YAKEEN NEET 2.0

2026

Units and Measurements

Physics

Assignment Solution 03

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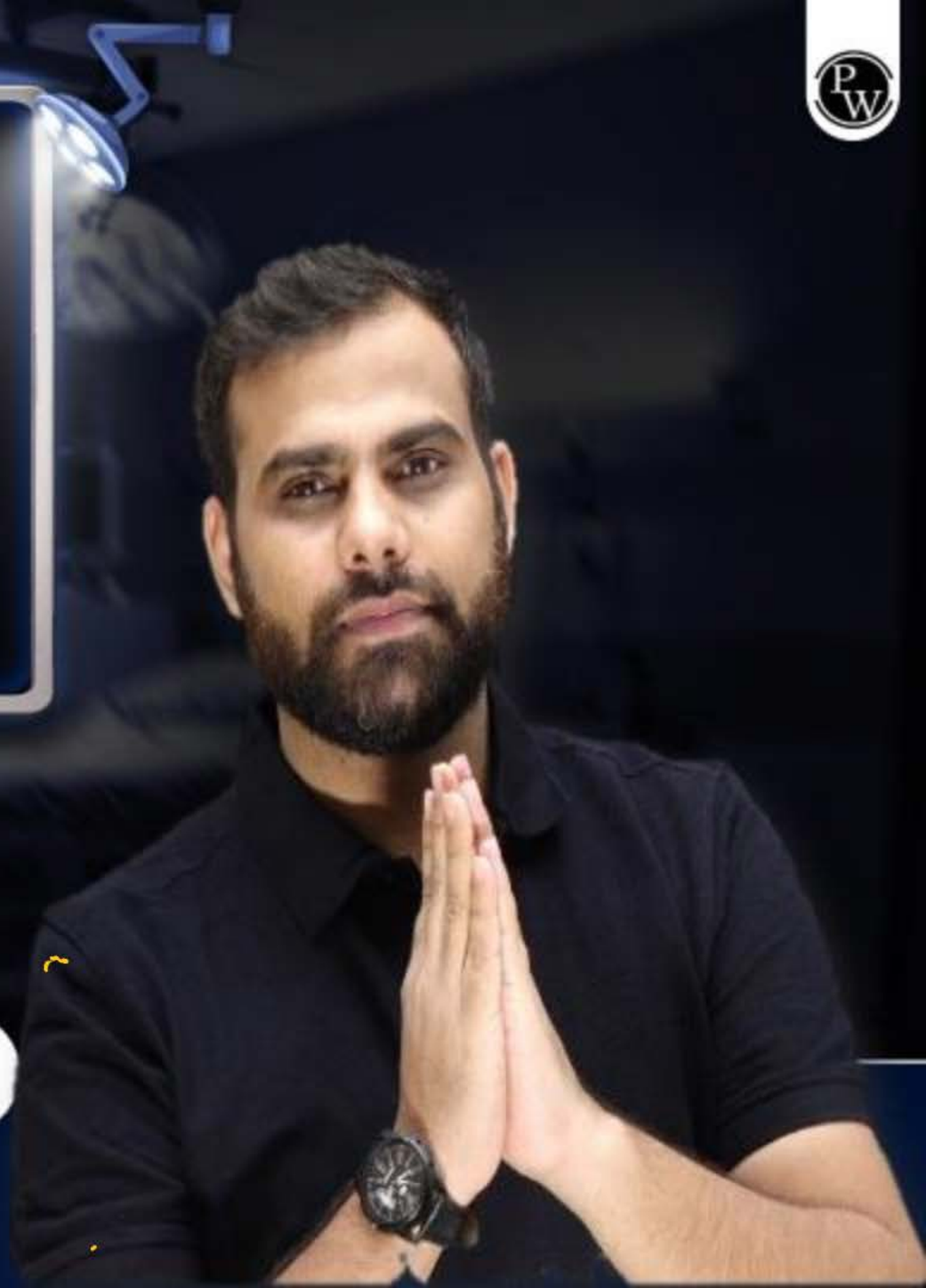

Question

If temperature $T_1 = (340K \pm 5K)$ and $T_2 = (300K \pm 10K)$. Find error in tempearure difference?

