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CHEMISTRY

INORGANIC CHEMISTRY II

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|-----------------|--------------------|
| Level & Board | AQA (A-LEVEL) |
| TOPIC: | AROMATIC CHEMISTRY |
| PAPER TYPE: | QUESTION PAPER - 2 |
| TOTAL QUESTIONS | 10 |
| TOTAL MARKS | 43 |

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Aromatic Chemistry - 2

1. This question is about nitrobenzenes.

(a) Nitrobenzene reacts when heated with a mixture of concentrated nitric acid and concentrated sulfuric acid to form a mixture of three isomeric dinitrobenzenes.

Write an equation for the reaction of concentrated nitric acid with concentrated sulfuric acid to form the species that reacts with nitrobenzene.

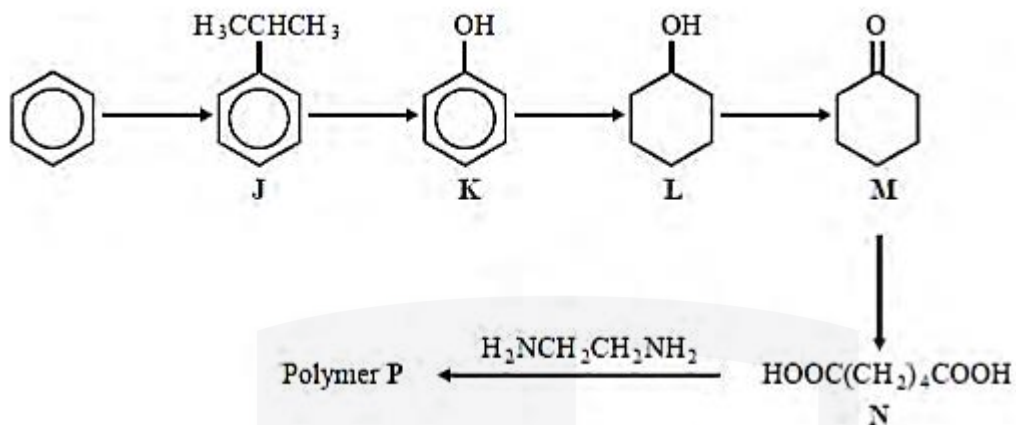
(1)

(b) Name and outline a mechanism for the reaction of this species with nitrobenzene to form 1,3-dinitrobenzene.

(4)

2. This question is about the following reaction scheme which shows the preparation of polymer P.

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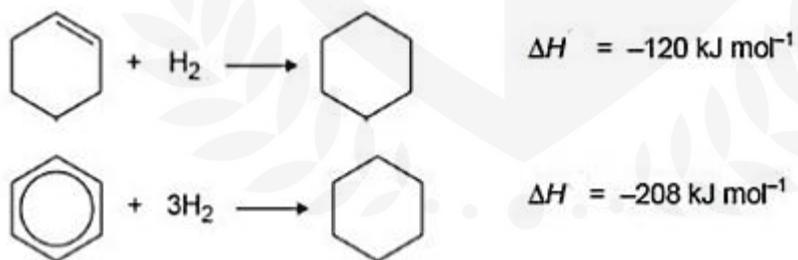


If 1.0 kg of benzene gave 0.98 kg of J, the percentage yield of J was

- A. 64
- B. 66
- C. 68
- D. 70

(1)

3. Data about the hydrogenation of cyclohexene and of benzene are given.



(a) Explain the bonding in and the shape of a benzene molecule.

