YAKEEN NEET 2.0

2026

Units and Measurements

Physics | Lecture - 11

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Topics to be covered

1. #
2.
3.
4.

Question on error

Screw gauge

Backlog wale → Detailed Backlog lecture se dekh lo.

5hr

Complete ho jaye
assignment solve

(a) Yes

(b) No

Assignment :- (1) time taking

(2) Kuch question Samjh hi nahi aata

→ solution video

(3) Kuch easy hoga.

(4) Time manage hi nahi horaha

Notes में Jayda time lay raha hai

↳ question ka pdf मिल जाएगा

M.R. Physics (soft copy) theory likho lo

The period of oscillation of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$ where l is about $100\ \text{cm}$ and is known to have $1\ \text{mm}$ accuracy. The period is about $2\ \text{s}$. The time of 100 oscillations is measured by a stop watch of least count $0.1\ \text{s}$. The percentage error in g is

(A) 0.1%

(B) 1%

(C) 0.2%

(D) 0.8%

$T = 2\pi\sqrt{\frac{l}{g}}$ $\quad \Delta T = 0.2\ \text{sec}$

(#) $\frac{\text{Total time measured}}{\text{no of oscillation}} = t\ (\text{time Period})$

$T = 2 \times 100$

$T = 200$

$T = \sqrt{\frac{l}{g}}$

$T^2 = \frac{l}{g}$

$g = \frac{l}{T^2}$

$100 \times \frac{\Delta g}{g} = \left[\frac{\Delta l}{l} + 2\frac{\Delta T}{T}\right] \times 100$

$= \left[\frac{10^{-3}\ \text{m}}{100 \times 10^{-2}\ \text{m}} + \frac{2 \times 0.1\ \text{s}}{200}\right] \times 100$

$= \frac{1}{100} + \frac{1}{100} = 0.2\%$

Time measure lete

$$y = \frac{1+x}{1-x}\left(\frac{u}{v}\right)$$

$\frac{dy}{dx} = ??$

(using division Rule)

Soln

$$\frac{dy}{dx} = \frac{(1-x)\frac{d(1+x)}{dx} - (1+x)\frac{d(1-x)}{dx}}{(1-x)^2} = \frac{(1-x)\times 1 - (1+x)(-1)}{(1-x)^2}$$

$$= \frac{1-x+1+x}{(1-x)2} = \frac{2}{(1-x)^2}$$

Ans

Question

Likhna hai

Consider the ratio $r = \frac{(1-a)}{(1+a)}$ to be determined by measuring a dimensionless quantity a. If the error in the measurement of a is Δa ($\Delta a/a << 1$), then what is the error Δr is determining r?

(JEE Adv. 2018)

$\frac{\Delta a}{a} <<< 1$

1. $\frac{\Delta a}{(1+a)^2}$ ✗

2. $\frac{-2\Delta a}{(1+a)^2}$ Ans ✓

3. $\frac{2\Delta a}{(1-a)^2}$ ✗

4. $\frac{2a\Delta a}{(1-a^2)}$ ✗

$\gamma = \frac{1-a}{1+a}$

diff^n w.r.t a

$$\left(\frac{d\gamma}{da}\right) = \frac{(1+a)\frac{d(1-a)}{da} - (1-a)\frac{d(1+a)}{da}}{(1+a)^2} = \frac{(1+a)(-1) - (1-a)\times 1}{(1+a)^2}$$

$$= \frac{-1-a-1+a}{(1+a)^2} = \frac{-2}{(1+a)^2}$$

$\therefore d\gamma = \frac{-2\,da}{(1+a)^2}$ Ans

Question

The current voltage relation of diode is given by $I = (e^{1000\,V/T} - 1)$ mA, where the applied voltage V is in volt and the temperature T is in kelvin. If a student makes an error measuring ± 0.01 V while measuring the current of 5 mA at 300 K, what will be the error in the value of current in mA? **(JEE Adv. 2018)**

1. 0.2 mA
2. 0.02 mA
3. 0.5 mA
4. 0.05 mA

← Absolute error

(ΔV)

$I = e^{\frac{1000V}{T}} - 1$

Put $I = 5$ mA

$5\text{mA} = (e^{\frac{1000V}{T}} - 1)\text{mA}$

$6 = e^{1000V/T}$ — (1)

(#) $I = e^{\frac{1000V}{T}} - 1$

$\frac{dI}{dV} = e^{\frac{1000V}{T}} \times \frac{1000}{T}\frac{(dV)}{dV}$ — (2)

$dI = e^{\frac{1000V}{T}} \frac{1000}{T} \times dV$

$= 2\cancel{0}\,e \frac{1000}{\cancel{300}} \times 0.01$

$= 20 \times 0.01 = 0.2$

Question

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)

given

$t = 5$ sec.

