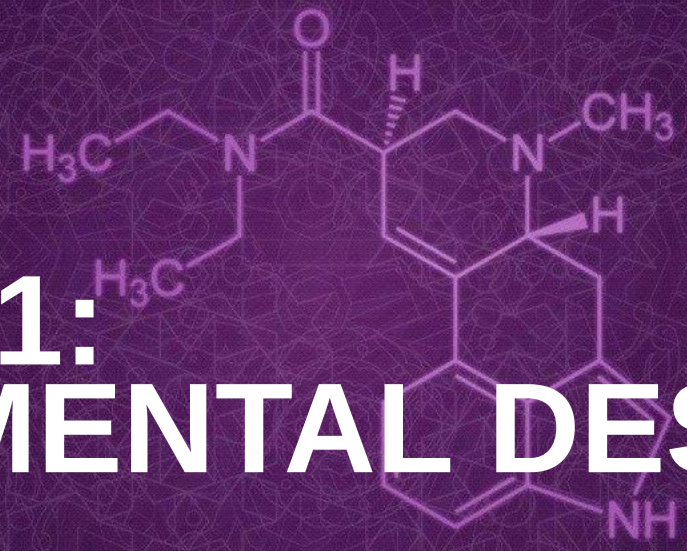


TOPIC 1.1: EXPERIMENTAL DESIGN

THE ABOUT

CHAPTER ANALYSIS

TIME

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

EXAM

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

WEIGHTAGE

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

KEY CONCEPT

EXPERIMENTAL DESIGN
APPARATUS FOR MEASUREMENT
GAS COLLECTION

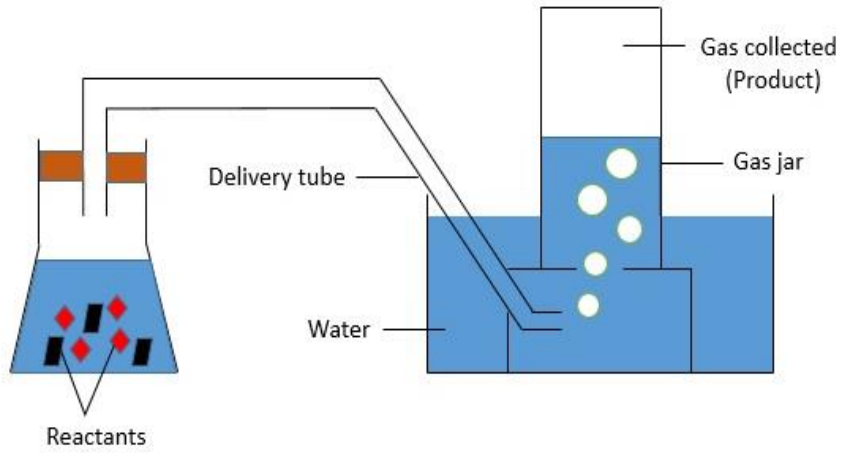
MUST KNOW

APPARATUS FOR MEASUREMENT

Apparatus	Smallest division	Uncertainty (1/2 of smallest division)	Example of value
Burette	0.1cm^3	0.05 cm^3	27.00 cm^3 28.85 cm^3
Pipette	fixed	fixed	25.0 cm^3 (fixed value)
Measuring cylinder	1 cm^3	0.5 cm^3	16.0 cm^3 17.5 cm^3
Digital stopwatch	0.01s	0.01s	26.46 s 1.5 mins
Thermometer	1^oC	0.5 ^oC	21.0 ^oC 46.5 ^oC
Electronic balance	0.01g	0.01g	4.53 g

KEY CONCEPT

DISPLACEMENT OF WATER



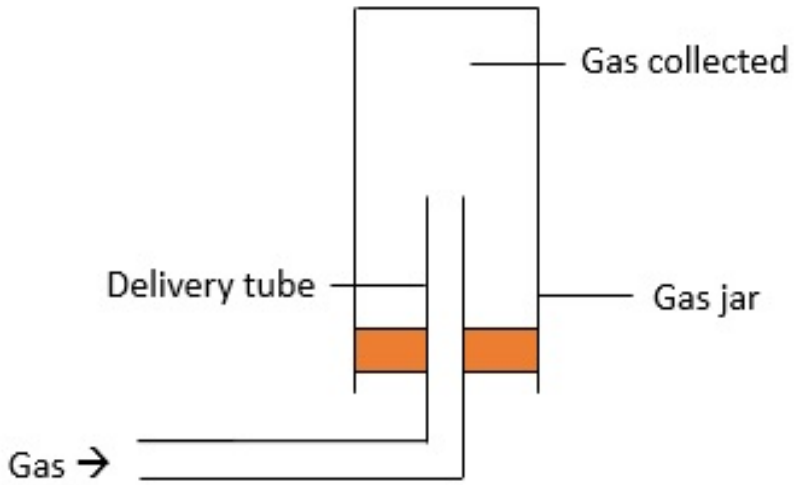
This method for collecting **gases which are insoluble or slightly soluble in water.**

As the gases does not dissolve in water, they would rise to the top of the gas jar.

