Physicsaholics

DPP – 4 (Unit & Dimension)

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/49

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Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/69

Q 1. 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) $5\mu m$

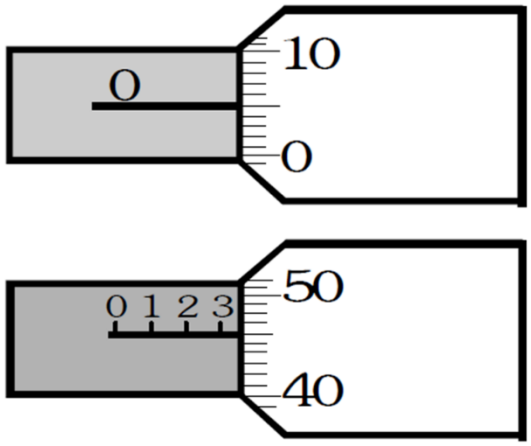
(c) $20\mu m$ (d) $50\mu m$

Q 2. 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) $\frac{1}{N-1}$

Q 3. 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

Q 4. 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) $\frac{n}{n-1}x$

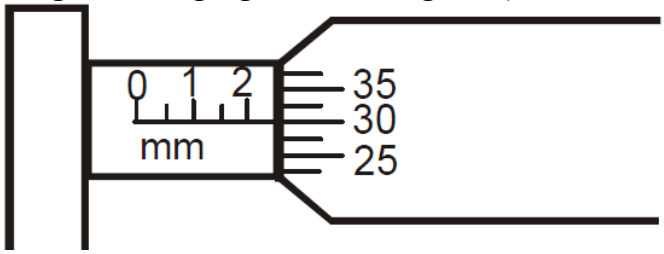
(c) $\frac{x}{n}$ (d) $\frac{x}{n-1}$

Q 5. 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

Q 6. 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

Q 7. 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

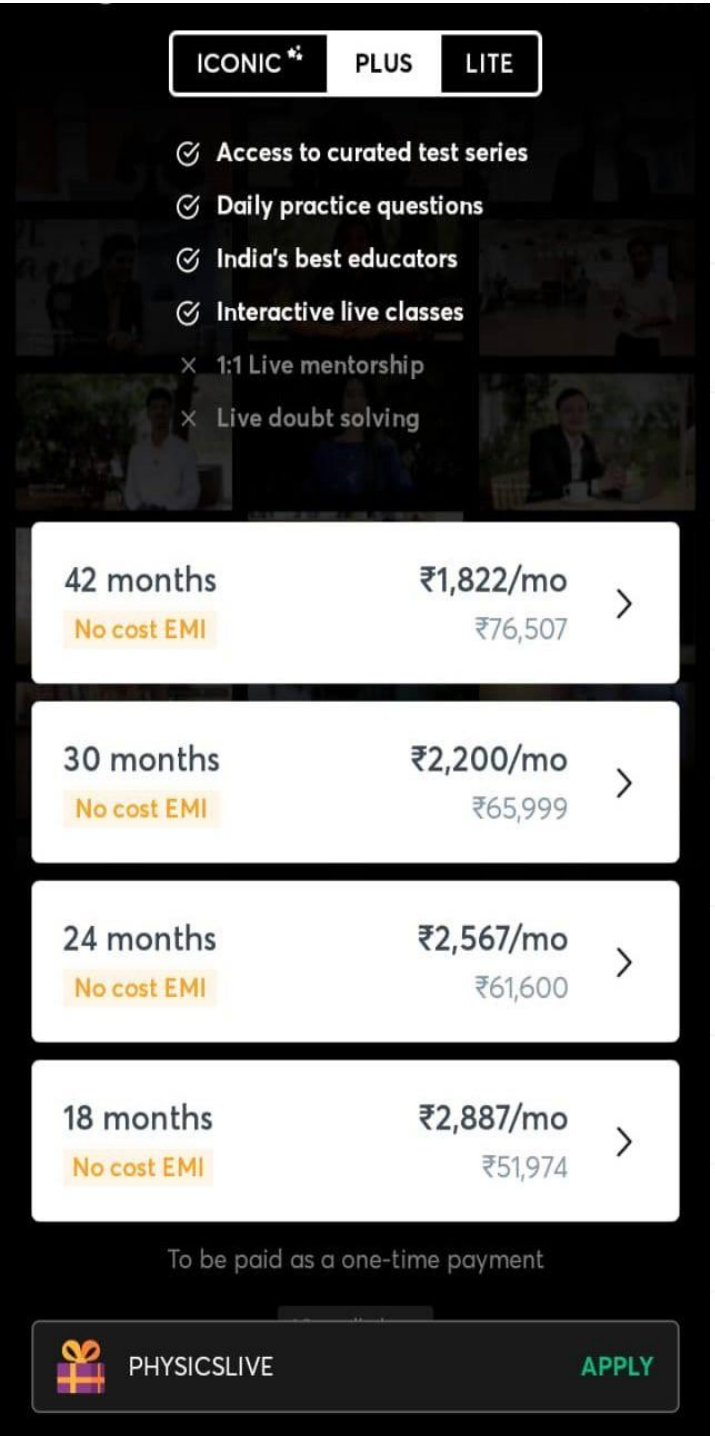
Q 8. In a vernier callipers, N divisions of the main scale coincide with N+m divisions of the vernier scale. What is the value of m for which the instrument has minimum least count?
(a) 1 (b) N
(c) Infinity (d) $\frac{N}{2}$

Q 9. 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) $0.02cm$

Q 10. 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

Answer Key

Q.1 c	**Q.2 c**	**Q.3 b**	**Q.4 c**	**Q.5 d**
Q.6 a	**Q.7 c**	**Q.8 a**	**Q.9 b**	**Q.10 c**