$\alpha = 0.2$ sec

$100 \times \frac{\Delta A}{A} = 1.25\%$

$100 \times \frac{\Delta t}{t} = 1.50\%$

$100 \times \frac{dE}{E} = ??$

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

diff^n of E w.r.t time

$\frac{dE}{dt} = \frac{dA^2}{dt} e^{-\alpha t} + A^2 \frac{de^{-\alpha t}}{dt}$

$\frac{dE}{dt} = 2A \frac{dA}{dt} e^{-\alpha t} + A^2 e^{-\alpha t} \times (-\alpha)$

$dE = 2A e^{-\alpha t} dA - \alpha A^2 e^{-\alpha t} dt$

↳ ER JDTE log se kaafi hai hamne bina log ke kiya!

$\frac{dE}{E} \times 100 = \frac{2A e^{-\alpha t} dA}{A^2 e^{-\alpha t}} + \frac{\alpha A^2 e^{-\alpha t} dt}{A^2 e^{-\alpha t}}$

$\frac{dE}{E} \times 100 = \left[2 \frac{dA}{A} \times 100 + \alpha \frac{dt}{t} \times t \right]$ Ans

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

$= 2.5 + 1.5$

$= 4\%$

log se bhi kar sakte hai:—

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

taking log.

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

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

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

differentiate

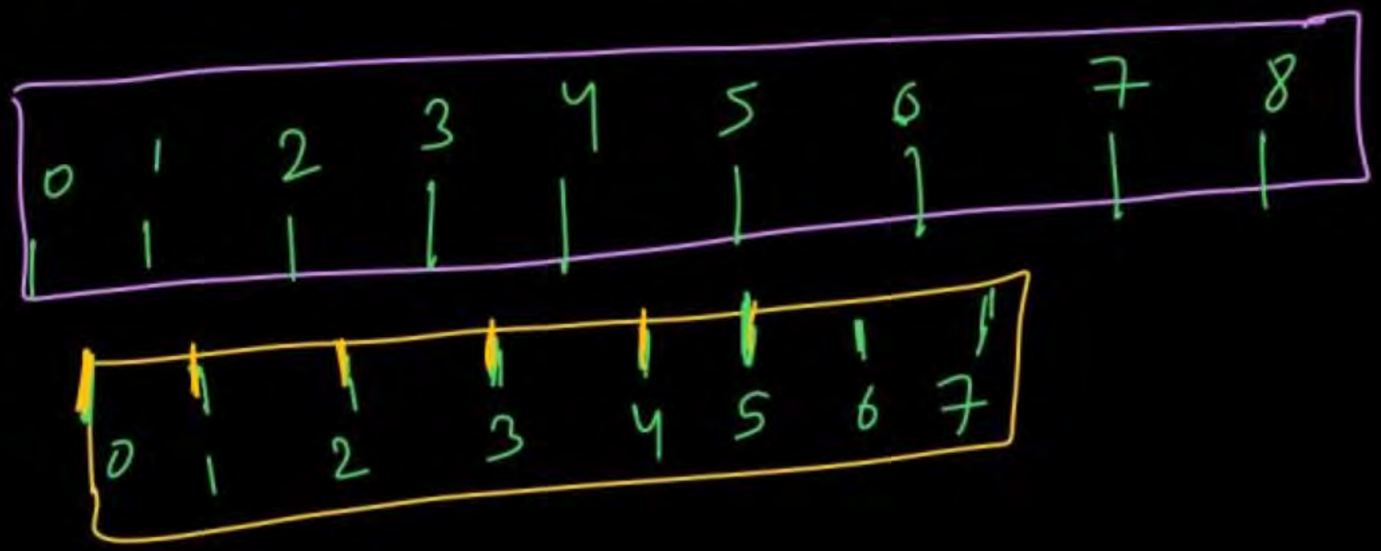
$$\frac{dE}{E} = 2\frac{dA}{A} + \alpha\, dt$$

Put value.

$$\frac{dE}{E} = 2\frac{dA}{dt} + \alpha \frac{dt}{t}\, dt$$

But product rule se easy hai direct Ratne ya log use karne se.

