Solution

NEET UG PHY - SAMPLE PAPER - 12 - 01

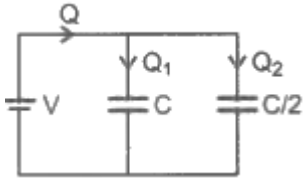
NEET-UG - Physics

Section A

1. **(a)** The time of travel will be more in the case of the proton.
   Explanation: The time required to fall through distance d is
   d = $\frac{1}{2}\left(\frac{qE}{m}\right)t^2$ or t = $\sqrt{\frac{2dm}{qE}}$
   Since $t^2 \propto$ m, a proton takes more time.

2. **(c)** $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$
   Explanation: According to Coulomb's law, the force of repulsion between the two positive ions each of charge q, separated by a distance d is given by:
   F = $\frac{1}{4\pi\varepsilon_0}\frac{(q)(q)}{d^2}$
   or F = $\frac{q^2}{4\pi\varepsilon_0 d^2}$
   $q^2 = 4\pi\varepsilon_0 Fd^2$
   or q = $\sqrt{4\pi\varepsilon_0 Fd^2}$ ...(i)
   Since, q = ne
   where, n = number of electrons missing from each ion
   e = magnitude of charge on electron
   $\therefore n = \frac{q}{e}$
   n = $\frac{\sqrt{4\pi\varepsilon_0 Fd^2}}{e}$ [Using eqn. (i)]
   = $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$

3. **(c)** $\frac{3}{4}CV^2$
   Explanation:
   As the capacitors are connected in parallel, therefore, potential difference across both the condensers remains the same.



   $\therefore \quad Q_1 = CV; Q_2 = \frac{C}{2}V$
   Also, Q = Q_1 + Q_2
   $= CV + \frac{C}{2}V = \frac{3}{2}CV$
   work done in charging fully both the condensers is given by:
   $W = \frac{1}{2}QV = \frac{1}{2} \times \left(\frac{3}{2}CV\right)V = \frac{3}{4}CV^2$

4. **(c)** Equipotential surface is spherical
   Explanation: Equipotential surface:
   i. P.D difference between two points on the surface is zero always since the potential is the same everywhere in the equipotential surface.
   ii. The EF is always perpendicular to the surface because there is no potential gradient along any direction parallel to the surface P so no EF parallel to the surface
   iii. The equipotential surfaces can have any shape, not just a sphere.

iv. No work is done in moving a charge along the surface because the potential difference is zero.

5. **(c)** zero

   Explanation: The electrostatic force due to one Cs^+ ion is balanced by diagonally opposite other Cs^+ ion. Thus, the net electrostatic force on Cl^- ion due to eight Cs^+ ions is zero.

6. **(d)** 1 ohm

   Explanation: 2R + 2 $\times$ 2 = 6 V or R = 1 ohm

7. **(c)** 2V

   Explanation: No current flows through the branch consisting galvanometer. Hence, resistance's ^ (= 500 Ω) and i?(=100Ω) are joined in series across the battery of Vx (= 12 volt).

   .∴Potential drop across R(= 100 Ω.)

   $= V_B = \left(\frac{12}{500+100}\right) \times 100 = 2\text{volt}$

8. **(c)** 2Ω

   Explanation: 2Ω

9. **(c)** $l_2 + l_3$

   Explanation: $l_2 + l_3$

10. **(b)** $\frac{E_1}{R_1}$

    Explanation: i = $\frac{\varepsilon_1}{R_1}$ as R_2 is also shorted.

11. **(c)** 50 m/s

    Explanation: 50 m/s

12. **(d)** 1.13 $\times$ 10^{-5} T

    Explanation: 1.13 $\times$ 10^{-5} T

13. **(d)** diamagnetic

    Explanation: diamagnetic

14. **(c)** 1.5

    Explanation: Pole strength m = 10^{-4}Am and length = 0.1m

    $\tau = \overrightarrow{M} \times \overrightarrow{B} = MB\sin\theta = m \times (2l) \times B\sin\theta = 10^{-4} \times 0.1 \times 30\sin 30^\circ = 1.5 \times 10^{-4}\text{Nm}$

15. **(d)** only ii

    Explanation: (Basically, to avoid the magnetic flux flow due to the magnetic field set up, the coils would try to repel each other following Lenz law) If the current passes through one of the coils then a magnetic field will set up in the coil which will also pass through the other coil. This will create a magnetic flux passing through the other coil. Due to Lenz law, the other coil will 'try' to oppose this flux by a current passing through the other coil which will decrease the magnetic flux because of the first coil. This current will obviously be opposite in direction to the direction of the first coil and becomes opposite currents repel.

