Sample Paper-04

Class 11th NEET (2024)

PHYSICS

ANSWER KEY

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

HINTS AND SOLUTION

1. **(3)**

Given, $P = a^{1/2}b^2c^3d^{-4}$

Maximum relative error,

$$\frac{\Delta P}{P} = \frac{1}{2}\frac{\Delta a}{a} + 2\frac{\Delta b}{b} + 3\frac{\Delta c}{c} + 4\frac{\Delta d}{d}$$

$$= \frac{1}{2}\times 2 + 2\times 1 + 3\times 3 + 4\times 5 = 32\%$$

2. **(3)**

For minimum value of m, the final temperature of the mixture must be 0°C.

We know that,

Heat lost by steam = Heat gained by ice

$\Rightarrow$ $mL_{vapor} + mC_{water}\,\Delta T = m_iC_{ice}\,\Delta T + m_{ice}L_{melt}$

$\Rightarrow$ $m \times 540 + m \times 1 \times 100$

$= 20 \times 0.5 \times 10 + 20 \times 80$

$\Rightarrow$ $540\,m + 100\,m = 100 + 1600 = 640\,m = 1700$

$$m = \frac{1700}{640} = m = \frac{170}{64} = \frac{85}{32}\,gm$$

3. **(4)**

$\mu_r < \mu_k < \mu_s$

4. **(1)**

We know that,

$$g = \frac{GM}{R^2} = \frac{G\left(\frac{4}{3}\pi R^3\right)\rho}{R^2} = \frac{4}{3}\pi GR\rho$$

$$\frac{g'}{g} = \frac{R'}{R} = \frac{0.2R}{R} = 0.2$$

$\therefore$ $g' = 0.2\,\mathrm{g}$

5. **(3)**

Frictional force = μ mg

= 0.4 × 5 × 10 = 20 N

pseudo force = ma = 5 × a

Now, pseudo force = frictional force

ma = 20N

$$a = \frac{20}{5} = 4\,\mathrm{ms}^{-2}.$$

6. **(2)**

$$x_{\mathrm{cm}} = \frac{1\times 0 + 1\times PQ + 1\times PR}{1+1+1} = \frac{PQ+PR}{3} \text{ and } y_{\mathrm{cm}} = 0$$

7. **(2)**

$$W = \int_0^{x_1} F\,dx = \int_0^{x_1} c\,x dx = \left[\frac{1}{2}cx^2\right]_0^{x_1}$$

$$= \frac{1}{2}c(x_1^2 - 0) = \frac{1}{2}cx_1^2$$

8. **(1)**

Frequency does not depend upon radius. As length is doubled, fundamental frequency becomes half.

9. **(3)**

Covering a portion of lens does not effect position and size of image

10. **(2)**

$a = 6t + 5$

$$\frac{dv}{dt} = (6t+5)$$

$$dv = (6t+5)dt \Rightarrow \int_0^v dv = \int_0^t (6t+5)dt$$

$$\Rightarrow v = \frac{6t^2}{2} + 5t$$

$$\Rightarrow \frac{dx}{dt} = 3t^2 + 5t$$

$$\Rightarrow \int_0^x dx = \int_0^2 (3t^2+5t)dt$$

$$\Rightarrow x = \left(\frac{3t^3}{3} + \frac{5t^2}{2}\right)_0^2$$

$$x = 8 + 5\times\frac{4}{2}$$

$x = 18\ m$

11. **(2)**

K = 800 N/m

$d\omega = Fdx$

$$\omega = K\int_5^{15} xdx$$

$$\omega = 800 \times \left(\frac{x^2}{2}\right)_5^{15}$$

$\omega = 400\,(15^2 - 5^2) \times 10^{-4}$

$\omega = 400 \times 200 \times 10^{-4}$

ω = 8 J.

