

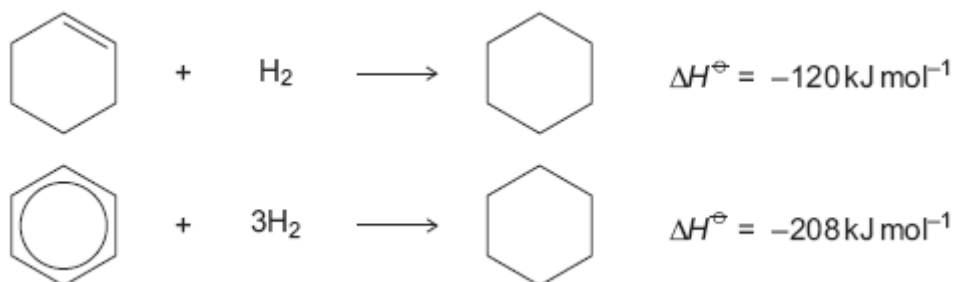


Aromatic Chemistry Test



Answer ALL Questions. Max 50 marks. To Pass the Rates of Reaction & Chemical Equilibrium Test you will need to achieve a score of greater than 70%.

1. The hydrocarbons benzene and cyclohexene are both unsaturated compounds. Benzene normally undergoes substitution reactions, but cyclohexene normally undergoes addition reactions.
 - (a) The molecule cyclohexatriene does not exist and is described as hypothetical. Use the following data to state and explain the stability of benzene compared with the hypothetical cyclohexatriene.



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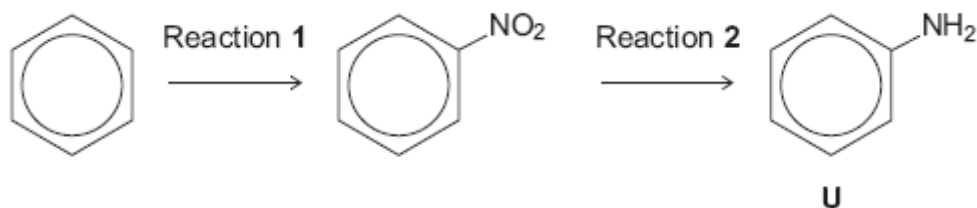
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(4)

- (b) Benzene can be converted into amine **U** by the two-step synthesis shown below.



The mechanism of Reaction **1** involves attack by an electrophile.

Give the reagents used to produce the electrophile needed in Reaction **1**.

Write an equation showing the formation of this electrophile.

Outline a mechanism for the reaction of this electrophile with benzene.

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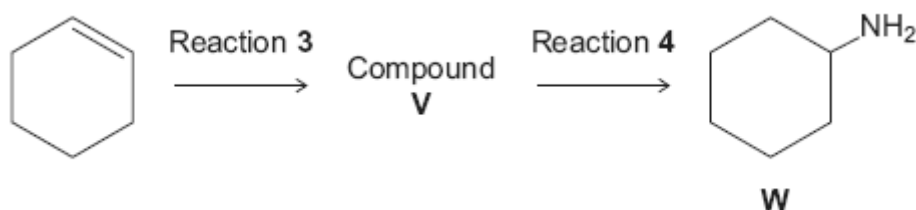
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(6)

- (c) Cyclohexene can be converted into amine **W** by the two-step synthesis shown below.



Suggest an identity for compound **V**.

For Reaction **3**, give the reagent used and name the mechanism.

For Reaction **4**, give the reagent and condition used and name the mechanism.

Equations and mechanisms with curly arrows are **not** required.

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(6)

(d) Explain why amine **U** is a weaker base than amine **W**.

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(3)

(Total 19 marks)

2. Give a reagent that could be used in a test-tube reaction to distinguish between benzene and cyclohexene.
Describe what you would see when the reagent is added to each compound and the test tube is shaken.

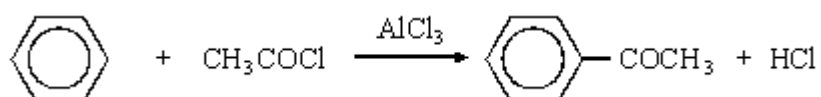
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(3)

(Total 3 marks)

3. An equation for the formation of phenylethanone is shown below. In this reaction a reactive intermediate is formed from ethanoyl chloride. This intermediate then reacts with benzene.



- (i) Give the formula of the reactive intermediate.

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- (ii) Outline a mechanism for the reaction of this intermediate with benzene to form phenylethanone.

(4)

(Total 4 marks)

4. (a) Outline a mechanism for the formation of ethylamine from bromoethane. State why the ethylamine formed is contaminated with other amines. Suggest how the reaction conditions could be modified to minimise this contamination.

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(6)

- (b) Suggest one reason why phenylamine cannot be prepared from bromobenzene in a similar way. Outline a synthesis of phenylamine from benzene. In your answer you should give reagents and conditions for each step, but equations and mechanisms are not required.

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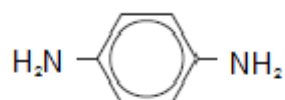
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(5)**(Total 11 marks)**

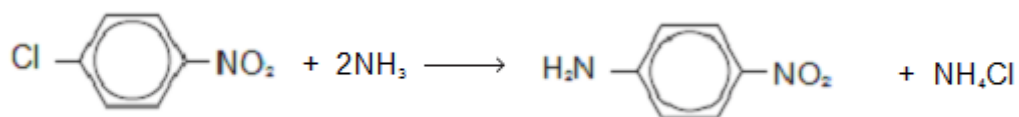
- 5.** Kevlar is a polymer used in protective clothing.

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



X

Stage 2



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

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(2)

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

.....

(1)

- (c) 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)

- (d) 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 10 marks)

6. Which one of the following does **not** contain any delocalised electrons?

- A poly(propene)
- B benzene
- C graphite
- D sodium

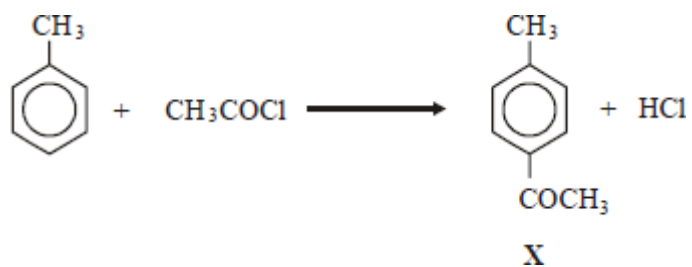
(Total 1 mark)

7. The relative molecular mass (M_r) of benzene-1,4-dicarboxylic acid is

- A 164
- B 166
- C 168
- C 170

(Total 1 mark)

8. Ethanoyl chloride reacts with methylbenzene forming compound **X** according to the equation below.



If the experimental yield is 40.0%, the mass in grams of **X** ($M_r = 134.0$) formed from 18.4 g of methylbenzene ($M_r = 92.0$) is

- A** 26.8
- B** 16.1
- C** 10.7
- D** 7.4

(Total 1 mark)