



Chapter – 01 – Unit & Measurement

General Instructions: *Answer all the questions.*

1. The number of significant digits in 6.320 J is 1
a. 6 b. 4 c. 3 d. 5
2. Newton is the SI unit of 1
a. acceleration b. work c. power d. force
3. The dimensions of Kinetic energy is same as that of 1
a. Pressure b. Work c. Momentum d. Force
4. 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? 1
a. 500 b. 450 c. 600 d. 550
5. The number of significant digits in 0.0006032 is 1
a. 4 b. 6 c. 5 d. 3
6. Define S.I. unit of solid angle? 1
7. How many light years make 1 parsec? 1
8. Is it Possible to have length and velocity both as fundamental quantities? Why? 1
9. The principle of 'parallax' in section 2.3.1 is used in the determination of distances of very distant stars. The baseline AB is the line joining the Earth's two locations six months apart in its orbit around the Sun. That is, the baseline is about the diameter of the Earth's orbit = 3×10^{11} m. However, even the nearest stars are so distant that with such a long baseline, they show parallax only of the order of 1" (second) of arc or so. A parsec is a convenient unit of length on the astronomical scale. It is the distance of an object that will show a parallax of 1" (second) of arc from opposite ends of a baseline equal to the distance from the Earth to the Sun. How much is a parsec in terms of meters? 2
10. The resistance R is the ratio of potential difference V and current I. What is the percentage error in R if V is (100 ± 5) V and I is (10 ± 2) A? 2
11. The Sun's angular diameter is measured to be 1920". The distance r of the sun from the earth is 1.496 10¹¹ m. What is the diameter of the Sun? 2
12. A great physicist of this century (P.A.M. Dirac) loved playing with numerical values of Fundamental constants of nature. This led him to an interesting observation. Dirac found that from the basic constants of atomic physics (c, e, mass of electron, mass of proton) and the gravitational constant G, he could arrive at a number with the dimension of time. Further, it was a very large number, its magnitude being close to the present estimate on the age of the universe (15 billion years). From the table of fundamental constants in this book, try to see if you too can construct this number (or any other interesting number you can think of). If its coincidence with the age of the universe were significant, what would this imply for the constancy of fundamental constants? 3
13. The farthest objects in our Universe discovered by modern astronomers are so distant that light emitted by them takes billions of years to reach the Earth. These objects (known as quasars) have many puzzling features, which have not yet been satisfactorily explained. What is the distance in km of a quasar from which light takes 3.0 billion years to reach us? 3

14. A book with many printing errors contains four different formulas for the displacement y of a particle undergoing a certain periodic motion: (a = maximum displacement of the particle, v = speed of the particle. T = time-period of motion). Rule out the wrong formulas on dimensional grounds. 3

i. $y = \alpha \sin\left(\frac{2\pi t}{T}\right)$

ii. $y = a \sin vt$

iii. $y = \left(\frac{a}{T}\right) \sin \frac{t}{a}$

iv. $y = (a\sqrt{2}) \left(\sin \frac{2\pi t}{T} + \cos \frac{2\pi t}{T}\right)$

15. The diameter of a wire as measured by a screw found to be 1.328, 1.330, 1.325, 1.326, 1.334 and 1.336 cm. Calculate: 5

i. mean value of diameter

ii. absolute error in each measurement

iii. mean absolute error

iv. fractional error

v. percentage error

vi. diameter of wire.