SAMPLE PAPER

2019 NEET

PHYSICS

SET–2

Roll No. | | | | | | | |

ANSWER AND SOLUTION

1. (a)
ML = mass × latent heat = energy = **charge** × **potential**

2. (c)
If is the total time to fall through height *h*,

then $h = \frac{1}{2} \times 10 \times t^2 = 5t^2$

and $h - 40 = \frac{1}{2} \times 10\,(t-2)^2 = 5\,(t-2)^2$

or $5t^2 - 40 = 5\,(t^2 - 4\,t + 4)$;

On solving, we get t = 3 s

$\therefore$ $h = 5 \times 3^2 =$ **45 m**

3. (c)

From $\omega = \sqrt{\frac{g}{h}}$; $h_1 = \frac{g}{\omega_1^2}$ and $h_2 = \frac{g}{\omega_2^2}$

Difference in evels,

$$\triangle h = h_2 - h_1 = g\left[\frac{1}{\omega_2^2} - \frac{1}{\omega_1^2}\right]$$

Here, $\omega_1 = 2\pi n_1 = 2\pi\left(\frac{75}{60}\right) = \frac{5}{2}\pi$

$$\omega_2 = 2\pi n_1 = 2\pi\left(\frac{80}{60}\right) = \frac{8}{3}\pi$$

$$\triangle h = 9.8\left[\frac{1}{(8\pi/3)^2} - \frac{1}{(5\pi/2)^2}\right]$$

$$\approx 0.02 \text{ m} = \mathbf{2 \text{ cm}}$$

4. (d)

M.I. of a cylinder about an axis passing through the centre and perpendicular to its length is

$$I_c = M\left[\frac{R^2}{4} + \frac{L^2}{12}\right]$$

Using theorem of parallel axes, moment of inertia of the cylinder about an axis through its edge would be

$$I = I_c + M\left(\frac{L}{2}\right)^2 = M\left[\frac{R^2}{4} + \frac{L^2}{12} + \frac{L^2}{4}\right]$$

$$= M\left[\frac{R^2}{4} + \frac{L^2}{3}\right]$$

When $L = 6\ R$, then

$$I = M\left[\frac{R^2}{4} + \frac{(6R)^2}{3}\right] = \frac{49}{4}MR^2$$

5. (c)

Escape velocity, $v_e = \sqrt{\frac{2GM}{R}}$

$$v_e' = \sqrt{\frac{2\,G(99\,M/100)}{99\,R/100}} = \sqrt{\frac{2\,GM}{R}} = v_e$$

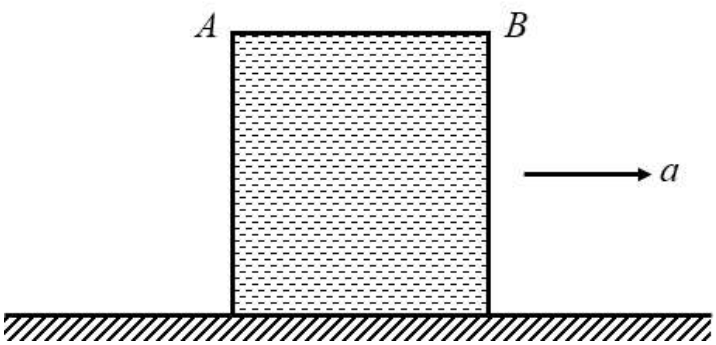
Also, $\quad g = \frac{GM}{R^2}$

and $\quad g' = \frac{G(99\,M/100)}{(99\,R/100)^2} = \frac{100}{99}\frac{GM}{R^2} = \frac{100}{99}g$

Thus $\quad \mathbf{g' > g}$

6. (b)

Refer to figure given here, due to acceleration of box towards right, force acts on water towards right. The resultant of this force and force due to gravity will try to incline the level of water in box from A to B. Due to it, the pressure decreases from A to B. As a result of it, the resultant normal force by the water on the top of the box will be passing a point towards the left of centre.



