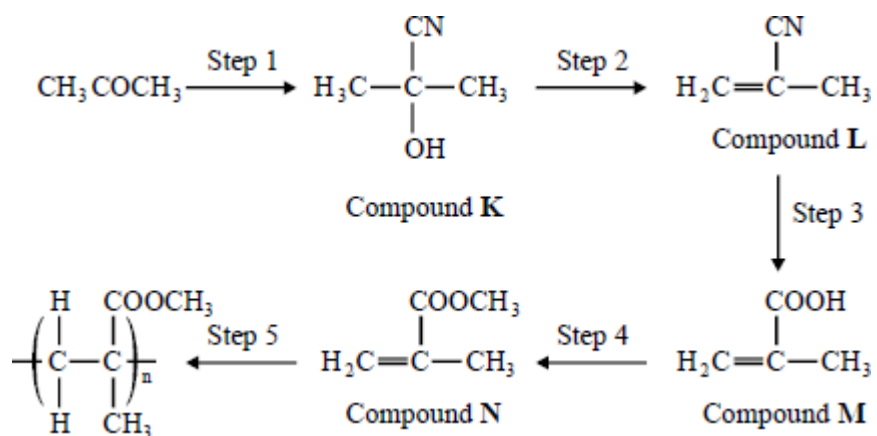
**4**

Which one of the following pairs reacts to form an organic product with only 2 singlets in its proton n.m.r. spectrum?

- A** ethene and bromine
- B** propan-2-ol and acidified potassium dichromate(VI)
- C** ethanol and concentrated sulphuric acid
- D** epoxyethane and water in the presence of dilute sulphuric acid

**(Total 1 mark)**

- 5 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  $\text{H}_2\text{SO}_4$
- D Step 4  $\text{CH}_3\text{OH}$  with an acid catalyst

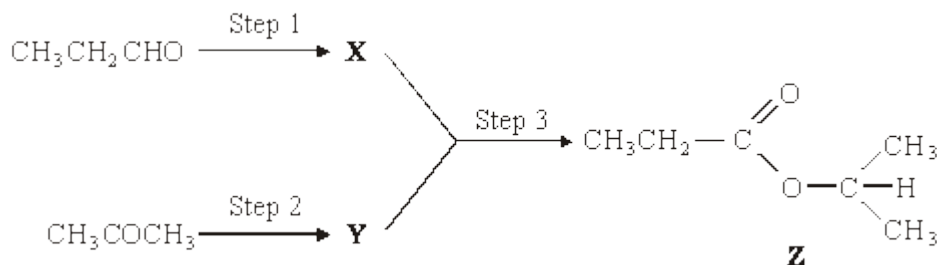
(Total 1 mark)

- 6 (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.



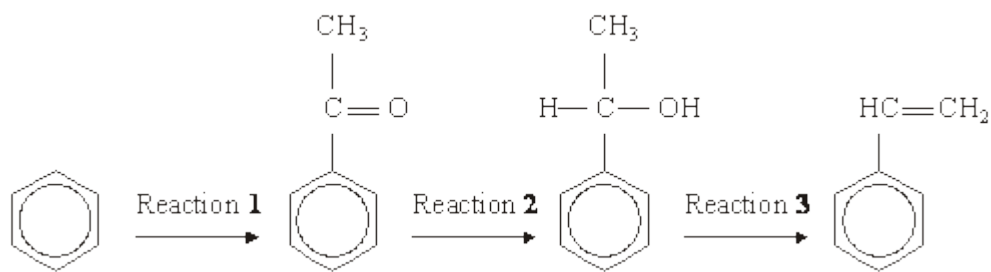
Identify compounds **X** and **Y**.

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)

7

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

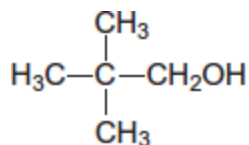
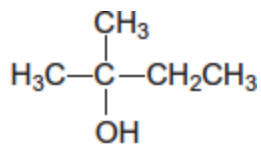
(2)  
(Total 14 marks)

**8**

Describe how you could distinguish between the compounds in the following pairs using **one** simple test-tube reaction in each case.

For each pair, identify a reagent and state what you would observe when both compounds are tested separately with this reagent.

