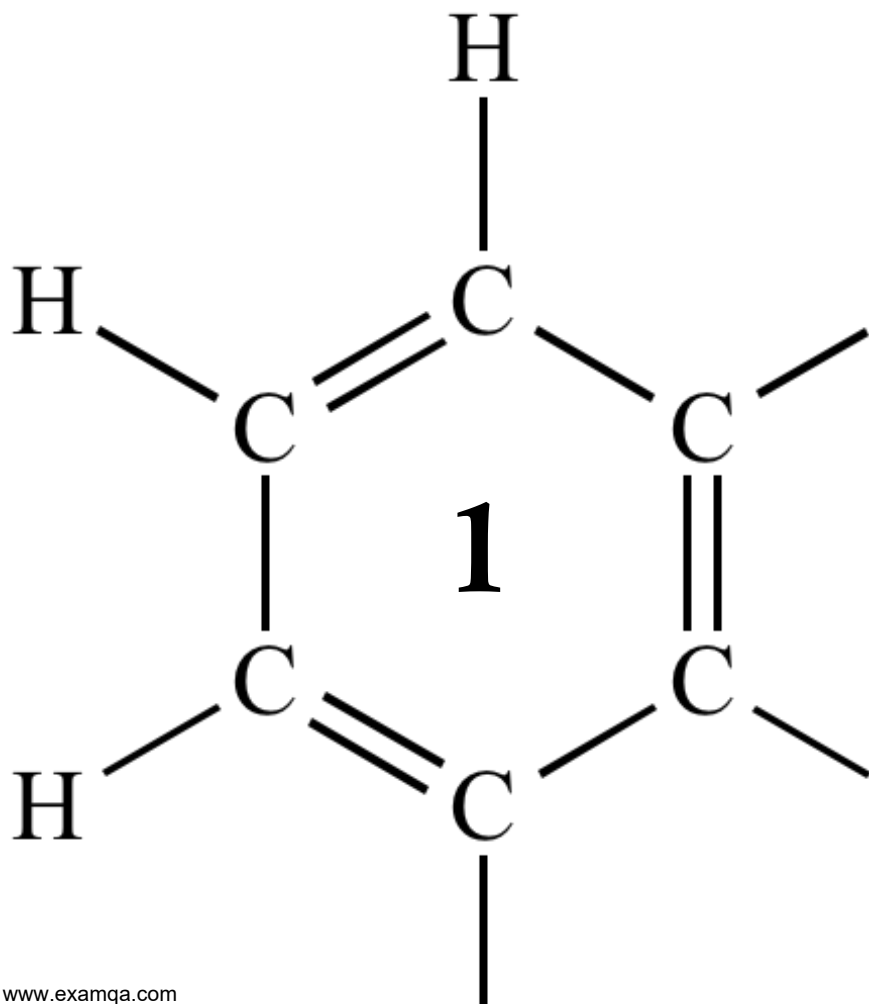


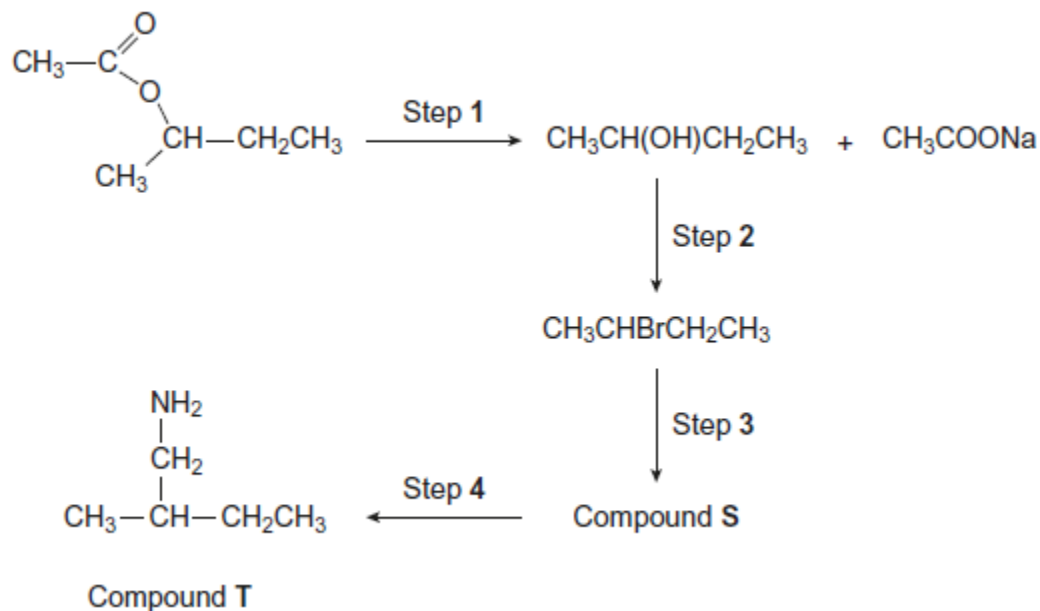
AQA A2 CHEMISTRY
SYNTHESIS ~ ANALYSIS

ORGANIC SYNTHESIS



1

A four-step synthesis of compound **T** is shown.



- (a) Give the reagent and conditions for Step 1.
State how you could obtain a sample of the alcohol from the reaction mixture formed in Step 1.

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(3)

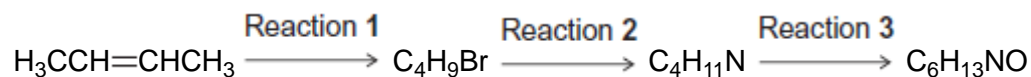
- (b) Draw the structure of compound **S**.
For each of Steps 3 and 4, give a reagent and one condition, other than heat.

