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Jars Education

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Time : 1 Hour 15 Minute

STD 11 Science Physics
Chapter Based Test

Total Marks : 40

Section A

* **Choose The Right Answer From The Given Options.[1 Marks Each]** **[4]**

1. Among the given following system of unit which is not based on unit of mass, length and time?
   (A) CGS
   (B) FPS
   (C) MKS
   (D) SI
2. You measure two quantities as $\mathrm{A} = 1.0\mathrm{m} \pm 0.2\mathrm{m},\ \mathrm{B} = 2.0\mathrm{m} \pm 0.2\mathrm{m}$. We should report correct value for $\sqrt{\mathrm{AB}}$ as:
   (A) $1.4\mathrm{m} \pm 0.4\mathrm{m}.$
   (B) $1.41\mathrm{m} \pm 0.15\mathrm{m}.$
   (C) $1.4\mathrm{m} \pm 0.3\mathrm{m}.$
   (D) $1.4\mathrm{m} \pm 0.2\mathrm{m}.$
3. The physical quantities not having same dimensions are:
   (A) Momentum and Planck's constant.
   (B) Speed and $(\mu_0 \in_0)^{\frac{-1}{2}}$
   (C) Speed and $\sqrt{\frac{\mathrm{p}}{\rho}}$
   (D) Surface tension and spring constant.
4. When 1m, 1kg and 1 min are taken as the fundamental units, the magnitude of the force is 36 units. What will be the value of this force in CGS system?
   (A) 10^5 dyne
   (B) 10^3 dyne
   (C) 10^8 dyne
   (D) 10^4 dyne

* **Fill In The Blanks** **[3]**

5. Fill in the blanks by suitable conversions:
   $6\mathrm{ms}^{-2}$ = _____ kmh^{-2}.
6. Fill in the blanks:
   The surface area of a solid cylinder of radius 2.0cm and height 10.0cm is equal to ... $(\mathrm{mm})^2$
7. Fill in the blanks:
   S.I. unit of angle is ______.

* **Answer The Following Questions In One Sentence.[1 Marks Each]** **[4]**

8.

Calculate the length of the arc of a circle of radius 31.0cm which subtends an angle of $\frac{\pi}{6}$ at the centre.

9. A LASER is a source of very intense, monochromatic, and unidirectional beam of light. These properties of a laser light can be exploited to measure long distances. The distance of the Moon from the Earth has been already determined very precisely using a laser as a source of light. A laser light beamed at the Moon takes 2.56s to return after reflection at the Moon's surface. How much is the radius of the lunar orbit around the Earth?

10. Express a joule in terms of fundamental unit.

11. Find the dimensional formulae of (i) Kinetic energy and (ii) Pressure.

Section B

*** Given Section consists of questions of 2 marks each.** **[6]**

1. Just as precise measurements are necessary in science, it is equally important to be able to make rough estimates of quantities using rudimentary ideas and common observations. Think of ways by which you can estimate the following (where an estimate is difficult to obtain, try to get an upper bound on the quantity):
   The wind speed during a storm.

2. It is claimed that two cesium clocks, if allowed to run for 100 years, free from any disturbance, may differ by only about 0.02s. What does this imply for the accuracy of the standard cesium clock in measuring a time-interval of 1s?

3. How many metric tons are there in teragram?

Section C

*** Given Section consists of questions of 3 marks each.** **[9]**

1. The radius of the Earth is 6.37×10^6 m and its mass is 5.975×10^{24} kg. Find the Earth's average density to appropriate significant figures.

2. The distance of the Sun from the Earth is 1.496×10^{11} m (i.e., 1 A.U.). If the angular diameter of the Sun is 2000", find the diameter of the Sun.

3. The density of a cylindrical rod was measured by using the formula:
   $\rho = \frac{4\mathrm{m}}{\pi \mathrm{D}^2 \mathrm{l}}$

Section D

*** Given Section consists of questions of 5 marks each.** **[10]**

1. 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?

2. A large fluid star oscillates in space under the influence of its own gravitational field. Using dimensional analysis find the expression for its period (T) of oscillation in terms of radius of star (R) mean density of fluid (p) and universal gravitational constant (G).

Section E

*** Case study based questions** **[4]**

1. Read the passage given below and answer the following questions from 1 to 5.

The rules for determining the uncertainty or error in the measured quantity in arithmetic operations can be understood from the following examples.

a.) If the length and breadth of a thin rectangular sheet are measured, using a metre scale as 16.2cm and, 10.1 cm respectively, there are three significant figures in each measurement. It means that the length L may be written as L = 16.2 ± 0.1cm = 16.2cm ± 0.6%.

Similarly, the breadth b may be written as b = 10.1 ± 0.1 cm = 10.1 cm ± 1%

Then, the error of the product of two (or more) experimental values, using the combination of errors rule, will be L*b = 163.62cm^2 + 1.6% = 163.62 + 2.6cm^2

This leads us to quote the final result as L*b = 164 + 3cm^2. Here 3cm^2 is the uncertainty or error in the estimation of area of rectangular sheet.

b) If a set of experimental data is specified to n significant figures a result obtained by combining the data will also be valid to n significant figures.However, if data are subtracted, the number of significant figures can be reduced.For example, 12.9g – 7.06g, both specified to three significant figures, cannot properly be evaluated as 5.84g but only as 5.8g, as uncertainties in subtraction or addition combine in a different fashion (smallest number of decimal places rather than the number of significant figures in any of the number added or subtracted).

c.) The relative error of a value of number specified to significant figures depends not only on n but also on the number itself. For example, the accuracy in measurement of mass 1.02g is ± 0.01g whereas another measurement 9.89g is also accurate to ± 0.01g. The relative error in 1.02g is:

= (± 0.01/1.02) × 100% = ± 1%

Similarly, the relative error in 9.89 g is = (± 0.01/9.89) × 100% = ± 0.1%

Finally, remember that intermediate results in a multi-step computation should be calculated to one more significant figure in every measurement than the number of digits in the least precise measurement.

d.) The nature of a physical quantity is described by its dimensions. All the physical quantities represented by derived units can be expressed in terms of some combination of seven fundamental or base quantities. We shall call these base quantities as the seven dimensions of the physical world, which are denoted with square brackets [ ]. Thus, length has the dimension [L], mass [M], time [T], electric current [A], thermodynamic temperature [K], luminous intensity [cd], and amount of substance [mol]. The dimensions of a physical quantity are the powers (or exponents) to which the base quantities are raised to represent that quantity. Note that using the square brackets [ ] round a quantity means that we are dealing with 'the dimensions of' the quantity. In mechanics, all the physical quantities can be written in terms of the dimensions [L], [M] and [T]. For example, the volume occupied by an object is expressed as the product of length, breadth and height, or three lengths. Hence the dimensions of volume are [L] × [L] × [L] = [L^3].

i. Dimensions of area is:

   a. $[L^2]$
   b. $[L^3]$
   c. $[M^2]$
   d. None of these
ii. dimensions of volume are:
   a. $[L^2]$
   b. $[L]$
   c. $[L^3]$
   d. None of these
iii. What is uncertainty in physics? Explain with one example:
iv. define dimensions of a physical quantity:
v. Give list for 7 base quantities with dimensions:

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