Sample Paper-01

Class 12th NEET (2024)

PHYSICS

ANSWER KEY

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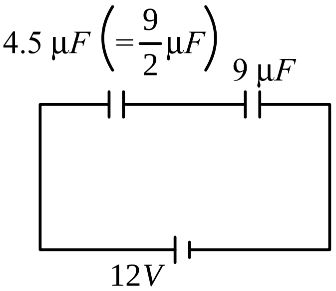
40.	(3)
41.	(1)
42.	(2)
43.	(1)
44.	(3)
45.	(2)
46.	(2)
47.	(4)
48.	(2)
49.	(3)
50.	(4)

HINTS AND SOLUTION

1. **(4)**

The given circuit can be redrawn as follows potential difference across 4.5 μF capacitor.

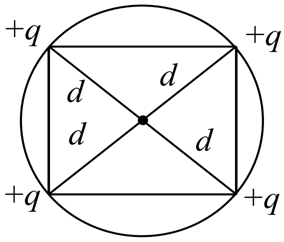


the potential difference across the 4.5 μF capacitor is

$$V = \frac{9}{\left(\frac{9}{2}+9\right)} \times 12 = 8V$$

2. **(2)**

Potential at centre due to all charges are



$$= \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{d}+\frac{q}{d}+\frac{q}{d}+\frac{q}{d}\right]$$

$$= \frac{1}{4\pi\varepsilon_0}\frac{4q}{d} \text{ in S.I. unit}$$

$$= \frac{4q}{d} \text{ in C.G.S. unit}$$

3. **(4)**

Since, the body is connected to earth and the electrons from the earth flow to the body so, it loses its positive charge. Hence, it implies that previously it was positively charged.

4. **(1)**

Potential energy of electric dipole,

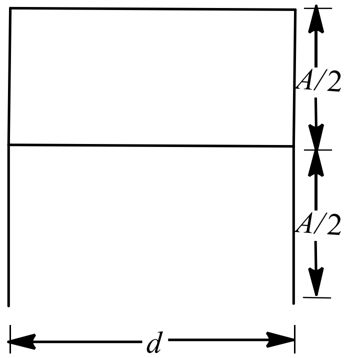
$U = -\vec{p}.\vec{E} = -pE\cos\theta.$

In Fig. (a), $\theta = \pi$ rad hence

$U = -pE\cos\pi = +pE$ = maximum.

5. **(3)**

The dielectric is introduced such that, half of its area is occupied by it.



In the given case the two capacitors are in parallel.

$\therefore \quad C'' = C_1 + C_2$

$$C_1 = \frac{A\varepsilon_0}{2d}$$

and $C_2 = \frac{KA\varepsilon_0}{2d}$

Thus, $C'' = \frac{A\varepsilon_0}{2d} + \frac{KA\varepsilon_0}{2d}$

$$C'' = \frac{C}{2}(1+K)$$

6. **(3)**

Electric potential inside the hollow conducting sphere is constant and equal to potential at the surface of the sphere $= \frac{Q}{4\pi\varepsilon_0 R}$.

7. **(2)**

$$P = i^2R \Rightarrow \frac{\Delta P}{P} = \frac{2\Delta i}{i}[R \rightarrow \text{Constant}]$$

$\Rightarrow$ % change in power = 2 × % change in current = 2 × 1 = 2%

8. **(1)**

At point A the slope of the graph will be negative. Hence resistance is negative.

9. **(3)**

According to Kirchhoff's first rule

$I + 4 + 2 - 3 - 5 = 0$

$I + 6 - 8 = 0$

$\Rightarrow I = 2\text{A}$

10. **(3)**
Force of attraction on the arm *SP* of loop due to conductor will be stronger than the force of repulsion on arm *QR* of the loop. Due to which the loop will move towards the conductor.