7. (b)

$$l = l_0\left(1 + \frac{1}{100}\right);$$

$$2l^2 = 2l_0^2\left(1 + \frac{1}{100}\right)^2 = 2l_0^2\left[1 + \frac{2}{100}\right]$$

or $$2l^2 - 2l_0^2 = 2l_0^2 \times \frac{2}{100} \quad \text{or} \quad \triangle S = S_0 \times \frac{2}{100}$$

or $$\frac{\triangle S}{S_0} = \frac{2}{100} = \mathbf{2\%}$$

8. (c)

(*i*) $x = A \sin [(\omega + \delta)\, t]$; Here angular frequency $= (\omega + \delta)$. Hence it represents SHM.

(*ii*) $x = A \cos^3 \omega t = A\left[\frac{\cos 3\omega t + 3\cos \omega t}{4}\right]$

It is combination of two motions of angular frequencies 3 ω, hence it does not represent SHM.

(*iii*) $x = \frac{A}{\tan^2(\omega t + \delta) + 1} = A \cos^2 (\omega t + \delta)$

$$= \frac{A(1 + \cos 2\,\omega t)}{2};$$

It represents SHM.

9. (c)

If ball 1 is neutral, ball 2 may be positive, ball 3 may be positive ; ball 4 may be negative and ball 5 may be negative. This would satisfy the conditions of the question.

10. (d)

$$B_1 = \frac{\mu}{4\pi}\frac{2\pi I_1}{r_1} \qquad \text{and} \qquad B_2 = \frac{\mu}{4\pi}\frac{2\pi I_2}{r_2}$$

Here $\overrightarrow{B_1}$ and $\overrightarrow{B_2}$ are in opposite directions, therefore the resultant magnetic field induction is

$$B = B_1 - B_2 = \frac{\mu_0 I_1}{2r1} - \frac{\mu_0 I_2}{2r_2} = \frac{\mu_0 I_1}{2r_1} - \frac{\mu_0 I_2}{2 \times 2r_1}$$

$$= \frac{\mu_0}{4r_1}(2I_1 - I_2)$$

As per question, $B = B_1/2$; so

$$\frac{\mu_0}{4r_1}(2I_1 - I_2) = \frac{1}{2} \times \frac{\mu_0 I_1}{2r_1}$$

or $2I_1 - I_2 = I_1$ or $\boldsymbol{I_1 = I_2}$

11. (b)

The effective value of the resulting current is calculated from total heat produced in a given resistance.

$$I_r^2 R = 5^2 R + \left(\frac{10}{\sqrt{2}}\right)^2 R = 25R + 50R = 75R$$

$$I_r = \mathbf{5\sqrt{3}\ A}$$

12. $$\frac{a}{b} = \frac{4}{3} \quad \text{or} \quad a = \frac{4b}{3}$$

$$\frac{I_{\max}}{I_{\min}} = \frac{(a+b)^2}{(a-b)^2} = \frac{[(4b/3)+b]^2}{[(4b/3)-b]^2} = \frac{(7b/3)^2}{(b/3)^2} = \mathbf{49:1}$$

13. (d)

Here $i = 60°$; As the ray emerges from the sphere parallel to line AB, therefore, net deviation of the ray, $\delta = 60°$. But, deviation of two refractions through a sphere

$\delta = 2\ (i - r)$ or $60° = 2\ (i - r)$ or $i - r = 30°$ or $60° - r = 30°$ or $r = 30°$

$$\mu = \frac{\sin i}{\sin r} = \frac{\sin 60°}{\sin 30°} = \frac{\sqrt{3}/2}{1/2} = \sqrt{3}$$

14. (b)

In displacement method, total magnification $m = \sqrt{m_1 m_2}$. Therefore area of source $= \sqrt{A_1 A_2}$.

