



# PHYSICS

**BOOKS - VGS PUBLICATION-BRILLIANT**

## UNITS AND MEASUREMENTS

### Very Short Answer Questions

1. Distinguish between accuracy and precision.



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2. What are the different types of errors that can occur in a measurement?



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3. How can systematic errors be minimised or eliminated?



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4. Illustrate how the result of a measurement is to be reported indicating the error involved.



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5. What do you mean by significant figures?



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6. Distinguish between fundamental units and derived units.



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7. Why do we have different units for the same physical quantity?



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8. What is dimensional analysis?



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9. How many orders of magnitude greater is the radius of the atom as compared to that of the nucleus?



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10. Express unified atomic mass unit In kg.



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**Short Answer Questions**

1. The vernier scale of an instrument has 50 divisions which coincide with 49 main scale divisions. If each main scale division is 0.5 mm, then using the instrument what would be the minimum inaccuracy in the measurement of distance?



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2. In a system of units , the unit of force is 100N, unit of length is 10m and the unit of

times is 100s. What is the unit of mass in this system?



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**3.** The distance of a galaxy from Earth is of the order of  $10^{25}$  m. Calculate the order or magnitude of the time taken by light to reach us from the galaxy.



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4. The Earth-moon distance is about 60 Earth radius. What will be the approximate diameter of the Earth as seen from the moon?



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5. Three measurements of the time for 20 oscillations of a pendulum give  $t_1 = 39.6s$ ,  $t_2 = 39.9$  and  $t_3 = 39.5s$ . What is the precision in the measurements? What is the accuracy of the measurements?







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6.  $1 \text{ calorie} = 4.2 \text{ J}$  where  $1 \text{ J} = 1 \text{ kg m}^2 \text{ s}^{-2}$ . Suppose we employ a system of units in which the unit of mass is  $\alpha \text{ kg}$ , the unit of length is  $\beta \text{ m}$  and the unit of time  $\gamma \text{ s}$ , show that a calorie has a magnitude  $4.2\alpha^{-1}\beta^{-2}\gamma^{-2}$  in the new system.



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7. A new unit of length is chosen so that the speed of light in vacuum is  $1 \text{ m s}^{-1}$ . If light

takes 8 min and 20 s to cover this distance, what is the distance between the Sun and Earth in terms of the new unit?



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8. A student measures the thickness of a human hair using a microscope of magnification 100. He makes 20 observations and find that the average thickness (as viewed in the microscope) is 3.5 mm. What is the estimate of the thickness of hair?



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9. A physical quantity  $X$  is related to four measurable quantities  $a, b, c$  and  $d$  as follows.

$$X = a^2 b^3 c^{5/2} d^{-2}$$

The percentage error in the measurement of  $a, b, c$  and  $d$  are  $1\%$ ,  $2\%$ ,  $3\%$  and  $4\%$  respectively. What is the percentage error in  $X$ ?



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10. The velocity of a body is given by

$$v = At^2 + Bt + C.$$

If  $v$  and  $t$  are expressed in SI, what are the units of  $A, B$  and  $C$ ?



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## Problems

1. In the expression  $P = Et^2m^{-5}G^{-2}$  the quantities  $E, l, m$  and  $G$  denote energy, angular momentum, mass and gravitational constant

respectively. Show that  $P$  is a dimensionless quantity.



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2. If the velocity of light  $c$ , Planck's constant,  $h$  and the gravitational constant  $G$  are taken as fundamental quantities, then express mass, length and time in terms of dimensions of these quantities.



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3. An artificial satellite is revolving around a planet of mass  $M$  and radius  $R$ , in a circular orbit of radius  $r$ . Using dimensional analysis show that the period of the satellite.

$$T = \frac{k}{R} \sqrt{\frac{r^3}{g}}$$

where  $k$  is a dimensionless constant and  $g$  is acceleration due to gravity.



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4. State the number of significant figures in the following

6729



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5. State the number of significant figures in the following

0.024



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6. State the number of significant figures in the following

0.08240



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7. State the number of significant figures in the following

6.032



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8. State the number of significant figures in the following

$$4.57 \times 10^8$$



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9. A stick has a length of 12.132cm and another has a length of 12.4 cm. IF the two sticks are placed end and to what is the total length? IF the two sticks are placed side by side, what is the difference in their lengths?



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**10.** Each side of a cube is measured to be 7.203 m. What is total surface area?



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**11.** Each side of a cube is measured to be 7.203 m. What is the volume of the cube, to appropriate significant figures?



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**12.** The measured mass and volume of a body are 2.42 g and  $4.7 \text{ cm}^3$  respectively with possible errors 0.01 g and  $0.1 \text{ cm}^3$ . Find the maximum error in density.



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**13.** The error in measurement of radius of a sphere is 1%. What is the error in the measurement of volume?



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**14.** The percentage error in the mass and speed are 2% and 3% respectively. What is the maximum error in kinetic energy calculated using these quantities?



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**15.** One mole of an ideal gas at standard temperature and pressure occupies 22.4 L (molar volume). IF the size of the hydrogent molecule is about 1A. What is the ratio of

molar volume to the atomic volume of a mole of hydrogen?



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