Sample Paper-01

Dropper NEET (2024)

PHYSICS

ANSWER KEY

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

HINTS AND SOLUTION

1. **(1)**

$I = I_0 + I_1 \sin \omega t$

$$I^2_{rms} = \frac{\int_0^{\tau} I^2 dt}{\int_0^{\tau} dt} \quad T = \frac{2\pi}{\omega}$$

$$= \frac{\int_0^{T} (I_0^2 + I_1^2 \sin^2 \omega t + 2I_0 I_1 \sin \omega t) dt}{\int_O^{T} dt}$$

$$I^2_{rms} = \frac{I_0^2 T + \frac{I_1^2 T}{2} + O}{T} \Rightarrow I_{rms} = \sqrt{I_0^2 + \frac{I_1^2}{2}}$$

2. **(2)**

Input power = output power = 10^4 W

$\therefore \quad \therefore e_s i_s = 10^4 \Rightarrow e_s = \frac{10^4}{25}$

$\therefore \frac{e_s}{e_p} = \frac{n_s}{n_p} = \frac{1}{8} \Rightarrow e_s \times 8 = e_p = \frac{10^4 \times 8}{25} V$

3. **(2)**

Acceleration due to gravity at a depth d under the earth's surface

$$g' = g_s \left(1 - \frac{d}{R}\right)$$

According to the question $g' = \frac{g_s}{n}$

$$\frac{g_s}{n} = g_s \left(1 - \frac{d}{R}\right)$$

We can also write it as,

$$\frac{1}{n} = \left(1 - \frac{d}{R}\right)$$

$$d = R\left(\frac{n-1}{n}\right)$$

4. **(4)**

Work done by a gas in a process is: from the PV diagram is the area enclosed by the loop.

As we can see both loops ABC and DEF have the same area enclosed.

Hence $W_{ABC} = -W_{DEF}$

However, the magnitude are opposite.

5. **(3)**

If a is downward acceleration of 4 kg block, the upward acceleration of 1 kg block must be 2a.

The equation of motion on 4 kg block is

$4g - 2T = 4a$ …..(i)

The equation of motion on 1 kg block is

$T - 1g = 1 \times 2a$ ….(ii)

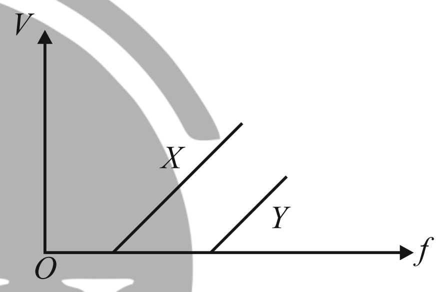
or $2T - 2g = 4a$ …(iii)

On adding (i) and (iii), we get

$2g = 8a$ or $a = \frac{g}{4}$

$\therefore$ Acceleration of 1 kg block $= 2a = \frac{g}{2}$ upwards

6. **(1)**



Greater work function means more negative potential is required to stop the ejection of electrons. Moreover, the slope of both the graphs will be the same.

7. **(1)**

Additional kinetic energy it gains is.

K′ = eV = 50 eV

Total kinetic energy is equal to $150 \times 1.6 \times 10^{-19}$J

The de Broglie wavelength is.

$$\lambda = \frac{h}{\sqrt{2mK}} = \frac{6.63 \times 10^{-34}}{\sqrt{2 \times 9.1 \times 10^{-31} \times 150 \times 1.6 \times 10^{-19}}} = 1 \times 10^{-10} \text{ m}$$

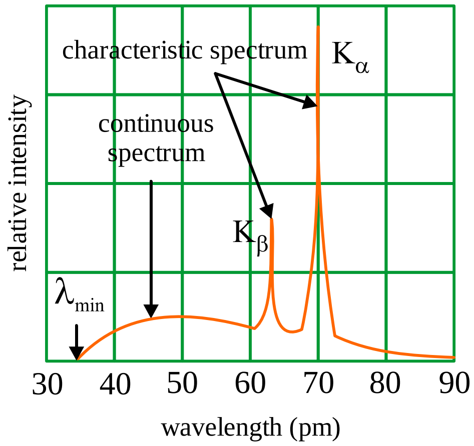
$\lambda = 1\text{Å}$

8. **(3)**

For a body to purely roll down the inclined plane, static friction will act at the contact point and the point will not slip on the surface. Hence work done by friction force is zero.

9. **(3)**

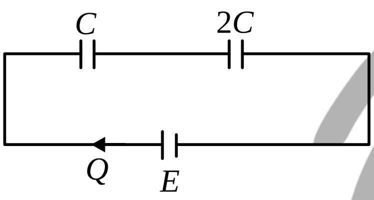
Q and P represents $K\alpha$ and $K\beta$ lines respectively.



