

## Propagation of Errors.

(1) **Error in sum of the quantities:** Suppose  $x = a + b$

Let  $\Delta a$  = absolute error in measurement of a

$\Delta b$  = absolute error in measurement of b

$\Delta x$  = absolute error in calculation of x i.e. sum of a and b.

The maximum absolute error in x is  $\Delta x = \pm(\Delta a + \Delta b)$

Percentage error in the value of  $x = \frac{(\Delta a + \Delta b)}{a + b} \times 100\%$

(2) **Error in difference of the quantities:** Suppose  $x = a - b$

Let  $\Delta a$  = absolute error in measurement of a,

$\Delta b$  = absolute error in measurement of b

$\Delta x$  = absolute error in calculation of x i.e. difference of a and b.

The maximum absolute error in x is  $\Delta x = \pm(\Delta a + \Delta b)$

Percentage error in the value of  $x = \frac{(\Delta a + \Delta b)}{a - b} \times 100\%$

(3) **Error in product of quantities:** Suppose  $x = a \times b$

Let  $\Delta a$  = absolute error in measurement of a,

$\Delta b$  = absolute error in measurement of b

$\Delta x$  = absolute error in calculation of x i.e. product of a and b.

The maximum fractional error in x is  $\frac{\Delta x}{x} = \pm \left( \frac{\Delta a}{a} + \frac{\Delta b}{b} \right)$

Percentage error in the value of x = (Percentage error in value of a) + (Percentage error in value of b)

(4) **Error in division of quantities:** Suppose  $x = \frac{a}{b}$

Let  $\Delta a$  = absolute error in measurement of a,

$\Delta b$  = absolute error in measurement of b

$\Delta x$  = absolute error in calculation of x i.e. division of a and b.

The maximum fractional error in x is  $\frac{\Delta x}{x} = \pm \left( \frac{\Delta a}{a} + \frac{\Delta b}{b} \right)$

Percentage error in the value of  $x =$  (Percentage error in value of  $a$ ) +  
(Percentage error in value of  $b$ )

(5) **Error in quantity raised to some power:** Suppose  $x = \frac{a^n}{b^m}$

Let  $\Delta a =$  absolute error in measurement of  $a$ ,

$\Delta b =$  absolute error in measurement of  $b$

$\Delta x =$  absolute error in calculation of  $x$

The maximum fractional error in  $x$  is  $\frac{\Delta x}{x} = \pm \left( n \frac{\Delta a}{a} + m \frac{\Delta b}{b} \right)$

Percentage error in the value of  $x = n$  (Percentage error in value of  $a$ ) +  $m$   
(Percentage error in value of  $b$ )

Note: The quantity which have maximum power must be measured carefully because its contribution to error is maximum.