Sample Paper-03

DROPPER NEET (2024)

PHYSICS

ANSWER KEY

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

HINTS AND SOLUTION

1. (3)

$I_{max} = (\sqrt{I} + \sqrt{4I})^2$

$= 9I$

$I_{min} = (\sqrt{4I} - \sqrt{I})^2 = I$

$\frac{I_{max} - I_{min}}{I_{max}} = \frac{9I - I}{9I} = \frac{8}{9}$

2. (3)

$y(x,t) = 2.0\cos(20\pi t - 2\pi \times 0.008x + 2\pi \times 0.35)$

$\Delta\phi = 2\pi \frac{8\times10^{-3}}{10^{-2}} \times 4$

$\Delta\varphi = 6.4\pi$

3. (4)

$C = \frac{A\epsilon_0}{d}$

Capacitance of the parallel plate capacitor depends on area of the plate, medium between the plates and distance between the plates.

4. (3)

Independent of the distance between the plates. For isolated capacitor, Q = constant.

$E = \frac{\sigma}{2\varepsilon_0} = \frac{Q}{2A\varepsilon_0}$

$F = QE = \frac{Q^2}{2\varepsilon_0 A}$

5. (1)

The power loss in the circuit is 0.79 W.

$V_0 = 10V$, $\omega = 314$ rad/s

$P = V_{rms}\, i_{rms} \cos\phi$

$= V_{rms}\left(\frac{V_{rms}}{Z}\right)\left(\frac{R}{Z}\right) = \frac{(V_{rms})^2 R}{Z^2}$

$X_L = \omega L = (314)(20 \times 10^{-3}) = 6.280$

$X_C = \frac{1}{\omega C} = \frac{1}{314\times100\times10^{-6}} = 31.84\Omega$

$R = 50\Omega$

$Z = \sqrt{(X_C - X_L)^2 + R^2}$

$= \sqrt{(31.84-6.28)^2 + (50)^2} = 56\Omega$

$\Rightarrow P = \frac{(10)^2 \times 50}{(56)^2} = 0.79W$

6. (3)

Net electric field due to a short electric dipole is given by

$E = \frac{kp}{r^3}\sqrt{3\cos^2\theta + 1}$

$E = \frac{9\times10^9 \times \sqrt{13}\times10^{-6}}{10^3}\sqrt{3\cos^2(180° - 30°) + 1}$

$E = 9\times\sqrt{13}\times\sqrt{3\times\left(\frac{-\sqrt{3}}{2}\right)^2 + 1}$

$\left\{\begin{matrix} \cos(180° - 30°) = -\cos 30° \\ = -\cos 30° = \frac{-\sqrt{3}}{2} \end{matrix}\right\}$

$= 9\times\sqrt{13}\sqrt{\frac{9}{4} + 1}$

$= 9\sqrt{13}\times\sqrt{\frac{13}{4}} = 58.5\,\text{N/C}$

7. (3)

$F = mg$

$= 5\left[4\hat{i} + 5\hat{j}\right] = 20\hat{i} + 25\hat{j}$

$|F| = \sqrt{400 + 625} = \sqrt{1025} \approx 32\,\text{N}$

8. (2)

Direction of propagation of wave is given by $\vec{v} = \vec{E}\times\vec{B}$. Since direction of propagation of wave is in +x direction and oscillation of electric field is in +y direction, magnetic field should oscillate in +z direction.

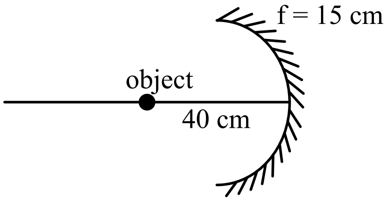
9. (4)

Focal length of a lens

$\frac{1}{f} = (\mu - 1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$

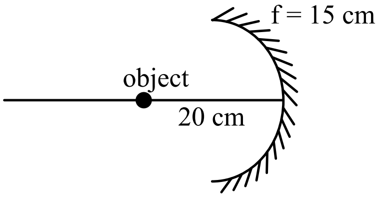
On increasing value of λ value of μ decreases.

