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Class: 11
Subject: Physics
Topic: Units, Measurements and Dimensions
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

Q1. The physical quantity having the dimensional formula $[M^{-1}L^{-3}T^{3}A^{2}]$ is

A. resistance
B. resistivity
C. conductivity
D. electromotive force

Answers: C
The physical quantity having the dimensional formula $[M^{-1}L^{-3}T^{3}A^{2}]$ is conductivity

Q2. If the error in the measurement of radius of a sphere is 1%, what will be the error in the measurement of its volume?

A. 1%
B. 1/3%
C. 3%
D. 10%

Answers: C

In the product form, relative or percentage errors add up to give the net error, i.e.
Percentage error in r = 1%
$\Delta r^3/r = 3\Delta r/r$
Percentage error in V = 3%

Q3. In the expression $S = a + bt + ct^2$, 'S' is measured in metres (m) and 't' in seconds (s). The unit of 'c' is

A. m^2
B. m
C. ms^{-1}
D. ms^{-2}

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Answers: D

Here the left hand side of the expression has units of displacement. To make the right hand side equal to left hand side, units of each expression on right hand side should be metres. Since c is multiplied by the square of second, so value of c should be ms^{-2}so that when multiplied by time, s^2 will yield metre. Hence, option 4 is the answer

Q4. The volume of a cube in m^3 is equal to the surface area of the cube in m^2. The volume of the cube is

A. 64 m^3
B. 216 m^3
C. 512 m^3
D. 196 m^3

Answers: B

Let side of cube be 'a' metres.
Surface area of cube = Volume of cube
=> 6 x a x a = a x a x a
=> a = 6
=> Volume of cube = a^3 = 216 m^3

Q5. If 'C' and 'R' denote capacitance and resistance respectively, what will be the dimensions of 'C R'?

A. $[M^0L^0TA^0]$
B. $[ML^0TA^{-2}]$
C. $[ML^0TA^2]$
D. $[MLTA^{-2}]$

Answers: A

For a *R-C* circuit a time constant is calculated as product of *R* and *C*.

$\therefore$ Dimensions of $R\,C$ = Dimensions of time

$= [M^0\ L^0 T A^0]$.

Alternative : Dimensions of capacitance *C* and *R* are

$C = [M^{-1}L^{-2}T^4A^2]$, $R = [ML^2T^{-3}A^{-2}]$

$\therefore$ Dimensions of CR

$= [M^{-1}L^{-2}T^4A^2]\,[ML^2T^{-3}A^{-2}]$

$= [M^0L^0TA^0]$

Q6. The 'rad' is the correct unit used to report the measurement of

A. the ability of a beam of gamma ray photons to produce ions in a target
B. the energy delivered by radiation to a target
C. the biological effect of a radiation
D. the rate of decay of a radioactive source

Answers: C

A unit of energy absorbed from ionising radiation is equal to 100 ergs per gram or 0.01 joules per kilogram of irradiated material. It has been replaced as a standard scientific unit by the gray.The 'rad' is the correct unit used to report the measurement of the biological effect of a radiation

Q7. Match List I (physical quantities) with List II (related units).

List-I	**List-II**
A. Magnetic field intensity	1. Wb m^{-1}
B. Magnetic flux	2. Wb m^{-2}
C. Magnetic potential	3. Wb
D. Magnetic induction	4. Am^{-1}

A. A - 4, B - 3, C - 1, D - 2
B. A - 1, B - 4, C - 2, D - 3
C. A - 3, B - 1, C - 4, D - 2

D. A - 2, B - 4, C - 1, D - 3

Answers: -A

Unit of magnetic field intensity is Am^{-1}.
Unit of magnetic flux is Wb (weber)
Unit of magnetic potential is Wbm^{-1}.
Unit of magnetic induction is Wbm^{-2}.

Q8. The chosen standard quantity with which other quantities have to be compared is called the _____.

A. measurement
B. unit
C. magnitude
D. direction

Answers: B

This is the definition of unit.

Q9. Out of the following four dimensional quantities, which one can be called a dimensional constant?

A. Acceleration due to gravity
B. Surface tension of water
C. Weight of a standard kilogram mass
D. Velocity of light in vacuum

Answers: D

Velocity (derived physical quantity) of light in vaccum is independent of all parameters. Thus, it is a constant.
Acceleration, Surface Tension & Weight all depends on some other physical quantity.

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Q10.The dimensions of epsilon x E (where epsilon: permittivity of free space, E : electric field) are

A. $[MLT^{-1}]$
B. $[ML^2T^{-2}]$
C. $[ML^{-1}T^{-2}]$
D. $[ML^2T^{-1}]$

Answers: C

Dimensions = $[M^{-1}L^{-3}A^2T^{-4}][MLA^{-1}T^{-3}]^2 = [ML^{-1}T^{-2}]$

Q11. Which of the following is **not** a physical quantity?

