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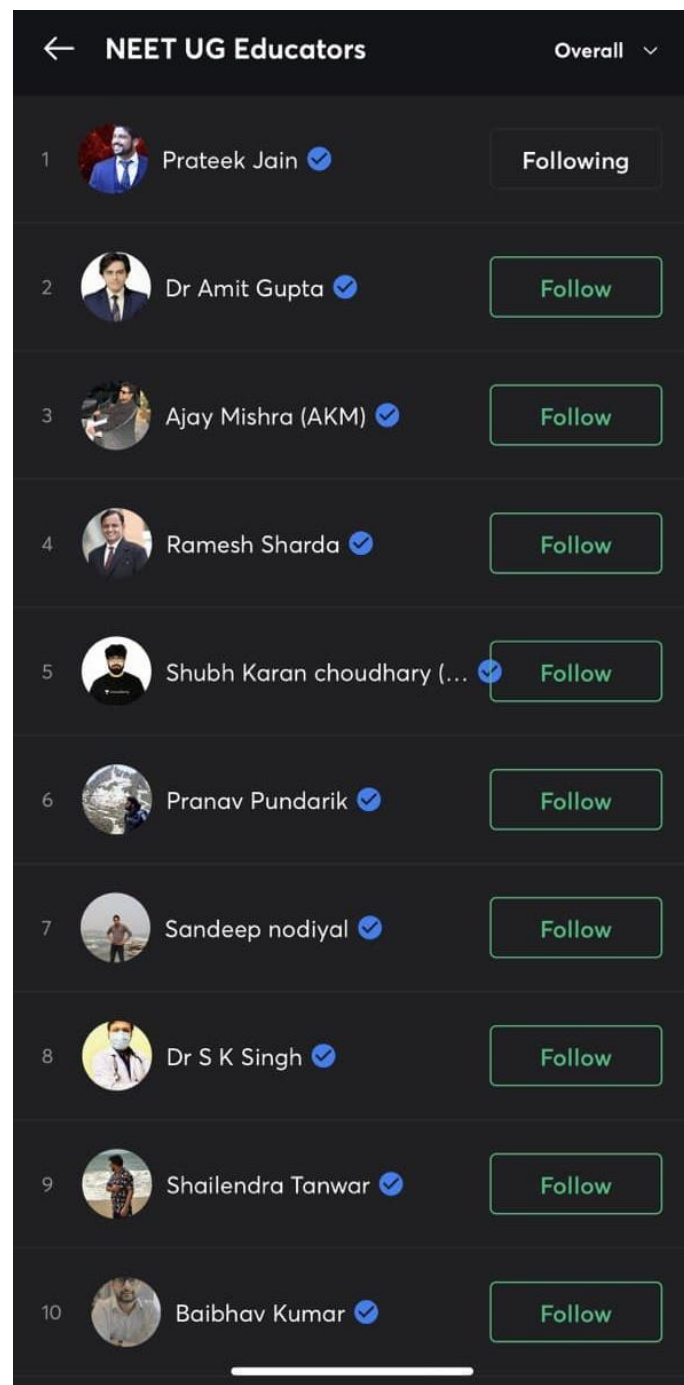# SIR PRATEEK JAIN

