Solution

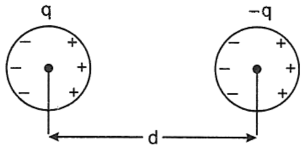
NEET UG - PHYSICS SAMPLE PAPER - 12 - 03

NEET-UG - Physics

Section A

1.

(b) more than $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{d^2}$

Explanation: 

Because of induction, the effective force between them becomes equal to or greater than

F = $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{d^2}$

2.

(d) perpendicular to the equatorial line and opposite to $\vec{P}$

Explanation: perpendicular to the equatorial line and opposite to $\vec{P}$

3.

(d) independent of the distance between the plates

Explanation: F = QE

$= Q\left(\frac{\sigma}{2\varepsilon_0}\right) = Q\left(\frac{Q/A}{2\varepsilon_0}\right)$

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

Hence, electrostatic force between the plates, is independent of the distance between the plates.

4.

(d) 8

Explanation: $C = 8 \times 10^{-6}\text{F}$, V = 250 volt

Required capacitance, $C' = 16\mu\text{F} = 16 \times 10^{-6}\text{F}$

Required voltage, V' = 1000 volt

we know that the required combination can be obtained by making m rows of n capacitors.

Therefore, the minimum number of capacitors required (N) $= m \times n$. We also know that when n capacitors are connected in series then effective voltage,

$V' = 1000 = n \times 250$

$n = \frac{1000}{250} = 4$

The effective capacitance of 4 capacitors in one row $\frac{1}{C} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{4}{8}$

or $C = 2\mu\text{F}$

Required capacitance C' $= 16 = m \times 2$

$m = \frac{16}{2} = 8$

Therefore, the minimum number of capacitors (N)

5.

(d) 4 volt

Explanation: 4 volt

6.

(b) 4.5 Ω

Explanation: 4.5 Ω

7.

(d) 0.2 amp

Explanation: 0.2 amp

8.

(b) halved

Explanation: halved

9.

(d) 2.5 Ω

Explanation: 2.5 Ω

10. **(a)** 40Ω

Explanation: 40Ω

11.

(b) 3.9 $\times$ 10^{-5} T

Explanation: $\frac{B_a}{B_c} = \frac{r^3}{\left(r^2+x^2\right)^{3/2}}$

$B_a = B_c \times \frac{r^3}{\left(r^2+x^2\right)^{3/2}}$

$= 0.50 \times 10^{-4} \times \frac{(0.12)^3}{\left[(0.12)^2+(0.05)^2\right]^{3/2}}$

$= 0.50 \times 10^{-4} \times \left(\frac{0.12}{0.13}\right)^3$

$= 3.9 \times 10^{-5}$ T

12.

(c) $\frac{x}{8}$

Explanation: Magnetic field at the centre of a circular loop of radius R carrying current I is,

$B = \frac{\mu_0 2\pi I}{4\pi R} = \frac{\mu_0 I}{2R}$

Its magnetic moment is, M = IA = I(πR^2)

$\therefore \frac{B}{M} = \frac{\mu_0 I}{2R} \times \frac{1}{I\pi R^2} = \frac{\mu_0}{2\pi R^3}$ = x (Given)

When both the current and the radius is doubled, the ratio becomes

$\therefore \frac{B'}{M'} = \frac{\mu_0}{2\pi(2R)^3} = \frac{1}{8}\left(\frac{\mu_0}{2\pi R^3}\right) = \frac{x}{8}$

13. **(a)** r^{-3}

Explanation: r^{-3}

14.

(b) decrease by 15^o

Explanation: decrease by 15^o

15. **(a)** 110 $\times$ 90watt

Explanation: Power = (armature current) $\times$ (back emf)

= 90 $\times$ 110 = 9900 watt

16.

(c) only iii

Explanation: No induced current is set-up as the magnetic field lines of the earth are not cut by the falling conductor.

17.

(d) 50 Hz

Explanation: Y = 100V, C = 2μF = 20 $\times$ 10^{-6}

I = 0.628A, V = ?

$X_C = \frac{V}{I} = \frac{100}{0.628}$

$\Rightarrow \frac{1}{2\pi v C} = \frac{100}{0.628}$

$V = \frac{0.628}{100 \times 2\pi C}$

= 50 Hz

18.

(c) maximum but finite

Explanation: At resonance $X_L = X_C \Rightarrow Z = R$ and current is maximum but finite, which is $I_{max} = \frac{E}{R}$, where E is applied voltage.

19.

(c) 0

Explanation: 0

20.

(b) $E_0k = B_0\omega$

Explanation: We know that, $E_0 = cB_0$

c = $v\lambda = \frac{\omega}{2\pi}\lambda = \frac{\omega}{k}$ $\left(\because k = \frac{2\pi}{\lambda}\right)$

Thus, $E_0 = \frac{\omega}{k}B_0$ or $E_0k = B_0\omega$

21.

(c) 8.86×10^{-12}

Explanation: Amplitude of the electric field and magnetic field are related by the relation

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

Average energy density of the magnetic field is

$u_B = \frac{1}{4}\frac{B_0^2}{\mu_0}$

= $\frac{1}{4}\frac{E_0^2}{\mu_0 c^2}$ $\left(\because B_0 = \frac{E_0}{c}\right)$

= $\frac{1}{4}\varepsilon_0 E_0^2$ $\left(\because \quad c = \frac{1}{\sqrt{\mu_0\varepsilon_0}}\right)$

= $\frac{1}{4} \times 8.854 \times 10^{-12} \times (2)^2$

= 8.854×10^{-12} J m^{-3}

= 8.86×10^{-12} J m^{-3}

22.