15. (d)

As per question,

$$\frac{1}{2}mv_m^2 = E - \phi_0 = \frac{hc}{\lambda} - \phi_0 \qquad \text{...(i)}$$

$$\frac{hc}{\lambda} = 2 \text{ eV},$$

when λ becomes $0.75\ \lambda$ and v becomes $2\ v$, then

$$\frac{1}{2}m(2v)^2 = \frac{hc}{0.75\lambda} - \phi_0 \qquad \text{...(ii)}$$

solving (i) and (ii) we get, $\phi_0 = \mathbf{1.8\ eV.}$

16. (c)

$$\lambda = h/p \qquad \text{...(i)}$$

$$\left(\lambda + \frac{0.25}{100}\lambda\right) = \frac{h}{(p - p_0)}$$

or $$\frac{100.25\lambda}{100} = \frac{h}{(p - p_0)} \qquad \text{...(ii)}$$

From (i) and (ii), $\dfrac{100.25}{100} = \dfrac{p}{(p - p_0)}$

On solving, $p = \mathbf{401\ p_0}$.

17. (d)

$$n = \frac{t}{T} = \frac{3 \times 60}{60} = 3$$

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^n = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$$

Fraction decayed $= \frac{N_0 - N}{N_0} = \left(1 - \frac{N}{N_0}\right) = 1 - \frac{1}{8} = \frac{7}{8}$

% Fraction decayed $= \frac{7}{8} \times 100 =$ **87.5%**

18. (b)

$$E = E_4 - E_1 = \frac{13.6}{4^2} - \left(-\frac{13.6}{1^2}\right)$$
$$= -0.85 + 13.6 = 12.75 \text{ eV}$$
$$p = \frac{E}{c} = \frac{12.75 \times 1.6 \times 10^{-19}}{3 \times 10^8}$$
$$= \mathbf{6.8 \times 10^{-27} \text{ kg ms}^{-1}}$$

This must be the momentum of recoiled hydrogen atom in opposite direction.

19. (d)

Area of region covered = $\pi d^2 = \pi (2\ h\ R)$
$= \pi \times 2 \times 150 \times 6.4 \times 10^6 = 1.92\ \pi \times 10^9\ \text{m}^2$
$= \mathbf{1.92\ \pi \times 10^3\ km^2}$

20. (d)

$$\frac{\vec{A} \times \vec{B}}{\vec{A}.\vec{B}} = \frac{AB \sin\theta \hat{n}}{AB \cos\theta} = \tan\theta \hat{n}$$

Thus Assertion is wrong.
$(\vec{A} \times \vec{B})$ is a vector quantity and $\vec{A}.\vec{B}$ is a scalar quantity. Thus Reason is also wrong.

21. (c)

Here, Assertion is true and the Reason is false.

22. (d)

the direction of magnetic field produced by a linear conductor carrying current is given by Right Hand Thumb Rule and not Ampere's law. The Ampere's law states that : $\oint \vec{B}.\vec{dl} = \mu_0 I$.

Where I is the current through linear conductor. Thus, both Assertion and Reason are false.

23. (a)

The wavelength of microwaves is much less as compared to the wavelength of radiowaves. Therefore, their energy is larger as compared to that of radiowaves because $E = hc/\lambda$. Thus, both Assertion and Reason are true and Reason is the true explanation of Assertion.

24. (d)

Nature of X-ray spectrum is continuous and line spectrum. Thus Assertion is false. The Reason given here only explains the line X-ray spectrum and not continuous X-ray spectrum. Thus Reason is also false.

25. (d)

$$K.E.,\quad E_K = \frac{1}{2} I\omega^2$$

and Angular momentum $L = I\ \omega$

or $$L = \frac{2}{2}\frac{I\omega^2}{\omega} = \frac{2}{\omega}\left(\frac{1}{2} I\omega^2\right) = \frac{2E_K}{\omega} \qquad ...(i)$$

New angular momentum,

$$L' = \frac{2 \times E_K'}{\omega'} = \frac{2 \times (E_K/2)}{2\omega} = \frac{1}{4}\left(\frac{2E_K}{\omega}\right) = \frac{1}{4} L$$

26. (b)

