

CLASS- XI

SUB- PHYSICS

Ch- 2 (UNITS AND MEASUREMENTS)

HOTS QUESTIONS

1. Determine π^2 with due regard for significant figures. [Given $\pi = 3.14$]
2. A new unit of length is chosen such that the speed of light in vacuum is unity. What is the distance between the Sun and the Earth in terms of the new unit if light takes 8 min and 20 s to cover this distance.
3. Which of the following is the most precise device for measuring length:
(a) a vernier callipers with 20 divisions on the sliding scale.
(b) a screw gauge of pitch 1 mm and 100 divisions on the circular scale.
(c) an optical instrument that can measure length within a wavelength of light
4. In CGS system, the value of Stefan's constant (σ) is $5.67 \times 10^{-5} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ K}^{-4}$. Write down its value in SI units.
5. Find the area of the circle of radius 3.458 cm upto correct significant figures.
6. When white light travels through glass the refractive index $\mu = \frac{\text{velocity of light in air}}{\text{velocity of light in glass}}$ is found to vary with wavelength as $\mu = A + \frac{B}{\lambda^2}$ where A and B are constants. Using the principle of homogeneity of dimensions, determine the SI unit in which A and B must be expressed.
7. Saheli's mother was selling old newspapers to a man. When he was weighing the newspapers, Saheli saw that he had kept something below the pan of balance while balancing. She asked him to show her below the balance. Realising that he had been caught, he started apologising and removed the magnet which he had placed below the pan.
(i) What values do you attribute to Saheli ?
(ii) If the initial reading on the scale is $(2 \pm 0.2) \text{ kg}$ and final reading is $(36 \pm 0.3) \text{ kg}$, calculate the increase in mass with proper error limits.
(iii) What other methods do shopkeepers usually use to cheat customers ?
8. Show that if 'e' is electronic charge, h is Planck's constant, c is the velocity of light and ϵ_0 is electric permittivity of free space, the $\frac{e^2}{\epsilon_0 hc}$ is dimensionless.

9. The pair(s) of physical quantities that have the same dimensions is (are):
- (a) volumetric strain and coefficient of friction.
 - (b) disintegration constant of a radioactive substance and frequency of light wave.
 - (c) heat capacity and gravitational potential.
 - (d) Planck's constant and torque.

10. Using the principle of homogeneity of dimensions find which of the following is correct. where T is the time period, G is gravitational constant, M is mass and r is the radius of the orbit.

(i) $T^2 = 4\pi^2 r^2$

(ii) $T^2 = \frac{4\pi^2 r^3}{G}$

(iii) $T^2 = \frac{4\pi^2 r^3}{GM}$