(5)

(Total 8 marks)

2

The N-substituted amide C₆H₁₃NO 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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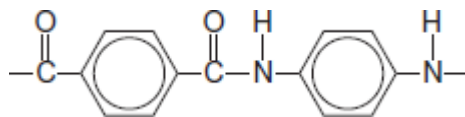
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(Total 9 marks)

3

Kevlar is a polymer used in protective clothing.
The repeating unit within the polymer chains of Kevlar is shown.

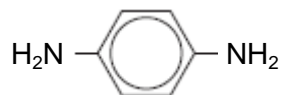


(a) Name the strongest type of interaction between polymer chains of Kevlar.

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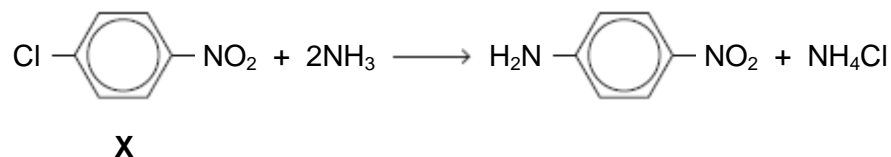
(1)

- (b) One of the monomers used in the synthesis of Kevlar is

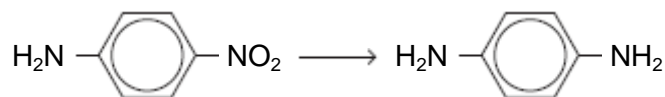


An industrial synthesis of this monomer uses the following two-stage process starting from compound **X**.

Stage 1



Stage 2



- (i) Suggest why the reaction of ammonia with **X** in Stage 1 might be considered unexpected.

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(2)

- (ii) Suggest a combination of reagents for the reaction in Stage 2.

.....

(1)

- (iii) Compound **X** can be produced by nitration of chlorobenzene.

Give the combination of reagents for this nitration of chlorobenzene.

Write an equation or equations to show the formation of a reactive intermediate from these reagents.

Reagents

.....

Equation(s)

.....

(3)

- (iv) Name and outline a mechanism for the formation of **X** from chlorobenzene and the reactive intermediate in part (iii).

Name of mechanism

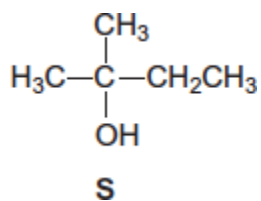
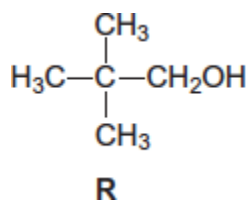
Mechanism

(4)
(Total 11 marks)

- 4** 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)



Reagent

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

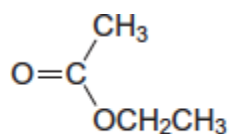
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Observation with **S**.....

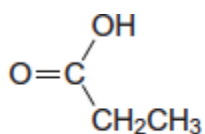
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(3)

(b)



T



U

Reagent

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

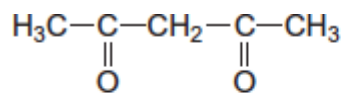
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Observation with **U**.....

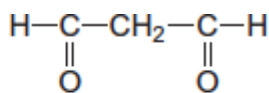
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(3)

(c)



V



W

Reagent

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

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

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(3)
(Total 9 marks)

5

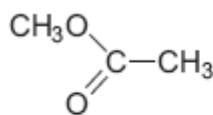
Organic chemists use a variety of methods to distinguish between compounds. These methods include analytical and spectroscopic techniques.

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

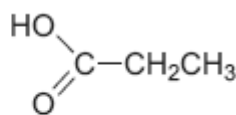
For each pair, suggest a suitable reagent or reagents that could be added separately to each compound in order to distinguish them.

Describe what you would observe with each compound.

(i)



E



F

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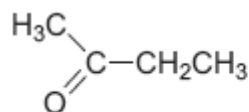
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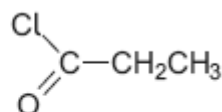
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(3)

(ii)



G



H

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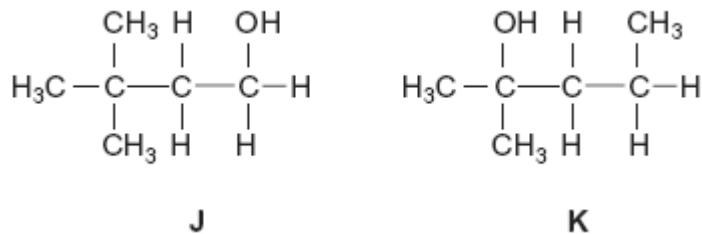
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(3)

(iii)



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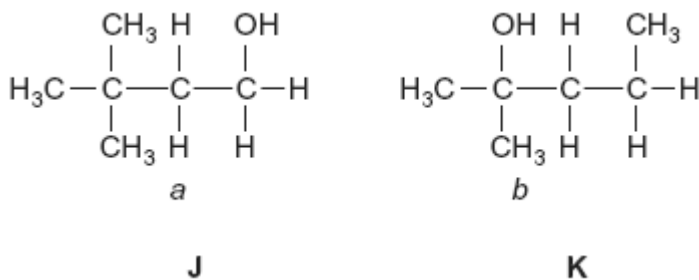
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(3)

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



(i) Name compound **J**.

Give the total number of peaks in the ^1H 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 ^1H 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)

6

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)