19 This question is about benzene.

(a) Over time, the Kekulé and delocalised models have been used to describe the bonding and structure of a benzene molecule.

(i) Describe, in terms of orbital overlap, the similarities and differences between the bonding in the Kekulé model and the delocalised model of benzene.

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..... **[3]**

(ii) Experimental evidence led to the general acceptance of the delocalised model over the Kekulé model.

Describe **two** pieces of evidence to support the delocalised model of benzene.

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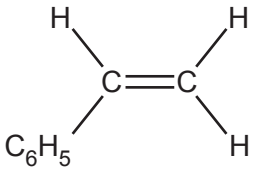
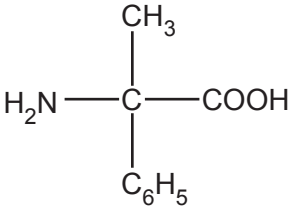
..... **[2]**

(b) Benzene can be used as the starting material for the synthesis of compounds **D** and **E**, shown below.

In the diagrams C_6H_5 is a phenyl group.



compound D



compound E

Compounds **D** and **E** can be converted into polymers.

(i) Draw **two** repeat units of these polymers.

Two repeat units of polymer formed from **D**

Two repeat units of polymer formed from **E**

[3]

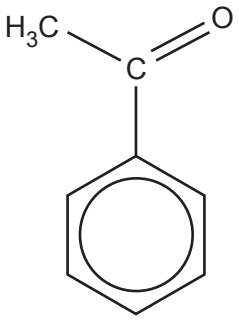
(ii) State the **type** of polymer formed from compounds **D** and **E**.

From compound **D** .....

From compound **E** .....

[1]

(iii) In the synthesis of compounds **D** and **E**, benzene is first reacted with ethanoyl chloride, CH_3COCl, to form phenylethanone, shown below.



phenylethanone

The reaction takes place in the presence of aluminium chloride, $AlCl_3$, which acts as a catalyst.

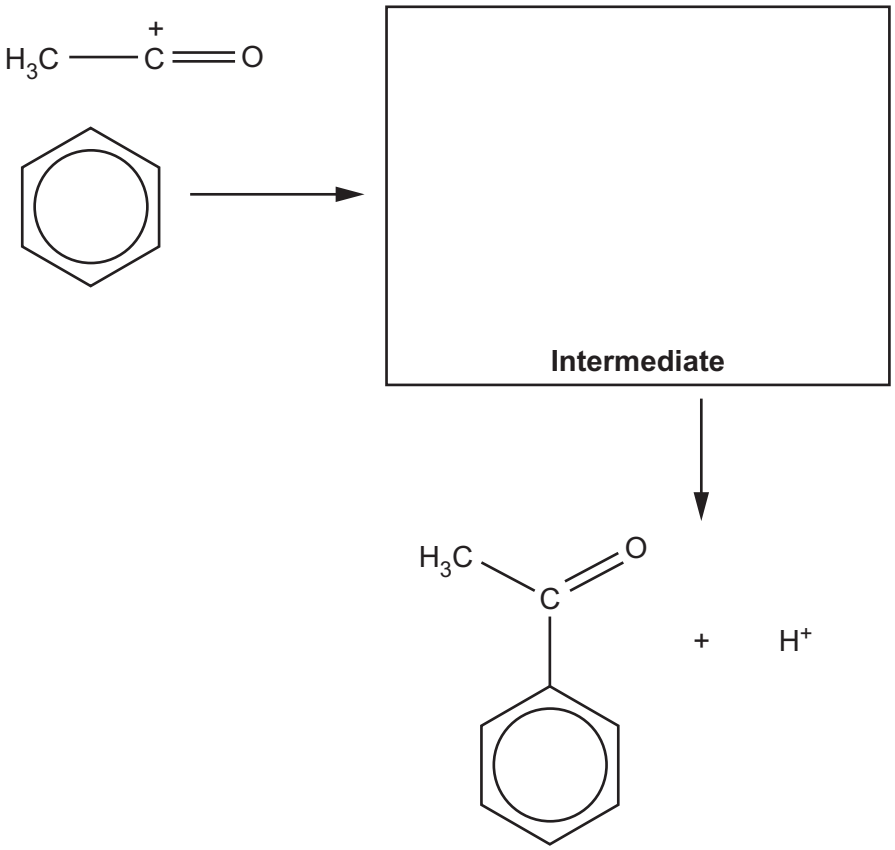
In the mechanism for this reaction,

- ethanoyl chloride first reacts with aluminium chloride to form the $CH_3–C^+=O$ cation
- the $CH_3–C^+=O$ cation then behaves as an electrophile.