11. **(3)**
Magnetic field produced by wire is perpendicular to the motion of electron and it is given by
$$B = \frac{\mu_0}{4\pi}.\frac{2i}{r} = 10^{-7} \times \frac{2\times 5}{0.1} = 10^{-5} Wb/m^2$$
Hence force on electron
$F = qvB = (1.6 \times 10^{-19}) \times 5 \times 10^{6} \times 10^{-5})$
$= 8 \times 10^{-18}$ N

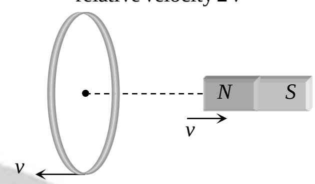
12. **(1)**
$m_1 : m_2 = 1 : 1$
$q_1 : q_2 = 1 : 2$
$v_1 : v_2 = 2 : 3$
Radius of path of charged particle moving in uniform magnetic field,
$$r = \frac{mv}{Bq}$$
$$\therefore \quad \frac{r_1}{r_2} = \left(\frac{m_1}{m_2}\right)\left(\frac{v_1}{v_2}\right)\times\left(\frac{q_2}{q_1}\right) = \frac{1}{1}\times\frac{2}{3}\times\frac{2}{1} = \frac{4}{3}$$
$r_1 : r_2 = 4 : 3$

13. **(3)**
For paramagnetic materials, the magnetic susceptibility gives information on the molecular dipole moment and hence on the electronic structure of the molecules in the material. The paramagnetic contribution to the molar magnetic susceptibility of a material, χ is related to the molecular magnetic moment *M* by the Curie relation.
$$\chi = \text{constant}\times\frac{M}{T} \Rightarrow \chi \propto \frac{1}{T}$$

14. **(3)**
The relative magnetic permeability (μ_r) of ferromagnetic material like iron is of order of 1000.

15. **(2)**
An electron moving around the nucleus has a magnetic moment μ given by
$$\mu = \frac{e}{2m} l$$
Where *l* is the magnitude of the angular momentum of the circulating electron around the nucleus. The smallest value of μ is called the bohr magneton μ_B and its value is $\mu_B = 9.27 \times 10^{-24}$ JT^{-1}

16. **(4)**
Mutual inductance between two coils in the same plane with their centers coinciding is given by
$$M = \frac{\mu_0}{4\pi}\left(\frac{2\pi^2 R_2^2 N_1 N_2}{R_1}\right) \text{henry}$$

17. **(2)**
$$\left(\frac{d\phi}{dt}\right)_{\text{In first case}} = e$$
$$\left(\frac{d\phi}{dt}\right)_{\text{relative velocity } 2v} = 2\left(\frac{d\phi}{dt}\right)_{I\text{ case}} = 2e$$


18. **(3)**
$$\phi = Mi \Rightarrow M = \frac{1.2\times 10^{-2}}{0.01} = 1.2\,H$$

19. **(1)**
Current $i = i_0 \sin(\omega t + \phi)$
$i_p = i_0 \sin \omega t \cos \phi + i_0 \cos \omega t \sin \phi$
Thus, $i_0 \cos \phi = 10$
$i_0 \sin \phi = 8$
Hence, $\tan \phi = \frac{4}{5}$

20. **(2)**
For a particular value of $\omega = (\omega_r$ say)
$X_L = X_C$
i.e., $\omega_r L = \frac{1}{\omega_r C}$
or $\omega_r = \frac{1}{\sqrt{LC}}$
or $2\pi v_r = \frac{1}{\sqrt{LC}}$
or $v_r = \frac{1}{2\pi\sqrt{LC}}$
$$\therefore \quad v_r = \frac{1}{2\times 3.14\times\sqrt{5\times 80\times 10^{-6}}}$$
$$= \frac{1}{2\times 3.14\times 2\times 10^{-2}}$$
$$= \frac{100}{3.14\times 4}$$
$$= \frac{25}{3.15} = \frac{25}{\pi}\text{Hz}$$