Let Δl_1 and Δl_2 be the extension in the two rods and Δl be the total extension in the composite rod under the effect of force F. Then

$$\Delta l = \Delta l_1 + \Delta l_2$$

or $$\frac{F \times 2l}{YA} = \frac{Fl}{Y_1 A} + \frac{Fl}{Y_2 A}$$

or $$\frac{2}{Y} = \frac{1}{Y_1} + \frac{1}{Y_2} = \frac{Y_1 + Y_2}{Y_1 Y_2} \quad \text{or} \quad Y = \frac{2Y_1 Y_2}{Y_1 + Y_2}$$

27. (c)

For mixture,

$$C_v = \frac{n_1 C_{v_1} + n_2 C_{v_2}}{n_1 + n_2} = \frac{3 \times \frac{5}{2}R + 1 \times \frac{3}{2}R}{3+1} = \frac{9R}{4}$$

$$C_p = C_v + R = \frac{9R}{4} + R = \frac{13R}{4}$$

28. (c)

$$P' = \frac{PV}{V'} = \frac{10^5 \times V}{\left(V - \frac{3}{5}V\right)} = \frac{5}{2} \times 10^5 \ \text{Nm}^{-2}$$

Pressure due to water in the tank

$$= P' - P = \frac{5}{2} \times 10^5 - 10^5 = \frac{3}{2} \times 10^5 \ \text{Nm}^{-2}$$

Depth of water tank $= \frac{3}{2} \times \frac{10^5}{10^3 \times 10}$ = **15 m**

29. (d)

For required condition, the mid point of the string must be node. for a string fixed at both ends, the mid point of the string will be node, if it is vibrating with even harmonics.

30. (b)

As, $$V = \frac{q}{4\pi\epsilon_0 R}; \frac{q}{4\pi\epsilon_0} = VR$$

$$E = \frac{q}{4\pi\epsilon_0 r^2} = \frac{VR}{r^2}$$

31. (b)

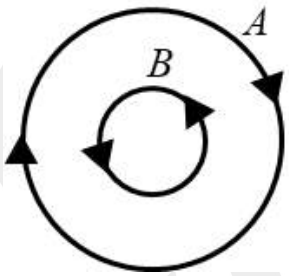
$$I_g = \frac{V}{G} \quad \text{and} \quad I_g' = \frac{V/n}{G} = \frac{V}{nG}$$

As $(I_g - I_g')S = I_g' G$

so $S = \dfrac{I_g' G}{(I_g - I_g')} = \dfrac{VG/nG}{\frac{V}{G} - \frac{V}{nG}} = \dfrac{G}{n-1}$

32. (b)

In figure given here, current in loop A is clockwise. Magnetic field/flux is inwards. As current in A increases, inwards flux increases. To oppose it, the flux due to current in inner loop B must be outwards. It will be so when induced current is **counter clockwise**.



33. (b)

Here, $V_L = 60\ V; V_C = 30\ V; V_R = 40\ V$

The supply voltage $V = \sqrt{V_R^2 + (V_L - V_C)^2}$

$= \sqrt{40^2 + (60-30)^2} =$ **50 V**

34. (a)

$$I_R = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$$

or $I_0 = I + I + 2I\cos 0° = 4I$

When one of the slits is closed, intensity on the same spot $= I = I_0/4$

35. (c)

$$\frac{1}{f_a} = ({}^a\mu_g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

and $\dfrac{1}{f_\omega} = ({}^\omega\mu_g - 1)\left(\dfrac{1}{R_1} - \dfrac{1}{R_2}\right)$

$$\frac{1}{f_\omega} = \left(\frac{{}^a\mu_g}{{}^a\mu_\omega} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\therefore \quad \frac{f_\omega}{f_a} = \frac{{}^a\mu_g - 1}{\left(\frac{{}^a\mu_g}{{}^a\mu_\omega} - 1\right)} = \frac{1.5-1}{\left(\frac{1.5}{4/3} - 1\right)} = 4$$

or $f_\omega = 4f_a = 4 \times 8 = 32$

$\therefore$ Change in focal length $= f_\omega - f_a = 32 - 8 = \mathbf{24\ cm}$

