

Determination of specific surface

There are 2 methods to determine specific surface:

- (1) Adsorption method
- (2) Air permeability method

(1) Adsorption method:

→ A large specific surface allows for adsorption of gases.

→ At low pressure, the gas is adsorbed on surface of adsorbent & tends to form a monolayer.

→ At saturation the amount of adsorption is a function of surface area of powder at adsorbent.

→ This can be explained by an equation called

BET equation

→ The expression of equation is

$$\frac{P}{V(P_0 - P)} = \frac{1}{Vm b} + \frac{b - P}{Vm b} \frac{P}{P_0}$$

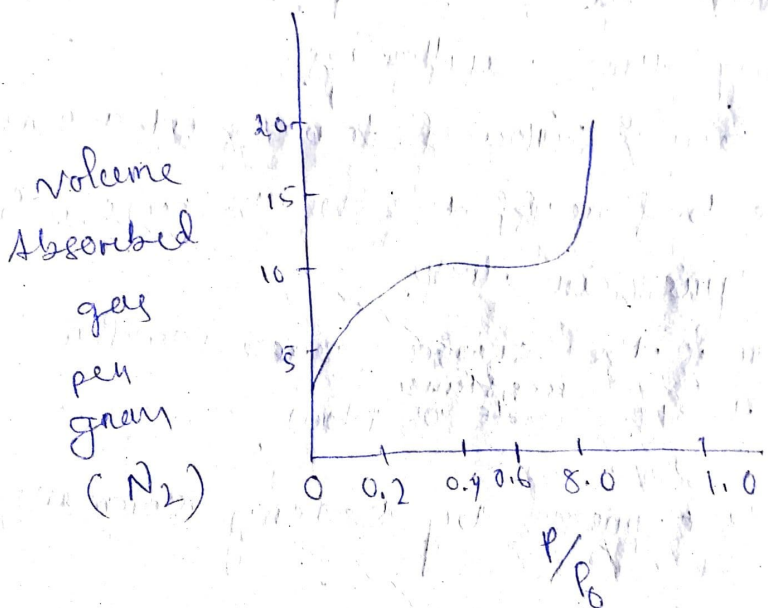
where, p = pressure of adsorbate i.e. gas
 while V = the volume of the vapour or gas per gram.

P_0 = vapour pressure at the saturation

V_M = Amount of vapour adsorbed per unit mass of adsorbent

B = constant proportional to heat of adsorption & latent heat of condensation of subsequent layer.

→ If you plot a graph by taking volume of gas adsorbed per gram of adsorbent against the pressure of the gas at constant temp then following plot is expressed.



BET = Brunauer Emmett Teller equation

Procedure

The known amount of powder is introduced into the sample tube.

→ The gases present in this powder are evaluated

→ The N_2 gas will be applied over the powder

at constant temp. with some pressure.
 ⇒ The amount of N_2 gas absorbed is related to the specific surface of powder and if we plot a graph by taking volume of absorbed gas vs pressure will get the specific surface of the powder.

⇒ The area under the curve is proportional to the ^{gas} adsorbed on the particles.

② Air permeability: - (Fisher's subsieve sizer)

Principle:

Here the powder is taken in a compact plug whose surface ~~surface~~ contact appears as the series of capillaries.

⇒ When the air is allowed to pass the air travels through these capillaries.

⇒ When the air is allowed to pass at a constant pressure the bed resist the flow of air which results in the pressure drop.

⇒ The greater is the surface area powder greater will be the ^{resistance} rate of flow.

⇒ This can be expressed by Kozeny's equation.

$$v \propto \frac{A}{\eta S_w^2} \cdot \frac{\Delta p t}{kL} \cdot \frac{E}{(1-E)^2}$$

- A = cross-sectional area of the bed
- Δp = pressure difference of the plug
- t = time of flow
- L = length of sample holder

E = porosity of the powder

S_w = surface area per gm. of the powder

η = viscosity of the area

k = constant

V = volume of the air flowing through the bed,

Method:

This instrument is called Fisher subsieve sizer
 \Rightarrow it consists of sample tube containing packed powder sample

\Rightarrow One end of the powder sample is connected to air pump and another is attached to a manometer.

\Rightarrow The air pump is connected to the constant pressure regulator.

\Rightarrow Air is passed through a drier to remove any moisture.