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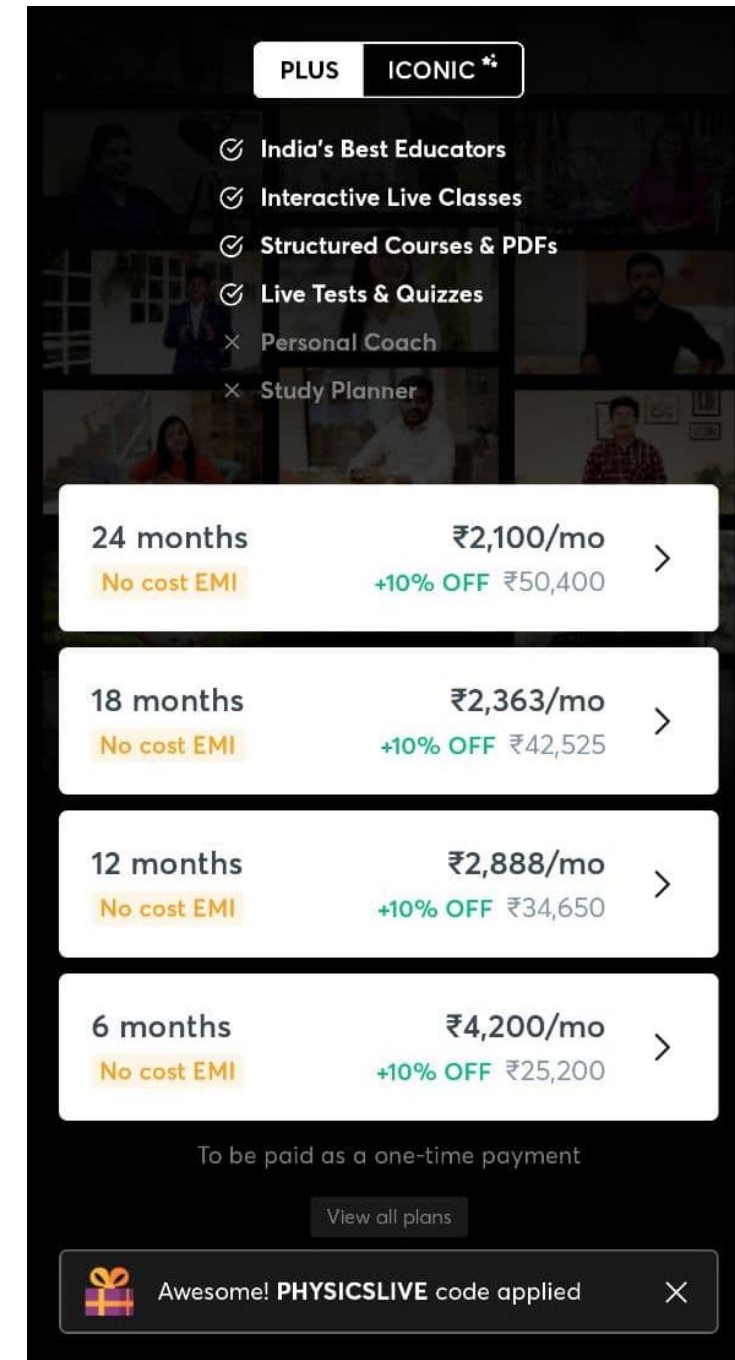
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NEET & AIIMS PYQs Solutions

Vernier Callipers,Screw gauge

By Physicsaholics Team

Q) A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale.

The pitch of the screw gauge is :

$$LC = \frac{\boxed{Pitch}}{no\ of\ divisions}$$

(1) 0.5 mm

(2) 1.0 mm

(3) 0.01 mm

(4) 0.25 mm

$$Pitch = LC \times no\ of\ division$$

$$= \cdot01mm \times 50$$

$$= \cdot50mm$$

Ans. 1

In a vernier callipers N divisions of vernier scale coincide with $N - 1$ divisions of main scale (in which length of one division is 1 mm). The least count of the instrument should be

[CBSE AIPMT 1994]

N parts of V scale $= (N-1)$ mm

$1 \quad '' \quad = \left(\frac{N-1}{N}\right)$ mm

(a) N

(b) $N - 1$

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

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

$LC = 1mm - \left(\frac{N-1}{N}\right) mm$

$= \frac{N - N + 1}{N} mm = \frac{1}{N} mm = \frac{1}{10N} cm$

slightly wrong

Ans. (c) (Ans. is given in cm.)

