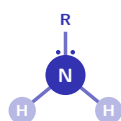


Nitrogen Compounds

A-Level Chemistry • Topic 34

A-Level Chemistry



Nitrogen Compounds

What we will cover

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



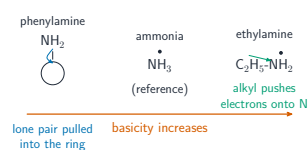
azo compounds are dyes

1 Amines

Nitrogen Compounds

Amines

Amines and basicity



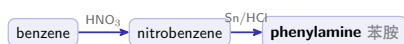
An **amine** 胺's **basicity** 碱性 comes from its N lone pair accepting H^+ .

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

Nitrogen Compounds

Amines

Phenylamine and azo dyes



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

Nitrogen Compounds

Amines

Amides



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

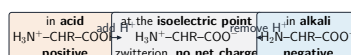
- **hydrolysis** 水解 $\rightarrow$ the acid + the amine
- **reduction** 还原 ($LiAlH_4$) $\rightarrow$ an amine

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

2 Amino acids

Nitrogen Compounds
└ Amino acids

Zwitterions



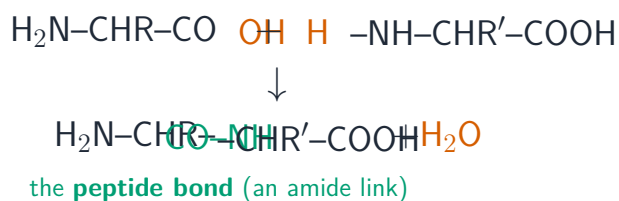
An **amino acid** 氨基酸 has a basic $-\text{NH}_2$ & an acidic $-\text{COOH}$.

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.

Nitrogen Compounds
└ Amino acids

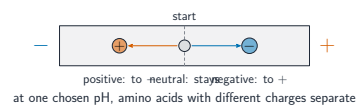
Peptide bonds

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.



Nitrogen Compounds
└ Amino acids

Electrophoresis



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

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

So they separate.

3 Recap

Nitrogen Compounds
└ Recap

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** ⇒ weak base.
Lone pair **pushed at by alkyl groups** ⇒ strong base.

Topic 34 – key takeaways

1 Basicity

phenylamine < ammonia < ethylamine

3 Amino acids

zwitterion; isoelectric point

2 Azo dyes

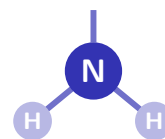
diazonium + phenol → coloured
 —N=N—

4 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