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**OCR A2 CHEMISTRY UNIT 4 MODULE 1** 

**ASSESSMENT POINT 1** 

**39 MINUTES** 

31 MARKS

## Answer all the questions.

|   |       | e and phenol are used in the chemical and pharmaceutical industry as starting matering more complex aromatic compounds. | als |
|---|-------|---|-----|
| (a)   | Ber   | zene can be nitrated to form nitrobenzene, $\mathrm{C_6H_5NO_2}$ .  |     |
|   | (i)   | State the reagents and conditions needed for the nitration of benzene.  |     |
|   |       |   |     |
|   |       |   | [3] |
|   | (ii)  | An electrophile is formed during the nitration of benzene.  | •   |
|   |       | What is the formula of the electrophile?  |     |
|   |       |   | [1] |
|   | (iii) | Write an equation for the production of the electrophile.   |     |
|   |       |   | [1] |
|   | (iv)  | Describe, with the aid of curly arrows, the mechanism for the nitration of benzene.                                     |     |
|   |       |   |     |
|   |       |   |     |
|   |       |   |     |
|   |       |   |     |
| -   |       |   | [4] |
| (v) 3.9g of benzene were nitrated to give 4.9g of nitrobenzene. |       |   | • • |
|   |       |   |     |
|   |       | Calculate the percentage yield. Give your answer to two significant figures.  |     |

1

| (b) Benzene and phenol both react with bromine. |            |  |  |  |  |
|---|------------|--|--|--|--|
|   | The<br>The | e reaction between benzene and bromine requires a catalyst.<br>e reaction between phenol and bromine does <b>not</b> require a catalyst.   |  |  |  |
|   | (i)        | Identify a suitable catalyst for the reaction between benzene and bromine.   |  |  |  |
|   |            | [1]  |  |  |  |
|   | (ii)       | In this question, one mark is available for the quality of use and organisation of scientific terms.   |  |  |  |
|   |            | <ul> <li>Describe what you would see when phenol reacts with bromine and identify the organic product.</li> <li>Explain the relative ease of bromination of phenol compared with benzene.</li> </ul> |  |  |  |
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|   |            | [6]  |  |  |  |
| •   |            | Quality of Written Communication [1]   |  |  |  |

[Total: 20] Turn over

- 2 Azo dyes can be made from amines and phenois.
  - (a) Describe how you could prepare a sample of an azo dye in the laboratory from phenylamine, phenol and any other reagents.

Include in your answer:

- · essential reagents and conditions for each stage;
- the displayed formula of the organic products in each stage.

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| [5]  |
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(b) Resorcinol Yellow, E103, is an azo dye which was used as a colouring agent in food.

The structure of E103 is shown below.

E103

- (i) On the structure above, draw a circle around the functional group that identifies E103 as an azo dye. [1]
- (ii) How many carbon and hydrogen atoms are there in the structure of E103 shown above?

carbon atoms, .....

hydrogen atoms. .....

| (iii) | In the boxes below, draw the structure used to make <b>E103</b> by the method de | es of a phenol and an amine that could have been escribed in (a). |
|-------|--|---|
|       |  |   |
|       | •  |   |
|       |  |   |
| ·     |  |   |
|       | phenol   | amine   |

[2]

(c) E103 can also be used as an acid-base indicator. At high pH, E103 turns red.

Suggest the structure of E103 at high pH.

[1]

[Total: 11]