Some examples of gases collected via this method includes **H_2, O_2, CO and CO_2**.

KEY CONCEPT

UPWARDS DELIVERY



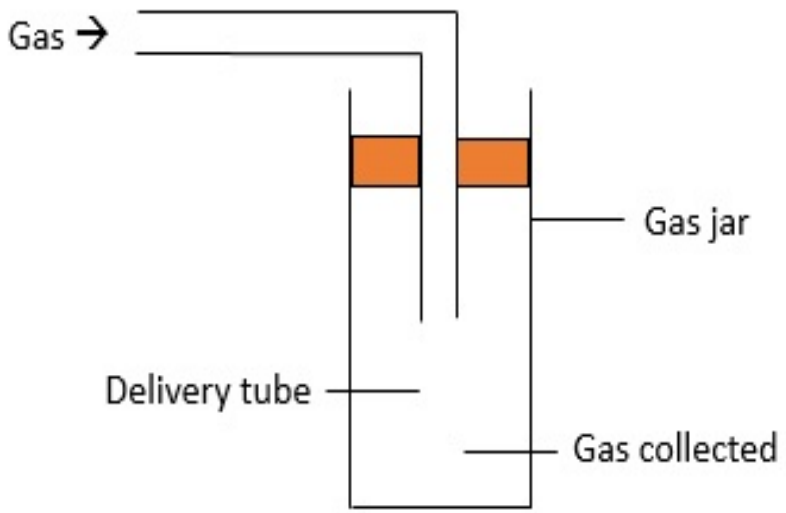
This method is used to collect gases which have a **lighter density as compared to air***.

NH_3 & **H_2** are gases which can be collected using this method.

** Mr of air is around **28.8**. (78% **N_2** + 21% **O_2**)*

KEY CONCEPT

DOWNWARDS DELIVERY



This method is used to collect gases which have a **heavier density as compared to air*.**

Some examples of gases collected using this method includes **Cl_2, HCl and SO_2.**

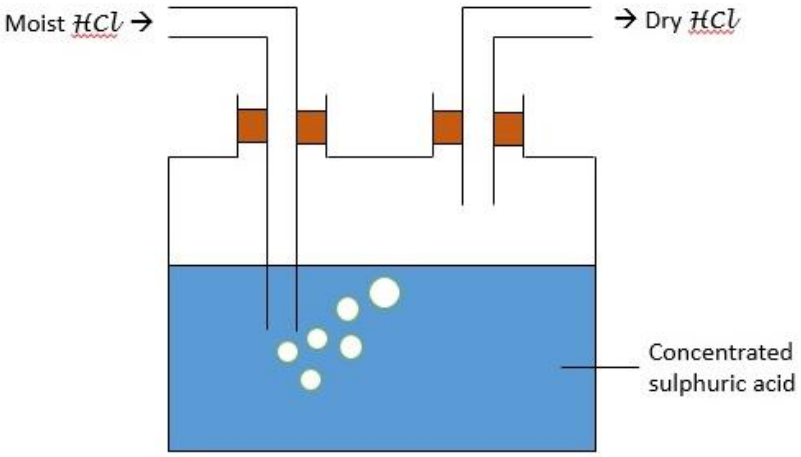
** Mr of air is around **28.8**. (78% **N_2** + 21% **O_2**)*

KEY CONCEPT

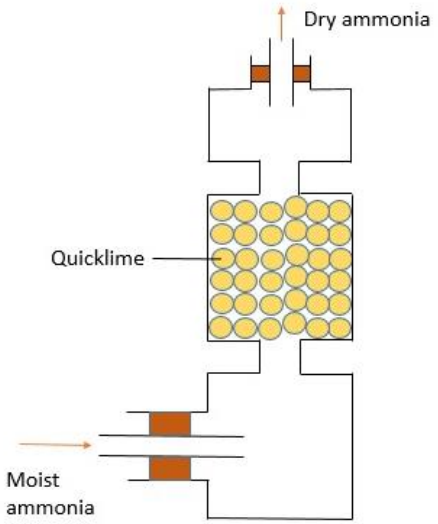
DRYING OF GAS

To dry a sample of gas, we can pass it through drying agents like:

