Sample Paper-05

Class 11th NEET (2024)

PHYSICS

ANSWER KEY

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

HINTS AND SOLUTION

1. **(4)**

Let M_1, L_1, T_1 and M_2, L_2, T_2 are units of mass length and time given two systems.

$$n_1 u_1 = n_2 u_2$$

So, $n_2 = n_1\left[\frac{M_1}{M_2}\right]^a \times \left[\frac{L_1}{L_2}\right]^b \times \left[\frac{T_1}{T_2}\right]^c$

Dimension of energy = $[ML^2T^{-2}]$

$$n_2 = \left[\frac{1}{x}\right]\left[\frac{1}{y}\right]^2\left[\frac{1}{z}\right]^{-2}$$

$$n_2 = \frac{z^2}{xy^2}$$

Hence 10 J $= \frac{10z^2}{xy^2}$

2. **(1)**

Let m = mass of both the bodies

v_i = initial velocity

v_f = final velocity

By conversation of momentum

$mv - mv = 2mv_f$

$\Rightarrow \quad 2mv_f = 0$

$v_f = 0$

3. **(1)**

We know that

$$\rho_1 A_1 V_1 = \rho_2 A_2 V_2$$

(Equation of continuity)

$\Rightarrow \quad \rho_1 \pi r_1^2 V_1 = \rho \pi r_2^2 V_2$

$\Rightarrow \quad r_1^2 V_1 = r_2^2 V_2$

$\Rightarrow \quad \frac{V_1}{V_2} = \frac{r_2^2}{M^2} = \left(\frac{2}{3}\right)^2 = \frac{4}{9} = 4:9$

4. **(2)**

Given mass of man = 80 kg

Mass of plank = 40 kg

C.M of system remains unchanged

Let displacement of plank = x

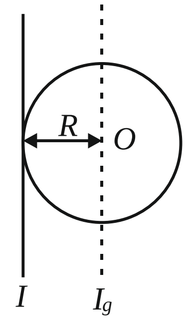
displacement of man = $6m$

So, $80(6 - x) = 40x$

$\Rightarrow \quad 12 - 2x = x$

$\Rightarrow \quad x = 4\text{m}$

5. **(3)**



Given $I = 40$

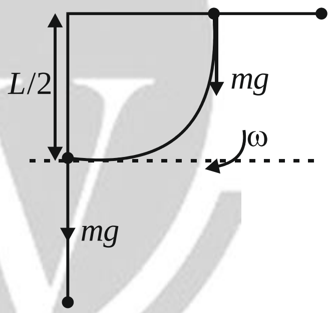
$$40 = \frac{2}{5}MR^2 \qquad \Rightarrow \quad MR^2 = 100 \; kg\, m^2$$

Using parallel axis theorem,

$$I_{CM} + MR^2 = \frac{2}{5}MR^2 + MR^2 = \frac{7}{5}MR^2$$

$$= \frac{7}{5} \times MR^2 = \frac{7}{5} \times 100 = 140 kg\, m^2$$

6. **(2)**



Initial potential energy $U_1 = mg\frac{L}{2}$

Initial kinetic energy $K_1 = 0$

Final potential energy $U_2 = 0$

Final kinetic energy

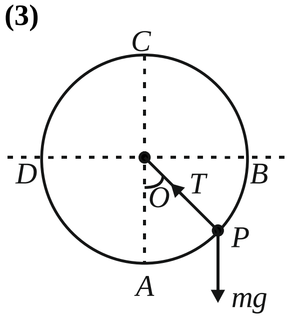
$$K_2 = \frac{1}{2}I\omega^2 = \frac{1}{2} \times \frac{ml^2}{3} \times \omega^2 = \frac{mL^2\omega^2}{6}$$

$$U_1 + K_1 = U_2 + K_L$$

$$mg\frac{L}{2} + O = O + \frac{mL^2\omega^2}{6} \quad \text{(conservation of energy)}$$

$$\Rightarrow \quad \omega^2 = \frac{3g}{L} = \omega = \sqrt{\frac{3g}{L}}$$

7. **(3)**



Tension at general point P, according to Newton second law of motion.