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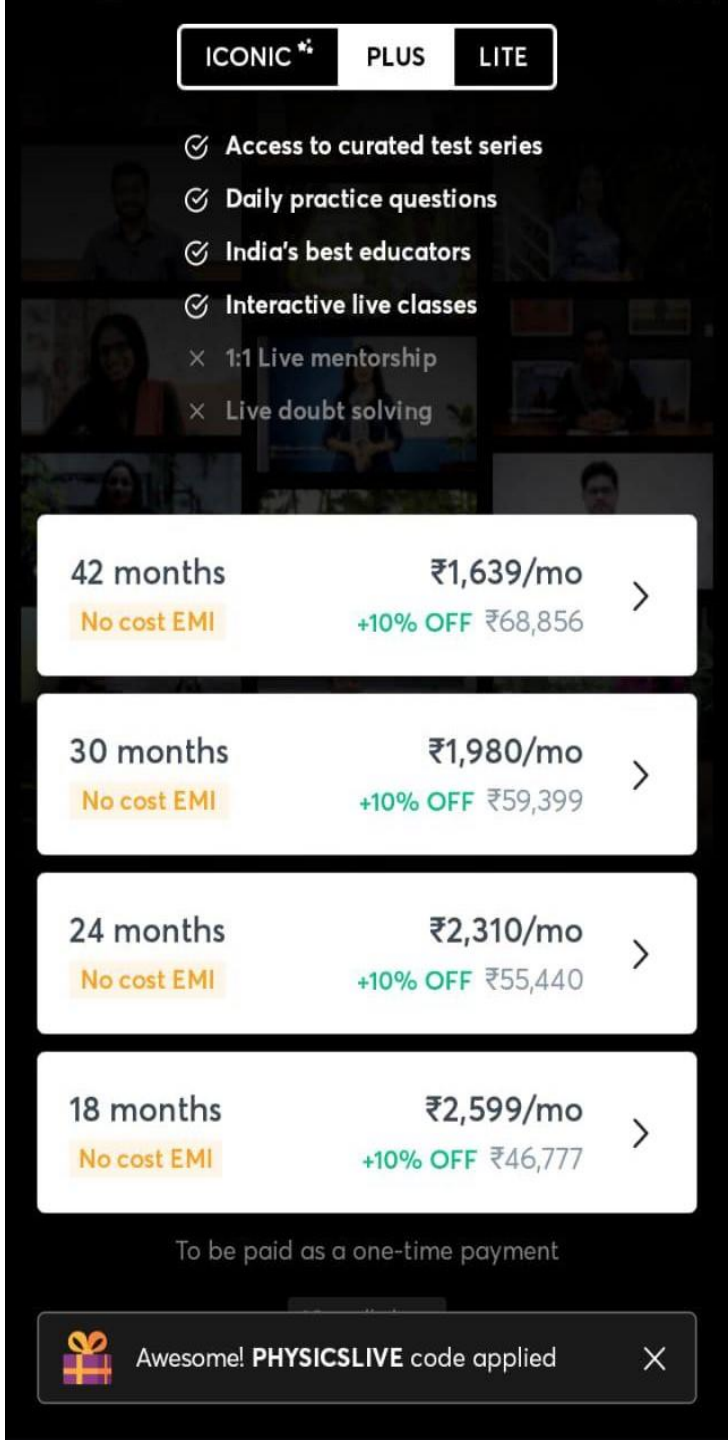

Written Solution

DPP-4 Screw gauge & Vernier calliper

By Physicsaholics Team

Solution: 1

1 MSD = 1 mm.

number of divisions in Vernier Scale = 50

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

$$= 0.02 \text{ mm}$$

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

Ans. c

Solution: 2

Given; N (VSD) $= (N-1)$ MSD.

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, L.C. $= \frac{1}{N}$ mm $= \frac{1}{10N}$ c.m.

Ans. c

Solution: 3

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

Zero error = + 5 division of circular scale.

Reading = M.S.R + L.C. × V.S.R.

$$= (3 \times 2\,mm) + (0.01\,mm)[46 - 5]$$

∴ 46 division in vernier scale

4 − 5 → correction for zero error.

Reading = $6\,mm + 0.01 \times 41 = 6 + 0.41\,mm$

$= 6.41\,mm.$

Ans. b

Solution: 4

$1\ MSD = x\ cm.$

$n\ VSD = (n-1)\ MSD$

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

$L.C = 1\ MSD - 1\ VSD$

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

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

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

$\therefore\ 1\ MSD = x\ cm.$

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

Ans. c

Solution: 5

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.

Ans. d

Solution: 6

In this diagram of Screwgauge:

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

Reading = MSR + (L.C.) × VSR

= 2 mm + (0.01) × 30 mm.

= 2 mm + 0.30 mm

= 2.30 mm

Ans. a

Solution: 7

1 MSD = 0.1 cm

LC = 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 × n

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

if n = 10 ; m = 0.8 cm Ans

Ans. c

Solution: 8

given, N MSD $= N+m$ VSD

L.C. $= 1$ MSD $- 1$ VSD

N MSD $= N+m$ VSD

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

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

$= \frac{m}{N+m}$ MSD

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

& we do not want zero L.C.

we want finite L.C.

so, $m = 1$

Ans. a

Solution: 9

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.

Ans. b

Solution: 10

L.C. = 0.001 cm.

means, instrument can measure upto minimum 0.001 cm.

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

with this screw gauge,

upto [3 digits after decimal]

Ans. c

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