3. Force on wire Q due to R ;

\[ F_R = 10^{-7} \times \frac{2 \times 20 \times 10}{(2 \times 10^{-2})} \times (10 \times 10^{-2}) \]

\[ = 2 \times 10^{-4} \text{ N} \text{ (Repulsive)} \]

Force on wire Q due to P ;

\[ F_P = 10^{-7} \times 2 \times \frac{10 \times 30}{(10 \times 10^{-2})} \times (10 \times 10^{-2}) \]

\[ = 0.6 \times 10^{-4} \text{ N} \text{ (Repulsive)} \]

Hence net force

\[ F_{net} = F_R - F_P = 2 \times 10^{-4} - 0.6 \times 10^{-4} \]

\[ = 1.4 \times 10^{-4} \text{ N} \text{ (towards right i.e. in the direction of } \overrightarrow{F_R} \text{)} \]

5. \( \lambda_r > \lambda_G > \lambda_B \)

\( \beta \propto \lambda \)

\( \beta_r > \beta_G > \beta_B \)

6. \[ F \propto \frac{GM^2}{R^2} \propto \frac{(R^3)^2}{R^2} \]

\[ F \propto R^4 \]
7. At \( t = 0 \) whole current passes through capacitance; so effective resistance of circuit is \( 1000 \Omega \) and current \( i = \frac{2}{1000} = 2 \times 10^{-3} \) A = 2mA. After sufficient time, steady state is reached; then there is no current in capacitor branch; so effective resistance of circuit is \( 1000 + 1000 = 2000 \Omega \) and current \( i = \frac{2}{1000} = 1 \times 10^{-3} \) A = 1mA i.e., current is 2mA at \( t = 0 \) and with time it goes to 1mA.

8. \( \tau = MB_R \sin \theta \Rightarrow 0.032 = M \times 0.16 \times \sin 30^\circ \)
\( \Rightarrow M = 0.4 J / \text{tesla} \)

10. The series in uv region is Lyman series. Longest wavelength corresponds to minimum energy which occurs in transition from \( n = 2 \) to \( n = 1 \).
\[ \therefore 122 = \frac{1/R}{1 - \left(\frac{1}{3^2}\right)} \]

The smallest wavelength in the infrared region corresponds to maximum energy of Paschen series
\[ \lambda = \frac{1/R}{3^2 - \infty} \]

from (1) and (2) \( \lambda = 823.5 \) nm.

11. \[ g = \frac{4}{3} G \rho \pi R \]
\[ g \propto R \]

12. \[ V_Q > Q_p \]
\[ I_1 = I_2 = I/2 \]
by kirchoff’s law
\[ 20 = (3 + 2) I_1 + 1.5 I \]
\[ 20 = 5 \times \frac{1}{2} + 1.5 I \]
\[ 20 = 41 \Rightarrow I = 5 \text{ amp} \]
\[ I_1 = \frac{5}{2} = 2.5 A \Rightarrow I_2 = 2.5 A \]
\[ V_p + (2.5)3 - (2.5)2 = V_Q \]
\[ V_Q - V_p = 2.5 \text{ Volt} \]

13. Equivalent resistance of the given Wheatstone bridge circuit (balanced) is \( 3 \Omega \) so total resistance in circuit is \( R = 3 + 1 = 4 \Omega \). The emf induces in the loop \( e = Bvl \).
So induced current
\[ i = \frac{e}{R} \Rightarrow 10^{\frac{3}{2}} = \frac{2 \times \sqrt{5} \times (10 \times 10^2)}{4} \]
\[ \Rightarrow v = 2 \text{ cm/sec} \]

14. \[ i = 45^\circ \]
T.I.R. will take place for blue and green.

