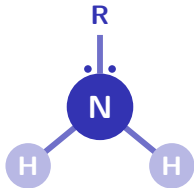


Nitrogen Compounds

A-Level Chemistry ■ Topic 34

A-Level Chemistry



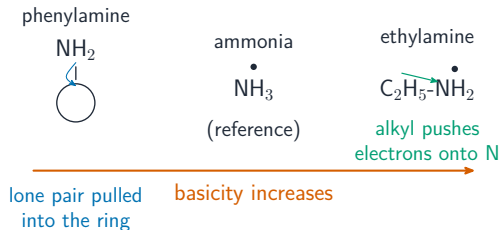
What we will cover

- 1 Amines & basicity
- 2 Phenylamine & azo dyes
- 3 Amides
- 4 Zwitterions
- 5 Peptide bonds
- 6 Electrophoresis



azo compounds are dyes

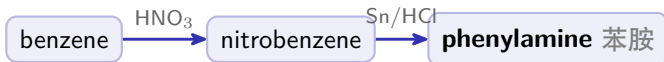
Amines and basicity



An **amine** 胺's **basicity** 碱性 comes from its N lone pair accepting H^+ .

Order: **phenylamine** 苯胺 < ammonia < ethylamine. An alkyl group pushes electrons in; a ring pulls the lone pair away.

Phenylamine and azo dyes



A **diazonium salt** 重氮盐 (made below 10 °C) couples with phenol to form a brightly coloured **azo compound** 偶氮化合物 (–N=N–) – used as a **dye** 染料.

Amides

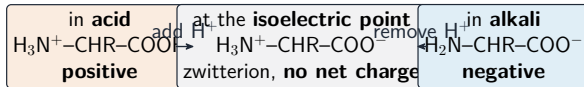


An **amide** 酰胺 is made from ammonia or an amine with an acyl chloride.

- **hydrolysis** 水解 → the acid + the amine
- **reduction** 还原 (LiAlH_4) → an amine

It is a much **weaker base** than an amine (lone pair delocalised onto $\text{C}=\text{O}$).

Zwitterions



An **amino acid** 氨基酸 has a basic $-\text{NH}_2$ & an acidic $-\text{COOH}$.

It forms a **zwitterion** 两性离子 (both charges, no net). It is positive in acid, negative in alkali, and neutral at the **isoelectric point** 等电点.

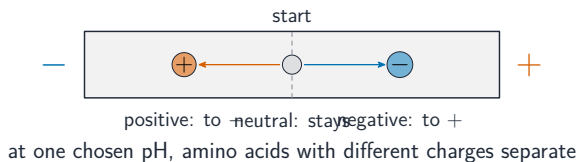
Peptide bonds



the **peptide bond** (an amide link)

Two amino acids **condense** 缩合: the $-\text{OH}$ and $-\text{H}$ leave as water, forming a **peptide bond** 肽键 (an amide link). Two give a **dipeptide** 二肽, three a tripeptide.

Electrophoresis



In **electrophoresis** 电泳 at a chosen pH:

- positive amino acid → the - electrode
- negative → the + electrode
- neutral (isoelectric) → stays put

So they separate.

Worked example – why is phenylamine a weak base?

Explain why phenylamine is a much weaker base than ethylamine.

- Base strength depends on how **available** the N lone pair is to accept H^+ .
- In phenylamine the lone pair **overlaps with the ring's delocalised π system**.
- It is drawn **into** the ring, so it is far less available.
- In ethylamine the alkyl group pushes density **onto** N – the opposite effect.
- Order: **ethylamine > ammonia > phenylamine**.

Lone pair **delocalised into a ring** $\Rightarrow$ weak base.
Lone pair **pushed at by alkyl groups** $\Rightarrow$ strong base.

Topic 34 – key takeaways

1

Basicity

phenylamine < ammonia <
ethylamine

2

Azo dyes

diazonium + phenol $\rightarrow$ coloured
 $-\text{N}=\text{N}-$

3

Amino acids

zwitterion; isoelectric point

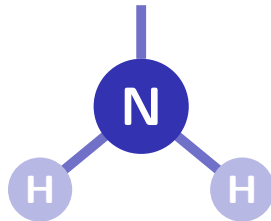
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Peptides

condense to form peptide bonds;
electrophoresis

Check yourself

- 1 Which is the strongest base of the three amines?
- 2 What group makes azo dyes coloured?
- 3 What is an amino acid at its isoelectric point?
- 4 What bond joins two amino acids?



Answers 1. ethylamine 2. the azo group —N=N— 3. a neutral zwitterion 4. a peptide bond