Net force towards centre = centripetal force

T- mg cos θ = $\frac{mv^2}{l}$

or $T = \frac{m}{l}\left[u^2 - gl(2-3\cos\theta)\right]$

for position A : θ = 0° $T = \frac{mu^2}{l} + mg$

for position B : θ = 90° $T = \frac{mu^2}{l} - 2mg$

for position C : θ = 180° $T = \frac{mu^2}{l} - 5mg$

for position D : θ = 270° $T = \frac{mu^2}{l} - 2mg$

Hence, $T_C < (T_B = T_D) < T_A$

8. **(1)**

$Q_{gain} = Q_{lost}$

Heat, $Q = mC\Delta T$

Heat remained = Heat lost – Heat gained

= (5 × 1 × 20) – (2 × 0.5 × 20)

= 100 – 20 = 80 k cal

⇒ $m \times 80 = 80$

⇒ $m = 1$ kg

∴ Final mass of water = 5 + 1 = 6 kg

9. **(4)**

Since springs are connected in parallel.

So, the effective force constant will be.

$k_e = k_1 + k_2$

∴ $T = 2\pi\sqrt{\frac{m}{k_e}} = 2\pi\sqrt{\frac{m}{k_1+k_2}}$

10. **(2)**

(A) <u>Isobaric Process</u>
Pressure = Constant

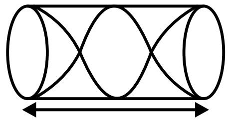
(B) <u>Isothermal Process</u>
(T) Temperature = Constant
(U) Internal Energy = Constant
$\Delta U = 0$

(C) <u>Adiabatic Process</u>
No exchange in heat between system and surroundings
Q = Constant

(D) <u>Isochoric Process</u>
Volume = Constant
$W.D = P\Delta V = 0$

11. **(1)**

(A) Tube open at both ends
2nd Harmonic

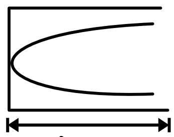


$\lambda = L$

$f = 2\left(\frac{v}{2L}\right) = \frac{v}{L}$

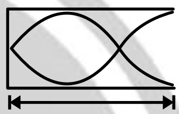
(B) Tube close at one end

Fundamental frequency $f = \frac{v}{4L}$



$\frac{\lambda}{4} = L$

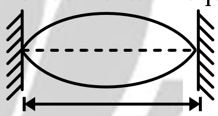
(C) Tube close at one end
1st Overtone



$\frac{3}{4}\lambda = L$

$f = \frac{3v}{4L}$

(D) String fixed at both ends
Fundamental frequency



$\frac{\lambda}{2} = L$

$= \frac{v}{2L}$

Option (1) is correct

12. **(4)**

It depends only on the mass and the radius of the planet or earth from where the body is to be projected. Also, does not depends on the mass of body as well as the direction of projection of body.

13. **(3)**

Horizontal component of velocity remains constant so, only vertical component of velocity changes.

$V_i = u \sin\theta$

$V_f = 0$

∴ change = $u \sin\theta$.

14. (2)

For initial velocity

V_i = slope = $\frac{16-0}{2-0} = 8\,m/s.$ $(t = 0 \text{ to } t = 2s)$

Final velocity V_f = slope at $t = 2s$ = 0 m/s

We know that,

Impulse $I = m(V_f - V_i) = 3 \times (0 - 8) = -24$ kg ms^{-1}

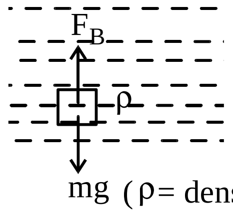
15. (1)

Ma = FB – Mg

$Ma = v\rho g - mg$

$a = \left(\frac{v\rho - m}{M}\right)$ = Constant

Acceleration will remain constant in upwards direction



(ρ= density of liquid)

16. (1)

Definition of Pascal's Law.