15. \[ E = KE + \phi \]
\[ = 10.4 + 1.7 = 12.1 \text{ eV} \]
for hydrogen atom
\[ E_1 = -13.6 \text{ eV} \]
\[ E_2 = -3.4 \text{ eV} \]
\[ E_3 = -1.5 \text{ eV} \]
and \( E_3 - E_1 = 12.1 \text{ eV} \)
so answer is \( n = 3 \) to 1

16. Required energy = \( \Delta \text{TE} \)
\[ = \frac{GMm}{2(6R)} - \frac{GMm}{2(4R)} = \frac{GMm}{24R} \]

17. \[ v \propto R \]
\[ \frac{V_{sy}}{V_6} = \frac{(3+10+6+1)}{6} = \frac{20}{6} \]
\[ \frac{V_{sy}}{48} = \frac{20}{6} = V_{sy} = 160 \text{ Volt} \]
18. Angle between normal to the plane of the coil and direction of magnetic field is $\theta = 60^o$

\[ \therefore \text{Flux linked with coil} \quad \phi = BA \cos \theta \]

\[ = 4.0 \times 0.5 \times \cos 60^o \quad \Rightarrow \phi = 1 \text{ weber} \]

19. $d$ : distance between lenses

\[ \frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2} \]

\[ P = \frac{1}{F} = 0 \]

\[ \frac{d}{f_1 f_2} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{f_2 + f_1}{f_1 f_2} \]

\[ d = f_1 + f_2 \]

21. \[ 4 \left( \frac{k(q)(-q)}{a} \right) + \frac{2k(q)(q)}{a} \sqrt{2} \]

22. \[ \begin{array}{c}
\begin{array}{c}
\hspace{1cm} \Omega
\end{array}
\end{array} \]

23. Force needed to move the rod is

\[ F = \frac{B^2 v l^2}{R} = \frac{(0.15)^2 \times 2 \times (0.5)^2}{3} \]

\[ = 3.75 \times 10^{-3} \text{N} \]

24. \[ \frac{v_i}{v_0} = -\left( \frac{f}{u-f} \right)^2 = -\left[ \frac{-24}{-60(-24)} \right]^2 \]

\[ = -\left[ \frac{-24}{36} \right]^2 = \frac{4}{9} \]

\[ \frac{v_i}{9} = -\frac{4}{9} \quad \Rightarrow v_i = -4 \text{ cm/sec} \]

26. \[ F \propto E \propto \frac{1}{r^3} \]

28. At any instant $t$ flux linked with smaller loop \[ \phi = BA \cos \omega t \] where $B = \text{magnetic field produced by larger loop at its centre} = \frac{\mu_0 i}{2x}$. So

\[ \phi = \frac{\mu_0 i A}{2x} \cos \omega t \quad \Rightarrow \frac{e}{R} = \frac{\mu_0 i \omega A}{2x} \sin \omega t \]

29. T.I.R. can occur from A to B i.e. $\mu_a > \mu_b$

B to C i.e. $\mu_b > \mu_c$

$\mu_a > \mu_b > \mu_c$

\[ \frac{1}{\sin C_1} > \frac{1}{\sin C_2} > \frac{1}{\sin C_3} \]

\[ \sin C_1 < \sin C_2 < \sin C_3 \]

\[ C_1 < C_2 < C_3 \]

30. \[ \frac{\lambda_1}{\lambda_2} = \frac{\sqrt{2mE}}{hc} \implies \frac{\lambda_1}{\lambda_2} \propto \frac{E}{\sqrt{m}} \]

Therefore, the correct option is (2).

32. \[ \frac{1}{R} = \frac{1}{10} + \frac{1}{10} = \frac{2}{10} = \frac{1}{5} \quad \text{or} \quad R_1 = 5\Omega \]

\[ R_2 = 4\Omega, \quad l_1 = 40 \text{ cm}, \quad l_2 = ? \]

\[ l_2 = l_1 \frac{R_2}{R_1} \quad \text{or} \quad l_2 = \frac{40 \times 4}{5} = 32 \text{ cm} \]

33. \[ Q_t = Q \sin \omega t \]

energy stored = \[ \frac{Q^2}{2C} \]

when this energy is stored equally between electric and magnetic field then,

\[ E_m = E = \frac{1}{2} \frac{Q^2}{2C} \]

\[ E_e = \frac{Q_t^2}{2C} = \frac{1}{2} \times \frac{Q^2}{2C} \]

\[ Q_t = \frac{Q}{\sqrt{2}} \]
34. \[ n_2 > n_1 \]

35. \( (A + B) \cdot (A - B) = 1 \)

for output 1, \((A + B)\) should be 1

\[ A + B = 1 \]

output of NOR gate is 1 only when A and B both are 0.

\[ 2400 \]

