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Lecture no.2

Micrometer screw gauge

BY

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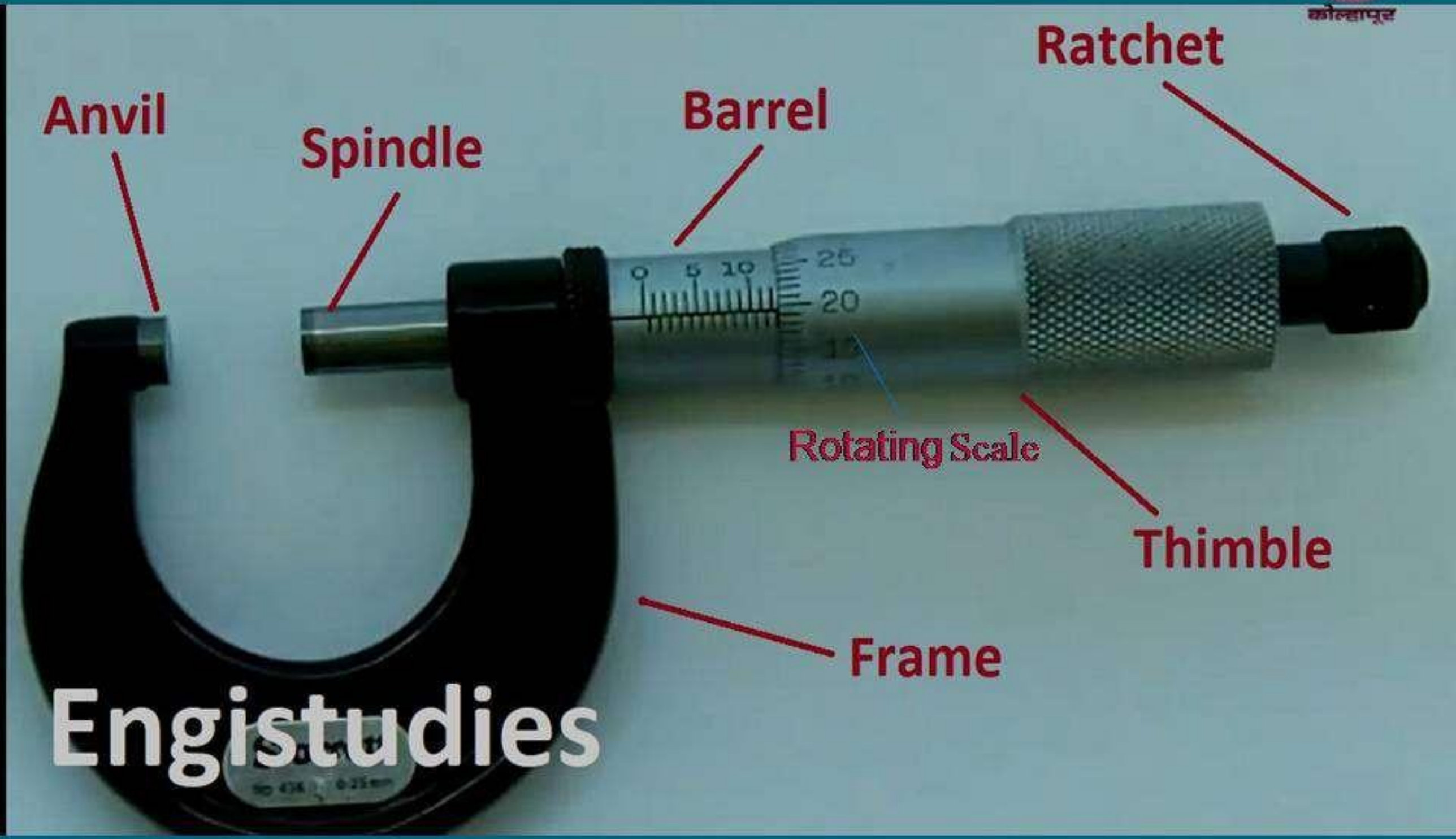
