YAKEEN NEET 2.0

2026

HOME WORK

Units and Measurements

Physics

Homework Solution 01 (of Lec-11)

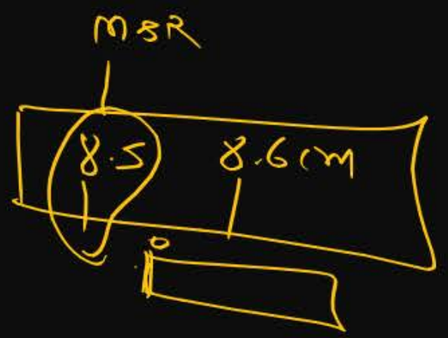
By- Manish Raj (MR Sir)

Question

zero error = 0.02 cm

The vernier scale used for measurement has a positive zero error of 0.2 mm. If while taking a measurement it was noted that zero on the vernier scale lies between 8.5 cm and 8.6 cm. and vernier coincidence is 6, then the correct value of measurement is _____ (least count = 0.01 cm) **[17 March, 2021 (Shift-I)]**

1. 8.58 cm
2. 8.54 cm
3. 8.56 cm
4. 8.36 cm



Read = 8.5 cm + 6 × 0.01 cm

= 8.56 cm − 0.02 cm

= 8.54 cm

Question

A vernier calipers has 1 mm marks on the main scale. It has 20 equal divisions on the vernier scale which match with 16 main scale divisions. For this vernier calipers, the least count is **(IIT-JEE 2010)**

1. 0.02 mm
2. 0.05 mm
3. 0.1 mm
4. 0.2 mm

H/W

$20\,VSD = 16\,MSD$

$LC = 1\,mm - \frac{16\,MSD}{20}$

$= \left(\frac{20-16}{20}\right) 1\,mm$

$= \frac{4\,mm}{20}$

$= \frac{1}{5}\,mm$

$= 0.2\,mm$

Question

The least count of the main scale of a screw gauge is 1 mm. The minimum number of divisions on its circular scale required to measure 5 μm diameter of a wire is

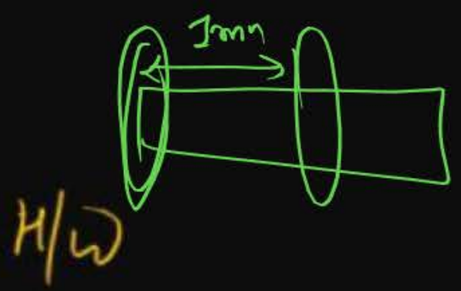
[3 Sep, 2020 (Shift-I)]

1. 50
2. 200
3. 100
4. 500

1 M.S.D = 1mm

$5\mu m = \frac{1mm}{\text{No of circ}}$

$\text{No of circ} = \frac{10^{-3}}{5\times10^{-6}} 10^3 = \frac{1000}{5} = 200$



Question

A screw gauge has 50 divisions on its circular scale. The circular scale is 4 units ahead of the pitch scale marking, prior to use. Upon one complete rotation of the circular scale, a displacement of 0.5 mm is noticed on the pitch scale. The nature of zero error involved, and the least count of the screw gauge, are respectively:

[6 Sep, 2020 (Shift-I)]

1. Negative, 2 μm
2. Positive, 10 μm
3. Positive, 0.1 mm
4. Positive, 0.1 μm

$4 \times L.C$

$4 \times \frac{0.5\,mm}{50} = 0.01mm$

$= 0.4 \times 0.01m$

$2m = 0.004mm$

Question

Assertion (A): If in five complete rotations of the circular scale, the distance travelled on main scale of the screw gauge is 5 mm and there are 50 total divisions on circular scale, then least count is 0.001 cm.

Reason (R) : $\frac{\text{Pitch}}{\text{Total divisions on circular scale}}$ **[27 July, 2021 (Shift-I)]**

1. A is correct but R is not correct.
2. A is not correct but R is correct.
3. Both A and R are correct and R is NOT the correct explanation of A.
4. Both A and R are correct and R is the correct explanation of A.