1. 50K
2. 40K
3. 15K
4. 5K

$$T' = T_2 - T_1$$

$$\Delta T' = \Delta T_2 + \Delta T_1$$

$$= 15K$$

Question

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

1. 10%
2. 7%
3. 4%
4. 14%

$$P = \frac{a^3 b^2}{cd}$$

$$100 \times \frac{\Delta P}{P} = \left[3\frac{\Delta a}{a} + 2\frac{\Delta b}{b} + \frac{\Delta c}{c} + \frac{\Delta d}{d}\right] \times 100$$

$$= 3\times 1 + 2\times 2 + 3 + 4$$

Question

The temperature of two bodies measured are $\theta_1 = 10°C \pm 0.4°C$ and $\theta_2 = 40°C \pm 0.3°C$. Find the sum and difference in temperature with error limit.

$T_1 = \theta_1 + \theta_2$

$= 10°C + 40°C = 50°C$

$\Delta T_1 = \Delta\theta_1 + \Delta\theta_2$

$= 0.3 + 0.4 = 0.7°C$

$T_{Read} = (50 \pm 0.7)°C$

$T_2 = \theta_2 - \theta_1$

$= 40 - 10 = 30°$

$\Delta T_2 = \Delta\theta_2 + \Delta\theta_1 = 0.7$

$T_2 = (30°C \pm 0.7°C)$

Question

Percentage error in measuring the radius and mass of a solid sphere are 2% & 1% respectively. Then error in measurement of moment of inertia with respect to its diameter is:

1. 3%
2. 6%
3. 5% ✓
4. 4%

$\frac{\Delta m}{m} \times 100 = 1\%$

$\frac{\Delta r}{r} \times 100 = 2\%$

$I = MR^2$

$\frac{\Delta I}{I} = \frac{\Delta m}{M} + 2\left(\frac{\Delta R}{R}\right)$

$= 5\%$

Question

The resistance of a conductor R = V/I where V = (50 ± 2) volt and I = (9 ± 0.3) Amp, find percentage error in R. aAlso find absolute error in R.

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

$$100 \times \frac{\Delta R}{R} = \left[\frac{\Delta V}{V} + \frac{\Delta I}{I}\right] \times 100$$

$$= \left(\frac{2}{50} + \frac{0.3}{9}\right) \times 100$$

Question

If percentage error in speed and mass are 1% and 2% then find percentage error in K.E.

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

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

$$= 2\% + 2 \times 1$$

$$= 4\%$$

Question

Find percentage error in length of simple pendulum if percentage error in time is 4% and acceleration due to gravity is 2%.

$$T = 2\pi\sqrt{\frac{l}{g}}$$

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

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

$$l = T^2 g$$

$$\% \left(\frac{\Delta l}{l}\right) = \left(2\left(\frac{\Delta T}{T}\right) + \frac{\Delta g}{g}\right)\%$$

$$= 2\left(\frac{\Delta T}{T} \times 100 + \frac{\Delta g}{g} \times 100\right)$$

$$= 2 \times 4 + 2 \cdot 1.$$

$$= 8 + 2 = 10\%$$

Question

The radius of a sphere is (5.3 ± 0.1) cm. The percentage error in its volume is

1. $\frac{0.1}{5.3} \times 100$
2. $3 \times \frac{0.1}{5.3} \times 100$
3. $\frac{3}{2} \times \frac{0.1}{5.3} \times 100$
4. $6 \times \frac{0.1}{0.3} \times 100$

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

$100 \times \frac{\Delta V}{V} = 3\frac{\Delta r}{r} \times 100$

$= 3\frac{0.1}{5.3} \times 100$

Question

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:

$V \propto r^3$

1. 2%
2. 4%
3. 6%
4. 8%

Question

A force F is applied on a square area of side L. If the percentage error in the measurement of L is 2% and that in F is 4%, what is the maximum percentage error in pressure?