36. (b)

$$K_A = \frac{hc}{\lambda_A} - \phi_0 \qquad \text{and} \qquad K_B = \frac{hc}{\lambda_B} - \phi_0$$

$$\therefore \quad \frac{K_A}{K_B} = \frac{\frac{hc}{2\lambda_B} - \phi_0}{\frac{hc}{\lambda_B} - \phi_0} < \frac{1}{2} \quad \text{or} \quad \boldsymbol{K_A < K_B/2}$$

37. (d)

If x alpha and y beta particles are emitted, then change in mass number = $4x = 238 - 206 = 32$

or $x = \mathbf{8}$

change in charge number = $(2x - y) = 92 - 82 = 10$

or $y = 2x - 10 = 2 \times 8 - 10 = \mathbf{6}$

38. (b)

Here, $m_1 = 0.3$; $m_2 = 0.4$

$$m = \sqrt{m_1^2 + m_2^2} = \sqrt{0.3^2 + 0.4^2} = \mathbf{0.5}$$

39. (c)

$\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$

or $(1 - \sin^2 \alpha) + (1 - \sin^2 \beta) + (1 - \sin^2 \gamma) = 1$

or $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 3 - 1 = \mathbf{2}$

40. (d)

$$\Delta\vec{r} = \vec{r_1} - \vec{r_2} = (3\hat{i} + 5\hat{j}) - (-5\hat{i} - 3\hat{j}) = (8\hat{i} + 8\hat{j})$$

$$\Delta\vec{v} = \vec{v_2} - \vec{v_1} = (a\hat{i} + 7\hat{j}) - (4\hat{i} + 3\hat{j}) = (a-4)\hat{i} + 4\hat{j}$$

As $\Delta\vec{v} = \frac{\Delta\vec{r}}{\Delta t}$

$$\therefore \quad (a-4)\hat{i} + 4\hat{j} = \frac{8\hat{i} + 8\hat{j}}{2}$$

or $a - 4 = 4$ or $a = 8$

41. (b)

Here, $u \sin\theta = y$; $u \cos\theta = x$

Now $H = \frac{u^2 \sin^2\theta}{2g} = \frac{y^2}{2g}$

and $R = \frac{u^2}{g} 2 \sin\theta \cos\theta = \frac{2xy}{g}$

As $R = 2H$; so $\frac{2xy}{g} = \frac{2y^2}{2g}$ or $y = \mathbf{2}\ \boldsymbol{x}$

42. (a)

As, $F = -\frac{dU}{dr}$;

so $dU = -F\,dr$

or $U = \int -F\,dr = \int \frac{K}{r^2}\,dr = -\frac{K}{r}$

$KE = \frac{1}{2}PE = \frac{K}{2r}$

Total energy = *KE* + *PE*

$= \frac{K}{2r} + \left(\frac{-K}{r}\right) = -\frac{\boldsymbol{K}}{\boldsymbol{2r}}$

43. (c)

Refer to figure given here, the mass of rod is concentrated at the centre of the rod. Therefore,

$mg \times \frac{l}{2} \times \frac{1}{2} I\omega^2 = \frac{1}{2}\left(\frac{ml^2}{3}\right)\omega^2$

or $l^2\omega^2 = 3gl$ or $l\omega = \sqrt{3\,gl}$

Velocity of other end of the rod at location *OB* is $v = l\omega = \sqrt{\boldsymbol{3\,gl}}$

44. (b)

$P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$

or $\frac{1}{2}\rho v_2^2 = (P_1 - P_2) + \frac{1}{2}\rho v_1^2 = (P_1 - P_2) \quad (\because v_1 = 0)$

or $v_2 = \sqrt{\frac{2(P_1 - P_2)}{\rho}}$

$= \sqrt{\frac{2 \times (3.5 \times 10^5 - 3 \times 10^5)}{10^3}}$

$=$ **10 m/s**

45. (b)

$C_v = \frac{1 \times \frac{5}{2}R + 1 \times \frac{3}{2}R}{1+1} = 2R$;

$C_p = 2R + R = 3R$

$\frac{C_p}{C_v} = \frac{3R}{2R} = 1.5$