21. **(4)**

$$V_{rms}=\sqrt{\frac{(T/2)V_0^2+0}{T}}=\frac{V_0}{\sqrt{2}}$$

22. **(2)**

Refractive index $=\frac{c_0}{c}=\frac{1/\sqrt{\mu_0\varepsilon_0}}{1/\sqrt{\mu\varepsilon}}$

$$=\sqrt{\frac{\mu\varepsilon}{\mu_0\varepsilon_0}}$$

23. **(4)**

Intensity of electromagnetic wave is

$$I=\frac{P_{av}}{4\pi\times r^2}=\frac{E_0^2}{2\mu_0 c}$$

or $E_0=\sqrt{\frac{\mu_0 cP_{av}}{2\pi r^2}}$

$$=\sqrt{\frac{(4\pi\times10^{-7})\times(3\times10^8)\times800}{2\pi\times(4)^2}}$$

$= 54.77\ Vm^{-1}$

24. **(1)**

Using the relation

$c=\frac{E_0}{B_0}, B_0=\frac{E_0}{c}$

$$=\frac{9.3}{3\times10^8}=3.1\times10^{-8}T$$

25. **(3)**

As seen from a rarer medium (L_2 or L_3) the interface L_1 L_2 is concave and L_2 L_3 is convex. The divergence produced by concave surface is much smaller than the convergence due to the convex surface. Hence, the arrangement corresponds to concave-convex lens.

26. **(4)**

In minimum deviation $i = e = 30°$, so angle between emergent ray and second refracting surface is 90° – 30 = 60°

27. **(4)**

Apparent depth is given by

$$d_{\text{apparent}}=\frac{d_1}{\mu_1}+\frac{d_2}{\mu_2}=\frac{6}{4/3}+\frac{6}{1.5}=4.5+4=8.5\,\text{cm}$$

28. **(4)**

If shift is equivalent to n fringes, then

$$n=\frac{(\mu-1)t}{\lambda}\Rightarrow n\propto t\Rightarrow\frac{t_2}{t_1}=\frac{n_2}{n_1}\Rightarrow t_2=\frac{n_2}{n_1}\times t$$

$$t_2=\frac{20}{30}\times4.8=3.2\,\text{mm}$$

29. **(3)**

Here $A^2=a_1^2+a_2^2+2a_1a_2\cos\delta$

$\because$ $a_1 = a_2 = a$

$\therefore$ $A^2=2a^2(1+\cos\delta)=2a^2\left(1+2\cos^2\frac{\delta}{2}-1\right)$

$\Rightarrow$ $A^2\propto\cos^2\frac{\delta}{2}$

Now, $I\propto A^2$ $\therefore$ $I\propto A^2\propto\cos^2\frac{\delta}{2}$

$\therefore$ $I\propto\cos^2\frac{\delta}{2}$

30. **(3)**

$\lambda_1 = 400$ nm, $\lambda_2 = 600$ nm, $d_1 = d$, $d_2 = \frac{d}{2}$

Width of central maxima $y=\frac{2\lambda D}{d}$

$$\frac{y_1}{y_2}=\frac{\lambda_1}{\lambda_2}\times\frac{d_2}{d_1}=\frac{400\times d}{600\times2\times d}=\frac{1}{3}$$

on $y_2 = 3y_1 = 3y$

31. **(2)**

From the given graph it is clear that if we extend the given graph for A and B, intercept of the line A on V axis will be smaller as compared to line B means work function of A is smaller than that of B

32. **(2)**

From relation $\lambda=\frac{h}{\sqrt{2mqV}}$ or $\lambda\propto\frac{1}{\sqrt{mq}}$

Hence, $\frac{\lambda_p}{\lambda_\alpha}=\sqrt{\frac{m_\alpha}{m_p}\times\frac{q_\alpha}{q_p}}$

$$=\sqrt{\frac{4m_p\times2e}{m_p\times e}}=\sqrt{8}$$

33. **(1)**

In tungsten, photoemission take place with a light of wavelength 2300 Å. As emission of electron is inversely proportional to wavelength, all the wavelengths smaller than 2300 Å will cause emission of electrons.

