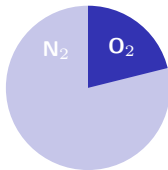


# Chemistry of the Environment

## IGCSE Chemistry ■ Topic 10

### IGCSE Chemistry



# What we will cover

- 1 Water: testing & treating
- 2 Fertilisers
- 3 The composition of air
- 4 Air pollutants & their effects
- 5 The greenhouse effect
- 6 Reducing pollution

|                                                                                                                                                                                                            |                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| is water <b>present</b> ? - a colour change                                                                                                                                                                | is it <b>pure</b> ? - fixed points |
|  →  cobalt(II) chloride: <b>blue</b> | melts at exactly 0 °C              |
|  →  copper(II) sulfate: <b>white</b> | boils at exactly 100 °C            |
| both use the <b>anhydrous</b> (dry) solid                                                                                                                                                                  |                                    |
| any dissolved substance changes these values                                                                                                                                                               |                                    |

*testing and treating water*

# Water: testing and purity

## is water present?

**anhydrous** 无水 cobalt  
chloride blue→pink; cop-  
per sulfate white→blue

## is wa

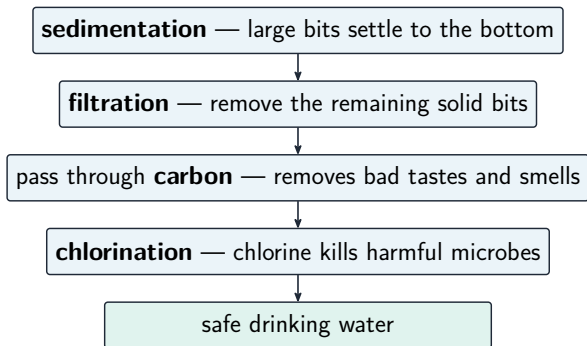
pure water  
0 °C & b  
impuritie

Natural water carries dissolved O<sub>2</sub>, minerals,  
**nitrates** 硝酸盐 & **phosphates** 磷酸盐 (which  
cause **deoxygenation** 缺氧), and microbes.



*Air pollution  
harms health and the environment*

# Treating drinking water

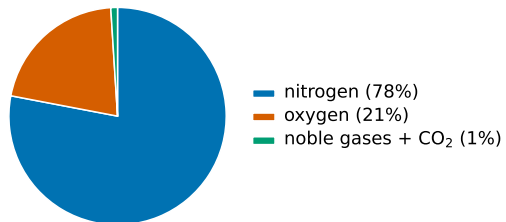


Steps to make water safe:

- **sedimentation** 沉降 & **filtration** 过滤 remove solids
- **carbon** 碳 removes tastes & smells
- **chlorination** 氯消毒 kills microbes

**Fertilisers** 肥料 (NPK) add nitrogen, phosphorus & potassium.

# The composition of air



Clean, dry air:

- 78% **nitrogen** 氮气 (N<sub>2</sub>)
- 21% **oxygen** 氧气 (O<sub>2</sub>)
- ~1% noble gases & CO<sub>2</sub>

## Air pollutants and their sources

**CO<sub>2</sub>** – complete **combustion** 燃烧 of carbon fuels (a greenhouse gas)

**CO & particulates** – **incomplete combustion** 不完全燃烧 of fuels

**oxides of nitrogen** – hot car engines

**sulfur dioxide** – burning fuels that contain **sulfur** 硫

## Effects of pollutants

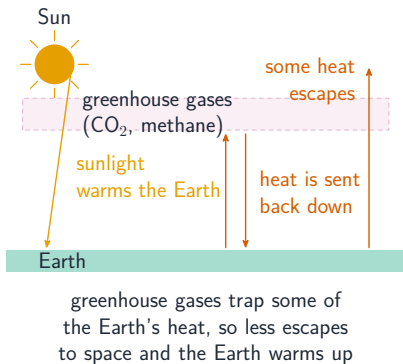
CO<sub>2</sub> & **methane** 甲烷: green-house → global warming

SO<sub>2</sub> & NO<sub>x</sub>: **acid rain** 酸雨

carbon monoxide: a toxic gas

**particulates** 颗粒物: breathing problems

# The greenhouse effect



**Greenhouse gases** 温室气体 let sunlight in but **absorb** the heat the Earth gives off.

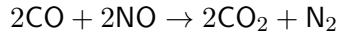
Less heat escapes to space, so the Earth warms – driving **climate change** 气候变化.



# Reducing pollution



- climate: trees, less fossil fuel, **renewable energy** 可再生能源
- acid rain: **catalytic converters** 催化转化器, low-sulfur fuels



## Worked example – stopping rust

**Iron rusts but zinc-coated iron does not, even when the coating is scratched. Explain.**

- Rusting needs **both** oxygen and water.
- A coat of paint or plastic works only as a **barrier** – scratch it and rust starts.
- Zinc is **more reactive** than iron, so it loses electrons in preference.
- The zinc corrodes instead  $\Rightarrow$  **sacrificial protection**, which still works when scratched.

Barrier methods fail once broken; **sacrificial protection** does not, because the more reactive metal is **oxidised instead**. Galvanising does both at once.

## Topic 10 – key takeaways

### 1 Water

settle, filter, carbon, chlorinate

### 2 Air

78% N<sub>2</sub>, 21% O<sub>2</sub>, ~1% other

### 3 Pollutants

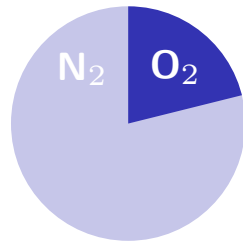
CO<sub>2</sub>/CH<sub>4</sub> warm; SO<sub>2</sub>/NO<sub>x</sub> acid  
rain

### 4 Greenhouse

traps the heat the Earth gives off

## Check yourself

- 1 What step in water treatment kills microbes?
- 2 What are the two main gases in clean air?
- 3 Which two pollutants cause acid rain?
- 4 Why does the greenhouse effect warm the Earth?



**Answers** 1. chlorination 2. nitrogen & oxygen 3. sulfur dioxide & oxides of nitrogen  
4. it traps heat the Earth radiates