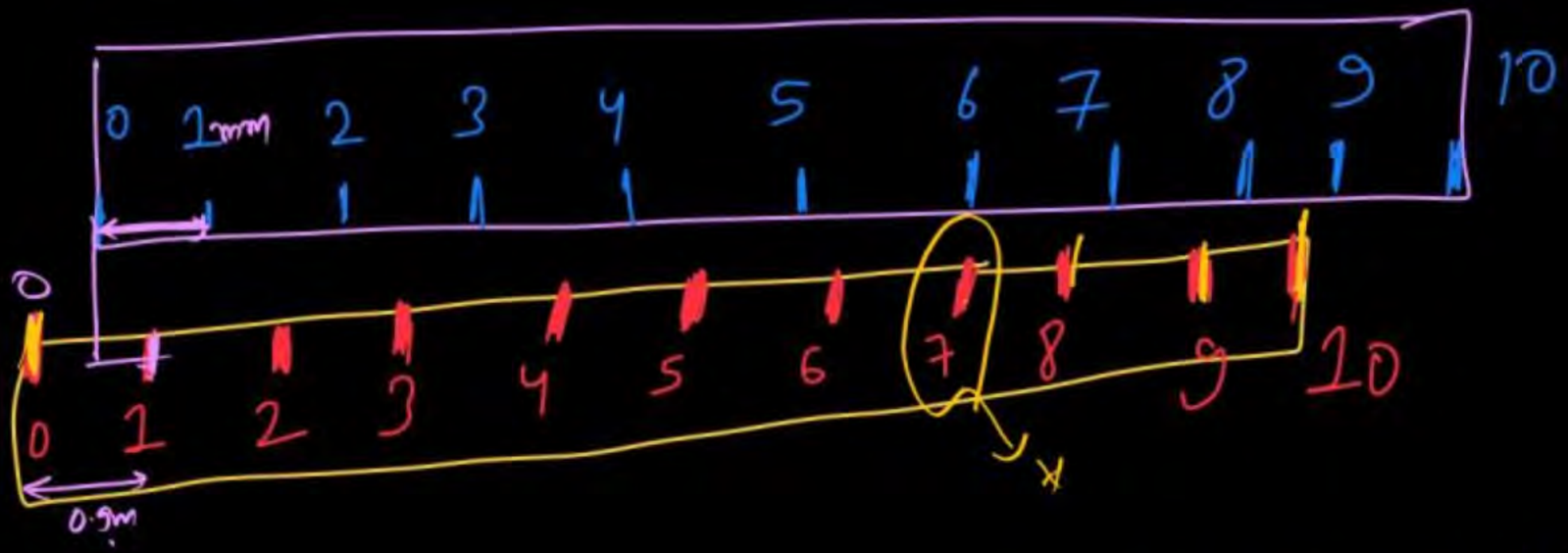
find zero error = ??



