Sample Paper-01

Class 11th NEET (2024)

## PHYSICS

## ANSWER KEY

| | | | |
|---|---|---|---|
| 1. | (2) | 26. | (2) |
| 2. | (3) | 27. | (2) |
| 3. | (1) | 28. | (4) |
| 4. | (3) | 29. | (3) |
| 5. | (3) | 30. | (2) |
| 6. | (3) | 31. | (1) |
| 7. | (4) | 32. | (2) |
| 8. | (1) | 33. | (3) |
| 9. | (4) | 34. | (1) |
| 10. | (4) | 35. | (3) |
| 11. | (1) | 36. | (4) |
| 12. | (4) | 37. | (1) |
| 13. | (2) | 38. | (2) |
| 14. | (3) | 39. | (2) |
| 15. | (2) | 40. | (1) |
| 16. | (1) | 41. | (4) |
| 17. | (1) | 42. | (4) |
| 18. | (2) | 43. | (1) |
| 19. | (3) | 44. | (3) |
| 20. | (1) | 45. | (3) |
| 21. | (4) | 46. | (4) |
| 22. | (1) | 47. | (4) |
| 23. | (1) | 48. | (3) |
| 24. | (1) | 49. | (3) |
| 25. | (1) | 50. | (3) |

## HINTS AND SOLUTION

**1.** **(2)**

Surface tension, $T = \frac{F}{l}$

$\therefore \quad [T] = \frac{[F]}{[l]}$

$= \frac{[MLT^{-2}]}{[L]} = [ML^0T^{-2}] = [MT^{-2}]$

**2.** **(3)**

Physical quantities having different dimensions –
Angular momentum = $[ML^2\,T^{-1}]$,
Frequency = $[T^{-1}]$

**3.** **(1)**

The velocity of a body at highest point of vertical circle is, $v = \sqrt{rg}$

or $\quad v^2 = rg$

or $\quad \frac{v^2}{rg}$ = constants $= \frac{(LT^{-1})^2}{L^1(LT^{-2})} = M^0L^0T^0$

Hence, $\frac{v^2}{rg}$ is dimensionless.

**4.** **(3)**

$S \propto t^2 \Rightarrow \frac{S_1}{S_2} = \left(\frac{10}{20}\right)^2 \Rightarrow S_2 = 4S_1$

**5.** **(3)**

Height $= \frac{1}{2}(12+8)3.6$ m=36m

**6.** **(3)**

$h = \frac{1}{2}gt^2 \Rightarrow t = \sqrt{2h/g}$

$t_a = \sqrt{\frac{2a}{g}}$ and $t_b = \sqrt{\frac{2b}{g}} \Rightarrow \frac{t_a}{t_b} = \sqrt{\frac{a}{b}}$

**7.** **(4)**

In a circular motion

$a = \frac{v^2}{r} \Rightarrow \frac{a_2}{a_1} = \left(\frac{v_2}{v_1}\right)^2 = \left(\frac{2v_1}{v_1}\right)^2 = 4$

**8.** **(1)**

The maximum velocity for a banked road with friction,

$v^2 = gr\left(\frac{\mu + tan\theta}{1 - \mu tan\theta}\right)$

$\Rightarrow v^2 = 9.8 \times 1000 \times \left(\frac{0.5+1}{1-0.5\times1}\right) \Rightarrow v = 172 m/s$

**9.** **(4)**

Maximum tension

$= \frac{mv^2}{r} = 16N$

$\Rightarrow \frac{16 \times v^2}{144} = 16 \Rightarrow v = 12 m/s$

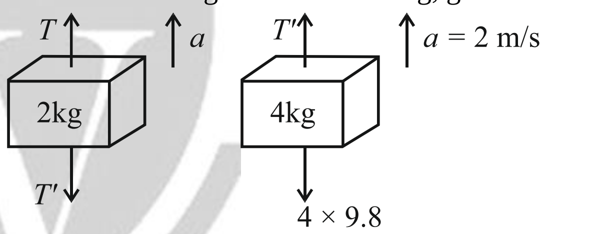
**10.** **(4)**

$R = 4H \cot\theta$, if $\theta = 45°$ then

$R = 4H \Rightarrow \frac{R}{H} = \frac{4}{1}$

**11.** **(1)**

*FBD* of mass 2 kg *FBD* of mass 4kg, g = 9.8 m/s$^2$




$T - T' - 19.6 = 4 \quad \ldots$(i)