(a)

**R****S**

Reagent .....

Observation with **R**.....

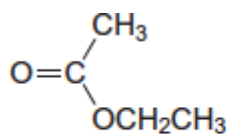
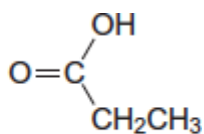
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Observation with **S**.....

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**(3)**

(b)

**T****U**

Reagent .....

Observation with **T**.....

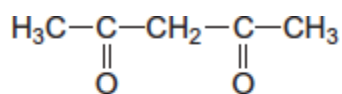
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Observation with **U**.....

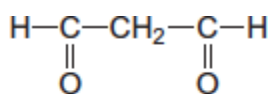
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**(3)**

(c)



**V**



**W**

Reagent .....

Observation with **V**.....

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Observation with **W**.....

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(3)  
(Total 9 marks)

**9** Which one of the following pairs of reagents reacts to form an organic product that shows only 2 peaks in its proton n.m.r. spectrum?

- A** butan-2-ol and acidified potassium dichromate(VI)
- B** ethanoyl chloride and methanol
- C** propanoic acid and ethanol in the presence of concentrated sulphuric acid
- D** ethene and hydrogen in the presence of nickel

(Total 1 mark)

**10**

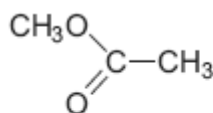
Organic chemists use a variety of methods to distinguish between compounds. These methods include analytical and spectroscopic techniques.

- (a) The following compounds can be distinguished by observing what happens in test-tube reactions.

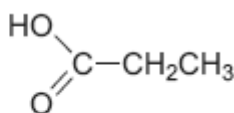
For each pair, suggest a suitable reagent or reagents that could be added separately to each compound in order to distinguish them.

Describe what you would observe with each compound.

(i)



**E**



**F**

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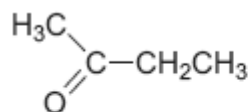
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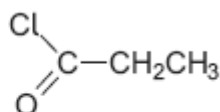
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**(3)**

(ii)



**G**



**H**

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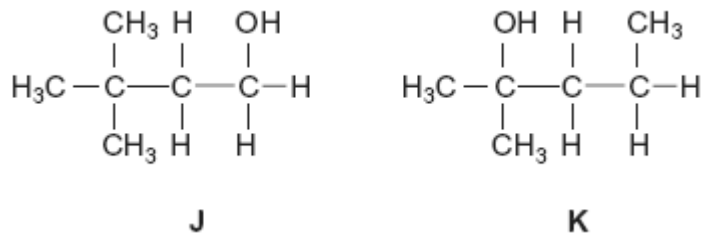
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**(3)**



(iii)



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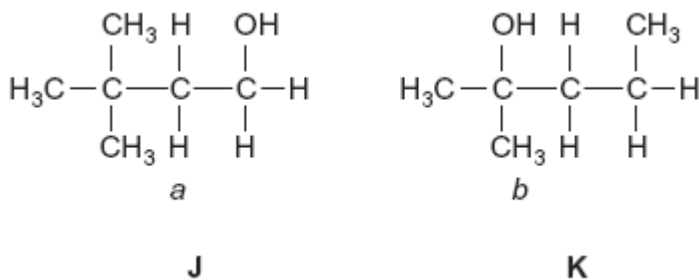
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**(3)**

(b) Compounds **J** and **K** can also be distinguished using spectroscopic techniques such as  $^1\text{H}$  n.m.r.



(i) Name compound **J**.

Give the total number of peaks in the  $^1\text{H}$  n.m.r. spectrum of **J**.

State the splitting pattern, if any, of the peak for the protons labelled *a*.

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**(3)**

(ii) Name compound **K**.

Give the total number of peaks in the  $^1\text{H}$  n.m.r. spectrum of **K**.

State the splitting pattern, if any, of the peak for the protons labelled *b*.

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(3)  
(Total 15 marks)

11

A chemist has discovered that the labels have fallen off four bottles each of which contains a different organic liquid. These liquids are known to be propan-2-ol, propanal, hexene and 1-bromopropane.

Suggest a series of test-tube reactions which a chemist could use to confirm the identities of the four compounds. State the reagents used and the observations expected.

(Total 10 marks)