PYQs on Following Subtopic:

Error

What is the fractional error in g calculated from $T = 2\pi\sqrt{\ell/g}$? Given fraction errors in T and l are $\pm$ x and $\pm$ y respectively? **AIIMS** *[2012]*

(a) $x + y$

(b) $x - y$

(c) $2x + y$

(d) $2x - y$

$$T^2 = \frac{4\pi^2 \ell}{g}$$

$$g = \frac{4\pi^2 \ell}{T^2}$$

$$\frac{\Delta g}{g} = \frac{\Delta \ell}{\ell} + 2\frac{\Delta T}{T}$$

$$= y + 2x$$

Ans. (c)

In an experiment, four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively. Quantity P is calculated $P = \dfrac{a^3 b^2}{cd}$%. Error in P is

(a) 14%

(b) 10%

(c) 7%

(d) 4%

Error in P

$= 3(1\%) + 2(2\%)$
$+ 1(3\%) + 1(4\%)$
$= 14\%$

Ans. (a)

If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be [CBSE AIPMT 2008]

(a) 4%   (b) 6%   (c) 8%   (d) 2%

$$V = \frac{4}{3}\pi r^3$$

% Error in V = 3(% Error in r)

$$= 3 \times 2$$

$$= 6$$

Ans. (b)

Assertion : The error in the measurement of radius of the sphere is 0.3%. The permissible error in its surface area is 0.6%

$A = 4\pi r^2$

/ Error in A = 2(/ Error in r)

Reason : The permissible error is calculated by the formula $\dfrac{\Delta A}{A} = \dfrac{4\Delta r}{r}$

AIIMS [2008]

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

Ans. (c)

The density of a cube is measured by measuring its mass and length of its sides. If the maximum error in the measurement of mass and length are 4% and 3% respectively, the maximum error in the measurement of density will be

[CBSE AIPMT 1996]

$\rho = \dfrac{m}{l^3}$

(a) 7% (b) 9% (c) 12% (d) 13%

% Error in $\rho = 4\% + 3(3\%) = 13\%$

Ans. (d)

The percentage errors in the measurement of mass and speed are 2% and 3% respectively. The error in kinetic energy obtained by measuring mass and speed, will be

$K = \frac{1}{2} m v^2$

[CBSE AIPMT 1995]

(a) 12%
(b) 10%
(c) 8%
(d) 2%

$$100 \times \frac{\Delta K}{K} = \left(\frac{\Delta m}{m} \times 100\right) + 2\left(\frac{\Delta v}{v} \times 100\right)$$

$$= 2\% + 2(3\%)$$

$$= 8\%.$$

Ans. (c)

A certain body weighs 22.42 g and has a measured volume of 4.7 cc. The possible error in the measurement of mass and volume are 0.01 g and 0.1 cc. Then, maximum error in the density will be

[CBSE AIPMT 1991]

(a) 22%

(b) 2%

(c) 0.2%

(d) 0.02%

Error in P

$= $ Error in m $+$ Error in V

$= \dfrac{0.01}{22.42} \times 100 + \dfrac{0.1}{4.7} \times 100$

$= \dfrac{1}{2242} + \dfrac{10}{4.7} =$

Ans. (b)

In an experiment, the percentage of error occurred in the measurement of physical quantities A, B, C and D are 1%, 2%, 3% and 4% respectively. Then the maximum percentage of error in the measurement X, where, $X = \dfrac{A^2 B^{1/2}}{C^{1/3} D^3}$ will be

$2(1) + \frac{1}{2}(2) + \frac{1}{3}(3) + 3(4)$

(a) 16%   (b) −10%   (c) 10%   (d) $\left(\dfrac{3}{13}\right)$%

Ans. (a)

A potential difference $V = 100 \pm 5$ V, when applied across a resistance, gives a current $I = 10 \pm 0.2$ A. What is the percentage error in R?

