

Week 21

IGCSE Chemistry

Homework bundle for this week

本周作业合集

exercises.lol

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10. Chemistry of the environment

Starter Quiz · 课前小测

IGCSE Chemistry

Name: _____ Score: _____

1. Chlorine is added during water treatment to:

- ☐ kill harmful microbes
- ☐ remove solid particles
- ☐ add minerals
- ☐ colour the water

2. NPK fertilisers supply nitrogen, phosphorus and:

- ☐ potassium
- ☐ oxygen
- ☐ carbon
- ☐ sulfur

3. Approximately what percentage of clean air is nitrogen?

4. Which are greenhouse gases? (Select all that apply.)

- ☐ carbon dioxide
- ☐ methane
- ☐ nitrogen
- ☐ oxygen

Tick every correct option.

5. Anhydrous copper sulfate turns which colour in the presence of water?

- ☐ white to blue
- ☐ blue to white
- ☐ green to red
- ☐ colourless to purple

6. Nitrogen in fertiliser mainly helps plants with:

- ☐ healthy leaves and growth
- ☐ making oxygen
- ☐ absorbing sunlight only
- ☐ producing pollen

7. Approximately what percentage of clean air is oxygen?

8. Greenhouse gases cause global warming by:

- ☐ trapping heat in the atmosphere
- ☐ cooling the Earth
- ☐ removing oxygen
- ☐ causing acid rain

9. At what temperature (°C) does pure water boil at normal pressure?

10. Filtration removes solid particles from water.

- ☐ True ☐ False

10. Chemistry of the environment

Answers · 答案

IGCSE Chemistry

1. kill harmful microbes

Chlorination sterilises the water.

2. potassium

N, P and K are the three key nutrients.

3. 78

Air is about 78% nitrogen.

4. carbon dioxide; methane

CO₂ and methane trap heat; nitrogen and oxygen do not.

5. white to blue

White anhydrous copper sulfate turns blue with water.

6. healthy leaves and growth

Nitrogen is used to make proteins for growth.

7. 21

Air is about 21% oxygen.

8. trapping heat in the atmosphere

They trap outgoing heat.

9. 100

Pure water boils at exactly 100 °C.

10. True

It removes insoluble solids.

10.1 Water

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS water 水 • carbon 碳 • anhydrous 无水 • microbes 微生物 • oxygen 氧气

Objective

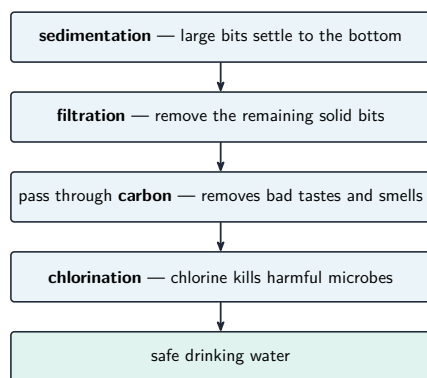
Build the skills to answer exam questions on **water** 水 — testing for water and for purity, what natural water contains, and **water treatment** 水处理.

You must be able to:

- give the chemical tests for water and the tests for purity
- describe what is in natural water (helpful and harmful)
- describe the steps in treating drinking water

1 Worked examples

■ Testing and treating water



Treatment: settle, filter, remove tastes with carbon, then chlorinate to kill microbes

- **test for water:** anhydrous copper(II) sulfate white→blue; cobalt(II) chloride blue→pink.
- **test for purity:** pure water melts at 0 °C and boils at 100 °C.

2 Practice

2.1 A student is given a colourless liquid and a strip of dry cobalt(II) chloride paper. Describe what she would see if the liquid contains water, and state what this test does **not** tell her. [2]

2.2 State the role of chlorine in water treatment. [1]

3 Exam-style questions

3.1 To show that a sample of water is **pure**, you would: [1]

- **A** add cobalt(II) chloride
- **B** check it boils at exactly 100 °C
- **C** filter it
- **D** add chlorine

3.2 Drinking water is treated in steps.

(a) State the purpose of passing the water through carbon. [1]

(b) Explain why nitrates in natural water can be harmful to aquatic life. [2]

3.3 Explain why distilled water, not tap water, is used in chemistry experiments. [2]

Solutions

2.1 The paper turns from blue to pink; the test shows only that water is present, not that the liquid is pure water, so it cannot distinguish pure water from a solution.

2.2 it kills harmful microbes.

