



Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. nitrogen
2. zinc
3. downward displacement of water
4. manganese dioxide
5. reduction
6. stratosphere
7. ultraviolet
8. Haber

K • 4

Each carries 0.5 mark.

2 Label the diagram

- | | |
|-----------------------------|--------------------|
| 1. thistle funnel | 4. granulated zinc |
| 2. Woulfe's bottle | 5. delivery tube |
| 3. dilute hydrochloric acid | 6. beehive shelf |

K • 3

Each carries 0.5 mark.

3 Multiple choice

- i. d. KClO_3

K • 1

Potassium chlorate, with manganese dioxide as a catalyst: $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$. Hydrogen peroxide also gives oxygen, but without heating. Calcium carbonate gives carbon dioxide when heated, and Fe_2O_3 gives no oxygen when heated.

- ii. c. magnesium oxide

K • 1

$2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$. Magnesium nitride forms when magnesium burns in nitrogen.

- iii. b. reduction

U • 1

Hydrogen removes the oxygen from the metal oxide: removal of oxygen is reduction ($\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$). Hydrogenation is adding hydrogen to a compound, such as vegetable oil.

- iv. a. chlorofluorocarbon

K • 1

CFCs release chlorine atoms in the stratosphere, and each destroys thousands of ozone molecules. Methane and carbon dioxide are greenhouse gases; sulphur dioxide causes acid rain.

- v. b. CO_2

U • 1

In respiration, glucose and oxygen give carbon dioxide, water and energy. There is no calcium in the reactants, so CaO and CaCO_3 are impossible.

4 Very short answers

- a. MARKING SCHEME

K • 1

✓ Lavoisier.

- b. MARKING SCHEME

K • 1

✓ A glowing splint put into the jar bursts into flame.

- c. MARKING SCHEME

U • 1

✓ Nitrogen is unreactive and keeps oxygen away, so the food doesn't go stale.



5 Short answers

- a. MARKING SCHEME K · 2
- ✓ A burning splint is brought to the mouth of the jar.
 - ✓ The gas burns with a “pop” sound (and a pale blue flame): it is hydrogen.
- b. MARKING SCHEME U · 2
- ✓ The ozone layer absorbs most of the Sun’s harmful ultraviolet rays, so they don’t reach the Earth’s surface.
 - ✓ UV rays would cause skin cancer and cataracts and harm plants and animals, so it protects life on Earth.
- c. MARKING SCHEME U · 2
- ✓ Hydrogen is almost insoluble and oxygen only slightly soluble in water, so little gas is lost by dissolving.
 - ✓ The gas pushes the water out of the jar, giving a pure gas unmixed with air.
- d. MARKING SCHEME U · 2
- ✓ a. So that condensed moisture runs out and doesn’t flow back onto the hot glass and crack it.
 - ✓ b. So that water isn’t sucked back into the hot test tube as it cools.

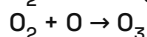
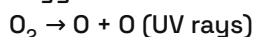
6 Long answer

ANSWER

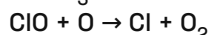
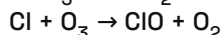
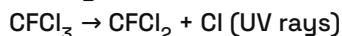
U · 4

The **ozone layer** is a layer of ozone gas (O_3) in the stratosphere, roughly 15 to 35 km above the Earth, which absorbs most of the Sun’s ultraviolet rays.

Formation: UV rays split oxygen molecules into oxygen atoms, and each atom joins an oxygen molecule to form ozone:



Depletion: CFCs and similar chemicals rise into the stratosphere, where UV rays break them and release chlorine atoms. Each chlorine atom breaks ozone into oxygen and is set free again, so one atom destroys thousands of ozone molecules:



MARKING SCHEME

- ✓ The ozone layer is a layer of ozone (O_3) in the stratosphere, about 15 to 35 km up, which absorbs the Sun’s UV rays.
- ✓ Formation: UV rays split oxygen molecules, $O_2 \rightarrow O + O$, and an oxygen atom joins a molecule, $O_2 + O \rightarrow O_3$.
- ✓ Depletion: UV rays break CFCs in the stratosphere and release chlorine atoms, e.g. $CFCl_3 \rightarrow CFCl_2 + Cl$.
- ✓ Each chlorine atom destroys ozone again and again: $Cl + O_3 \rightarrow ClO + O_2$, $ClO + O \rightarrow Cl + O_2$.

7 Complete and balance

- a. MARKING SCHEME A · 1
- ✓ $2Na + H_2 \rightarrow 2NaH$.
- b. MARKING SCHEME A · 1
- ✓ $2KClO_3 \rightarrow 2KCl + 3O_2$.
- c. MARKING SCHEME A · 1
- ✓ $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy}$.
- d. MARKING SCHEME A · 1
- ✓ $4P + 5O_2 \rightarrow 2P_2O_5$.



8 Think

ANSWER

HA · 2

The candle used up only the oxygen, about a fifth of the air. The gas left, mostly nitrogen, doesn't help things burn (the candle went out in it) and doesn't dissolve in water (the water didn't rise into it).

MARKING SCHEME

- ✓ The gas left doesn't support burning, since the candle went out while it was still there.
- ✓ It doesn't dissolve in water (the water rose only into the space of the oxygen used): it is mostly nitrogen.

9 Activity: Which gas is it?

(not marked)

WHAT STUDENTS SHOULD FIND

Hydrogen, from granulated zinc and dilute hydrochloric acid: a burning splint at the mouth of the jar gives a "pop" and a pale blue flame. Oxygen, from potassium chlorate heated with manganese dioxide (or hydrogen peroxide with manganese dioxide): a glowing splint bursts into flame. Nitrogen, from sodium nitrite and ammonium chloride heated gently: a burning splint goes out, and the gas doesn't burn.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	14	13	4	2	33