$T' - 39.2 = 8 \quad \ldots$(ii)

From (ii), $T' = 47.2$ N

And substituting $T'$ in (i), we get

$T = 4 + 19.6 + 47.2 \Rightarrow T = 70.8$ N

**12.** **(4)**

$F = mg \sin 30° = 50\ N = 5$kg-wt

**13.** **(2)**

Using the relation

$\frac{mv^2}{r} = \mu R, R = mg$

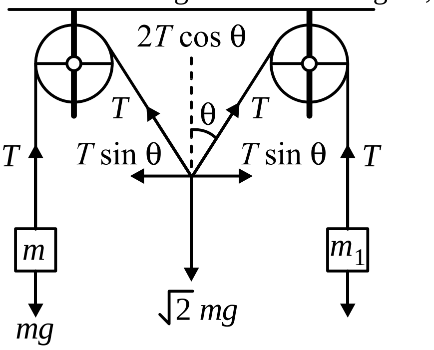
$\frac{mv^2}{r} = \mu mg$

or $\quad v^2 = \mu rg \qquad$ or $\quad v^2 = 0.6 \times 150 \times 10$

or $\quad v = 30$ ms$^{-1}$)

**14.** **(3)**

From force diagram shown in figure,




$T = mg$ …(i)

and $2T\cos\theta = \sqrt{2}\,mg$ …(ii)

Combing Eqs. (i) and (ii), we have

$2mg\cos\theta = \sqrt{2}\,mg$

or $\cos\theta = 1/\sqrt{2}$

or $\theta = 45°$

**15.** **(2)**

Gravitational force is a conservative force and work done against it is a point function i.e. does not depend on the path.

**16.** **(1)**

Momentum would be maximum when *KE* would be maximum, and this is the case when total elastic *PE* is converted to *KE*.

According to conservation of energy

$$\frac{1}{2}kL^2 = \frac{1}{2}Mv^2$$

or $kL^2 = \frac{(Mv)^2}{M}$

$MKL^2 = p^2$ $(p = Mv)$

$\therefore$ $p = L\sqrt{MK}$

**17.** **(1)**

We know that $P = F \times v = F \times \frac{L}{T}$

As $F = [MLT^{-2}]$ = constant

$\therefore\ L \propto T^2$

$\therefore\ P = F \times \frac{L}{T} = F \times \frac{T^2}{T} = F \times T$

or $P \propto T$

**18.** **(2)**

M.I. of block about $x$ axis, $I_x = \frac{m}{12}(b^2 + t^2)$

M.I. of block about $y$ axis, $I_y = \frac{m}{12}(l^2 + t^2)$

M.I. of block about $z$ axis, $I_z = \frac{m}{12}(l^2 + b^2)$

As $l > b > t \therefore I_z > I_y > I_x$

**19.** **(3)**

Given, $I = \frac{2}{5}MR^2$

Using the theorem of parallel axes, moment of inertia of the sphere about a parallel axis tangential to the sphere is

$$I' = I + MR^2 = \frac{2}{5}MR^2 + MR^2 = \frac{7}{5}MR^2$$

$$\therefore\quad I' = MK^2 = \frac{7}{5}MR^2,\ K = \left(\sqrt{\frac{7}{5}}\right)R$$

**20.** **(1)**

$$K_N = \frac{1}{2}mv^2\left(1 + \frac{K^2}{R^2}\right) = \frac{1}{2}mv^2\left(1 + \frac{2}{5}\right) = \frac{7}{10}mv^2$$

**21.** **(4)**

$$v_e = \sqrt{\frac{2GM}{(R+h)}}$$

Clearly, we can see it is dependent of height ($h$)

**22.** **(1)**

$$K.E. = \frac{GMm}{2R}$$

**23.** **(1)**

$$v_e = \sqrt{\frac{2GM}{R}} = 100 \Rightarrow \frac{GM}{R} = 5000$$

Potential energy $U = -\frac{GMm}{R} = -5000\,J$

**24.** **(1)**

In the figure OA, stress ∝ strain i.e. Hooke's law hold good

**25.** **(1)**

$Y = \frac{Fl}{A\Delta l}$ $or$ $\Delta l \propto \frac{F}{r^2}$

Or $\frac{\Delta l_2}{\Delta l_1} = \frac{F_2}{F_1} \times \frac{r_1^2}{r_2^2}$

Or $\frac{\Delta l_2}{\Delta l_1} = 2 \times 2 \times 2 = 8$

Or $\Delta l_2 = 8\Delta l_1 = 8 \times 1\,mm = 8\,mm$

**26.** **(2)**

$$\frac{3}{\eta} + \frac{1}{K} = \frac{9}{Y}$$

$$\frac{1}{K} = \frac{9}{Y} = \frac{3}{\eta}\ or\ \frac{1}{K} = \frac{9}{3\eta} - \frac{3}{\eta} = 0 \Rightarrow K = \infty$$