3.1 B. Pure water boils at exactly 100 °C (impurities change this).

3.2 (a) it removes bad tastes and smells.

(b) nitrates cause deoxygenation (loss of oxygen) in the water; so aquatic life cannot get enough oxygen.

3.3 tap water contains dissolved impurities; these could interfere with reactions, whereas distilled water has far fewer impurities.

30 Which flow chart describes the correct treatment sequence of the domestic water supply?

- A** filtration → chlorination → sedimentation
- B** sedimentation → chlorination → filtration
- C** chlorination → filtration → sedimentation
- D** sedimentation → filtration → chlorination

29 Water is added separately to anhydrous copper(II) sulfate and to anhydrous cobalt(II) chloride.

Which row shows the colour changes?

	anhydrous copper(II) sulfate	anhydrous cobalt(II) chloride
A	blue to white	blue to pink
B	blue to white	pink to blue
C	white to blue	blue to pink
D	white to blue	pink to blue

28 A sample of water taken from a river contains harmful microbes.

What is a source of harmful microbes in the river water?

- A** sewage
- B** fertilisers
- C** detergents
- D** plastics

29 Anhydrous copper(II) sulfate and anhydrous cobalt(II) chloride change colour when water is added to them.

Which row shows the correct colour changes?

	copper(II) sulfate	cobalt(II) chloride
A	blue to white	blue to pink
B	blue to white	pink to blue
C	white to blue	blue to pink
D	white to blue	pink to blue

31 A sample of river water contains a high concentration of nitrates from fertilisers.

Which statements about the river water are correct?

- 1 It has a boiling point of 100 °C.
- 2 Its melting point is below 0 °C.
- 3 It turns anhydrous cobalt(II) chloride from pink to blue.
- 4 It turns anhydrous copper(II) sulfate from white to blue.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

32 Which statements about the treatment of domestic water supplies are correct?

- 1 The water undergoes sedimentation to remove dissolved solids.
- 2 The water is filtered to remove insoluble solids.
- 3 The water is treated with carbon to improve the taste.
- 4 The water is chlorinated to decrease the pH.

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

10.2 Fertilisers

Name: _____ Class: _____ Date: _____

Total: 8 marks

KEY WORDS potassium 钾 • phosphorus 磷 • fertilisers 肥料 • nitrogen 氮气
• deoxygenation 缺氧

Objective

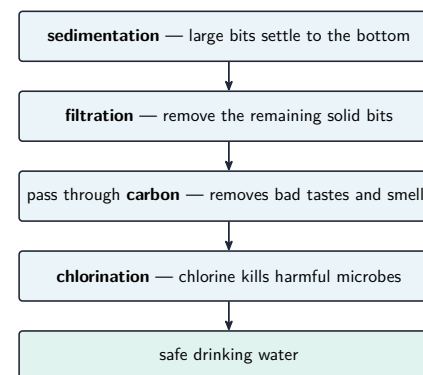
Build the skills to answer exam questions on **fertilisers** 肥料 — what they do and the three key elements (**NPK**).

You must be able to:

- state what fertilisers are used for
- name the three elements in NPK fertilisers
- recognise common fertilisers (ammonium salts, nitrates)

1 Worked examples

■ NPK fertilisers



Fertilisers add the elements plants need; excess nitrates can run off into water

- **fertilisers** help plants grow; common ones are ammonium salts and nitrates.
- **NPK** supplies Nitrogen, Phosphorus and **K** (potassium).

2 Practice

2.1 State what fertilisers are used for. [1]

2.2 Name the three elements in an NPK fertiliser. [3]

3 Exam-style questions

3.1 The letter N in NPK fertiliser stands for: [1]

- **A** sodium
- **B** nickel
- **C** nitrogen
- **D** neon

3.2 Ammonium nitrate is used as a fertiliser.

(a) Name the element it supplies that promotes leaf growth. [1]

(b) Explain one problem caused if too much fertiliser washes into rivers. [2]

Solutions

2.1 to help plants grow (replacing nutrients in the soil).

2.2 nitrogen, phosphorus and potassium.

3.1 **C**. N stands for nitrogen.

3.2 (a) nitrogen.

(b) the extra nitrates cause deoxygenation of the water, which harms aquatic life.