34. **(2)**
Energy of electron in nth energy level in hydrogen atom

$= \frac{-13.6}{n^2}$ eV

Here, $= \frac{-13.6}{n^2} = -3.4$ eV

So, $n = 2$

Angular momentum from Bohr's principle

$= n\frac{h}{2\pi} = \frac{2 \times 6.626 \times 10^{-34}}{2 \times 3.14}$

$= 2.11 \times 10^{-34}$ Js

35. **(1)**
From Bohr's model of atom, the wave number is given by

$\frac{1}{\lambda} = R\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right)$

where R is Rydberg's constant and n_1 and n_2 the energy levels.

Given, $n_2 = 2$, $n_1 = 3$

$\therefore \quad \frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$

$\frac{1}{\lambda} = R\left[\frac{5}{36}\right]$

$\Rightarrow \quad \lambda = \frac{36}{5R}$

This gives corresponding wavelength of Balmer series.

36. **(3)**
According to Bohr's theory of atom electrons can revolve only in those orbits in which their angular momentum is an integral multiple of $h/2\pi$, where h is Planck's constant.

Angular momentum $= mvr = \frac{nh}{2\pi}$

Hence, angular momentum is quantized.

The energy of electron in nth orbit of hydrogen atom,

$E = \frac{Rhc}{n^2}$ joule

Thus, it is obvious that the hydrogen atom has some characteristics energy state. In fact, this is true for the atom of each element, *ie,* each atom has its energy quantized.

Hence, both energy and angular momentum are quantised.

37. **(4)**
The disintegration can be shown as below

$_{72}X^{180} \xrightarrow[-2\alpha]{-2\beta^-} X_4$

Loss in atomic number = 72 + 2 – 4 = 70

Loss in mass number = 180 – 8 = 172

So, final nucleus is $_{70}X_4^{172}$.

38. **(1)**

$C = \frac{\varepsilon_0 kA}{d} \Rightarrow C \propto \frac{k}{d}$

$\therefore \quad \frac{C_1}{C_2} = \frac{k_1}{d_1} \times \frac{d_2}{k_2} = \frac{k}{d} \times \frac{d/2}{3k} = \frac{1}{6}$

$C_2 = 6C_1$

Again, for capacity of a capacitor, $C = \frac{k\varepsilon_0 A}{d}$

Therefore, capacity of a capacitor depends upon the medium between two plates of capacitor.

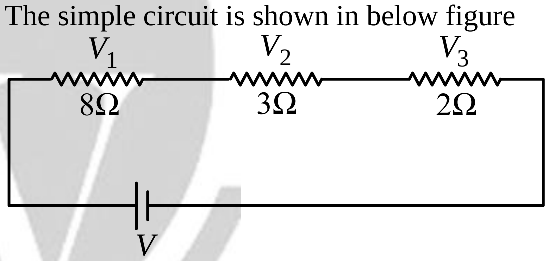
39. **(1)**
Electric charge = [AT]

Electric field strength = $[MLT^{-3}A^{-1}]$

Absolute permittivity = $[M^{-1}L^{-3}T^4A^2]$

Electric dipole = $[M^0L^1T^1A^1]$

40. **(3)**
The simple circuit is shown in below figure



As, 3Ω and 6Ω are in parallel connection.

Hence, potential difference across 6Ω is also 20V.

And, for 8Ω, $\frac{V_1}{8} = \frac{20}{3} + \frac{20}{6} = \frac{60}{6} = 10$ or $V_1 = 80$V

Similarly, for 12Ω and 4Ω, $\frac{V_1}{8} = \frac{V_2}{3}$

$\Rightarrow \quad \frac{80}{8} = \frac{V_2}{3} \quad \Rightarrow \quad V_2 = 30$ V.

41. **(1)**
In an unbiased *p*-*n* Junction, holes diffuse from *p* region to n region while electrons diffuse from *n* region to *p* region due to difference in concentration of hole and electrons on either side of junction.