12. **(3)**

$$\frac{mv_0^2}{(\text{Re}+h)}=\frac{GMem}{(\text{Re}+h)^2}$$

$$\Rightarrow \quad v_0^2=\frac{GMe}{(\text{Re}+h)}$$

$$v_0=\sqrt{\frac{GMe}{(\text{Re}+h)}}$$

13. **(2)**

Loss in potential energy = Gain in kinetic energy

$$-\frac{GMm}{R}-\left(-\frac{3}{2}\frac{GMm}{R}\right)=\frac{1}{2}mv^2$$

$$\Rightarrow \quad -\frac{GMm}{2R}=\frac{1}{2}mv^2 \Rightarrow \sqrt{\frac{GM}{R}}=\sqrt{gR}$$

14. **(2)**

$$\text{stress}=\frac{mg}{\pi r^2}=\frac{4\times(3.1\pi)}{\pi\times4\times10^{-6}}=3.1\times10^6\ \text{N/m}^2$$

15. **(1)**

$$X_{\text{cm}}=\frac{m_1x_1+m_2x_2+m_3x_3}{m_1+m_2+m_3}$$

$$X_{\text{cm}}=\frac{300\times(0)+500(40)+400\times70}{300+500+400}$$

$$X_{\text{cm}}=\frac{500\times40+400\times700}{1200}=40\,\text{cm}$$

16. **(4)**

$$\frac{P_1V_1}{T_1}=\frac{P_2V_2}{T_2}$$

$$\therefore \quad V_2=\frac{P_1V_1}{T_1}\times\frac{T_2}{P_2}=\frac{4\times1500\times270}{300\times2}=2700\ \text{m}^3$$

17. **(4)**

$$\frac{c^2}{g}=\frac{L^2T^{-2}}{LT^{-2}}=[L]$$

18. **(4)**

Use a = μg and $v^2 = u^2 + 2as$

19. **(4)**

Load supported by sonometer wire = 4 kg

Tension in sonometer wire = 4 g

If μ = mass per unit length

Then frequency $\upsilon=\frac{1}{2l}\sqrt{\frac{T}{\mu}}$

$$\Rightarrow \quad 416=\frac{1}{2l}\sqrt{\frac{4g}{\mu}}$$

When length is doubled, i.e., $l' = 2l$

Let new load = L

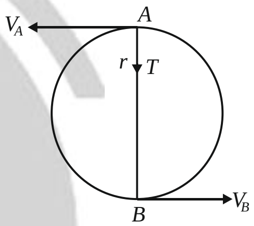
As, $\upsilon' = \upsilon$

$$\therefore \quad \frac{1}{2l`}\sqrt{\frac{Lg}{\mu}}=\frac{1}{2l}\sqrt{\frac{4g}{\mu}} \Rightarrow \frac{1}{4l`}\sqrt{\frac{Lg}{\mu}}=\frac{1}{2l}\sqrt{\frac{4g}{\mu}}$$

$$\Rightarrow \sqrt{L}=2\times2 \Rightarrow L=16\ kg$$

20. **(1)**

Let velocity at $A = v_A$ and velocity at $B = v_B$



Applying conservation of energy at A & B

$$\frac{1}{2}mv_A^2+2gmr=\frac{1}{2}mv_B^2$$

$$v_B^2=v_A^2+4gr \quad ...(i)$$

Now as it is moving in circular path it has centripetal force.

At point $A \Rightarrow T \quad T+mg=\frac{mv_A^2}{r}$

For minimum velocity $T \geq 0$

or $\frac{mv_A^2}{r}\geq mg \Rightarrow v_A^2 \geq gr \Rightarrow v_A \geq \sqrt{gr}$

21. **(4)**

As body covers equal angles in equal time intervals. Its angular velocity and hence magnitude of linear velocity is constant.

22. **(1)**

The rotational kinetic energy of the disc is

$$K_{\text{rot}} = \frac{1}{2}I\omega^2 = \frac{1}{2}\left(\frac{1}{2}MR^2\right)\omega^2 \frac{1}{4}MR^2\omega^2$$

The translational kinetic energy is

$$K_{\text{trans}} = \frac{1}{2}Mv_{\text{CM}}^2$$

Where v_{CM} is the linear velocity of its centre of mass.