1 pm (picometre) = 10^{-12} m = 0.01 Å

10. **(2)**

Reduced form of circuit will be as follow:



$$\therefore \quad C_{eq} = \frac{2C \times C}{2C + C} = \frac{2C}{3}$$

The charge flows through cell will be,

$Q = C_{eq} \times E$

$$\Rightarrow \quad Q = \left(\frac{2C}{3}\right)E = \frac{2EC}{3}$$

$$\Rightarrow \quad Q = \frac{2A\epsilon_0 E}{3d}$$

11. **(2)**

We will write voltage drop equation as we go from A to B.

$$V_A - iR + V + L\frac{di}{dt} = V_B$$

$V_A - 5 \times 1 + 15 - 5 \times 10^{-3} \times (-10^3) = V_B$

$V_B - V_A = 15$

12. **(1)**

As acceleration of the box is due to static friction,

$\therefore \quad ma = f_s \leq \mu_s N = \mu_s mg$

$a \leq \mu_s g$

$\therefore \quad a_{max} = \mu_s g = 0.2 \times 10 ms^{-2} = 2 ms^{-2}$

13. **(2)**

M is outwards or along $\hat{k}$ direction.

$M = IA$

$$A = a^2 + \left(\frac{\pi a^2}{4}\right)2$$

$$\therefore \quad M = \left(\frac{\pi}{2} + 1\right)a^2 I\hat{k}$$

14. **(3)**

The graph of the isothermal process shifts away from the origin as the temperature of the process is increased.

Therefore, the curve farthest from the origin should have the highest temperature whereas the curve closer to the origin have the lowest temperature. So, the correct answer is $T_1 > T_2 > T_3$.

15. **(2)**

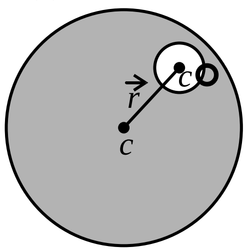
At the centre of the square net force on the charge is zero. However, in this position the charge is in unstable equilibrium and hence its potential energy is maximum and finite. The four charges are assumed to be placed symmetrically about the origin in YZ plane.

16. **(2)**

We know electric field inside a cavity $\vec{E} = \frac{\rho}{3\varepsilon_0}\vec{r}$

When $\vec{r}$ is vector joining centre of sphere to centre of cavity, this electric field is uniform inside the cavity.

Hence option (2) is correct.



17. **(2)**

$$\frac{v^2}{R} = a_t$$

$$\frac{v^2}{20} = 5$$

$$\Rightarrow \quad v = \sqrt{100} = 10 \text{ cm/s}$$

Using $v = u + a_t \cdot t$

$u = 0$

$10 = 0 + 5t$ or $t = 2$s.

18. **(2)**

The $B{-}H$ curve is used to study the magnetic properties of a material. Elements show different behaviour under magnetisation.

The ratio of magnetic induction to magnetic intensity is called magnetic permeability and is denoted by μ. The magnetic permeability can be used to measure a material's resistance to the magnetic field. The formula for permeability is given by

$$\mu = \frac{B}{H}$$

We know that iron is a ferromagnetic material. Materials like iron do not have a constant permeability. The permeability increases with increase in magnetic field, after reaching a maximum value it will start decreasing.

19. **(3)**

When the mass is placed at the position of the vertical circle, the total force on the mass is:

$F = mg + ml\omega^2$

$= 14.5 \times 9.8 + 14.5 \times 1 \times (12.56)^2$

$= 2429.53\ N$

Young's modulus = Stress/Strain

$$Y = \frac{F/A}{\Delta l} l = \frac{F}{A}\frac{l}{\Delta l} l$$

$$\therefore \quad \Delta l = \frac{Fl}{AY}$$

Young's modulus for steel = 2×10^{11} Pa

$$\Delta l = \frac{2429.53 \times 1}{0.065 \times 10^{-4} \times 2 \times 10^{11}}$$

$\Rightarrow \quad \Delta l = 1.87 \times 10^{-3}$m

Hence, the elongation of the wire is 1.87×10^{-3}m.

20. **(2)**

The total length of the rod is L. Since, the rod is bent at the middle, so each part of it will have same length $\frac{L}{2}$ and mass $\frac{M}{2}$.

