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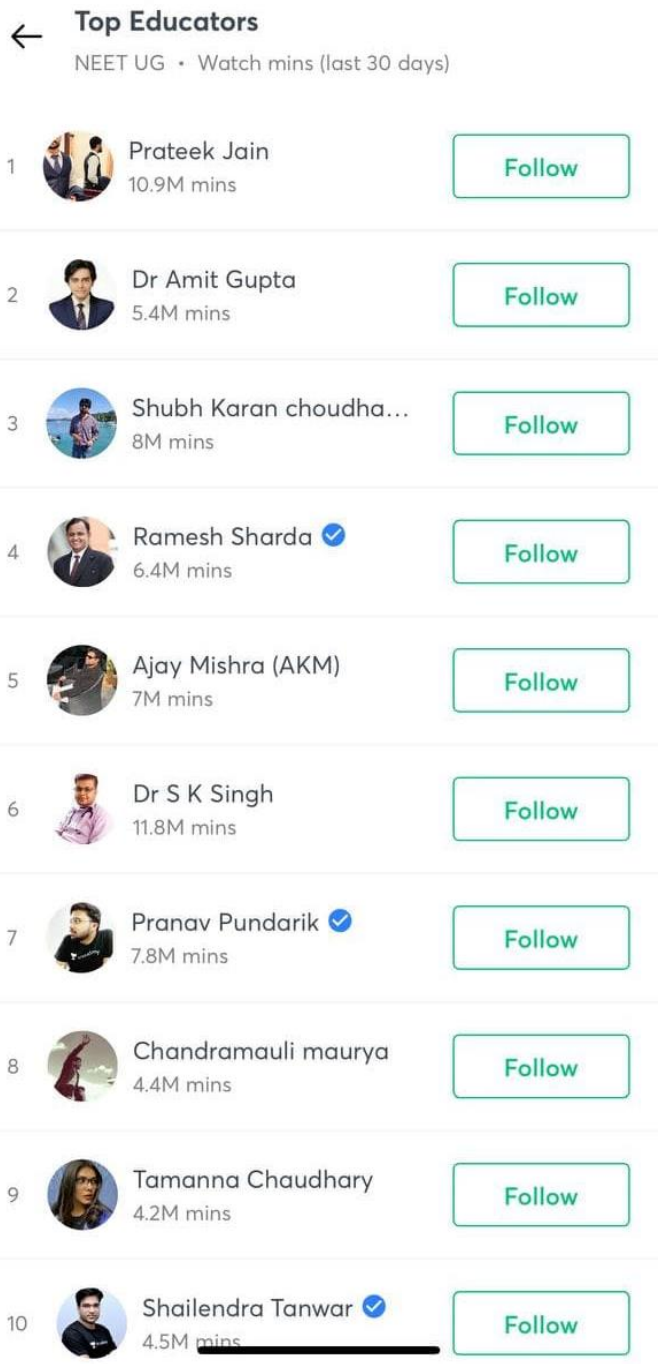

