

Daily Practice Problems-05

- Which of the following length measurements is most precise and why?
a) 2.0 cm b) 2.00 cm c) 2.000 cm
- A body travels uniformly a distance of (13.8 ± 0.2) m in a time (4.0 ± 0.3) s. Find the velocity of the body within error limits and the percentage error.
- The error in the measurement of the radius of a sphere is 1% . Find the error in the measurement of volume.
- Given $R_1 = 5.0 \pm 0.2 \Omega$ and $R_2 = 10.0 \pm 0.1 \Omega$. What is the total resistance in parallel with possible % error?
- The length of one rod is 2.53 cm and that of the other is 1.27 cm. The least count of the measuring instrument is 0.01 cm. If the two rods are put together end to end, find the combined length.
- The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of the plate by using the formula $P=F/A$. If the maximum errors in the measurement of force and length are 4% and 2% respectively, then what is the maximum error in the measurement of pressure?
- The resistance $R= V/I$, where $V=100 \pm 5$ V and $i=10 \pm 0.2$ A. What is the total error in R?
- According to Joule's law of heating, heat produced $H=I^2Rt$, where I is the current, R is resistance and t is the time. If the errors in the measurement of I,R and t are 3%, 4%, and 6%, respectively, find the error in the measurement of H.
- A physical quantity P is given by $P=(A^3B^{1/2})(C^{-4}D^{3/2})$. Which quantity among A,B,C, and D brings in the maximum percentage error in P?
- The diameter and height of a cylinder are measured by a meter scale to be 12.6 ± 0.1 cm and 34.2 ± 0.1 cm respectively. What will be the value of its volume in appropriate significant figures?
a) 4300 ± 80 cm³ b) 4260 ± 80 cm³ c) 4264.4 ± 81.0 cm³ d) 4264 ± 81 cm³
- The density of a material in the shape of a cube is determined by measuring three sides of the cube and its mass. If the relative errors in measuring the mass and length are γ 1.5% and 1%, the maximum error in determining the density is:
a) 6% b) 2.5% c) 3.5% d) 4.5%
- A person measures the depth of a well by measuring the time interval between dropping a stone and receiving the sound of impact with the bottom of the well. The error in his measurement of time is $\delta T=0.01$ s and he measures the depth of the well to be $L=20$ m. Take the acceleration due to gravity $g=10\text{ms}^{-2}$ and the velocity of sound is 300ms^{-1} . Then the fractional error in the measurement, $\frac{\delta L}{L}$ is closest to: a) 1% b) 5% c) 3% d) 0.2%
- In a simple pendulum, experiment for determination of acceleration due to gravity (g), time taken for 20 oscillations is measured by using a watch of 1 second least count. The mean value of time taken comes out to be 30 s. The length of the pendulum is measured by using a meter scale of least count 1 mm and the value obtained 55.0 cm. The percentage error in the determination of g is close to: a) 0.7% b) 6.8% c) 3.5% d) 0.2%
- The period of oscillation of a simple pendulum is $T=2\pi\sqrt{\frac{L}{G}}$, Measured value of L is 20.0cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 90 s using a wrist watch of 1s resolution. The accuracy in the determination of g is:
a) 3% b) 2% c) 1% d) 5%
- Students I,II, and III perform an experiment for measuring the acceleration due to gravity (g) using a simple pendulum. They use different lengths of the pendulum and/or record time for different

number of oscillations. The observations are shown in the table.

Least count for length= 0.1cm, Least count for time=0.1 s

Student	Length of the Pendulum(cm)	Number of oscillations (n)	Total time for (n) oscillations	Time Period (s)
I	64.0	8	128.0	16.0
II	64.0	4	64.0	16.0
III	20.0	4	36.0	9.0

If E_I , E_{II} , E_{III} are the percentage errors in g , i.e. $\frac{\Delta g}{g} \times 100$ for students I, II and III, respectively

- a) $E_I=0$ b) E_I is minimum c) $E_I=E_{II}$ d) E_{II} is maximum

16. A student uses a simple pendulum of exactly 1 m length to determine g , the acceleration due to gravity. He uses a stop watch with the least count of 1s for this and records 40 s for 20 oscillations. For this observation, which of the following statement(s) is/are true?
 a) Error ΔT in measuring T , the time period, is 0.05 s
 b) Error ΔT in measuring T , the time period, is 1 s
 c) Percentage error in the determination of g is 5%
 d) Percentage error in the determination of g is 2.5%
17. In an experiment to determine the acceleration due to gravity g , the formula used for the time period of a periodic motion $T=2\pi\sqrt{7(R-r)}/5g$. The values of R and r are measured to be (60 ± 1) mm and (10 ± 1) mm, respectively. In five consecutive measurements, the time period is found to be 0.52 s, 0.56s, 0.57 s, 0.54 s and 0.59 s. The least count of the watch used for the measurement of time period is 0.01 s. Which of the following statement(s) is/are true?
 a) The error in the measurement of r is 10%
 b) The error in the measurement of T is 3.57%
 c) The error in the measurement of T is 2%
 d) The error in the measurement of g is 11%

Answers

1. c)
2. 3.45 ms^{-1} , 8.95%
3. 3 %
4. $3.3\Omega \pm 7 \%$
5. (3.80 ± 0.02) cm
6. 8%
7. 7%
8. 16%
9. Quantity C
10. b)
11. d)
12. a)
13. b)
14. a)
15. b)
16. a) and c)

17. a), b) and d)

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