Now, $v_{CM} = R\omega$

Therefore, $K_{\text{trans}} = \frac{1}{2}MR^2\omega^2$

Thus,

$$K_{\text{trans}} = \frac{1}{4}MR^2\omega^2 + \frac{1}{2}MR^2\omega^2 = \frac{3}{4}MR^2\omega^2$$

$$\therefore \quad \frac{K_{\text{rot}}}{K_{\text{total}}} = \frac{\frac{1}{4}MR^2\omega^2}{\frac{3}{4}MR^2\omega^2} = \frac{1}{3}$$

23. **(4)**

$$I = \frac{1}{2}mR^2 = \frac{1}{2}m\frac{D^2}{4}$$

$$I \propto D^2$$

$$\Rightarrow \frac{I_A}{I_B} = \left(\frac{D_A}{D_B}\right)^2 = \left(\frac{2D_B}{D_B}\right)^2$$

$$\Rightarrow I_A = 4I_B$$

24. **(2)**

At highest point $v = v\cos 45^\circ = \frac{v}{\sqrt{2}}$

$\therefore$ Momentum $P = \frac{mv}{\sqrt{2}}$

Also, Angular momentum $L = \frac{mv}{\sqrt{2}(h)}$

Here, $h = \frac{v^2 \sin^2 45^\circ}{2g} = \frac{v^2}{4g}$

$$\therefore \quad L = \frac{mv}{\sqrt{2}}\frac{v^2}{4g} = \frac{mv^3}{4\sqrt{2}g}$$

25. **(4)**

Position and angular, momentum both lie in same plane. Hence, using right hand rule, it points in z-direction.

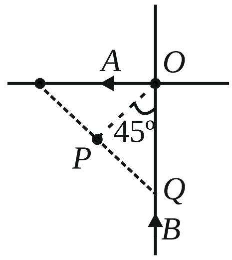
26. **(4)**

$$\eta = \frac{P(r^2 + x^2)}{4vl}$$

$= [ML^{-1}T^{-2}]\,[L^2]\,[LT^{-1}]^{-1}\,[L^{-1}]$

$= [ML^{-1}T^{-2}]\,[L^2]\,[L^{-1}T]\,[L^{-1}] = [ML^{-1}T^{-1}]$

27. **(4)**



$$\overrightarrow{V_{AB}} = \overrightarrow{V_A} - (-\overrightarrow{V_B}) = \overrightarrow{V_A} + \overrightarrow{V_B}$$

$$|V_{AB}| = \sqrt{V_A^2 + V_B^2}$$

$$\sqrt{10^2 + 10^2} = 10\sqrt{2}$$

($\because$ $V_A = V_B = 10$ km/h)

From the diagram, the shortest distance between ships A and B is PQ.

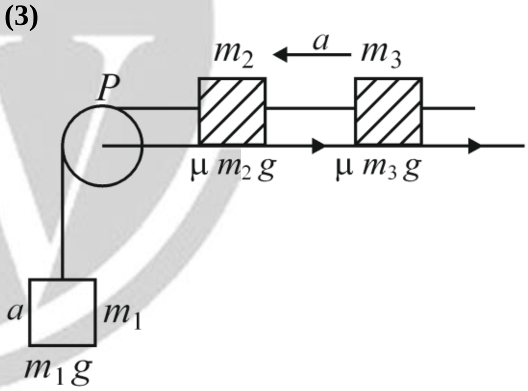
$\sin 45^\circ = \frac{PQ}{OQ}$ and $OQ = 100km.$

