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# TOPIC 1.1: EXPERIMENTAL DESIGN



THE ABOUT

# CHAPTER ANALYSIS



TIME

- Straight forward chapter
- 1 **key** concept



EXAM

- Usually tested only in MCQ
- Useful knowledge for Practical Exam

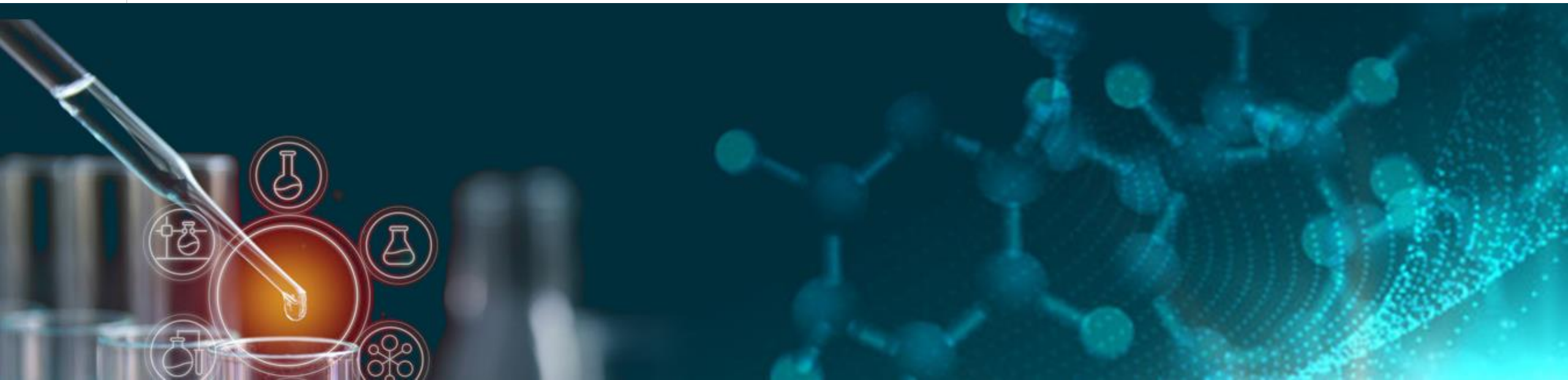


WEIGHTAGE

- Light overall weightage
- Constitute to **0.5%** of marks for past 5 year papers

KEY CONCEPT

# EXPERIMENTAL DESIGN APPARATUS FOR MEASUREMENT GAS COLLECTION



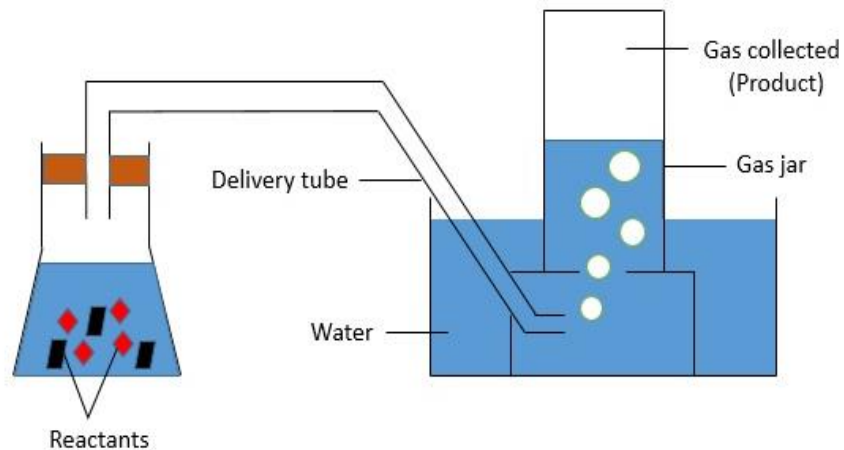
## MUST KNOW

# APPARATUS FOR MEASUREMENT

Apparatus	Smallest division	Uncertainty (1/2 of smallest division)	Example
Burette	0.1 cm <sup>3</sup>	0.05 cm <sup>3</sup>	27.00 cm <sup>3</sup> 28.85 cm <sup>3</sup>
Pipette	fixed	fixed	25.0 cm <sup>3</sup> (fixed value)
Measuring cylinder	1 cm <sup>3</sup>	0.5 cm <sup>3</sup>	16.0 cm <sup>3</sup> 23.5 cm <sup>3</sup>
Electronic balance	0.01 g	0.01 g	4.53 g
Digital stopwatch	0.01 s	0.01 s	26.46 s 1.5 mins
Thermometer	1 °C	0.5 °C	21.0 °C 46.5 °C