10. (2)



$$v_1 = \frac{uf}{u-f} = \frac{(-40)(-15)}{-40+15}$$

$$= \frac{600}{-25} = -24\,\text{cm}$$



$$v_2 = \frac{uf}{u-f} = \frac{(-20)(-15)}{-20+15}$$

$$= \frac{300}{-5} = -60\,\text{cm}$$

Displacement of image = $v_2 - v_1 = -36$ cm

i.e., 36 cm away from the mirror.

11. (3)

Energy strored in a inductor is given as

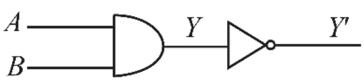
$$U = \frac{1}{2}LI^2$$

$$L = \frac{2U}{I^2}$$

$$L = \frac{2\times 25\times 10^{-3}}{(60\times 10^{-3})^2}$$

$L = 13.89\ H$

12. (3)



$Y = A\,.\,B$

$Y' = \overline{Y} = \overline{A.B}$

13. (3)

Total energy = $-E_k$ (For satellites in orbits)

Also, total energy ≥ 0 (For escape)

$\Rightarrow -E_k + E \geq 0$

$\Rightarrow E \geq E_k$

14. (2)

$$K_t = \frac{1}{2}mv^2 \qquad \ldots (1)$$

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

$$I = \frac{2}{5}mR^2 \ \&\ \omega = \frac{v}{R}$$

$$K_t + K_r = \frac{1}{2}mv^2 + \frac{1}{2}.\frac{2}{5}mR^2.\frac{v^2}{R^2}$$

$$= \frac{1}{2}mv^2 + \frac{1}{5}mv^2$$

$$K_t + K_r = \frac{7}{10}mv^2 \qquad \ldots (2)$$

$$\therefore \quad K_t : (K_t + K_r) = \frac{1}{2}mv^2 : \frac{7}{10}mv^2$$

$K_t : (K_t + K_r) = 5 : 7$

15. (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

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

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

16. (1)

$$Y = \frac{F\ell}{A\Delta\ell}$$

$$F = \frac{YA\Delta\ell}{\ell} \qquad \ldots (1)$$

$\because$ Wires have some volume

$\therefore \quad A\ell = 3A\ell_1$

$\ell = 3\ell_1$

$$F_1 = \frac{Y3A\Delta\ell}{\ell_1} \qquad \ldots (2)$$

$$\frac{F_1}{F} = \frac{Y3A\Delta\ell}{\ell_1} \times \frac{\ell}{YA\Delta\ell}$$

$$\frac{F_1}{F} = 3\times 3$$

$F_1 = 9F$

17. (1)

$$\frac{\text{work done}}{\text{heat absorved}} = \frac{nC_p\Delta T - nC_v\Delta T}{nC_p\Delta T}$$

$$= 1 - \frac{1}{r} = \frac{2}{5}$$

18. **(1)**

For Adiabatic process

$TV^{\gamma-1}$ = constant

$\log T + (\gamma - 1)\log V$ = 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.

19. **(3)**

Frictional force = μmg

= 0.4 × 5 × 10 = 20 N

pseudo force = $ma = 5 \times a$

pseudo force = frictional force

$ma = 5 \times a = 20$

$\Rightarrow a = \frac{20}{5} = 4\,\text{ms}^{-2}$

20. **(1)**

W = loss in KE = $\frac{1}{2}I\omega^2$

$I_A = \frac{2}{5}MR^2 = 0.4MR^2$

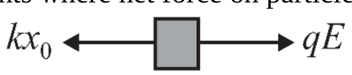
$I_B = \frac{1}{2}MR^2 = 0.5MR^2$

$I_C = MR^2$

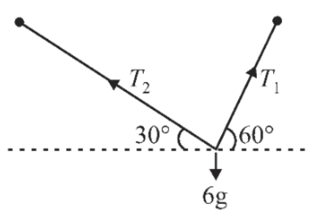
$\therefore W_C > W_B > W_A$

21. **(4)**

$T = 2\pi\sqrt{\frac{m}{k}}$ Time period remains unchanged as it depends on the mass of the block and force constant. But, the near position changes as this is the points where net force on particle is zero.



