Answer on Question #42892, Physics, Other

17. The diameter of a given wire is measured by a screw gauze. The three measurements of the diameter give the reading in cm as 0.036, 0.035 and 0.037. What is the percentage error of the measurements?

Solution.

As we can assume from given data, the accuracy of a screw gauge is 0.001 cm. Due to scatter of obtained values we have statistical error:

$$\Delta d = \frac{\Delta d_1 + \Delta d_2 + \Delta d_3}{3} = \frac{0.002}{3} cm \approx 0.00067 cm,$$

which is less than accuracy of a screw gauge. So we take

$$\Delta d = 0.001 cm$$

Average value of diameter is

$$\bar{d} = \frac{d_1 + d_2 + d_3}{3} = 0.0035 cm$$

Percentage error is:

$$\varepsilon_d = \frac{\Delta d}{\bar{d}} = \frac{0.001}{0.035} \approx 0.028 = 2.8\%$$

Answer: (b) 2.8%

18. Which of the following ratios has the dimension of mass?

Answer: (b) Surface tension / (Angular velocity)^2

Check:

$$\left[\frac{\sigma}{\omega^2}\right] = \frac{J/m^2}{1/s^2} = \frac{kg * m^2}{s^2 * \frac{m^2}{s^2}} = kg$$

19. The distance *x* of a particle moving in one dimension under the action of constant force is related to the time t by the relation

$$t = \sqrt{x} + 3$$

Find the displacement of the particle when its velocity is 6.0 m/s

Solution.

We need the relation between displacement x and velocity V.

Reverse relation *x(t)*:
$x = (t-3)^2$

Velocity is a first derivative of *x(t)*:

$$V = \frac{dx}{dt} = 2 * (t-3)$$

Thus,

$$t = \frac{V+6}{2}$$

Let's substitute time *t* in relation *x(t):*

$$x = \left(\frac{V+6}{2} - 3\right)^2 = \left(\frac{V}{2}\right)^2$$

Final substitution with given numbers:

$$x = \left(\frac{V}{2}\right)^2 = \left(\frac{6}{2}\right)^2 = 9$$

Answer: (a) 9.0 m