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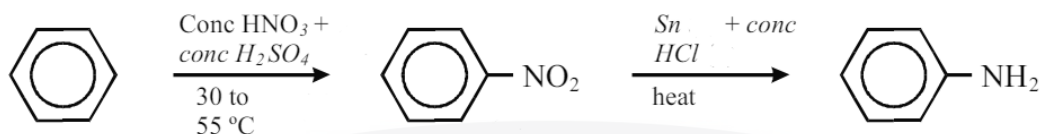
ORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	ORGANIC SYNTHESIS
PAPER TYPE:	SOLUTION - 1
TOTAL QUESTIONS	10
TOTAL MARKS	/27

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Organic Synthesis - I

1.

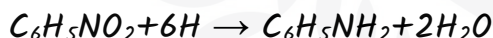


Nitration of Benzene:

- **Reagents:** Concentrated nitric acid (HNO_3) and concentrated sulfuric acid (H_2SO_4).
- **Conditions:** The mixture is heated to around 50°C .
- **Reaction:** Benzene reacts with the nitrating mixture to form nitrobenzene.
- **Equation:** $\text{C}_6\text{H}_6 + \text{HNO}_3 \rightarrow \text{C}_6\text{H}_5\text{NO}_2 + \text{H}_2\text{O}$

Reduction of Nitrobenzene to Phenylamine:

- **Reagents:** Tin (Sn) and concentrated hydrochloric acid (HCl)
- **Conditions:** Heat under reflux.
- **Reaction:** Nitrobenzene is reduced to phenylamine.
- **Equation:**



The tin and hydrochloric acid first produce hydrogen in situ, which reduces the nitro group to an amino group.

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(6)

2. B

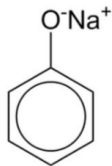
(1)

3.

(a)

If phenol is reacted with sodium hydroxide solution:

Organic product: $\text{C}_6\text{H}_5\text{O}^- \text{Na}^+$

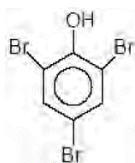


(1)

(b)

If phenol is reacted with Aqueous bromine:

Organic product:

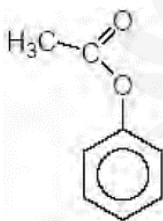


(1)

(c)

If phenol is reacted with Ethanoyl chloride:

Organic product:



(1)

4. D

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(1)

5.

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(a)

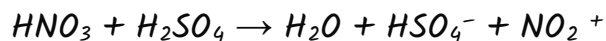
Benzene to nitrobenzene (**Nitration of Benzene**):

Reagents: Concentrated nitric acid (HNO_3) and concentrated sulfuric acid (H_2SO_4).

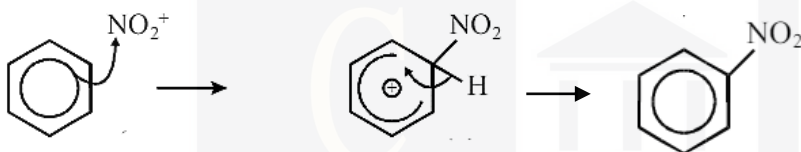
Conditions: The mixture is heated to around 50°C .

(2)

(b)

Formation of NO_2^+ 

Mechanism:



(4)

(c)

Name of mechanism:

Electrophilic substitution

(1)

6. B

(1)

7.

(a)

Benzene is produced from:

Petroleum (Crude Oil)

Coal

These natural resources are processed to extract benzene through methods such as catalytic reforming (for petroleum) and coking (for coal).

(1)

(b)

Methoxybenzene (anisole) is used in schools and colleges instead of benzene because:

Non-Carcinogenic:

Methoxybenzene is not a known carcinogen, unlike benzene.

Lower Toxicity:

It is less toxic and not a cumulative poison, making it safer for repeated exposure.

Legal Restrictions:

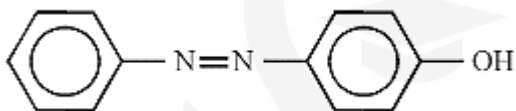
The use of benzene in schools is illegal due to its high toxicity and carcinogenic properties.

8. D

(1)

9.

(1)



To synthesize 4-hydroxyazobenzene from phenylamine and phenol, the process involves diazotization followed by a coupling reaction.

Diazotization of Phenylamine:

Intermediate:

Benzene diazonium chloride ($C_6H_5N_2^+Cl^-$) or $C_6H_5N_2^+ \equiv N^-$

Reagents: Sodium nitrite ($NaNO_2$) and hydrochloric acid (HCl)

Conditions: $0-10^\circ C$

Reaction: $C_6H_5NH_2 + HCl + NaNO_2 \rightarrow C_6H_5N_2^+Cl^- + NaCl + H_2O$

Coupling with Phenol

Reagents: Alkaline solution of phenol (phenol dissolved in sodium hydroxide, $NaOH$)

Conditions: $0-10^\circ C$

Reaction:

$C_6H_5N_2^+Cl^- + C_6H_5OH + NaOH \rightarrow C_6H_5N=NC_6H_4OH + NaCl + H_2O$

(4)

10. D

(1)

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