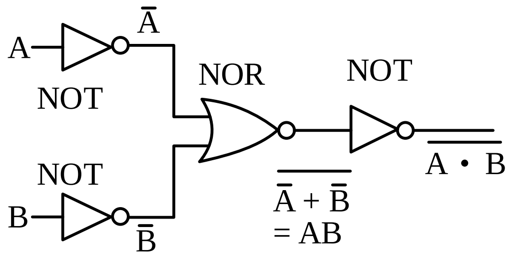
Moment of inertia of each part about an axis passing through its one end $= \frac{1}{3}\left(\frac{M}{2}\right)\left(\frac{L}{2}\right)^2$

Hence, net moment of inertia about an axis passing through its middle point O is

$$I = \frac{1}{3}\left[\frac{M}{2}\right]\left[\frac{L}{2}\right]^2 + \frac{1}{3}\left[\frac{M}{2}\right]\left[\frac{L}{2}\right]^2$$

$$= \frac{1}{3}\left[\frac{ML^2}{8} + \frac{ML^2}{8}\right] = \frac{ML^2}{12}$$

21. **(4)**



Hence option (4) is correct.

22. **(4)**

Applying conservation of moles,

$n_1 + n_2 = n$

$$\Rightarrow \quad \frac{P_1V_1}{RT} + \frac{P_2V_2}{RT} = \frac{PV}{RT}$$

$\Rightarrow \quad P_1V_1 + P_2V_2 = PV$

$$\Rightarrow \quad \left(\frac{4T}{r_1}\right)\left(\frac{4}{3}\pi r_1^3\right) + \left(\frac{4T}{r_2}\right)\left(\frac{4}{3}\pi r_2^3\right) = \left(\frac{4T}{r}\right)\left(\frac{4}{3}\pi r^3\right)$$

$$\Rightarrow \quad r_1^2 + r_2^2 = r^2$$

$$\Rightarrow \quad r^2 = \sqrt{3^2 + 4^2} = 5\text{cm}$$

Hence the radius of the new bubble is 5 cm.

23. **(1)**

$A^2 + A^2 + 2A^2 \cos\theta = n^2 (A^2 + A^2 - 2A^2 \cos\theta)$

$2 + 2\cos\theta = n^2 (2 - 2\cos\theta)$

$-2 + 2n^2 = 2n^2 \cos\theta + 2\cos\theta$

$$\cos\theta = \frac{n^2 - 1}{n^2 + 1}$$

$$\theta = \cos^{-1}\left(\frac{n^2 - 1}{n^2 + 1}\right)$$

24. **(2)**

$$v_x = \frac{dx}{dt} = 5$$

$$v_y = \frac{dy}{dt}$$

$= (4t + 1)$

At 45°, $v_x = v_y$

$\Rightarrow \quad t = 1s$

25. **(1)**

$v_0 = v_c$

$$\Rightarrow \quad \frac{v}{2L_0} = \frac{v}{4L_c} \Rightarrow \quad \frac{L_c}{L_0} = \frac{1}{2}$$

The ratio of the length of an close and open organ pipe is 1 : 2

26. (3)

Activity = number of disintegrations per unit time

Activity = $\left|\frac{dN}{dt}\right| = \lambda N$

where N = the total number of nuclei

Also, N = number of moles × $N_A = \left(\frac{m}{M}\right)N_A$

$\therefore$ Initial activity = $\frac{\lambda m N_A}{M}$

27. (2)

V is the orbital velocity. If Ve is the escape velocity, then $V_e = \sqrt{2}V$. The kinetic energy at the time of ejection

$$KE = \frac{1}{2}mV_e^2 = \frac{1}{2}m(\sqrt{2}V)^2 = \frac{1}{2}m \times 2V^2 = mV^2$$

28. (4)

$$i = \sqrt{2}\sin\left[\left(\omega t + \frac{\pi}{4} + \frac{\pi}{2}\right)\right]$$

Hence, phase difference between V and is $I = \frac{\pi}{2}$.

So, power consumed = 0.

29. (2)

For solid sphere, $\frac{k^2}{R^2} = \frac{2}{5}$

$$\therefore \quad v = \sqrt{\frac{2gh}{1+\frac{2}{5}}} = \sqrt{\frac{10}{7}gh}$$

As h is same in both the cases, therefore speed will same in both cases.

Time of descend,

$$t = \frac{1}{\sin\theta}\sqrt{\frac{2h}{g}\left(1+\frac{k^2}{R^2}\right)}$$

Where θ is angle of inclination.

For solid sphere, $\frac{k^2}{R^2} = \frac{2}{5}$

$$\therefore \quad t = \frac{1}{\sin\theta}\sqrt{\frac{14h}{5g}}$$

As h is same but θ is different in both the cases, hence time of descend will be different in both the cases.