Zero error = + 5 × 0.1 mm

= 0.5 mm ✓

find zero error

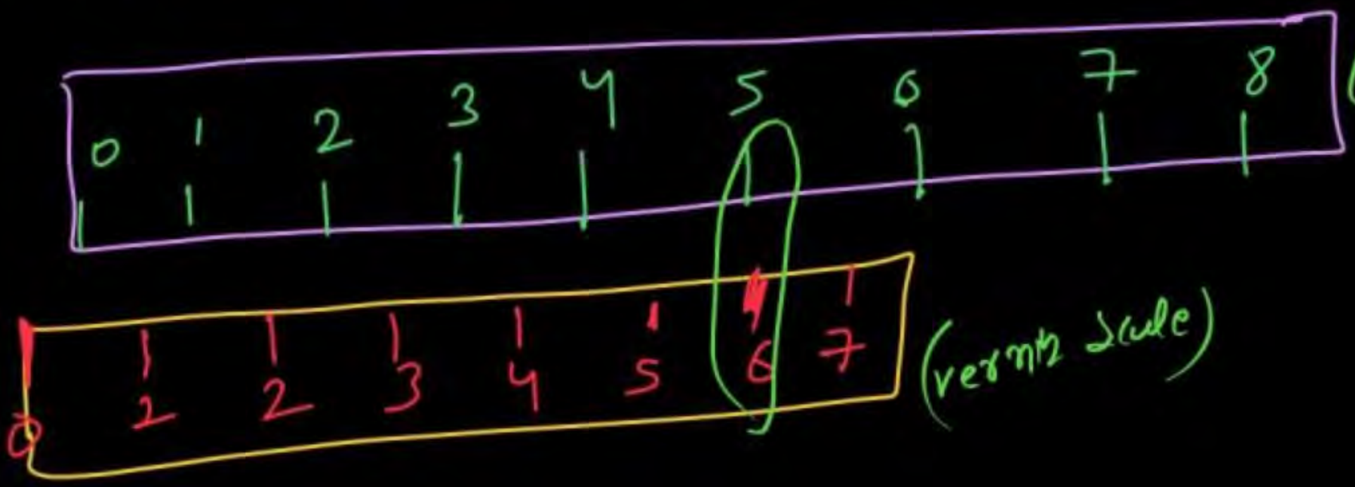


$= -(10-7) \times 0.1\text{mm} = -3 \times 0.1\text{mm} = -0.3\text{mm}$ ✓

Zero error = −ve (0.3mm)