36. \[ \rho \frac{4}{3} \pi R^3 \frac{g}{mg} = Q \left( \frac{2400}{d} \right) \]

\[ \therefore m = \rho \frac{4}{3} \pi R^3, E = \frac{2400}{d} \quad \ldots(1) \]

If radius \( r = \frac{R}{2} \), charge q, P.d = 600 v ,

\[ \Rightarrow E' = \frac{600}{d} \]

Now \( m'g = qE' \Rightarrow \frac{4}{3} \pi R^3 \frac{g}{2} = q \left( \frac{600}{d} \right) \quad \ldots(2) \]

by \( (2) \div (1) \)

\[ \frac{1}{8} = \frac{q}{4Q} \Rightarrow q = \frac{Q}{2} \]

37. Since the force on the rod CD is non-uniform it will experience force and torque. From the left hand side it can be seen that the force will be upward and torque is clockwise.

38. \( V_L = V_C \Rightarrow X_L = X_C \)

\[ i_{\text{max}} = \frac{V}{R} \]

If R is halved than current will be doubled.

so \( V_L = V_C = 2(10) = 20V \)

\[ V_R = I'R^2 = 2I \times \frac{R}{2} = IR = V_R = 10V \]

40. \( \alpha = \frac{\Delta I_c}{\Delta I_e} \). Here \( \Delta I_e = 5.00 A, \alpha = 0.98 \)

41. \( PE_A + KE_A = PE_B + KE_B \)

\[ qV_A + \frac{1}{2} mV_A^2 = qV_B + \frac{1}{2} mV_B^2 \]

\[ V_A^2 = \frac{2}{m} \left[ \frac{1}{2} mV_B^2 - qV_A \right] \]

42. By using right hand thumb rule or any other rule which helps to determine the direction of magnetic field.

43. \[ Q = \frac{\text{orL}}{R} = \frac{1}{\sqrt{1 + \frac{C}{R}}} \]

\[ Q = \frac{1}{\sqrt{\frac{9}{3}}} = \frac{1}{9} \]

45. Since \( I_E = I_B + I_C \). Therefore \( I_B = I_E - I_C \)

Here, \( I_E = 10 \frac{mA}{0.9} \approx 11A \)

46. \[ \text{C}_2\text{H}_5\text{CH} - \text{C}_2\text{H}_5 \Rightarrow \text{CH}_2\text{CH} = \text{CH} - \text{CH} = \text{CH}_2\text{CH} \]

48. Dehydration \( \xrightarrow{\text{stable product}} \)

50. It has no plane of symmetry

\[ \text{en} \quad \text{NH}_3 \]

\[ \text{en} \quad \text{NH}_3 \]

do not contain plane of symmetry
52. CH₃CH₂–NH–CH₂CH₃ → HNO₂ → N=O
   CH₃CH₂–N–CH₂CH₃
   [Nitrosoamine]
53. \[
\begin{array}{c}
\text{CH₃} \\
\text{O} \\
\text{Br} \\
\text{+ HO⁻} \text{Br}⁻
\end{array}
\rightarrow
\begin{array}{c}
\text{CH₃} \\
\text{O} \\
\text{Br} \\
\text{CH₃OH}
\end{array}
\]
54. NCERT XII / Part II / Pg.# 418, 422, 414
55. \[
\frac{d[O_2]}{dt} = \frac{9}{6} \frac{d[CO_2]}{dt}
\]
56. Iˢᵗ has POS, but II & III doesn’t have symmetry
57. NCERT XIIᵦ / part II / Pg.# 435
58. Reaction is not at chiral carbon
59. Nitrobenzene doesn’t perform F.C.R
60. \[
\text{A}_{\text{abs}} = \frac{K \times 1000}{N}
\]
61. NCERT XI / part II / Pg.# 408
62. Ph–C≡C–Me → Ph–C = C–Me
63. Ph–C≡C–Me (in D₂O/Hg²⁺) → Ph–C = C–Me
64. NCERT XII / part II / Pg.# 359
65. HNO₃ → NH₃ : V.f. of HNO₃ = 8
67. NCERT XII / Part II / Pg.# 286
68. PhMgBr + CH₃CH₃ → Ph–CH₃–CH₂OMg Br
69. Decarboxylation
70. 2e⁻ + S⁴⁺ → S⁴⁺
   2I⁻ → I₂ + 2e⁻