22. **(3)**



By Lami's Theorem

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

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

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

23. **(3)**

For a rolling body

Total $K.E. = \left(1 + \frac{K^2}{R^2}\right)\frac{1}{2}mv^2$

Rotational $K.E. = \frac{K^2}{R^2}\frac{1}{2}mv^2$

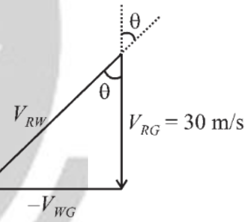
$\frac{\text{Rotational}\,K.E}{\text{Total}\,K.E.} = \frac{\frac{K^2}{R^2}}{1 + \frac{K^2}{R^2}} = \frac{\frac{2}{3}}{1 + \frac{2}{3}} = 0.4\left[\because \text{for shell}\,\frac{k^2}{R^2} = \frac{2}{3}\right]$

= 0.4 × 100

= 40%

24. **(2)**

$V_{RW} = V_{RG} - V_{WG}$



Using triangle law of vectors

$\tan\theta = \frac{|V_{WG}|}{|V_{RG}|} = \frac{10\sqrt{3}}{30} = \frac{1}{\sqrt{3}}$

θ = 30°

25. **(4)**

It is the property of material.

26. **(3)**

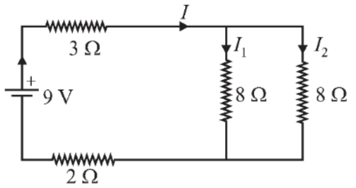
$P_1 V_1 = P_2 V_2$

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

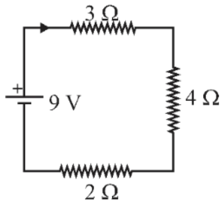
Where, h = depth of lake

$h\rho g = 7P0 \Rightarrow \text{h} = 7 \times \frac{H\rho g}{\rho g} = 7H$

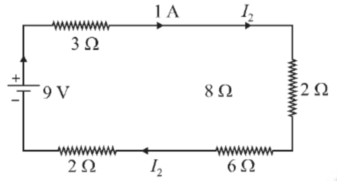
27. **(3)**



Current from battery



$$I = \frac{9}{3+4+2} = 1A$$



$$I_2 = \left(\frac{8}{8+8}\right) \times 1A = 0.5\,A$$

28. **(2)**
The bottom piece will have larger mass. As mass of bat is not uniformly distributed and if we cut from centre of mass then in the upper part, mass is distributed at far distance from centre of mass. Therefore, more mass would lie in bottom part of the bat.

29. **(3)**
When the *p*-*n* junction is forward biased, the applied voltage opposes the barrier voltage. So, the potential barrier across the junction is lowered.

30. **(2)**

$$Y_P = \frac{Y_1A_1 + Y_2A_2}{A_1 + A_2}$$

if $A_1 = A_2 = A$ (say)

$$Y_P = \frac{Y_1 + Y_2}{2}$$

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

32. **(2)**
$V = P\pi r^4/8\eta \Rightarrow V_2/V_1 = (r_2/r_1)^4$
$V_2 = V_1(1\,.\,1)^4 = 1.4641V$
$\Delta V = V_2 - V_1/V = 0.46$ or 46%

33. **(2)**
$\tau = I\alpha$
If $\alpha = 0 \Rightarrow \tau = 0$
Force is parallel or antiparallel to position vector.
$r = 5\hat{i} + 4\hat{j}$
So, force will be $F = n(5\hat{i} + 4\hat{j})$. Where n is any real number.