$= -0.3\text{mm}$

find zero error



Zero error = $-(10-6) \times 0.1\text{mm}$ ✓

$= -0.4\text{mm}$

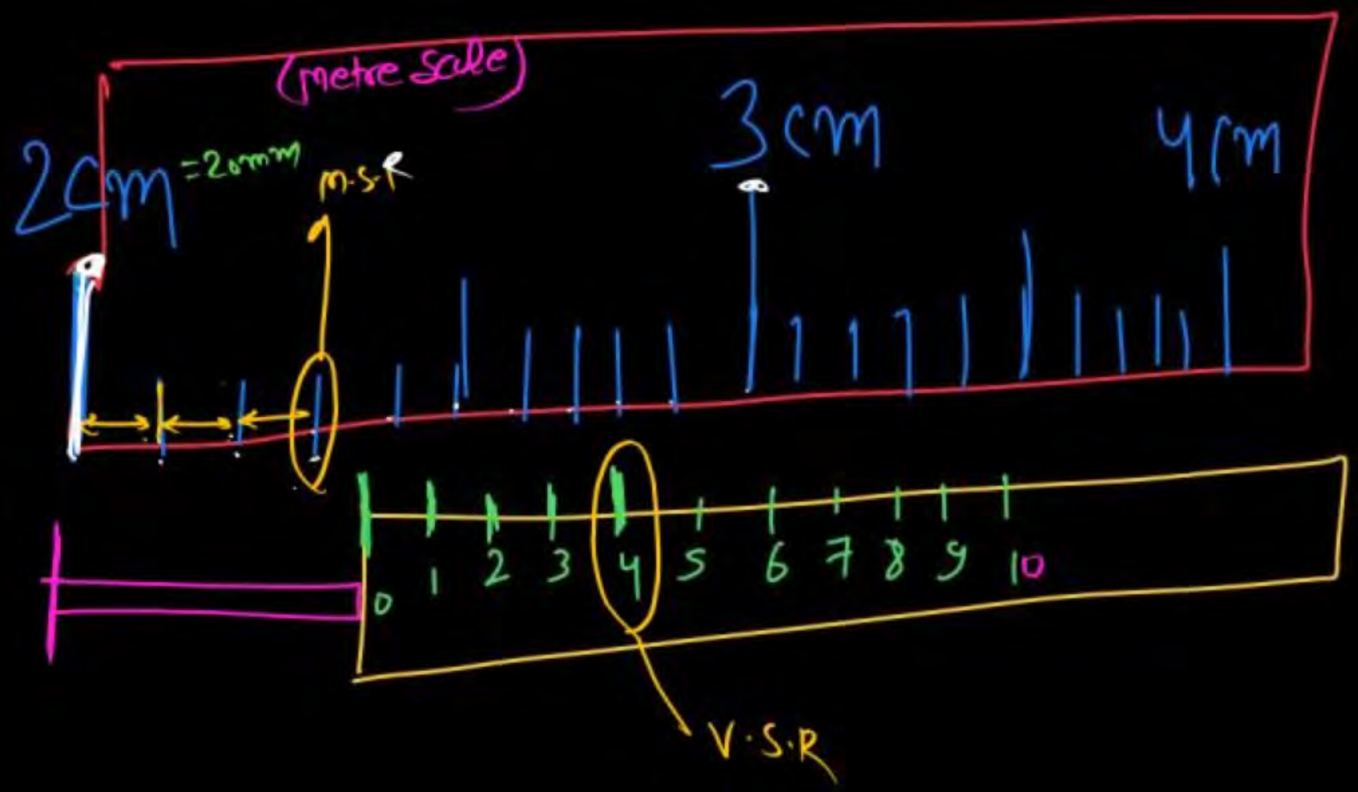
MR ✳ Box for zero error

+ve zero = Jo Vernier Scale ka divn × 0.1mm coincide kar raha hai

-ve zero = $(10 - \text{Jo vernier ka coincide kiya}) \times 0.1\text{mm}$

Metre Scale

(standard vernier calliper).



Find reads of Rod ??

Reading = M.S.R + L.C(V.S.R)

= 23mm + 0.1mm x 4 = 23.4mm = 2.34cm

Question

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

Question

Likho

* Zero error always subtracted with proper sign :—

The smallest division on the main scale of a Vernier calipers is 0.1 cm. Ten (10) divisions of the Vernier scale correspond to nine divisions of the main scale. The figure below on the left shows the reading of this caliper with no gap between its two jaws. The figure on the right shows the reading with a solid sphere held between the jaws. The correct diameter of the sphere is **(JEE Adv. 2021)**

= 1mm

1 M.S.D = 0.1cm

Standard Vernier caliper

L.C = 0.1mm = 0.01cm

1. 3.07 cm
2. 3.11 cm
3. 3.15 cm
4. 3.17 cm

final Ans = 3.11 − (−0.04) = 3.11 + 0.04 = 3.15

Zero error = −(10 − 6) × 0.01cm = −0.04cm

Reqd = (M.S.R) + L.C (V.S.R) = 3.1cm + 1 × 0.01cm = 3.1cm + 0.01 = 3.11cm

Question

The diameter of a cylinder is measured using a vernier calipers with no zero error. It is found that the zero of the vernier scale lies between 5.10 cm and 5.15 cm of the main scale. The vernier scale has 50 division equivalent to 2.45 cm. The 24th division of the vernier scale exactly coincides with one of the main scale divisions. The diameter of the cylinder is **(JEE Adv. 2013)**

