Expansion co-efficient and compressibility :-

(β) (K)

Average coefficient of volume expansion

$$= \frac{\text{change of volume per unit volume}}{\text{change of temperature}}$$

at constant pressure.

If all the changes are infinitesimal, then the differential coefficient of volume expansion is known as the volume expansivity which is denoted by β.

Thus, $\boxed{\beta = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P}$ $\Rightarrow \left(\frac{\partial V}{\partial T}\right)_P = \beta V$

Isothermal compressibility (K):

K is a Greek letter called kappa.

Isothermal compressibility is defined as the reciprocal of isothermal bulk modulus. So, first we have to define isothermal bulk modulus.

average bulk modulus $= -\frac{\text{change of pressure}}{\text{change in volume per unit volume}}$

Since an increase of pressure always produces a decrease of volume, the minus sign is introduced to make the bulk modulus a positive number.

When the changes are infinitesimal, we have differential bulk modulus. ~~denoted by B~~.

Again, if the temperature is kept constant, the bulk modulus is called <u>isothermal bulk modulus</u> denoted by B.

$$\therefore B = -\left.\frac{\partial P}{(\partial V/V)}\right|_T$$

$$\boxed{B = -V\left(\frac{\partial P}{\partial V}\right)_T}.$$

The reciprocal of B is known as isothermal compressibility (K).

$$\therefore \boxed{K = -\frac{1}{V}\left(\frac{\partial V}{\partial P}\right)_T}.$$

$$\Rightarrow \left(\frac{\partial V}{\partial P}\right)_T = -KV.$$