30 Nitrogen, phosphorus and potassium are essential elements for improved plant growth.

Which mixture provides all **three** essential elements?

	mixture	formulae
A	ammonium phosphate + potassium chloride	$(\text{NH}_4)_3\text{PO}_4$ + KCl
B	ammonium phosphate + ammonium nitrate	$(\text{NH}_4)_3\text{PO}_4$ + NH_4NO_3
C	ammonium phosphate + ammonium chloride	$(\text{NH}_4)_3\text{PO}_4$ + NH_4Cl
D	ammonium nitrate + potassium chloride	NH_4NO_3 + KCl

18 A farmer incorrectly adds two substances to the soil at the same time.

They react together to form a gas which turns damp red litmus paper blue.

What are the two substances?

- A** a basic oxide and a potassium salt
- B** a basic oxide and an ammonium salt
- C** an acidic oxide and a potassium salt
- D** an acidic oxide and an ammonium salt

10.3 Air quality and climate

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS carbon dioxide 二氧化碳 • sulfur 硫 • acid rain 酸雨 • carbon monoxide 一氧化碳
• methane 甲烷

Objective

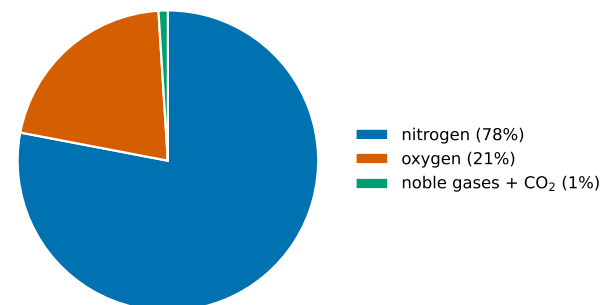
Build the skills to answer exam questions on **air quality and climate** 空气质量与气候 — air composition, **pollutants** 污染物 and their sources/effects, the **greenhouse effect** 温室效应, and ways to reduce pollution.

You must be able to:

- state the composition of clean dry air
- give the sources and effects of the common pollutants
- explain the greenhouse effect and pollution-reducing measures

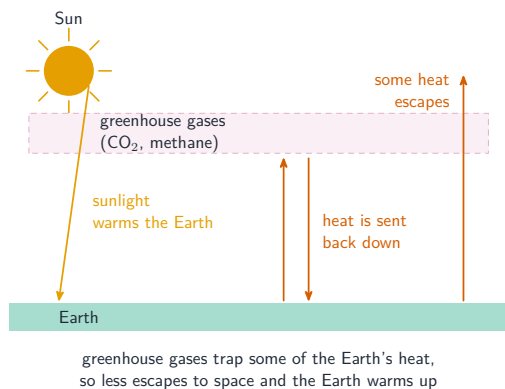
1 Worked examples

■ Air and the greenhouse effect



clean dry air $\approx$ 78% N₂, 21% O₂, 1% Ar/CO₂/others

Clean dry air $\approx$ 78% nitrogen, 21% oxygen, 1% other (noble gases + CO₂)



Greenhouse gases (CO₂, methane) absorb heat radiated by the Earth, warming it

- **pollutants:** CO (incomplete combustion, toxic); SO₂ (sulfur fuels, acid rain); NO_x (engines, acid rain).

2 Practice

2.1 State the approximate percentages of nitrogen and oxygen in clean dry air. [2]

2.2 Name the gas that causes acid rain from burning sulfur-containing fuels. [1]

3 Exam-style questions

3.1 Carbon monoxide is formed by: [1]

- A complete combustion of a fuel
- B incomplete combustion of a fuel
- C photosynthesis
- D respiration

3.2 Carbon dioxide and methane are greenhouse gases.

(a) Explain how greenhouse gases cause the Earth to warm up. [3]

(b) State one way to reduce the amount of carbon dioxide in the air. [1]

3.3 A catalytic converter removes oxides of nitrogen and carbon monoxide. Give one benefit of fitting one to a car. [1]

Solutions

2.1 about 78% nitrogen; about 21% oxygen.

2.2 sulfur dioxide.

3.1 B. Carbon monoxide comes from incomplete combustion.

3.2 (a) greenhouse gases let sunlight through to warm the Earth; they absorb the heat (thermal energy) the Earth gives off; and send some back down, so less heat escapes and the Earth warms.

(b) plant trees / burn fewer fossil fuels / use renewable energy.

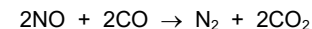
3.3 it reduces the harmful gases (NO_x and CO) released, improving air quality.

Name: _____

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30 Catalytic converters are used to remove oxides of nitrogen from exhaust gases.