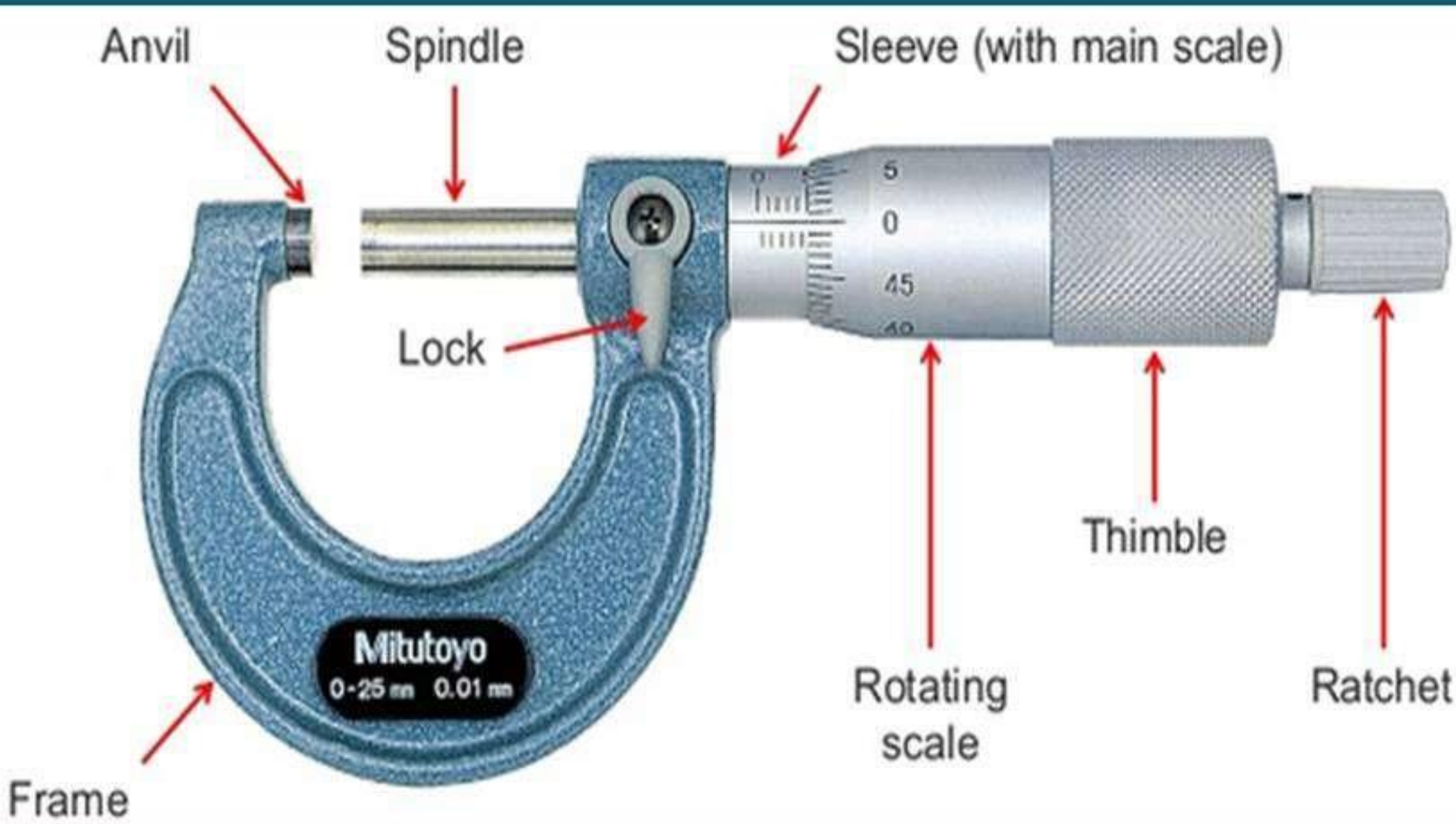
Least count of an instrument is the smallest quantity that can be accurately measured with it.