Final Answer = M.S.R + V.S.R × L.C
= 5.10 cm + 0.024 cm = 5.124 cm

1. 5.112 cm
2. 5.124 cm
3. 5.136 cm
4. 5.148 cm

1 M.S.D = (5.15 − 5.10) cm
1 M.S.D. = 0.05 cm

50 divs of V.S.D = 2.45 cm

$1\ \text{V.S.D} = \frac{2.45}{50} \times \frac{2}{2}$

$= \frac{4.9}{100} = 0.049$ cm

L.C = 0.05 − 0.049

L.C = 0.0001 cm

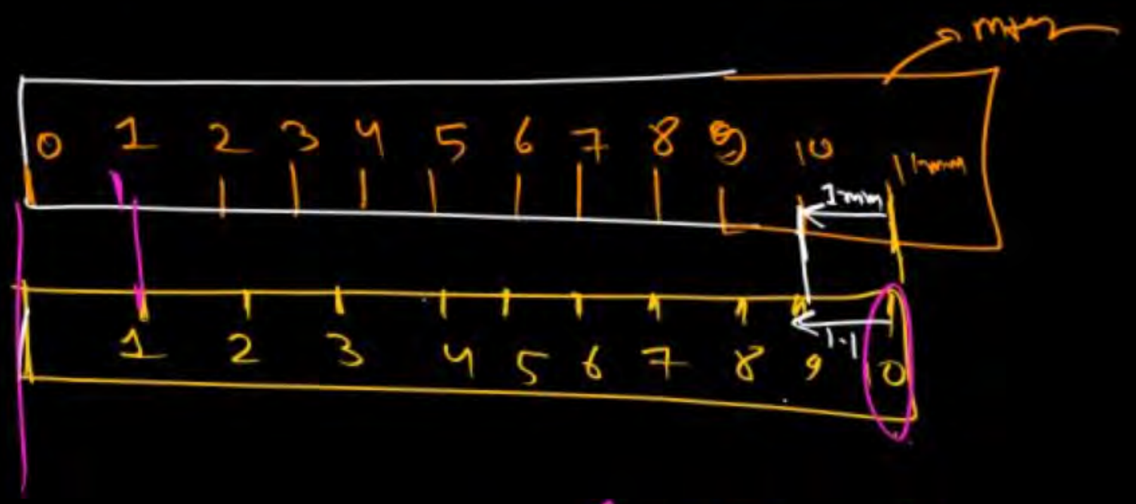
V.S.Reading = 24 × 0.0001 cm = 0.0024 cm

JEE Advance 2016 *

11 MSD = 10 VSD

Kuch ajib hai

Japani vernier caliper



10 VSD = 11mm

1 VSD = 1.1mm

Question

$1\ M.S.D = \frac{1}{10}cm = 1mm$

There are two vernier calipers both of which have 1 cm divided into 10 equal divisions on the main scale. The vernier scale of one of the calipers (C_1) has 10 equal divisions that correspond to 9 main scale divisions. The vernier scale of the other caliper (C_2) has 10 equal divisions that correspond to 11 main scale divisions. The readings of the two calipers are shown in the figure. The measured values (in cm) by calipers C_1 and C_2 respectively, are **(JEE Adv. 2016)**

1. 2.87 and 2.87
2. 2.87 and 2.83 (73%) Correct
3. 2.85 and 2.82
4. 2.87 and 2.86

L.C = 0.1mm = 0.01cm

Start at V.C

C_1

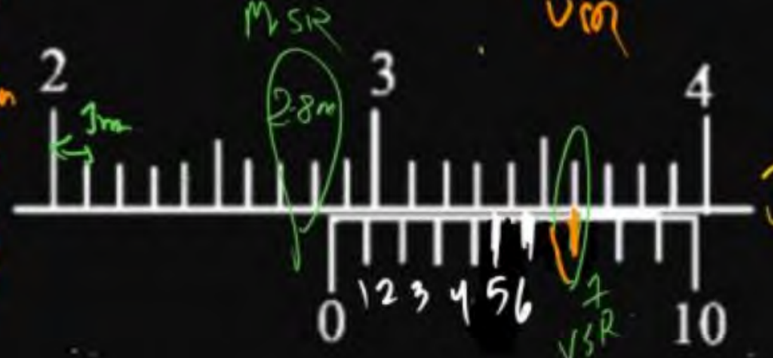
Reading = 2.8cm + 7 × 0.01cm = 2.87cm

Reading = 2.8cm + 3 × 0.01cm = 2.83cm

10 V.S.D = 11 M.S.D

C_2

Japan



Japani

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

Question

(Return to Basic)

If measured length of Rod is 1.56 cm then instrument used is

(a) metre scale L.C = 1mm

(b) Vernier calliper L.C = 0.1mm

(c) screw gauge L.C = 0.01mm

$L = 1.56\ cm$

$L = 15.6\ mm.$

→ Vernier Callipers

Question

Write down name of measuring instrument for given measurement :

(1) 87.3 mm (V.C)

(2) 0.831 cm = 8.31 mm (S.G)

(3) 6.7 cm = 67 mm (M.S)

(4) 6.7 mm → (V.C)

(5) 8.53 cm = 85.3 mm (V.C)

(6) 8.96 mm (S.G)

(7) 9.812 cm = 98.12 mm (S.G)

