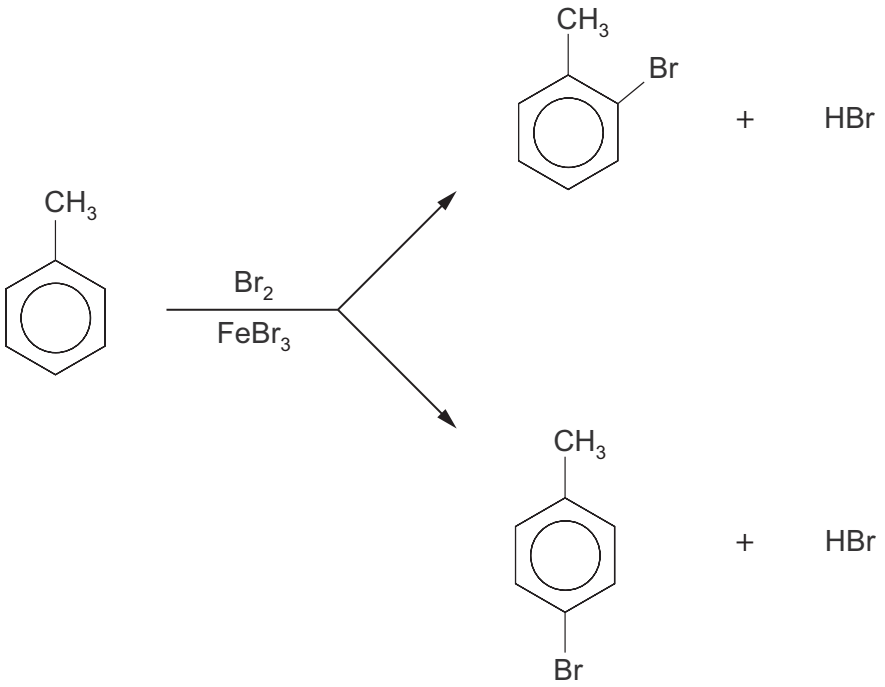
Examiner only

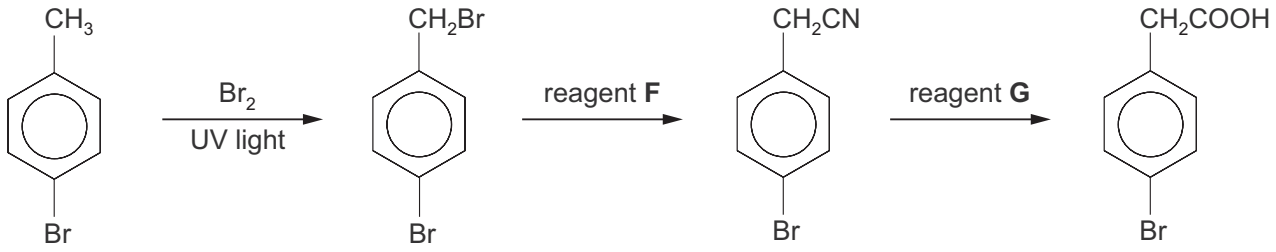
(b) The bromination of methylbenzene using electrophilic substitution gives a mixture of 2-bromomethylbenzene and 4-bromomethylbenzene.



Give the mechanism of the reaction that produces 4-bromomethylbenzene. [3]

Examiner only

(c) A reaction sequence to produce 4-bromophenylethanoic acid is shown below.



(i) The bromination of 4-bromomethylbenzene is a free radical process.

Give the equation for this reaction and then use the equation to calculate the minimum mass of bromine needed to convert 0.15 mol of 4-bromomethylbenzene to 4-bromo-1-(bromomethyl)benzene in the first stage of this reaction sequence.

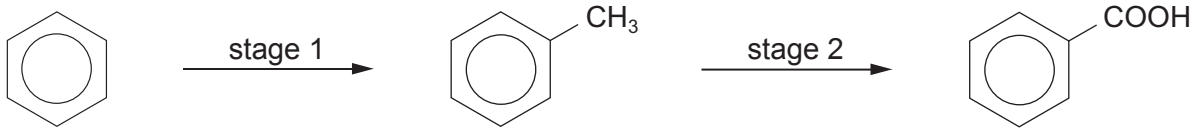
[2]

Mass of bromine = ... g

14

END OF PAPER

5. Benzene can be made into benzenecarboxylic acid (benzoic acid) using a two-stage process.



(a) Stage 1 proceeds using a mechanism that is similar to that of the halogenation of benzene. Describe the reaction in stage 1. You should include

- the reagent(s) needed
- the type of reaction
- the conditions needed
- details of the mechanism. [7]

END OF PAPER

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SECTION A

Answer **all** *questions in the spaces provided.*

1. *(a)* Complete the gaps in the following sentences choosing from the words: [3]

blue **yellow** **higher** **lower**

Each word can be used once, more than once or not at all.

Benzene is a colourless compound that absorbs energy in the ultraviolet region of the electromagnetic spectrum.

Nitrobenzene is a yellow compound that absorbs energy in the ..... region of the visible spectrum.

The absorption of energy for benzene occurs at a ..... energy and at a ..... frequency than for nitrobenzene.

(b) Methylbenzene can be produced from benzene using a Friedel-Crafts reaction.

(i) Give an equation for this reaction. [1]

(ii) State the role of the catalyst used in this reaction, apart from increasing the rate. [1]

.....

.....

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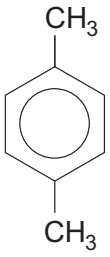
(c) The Friedel-Crafts reaction can also be used to introduce more than one methyl group to the benzene ring giving, for example, 1,4-dimethylbenzene.



The low resolution proton NMR spectrum of this compound shows two peaks with a peak area ratio of 3:2.

Explain how 1,4-dimethylbenzene produces this spectrum. [2]

.....

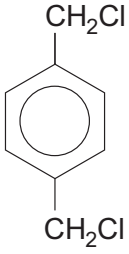
.....

.....

.....

1094 010003

(d) 1,4-Dimethylbenzene reacts with chlorine in a free radical reaction to give the liquid 1,4-di(chloromethyl)benzene.



(i) State the names of **two** methods that could be used to show that a sample of this compound is pure. [2]

Method 1 .....

Method 2 .....

(ii) Give the displayed formula of the compound produced when 1,4-di(chloromethyl)benzene reacts with an excess of aqueous sodium hydroxide. [1]