(b) $\frac{1}{r}$

Explanation: From a dipole antenna, the electromagnetic waves are radiated outwards. The amplitude of electric field vector E_0 which transports significant energy from the source falls off inversely as the distance r from the antenna, i.e., $E_0 \propto \frac{1}{r}$

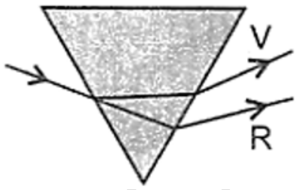
23.

(b) 1 m

Explanation: 1 m

24.

(b)



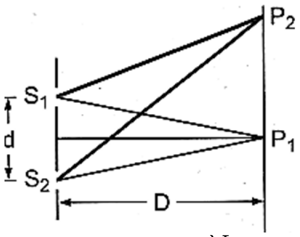
Explanation: Dispersion begins immediately after entering the prism. The angle of deviation is different for different colors.

25. **(a)** vertically upwards slightly

Explanation: vertically upwards slightly

26. **(a)** 16 : 1

Explanation:



Fringe width, $\beta = \frac{\lambda I}{d}$, Let the amplitude at that place where contructive interfere takes place be a.

The position of fringe at p_2 is,

$x = \frac{n\lambda D}{d}$

Given $\beta' = \left(\frac{\beta}{4}\right)$

$\therefore \frac{\lambda D}{4d} = \frac{n\lambda D}{d}$
or $n = \frac{1}{4}$
$\therefore \frac{I_1}{I_2} = \frac{a^2}{\left(\frac{a}{4}\right)^2}$
or $I_1 : I_2$ = 16 : 1

27.

(c) Singly ionized neon atom (Ne^+)

Explanation: Singly ionized neon has electron count more than one. Bohr's model is valid for atoms with single electron.

28. **(a)** $v_3 > v_2 > v_1$

Explanation: The stopping potential is more negative for a higher frequency of incident radiation.

29.

(c) $\frac{E}{c}$
Explanation: $\frac{E}{c}$

30.

(d) Lyman series

Explanation: Lyman series

31.

(d) $n_1 = 4$, $n_2 = 2$

Explanation: E = $\frac{-e^2}{2\times 4\pi\varepsilon_0} \times \frac{1}{r}$ = -13.6 $\frac{z^2}{n^2}$
$\therefore$ r $\propto$ n^2 = Kn^2
In an orbit, Iω = nh
or $mr^2\omega$ = nh
$\therefore \omega = \frac{2\pi}{T} = \frac{n\hbar}{mr^2} = \frac{n\hbar}{mK^2n^4}$
$\therefore$ T $\propto$ n^3
$T_1 = 8T_2$
$n_1^3 = 8n_2^3$ or $n_1 = 2n_2$
$\therefore n_1 : n_2$ = 4 : 2

32. **(a)** $Q_1 = (M_X - M_Y)c^2$ and $Q_2 = (M_X - M_Y - 2m_e)c^2$

Explanation: For a β^- decay,
$zX^A \rightarrow {}_{z+1}Y_1^A + {}_{-1}e^0 + \bar{v}$
$\therefore$ Q-Value of decay
= $[(M_X - Zm_e) - \{M_Y - (Z + 1)m_e\} - m_e)c^2$
= $(M_x - M_Y)c^2$
For a β^+ decay,
$zX^A \rightarrow {}_{z+1}Y_2^A + {}_{1}e^0 + v$
$\therefore$ Q-Value of decay
= $[(M_X - Zm_e) - \{M_Y - (Z - 1)m_e\} - m_e)c^2$
= $(M_X - M_Y - 2m_e)c^2$

33.

(c) 8 and 6 respectively
Explanation: The change in mass is 238 - 206 = 32 units. It means that $\frac{32}{4} = 8\alpha$ particles are emitted.
The change in atomic number will be 8 $\times$ 2 = 16
Therefore, the new element would have atomic number 92−16 = 76
But the final product Pb has atomic number 82. It means there would have been an emission of 82 - 46 = 6β particles.

34. **(a)** 49
Explanation: $\beta = \frac{I_c}{I_b}$

Since, $I_e = Ib + I_c$

$\therefore I_b = I_e - l_c = 5.60 - 5.488 = 0.112$ mA

$\beta = \frac{5.488}{0.112} = 49$

35.

(b) viscosity of air

Explanation: viscosity of air

Section B

36.

(c) A is true but R is false.

Explanation: A is true but R is false.

37. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation: Assertion and reason both are correct statements and reason is correct explanation for assertion.

38.

(c) A is true but R is false.

Explanation: A is true but R is false.

39.

(d) Assertion is wrong statement but reason is correct statement.

Explanation: Consider a conductor of length l and area of cross-section A. Time taken by the free electrons to cross the conductor, t = $\frac{l}{v_d}$.

Hence, current, I = $\frac{q}{t} = \frac{\text{Alne}}{l/v_d}$

or I = $neAv_d$ or I $\propto v_d$

Thus, current is directly proportional to drift velocity.

40. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation: In case of the electric field of an electric dipole, the electric lines of force originate from positive charge and end at negative charge. Since, isolated magnetic lines are closed continuous loops extending throughout the body of magnet, hence they form endless curves.

41. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation: Assertion and reason both are correct statements and reason is correct explanation for assertion.

42.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: In both the cases, the magnetic flux will change, and so there is an induced current.

43.

(c) A is true but R is false.

Explanation: A is true but R is false.

44.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Both A and R are true but R is not the correct explanation of A.

45.

(c) A is true but R is false.

Explanation: A is true but R is false.

46.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Both A and R are true but R is not the correct explanation of A.

47. **(a)** Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

Explanation: Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

48. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: Both A and R are true and R is the correct explanation of A.

49.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Both A and R are true but R is not the correct explanation of A.

50.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Both A and R are true but R is not the correct explanation of A.