1. 2%
2. 4%
3. 6%
4. 8% ✓

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

$$\frac{\Delta P}{P} = \frac{\Delta F}{F} + 2\frac{\Delta L}{L}$$

$$= 4\% + 2(2\%)$$

Question

A silver wire has a mass (0.6 ± 0.006)g, radius (0.5 ± 0.005)mm and length (4 ± 0.04)cm. The maximum percentage error in the measurement of its density will be:

[27 June, 2022]

1. 4%
2. 3%
3. 6%
4. 7%

$d = m/V$

$d = \frac{m}{\pi R^2 \ell}$

$\frac{\Delta d}{d} = \frac{\Delta m}{m} + 2\frac{\Delta R}{R} + \frac{\Delta \ell}{\ell}$

$\left(100 \times \frac{\Delta d}{d}\right) = 100\left(\frac{0.006}{0.6} + 2 \times \frac{0.005}{0.5} + \frac{0.01}{4}\right)$

$= 1 + 2 + 1$

Question

A physical 'y' is represented by the formula $y = m^2 r^{-4} g^x \ell^{-\frac{3}{2}}$ if the percentage errors found in y, m, r, ℓ and g are $18, 1, 0.5, 4$ and p respectively, then find the value of x and p. **[24 July 2021]**

1. 5 and ± 2
2. $\frac{16}{3}$ and $\pm\frac{3}{2}$
3. 8 and ± 2
4. 4 and ± 3

$xp = 8$

$\frac{16}{3} \times \frac{3}{2} =$

$y = m^2 r^{-4} g^x \ell^{-3/2}$

$\frac{\Delta y}{y} = 2\frac{\Delta m}{m} + 4\frac{\Delta r}{r} + x\frac{\Delta g}{g} + \frac{3}{2}\frac{\Delta \ell}{\ell}$

$18 = 2(1) + 4\left(\frac{1}{2}\right) + x \times p + \frac{3}{2} \times 4^2$

$18 = 2 + 2 + xp + 6$

$18 = 10 + xp$

Question

The resistance $R = \frac{V}{I}$, where $V = (50 \pm 2)V$ and $I = (20 \pm 0.2)$A. The percentage error in R is ' x ' %. The value of ' x ' to the nearest integer is _____.

[16 March, 2021]

Same as prev

Question

The radius of a sphere is measured to be (7.50 ± 0.85)cm. Suppose the percentage error in its volume is x. The value of x, to the nearest integer, is _____.

[18 March, 2021]

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

$\left[100 \times \frac{\Delta V}{V}\right] = 3\frac{\Delta r}{r} \times 100$

$= 3\,\frac{0.85}{7.50} \times 100$

Question

In the experiment of Ohm's law, a potential difference of 5.0 V is applied across the end of a conductor of length 10.0 cm and diameter of 5.00 mm. The measured current in the conductor is 2.00 A. The maximum permissible percentage error in the resistivity of the conductor is:

[18 March, 2021]

1. 3.9
2. 8.4
3. 3.0
4. 7.5

$5 \to 5.01$ $\quad 0.1$ $\quad \gamma = D/2$

$R = \rho l/A$

$V = IR$

$V = I \dfrac{\rho l}{A}$

$\rho = \dfrac{VA}{Il}$

$\rho = \dfrac{V \pi r^2}{Il} = \dfrac{V \pi D^2}{4Il}$

$\dfrac{\Delta\rho}{\rho} = \dfrac{\Delta V}{V} + 2\left(\dfrac{\Delta D}{D}\right) + \dfrac{\Delta I}{I} + \dfrac{\Delta l}{l}$

$\% \times \dfrac{\Delta\rho}{\rho} = 100\left[\left(\dfrac{0.1}{5}\right) + 2\left(\dfrac{0.01\,\text{mm}}{5\,\text{mm}}\right) + \left(\dfrac{0.01}{2}\right) + \dfrac{0.1}{10}\right]$