17. (3)

When the body is at centre there is no need to pull it towards the centre further. So, gravitational acceleration is zero at centre of earth.

18. (3)

From the graph,

$\frac{dv}{ds} = \tan 45^o = 1$

Acceleration, $a = \frac{dv}{dt} = \frac{dv}{ds}.\frac{ds}{dt}$

$\Rightarrow \quad a = \frac{dv}{ds}.\frac{ds}{dt} = \frac{dv}{ds}.v$

$\therefore \quad a = 1 \times 15 = 15\,m/s^2$

19. (2)

$dW = F.dx = (6x^2 - 4x + 8)dx$

$\int dW = \int (6x^2 - 4x + 8)dx$

$W = \left|\frac{6x^3}{3} - \frac{4x^2}{2} + 8x\right|_0^2$

$= \frac{6(2)^3}{3} - \frac{4(2)^2}{2} + 8(2) - 0$

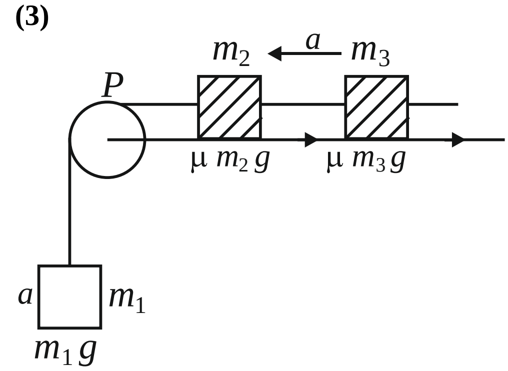
$2 \times 2^3 - 2^3 + 16$

$16 - 8 + 16 - 0$

$8 + 16$

$= 16 - 8 - 16 = 24$J

20. (3)



Frictional force on $m_2 = \mu m_2 g$

Frictional force on $m_3 = \mu m_3 g$

Let acceleration = a

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

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

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

21. (2)

τ × t = change in angular momentum.

$\tau \times 4 = 4J - J$

$\tau = \left(\frac{3}{4}\right)J$

22. (3)

In uniform circular motion, the force is always directed perpendicular to the displacement.

23. (3)

Stress: it is internal force per unit area of body if same force is applied to rubber and steel, then strain in rubber is more. It means that rubber is less elastic than steel.

24. (3)

Two physical quantities may have same dimensions but different units

For example

	Unit	Dimension
Work →	J	$[M^1L^2T^{-2}]$
Torque →	N.m	$[M^1L^2T^{-2}]$

Dimensionally correct equation may be physically correct,

Hence, option (3) is correct.

25. (2)

Molar specific heat capacity of the gas can have any from $-\infty$ to ∞

$C = \frac{1}{n}\left[\frac{\Delta Q}{\Delta T}\right]$

For isothermal process

$\Delta T = 0$

$C = \infty$

26. (2)

Relative permeability

$= \frac{\mu}{\mu_0}$ or $\frac{\text{Permeability of any medium}}{\text{Permeability of free space}}$

Dimension $\rightarrow$ $[M^0L^0T^0]$

Reynold number is numeric value determine the type of flow of fluid.

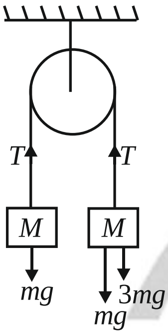
Numeric value have no dimension

Refractive index = $\frac{\text{Speed of light in a medium}}{\text{Speed of light in free space}}$

Dimensionless quantity

Option (2) is correct.

27. (3)



mg + 3mg – T = ma … (1)

4 mg – T = ma

Also, T – mg = ma … (2)

$\Rightarrow$ T = 4mg – ma

mg + ma = 4 mg – ma

– 3 mg = – 2ma

$a = \frac{3}{2}g$

28. (3)

At constant pressure and volume.