The equation represents one of the reactions that occur in a catalytic converter.



What is a disadvantage of using a catalytic converter to remove oxides of nitrogen?

A CO is an essential reactant in photosynthesis.

B CO_2 is a greenhouse gas.

C N_2 is acidic.

D N_2 is toxic.

31 Some gases are present in clean, dry air, while other gases are **only** present in polluted air.

Which row is correct?

	a gas present in clean, dry air	a gas only present in polluted air
A	argon	carbon dioxide
B	argon	nitrogen dioxide
C	sulfur dioxide	carbon dioxide
D	sulfur dioxide	nitrogen dioxide

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31 Which statement about oxides of nitrogen is correct?

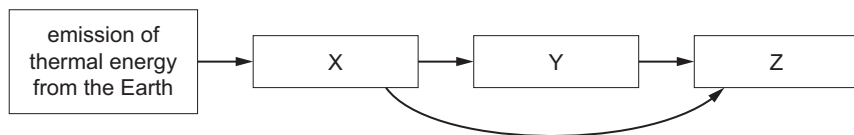
A They are made in car engines by the incomplete combustion of gasoline at a high temperature.

B They are made in car engines when nitrogen in gasoline reacts with oxygen in air at a high temperature.

C They are removed from car exhausts by catalytic converters and form nitrogen and sulfur dioxide.

D They are removed from car exhausts when they react with carbon monoxide in catalytic converters.

- 33 The diagram represents two processes, X and Y, and their effect, Z, in increasing global warming.



Which row identifies X, Y and Z?

	X	Y	Z
A	absorption of thermal energy by greenhouse gases	emission of thermal energy to the Earth	reduced thermal energy loss to space
B	emission of thermal energy by greenhouse gases	emission of thermal energy to space	reduced thermal energy loss to space
C	absorption of thermal energy by greenhouse gases	emission of thermal energy to the Earth	increased thermal energy loss to space
D	emission of thermal energy by greenhouse gases	emission of thermal energy to space	increased thermal energy loss to space

- 29 Cars are fitted with catalytic converters.

Which equation represents a reaction that takes place in a catalytic converter?

- A** $\text{CO}_2 + \text{NO}_2 \rightarrow \text{CO} + \text{NO} + \text{O}_2$
B $2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$
C $\text{CO}_2 + \text{N}_2 \rightarrow \text{C} + 2\text{NO}$
D $\text{C} + \text{NO}_2 \rightarrow \text{CO} + \text{NO}$

- 30 Three statements about greenhouse gases and global warming are listed.

- 1 A greenhouse gas molecule can absorb and emit thermal energy.
- 2 The Earth is a source of thermal energy.
- 3 Thermal energy emitted by a greenhouse gas molecule is sent out in all directions.

Which statements are correct?

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

- 31 Which statements help explain why an increasing amount of carbon dioxide or methane in the atmosphere causes global warming?

- 1 Carbon dioxide absorbs thermal energy from the Earth.
- 2 Methane does **not** absorb thermal energy from the Sun.
- 3 Carbon dioxide does **not** reflect thermal energy from the Sun to the Earth.
- 4 Methane reflects thermal energy from the Earth back to the Earth.

- A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

- 32 The exhaust gases from cars contain oxides of nitrogen.

How are these oxides of nitrogen formed?

- A** Nitrogen and oxygen from the air react together at the high temperatures in the engine.
B Nitrogen and oxygen from the petrol react together in the car exhaust.
C Nitrogen from the petrol reacts with oxygen at the high temperatures in the engine.
D Nitrogen reacts with oxygen from the air in the catalytic converter.

- 30 Gases which cause acid rain form in car engines.

These gases can be removed using a catalytic converter.

Which equation represents the removal of one of these gases using a catalytic converter?

- A** $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$
B $2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$
C $\text{N}_2 + 2\text{O}_2 \rightarrow 2\text{NO}_2$
D $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$

- 34 Nitrogen monoxide, NO, and carbon monoxide, CO, are both removed from the exhaust gases of a car by a catalytic converter.

Which statement describes how nitrogen monoxide and carbon monoxide are removed by a catalytic converter?

- A** Nitrogen monoxide and carbon monoxide are both reduced.
B Nitrogen monoxide and carbon monoxide are both oxidised.
C Nitrogen monoxide is oxidised and carbon monoxide is reduced.
D Nitrogen monoxide is reduced and carbon monoxide is oxidised.