(a) 2% (b) 5% (c) 7% (d) 8%

$$R = \frac{V}{I}$$

$$\% \text{ Error in } R = \frac{dV}{V} \times 100 + \frac{dI}{I} \times 100$$

$$= \frac{5}{100} \times 100 + \frac{0.2}{10} \times 100$$

$$= 5 + 2 = 7\%$$

Ans. (c)

The density of a cube is measured by measuring its mass and length of its sides. If the maximum error in the measurement of mass and length are 4% and 3% respectively, the maximum error in the measurement of density will be **[2013]**

$\rho = m/V = m/\ell^3$

(a) ~~7%~~

% Error in ρ

= % Error in m + 3(% Error in ℓ)

= 4 + 3(3)

= 13%

(b) 9%

(c) 12%

(d) 13%

AIIMS

Ans. (d)

The least count of a stop watch is (0.2) second. The time of 20 oscillations of a pendulum is measured to be (25) second. The percentage error in the measurement of time will be *[2015]*

(a) 8%

(b) 1.8%

(c) 0.8%

(d) 0.1%

AIIMS

$$\% \text{ Error} = \frac{.2}{25} \times 100 = 8\%$$

Ans. (c)

A force F is applied onto a square plate of side L. If the percentage error in determining L is 2% and that in F is (4%,) the permissible percentage error in determining the pressure is *[2017]*

(a) 2%

(b) 4%

(c) 6%

(d) 8%

AIIMS

$P = \dfrac{F}{L^2}$

% Error in P

= % Error in F + 2(% Error in L)

= 4 + 2(2)

= 8%

Ans. (d)

Assertion : When percentage errors in the measurement of mass and velocity are 1% and 2% respectively, the percentage error in K.E. is 5%.

Reason : $\dfrac{\Delta E}{E} = \dfrac{\Delta m}{m} + \dfrac{2\Delta v}{v}$

$$E = \frac{1}{2}mv^2$$

$$\frac{\Delta E}{E} = \frac{\Delta m}{m} + 2\left(\frac{\Delta v}{v}\right)$$

$$1 + 2(2)$$

$$= 5\%$$

AIIMS [2010]

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

Ans. (a)

Assertion: In the measurement of physical quantities direct and indirect methods are used.

Reason : The accuracy and precision of measuring instruments along with errors in measurements should be taken into account, while expressing the result. **AIIMS[2017]**

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

Ans. (b)

The percentage error in measuring M, L and T are 1%, 1.5% and 3% respectively. Then the percentage error in measuring the physical quantity with dimensions $[ML^{-1}T^{-1}]$ is

(a) 1%

(b) 3.5%

(c) 3%

(d) 5.5%

AIIMS 2018

$X = ML^{-1}T^{-1}$

% Error = % Error in M
+ % Error in L
+ % Error in T.

Ans. (d)

PYQs on Following Subtopic:

Significant figure

The length and breadth of a metal sheet are 3.124 m and 3.002 m respectively. The area of this sheet upto four correct significant figure is : **[2001]**

(a) 9.378 m^2 (b) 9.37 m^2 **AIIMS**

(c) 9.378248 m^2 (d) 9.3782 m^2

$$3.124 \times 3.002$$

Ans. (a)

Assertion : The number of significant figures depends on the least count of measuring instrument.

Reason : Significant figures define the accuracy of measuring instrument.

1 2 3 4 5 6 6 m

1 2 3

1.1 4 3 8 6 9 1 2

AIIMS *[2016]*

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

Ans. (b)(wrong)
Correct answer is c.

The mass of a box measured by a grocer's balance is 2.3 kg. Two gold pieces of masses 20.15 g and 20.17 g are added to the box. What is the total mass of the box and the difference in the masses of the pieces to correct significant figures?

(a) 2.34 kg, 0 g

(b) 2.3 kg, 0.02 g

(c) 2.34 kg, 0.02 g

(d) 2.3 kg, 0 g

AIIMS 2018

Ans. (b)

Q) Taking into account of the significant figures, what is the value of 9.99 m – 0.0099 m?

$$\begin{array}{r} 9\ 9\ 9\ 0\ 0 \\ 0\ 0\ 0\ 9\ 9 \\ \hline 9.9801 \end{array}$$

(1) 9.980 m

(2) 9.9 m

(3) 9.9801 m

(4) 9.98 m

NEET 2020

Ans. (4)

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