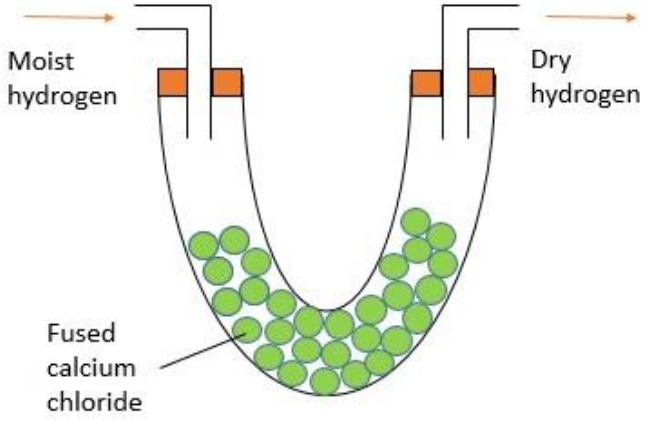
- **concentrated sulfuric acid**
- **quicklime (calcium oxide)**
- **fused calcium chloride** (calcium chloride)



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



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 7.1 ‘Acid & Bases’

Concentrated sulfuric acid

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

Quicklime (Calcium Oxide)

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

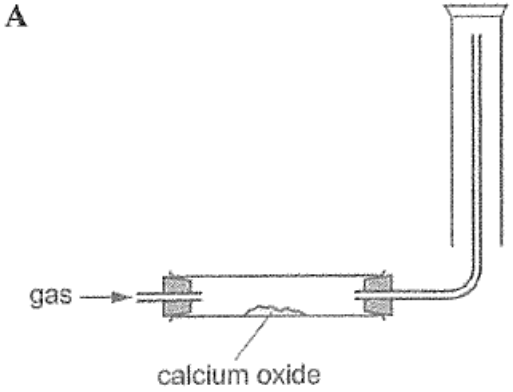
Fused Calcium Chloride

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

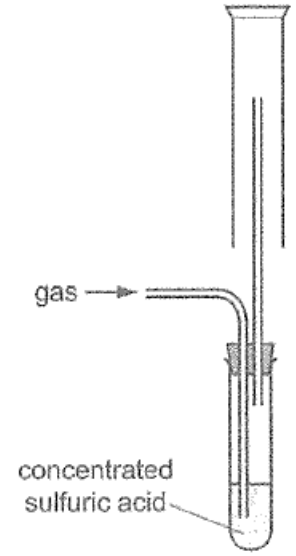
Try it yourself! (TYS Question)

6. A gas turns moist red litmus paper blue, is soluble in water and is less dense than air.
Which diagram shows a correct way of drying and collecting the gas? (N2019/P1/Q1)

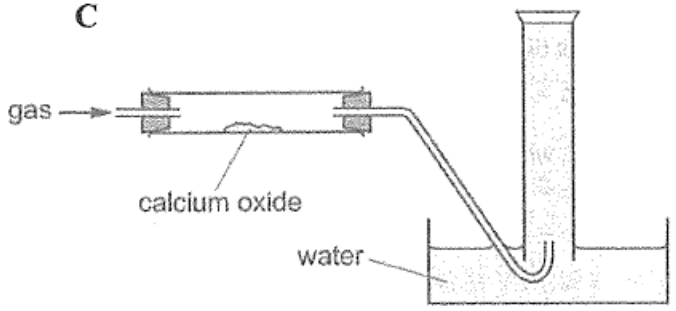
A



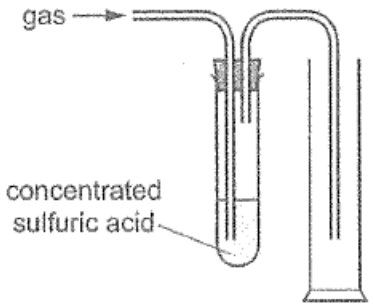
B



C



D



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Answer:

6. **A**
Use a basic/neutral drying agent so that the alkaline gas will not react with the drying agent. Collect the gas using upward delivery since it is less dense than air.

Try it yourself! (TYS Question)

7. When an excess of dilute acid is added to a known quantity of sodium carbonate, the temperature of the mixture changes.
An experiment is designed to measure the temperature change when all the carbonate reacts with the acid.
In addition to a thermometer and measuring cylinder, the following pieces of apparatus are available.

1 gas syringe
2 stopwatch
3 balance
4 Styrofoam cup

Which pieces of apparatus are needed for this experiment? (N2020/P1/Q1)

A 1, 2, 3 and 4
B 1 and 2 only
C 2, 3 and 4 only
D 3 and 4 only

( )

Answer:

7. **D**
The use of a balance is necessary to determine if all the carbonate has reacted with the acid. A Styrofoam beaker is needed to minimise the heat loss to the surroundings since this is an experiment which measures temperature change.

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