

Question bank physics

Units and measurements

Q1. Multiple choice Questions.

- The solid angle subtended by a hemisphere at its centre is
 - 4π sr
 - 3π sr
 - 2π sr
 - π sr
- Which of the following is 'not' a unit of energy
 - watt.hour
 - calorie
 - Megawatt
 - electron . volt
- If 2% is the error in the measurement of a diameter of a sphere then error in the measurement of its volume is
 - 2%
 - 6%
 - 8%
 - 12%
- $[L^1 M^1 T^{-2}]$ is the dimensional formula for
 - velocity
 - Acceleration
 - Force
 - Work
- Dimensions of kinetic energy are the same as that of
 - Force
 - Acceleration
 - Work
 - Pressure
- Which of the following is not a fundamental unit?
 - meter
 - kilogram
 - centigrade
 - volt
- Let pressure $P = (x + a) / b$ where x is the distance. The dimensions of a/b are
 - $[L^{-1} M^1 T^{-1}]$
 - $[L^{-1} M^1 T^{-2}]$
 - $[L^1 M^{-1} T^{-2}]$
 - $[L^1 M^1 T^{-1}]$
- The number of significant figures in 2345000 is
 - 7
 - 6
 - 5
 - 4
- The error in the measurement of the sides of a rectangle is 1%. The error in the measurement of its area is
 - 1 %
 - $\frac{1}{2}$ %
 - 2 %
 - 3 %

Q2. Very short answer

- Define unit
- What is fundamental quantity
- Name the supplementary units
- What is plane angle?
- What is solid angle?
- Define dimensions of physical quantity?

Q3. Short Answer

1. Using dimensional analysis, Find value of x in the equation $1 \text{ N} = x \text{ dyne}$
2. Derive the formula for 'kinetic energy' of a particle having mass 'm' and velocity 'V' using dimensional analysis.
3. Define absolute error, mean absolute error, relative error and mean percentage error
4. What are the dimensions of the quantity $l \sqrt{\frac{l}{g}}$, l being the length and g the acceleration due to gravity
5. Prove that equation $v^2 = u^2 + 2as$ is dimensionally correct
6. The distance travelled by an object in time $(100 \pm 1) \text{ s}$ is $(5.2 \pm 0.1) \text{ m}$. What is the speed and percentage error in it
7. Find the percentage error in kinetic energy of body having mass $60.0 \pm 0.3 \text{ g}$ moving with a velocity $25.0 \pm 0.1 \text{ cm/s}$
8. Nuclear radius R has a dependence on the mass number (A) as $R = 1.3 \times 10^{-16} A^{1/3} \text{ m}$. For a nucleus of mass number $A = 125$, obtain the order of magnitude of R expressed in meter.

Q4. Answer in Brief

1. State applications of dimensional analysis
2. $V = at + \frac{b}{t+c} + v_0$ 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. 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 dimensional analysis that $v = k\sqrt{gh}$ where k is a constant
4. In ohm's Expt the values of the unknown resistance were Round to the 6.12Ω , 6.09Ω , 6.22Ω , 6.15Ω . Calculate the absolute error, relative error, and percentage error in these measurements.
5. If the formula for a physical quantity is $x = \frac{a^4 b^3}{c^{1/3} d^{1/2}}$ and of the percentage error in the measurements of a, b, c and d are 2%, 3%, 3% and 4% respectively, calculate percentage error in X.
6. Explain the types of error involved in the measurements of physical quantities.

Electric currents through conductors

Q1. Multiple Choice Question.

- Which of the following is an ohmic conductor?
 - Transistor
 - vaccume tube
 - electrolyte
 - Nichrome wire
- Five dry cells, each of voltage 1.5V are connected as shown in diagram



What is the overall voltage with this arrangement

- 0V
 - 4.5V
 - 6V
 - 7.5V
- You are given four bulbs of 25W, 40W, 60W and 100W of power all operating at 230 volt. Which of them has the lowest resistance?
 - 25
 - 40W
 - 60W
 - 100W
 - The wire of length L and resistance R is stretched so that its radius of cross section is halved What is its new resistance?
 - 4R
 - 5R
 - 8R
 - 16R
 - The colour code for a resistor of resistance 23×10^4 with 5% tolerance is
 - Brown, Violet, White and Silver
 - Red, Orange, Yellow and Gold
 - Orange, Blue, Yellow and Silver
 - Red, Yellow, Orange and Gold
 - Masses of three pieces of wires made of the same metal are in the ratio 1 : 3 : 5 and their lengths are in the ratio 5 : 3 : 1. The ratios of their resistances are
 - 1 : 3 : 5
 - 5 : 3 : 1
 - 1 : 15 : 125
 - 125 : 15 : 1
 - The internal resistance of a cell of emf 2V is 0.1Ω , it is connected to a resistance of 0.9Ω . The voltage across the cell will be
 - 0.5V
 - 1.8V
 - 1.95V
 - 3V

8. Reciprocal of resistivity is
 - a) resistance
 - b) conductivity
 - c) inductance
 - d) super conductivity

9. $R_1 = 5\Omega$, $R_2 = 5\Omega$ connected in parallel combination, $R_p = ?$
 - a) 2.5Ω
 - b) 20Ω
 - c) 5.2Ω
 - d) 10Ω

Q.2. Very short answer questions?

1. In series combination of cells, effective internal resistance ?
2. What is S.I. unit of specific resistance?
3. What is S.I. unit of current density ?
4. $R_1 = 7\Omega$, $R_2 = 8.5\Omega$, are in series combination then $R_s = ?$
5. Power(P) = 20W , Voltage (V) = 5volt then current(I) = ?

Q.3 Short answer question

(1M)

1. Define one ohm resistance
2. Define specific resistance
3. Define drift velocity
4. A battery after a long use has an emf 24 volt and an internal resistance 48Ω . Calculate the maximum current drawn from battery ?
5. Define temperature coefficient of resistance
6. State any one advantage of cells in series
7. Find value of resistance for the following colour code Blue Green Red Gold
8. State advantage of cells in parallel.

Q.4 Long answer (3 M)

1. Distinguish between ohmic and non ohmic substances explain with help of example
2. Prove that the current density of a metallic conductor is directly proportional to the drift speed of electrons.
3. A silver wire has a resistance of 4.2Ω at 27°C and resistance 5.4Ω at 100°C . Determine

the temperature coefficient of resistance.

4. The heating element connected to 230 Volt draws a current of 5A. Determine the amount of heat dissipated in 1 hour ($J = 4.2 \text{ J/cal}$)

Q.5. Answer the following : (2 M)

1. DC current flows in a metal piece of non-uniform cross section. Which of these quantities remains constant along the conductor: current , current density or drift speed?
2. Derive expression for specific resistance of a material
3. Explain series combination of resistors.
4. A current 4A flows through an automobile headlight . How many electrons flow through the headlight in a time 2 hrs.
5. What is the resistance of one of the rails of a railway track 20 km long. The cross section area of rail is 25 cm^2 and the rail is made of steel having resistivity at 20°C as $6 \times 10^{-8} \Omega\text{m}$