A. Kilogram
B. Impulse
C. Energy
D. Density

Answers: A

Kilogram is the SI unit of mass, while all others are given physical quantities. Here mass is given as the physical quantity.

Q12. The velocity 'v' of a particle at time 't' is given by 'v' = at + b/t + cL/t^2, where 'a', 'b' and 'c' are constants. The dimensions of 'a', 'b' and 'c' respectively, are

A. $[LT^{-2}]$, [L] and [T]
B. $[L^2]$, [T] and $[LT^2]$
C. $[LT^2]$, [LT] and [L]
D. [L], [LT] and $[T^2]$

Answers: A

'at' must have the dimensions of velocity.
So let the dimension of 'a' be $[M^xL^yT^z]$.
$[M^xL^yT^z][T] = [M^0L^1T^{-1}]$
$[M^xL^yT^z] = [M^0L^1T^{-2}]$
Hence, the dimensions of 'a' = $[L^1T^{-2}]$
Only option (1) satisfies the given result

Q13. If a screw gauge moves 1mm in two rotations, the pitch of the screw gauge is _____.

A. 1 mm
B. 2 mm
C. 0.5 mm
D. 3 mm

Answers: C

Pitch = Distance covered by screw head / number of rotations
= 1 mm / 2
= 0.5 mm

Q14. What is the dimensional formula of thermal conductivity?

A. $[MLT^{-1}\theta^{-1}]$
B. $[MLT^{-3}\theta^{-1}]$
C. $[M^2LT^{-3}\theta^{-2}]$
D. $[ML^2T^{-2}\theta]$

Answers: dQ/dt= KA dT/dx

Q15. Which of the following units denotes the dimensions $[ML^2/Q^2]$, where 'Q' represents the electric charge?

A. Wb/m^2
B. Henry(H)
C. H/m^2
D. Weber(Wb)

Answers: B

Units and Dimensional Formula of 'L'

S.I. unit : $\frac{\text{weber}}{\text{amp.}} = \frac{\text{tesla} \times m^2}{\text{amp.}}$

$= \frac{N \times m}{amp^2}$

$= \frac{\text{joule}}{amp^2}$

$= \frac{\text{coulomb} \times \text{volt}}{amp^2}$

$= \frac{\text{volt} \times \text{sec.}}{\text{amp.}}$

$=$ ohm $\times$ sec ($\Omega \times$ sec)

But practical unit is henry (H). Its dimensiona

$[L] = [ML^2T^{-2}A^{-2}]$

Since Q = AT, so second option is the correct answer, which is Henry (H).

Q16. In the relation $P = \frac{\alpha}{\beta} e^{\frac{-\alpha z}{k\theta}}$, 'P' is pressure, 'z' is distance, 'k' is Boltzmann constant and 'θ' is temperature, what will be the dimensional formula of β?

A. $[M^0L^2T^0]$
B. $[ML^2T]$
C. $[ML^0T^{-1}]$
D. $[ML^2T^{-1}]$

Answers: A

In given equation, $\frac{\alpha z}{k\theta}$ should be dimensionless.

$$\therefore \quad \alpha = \frac{k\theta}{z}$$

$$\Rightarrow \quad [a] = \frac{[ML^2T^{-2}K^{-1} \times K]}{[L]} = [MLT^{-2}]$$

and $$P = \frac{\alpha}{\beta}$$

$$\Rightarrow \quad [\beta] = \left[\frac{\alpha}{\rho}\right] = \frac{[MLT^{-2}]}{[ML^{-1}T^{-2}]} = [M^0L^2T^0]$$

Q17.A force 'F' is applied on a square plate of side 'L'. If percentage error in determination of 'L' is 3% and 'F' is 4%, the permissible error in pressure is

A. 2%
B. 4%
C. 6%
D. 10%

Answers: D

We know that, $p = \frac{F}{A} = \frac{F}{L^2} = FL^{-2}$

$$\% \text{ error in pressure} = (\% \text{ error in } F) + 2\,(\text{error in } L)$$
$$= (4\%) + 2\,(3\%)$$
$$= 10\%$$

Q18. What is dimensional formula of Torque?

A. ML^2T^{-2}
B. MLT^2
C. $M^1L^2T^{-1}$
D. None of these

Answers: A

Self-Explanatory

Q19. The dimensional formula of electric potential are

A. $[ML^2T^{-3}A^{-1}]$

B. $[MLT^{-3}A^{-1}]$

C. $[ML^2TA]$

D. $[ML^2T^{-1}A]$

Answers: A