

# 12 Nitrogen and its compounds – Part 2

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) |
|---------------------|-------|----------------------------|
| oxides of nitrogen  | 氮氧化物  | _____                      |
| engine              | 发动机   | _____                      |
| catalytic converter | 催化转化器 | _____                      |
| exhaust gases       | 尾气    | _____                      |
| acid rain           | 酸雨    | _____                      |

## Recall

From Part 1 you know nitrogen is unreactive — but at very high temperatures it does react. Here we meet the **oxides of nitrogen** 氮氧化物 and the pollution they cause.

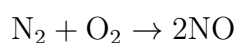
- Inside a hot engine, nitrogen and oxygen combine.
- The oxides (NO, NO<sub>2</sub>) cause smog and acid rain.

## New ideas

Read these first, then do the Practice.

### ■ 1 Where the oxides come from

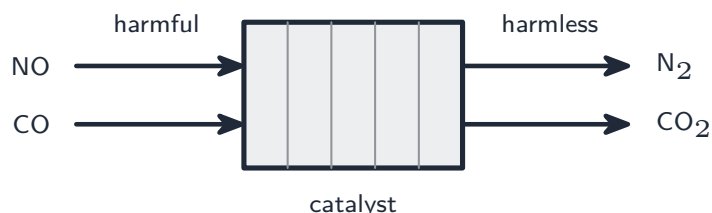
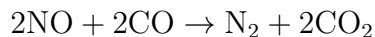
Oxides of nitrogen (NO<sub>x</sub>) form when nitrogen and oxygen react at high temperature:



- **natural** — **lightning** gives enough energy.
- **man-made** — the high temperature inside a car **engine** 发动机.

## ■ 2 The catalytic converter

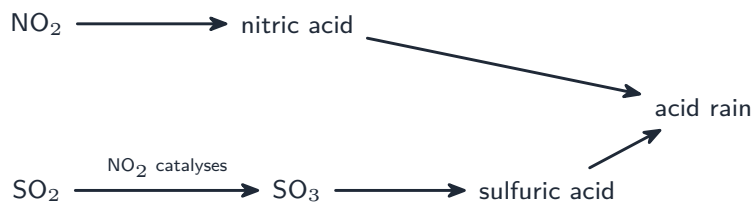
A **catalytic converter** 催化转化器 cleans the **exhaust gases** 尾气, letting the harmful gases react to form harmless ones:



## ■ 3 Acid rain

The oxides also cause **acid rain** 酸雨:

- NO<sub>2</sub> dissolves in rain to form **nitric acid**.
- NO<sub>2</sub> also speeds up (catalyses) the change of SO<sub>2</sub> into SO<sub>3</sub>, which forms **sulfuric acid**.



**Watch out:** in a catalytic converter the *harmful* gases (NO, CO) react together to make *harmless* ones (N<sub>2</sub>, CO<sub>2</sub>). The catalyst only speeds this up — it is not used up.

## Practice

Try these in order.

**12.1** Write the equation for nitrogen and oxygen forming nitrogen monoxide. [1]

**12.2** State one natural and one man-made source of oxides of nitrogen. [2]

**12.3** Write the equation for the reaction in a catalytic converter that removes NO and

CO. [2]

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**12.4** Name the harmless products formed in a catalytic converter. [2]

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**12.5** Explain the **two** ways oxides of nitrogen contribute to acid rain. [2]

**12.6 Challenge.** Explain why oxides of nitrogen form inside a hot car engine but not in ordinary air. [2]

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