A-LEVEL CHEMISTRY • HOLIDAY HOMEWORK 假期作业

12 Nitrogen and its compounds – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)		
nitrogen	氮			
ammonia	氨			
lone pair	孤对电子			
triple bond	三键			
bond energy	键能			
non-polar	非极性			
base	碱			
proton	质子			
coordinate bond	配位键			
ammonium ion	铵离子			

Recall

At IGCSE you learned that air is mostly **nitrogen** 氮, and you met **ammonia** 氨 (NH_3). Now we explain why nitrogen barely reacts, and why ammonia is a base.

- Nitrogen gas is N_2 — two atoms joined by a strong bond.
- Ammonia has a **lone pair** 孤对电子 that makes it a base.

Nothing here is harder than IGCSE — it just adds the reasons.

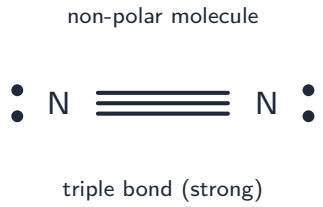
New ideas

Read these first, then do the Practice.

1 Why nitrogen is unreactive

N_2 makes up most of the air but reacts with very little, for two reasons:

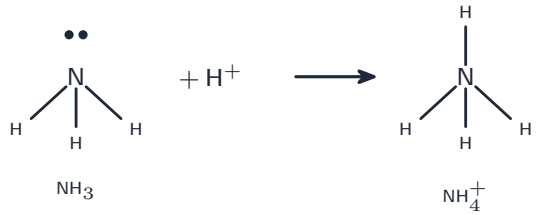
- the atoms are joined by a **triple bond** 三键 with a very high **bond energy** 键能 — hard to break.
- the molecule is symmetrical and **non-polar** 非极性, so nothing attracts other molecules to it.



2 Ammonia as a base

Ammonia is a **base** 碱 because the **lone pair** 孤对电子 on its nitrogen can accept a **proton** 质子 (H^+):

$$NH_3 + H^+ \rightarrow NH_4^+$$



The new bond is a **coordinate bond** 配位键 (both electrons came from nitrogen). The **ammonium ion** 铵离子 NH_4^+ has four identical N–H bonds.

■ 3 Test for an ammonium salt

Warm an ammonium salt with sodium hydroxide to push out ammonia gas:

$$NH_4Cl + NaOH \rightarrow NaCl + NH_3 + H_2O$$

The sharp smell, and **damp red litmus turning blue**, confirms an ammonium salt.

Watch out: ammonia is a base because of its lone pair, which accepts an H^+ to form a coordinate bond. Once the ammonium ion has formed, all four N–H bonds are identical — you cannot tell the coordinate one apart.

Practice

Try these in order.

12.1 State the two reasons nitrogen gas is unreactive. [2]

12.2 What feature of ammonia allows it to act as a base? [1]

12.3 Write the equation for ammonia accepting a proton. [1]

12.4 The fourth N–H bond in the ammonium ion is a coordinate bond. Explain what this means. [2]

12.5 Describe the test for an ammonium salt and its result. [2]

12.6 Challenge. Ammonia (NH_3) can act as a base, but the ammonium ion (NH_4^+) cannot. Explain why, in terms of the lone pair. [2]