**27.** **(2)**
Work done = $\frac{1}{2}F \times \Delta l = \frac{1}{2}\ Mgl$

**28.** **(4)**
Tension in spring $T$ = upthrust – weight of sphere
$= V\sigma g - V\rho g = V\eta\rho g - V\rho g$ [As $\sigma = \eta\rho$]
$= (\eta - 1)V\rho g = (\eta - 1)mg$

**29.** **(3)**
$P_1 V_1 = P_2 V_2$

$\Rightarrow (P_0 + h\rho g) \times \frac{4}{3}\pi r^3 = P_0 \times \frac{4}{3}\pi(2r)^3$

Where, $h$ = depth of lake

$\Rightarrow h\rho g = 7P_0 \Rightarrow h = 7 \times \frac{H\rho g}{\rho g} = 7H$

**30.** **(2)**
$V = \frac{P\pi r^4}{8\eta l} \Rightarrow \frac{V_2}{V_1} = \left(\frac{r_2}{r_1}\right)^4$

$\Rightarrow V_2 = V_1\left(\frac{110}{100}\right)^4 = V_1(1.1)^4 = 1.4641V$

$\frac{\Delta V}{V} = \frac{V_2 - V_1}{V} = \frac{1.4641V - V}{V} = 0.46$ or 46%

**31.** **(1)**
An opaque body does not transmit any radiation, hence transmission coefficient of an opaque body is zero

**32.** **(2)**
Wien's displacement law is given by
$\lambda_m T = constant$ (say $b$)
Given, $b$ = Wien's constant = $2.93 \times 10^{-3}\ m - K$
$\lambda_m = 2.93 \times 10^{-10} m$
Substituting the values, we obtain

$T = \frac{b}{\lambda_m} = \frac{2.93 \times 10^{-3}}{2.93 \times 10^{-10}} = 10^7\ K$

**33.** **(3)**
Equivalent thermal conductivity of the compound, slab,

$K_{eq} = \frac{l_1 + l_2}{\frac{l_1}{K_1} + \frac{l_2}{K_2}} = \frac{l + l}{\frac{l}{K} + \frac{l}{2K}} = \frac{2l}{\frac{3l}{2K}} = \frac{4}{3}$ K

**34.** **(1)**
Heat absorbed by the system at constant pressure.
$Q = nc_p\Delta T$
Change in internal energy $\Delta U = nc_v\Delta T$
$W = Q - \Delta U$

$\therefore \frac{W}{Q} = \frac{Q - \Delta U}{Q} = 1 - \frac{\Delta U}{Q}$

$= 1 - \frac{nc_v\Delta T}{nc_p\Delta T} = 1 - \frac{c_v}{c_p} = \left(1 - \frac{1}{\gamma}\right)$

**35.** **(3)**
$PV^\gamma = K$ or $P\gamma V^{\gamma-1}dV + dP.V^\gamma = 0$
$\Rightarrow \frac{dP}{P} = -\gamma\frac{dV}{V}$ or $\frac{dP}{P} \times 100 = -\gamma\left(\frac{dV}{V} \times 100\right)$
$= -1.4 \times 5 = 7\%$

**36.** **(4)**
Work done = Area under curve
$= \frac{6P_1 \times 3V_1}{2} = 9\ P_1V_1$

**37.** **(1)**
$\because \theta_1 < \theta_2 \Rightarrow tan\ \theta_1 < tan\ \theta_2$
$\Rightarrow \left(\frac{V}{T}\right)_1 < \left(\frac{V}{T}\right)_2$
Form $PV = nRT; \frac{V}{T} \propto \frac{1}{P}$
Hence $\left(\frac{1}{P}\right)_1 < \left(\frac{1}{P}\right)_2 \Rightarrow P_1 > P_2$

