ABSORPTION COEFFICIENT

When a sound wave strikes a surface, a part of its energy is absorbed, a part of it is transmitted and the remaining part is reflected.

The property of the surface to convert sound energy into other forms of energy is known as absorption.

The effectiveness of absorption of sound energy by the surface is expressed as absorption coefficient.

Absorption coefficient (a) is defined as the ratio of sound energy absorbed by its surface to that of total sound energy incident on the surface.

$$a = \frac{\text{Sound energy absorbed by the surface}}{\text{Total sound energy incident on the surface}}$$

Practical definition of absorption coefficient

In order to compare the relative sound absorption of different materials the open window is taken as standard reference since it is a perfect sound absorber.

It is so because the whole of the sound energy passes through the open window and none is reflected.

Absorption coefficient of a surface is the ratio of sound energy absorbed by **1 m^2** of the surface to that absorbed by **1 m^2 of an open window**.

$$a = \frac{\text{Sound energy absorbed by } 1m^2 \text{ of the surface}}{\text{Sound energy absorbed by } 1m^2 \text{ of open window}}$$

DETERMINATION OF ABSORPTION COEFFICIENT

Let us consider a sample for which the absorption coefficient is to be measured. Initially without this material the reverberation time in a room is measured and let it be T_1.

Now the given sample is kept inside the room and again the reverberation time is measured and let it be T_2.

Then from sabine's formula

For case (i) (i.e) without the sample

$$T_1 = 0.167V/\Sigma as \qquad \text{.....(1)}$$

Where Total absorption = $\Sigma as = a_1s_1+a_2s_2+\ldots\ldots$
[for all the materials such as doors, windows, etc.]

For case (ii) (i.e.) Including the sample material

$$T_2 = 0.167V/ \Sigma as+a_ms_m \qquad \text{.....(2)}$$

Where a_m = absorption coefficient of the material to be found

s_m = surface area of the material.

Therefore from equ. (1) we have

$$\Sigma as = 0.167V/T_1 \qquad \text{.....(3)}$$

From equ. (2) we have $\Sigma as+a_ms_m = 0.167V/T_2$

Subtracting equ. (3) from equ. (4) we have

$$a_m s_m = 0.167V(1/T_2 - 1/T_1)$$

(or) $$a_m = 0.167V/s_m[T_1 - T_2/T_1T_2]$$

Hence, by knowing the terms on the right hand side the absorption coefficient of the given sample can be determined.