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Physics XI

1 Physical World and Measurement

Question Trend Analysis: (2007 - 2017)

Yr	2007	2008	2009	2010	2011	2012	2013	2014	2015		2016		2017
Qn	1	1	2	1	-	1	3	1	1	-	1	-	-

2007

1. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be

1) $ML^2T^{-3}I^{-2}$ *2)* $ML^2T^{-3}I^{-1}$
3) ML^2T^{-2} *4)* $ML^2T^{-1}I^{-1}$

Ans: 1

Key:

Resistance,

$$R = \frac{\text{potential difference}}{\text{current}}$$

$$= \frac{V}{i} = \frac{W}{qi}$$

∴ Potential difference is equal to work done per unit charge

So, Dimensions of R

$$= \frac{[\text{Dimensions of work}]}{[\text{Dimensions of charge}][\text{Dimensions of current}]}$$

$$= \frac{[ML^2T^{-2}]}{[IT][I]} = [ML^2T^{-3}I^{-2}]$$

2008

2. If M (A;Z), M_p and M_n denote the masses of the nucleus ${}^{A}_{Z}X$ proton and neutron respectively in units of u ($1\,u = 931.5\ MeV/c^2$) and BE represents its bonding energy in MeV, then:

1) $M(A, Z) = ZM_p + (A-Z)M_n - BE/C^2$
2) $M(A, Z) = ZM_p + (A-Z)M_n + BE$
3) $M(A, Z) = ZM_p + (A-Z)M_n - BE$
4) $M(A, Z) = ZM_p + (A-Z)M_n + BE/C^2$

Ans: 1

2009

3. If the dimensions of a physical quantity are given by $M^a L^b T^c$, then the physical quantity will be:

1) Velocity if $a = 1, b = 0, c = -1$
2) Acceleration if $a = 1, b = 1, c = -2$
3) Force if $a = 0, b = -1, c = -2$
4) Pressure if $a = 1, b = -1, c = -2$

Ans: 4

4. An explosion blows a rock into three parts. Two parts go off at right angles to each other. These two are, 1 kg first part moving with a velocity of 12 ms^{-1} and 2 kg second part moving with a velocity of 8 ms^{-1}. If the third part flies off with a velocity of 4 ms^{-1}, its mass would be:

1) 7 kg *2) 17 kg*
3) 3 kg *4) 5 kg* ***Ans: 4***

Key:
Momentum of first part
$= 1 \times 12 = 12$ kg ms^{-1}
Momentum of the second part
$= 2 \times 8 = 16$ kg ms^{-1}
$\therefore$ Resultant momentum
$= \sqrt{(12)^2 + (16)^2} = 20$ kg ms^{-1}
The third part should also have the same momentum.
Let the mass of the third part be M, then $4 \times M = 20$
$M = 5$ kg

2010

5. The dimension of $\frac{1}{2}\varepsilon_0 E^2$, where ε_0 is - permittivity of free space and E is electric field, is:

1) ML^2T^{-2} *2) $M^{-1}T^{-2}$*
3) ML^2T^{-1} *4) MLT^{-1}* ***Ans: 2***

Key:
Dimensions of $\varepsilon_0 = [M^{-1}L^{-3}T^4A^2]$
Dimensions of $E = [MLT^{-3}A^{-1}]$
$\therefore$ Dimensions of $\frac{1}{2}\varepsilon_0 E^2$
$= [M^1L^{-3}T^4A^2] \times [M^2L^2T^{-6}A^{-2}]$
$= [M^{-1}L^{-3}]$

2012

6. An electric dipole of moment 'p' is placed an electric of intensity 'E'. The dipole acquires a position such that the axis of the dipole makes an angle θ with the direction of the field. Assuming that the potential energy of the dipole to be zero when $\theta = 90°$, the torque and the potential energy of the dipole will respectively be:

1) $pE\sin\theta, -2pE\cos\theta$
2) $pE\sin\theta, 2pE\cos\theta$
3) $pE\sin\theta, pE\cos\theta$
4) $pE\sin\theta, -pE\cos\theta$

Ans: 4

2013

7. In an experiment four quantities a, b, c and d are measured with percentage error 1 %, 2 %, 3 % and 4 % respectively. Quantity P is calculated as follows:

$P = \frac{a^3b^2}{cd}$, % error in P is
1) 14 % 2) 10 %
3) 7 % 4) 4%

Ans: 1

Key:

Here, $P = \frac{a^3b^2}{cd}$

$\therefore \frac{\Delta P}{P} \times 100$

$= \left(\frac{3\Delta a}{a} + \frac{2\Delta b}{b} + \frac{\Delta c}{c} + \frac{\Delta d}{d}\right) \times 100$

$= 3\frac{\Delta a}{a} \times 100 + 2\frac{\Delta b}{b} \times 100 + \frac{\Delta c}{c} \times 100 + \frac{\Delta d}{d} \times 100$

$= 3 \times 1 + 2 \times 2 + 3 + 4$

$= 3 + 4 + 3 + 4 = 14\ \%$

8. A uniform force of $(3\hat{i} + \hat{j})$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $(2\hat{i}+\hat{k})$ meter to position $(4\hat{i} +3\hat{j}-\hat{k})$ meter. The work done by the force on the particle is

1) 9J *2) 6J*
3) 13J *4) 15J*

Ans: 1

Key:

Given, force F = 3i+j

r_1 = (2i+k)m and

r_2 = (4i+3j-k)m

$\therefore s = r_2 - r_1$ = (4i+3j-k) - (2i+k)

= (2i+3j-2k)m

W = F.S

= (3i+j).(2i+3j-2k)

= 3× 2 +3+0

= 6+3

= 9J

9. The pair of quantities having same dimensions is

1) Young's modulus and Energy
2) Impulse and Surface Tension
3) Angular momentum and Work
4) Work and Torque

Ans: 4

2014

10. If force (F), velocity (v) and time (T) are taken as fundamental units, then the dimensions of mass are

1) $[FvT^{-1}]$ *2) $[FvT^{-2}]$*
3) $[Fv^{-1}T^{-1}]$ *4) $[Fv^{-1}T]$*

Ans: 4

2015

11. If energy (E), velocity (v) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be:

1) $[Ev^{-1}T^{-2}]$ *2) $[Ev^{-2}T^{-2}]$*
3) $[E^{-2}v^{-1}T^{-3}]$ *4) $[Ev^{-2}T^{-1}]$*

Ans: 2

2016

12. A disk and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first

1) Depends on their masses
2) Disk
3) Sphere
4) both reach at the same time

Ans:(3)