$PV = \mu_1 RT_1 = \mu_2 RT_2$

$\frac{m}{M} R \times 300 = \frac{2m}{3M} \times RT_2$

$T_2 = \frac{3}{2} \times 300 = 450\,K$

29. (3)

u = 4 m/s at x = 0

we know heat $k_i = \frac{1}{2}mv^2 = \frac{1}{2} \times 2 \times 16 = 16\text{J}$

W_{net} = area from x = 0 to x = 3.

$= \frac{1}{2} \times 4 \times 1 - \frac{1}{2} \times 4 \times 1 - 4 \times 1 = -4\text{J}$

Let K.E of body (at x = 3) = k_3

Work done W = change in K.E

– 4 = k_3 – 16 J

$\Rightarrow$ k_3 = 12 J

30. (2)

Metal has high thermal conductivity i.e.; they are good conductors of heat.

31. (2)

Under the effect of surface tension. After melting water drop will be of spherical in shape.

32. (2)

We know that,

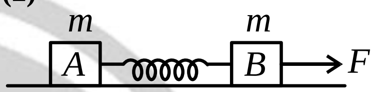
$dQ = dU + dW$

$\because \quad \Delta Q = mL \qquad (m = ig)$

$2240 = \Delta U + 168$

$\Delta U = 2240 - 168 = 2072\,J$

33. (2)



$a_{c.m.} = \frac{F_{net}}{\text{total mass}} = \frac{F}{2m}$

Option (2) is correct.

34. (1)

Acceleration due to gravity at surface, $g = \frac{Gm}{R^2}$

Taking log both sides, $\frac{\Delta g}{g} = -\frac{2\Delta R}{R}$

Now as, $\frac{\Delta R}{R} = -1\%$ $\Rightarrow$ $\frac{\Delta g}{g} = 2\%$

35. (1)

We know that $Y = \frac{FL}{\Delta l A}$ $\Rightarrow$ $\Delta l = \frac{FL}{YA}$

For same load elongation in B is greater than A

$\Delta l_B > \Delta l_A$.

$Y_A > Y_B$

36. (2)

We know that $I_{disc} = \frac{5}{4}MR^2 = MK^2_{disc}$

$I_{ring} = \frac{3}{2}MR^2 = MK^2_{ring}$

$= \frac{K_{disc}}{K_{ring}} = \sqrt{\frac{5}{6}} = \sqrt{5} : \sqrt{6}$.

37. **(1)**

Given, $V' = 2V$

$$\frac{4}{3}\pi R^3 = 2\times\frac{4}{3}\pi r^2 \quad \Rightarrow \quad R = 2^{1/3} r$$

As $v \propto r^2$

$$\therefore \quad \frac{v'}{v} = \frac{R^2}{r^2} = \frac{(2^{1/3})^2 r^2}{r^2} = (2)^{2/3}$$

$$v' = v(2)^{2/3} = 5(4)^{1/3}.$$

38. **(2)**

For spring-block system, $n = \frac{1}{2\pi}\sqrt{\frac{K}{M}}$

$$K = \frac{K_1K_2}{K_1+K_2} = \frac{K.K}{K+K} = \frac{K}{2} \qquad \text{(in series)}$$

So, $n = \frac{1}{2\pi}\sqrt{\frac{K}{2M}}$

39. **(3)**

In uniform circular motion, v = constant.

$a_t = 0$ and $a_r \neq 0$.