Complete the mechanism for the reaction.

Include equations to show the role of the $AlCl_3$ catalyst, relevant curly arrows and the structure of the intermediate.

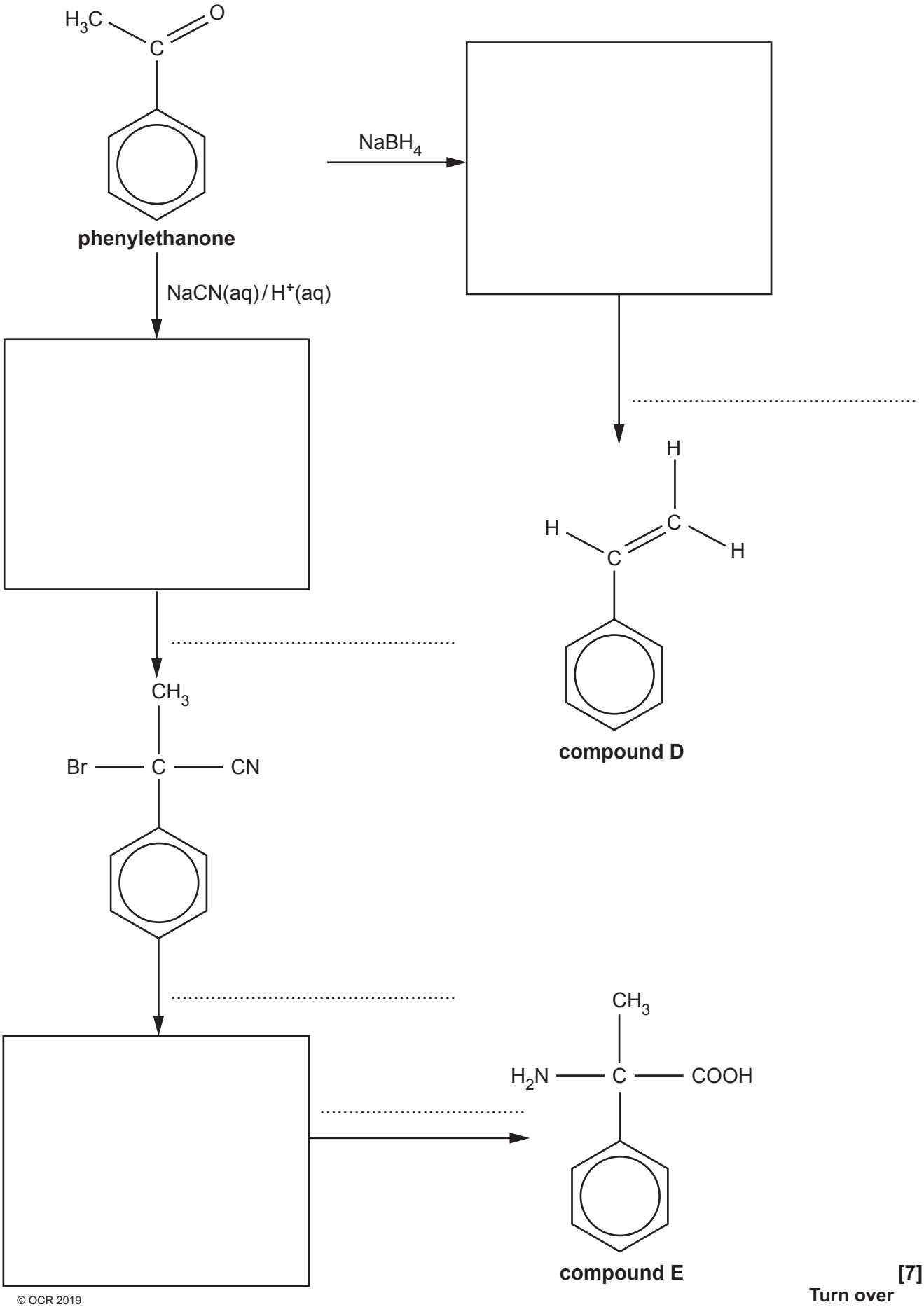
Formation of electrophile .....



Regeneration of catalyst .....

[5]

(iv) Complete the flowchart for the synthesis of compounds **D** and **E** from phenylethanone.



[7]