## KEY CONCEPT

# DISPLACEMENT OF WATER



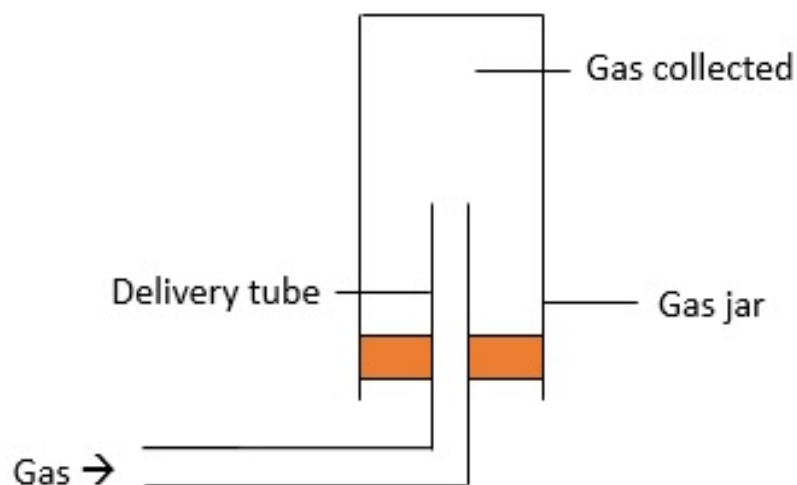
This method is suitable for collecting **gases which are insoluble or only slightly soluble in water.**

As the gases cannot dissolve in water and are lighter in density than water, they would rise to the top of the gas jar and be collected there.

Some examples of gases collected via this way include **H<sub>2</sub>, O<sub>2</sub>, CO and CO<sub>2</sub>.**

## KEY CONCEPT

# UPWARDS DELIVERY



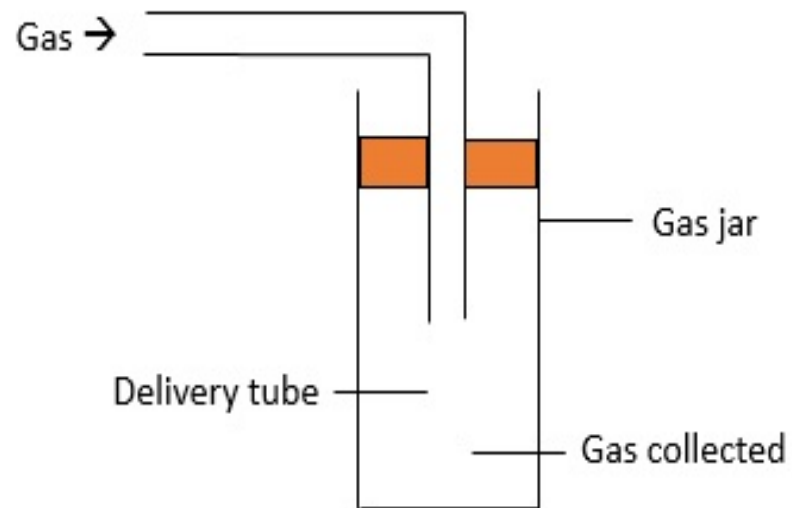
This method is used to collect gases which are soluble in water and has a **lighter density as compared to air**\*.

**NH<sub>3</sub>** & **H<sub>2</sub>** are gases which can be collected this way.

\* *Mr of air is around **28.8**. (78% **N<sub>2</sub>** + 21% **O<sub>2</sub>**)*

## KEY CONCEPT

# DOWNWARDS DELIVERY



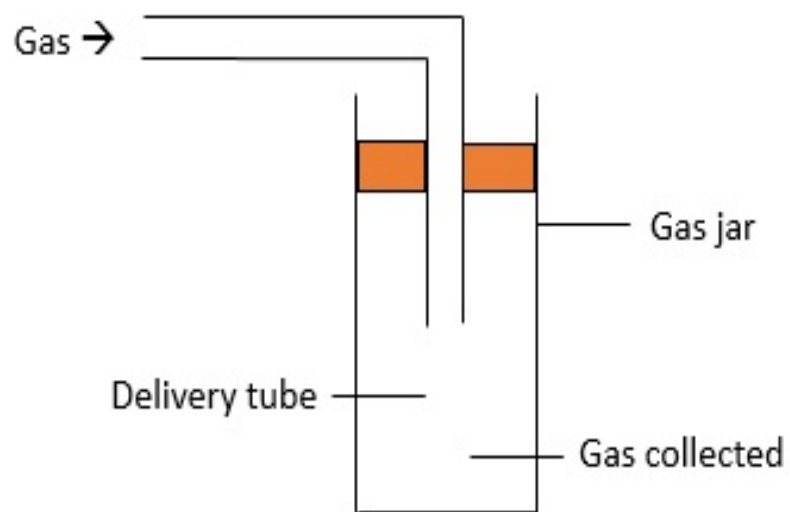
This method is used to collect gases which are soluble in water and has a **heavier density as compared to air**\*.

