

# CAIE Chemistry IGCSE

## 12.5 Identification of ions and gases

### Flashcards

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How would you test for carbonates  
( $\text{CO}_3^{2-}$ ) ?



## How would you test for carbonates ( $\text{CO}_3^{2-}$ ) ?

- React with nitric acid, to create carbon dioxide.
- This gas can be bubbled through limewater
- If the limewater goes cloudy, a carbonate is present



How would you test for the halides  
(chlorides, bromides, iodides) ?





## How would you test for the halides (chlorides, bromides, iodides) ?

- Add dilute nitric acid to the sample, followed by silver nitrate solution
- Chlorides produce a white precipitate
- Bromides produce a cream precipitate
- Iodides produce a yellow precipitate



How would you test for nitrates ( $\text{NO}_3^-$ )?



## How would you test for nitrates ( $\text{NO}_3^-$ )?

- Add aqueous sodium hydroxide
- Then add aluminium powder or foil and heat the mixture strongly.
- If nitrate ions are present, they will be reduced to ammonia, giving off ammonia gas.
- This can be identified by testing it with damp red litmus paper, which will turn blue in its presence.



How would you test for sulfates  
( $\text{SO}_4^{2-}$ )?



How would you test for sulfates ( $\text{SO}_4^{2-}$ )?

- First add dilute hydrochloric acid, followed by barium chloride solution
- A white precipitate will form if sulfate ions are in this solution



How would you test for sulfites ( $\text{SO}_3^{2-}$ )?



## How would you test for sulfites ( $\text{SO}_3^{2-}$ )?

- Add a dilute acid and heat gently
- Sulfur dioxide gas is given off
- Bubble this gas through aqueous potassium manganate(VII)
- There will be a colour change from purple to colourless if the sulfite ion is present.



What happens when a few drops of NaOH and excess NaOH is added to aluminium ions ( $\text{Al}^{3+}$ )?





What happens when a few drops of NaOH and excess NaOH is added to aluminium ions ( $\text{Al}^{3+}$ )?

**Observation after a few drops of NaOH is added**

White precipitate forms

**Observation after excess NaOH is added**

Precipitate redissolves



What happens when a few drops of NaOH and excess NaOH is added to ammonium ions ( $\text{NH}_4^+$ )?



What happens when a few drops of NaOH and excess NaOH is added to ammonium ions ( $\text{NH}_4^+$ )?

**Observation after a few drops of NaOH is added**

Ammonia gas given off (identified by testing it with damp red litmus paper, which will turn blue in its presence)

**Observation after excess NaOH is added**

No change



What happens when a few drops of NaOH and excess NaOH is added to calcium ions ( $\text{Ca}^{2+}$ )?



What happens when a few drops of NaOH and excess NaOH is added to calcium ions ( $\text{Ca}^{2+}$ )?

**Observation after a few drops of NaOH is added**

White precipitate forms

**Observation after excess NaOH is added**

No change



What happens when a few drops of NaOH and excess NaOH is added to chromium (III) ions ( $\text{Cr}^{3+}$ )?



What happens when a few drops of NaOH and excess NaOH is added to chromium (III) ions ( $\text{Cr}^{3+}$ )?

**Observation after a few drops of NaOH is added**

Grey-green precipitate forms

**Observation after excess NaOH is added**

Dark green solution forms



What happens when a few drops of NaOH and excess NaOH is added to copper (II) ions ( $\text{Cu}^{2+}$ )?





What happens when a few drops of NaOH and excess NaOH is added to copper (II) ions ( $\text{Cu}^{2+}$ )?

**Observation after a few drops of NaOH is added**

Blue precipitate forms

**Observation after excess NaOH is added**

No change



What happens when a few drops of NaOH and excess NaOH is added to iron (II) ions ( $\text{Fe}^{2+}$ )?



What happens when a few drops of NaOH and excess NaOH is added to iron (II) ions ( $\text{Fe}^{2+}$ )?

**Observation after a few drops of NaOH is added**

**Green precipitate** forms

**Observation after excess NaOH is added**

No change



What happens when a few drops of NaOH and excess NaOH is added to iron (III) ions ( $\text{Fe}^{3+}$ )?



What happens when a few drops of NaOH and excess NaOH is added to iron (III) ions ( $\text{Fe}^{3+}$ )?

**Observation after a few drops of NaOH is added**

Orange-brown precipitate forms

**Observation after excess NaOH is added**

No change



What happens when a few drops of NaOH and excess NaOH is added to zinc ions ( $\text{Zn}^{2+}$ )?



What happens when a few drops of NaOH and excess NaOH is added to zinc ions ( $\text{Zn}^{2+}$ )?

**Observation after a few drops of NaOH is added**

White precipitate forms

**Observation after excess NaOH is added**

Precipitate redissolves



What happens when a few drops of ammonia and excess ammonia is added to aluminium ions ( $\text{Al}^{3+}$ )?





What happens when a few drops of ammonia and excess ammonia is added to aluminium ions ( $\text{Al}^{3+}$ )?