Anvil
Spindle
Sleeve (with main scale)
Lock
Mitutoyo
0-25 mm 0.01 mm
Frame
Rotating scale
Thimble
Ratchet

Least count of micrometer screw gauze is mathematically defined as,

$$\text{Least count} = \frac{\text{Pitch of the screw}}{\text{Total number of divisions on rotating/circular/vernier scale}}$$

Pitch of the screw = 0.1

Total number of divisions on rotating/circular/vernier scale = 100

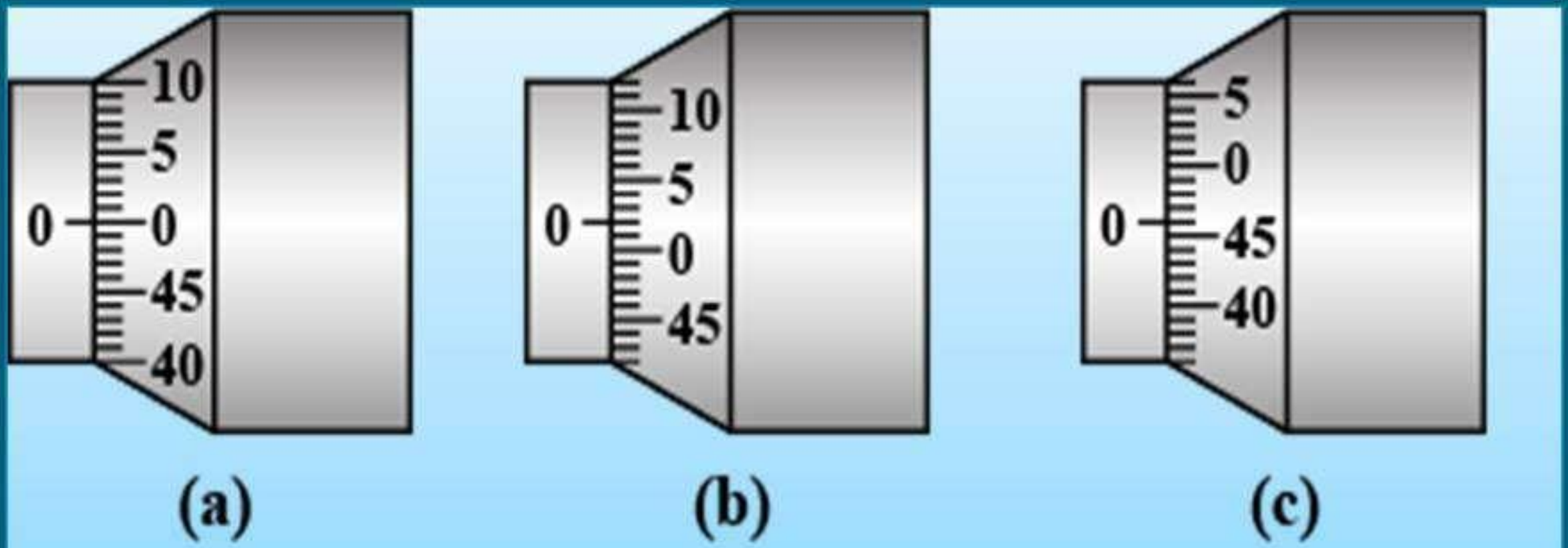
$$\text{Least count} = \frac{0.1}{100}$$

$$= 0.001 \text{ cm}$$

Zero error

When anvil and spindle touch each other, the zero of the sleeve or main scale/datum line should coincide with the zero of rotating/circular/vernier scale. If it is not so, the instrument is said to possess zero error

Zero error may be positive or negative, depending upon whether the zero of rotating/circular/vernier scale lies to the above or below the zero of the sleeve or main scale. This is shown by the Fig. (b) and (c). In this situation, a correction is required to the observed readings.



(a) (b) (c)

No zero error Positive zero error Negative zero error

No zero error

(a)

No zero error

Fig (i) shows an example of no zero error. From the figure, one can see that when anvil and spindle touch each other, zero of the rotating/circular/vernier scale reading is exactly coincide with of zero of the main scale/datum line. Hence, there is no zero error in this case.

Positive zero error

(b)

Positive zero error

Fig (b) shows an example of positive zero error. From the figure, one can see that when anvil and spindle touch each other, zero of the rotating/circular/vernier scale is shifted to the below of zero of the main scale/datum line . In Fig. (b), 2nd rotating/circular/vernier division is coinciding with zero of a main scale/datum line reading.

∴ Zero Error = + 2 × Least Count = + 0.002 cm

Hence, the zero error is positive in this case.

For any measurements done, the zero error should be 'subtracted' from the observed reading.

∴ True Reading = Observed reading – (+ Zero error)

Negative zero error

(c)

Negative zero error

Fig (c) shows an example of negative zero error. From the figure, one can see that when anvil and spindle touch each other, zero of the rotating/circular/vernier scale reading scale is shifted to the above of zero of the main scale/datum line. In Fig. (c), 4th rotating/circular/vernier scale reading division is coinciding with zero of a main scale/datum line reading.

$\therefore$ Zero Error = - 4 $\times$ Least Count = - 0.004 cm

Hence, the zero error is negative in this case.

For any measurements done, the zero error should be 'subtracted' from the observed reading.

The last graduation visible to the left of the thimble is 7 mm and the thimble lines up with the main scale at 38 hundredths of a millimetre (0.38 mm), therefore the resulting is 7 .38 mm

Main scale reading =0.7cm

rotating/circular/vernier scale reading =38

Rotating/circular/Vernier scale reading × Least count = 38 × 0.001 = 0.038

Obtained reading = Main scale reading + Rotating/circular/Vernier scale reading × Least count

= 0.7 + 38 × 0.001

= 0.738cm

Main scale reading=0.75cm

Rotating/circular/Vernier scale reading =22

Rotating/circular/Vernier scale reading × Least count = 22 × 0.001 = 0.022

Obtained reading = Main scale reading + Rotating/circular/Vernier scale reading × Least count

= 0.75 + 22 × 0.001

= 0.772cm