42. **(2)**

$L = n\left(\frac{h}{2\pi}\right), i.e. L \propto n.$

In ground state $n = 1$,

So, L = minimum.

43. **(1)**

When unpolarised light coming from sun, enters the atmosphere of earth, then it scatters due to presence of atmospheric particles. The scattered light seen in a direction perpendicular to the direction of incidence is found to be plane polarised. When the light from the sun incident on reflecting surface of earth at an angle of polarisation, then reflecting light is polarised. Little amount of light is incident on polarising direction, hence reflected light is partially polarised. Hence, Statement I and Statement II both are correct.

44. **(3)**

If $V = V_0 \sin \omega t$, then current function will lead the voltage function by 90°.

$\therefore \quad I = I_0 \cos \omega t$

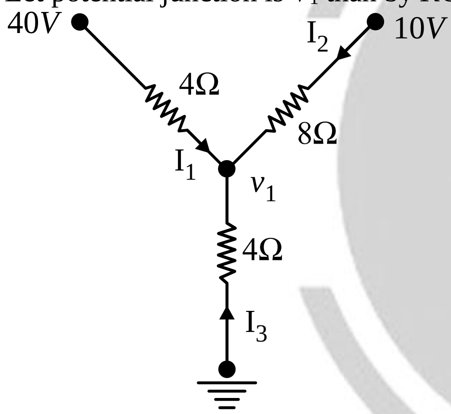
$\therefore$ Instantaneous power,

$P = VI = V_0 I_0 \sin \omega t \cos \omega t$

or $\quad P \neq 0$ at all times

45. **(2)**

Let potential junction is V_1 than by KCL



$I_1 + I_2 + I_3 = 0$

$$\frac{40 - V_1}{4} + \frac{10 - V_1}{8} + \frac{0 - V_1}{4} = 0$$

$90 - 5V_1 = 0$

$$V_1 = \frac{90}{5} = 18\,\text{volt} = I_2 = \frac{18 - 10}{8} = 1A$$

46. **(2)**

Kinetic energy of photoelectrons is independent of intensity of incident light.

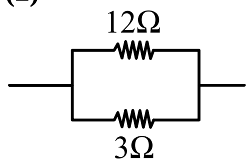
47. **(4)**

α-particles are scattered by the nucleus due to the force of repulsion between them and the nucleus.

Trajectories of particles 1, 2, and 3 clearly indicate influence of force of repulsion. But the trajectory of particle 4 indicate influence of force of attraction, which is not possible.

Hence, (4) is the correct answer.

48. **(2)**

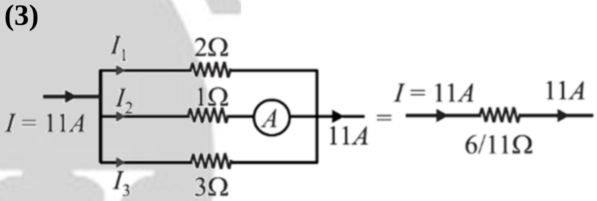


$$I = \frac{V}{R_{eq}}$$

$$R_{eq} = \frac{12 \times 3}{15} = \frac{12}{5}\,\Omega$$

$$I = \frac{4.8}{\frac{12}{5}} = 2A$$

49. **(3)**



$$V = 11 \times \frac{6}{11} = 6\,\text{volt}$$

Now,

$V = I_2 \times 1$

$6 = I_2 \times 1$

$\boxed{I_2 = 6A}$

50. **(4)**

$$\frac{I_{max} - I_{min}}{I_{max} + I_{min}} = \frac{\left(\sqrt{I_1} + \sqrt{I_2}\right)^2 - \left(\sqrt{I_1} - \sqrt{I_2}\right)^2}{\left(\sqrt{I_1} + \sqrt{I_2}\right)^2 + \left(\sqrt{I_1} - \sqrt{I_2}\right)^2}$$

$$= \frac{2\sqrt{I_1 I_2}}{I_1 + I_2}$$