Then,

$$PQ = OQX \sin 45^\circ = 100 \times \frac{1}{\sqrt{2}} = 50\sqrt{2}h$$

Time taken = $\frac{distance}{velerity} = \frac{50\sqrt{2}}{10\sqrt{2}} = 5h$

28. **(3)**



Frictional force on $m_2 = \mu\, m_2\, g$

Frictional force on $m_3 = \mu\, m_3\, g$

Let acceleration = a

$$\therefore \quad a = \frac{m_1 g - \mu m_2 g - \mu m_2 g}{m_1 + m_2 + m_3}$$

$$a = g\frac{(1-2\mu)}{3} \quad (m_1 = m_2 = m_3 = m)$$

Hence downward acceleration of m_1 is $g\frac{(1-2\mu)}{3}$

29. **(1)**

We know that rate of heat flow $H = \frac{KA\Delta T}{\Delta x}$

ΔT & Δx same for both rods

So, $\frac{H}{KA} = \text{constant}$

i.e., $\frac{H_1}{K_1A_1} = \frac{H_2}{K_2A_2}$

$\Rightarrow \frac{H_1}{H_2} = \frac{K_1A_1}{K_2A_2} = 6$

$\Rightarrow K_1A_1 = 6K_2A_2$

30. **(2)**

$\because n = \frac{v}{2\ell}$

$\Rightarrow \ell = \frac{v}{2n}$

also $\ell_1 = \frac{v}{2n_1}$

& $\ell_2 = \frac{v}{2n_2}$

$\therefore \ell = \ell_1 + \ell_2$

$\frac{v}{2n} = \frac{v}{2n_1} + \frac{v}{2n_2}$

$\Rightarrow \frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2}$

$\Rightarrow n = \frac{n_1 n_2}{n_1 + n_2}$

31. **(1)**

The number of beats will be the difference of frequencies of two strings.

Frequency of first string $f_1 = \frac{2}{l_1}\sqrt{\frac{T}{m}}$

$= \frac{1}{2\times 5.16\times 10^{-2}}\sqrt{\frac{20}{10^{-3}}} = 137$

Similarly, for 2nd string

$= \frac{1}{2\times 49.1\times 10^{-2}}\sqrt{\frac{20}{10^{-3}}} = 144$

No. of beats = $f_2 - f_1$ = 144 – 137 = 7 beats

32. **(3)**

For isothermal expansion

$PV = P'(2V) \Rightarrow \quad P' = \frac{P}{2}$

For adiabatic expansion

$P'(2V)^\gamma = P_f(16V)^\gamma \qquad (PV^\gamma = C)$

Putting value of P'

$P_f = \frac{P}{2}\left(\frac{2V}{16V}\right)^{5/3} = \frac{P}{64}$

33. **(2)**

We know that,

$T = 2\pi\sqrt{\frac{m}{k}} \qquad \therefore \quad k = \frac{4\pi^2 m}{T^2}$

In the given situation

$k = k_1 + k_2$

$\therefore \qquad \frac{4\pi^2 m}{t_0^2} = \frac{4\pi^2 m}{t_1^2} + \frac{4\pi^2 m}{t_2^2}$

$\therefore \qquad t_0^{-2} = t_1^{-2} + t_2^{-2}$

34. **(1)**

Since work done at constant pressure is more than at constant volume. So that C_p is greater than C_v.

35. **(1)**

Pumping air inside the tyre is an adiabatic process, as it's very quick and compressed air inserts inside the tyre.

36. **(1)**

As work done = 0

$\Delta U = mc\Delta T = 100\times 10^{-3}\times 4184\times(50^\circ C - 30)$

$= 8.4\,kJ$

37. **(2)**

$h = \frac{2T\cos\theta}{\rho g r}$ ...(1)

mass $M = \rho V$

$\therefore M = \rho hA = \rho h\pi r^2$ ...(2)

From (1) & (2)

$M = \rho\pi r^2 \times \frac{2T\cos\theta}{\rho g r}$

$\Rightarrow M \propto r$

$\Rightarrow \frac{M}{M'} = \frac{r}{2r}$

$\Rightarrow M' = 2M$

38. **(1)**

We know that height to which liquid will rise is given by

$$h = \frac{2T}{r\rho g}$$

So, $So, \frac{h_1}{h_2} = \frac{r_2\rho_2}{r_1\rho_1} = \frac{3\times4}{2\times5} = \frac{6}{5}$

39. **(1)**

Write in fraction instead of ℓ

Here, A = 0.1 cm^2 = 0.1 × 10^{-4} m^2

$Y = 2 \times 10^{11}$ Nm^{-2}

$$\frac{\Delta L}{L} = 0.1\% = \frac{0.1}{100} = 0.1\times10^{-2}$$

As $Y = \frac{F}{A}\times\frac{L}{\Delta L}$

$\Rightarrow F = Y\frac{\Delta L}{L}A = 2\times10^{11}\times0.1\times10^{-2}\times0.1\times10^{-4}$

= 2000 N.

