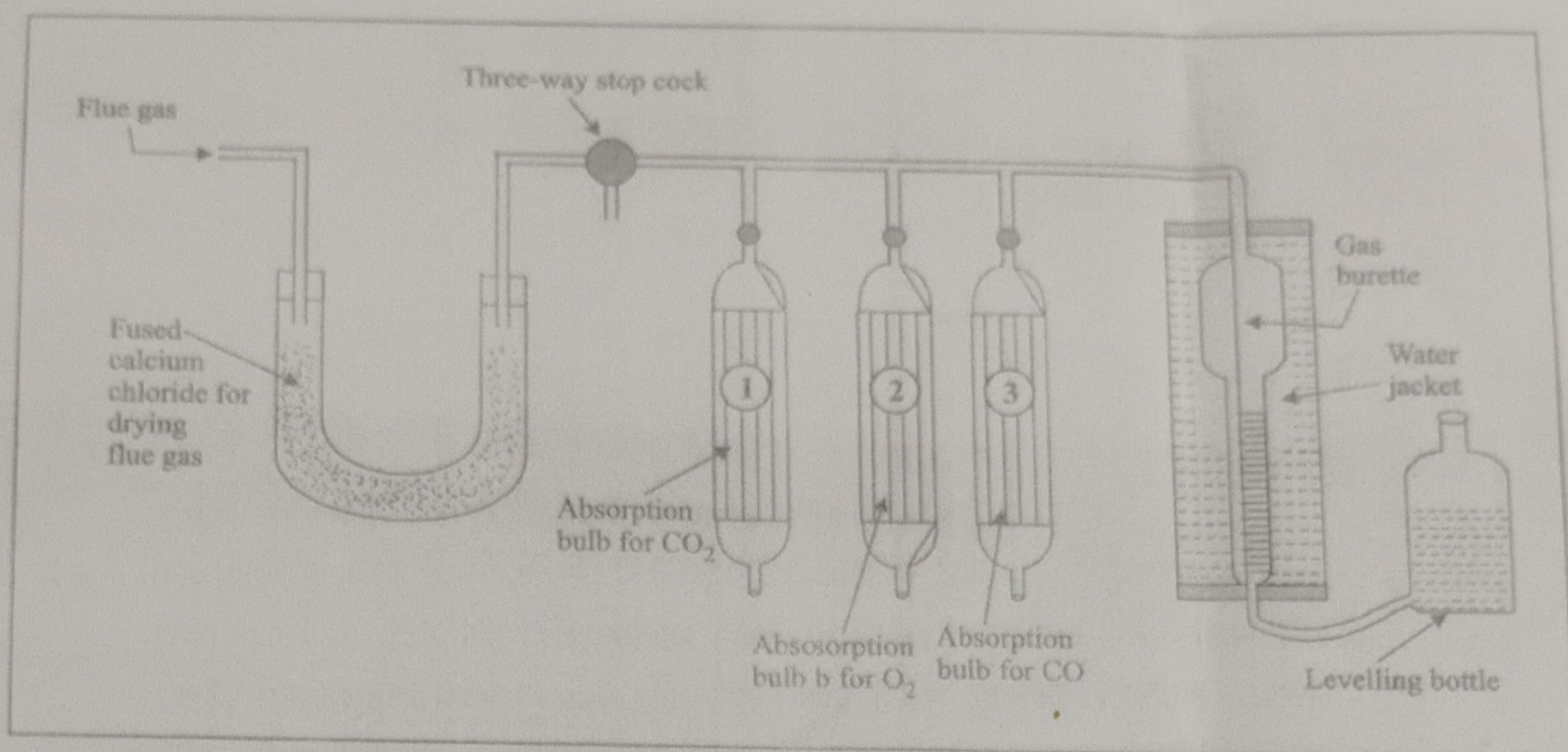


ORSAT APPARATUS

Fig. 6.1 Orsat's apparatus



The mixture of gases (like CO_2 , O_2 , CO , etc) coming out from the combustion chamber is called flue gases. The analysis of a flue gas would give an idea about the complete or incomplete combustion process. The analysis of flue gases is carried out by using orsat's apparatus.

Description of orsat's apparatus

It consists of a horizontal tube. At one end of this tube, U-tube containing fused CaCl_2 is connected through 3-way stop cock. The other end of this tube is connected with a graduated burette. The burette is surrounded by a water-jacket to keep the temperature of gas constant. The lower end of the burette is connected to a water reservoir by means of a rubber tube. The level of water in the burette can be raised or lowered by raising or lowering the reservoir (fig 6.1).

The horizontal tube is also connected with three different absorption bulbs 1, 2, and 3 for absorbing CO_2 , O_2 and CO .

Bulb	Reagent	Function
1	Potassium hydroxide solution.	Absorbs only CO_2
2	Alkaline pyrogallol solution.	Absorbs CO_2 and O_2
3	Ammoniacal cuprous chloride solution.	Absorbs CO_2 , O_2 and CO

Working

The 3-way stop-cock is opened to the atmosphere and the reservoir is raised, till the burette is completely filled with water and air is excluded from the burette. The 3-way stop-cock is now connected to the flue gas supply and the flue gas is sucked into the burette and the volume of flue gas is adjusted to 100 cc by raising and lowering the reservoir. Then the 3-way stop cock is closed.

(a) Absorption of CO_2

The stopper of the absorption bulb-1, containing KOH solution, is opened and all the gas is passed into the bulb-1 by raising the level of water in the burette. The gas enters into the bulb-1, where CO_2 present in the flue gas is absorbed by KOH

The gas is again sent to the burette. This process is repeated several times to ensure complete absorption of CO_2 . The decrease in volume of the flue gas in the burette indicates the volume of CO_2 in 100 cc of the flue gas.

(b) Absorption of O_2

Stop-cock of bulb-1 is closed and stop cock of bulb-2 is opened. The gas is again sent into the absorption bulb-2, where O_2 present in the flue gas is absorbed by alkaline pyrogallol. The decrease in volume of the flue gas in the burette indicates the volume of O_2 .

(c) Absorption of CO

Now stop-cock of bulb-2 is closed and stop-cock of bulb-3 is opened. The remaining gas is sent into the absorption bulb-3, where CO present in the flue gas is absorbed by ammoniacal cuprous chloride. The decrease in volume of the flue gas in the burette indicates the volume of CO. The remaining gas in the burette after the absorption of CO_2 , O_2 & CO is taken as nitrogen.

Significance (or) uses of flue gas analysis

1. Flue gas analysis gives an idea about the complete or incomplete combustion process.
2. If the flue gases contain considerable amount of CO, it indicates that incomplete combustion is occurring and it also indicates that the short supply of O_2 .
3. If the flue gases contain considerable amount of O_2 , it indicates that complete combustion is occurring and also it indicates that the excess of O_2 is supplied.

Precautions

1. Care must be taken in such a way that, the reagents in the absorption bulb 1, 2 and 3 should be brought to the etched marked level one by one by raising and lowering reservoir bottle.
2. All the air from the reservoir bottle is expelled to atmosphere by lifting the reservoir bottle.
3. It is essential that CO_2 , O_2 and CO are absorbed in that order only.
4. As the CO content in flue gas is very small, it should be measured quite carefully.