16. **(a)** 0.2 volt

    Explanation: 0.2 volt

17.

(d) zero watt

Explanation: The voltage can be written as,

V = 5 (sin $\omega t + \frac{\pi}{2}$)

The angle between the voltage and the current is 90^o.

The power dissipated in the circuit is given as,

$P = V_{rms}\ I_{rms} \cos \phi$

$= V_{rms}\ I_{rms} \cos 90^o$

= 0

Thus, the power dissipated in the circuit is 0.

18. **(a)** either purely inductive or purely capacitive

Explanation: The average power dissipated in an AC circuit is given by, $P = E_V I_V \cos \phi$ where E_V and I_V are rms values of voltage and current respectively. cos ϕ is the power factor. For both inductor and capacitor, $\phi = 90^o$ i.e., cos ϕ = 0. Hence, the average power dissipated per cycle is zero for them.

19.

(c) $\frac{E_0 I_0}{2} cos\phi$

Explanation: $P_{av} = E_v I_v\ cos\phi$

$= \frac{E_0}{\sqrt{2}} \times \frac{I_0}{\sqrt{2}} cos\phi = \frac{E_0\ I_0}{2} cos\phi$

where ,$cos\phi$ is called the power factor of ac circuit.

20.

(d) 0.09 N

Explanation: Radiation pressure on reflecting surface is

$P = \frac{2I}{c} = \frac{2 \times 1350}{3 \times 10^8} \text{Nm}^{-2}$

Total force on the surface

= PA

$= \frac{2 \times 1.35 \times 10^3}{3 \times 10^8} \times 10^4$

$= 9 \times 10^{-2}$ N = 0.09 N

21. **(a)** only ii

Explanation: radioactive sources, X-ray tube, sodium vapour lamp, crystal oscillator

22. **(a)** 2.83×10^{-8} T

Explanation: $E_0 = cB_0$

$E_{rms} = \frac{E_0}{\sqrt{2}}$

or, $E_{rms} \sqrt{2} = E_0 = cB_0$

$\therefore B_0 = \frac{E_{\text{rms}} \sqrt{2}}{C} = \frac{6\sqrt{2}}{3 \times 10^8}$

$= 2.83 \times 10^{-8}$ T

23.

(c) a real, inverted, same-sized image can be formed using a convex mirror

Explanation: The convex mirror always forms, virtual, erect, and smaller images.

24.

(b) 0.4 cm away from the mirror

Explanation: From mirror equation,

$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = -\frac{1}{20} - \frac{1}{10}$

$= -\frac{3}{20}$

$\therefore \quad \frac{1}{v'} = -\frac{3}{20} + \frac{1}{9.9}$ or v' = -20.4 cm

i.e., shift is 0.4 cm away from the mirror.

25.

(b) 1 m

Explanation: Fringe width, $\beta = \frac{\lambda D}{d}$

$\therefore D = \frac{\beta d}{\lambda} = \frac{4\times10^{-3}\times0.1\times10^{-3}}{4\times10^{-7}} = 1\text{m}$

26.

(c) frequency

Explanation: frequency

27. **(a)** 2 : 1

Explanation: Work function, $\phi = \frac{hc}{\lambda}$

$\therefore \phi \propto \frac{1}{\lambda}$

or $\frac{\phi_1}{\phi_2} = \frac{\lambda_2}{\lambda_1} = \frac{600}{300} = \frac{2}{1}$

28.

(d) $\frac{E}{p}$

Explanation: $\frac{E}{p}$

29.

(d) all have the maximum KE equal to 1.36 eV

Explanation: V_s = 1.36 volt

$\therefore eV_s$ = 1.36 eV

or $\frac{1}{2}$ m$(v_{max.})^2$ = 1.36 eV

i.e., various electrons have KE between zero and 1.36 eV

30.

(b) Balmer series

Explanation: Balmer series

31.

