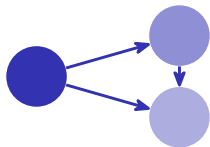


Organic Synthesis

A-Level Chemistry ■ Topic 36

A-Level Chemistry



What we will cover

1 Identifying functional groups

2 The A Level reaction map

3 Planning a route

add this	you see	functional group
bromine water (no catalyst)	white precipitate	phenol or phenylamine
cold water	violent, HCl fumes	acyl chloride
neutral FeCl_3	purple colour	phenol

tests point to a group

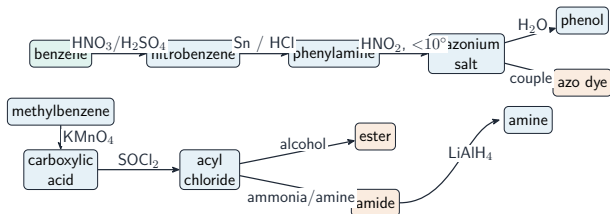
Identifying functional groups

add this	you see	functional group
bromine water (no catalyst)	white precipitate	phenol or phenylamine
cold water	violent, HCl fumes	acyl chloride
neutral FeCl_3	purple colour	phenol

A Level identification tests:

- bromine water, no catalyst, white ppt → phenol or phenylamine
- violent with cold water, HCl fumes → **acyl chloride** 酰氯
- purple with neutral FeCl_3 → **phenol** 苯酚

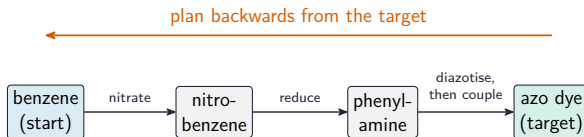
The A Level reaction map



The new chains link up:

- aromatic: benzene $\rightarrow$ nitrobenzene $\rightarrow$ phenylamine $\rightarrow$ diazonium $\rightarrow$ phenol / azo dye
- acyl: acid $\rightarrow$ acyl chloride $\rightarrow$ ester / amide

Planning a route



To devise a **synthetic route** 合成路线, work **backwards** from the target.

State the **reaction type** 反应类型 for each step (substitution, addition–elimination, oxidation...) and watch for **by-products** 副产物.

Worked example – benzene to phenylamine

Suggest a route from benzene to phenylamine, with reagents and conditions for each step.

- There is **no way** to put NH_2 straight onto the ring – it takes two steps.
- Step 1 **nitrate**: concentrated HNO_3 + concentrated H_2SO_4 , $55^\circ\text{C} \Rightarrow$ nitrobenzene.
- Step 2 **reduce**: Sn + concentrated HCl , reflux; then add **excess** NaOH .
- The reduction gives the salt $\text{C}_6\text{H}_5\text{NH}_3^+$ first; the NaOH frees **phenylamine**.

Benzene $\rightarrow \text{NH}_2$ is *always* nitrate-then-reduce. Then phenylamine + HNO_2 at 5°C gives the diazonium ion for azo dyes.

Topic 36 – key takeaways

1 Tests

each reagent identifies a group

2 Aromatic chain

benzene to phenylamine to
phenol/azo dye

3 Acyl chain

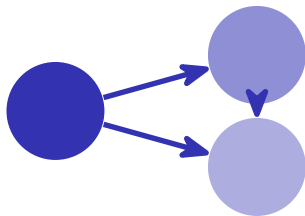
acid to acyl chloride to
ester/amide

4 Plan backwards

from the target; state reagent &
type

Check yourself

- 1 What gives a purple colour with neutral FeCl_3 ?
- 2 Benzene to phenylamine takes how many steps?
- 3 Which way should you plan a synthesis?
- 4 What converts an acid to an acyl chloride?



Answers 1. a phenol 2. two 3. backwards from the target 4. SOCl_2 or PCl_5