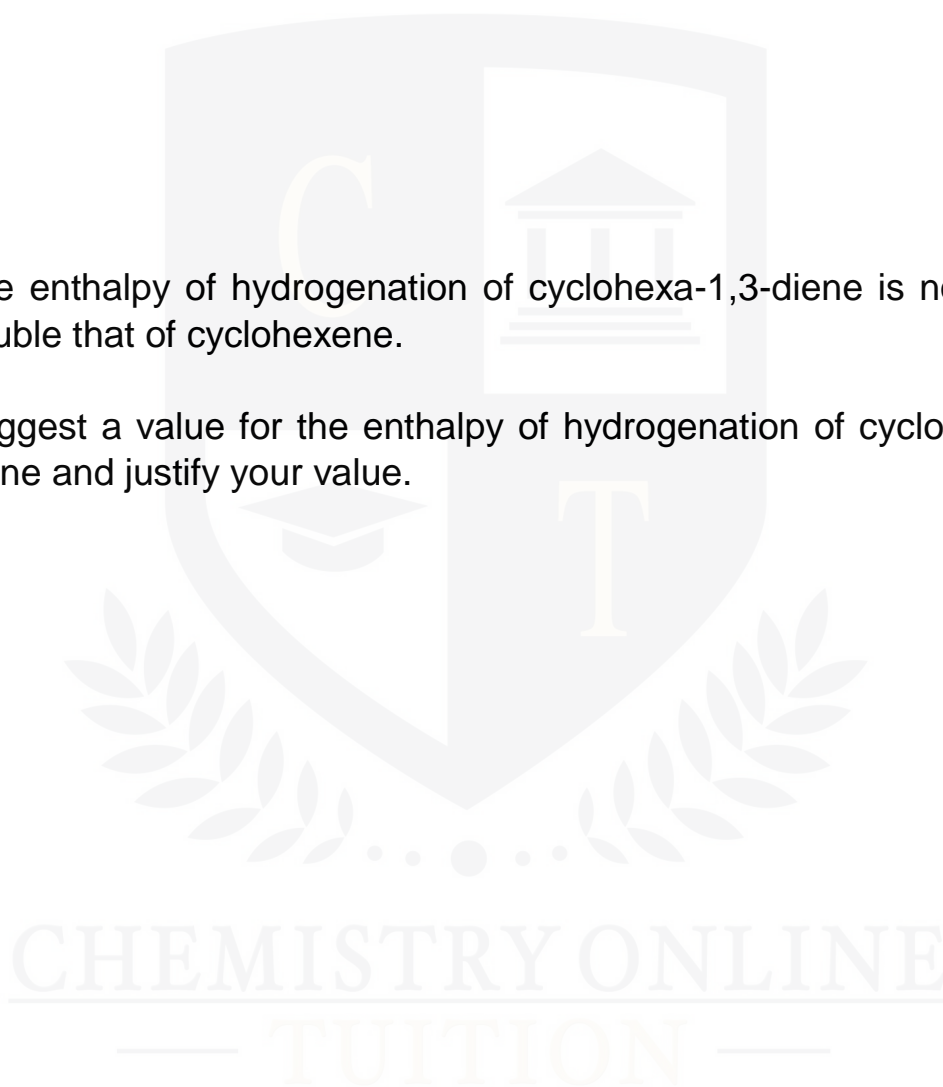
Compare the stability of benzene with that of the hypothetical cyclohexa-1,3,5-triene molecule.

Use the data in your answer.

(6)

(b) The enthalpy of hydrogenation of cyclohexa-1,3-diene is not exactly double that of cyclohexene.

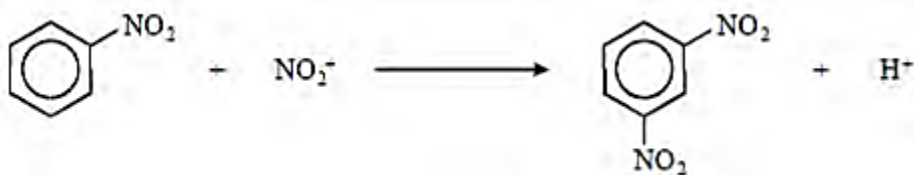
Suggest a value for the enthalpy of hydrogenation of cyclohexa-1,3-diene and justify your value.



(3)

4. 1,3-dinitrobenzene can be prepared by heating nitrobenzene with a mixture of fuming nitric acid and concentrated sulphuric acid.

The reaction can be represented by the following equation.



If the yield of the reaction is 55%, the mass of 1,3-dinitrobenzene produced from 12.30 g of nitrobenzene is

- A. 16.90 g
- B. 16.80 g
- C. 9.30 g
- D. 9.24 g

(1)

5. Write an equation for the reaction between an excess of cyclohexylamine and ethanoyl chloride.

Name and outline the mechanism for this reaction.
You may use RNH_2 to represent cyclohexylamine.

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(6)

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

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

(1)

7. Methylamine is a weak Bronsted-Lowry base and can be used in aqueous solution with one other substance to prepare a basic buffer.

(a) Explain the term Bronsted-Lowry base and write an equation for the reaction of methylamine with water to produce an alkaline solution.

(2)

(b) Suggest a substance that could be added to aqueous methylamine to produce a basic buffer.

(2)

(c) Explain how the buffer solution is able to resist a change in pH when a small amount of sodium hydroxide is added.

(2)

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(d) Explain why methylamine is a stronger base than ammonia.

(2)

(e) A cation is formed when methylamine reacts with a large excess of bromoethane.

Name the mechanism involved in the reaction and draw the structure of the cation formed.

(4)

8. The nitration of benzene uses a nitrating mixture of concentrated nitric acid and concentrated sulfuric acid.

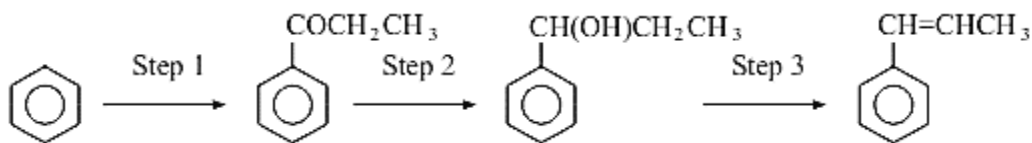


Which statement is correct?