Some examples of gases collected this way include **Cl<sub>2</sub>, HCl and SO<sub>2</sub>**.

\* *Mr of air is around **28.8**. (78% **N<sub>2</sub>** + 21% **O<sub>2</sub>**)*

## KEY CONCEPT

# DOWNWARDS DELIVERY



This method is used to collect gases which are soluble in water and has a **heavier density as compared to air\***.

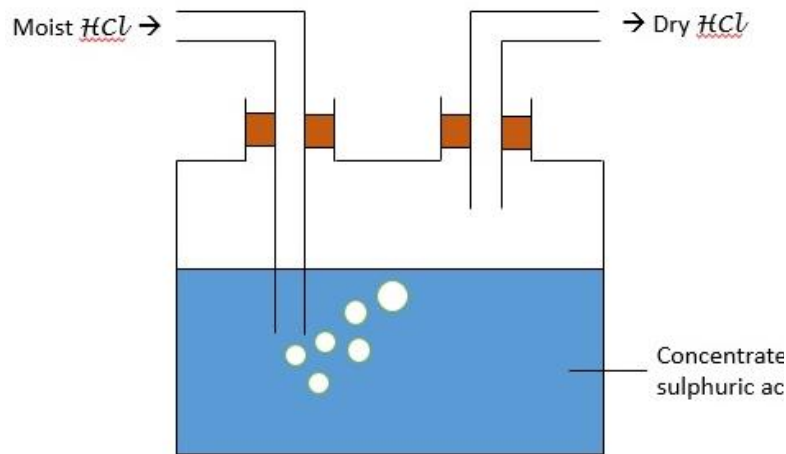
Some examples of gases collected this way include  **$\text{Cl}_2$ ,  $\text{HCl}$  and  $\text{SO}_2$** .

\* *Mr of air is around **28.8**. (78%  $\text{N}_2$  + 21%  $\text{O}_2$ )*



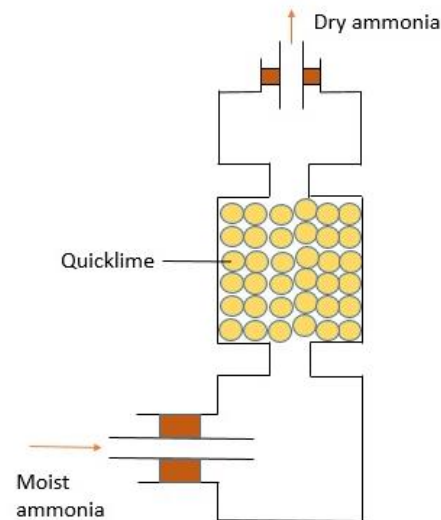
## KEY CONCEPT

# DRYING OF GAS

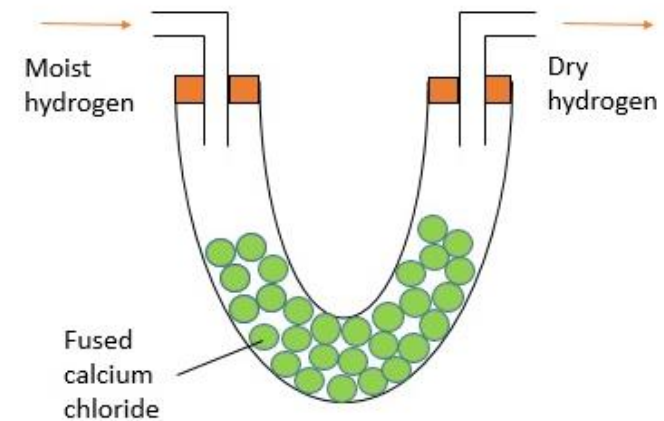


Using concentrated sulphuric acid to dry most gases including chlorine and hydrogen chloride

To prepare a dry sample of gas, we can pass it through drying agents like **concentrated sulfuric acid**, **quicklime (calcium oxide)** and **fused calcium chloride** (heated calcium chloride).



Quicklime is used in drying ammonia



Fused calcium chloride can also be used to dry most of the gases

ADVANCED

# things to note

For drying of gas, which set up to use depends on the nature of the gas. (acidic or alkaline)

Using a **wrong set up will cause the gas to neutralise with the drying agent instead.**

To know whether the gas is acidic or alkaline, refer to chapter 6.1 'Acid & Bases'

## Concentrated sulfuric acid

This set up is used to dry acid gas only. (chlorine / hydrogen chloride gas/ carbon dioxide / sulfur dioxide)

## Quicklime (Calcium Oxide)

This set up is used to dry alkaline gas only. (Ammonia)

## Fused Calcium Chloride

Best choice as it can dry most gases since its neutral!

For more notes & learning materials, visit:  
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