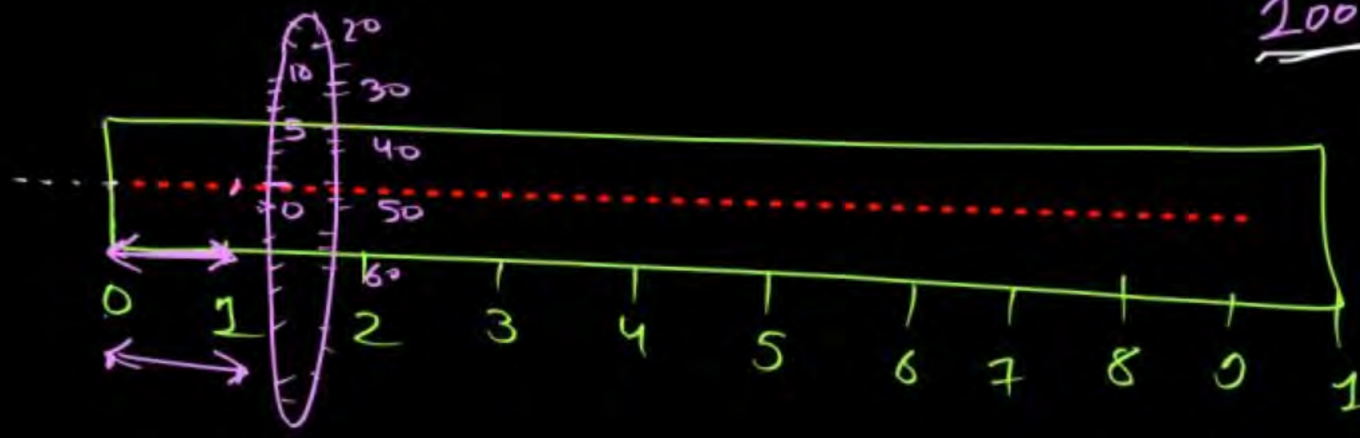
V.C → Verniz Callipr2

S.G → Screw gauge

Screw gauge

Pitch = 1 (M.S.D) = Distance Travalled by circular scale on the main scale in one Rotation. is called Pitch

100 division ref^n ko cut kiya to circul scale 1mm travel kiya



1 division ref^n ko cut kar kr rotate kiya = 1mm / 100

1 division

Readiy = (M.S.R) + C.S.R (L.C)

To visible hai main scale

L.C. = 1 M.S.D / no of circul Divis

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

H/W

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

H/W

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.

n/w

Question

A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and zero of circular scale division coincides with 25 divisions above the reference level. If screw gauge has a zero error of – 0.004 cm, the correct diameter of the ball is

[NEET-2021]

1. 0.521 cm
2. 0.525 cm
3. 0.053 cm
4. 0.529 cm

L.C = 0.001 cm

M.S.R = 0.5 cm = 5 mm

Reading = 0.5 cm + 0.001 × 25

= 0.5 cm + 25 × 0.001 cm

= 0.5 cm + 0.025 cm

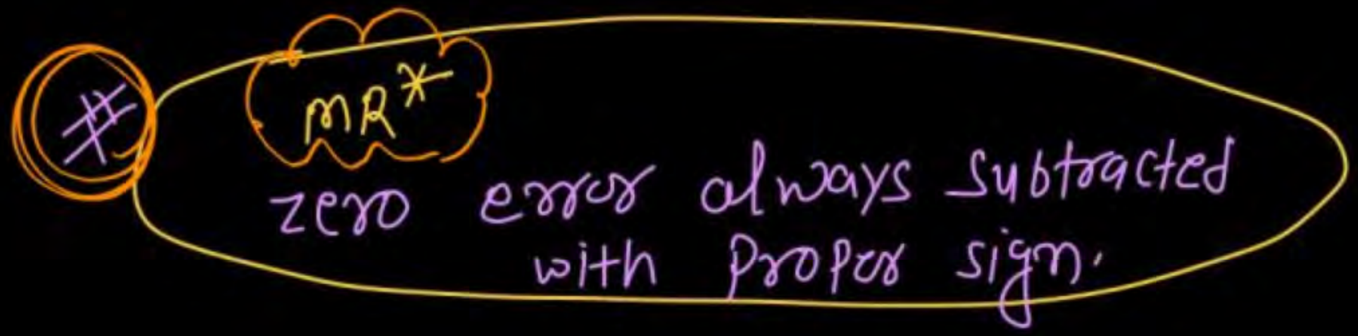
= 0.525 cm

Final = 0.525 cm − (−0.004 cm)

= 0.529 cm

+ve zero error → gf zero of circular Scale is below the refrence level *

-ve zero error → gf zero of circular scale is above the refrence level.