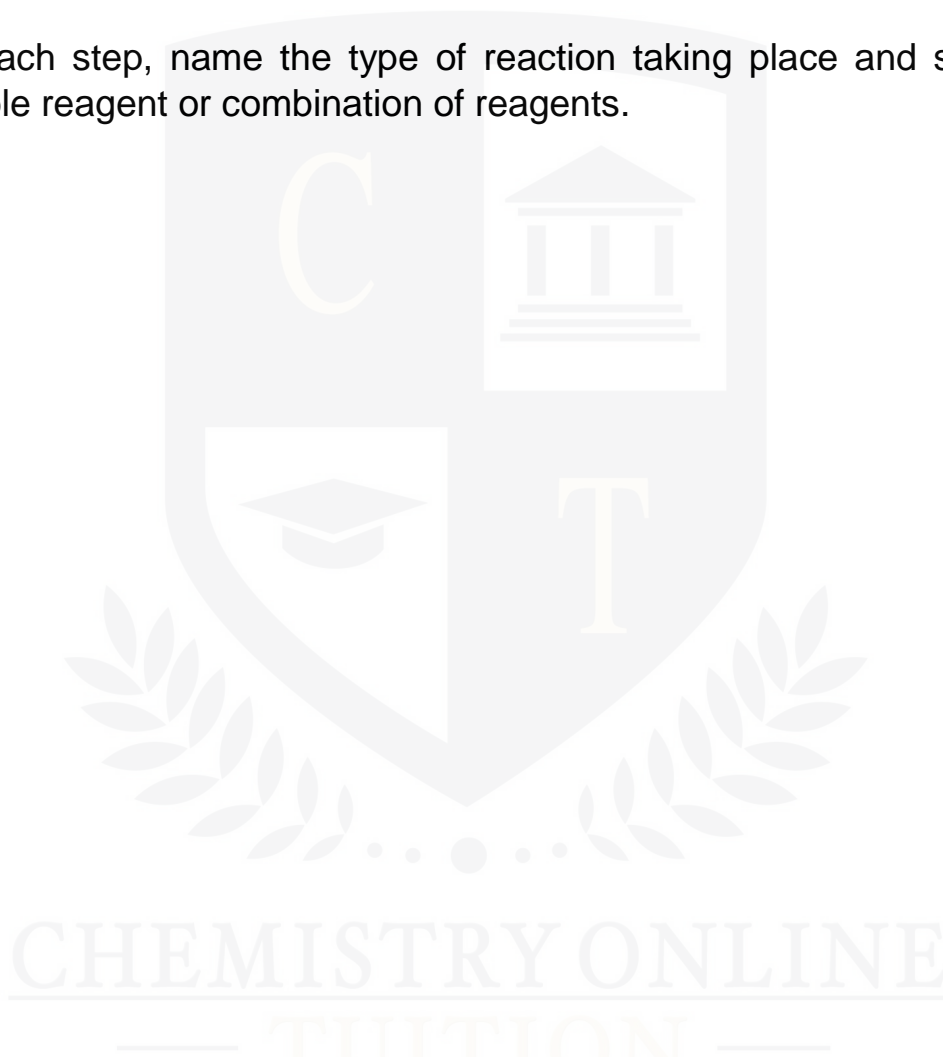
- A.** HNO_3 acts as a base.
- B.** HNO_3 acts as a catalyst.
- C.** HNO_3 acts as an electrophile.
- D.** HNO_3 acts as a reducing agent.

(1)

9. Consider the following reaction sequence.



For each step, name the type of reaction taking place and suggest a suitable reagent or combination of reagents.

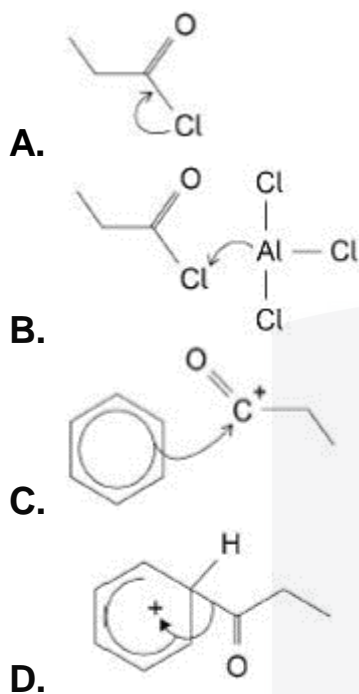


(6)

10. The reaction between propanoyl chloride and benzene is an example of acylation.

Which is a correct representation of part of the mechanism of this reaction?

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(1)

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