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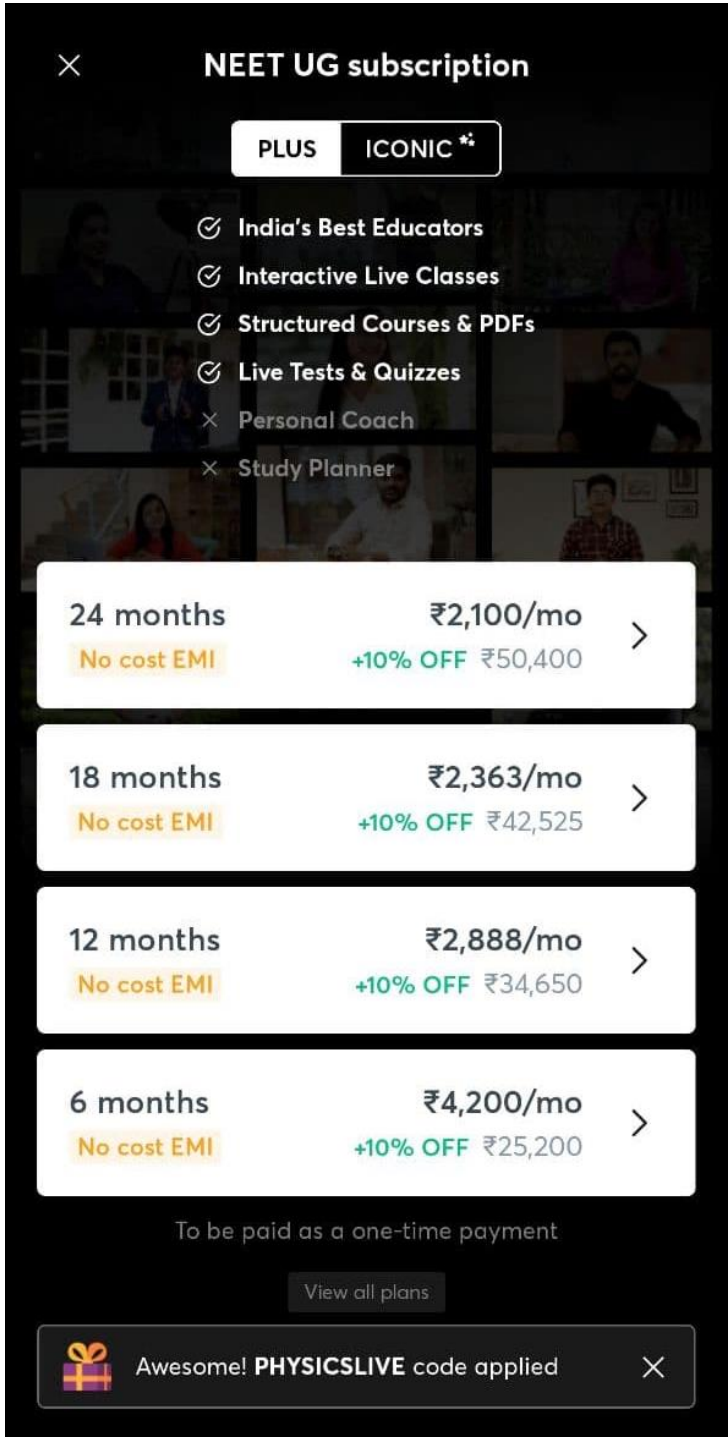

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NEET & JEE-Main
Physics DPP

DPP-4 Screw gauge & Vernier calliper

By Physicsaholics Team

Q) In a screw gauge, the main scale has divisions in millimeter and circular scale has 50 divisions. The least count of screw gauge is

(a) $2\mu m$

(b) $5\mu m$

(c) $20\mu m$

(d) $50\mu m$

Ans. c

1 MSD = 1 mm.

number of divisions in Vernier Scale = 50

$$L.C. = \frac{1 \text{ mm}}{50}$$

$$= 0.02 \text{ mm}$$

$$= 20 \mu\text{m}.$$

Q) In a vernier calliper, N divisions of vernier scale coincide with (N – 1) divisions of main scale (in which 1 division represents 1mm). The least count of the instrument in cm should be:

(a) N

(b) $N-1$

(c) $\frac{1}{10N}$

(d) $\frac{1}{N-1}$

Ans. c

Given; N (VSD) $= (N-1)$ M.S.D.

1 Division of Main Scale = 1 mm.

So, L.C. = 1 MSD − 1 VSD

From given equation

$$N \text{ VSD} = N-1 \text{ MSD}$$

$$1 \text{ VSD} = \frac{N-1}{N} \text{ MSD} = \left(1-\frac{1}{N}\right) \text{MSD}$$

So, L.C. = 1 MSD − 1 VSD = 1 MSD $-\left(1-\frac{1}{N}\right)$ MSD

$$= \frac{1}{N} \text{MSD} = \frac{1}{N} \times (1 \text{ mm})$$

[$\because$ 1 MSD = 1 mm]

So, $\text{L.C.} = \frac{1}{N} \text{ mm} = \frac{1}{10N}$ C.M.