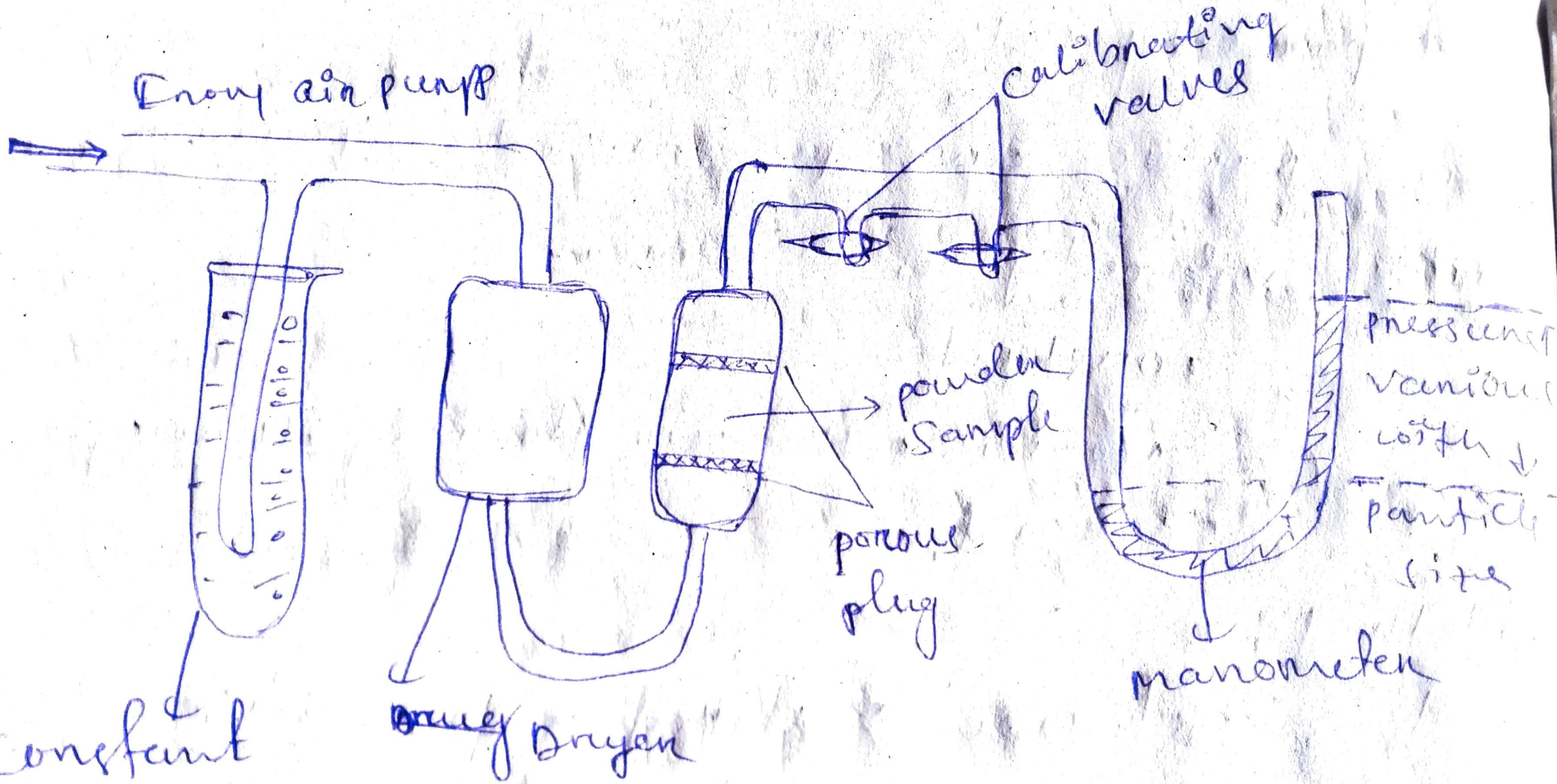
\Rightarrow Air is then allowed to flow through the packed powder in the sample tube.

\Rightarrow The pressure drop is measured by the manometer.

\Rightarrow Greater the pressure drop higher is the surface area.

Practical considerations:

1. More compact the plug, lower the porosity greater is the resistance to air flow.
2. The capillaries are not circular should be longer than the length of the bed.



(Fisher subsine & iten)

of 21/01/20