40. **(1)**

Apply W-E theorem,

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

Here $h = L \sin\theta$ and $\omega = \frac{V}{R}$

$$a = \frac{mg\sin\theta}{m + \frac{I}{K^2}} = \frac{mg\sin\theta}{m + \frac{m_R^2}{2_R^2}} \Rightarrow a = \frac{2}{3}g\sin\theta$$

$$v^2 - u^2 = 2as$$

$$v^2 = 2as = 2\times\frac{2}{3}g\sin\theta\times l = \frac{4}{3}gl\sin\theta$$

$$\therefore \quad v = \sqrt{\frac{4}{3}gl\sin\theta}$$

41. **(4)**

Fundamental frequency

$$f = \frac{v}{4l} = \frac{340}{4\times 0.85} = 100\ Hz$$

Natural frequencies will be

$$f = 100Hz,\ 300Hz,\ 500Hz,\ 700Hz,$$
$$900Hz,\ 1100\ Hz$$

$$\therefore \qquad n = 6$$

42. **(1)**

For Adiabatic process

$$TV^{\gamma-1} = \text{constant}$$
$$\log T + (\gamma-1)\log V = \text{constant}$$
$$\log T = -(\gamma-1)\log V + c$$
$$y = mx + c$$
$$\therefore \ \text{slope} = (\gamma-1) = \frac{4-2}{4-1} = \frac{2}{3}$$
$$\gamma - 1 = \frac{2}{3}$$
$$\gamma = 1 + \frac{2}{3} = \frac{5}{3}$$

So, gas is monatomic.

43. **(3)**

Let frequency = v

Given that it produces 4 beats with 288 Hz

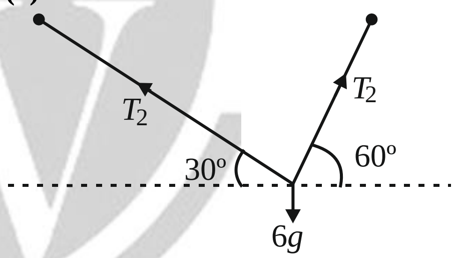
$\Rightarrow \qquad |v - 288\,\text{Hz}| = 4$

$\Rightarrow \qquad v = 292 \text{ or } 284\,\text{Hz}$

Since beat frequency drops due to waxing.

$\therefore \qquad v = 292\,\text{Hz}$

44. **(3)**



By Lami's Theorem

$$\frac{T_1}{\sin 120} = \frac{T_2}{\sin 150} = \frac{6g}{\sin 90}$$

$$T_1 = 6g\times\sin 120 = 60\times\frac{\sqrt{3}}{2} = 30\sqrt{3}N$$

$$T_2 = 6g\sin 150 = 60\times\frac{1}{2} = 30N$$

45. **(2)**

(A) – Definition of longitudinal waves

(B) – Definition of transverse waves

(C) – Definition of beats

(D) – Definition of stationary waves

Option (2) is correct.

46. **(3)**

$P = P_0 + h\rho g$

$= 1.01 \times 10^5 + 0.20 \times 1000 \times 10$

$= 1.01 \times 10^5 + 0.02 \times 10^5 = 1.03 \times 10^5\, Pa$

Area of bottom

$= \pi r^2 = 3.14 \times (0.1)^2 = 0.0314 m^2.$

Force on bottom $= 1.03 \times 10^5 \times 0.0314 = 3230 N$

47. **(1)**

At the centre of earth, $g = 0$

Therefore, a body has no weight at the centre of earth, and hence no centre of gravity.

But centre of mass of a body has nothing to do with gravity.

Therefore, centre of mass exists

Option (1) is correct

48. **(2)**

$$V = -G(1)\left[\frac{1}{1} + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + ...\right]$$

$$V = -G(1)\frac{1}{1 - \frac{1}{2}}$$

$$V = -2G$$

49. **(3)**

$U_{\min} = 20J$ at $x = 2m$

$U_{\min} + KE_{\max} = TE$

$KE_{\max} = 36 - 20 = 16J$

50. **(3)**

Frictional forces are non-conservation forces as work done by frictional force depends on path followed and independent of initial and final position.

Potential energies can be associated with conservative forces.

Option (3) is correct.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Library- https://smart.link/sdfez8ejd80if