30. (4)

A stationary wave is called such because, there is no wave velocity.

This means that all parts of the wave have the same wave. They all attain maximum position at the sometime. They go to mean position at the sometime, and they go to rest and maximum velocity at the sometime as well. Hence all is correct.

31. (4)

$Q_1 = Q_2$

$\therefore \quad ms_1 (32 - 20) = ms_2 (40 - 32)$

$\frac{s_1}{s_2} = \frac{8}{12} = \frac{2}{3}$.

32. (2)

$$\eta = \frac{P_{out}}{P_{in}} = \frac{V_s I_s}{V_p I_p}$$

$\Rightarrow \quad 0.9 = \frac{I_s \times 230}{5 \times 2300}$

$\Rightarrow \quad I_s = 45\,A$

33. (3)

According to Brewster's law,

$\tan i_p = \mu = \sqrt{3}$

$i_p = 60°$

34. (3)

Internal forces will be cancelled pairwise. They will not change the external force acting on an object. Momentum will be conserved.

We know that $F_{\text{external}} = \frac{dP}{dt}$ here,

F_{external} = external force applied to a system and we also know that at rate of change of linear momentum equals to the external force.

So internal force doesn't even change the velocity of the centre of mass which is given by the net external force acting on the system.

So only external forces can change the linear momentum not the internal force.

Moreover, internal forces can never ever change the total mechanical energy (kinetic energy potential energy) of an object. But they can only just convert a part of kinetic energy to potential energy. So, they can change the kinetic energy but total energy remains conserved.

35. (4)

Intensity of light $I \propto \frac{1}{d^2}$, where d = distance from surface.

$$\Rightarrow \frac{I_2}{I_1} = \frac{d_1^2}{d_2^2} = \frac{4^2}{1} = 16 \Rightarrow I_2 = 16I_1$$

As current is proportional to intensity of light, new value of current = 16 × 5 mA = 80 mA.

36. (2)

We know,

$$\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\frac{A}{2}}$$

$$\Rightarrow \sqrt{2} = \frac{\sin i}{\sin\frac{60}{2}}$$

$$\Rightarrow \sin i = \sqrt{2} \times \sin(30)$$

$$\Rightarrow \sin i = \sqrt{2} \times \frac{1}{2}$$

Multiply and divide by $\sqrt{2}$, we get

$$\sin i = \frac{1}{\sqrt{2}}$$

$$\Rightarrow i = 45°$$

37. (1)

From theorem of parallel axis

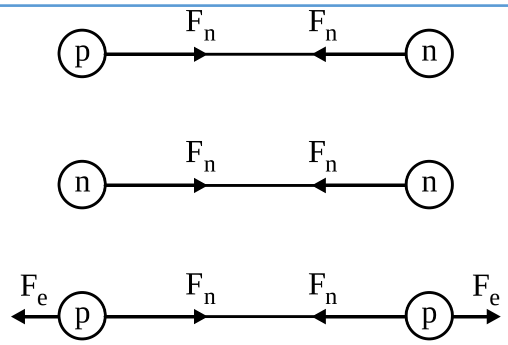
$I = I_{CM} + Mr^2$

Hence, moment of inertia is minimum about axis passing through *CM* among another parallel axis.

38. (4)

The strong nuclear forces between any two nucleons are same for any nucleon pair -proton - proton pair, proton- neutron pair or neutron-neutron pair.

But there will be an additional electrostatic repulsion between proton - proton pair because both are charged positively, and similar charges repel each other.



So, $F_1 = (F_n - F_e)$

$F_2 = F_3 = F_n$

Thus, $F_2 = F_3 > F_1$ option (4)

39. (1)

(A) Stress × Strain = $Nm^{-2}.\ \frac{m^3}{m^3} = Jm^{-3}$

(B) $\frac{YA}{l} = \frac{Nm^{-2}m^2}{m} = Nm^{-1}$

(C) $Yl^3 = Nm^{-2}\ m^3 = Nm = J$

(D) $\frac{Fl}{AY} = \frac{Nm}{m^2 Nm^{-2}} = m$

Hence,

A $\rightarrow$ r, B $\rightarrow$ q, C $\rightarrow$ p, D $\rightarrow$ s.

40. (1)

As, $r = \frac{mv}{Bq} = \frac{p}{Bq} = \frac{\sqrt{2Km}}{Bq}$

$$\Rightarrow \omega = \frac{Bq}{m}$$

Hence,

A $\rightarrow$ p, B $\rightarrow$ q, C $\rightarrow$ p, D $\rightarrow$ q.

