SATISH SCIENCE ACADEMY

DHANORI PUNE-411015

UNITS AND MEASUREMENT

Class 11 - Physics

Section A

1. The error in the measurement of the sides of a rectangle is 1%. The error in the measurement of its area is **[1]**

   a) None of these
   b) $\frac{1}{2}\%$
   c) 2%
   d) 1%

2. light year is a unit of _____. **[1]**

   a) Distance
   b) Time
   c) Luminosity
   d) Mass

3. Which of the following is not a fundamental unit? **[1]**

   a) centigrade
   b) kg
   c) cm
   d) volt

4. $[L^1M^1T^{-1}]$ is the dimensional formula for **[1]**

   a) Velocity
   b) Work
   c) Force
   d) Acceleration

5. Dimensions of kinetic energy are the same as that of _____. **[1]**

   a) Acceleration
   b) Work
   c) Force
   d) Pressure

6. Define absolute error. **[1]**
7. If the measured values of the two quantities are $A \pm \Delta A$ and $B \pm \Delta B, \Delta A$ and ΔB being the mean absolute errors. What is the maximum possible error in $A \pm B$? **[1]**
8. Define mean percentage error. **[1]**

Section B

9. If the formula for a physical quantity is $X = \frac{\frac{a^4\,b^3}{c^{1/3}\,d^{1/2}}}{\text{and if the percentage error in the}}$ measurements of a, b, c and d are $2\%, 3\%, 3\%$ and 4% respectively. Calculate percentage error in X . **[2]**
10. Nuclear radius R has a dependence on the mass number (A) as $R = 1.3 \times 10^{-16} A^{1/3}\ m$. For a nucleus of mass number $A = 125$, obtain the order of magnitude of R expressed in the meter. **[2]**
11. Find the percentage error in kinetic energy of a body having mass $60.0 \pm 0.3\ g$ moving with a velocity of $25.0 \pm 0.1\ cm/s$. **[2]**
12. Write down the number of significant figures in the following: $0.003\ m^2, 0.1250 gmcm^{-2}$, $6.4 \times 10^6\ m, 1.6 \times 10^{-19} C, 9.1 \times 10^{-31}\ kg$. **[2]**

13. Define Mean absolute error. **[2]**

14. Star A is farther than star B. Which star will have a large parallax angle? **[2]**

Section C

15. In Ohm's experiments, the values of the unknown resistances were found to be 6.12Ω, $6.09\Omega, 6.22\Omega, 6.15\Omega$. **[3]**
Calculate the (mean) absolute error, relative error, and percentage error in these measurements.

16. When the planet Jupiter is at a distance of 824.7 million kilometers from the Earth, its angular diameter is measured to be $35.72''$ of arc. Calculate the diameter of Jupiter. **[3]**

17. A large ball 2 m in radius is made up of a rope of square cross-section with edge length 4 mm. Neglecting the air gaps in the ball, what is the total length of the rope to the nearest order of magnitude? **[3]**

18. The masses of two bodies are measured to be $15.7 \pm 0.2\ kg$ and $27.3 \pm 0.3\ kg$. What is the total mass of the two and the error in it? **[3]**

19. $v = at + \frac{b}{t+c} + v_0$ is a dimensionally valid equation. Obtain the dimensional formula for a, b and c where v is velocity, t is time and v_0 is initial velocity. **[3]**

20. The diameter of a sphere is 2.14 cm. Calculate the volume of the sphere to the correct number of significant figures **[3]**

21. The distance travelled by an object in time $(100 \pm 1)s$ is $(5.2 \pm 0.1)m$. What are the speed and its maximum relative error? **[3]**

22. Derive the formula of the kinetic energy of a particle having mass 'm' and velocity 'v', using dimensional analysis. **[3]**

23. What are the dimensions of the quantity $l\sqrt{l/g}$, l being the length, and g acceleration due to gravity? **[3]**

Section D

24. In a workshop, a worker measures the length of a steel plate with Vernier calipers having a least count 0.01 cm. Four such measurements of the length yielded the following values: 3.11 cm, 3.13 cm, 3.14 cm, 3.14 cm. Find the mean length, the mean absolute error, and the percentage error in the measured value of the length. **[4]**

25. If the length of a cylinder is $l = (4.00 \pm 0.001)cm$, radius $r = (0.0250 \pm 0.001)cm$ and mass $m = (6.25 \pm 0.01)g$. Calculate the percentage error in the determination of density. **[4]**

26. An object is falling freely under the gravitational force. Its velocity after travelling a distance h is v. If v depends upon gravitational acceleration g and distance, prove with the dimensional analysis that $v = \sqrt{gh}$ where k is a constant. **[4]**

27. An electron with charge e enters a uniform magnetic field $\vec{B}$ with a velocity $\vec{v}$. The velocity is perpendicular to the magnetic field. The force on the charge is given by $|\overrightarrow{F}| = B$ e v. **[4]**
Obtain the dimensions of $\overrightarrow{B}$.

28. The length, breadth and thickness of a rectangular sheet of metal are 4.234 m, 1.005 m and 2.01 cm respectively. Give the area and volume of the sheet to correct significant figures. **[4]**

29. Describe what is meant by significant figures and order of magnitude. **[4]**

30. Show that if $Z = \frac{A}{B}, \frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$ **[4]**