34. **(1)**
Nuclear forces are charge independent as it is interaction between $n - n$ as well as between $p - p$ and also between $n - p$.

35. **(2)**
Since the charged particle is at rest, initially, the magnetic field will not make it move, but initially the charged particle will experience an electrostatic force in the direction of electric field as a result of which it gains a velocity parallel to E or parallel to B and hence even after the motion of the particle it will not experience a magnetic force i.e., its trajectory is a straight line.

36. **(3)**
Nuclear radius is given by
$R = R_0\,(A)^{1/3}$

$$\frac{R_{(27)}}{R_{(64)}} = \frac{R_0(27)^{1/3}}{R_0(64)^{1/3}} \Rightarrow \left(\frac{27}{64}\right)^{1/3} = 3:4$$

37. **(3)**

$$B = \frac{\mu_0 i}{2R} = \frac{\mu_0 q}{2RT}$$

$$T = \frac{2\pi R}{v} \Rightarrow B \propto \frac{v}{R^2}$$

For electron in n^{th} energy state

$$v \propto \frac{1}{n} \text{ and } R \propto n^2$$

$$\Rightarrow B \propto \frac{1}{n^5}$$

38. **(2)**
Instantaneous current

$$I = \frac{V_0}{X_L}\sin\left(\omega t - \frac{\pi}{2}\right) = \frac{V_0}{\omega L}\sin\left(\omega t - \frac{\pi}{2}\right)$$

$= \frac{V_0}{\omega L}\cos\omega t$

Instantaneous power

$P = V \times I = V_0 \sin\omega t \times \left(-\frac{V_0}{\omega L}\cos\omega t\right)$

$= -\frac{V_0^2}{\omega L}\sin\omega t\cos\omega t = -\frac{V_0^2}{2\omega L}(2\sin\omega t\cos\omega t)$

$P = -\frac{V_0^2}{2\omega L}\sin(2\omega t)$

39. **(3)**

At constant pressure and volume.

$PV = \mu_1 RT_1 = \mu_2 RT_2$

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

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

40. **(3)**

As per conservation of momentum

$\therefore \frac{h}{\lambda} = mv$

$\therefore v = \frac{h}{\lambda m} = \frac{h}{m}RZ^2\left[\frac{1}{1^2} - \frac{1}{5^2}\right]$

$\therefore v = \frac{hR}{25} = \frac{24}{m}$

41. **(2)**

If v becomes double, then F (tendency to overturn) will become four times.

42. **(2)**

In half wave rectifier, we get the output only in one half cycle of input AC therefore, the frequency of the ripple of the output is same as that of input AC i.e., 50 Hz.

43. **(4)**

$L = \frac{nh}{2\pi}$

44. **(2)**

$B_0 = \frac{E_0}{c} = \frac{36}{3 \times 10^8} = 12 \times 10^{-8}\,T$

45. **(1)**

Electrostatic field lines don't form closed loops. Gauss's law is useful in calculation of electric field where system has some sort of symmetry.

46. **(1)**

Magnetic permeability is maximum for ferromagnetic materials.

47. **(3)**

Centre of positive and negative charges do not coincide in polar molecules.

48. **(3)**

The charge distribution on the inner surface of the cavity will be non-uniform but the charge distribution on the outer surface of the sphere will be uniform.

49. **(4)**

No. of photoelectrons emitted per second is directly proportional to intensity of light

$n_e \propto I \propto \frac{1}{d^2}$

Hence, if distance is doubled, Intensity becomes one-fourth.

50. **(3)**

The additional velocity be given to the space shuttle to get free from the influence of gravitational force.

= Escape velocity – Orbital Velocity

$= \sqrt{2gR} - \sqrt{gR} = \sqrt{2 \times 9.8 \times 6400 \times 1000} - \sqrt{9.8 \times 6400 \times 1000}$

= 3.28 Km/s = 11.2 – 7.919 = 3.28 km/s