Question

One centimeter on the main scale of Vernier calliper is divided into ten equal parts. If 10 divisions of Vernier scale coincide with 8 small divisions of the main scale, the least count of the callipers is:

1. 0.01 cm
2. 0.02 cm
3. 0.05 cm
4. 0.07 cm

1 MSD = 1mm

L.C = ✓

H/W

Question

The pitch of the screw gauge is 1 mm and there are 100 divisions on the circular scale. When nothing is put in between the jaws, the zero of the circular scale lies 8 divisions below the reference line. When a wire is placed between the jaws, the first linear scale division is clearly visible while 72nd division on circular scale coincides with the reference line, The radius of the wire is:

[25 Feb, 2021 (Shift-I)]

1. 0.82 mm
2. 1.64 mm
3. 0.90 mm
4. 1.80 mm

zero = +8 × 0.01mm = 0.08mm ✓

MSR = 1mm

Readn = 1mm + 0.72mm

= 1.72mm

N/A

Question

$\frac{P}{N}$ = pitch L.C = $\frac{P\ mm}{N}$

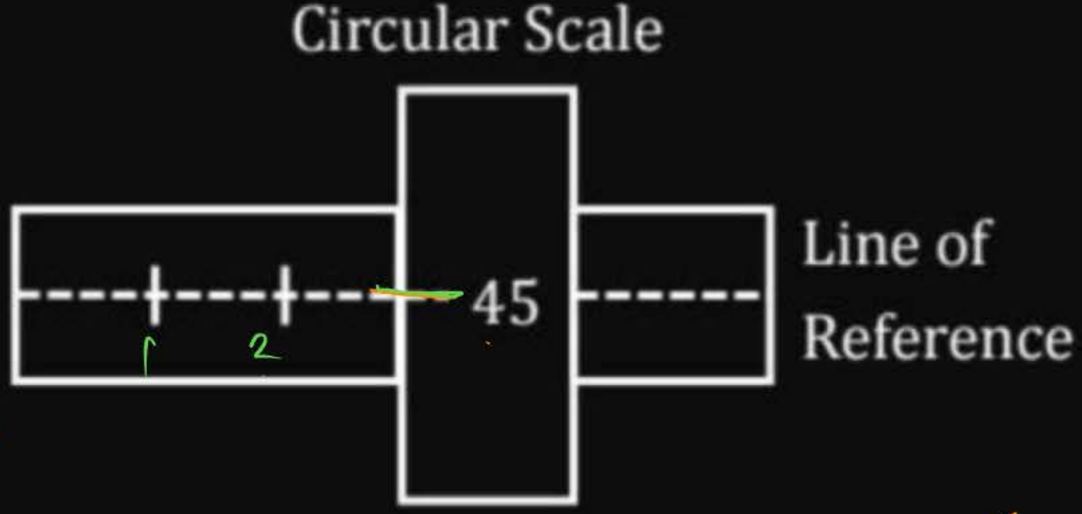
Consider a screw gauge without any zero error. What will be the final reading corresponding to the final state as shown? It is given that the circular head translates P MSD in N rotations. One MSD is equal to 1 mm.

1. $\left(\frac{P}{N}\right)\left(2+\frac{45}{100}\right)$ mm
2. $\left(\frac{N}{P}\right)\left(2+\frac{45}{N}\right)$ mm
3. $P\left(\frac{2}{N}+\frac{45}{100}\right)$ mm
4. $\left(2+\frac{45}{100}\times\frac{P}{N}\right)$ mm

Pitch = $\frac{P\ mm}{N}$

L.C = $\frac{\text{pitch}}{100} = \frac{P\ mm}{100N}$

$= 2\ mm + \frac{P}{100N} \times 45$



The circular scale has 100 divisions

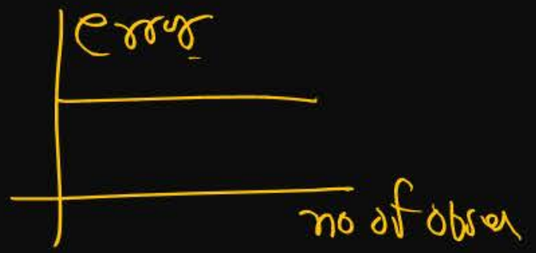
N/A

ERROR IN MEASUREMENT

Examples of sys

Systematic Error

- Reason is known ✓
- Fixed or constant error in magnitude
- Can't decrease by increasing no. of observation



L.C. Error

Random Error

- Reason of error is not known
- Irregular or varies in magnitude ✓
- Can be minimize by taking large no. of measurement ✓

$x \times n = \text{Const}$

$(\text{error})\ x \propto \frac{1}{n\ (\text{no of observations})}$

Systematic Error

↓

Type

↓

1. Instrumental error + zero error
2. Wrong experimental technique
3. Personal error

Random Error

↓

Type

↓

Due to random change in pressure temperature

Question

Zero error of an instrument introduces:

1. Systematic errors
2. Random errors
3. Both
4. None

Question

In 5 no of observation systematic error is 12% then find error is 20 observation?

Ay → 12%

Same

Question

In 5 no of observation random error is 12% then find error is 20 observation?