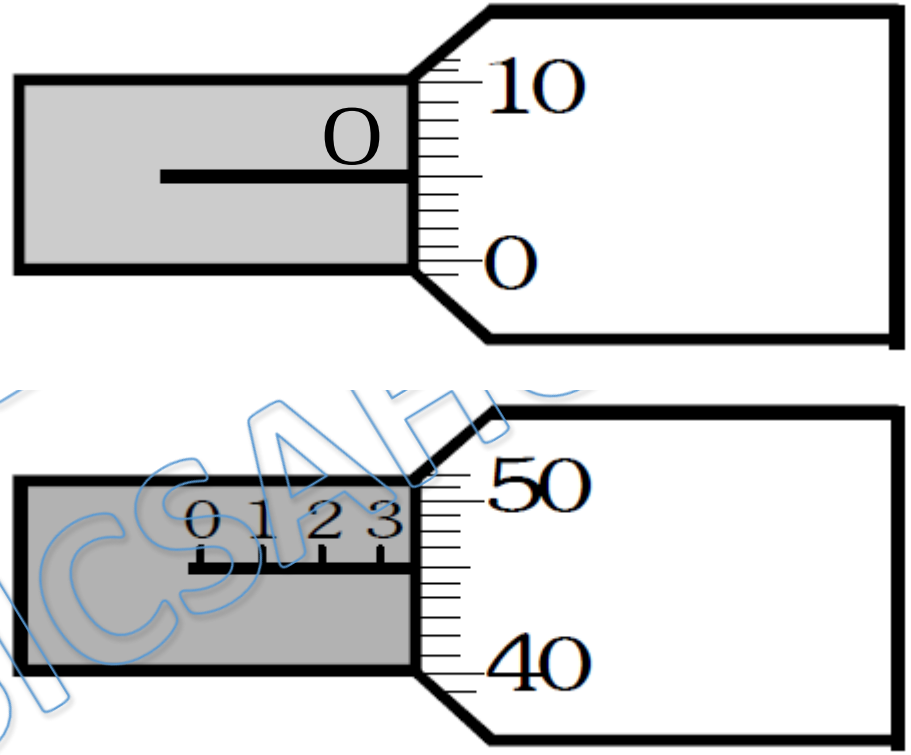
Q) The circular scale of a micrometer has 200 divisions and pitch of main scale is 2mm. Find the measured value of thickness of a thin sheet.

(a) 3.41 mm

(b) 6.41 mm

(c) 3.46 mm

(d) 3.51 mm



Ans. b

$$L.C. = \frac{2mm}{200} = 0.01\ mm.$$

Zero error = + 5 division of circular scale.

Reading = M.S.R + L.C. × V.S.R

= (3 × 2m) + (0.01mm)[46 − 5]

∵ 46 division in vernier scale

4 − 5 → correction for zero error.

Reading = 6mm + 0.01 × 41 = 6 + 0.41 mm

= 6.41 mm.

Q) In a vernier callipers, one main scale division is x cm and n divisions of the vernier scale coincide with (n-1) divisions of the main scale. The least count (in cm) of the callipers is :-

(a) $\frac{n-1}{n}x$

(b) $\frac{n}{n-1}x$

(c) $\frac{x}{n}$

(d) $\frac{x}{n-1}$

Ans. c

1 MSD = x cm.

n VSD = (n-1) MSD

$\therefore$ 1 VSD = $\frac{n-1}{n}$ MSD

L.C = 1 MSD - 1 VSD

= 1 MSD - $\left(\frac{n-1}{n}\right)$ MSD

= $\frac{n-(n-1)}{n}$ MSD

= $\frac{1}{n}$ MSD

$\because$ 1 MSD = x cm.

$\therefore$ L.C = $\frac{x}{n}$ cm.

Q) A screw gauge gives the following reading when used to measure the diameter of a wire.
Main scale reading : 0 mm.
Circular scale reading : 52 divisions
Given that 1 mm on main scale corresponds to 100 divisions of the circular scale.
The diameter of wire from the above data is :-

(a) 0.026 cm
(b) 0.005 cm
(c) 0.52 cm
(d) 0.052 cm

Ans. d

MSR = 0 mm

C.S.R = 52 divisions

$$L.C. = \frac{\text{Pitch of M.S.}}{\text{no. of divisions on V.S.}} = \frac{1\text{mm}}{100}$$

L.C. = 0.01 mm.

$\therefore$ Reading = MSR + L.C. × C.SR

= 0 + 0.01 × 52

= 0.52 mm.

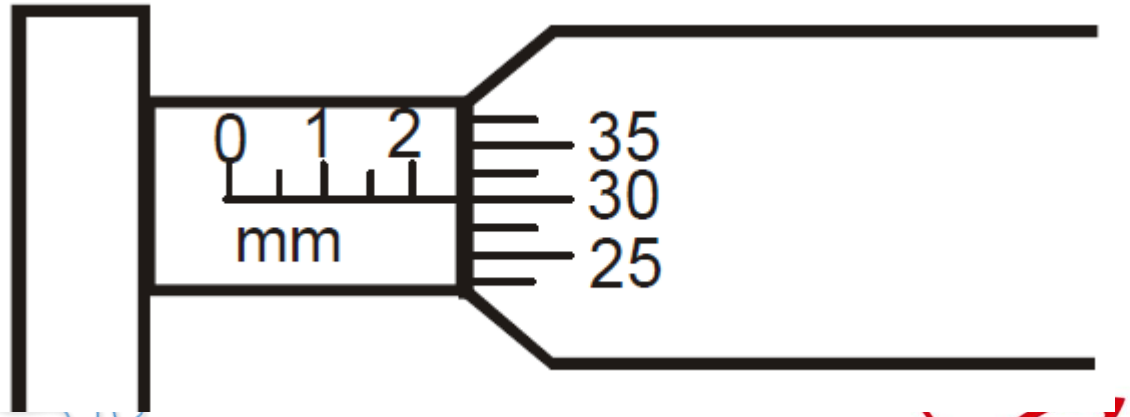
or

0.052 cm.