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

M/W

Question

Two full turns of the circular scale of gauge cover a distance of 1 mm on scale. The total number of divisions on circular scale is 50. Further, it is found that screw gauge has a zero error of –0.03 mm. While measuring the diameter of a thin wire a student notes the main scale reading of 3 mm and the number of circular scale division in line, with the main scale as 35. The diameter of the wire is

1. 3.32 mm
2. 3.73 mm
3. 3.67 mm
4. 3.38 mm

MSR

C.S.R

Reading $= 3\text{mm} + 35 \times 0.02\text{mm}$
$= 3\text{mm} + 0.35\text{m}$
$= 3.35\text{mm}$

1 Rotn $\rightarrow$ 0.5mm (Pitch)

L.C $= \frac{0.5\text{mm}}{50} = 0.01\text{mm}$

Ans

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 72^{nd} 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

N/D

Question

The pitch of a screw gauge is 1 mm and there are 100 division on its circular scale. When nothing is put in between its jaws, the zero of the circular scale lies 4 divisions below the reference line. When a steel wire is placed between the jaws, two main scale divisions are clearly visible and 67 divisions on the circular scale are observed. The diameter of the wire is

1. 2.71 mm
2. 2.67 mm
3. 2.63 mm
4. 2.65 mm

MSR + (CSR × LC)

Reading = 2mm + .67mm

= 2.67mm

zero error = +ve (4 × 0.01mm)

= +0.04mm

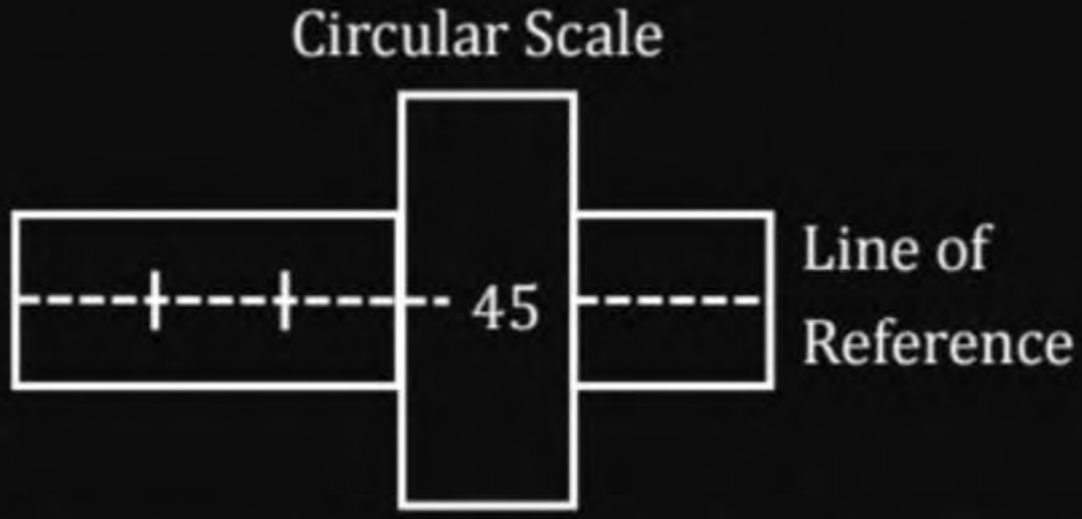
= 2.67mm − 0.04mm

= 2.63mm

Question

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



The circular scale has 100 divisions

n/a

ERROR IN MEASUREMENT

Systematic Error

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

L.C. Error

Random Error

- Irregular or varies in magnitude
- Can be minimize by taking large no. of measurement

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?

Question

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

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

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)]

Question

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)]

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)]

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

THANK YOU

HOME-WORK
4-5 Ques
Random