$5 \times 12\% = \frac{4}{20}\alpha$

$\alpha = 3\%$

Ab NEET?

Question

The main scale of a Vernier callipers has n divisions/cm. n divisions of the Vernier scale coincide with $(n-1)$ divisions of main scale. The least count of the Vernier callipers is

1. $\frac{1}{(n+1)(n-1)}$ cm
2. $\frac{1}{n}$ cm
3. $\frac{1}{n^2}$ cm ✓
4. $\frac{1}{n(n+1)}$ cm

1 V.S.D $= (n-1)$ m.s.D

1 cm $= n$ main divisions of main scale

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

$L.C = 1\ \text{M.S.D} - 1\ \text{V.S.D}$

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

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

$= \frac{1}{n}\left(1 - \frac{n-1}{n}\right) = \frac{1}{n}\left(\frac{n-(n-1)}{n}\right) = \frac{1}{n^2}$

Question

The one division of main scale of Vernier callipers reads 1 mm and 10 divisions of Vernier scale is equal to the 9 divisions on main scale. When the two jaws of the instrument touch each other, the zero of the Vernier lies to the right of zero of the main scale and its fourth division coincides with a main scale division. When a spherical bob is tightly placed between the two jaws, the zero of the Vernier scale lies in between 4.1 cm and 4.2 cm and 6th Vernier division coincides with a main scale division. The diameter of the bob will be _____ $\times 10^{-2}$ cm

[27 July, 2022 (Shift-I)]

Zero error = 0.4 mm ✓
= 0.04 cm

MSR = 4.1

final R = 4.1 cm + 6 × (0.01 cm) − 0.04 cm
= 4.16 cm − 0.04 cm
= 4.12 cm

Question

LC = 0.1 mm = 0.01 cm

The Vernier constant of Vernier callipers is 0.1 mm and it has zero error of (–0.05) cm. While measuring diameter of a sphere, the main scale reading is 1.7 cm and coinciding vernier division is 5. The corrected diameter will be _____ $\times 10^{-2}$ cm.

[29 June, 2022 (Shift-II)]

$= 1.7\,cm + 5 \times 0.01\,cm$

$= 1.75\,cm - (-0.05)\,cm$

zero

$= 1.78\,cm$

Question

One main scale division of a vernier calipers is 'a' cm and nth division of the vernier scale coincide with $(n-1)^{th}$ division of the main scale. The least count of the calipers (in mm) is

[16 March, 2021 (Shift-I)]

multiple

1. $\frac{10na}{n-1}$
2. $\frac{10a}{n-1}$
3. $\frac{10a}{n}$
4. $\left(\frac{n-1}{10n}\right)a$ N/A

Question

$\frac{d \ln x}{dx} = \frac{1}{x}$

The energy of a system as a function of time t is given as $E(t) = A^2 \exp(-\alpha t)$, where $\alpha = 0.2 s^{-1}$. The measurement of A has an error of 1.25%. If the error in the measurement of time is 1.50%, the percentage error in the value of $E(t)$ at $t = 5s$ is

(JEE Adv. 2015)

$$E = A^2 e^{-\alpha t}$$

$$\log_e E = \log_e (A^2 e^{-\alpha t})$$

$$\log_e E = \log_e A^2 + \log_e e^{-\alpha t}$$

$$\log_e E = 2 \log_e A - \alpha t$$

$$\frac{1}{E} \frac{dE}{} = 2 \frac{1}{A} \frac{dA}{} + \alpha \frac{dt}{}$$

$$\left(\frac{dE}{E}\right) = 2\left(\frac{dA}{A}\right) + \alpha \left(\frac{dt}{t}\right) t$$

$$= 2(1.25) + \frac{2}{10}(1.5) \times 5$$

$$= 2.5 + 1.5 = 4\%$$

$Z = A \cdot B$

$\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$ ✓

Question

$\frac{d \ln x}{dx} = \frac{1}{x}$

The energy of a system as a function of time t is given as $E(t) = A^2 \exp(-\alpha t)$, where $\alpha = 0.2 s^{-1}$. The measurement of A has an error of 1.25%. If the error in the measurement of time is 1.50%, the percentage error in the value of $E(t)$ at $t = 5s$ is

(JEE Adv. 2015)

$E = A^2 e^{-\alpha t}$

$Z = A \cdot B$

$\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$ ✓

$\frac{dE}{E} = 2\frac{\Delta A}{A} + \alpha\left(\frac{dt}{t}\right) t$

THANK YOU

HOME-WORK
4-5 Ques
systematic / Random