Q) What is the reading of screw gauge shown in figure? (100 divisions on circular scale)

(a) 2.30 mm (b) 2.29 mm

(c) 2.36 mm (d) 2.41 mm



Ans. a

In this diagram of Screwgauge:

$$L.C. = \frac{1\,mm}{100} = 0.01\,mm.$$

Reading = MSR + (L.C.) × VSR

= 2 mm + (0.01) × 30 mm.

= 2 mm + 0.30 mm

= 2.30 mm

Q) A vernier callipers having 1 main scale division = 0.1 cm is designed to have a least count of 0.02 cm. If n be the number of divisions on vernier scale and m be the length of vernier scale, then

(a) n= 10, m = 0.5 cm (b) n=9, m= 0.4 cm

(c) n=10, m = 0.8 cm (d) n=10, m= 0.2 cm

Ans. c

1 MSD = 0.1 cm

L.C = 0.02 cm

$\therefore$ L.C. = 1 MSD − 1 VSD

0.02 cm = 0.1 cm − 1 VSD

1 VSD = 0.08 cm

number of divisions on vernier scale = n

length of V.S. = 1 VSD × no of V.S.D.

$m = 0.08 \times n$

this equation is satisfied by only one option that is option 'a'.

if $n = 10$; $m = 0.8$ cm Ans

Q) In a vernier callipers, N divisions of the main scale coincide with N+m divisions of the vernier scale. What is the value of m for which the instrument has minimum least count?

(a) 1

(b) N

(c) Infinity

(d) $\frac{N}{2}$

Ans. a

given; N MSD = $N+m$ VSD.

L.C. = 1 MSD − 1 VSD

N MSD = $N+m$ VSD

$$1 \text{ VSD} = \frac{N}{N+m} \text{ MSD}$$

$$\therefore \text{L.C.} = 1 \text{ MSD} - \frac{N}{N+m} \text{ MSD}$$

$$= \left(1 - \frac{N}{N+m}\right) \text{MSD}$$

$$\text{L.C.} = \frac{m}{N+m} \text{ MSD}$$

$$\text{L.C.} = \frac{1}{\frac{N}{m}+1} \text{ MSD}$$

for min L.C.

denominator; $\left(\frac{N}{m}+1\right) \Rightarrow$ max.

denominator; $\left(\frac{N}{m}+1\right) \Rightarrow$ max.

& for $\left(\frac{N}{m}+1\right)$ max.

m = ~~minimum~~.

$(m)_{min} = 1$

[m can not be zero]

$m \neq 0$

$\therefore$ for $m = 0$

L.C. = 0 for $\text{L.C.} = \frac{m}{N+m}$

& we do not want zero L.C.

we want finite L.C.

so, $m = 1$

Q) A screw gauge advances by 3mm in 6 rotations. There are 50 divisions on circular scale. Find least count of screw gauge:

(a) $0.002cm$

(b) $0.001cm$

(c) $0.01cm$

(d) $0.02cm$

Ans. b

in 6 rotations = 3 mm.

in 1 rotation = $\frac{1}{2}$ mm.

1 rotation of circular Scale = 1 MSD

$\therefore$ 1 MSD = $\frac{1}{2}$ mm.

Also no. of divisions on circular scale = 50

$\therefore$ L.C. = $\frac{1 \text{ MSD}}{50} = \frac{\frac{1}{2} \text{ mm}}{50}$

L.C. = $\frac{1}{100}$ mm

L.C. = 0.01 mm.

or

0.001 cm.

Q) A student measured the diameter of a wire using a screw gauge with least count 0.001 cm and listed the measurements. The correct measurement is –

(a) 5.3 cm (b) 5.32 cm (c) 5.320 cm (d) 5.3200 cm

Ans. c

L.C. = 0.001 cm.

means, instrument can measure upto minimum 0.001 cm,

So, 5.320 cm ~~can~~ be measured can.

with this screw gauge, upto [3 digits after decimal]

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