**Observation after a few drops of ammonia is added**

White precipitate forms

**Observation after excess ammonia is added**

No change



What happens when a few drops of ammonia and excess ammonia is added to calcium ions ( $\text{Ca}^{2+}$ )?



What happens when a few drops of ammonia and excess ammonia is added to calcium ions ( $\text{Ca}^{2+}$ )?

**Observation after a few drops of ammonia is added**

Very faint precipitate forms

**Observation after excess ammonia is added**

No change



What happens when a few drops of ammonia and excess ammonia is added to chromium (III) ions ( $\text{Cr}^{3+}$ )?



What happens when a few drops of ammonia and excess ammonia is added to chromium (III) ions ( $\text{Cr}^{3+}$ )?

**Observation after a few drops of ammonia is added**

Grey-green precipitate forms

**Observation after excess ammonia is added**

No change



What happens when a few drops of ammonia and excess ammonia is added to copper (II) ions ( $\text{Cu}^{2+}$ )?



What happens when a few drops of ammonia and excess ammonia is added to copper (II) ions ( $\text{Cu}^{2+}$ )?

**Observation after a few drops of ammonia is added**

Light blue precipitate forms

**Observation after excess ammonia is added**

Precipitate dissolves to form a dark blue solution



What happens when a few drops of ammonia and excess ammonia is added to iron (II) ions ( $\text{Fe}^{2+}$ )?





What happens when a few drops of ammonia and excess ammonia is added to iron (II) ions ( $\text{Fe}^{2+}$ )?

**Observation after a few drops of ammonia is added**

Green precipitate forms

**Observation after excess ammonia is added**

No change



What happens when a few drops of ammonia and excess ammonia is added to iron(III) ions ( $\text{Fe}^{3+}$ )?



What happens when a few drops of ammonia and excess ammonia is added to iron(III) ions ( $\text{Fe}^{3+}$ )?

**Observation after a few drops of ammonia is added**

Orange-brown precipitate forms

**Observation after excess ammonia is added**

No change



What happens when a few drops of ammonia and excess ammonia is added to zinc ions ( $\text{Zn}^{2+}$ )?



What happens when a few drops of ammonia and excess ammonia is added to zinc ions ( $\text{Zn}^{2+}$ )?

**Observation after a few drops of ammonia is added**

White precipitate forms

**Observation after excess ammonia is added**

Precipitate dissolves to form a colourless solution



How would you distinguish between  
Aluminium ions,  $\text{Al}^{3+}$   
Calcium ions,  $\text{Ca}^{2+}$   
Zinc ions,  $\text{Zn}^{2+}$



# How would you distinguish between aluminium ions, calcium ions and zinc ions

-These 3 cations all produce white precipitates

- To distinguish Calcium ions ( $\text{Ca}^{2+}$ )

The white precipitate formed when NaOH is added does not dissolve in excess NaOH, whereas the hydroxide precipitates of aluminium and zinc do

- To distinguish Zinc ions ( $\text{Zn}^{2+}$ )

The white precipitate formed when a few drops of ammonia is added to zinc dissolves into a colourless solution when excess ammonia is added, but the white precipitate of aluminium doesn't dissolve



How would you test for ammonia  $\text{NH}_3$  (g)?





How would you test for ammonia  $\text{NH}_3$  (g)?

Turns damp red litmus paper blue



How would you test for carbon dioxide  
 $\text{CO}_2(\text{g})$ ?



# How would you test for carbon dioxide $\text{CO}_2(\text{g})$ ?

- Bubble the gas through the limewater (calcium hydroxide)
- If carbon dioxide is present, the limewater will turn cloudy



How would you test for chlorine  $\text{Cl}_2(\text{g})$ ?



How would you test for chlorine  $\text{Cl}_2(\text{g})$ ?

When damp litmus paper is put into chlorine gas the litmus paper is bleached and turns white



How would you test for hydrogen  $\text{H}_2(\text{g})$ ?



## How would you test for hydrogen $\text{H}_2(\text{g})$ ?

- Hold a burning splint at the open end of a test tube of the gas sample
- Creates a 'squeaky pop' sound if hydrogen gas is present



How would you test for oxygen  $O_2(g)$ ?





## How would you test for oxygen $O_2(g)$ ?

- Insert a glowing splint into a test tube of the gas sample
- Splint relights if oxygen gas is present



How would you test for sulfur dioxide  
 $\text{SO}_2(\text{g})$ ?



## How would you test for sulfur dioxide $\text{SO}_2(\text{g})$ ?

- Bubble the gas through aqueous potassium manganate(VII)
- If sulfur dioxide gas is present, there will be a colour change from **purple** to colourless



Suggest the flame results for the following cations:

- Lithium
- Sodium
- Potassium
- Calcium
- Barium
- Copper



# Suggest the flame results for the following cations:

Flame test results:

Cation	Flame colour
Lithium, $\text{Li}^+$	Crimson
Sodium, $\text{Na}^+$	Yellow
Potassium, $\text{K}^+$	Lilac
Calcium, $\text{Ca}^{2+}$	Red
Barium, $\text{Ba}^{2+}$	Yellow-green
Copper(II), $\text{Cu}^{2+}$	Blue-green

