

“I’ve been substituted”

Y13 UNIT 4 TEST 4

4.6 AROMATIC CHEMISTRY

4.7 AMINES

\r}ylvfz†^tzt2l

Answer all questions

Total 53 marks

Name:.....

Mark for Section A..... /43

Mark for Section B..... /11

Total: /53

Grade.....

SECTION A

1. Cumene, $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)_2$, is the major organic product obtained when benzene and propene react together in the presence of aluminium chloride and hydrogen chloride.

- (a) (i) Write an equation showing how a reactive species is formed from propene, aluminium chloride and hydrogen chloride.

.....
.....

- (ii) Name the type of substitution reaction which follows the formation of the reactive species above and outline a mechanism for this substitution.

Type of substitution

Mechanism

(6)

- (b) Explain why propylbenzene, $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{CH}_3$, is obtained only as a minor by-product in the above reaction.

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.....
.....
.....

(3)

- (c) Give the structure of a compound other than propene which could be used to make cumene from benzene in the presence of aluminium chloride.

.....

(1)

(Total 10 marks)

2. (a) Estimate a value for the enthalpy of hydrogenation of the hypothetical molecule cyclohexa-1,3,5-triene, given that the enthalpy of hydrogenation of cyclohexene is $-119.6 \text{ kJ mol}^{-1}$.

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.....

(2)

- (b) The enthalpy of hydrogenation of benzene is -208 kJ mol^{-1} . Explain why this value differs from that you have obtained for cyclohexa-1,3,5-triene.

.....
.....
.....

(2)

(Total 4 marks)

3. (a) Explain why ethylamine is a Brønsted-Lowry base.

.....
.....

(2)

- (b) Why is phenylamine a weaker base than ethylamine?

.....
.....

(2)

- (c) Ethylamine can be prepared from the reaction between bromoethane and ammonia

- (i) Name the type of reaction taking place.

.....

- (ii) Give the structures of **three** other organic substitution products which can be obtained from the reaction between bromoethane and ammonia.

Compound 1

Compound 2

Compound 3

(4)

- (d) Write an equation for the conversion of ethanenitrile into ethylamine and give one reason why this method of synthesis is superior to that in part (c).

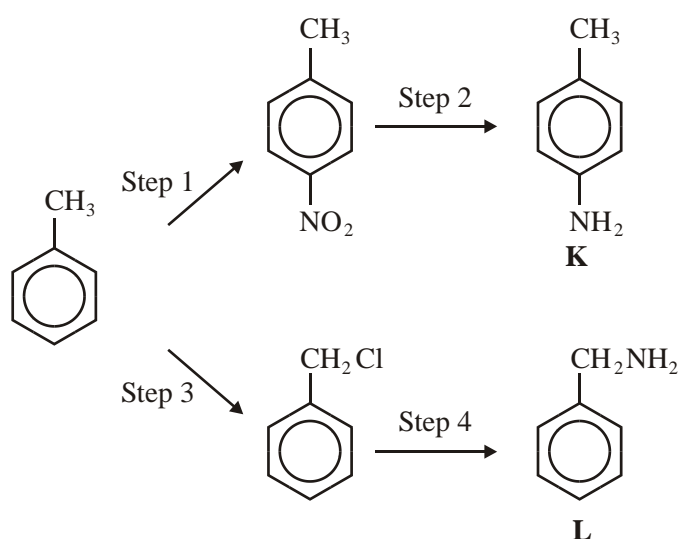
Equation

Reason

.....

(2)
(Total 10 marks)

4. The following reaction scheme shows the formation of two amines, **K** and **L**, from methylbenzene.



- (a) (i) Give the reagents needed to carry out Step 1. Write an equation for the formation from these reagents of the inorganic species which reacts with methylbenzene.

Reagents

.....

Equation

- (ii) Name and outline a mechanism for the reaction between this inorganic species and methylbenzene.

Name of mechanism

Mechanism

(7)

- (b) Give a suitable reagent or combination of reagents for Step 2.

.....

(1)

- (c) (i) Give the reagent for Step 4 and state a condition to ensure that the primary amine is the major product.

Reagent

Condition

- (ii) Name and outline a mechanism for Step 4.

Name of mechanism

Mechanism

(7)

- (d) Explain why amine **K** is a weaker base than ammonia.

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.....

.....

(2)

- (e) Draw the structure of the organic compound formed when a large excess of bromomethane reacts with amine **L**.

(1)

- (f) Draw the structure of the organic compound formed when ethanoyl chloride reacts with amine **L** in an addition–elimination reaction.

(1)

(Total 19 marks)

SECTION B

- (6)

- (5)

(Total 11 marks)

[illegible]