1. Magnetic flux $\Phi = BA\cos \theta$ for the top surface, the angle between normal to the surface and the $x$-axis is $\theta = 60^\circ$.

$\therefore \Phi = 0.2 \times (10 \times 10^{-4}) \times \cos 60^\circ = 10^{-3}\, \text{wb}$

2. (1) Equation $x = x_0 \sin \omega t$

rms value $= \frac{x_0}{\sqrt{2}}$

(2) Equation $x = x_0 \sin \cos \omega t$

$x = \frac{x_0}{2} \sin 2 \omega t$

rms value $= \frac{x_0}{\sqrt{2}} = \frac{x_0}{2\sqrt{2}}$

3. Glass-water: $\mu_g \sin i = \mu_w \sin r$

Water - air: $\mu_w \sin r = \mu_a \sin 90^\circ$

$\mu_g \sin i = \mu_w \sin 90^\circ = 1$

$\mu_a = 1/\sin i$

4. In 10 years the number of undecayed particles will be $N_0/4$. That is number of decayed particles will be $3N_0/4$. Hence probability of decay will be $75\%$.
6. Given \( B = 0.01 - 2t \) Tesla; \( \frac{dB}{dt} = -2\) Tesla/sec.

Induced emf
\[
e = -A \frac{dB}{dt} = -\frac{1}{2}(1^2) \times (-2)
\]
\[\Rightarrow e = 1\] V

Since magnetic field (∝) decreasing so according to Lenz’s law direction of induced current in upper part of square will be clockwise i.e. from A to C or in other words emf induces in a direction opposite to the main emf so resultant emf = 10 – 1 = 9 V.

![Diagram of square with magnetic field lines](image)

7. r.m.s. value of wattless current = \( \frac{i_0}{\sqrt{2}} \sin \phi \)

In this question \( i_0 = 1\) A and \( \phi = \frac{\pi}{2} \). So r.m.s. value of wattless current = \( \frac{1}{\sqrt{2}} \) A

8. \( u = -9 \) cm, \( f = 10 \) cm

\[
\frac{1}{v} - \frac{1}{u} = \frac{1}{v} - \frac{1}{-9} = \frac{1}{10}
\]
\[
\Rightarrow \frac{v}{10} = \frac{9}{90}
\]
\[
v = -90\] cm

\[
m = \frac{v}{u} = \frac{-90}{-9} = 10
\]

\[
\frac{A_1}{A_0} = m^2 \Rightarrow \frac{A_1}{1} = (10)^2
\]
\[A_1 = 100\] mm² = 1 cm²

9. Einstein’s photoelectric equation is

\[
\frac{hc}{\lambda} = eV_0 + W \quad \text{......(1)}
\]

According to given conditions

\[
\frac{hc}{\lambda} = e(5V_0) + W \quad \text{......(2)}
\]

and

\[
\frac{hc}{2\lambda} = eV_0 + W \quad \text{......(3)}
\]

From (2) and (3), we get

\[
\frac{5hc}{2\lambda} - \frac{hc}{\lambda} = 5W - W
\]

or

\[
4W = \frac{3hc}{2\lambda}
\]

or

\[
W = \frac{3hc}{8\lambda}
\]

or

\[
\frac{hc}{\lambda_0} = \frac{3hc}{8\lambda}
\]

\[
\Rightarrow \lambda_0 = \frac{8}{3}\lambda
\]

10. Energy of γ-ray photon

\[2 \times 0.5\text{ MeV} + 0.78\text{ meV} = 1.78\text{ MeV}\]

11. \( Q = CV = C(Bvl) = 10 \times 10^{-6} \times 4 \times 2 \times 1 = 80\) μC

According to Fleming’s right hand rule induced current flows from \( Q \) to \( P \). Hence \( P \) is at higher potential and \( Q \) is at lower potential. Therefore \( A \) is positively charged and \( B \) is negatively charged.

![Diagram of charged plates](image)

12. With dc:

\[P = \frac{V^2}{R} \Rightarrow R = \frac{(10)^2}{20} = 5\Omega;\]

With ac:

\[P = \frac{V_m^2 R}{Z^2} \Rightarrow Z^2 = \frac{(10)^2 \times 5}{10} = 50\Omega\]

Also

\[Z^2 = R^2 + 4\pi^2 v^2 L^2 \Rightarrow 50\]

\[= (5)^2 + 4(3.14)^2 v^2 (10 \times 10^{-3})^2\]

\[\Rightarrow v = 80\text{Hz}.\]
13. \( \text{R.P.} = \frac{a}{1.22\lambda} \)

14. The work function has no effect on current so long it has \( hv > W \). The photoelectric current is proportional to the intensity of light. Since, there is no change in the intensity of light, therefore \( I_1 = I_2 \).

15. \( D_1 \) is in reverse bias, \( D_2, D_3 \) in forward bias.

\[
\begin{align*}
R_{eq} &= \frac{10 \times 20}{10 + 20} = \frac{20}{3} \\
i &= \frac{10}{20/3} = 1.5A
\end{align*}
\]

16. By using \( i = \frac{e}{R} = -\frac{1}{R} \frac{d\phi}{dt} \)

\[
i = -\frac{1}{10} \frac{d}{dt} (6t^2 - 5t + 1) = -\frac{1}{10} (12t - 5)
\]

\[
i = -\frac{1}{10} (12 \times 0.25 - 5) = 0.2A
\]

18. \( m = -5 = \frac{f_o}{f_e} \Rightarrow f_o = 5f_e \),

\[
L = f_o + f_e = 36
\]

\[
6f_e = 36 \Rightarrow f_e = 6 \text{ cm}, \quad f_o = 5f_e = 30 \text{ cm}
\]

19. Stopping potential depends on the wavelength of the radiation and does not change with distance between the source and the photoelectric cell. Intensity of illumination varies inversely as the square of distance.