**38.** **(2)**
$\gamma = 7/5$ for a diatomic gas

**39.** **(2)**
Heat added to helium during expansion
$H = nC_V\Delta T = 8 \times \frac{3}{2}R \times 30$
$\left(C_V\ for\ monoatomic\ gas = \frac{3}{2}R\right)$
= 360 $R$
= 360 × 8.31 $J$ ($R$ = 8.31 $J\ mol^{-1} - K^{-1}$)
≈ 3000 J

**40.** **(1)**
Root mean square velocity ($v_{rms}$), given by

$v_{rms} = \sqrt{\frac{3RT}{M}}$

where $R$ is gas constant, $T$ the temperature and $M$ molecular weight.
Given, $T_1$ = 27°C = 273 + 27 = 300 K,
$T_2$ = 327°C = 327 + 273 = 600 $K$

$\therefore \frac{(v_{rms})_1}{(v_{rms})_2} = \sqrt{\frac{300}{600}} = \sqrt{\frac{1}{2}}$

$\Rightarrow (v_{rms})_2 = \sqrt{2}\ (v_{rms})_1$
Hence, rms speed increases $\sqrt{2}$ times.

**41.** **(4)**
To conserve linear momentum, forces can act on a system but their vector sum should be zero.

**42.** **(4)**
Gases inside the rocket are pushed backwards.

**43. (1)**

The correct option is A Statement -1 is true, statement -2 is true, and statement-2 is correct explanation of statement -1.

If it is a completely inelastic collision, then

$m_1v_1 + m_2v_2 = m_1v + m_2v$

$$\Rightarrow \quad v = \frac{m_1v_1 + m_2v_2}{m_1 + m_2}$$

$$KE = \frac{p_1^2}{2m_1} + \frac{p_2^2}{2m_2}$$


As $p_1$ and $p_2$ both simultaneously cannot be zero, total $KE$ cannot be lost.

**44. (3)**

Slope is negative. Therefore, velocity is negative. Velocity is increasing in magnitude along -ve $x$-direction. Therefore, acceleration also has to be negative.

**45. (3)**

Dimensions for energy and volume are different but energy divided by volume can give us a quantity (which will not be dimensionless, but will represent Energy Density)

**46. (4)**

$$v = \frac{\omega}{k} = \frac{\text{Co-efficient of } t}{\text{Co-efficient of } x} = \frac{2}{0.01}$$

= 200 cm/sec.

**47. (4)**

$Q_1 = ms\Delta T = 20 \times 0.53 \times 20 = 212 \rightarrow$ (IV)

$Q_2 = mL = 20 \times 80 = 1600 \rightarrow$ (I)

$Q_3 = ms\Delta T = 20 \times 1 \times 100 = 2000 \rightarrow$ (II)

$Q_4 = mL = 20 \times 540 = 10800 \rightarrow$ (III)

**[NCERT Class 11th, Page No. 213, 214]**

**48. (3)**

(A) $|A + B| = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

Here, $|A| = |B| = x$ and $\theta = 60°$

$\therefore |A + B| = \sqrt{3}x$

(B) $|A - B| = \sqrt{A^2 + B^2 - 2AB\cos\theta} = x$

(C) $A \cdot B = AB\cos\theta = \frac{x^2}{2}$

(D) $|A \times B| = AB\sin\theta = \frac{\sqrt{3}}{2}x^2$

Hence, A $\rightarrow$ III, B $\rightarrow$ II, C $\rightarrow$ IV, D $\rightarrow$ I

**49. (3)**

Total distance travelled = $s$

$$\text{Total time taken} = \frac{s/3}{10} + \frac{s/3}{20} + \frac{s/3}{60}$$

$$= \frac{s}{30} + \frac{s}{60} + \frac{s}{180} = \frac{10s}{180} = \frac{s}{18}$$

$$\text{Average speed} = \frac{\text{total distance travelled}}{\text{total timte taken}}$$

$$= \frac{s}{s/18} = 18\,\text{km/h}$$

**[NCERT Class 11th, Page No. 042]**

**50. (3)**

For an organ pipe open at one end,

Frequency of 1st overtone $n_1 = \frac{3v}{4l_1}$

For the organ pipe open at both ends,

Frequency of 3rd harmonic, $n_2 = \frac{3v}{2l_2}$

As $n_1 = n_2$

$$\therefore \quad \frac{3v}{4l_1} = \frac{3v}{2l_2} \text{ or } \frac{l_1}{l_2} = \frac{2}{4} = \frac{1}{2}$$