(c) $\frac{e}{2m}$

Explanation: Magnetic dipole moment

= IA = $\frac{e}{T}\left(\pi r^2\right) = \frac{e\pi r^2}{2\pi/\omega} = \frac{er^2\omega}{2}$ ...(i)

Angular momentum = mvr = $mr^2\omega$ ...(ii)

$\frac{\text{Magnetic dipole moment}}{\text{Angular momentum}} = \frac{er^2\omega}{2} \times \frac{1}{mr^2\omega} = \frac{e}{2m}$

32.

(b) $_{94}Pu^{239}$

Explanation: $_{94}Pu^{239}$

33.

(b) 19.6 MeV

Explanation: Number of particles emitted/sec,

$\frac{dN}{dt} = \lambda N$

$\therefore$ Number of particles emitted in 1 hour = λN $\times$ 3600

= $\frac{dN}{dt} \times 3600$

= $3.72 \times 10^{10} \times 3600$

Energy of all particles = 4.2×10^2 J

$\therefore$ Energy of one particle = $\frac{4.2\times10^2}{3.72\times36\times10^{12}}\text{J} \times \frac{1}{1.6\times10^{-13}}\text{MeV}$

= 19.6 MeV

34.

(d) I_B against V_{be} at constant V_{CE}

Explanation: The input characteristics of the CE (Common Emitter) mode transistor represents the variation of the input

current, i. e., base current I_b with the input voltage, i. e., base-emitter voltage V_{BE} at constant output voltage, i.e., collector-emitter voltage V_{CE}.

35.

(c) $\frac{V}{r^2}$

Explanation: According to Stoke's law,

terminal velocity (V) = $\frac{2}{9\eta}gr^2(\rho - \sigma)$

$\frac{V}{r^2} = \frac{2g(\rho-\sigma)}{9\eta}$ = constant

Thus, the V$\frac{V}{r^2}$ graph is a straight line having slope,

slope = $\frac{V}{r^2} = \frac{2g(\rho-\sigma)}{9\eta}$

Section B

36. **(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.

37.

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

Explanation: Assertion is correct statement but reason is wrong statement.

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

Explanation: Resistance wire R = $\rho\frac{l}{A}$.

where R is the resistivity of material which does not depend on the geometry of the wire. Since when the wire is banded, resistivity, length and area of cross-section do not change, therefore the resistance of wire also remains the same.

39.

(c) A is true but R is false.

Explanation: A is true but R is false.

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

Explanation: The magnetic field at distance from centre of loop, can be resolved into a component along x-axis and perpendicular to it. When perpendicular components are summed over the whole loop, the result is zero. That is, by symmetry any element on one side of the loop sets up a perpendicular component that cancels the component set up by an element dimetrically opposite to it.

41.

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

Explanation: Assertion is correct statement but reason is wrong statement.

42. **(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.

43.

(c) A is true but R is false.

Explanation: As P = VI, so for the transmission of same power, high voltage implies low current. At high voltages, heat losses ($H = I^2Rt$) are substantially reduced.

44.

(d) Both A and R are false.

Explanation: Velocity of light has different values in different media. It depends on the refractive index of the medium. Related by formula

$v_{\text{medium}} = \frac{\text{velocity in vacuum}}{\text{refractive index of medium}}$

45.

(d) A is false but R is true.

Explanation: A convex lens made of glass behaves as a convergent lens when placed in air or water. However when the same lens is immersed in carbon disulphide $(\mu = 1.63)$, it behaves as a divergent lens. Therefore when a convergent lens is placed inside a transparent medium of refractive index greater than that of material of the lens, it behaves as a divergent lens. Behaviour of a lens depends on the refractive index of a surrounding medium.

46.

(c) A is true but R is false.

Explanation: On immersing the apparatus in water, the wavelength of light decrease $\left(\lambda' = \frac{\lambda}{\mu}\right)$. Hence it follows from the expression of fringe width $\left(\beta = \frac{D\lambda}{d}\right)$, that when apparatus is immersed in a liquid, the fringe width will decrease. As $\mu \propto \frac{1}{\lambda}$ and refractive index of water is greater than air, therefore wavelength of light in water is smaller than wavelength in air.

47. **(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.

48.

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

Explanation: Both statement are true; but even it radiation of single wavelength is incident on photosensitive surface, electrons of different KE will be emitted.

49.

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

Explanation: The maximum number of a photon is given by all the transitions possible = ${}^4C_2 = 6$

The minimum number of transition =1, that is direct jumps from 44 to 11.

50. **(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.