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Questions:

Case Study Questions

1. In the study of Physics, we often have to measure the physical quantities. The numerical value of a measured quantity can only be approximate as it depends upon the least count of the measuring instrument used. The number of significant figures in any measurement indicates the degree of precision of that measurement. The importance of significant figures lies in calculation. A mathematical calculation cannot increase the precision of a physical measurement. Therefore, the number of significant figures in the sum or product of a group of numbers cannot be greater than the number that has the least number of significant figures because a chain cannot be stronger than its weakest link. The difference in the true value and the measured value of a quantity is the measure of error in measurement.
   (i) What are significant figures?
   (ii) Define least count
   (iii) Is there any relation between precision and accuracy?
   (iv) State the relationship between significant figures and precision.
   (v) Determine the maximum error in the addition of two physical quantities.
   (vi) How Systematic errors can be minimised?

2. To measure distance or length between two points, various methods are adopted which are categorised as direct and indirect methods. Direct methods are used to measure shorter but accessible distances while indirect methods are used for inaccessible distance. Large distances, such as the distance of a planet or star from earth can be measured by the Parallax method. Parallax is the change in position of an object with respect to fixed background when object is seen from two different positions. Parallex method is used for measuring distances of stars which are less than 100 light years away.
   (i) Name the instruments that are used to measure distance of the order 10^{-5} m.
   (ii) Define the terms 'basis' and parallactic angle used in Parallax method for measuring distance.
   (iii) What is the measure of basis in measuring distance of a nearby star by Parallax method?
   (iv) Why Parallax method is used for measuring distances of nearby stars only?
   (v) What is meant by angular diameter of moon?

5 Marks

3. A drop of olive oil of radius 0.25 mm spreads into a circular film of radius 10 cm on the water surface. Estimate the molecular size of olive oil.

4. The Sun is a hot plasma (ionized matter) with its inner core at a temperature exceeding 107 K, and its outer surface at a temperature of about 6000 K. At these high temperatures, no substance remains in a solid or liquid phase. In what range do you expect the mass density of the Sun to be, in the range of densities of solids and liquids or gases ? Check if your guess is correct from the following data : mass of the Sun = 2.0×10^{30} kg, radius of the Sun = 7.0×10^{8} m

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3 Marks

5. In successive measurements, the reading of the period of oscillation of a simple pendulum were found to be 2.63 s,2.56 s,2.42 s,2.71 s and 2.80 s in an experiment.Calculate mean absolute error

6. State the number of significant figures in the following :
   (a) 0.007 m^2.
   (b) 2.64×10^{24} kg
   (c) 0.2370 g/cm^3
   (d) 6.320 J
   (e) 6.032 N/m^2.
   (f) 0.0006032 m^2.

7. An Electrical Circuit
   Two resistances $R_1 = 100 \pm 3\Omega$ and $R_2 = 200 \pm 4\Omega$ are connected in series.What is their equivalent resistance?

2 Marks

8. Write down the number of significant figure in the following.
   12.000

9. Human heart is an inbuilt clock.comment.

10. A jeweller put a diamond weighing 5.42 g in a box weighing 1.2 Kg. Find the total weight of the box and the diamond to correct number of significant figures.

11. The photograph of a house occupies an area of 1.75 cm^2 on a 35 mm slide. The slide is projected on to a screen, and the area of the house on the screen is 1.55 m^2 . What is the linear magnification of the projector-screen arrangement.

12. A famous relation in physics relates 'moving mass' m to the 'rest mass' m_0 of a particle in terms of its speed v and the speed of light, c. (This relation first arose as a consequence of special relativity due to Albert Einstein). A boy recalls the relation almost correctly but forgets where to put the constant c. He writes : $m = \frac{m_0}{(1-v^2)^{1/2}}$. Guess where to put the missing c.