41. (2)

The velocity (v) is given by

$$v = f\lambda$$

$$\Rightarrow f = \frac{v}{\lambda}$$

Number of beats = difference in frequencies

$$\therefore f_1 - f_2 = v\left(\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right)$$

$$\frac{10}{3} = v\left(\frac{1}{1} - \frac{1}{1.01}\right)$$

$$\frac{10}{3} = v\left(\frac{0.01}{1.01}\right)$$

$$\Rightarrow v = \frac{10 \times 1.01}{3 \times 0.01} = 336.7 m/s$$

42. **(1)**

At 4 sec

$(2\pi r_2) = 2\lambda_2$

$(2\pi r_3) = 3\lambda_3$

$\therefore \quad \frac{\lambda_2}{\lambda_3} = \frac{3r_2}{2r_3}$ ....(i)

Now, $r \propto n^2$

$\therefore \quad \frac{r_2}{r_3} = \left(\frac{2}{3}\right)^2$

Substituting in Eq. (i), we get

$\frac{\lambda_2}{\lambda_3} = \frac{2}{3}$

43. **(2)**

$u = at = 8$m/s

$s_1 = \frac{1}{2}at^2 = \frac{1}{2} \times 2 \times 4^2 = 16$ m

From 4*s* to 8*s*

$a = 0$, v = constant = 8m/s

$\therefore \quad s_2 = vt = (8)(4) = 32$m

From 8*s* to 12*s*

$s_3 = s_1 = 16$ m

$\therefore \quad s_{Total} = s_1 + s_2 + s_3 = 64$m

44. **(3)**

Velocity of bullet + ice block,

$V = \frac{(10g) \times (20m/s)}{1000} g = 0.2m/s$

Loss of $KE = \frac{1}{2}mv^2 - \frac{1}{2}(m+M)V^2$

$= \frac{1}{2}\left[0.01 \times (20)^2 - 1 \times (0.2)^2\right]$

$= \frac{1}{2}[4 - 0.04] = 1.98\,J$

$\therefore$ Heat received by ice block.

$= \frac{1.98}{4.2 \times 2} cal$

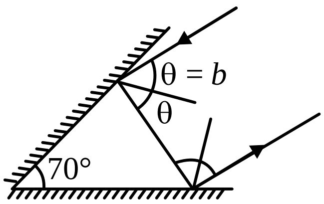
= 0.24 cal

$\therefore$ Mass of ice melted.

$= \frac{0.24cal}{80cal/g}$

= 0.003g

45. **(1)**



Angle of incidence = b = angle of reflection

Angle of incidence on the 2nd mirror

$90 - [180 - 70 - (90 - b)] = 70 - b$

Angle between the reflected ray & the mirror (2nd)

$= b + 20$

As it parallel to the 1st mirror

$b + 20 = 70$

$b = 70 - 20$

$b = 50$

46. **(2)**

When a battery is connected across the junction diode with its positive terminal connected to the p-side and the negative terminal connected to the n-side, the diode is said to be forward biased.

47. **(1)**

$\vec{S} = t\vec{u} + \frac{1}{2}t^2\vec{a}$

$\Rightarrow \quad 20\hat{i} + y_0\hat{j} = t_0(5\hat{j}) + \frac{1}{2}t_0^2(10\hat{i} + 4\hat{j})$

Equating components wise,

$20 = 5t_0^2$

$\Rightarrow \quad t_0 = 2$ sec

and

$y_0 = 5t_0 + 2t_0^2$

$\Rightarrow \quad y_0 = 18$ m

48. **(2)**

In photoelectric effect, an electron absorbs a quantum of energy (hv) of radiation. If this absorbed energy exceeds the minimum energy (work function ϕ_0 of the metal), the most loosely bound electron will emerge with maximum kinetic energy, more tightly bound electron will emerge with kinetic energies less than the maximum value.

Einstein's photoelectric equation:

$K_{max} = hv - \phi_0$

49. (3)

$t_1 = t_2 = \sqrt{\frac{2h}{g}}$ (where, h = height of tower)

$v_1 = \sqrt{2gh}$

While $v_2 = \sqrt{v_1^2 + v_0^2}$ (where, v_0 = initial velocity)

Therefore, both statements are correct.

50. (2)

$v \propto r^2$ and $m \propto r^3$

$\Rightarrow v \propto m^{2/3}$

$$\therefore \quad \frac{v_2}{v_1} = \left(\frac{m_2}{m_1}\right)^{2/3} = \left(\frac{8m}{m}\right)^{2/3} = 4$$

$\Rightarrow \quad v_2 = 4v$