40. **(2)**

Velocity head = $\frac{v^2}{2g}$

Pressure head = $\frac{P}{\rho g}$

but $\frac{v^2}{2g} = \frac{P}{\rho g}$

$$v^2 = \frac{2P}{\rho} = \frac{2\rho gh}{\rho}$$

$$v = \sqrt{2gh}$$

$$v = \sqrt{2\times10\times40\times10^{-2}}$$

$$v = \sqrt{8} = 2.8\,\text{m/s}$$

41. **(2)**

Work done

$$W = \frac{1}{2}F\times\Delta L$$

But $F = \frac{\gamma A\Delta L}{\ell}$

and $\Delta L = \ell\alpha t$

$$\therefore W = \frac{1}{2}(\gamma A\alpha t).(\ell\alpha t)$$

Hence option (2) is correct.

42. **(2)**

$$L_1' = L_1(1+\alpha_1\Delta t)$$

$$L_2' = L_2(1+\alpha_2\Delta t)$$

but $L_2' - L_1' = L_2 - L_1$

$$\therefore L_2(1+\alpha_2\Delta t) - L_1(1+\alpha_1\Delta t) = L_2 - L_1$$

$$L_2 + L_2\alpha_2\Delta t - L_1 - L_1\alpha_1\Delta t = L_2 - L_1$$

$$\Rightarrow L_2\alpha_2 = L_1\alpha_1$$

$$\Rightarrow \frac{L_1}{L_2} = \frac{\alpha_2}{\alpha_1}$$

43. **(3)**

Due to volume expansion of both mercury and flask, the change in volume of mercury relative to flask is given by

$\Delta V = V_0\,[\gamma_L - \gamma_g]\Delta\theta = V\,[\gamma_L - 3\alpha_g]\Delta\theta$

= 50 [180 × 10^{-6} – 3 × 9 × 10^{-6}] (38 – 18)

= 0.153 cc

44. **(4)**

At equilibrium, weight of the given block is balanced by force due to surface tension, i.e.,

2L. S = W

or $S = \frac{W}{2L} = \frac{1.5\times10^{-2}N}{2\times0.3m} = 0.025\,\text{Nm}^{-1}$

45. **(1)**

$$\phi = \frac{2\pi}{\lambda}\times\Delta k \Rightarrow 0.5\pi = \frac{2\pi}{\lambda}\times0.8$$

$\Rightarrow \lambda = 3.2m$

Now wave velocity

$V = f\lambda \Rightarrow V = f\lambda = 120 \times 3.2 = 384$ m/s

46. **(4)**

Let initial length $\ell_1 = 100$

Then final length $\ell_2 = 121$

We know that $T = 2\pi\sqrt{\frac{\ell}{g}} \Rightarrow \frac{T_1}{T_2} = \sqrt{\frac{\ell_1}{\ell_2}}$

Hence, $\frac{T_1}{T_2} = \sqrt{\frac{100}{121}} \Rightarrow T_2 = 1.1T_1$

$\therefore$ % increase = $\frac{T_2 - T_1}{T_1}\times100 = 10\%$

47. **(4)**

If V is velocity of combination (bag + bullet), then from principle of conservation of linear momentum.

$$(m + M)V = mv \text{ or } V = \frac{mv}{(m+M)}$$

$$K.E. = \frac{1}{2}(m+M)v^2 = \frac{m^2v^2}{2(m+M)}$$

48. **(1)**

Force of friction acting

$= \mu\, mg = 0.15 \times 60 \times 9.8$ N

Distance = 0.9 m

Work done = 0.15 × 60 × 9.8 × 0.9 = 79.4 J

49. **(4)**

At maximum height, $v = u \cos 45° = \frac{u}{\sqrt{2}}$;

$a_c = g$

$$r = \frac{\left(\frac{u}{\sqrt{2}}\right)^2}{g} = \frac{u^2}{2g}$$

50. **(1)**

Here, at is dimensionless

$$\Rightarrow \quad a = \frac{1}{t} = \left[\frac{1}{T}\right] = [T^{-1}]$$

$$x = \frac{V_0}{a} \text{ and } V_0 = xa = [LT^{-1}] = [M^0LT^{-1}]$$

PW Web/App - https://smart.link/7wwosivoicgd4

Library- https://smart.link/sdfez8ejd80if