$= \dfrac{12}{5}^2 + 2\left(\dfrac{1}{5}\right) + \dfrac{1}{2} + \dfrac{1}{10}$

$= 3 + 0.5 + 0.4 = 3.9$

Question

A wire of 1Ω has a length of 1 m. It is stretched till its length increases by 25%. The percentage change in resistance to the nearest integer is: **[26 Feb, 2021]**

1. 56%
2. 76%
3. 12.5%
4. 25%

$R_i = 1\,\Omega$, $l_i = 1\,m$

$l_f = 125\% \, l_i$

$l_f = \frac{125}{100} l_i$

$R \propto l^2$

$R_f = l_i^2$

$= \left(\frac{125}{100} l_i\right)^2$

$R_f = \frac{125 \times 125}{100 \times 100} = \frac{25}{16}$

$\% \text{ Chge} = \frac{R_f - R_i}{R_i} \times 100$

$= \frac{\frac{25}{16} - 1}{1} \times 100$

$= \frac{9}{16} \times 100$

$= 56.25$

$= 56.3$

Question

The least count of a stop watch is 1/5 second. The time of 20 oscillations of a pendulum is measured to be 25 seconds. The maximum percentage error in the measurement of time will be

1. 0.1%
2. 0.8%
3. 1.8%
4. 8%

$\Delta T = \frac{1}{5}$ sec

$T = 25$ sec

$\% \text{ error in } T = \frac{\Delta T}{T} \times 100$

$= \frac{1}{5 \times 25} \times 100$

$= \frac{4}{5} = 0.8\%$

Question

If the length of the pendulum in pendulum clock increases by 0.1%, then the error in time per day is

[26 Aug, 2021]

1. 8.64 s
2. 43.2 s
3. 86.4 s
4. 4.32 s

Time in a one day =

$T = 2\pi\sqrt{\frac{l}{g}}$

$T \propto \sqrt{l}$

$100 \times \frac{\Delta T}{T} = \frac{1}{2}\left(\frac{\Delta l}{l} \times 100\right)$

$100\frac{(\Delta T)}{T} = \frac{1}{2} \times 0.1 = \frac{1}{20}$

$\Delta T = \frac{T}{20 \times 100} = \frac{86400}{20 \times 100}$

$= \frac{86.4}{2} = 43.2$

Question

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

[BHU 2006]

1. 0.1%
2. 1%
3. 0.2%
4. 0.8%

In compt

$$\frac{\Delta g}{g} \times 100 = \frac{1\,mm}{100\,cm} + 2\,\frac{0.1}{}$$

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

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

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

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

If $y = \sin\theta$ then find Percentage error in y if Percentage error in θ is 2% at $\theta = \pi/6$

$$y = \sin\theta$$

$$\frac{dy}{d\theta} = \cos\theta$$

$$dy = \cos\theta\, d\theta$$

$$\frac{dy}{y} = \frac{\cos\theta\, d\theta}{\sin\theta}$$

$$\frac{dy}{y} = \frac{\cot\theta\, d\theta}{\theta}(\theta)$$

$$\left(100 \times \frac{dy}{y}\right) = \cot\theta \left(\frac{d\theta}{\theta}\right) \times \theta \quad (\times 100)$$

$$= \cot\frac{\pi}{6} \times 2 \times \frac{\pi}{180} = \frac{\pi}{\sqrt{3}}$$

Question

If $y = m \tan\theta$, where m is constant then find angle at which percentage error in 'y' will be minimum.

Soln

$y = m \tan\theta$

$\frac{dy}{d\theta} = m \sec^2\theta$

$dy = m \sec^2\theta \, d\theta$

$\left(\frac{dy}{y}\right) = \frac{m \sec^2\theta \, d\theta}{\tan\theta}$

$\frac{dy}{y} = \frac{m \, d\theta}{\cos\theta \sin\theta}$

$\left(\frac{dy}{y}\right)_{min} = \frac{2m \, d\theta}{2\sin\theta\cos\theta} = \frac{2m \, d\theta}{[\sin 2\theta]_{max}} \to 1$

$2\theta = 90$

$\theta = 45$ Ans

∴ error in y will be minm

hence $\left(\frac{dy}{y}\right)$ ko minimum karna hai

THANK YOU