Therefore \( I = 18.0 \times \left( \frac{0.2}{0.6} \right)^2 \text{ mA} = 2.0 \text{ mA} \)

20. Peak input current \( i = \frac{0.01}{1 \times 10^3} = 1 \times 10^{-5} \text{ A} \).

Now, \( \beta = \frac{\text{output current}}{\text{input current}} \)

so, output current = \( \beta \times \text{input current} \)

= \( 50 \times 10^{-5} \text{ A} \)

= \( 500 \times 10^{-6} \text{ A} = 500 \mu\text{A} \).

21. The direction of current in the solenoid is anticlockwise as seen by observer. On displacing it towards the loop a current in the loop will be induced in a direction so as to oppose the approach of solenoid. Therefore the direction of induced current as observed by the observer will be clockwise.

22. \( I_D = \frac{dq}{dt} = \frac{d}{dt} (VC) = C \frac{dV}{dt} \)

Here \( I_D = 1 \text{ A}, \quad C = 2 \times 10^{-6} \text{ F} \)

23. \( a_2 = 4 \mu\text{m} \)

\( a_1 = 7 \mu\text{m} \)

\( a_3 = 10 \mu\text{m} \)

Resultant amplitude \( A = \sqrt{(3)^2 + (4)^2} = 5 \mu\text{m} \)

24. Intensity of radiation will be halved every 2 hours.

After 12 hours it will be reduced by a factor of \( (2)^6 = 64 \). It will reach the safe level.

26. \( L_2 \) and \( L_3 \) are in parallel. Thus their combination gives \( L' = \frac{L_2 L_3}{L_2 + L_3} = 0.25 \text{H} \)

The \( L' \) and \( L_1 \) are in series, thus the equivalent inductance is \( L = L_1 + L' = 0.75 + 0.25 = 1 \text{H} \).
27. Wavelength of light

\[ \lambda \text{ in } X = \frac{\lambda}{1.5}, \text{ in } Y = \frac{\lambda}{\mu}, \text{ in } Z = \frac{\lambda}{1.6} \]

\( \lambda \) is wavelength in air

Number of wavelengths in \( X = \) number of wavelengths in \( Y + \) number of wavelengths in \( Z \)

\[ t = \frac{t}{3} + \frac{2t}{3} = \frac{\lambda}{\mu} + \frac{\lambda}{1.6} \]

\[ 1.5 = \frac{\mu}{3} + \frac{3.2}{3} \]

\[ \Rightarrow \frac{\mu}{3} = 1.5 - \frac{3.2}{3} = \frac{1.3}{3} \Rightarrow \mu = 1.3 \]

28. \( I = I_0 \cos^2 \theta \)

\( I_0 \) : Intensity of plane polarised light

\( I \) : Intensity of transmitted light

\( \theta \) : Angle between transmission axes of polariser and analyser

\( \theta = 0^\circ, I = I_0 \)

\( \theta = 90^\circ, I = 0 \)

29. \( \alpha \)-decay decreases the mass number by 4 and atomic number by 2. The \( \beta \)-decay increases the atomic number by 1. In \( \gamma \)-decay, there is no change in atomic as well as mass number.

30. | A | B | Y |
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AND gate

31. At position Q velocity of bob is \( \sqrt{2gl} \) so Ansis velocity of image wr to bob is \( \sqrt{2gl} + \sqrt{2gl} = 2\sqrt{2gl} \)

32. \( E_3 = E_1 + E_2 \)

\[ hv_3 = hv_1 + hv_2 \Rightarrow \frac{1}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2} \]

or \( \lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2} \)

33. Since final rays are parallel to principal axis i.e. image by lens is formed at centre of curvature at mirror.

\( d = 2f_1 + f_2 \)

34. \( \delta (A - 1) \Rightarrow y = (x - 1) A = x A - A \)

Comparing with \( y = mx + C \)

Slope : \( m = A \)

36. \( i_L = 5A \)

\( i_C = 2A \)

\( i_{LC} = I_L - I_C = 3A \)

\( X_{LC} = \frac{\lambda_{LC}}{I_{LC}} = \frac{75}{3} = 25\Omega \)

37. Binding energy per nucleon for helium

\[ = \frac{28}{4} = 7 \text{ MeV} \]

38. \( d = 0.1 \text{ mm} = 10^{-4} \text{ m}, D = 1.2 \text{ m}, \)

\( \beta = 6 \text{ mm} = 6 \times 10^{-3} \text{ m} \)

\[ \beta = \frac{D \lambda}{d} \]

\[ 6 \times 10^{-3} = \frac{1.2 \times \lambda}{10^{-4}} \Rightarrow \lambda = 5 \times 10^{-7} \text{ m} = 5000 \text{ Å} \]

39. 1 amu = 931 MeV.

Hence \( 0.0303 \text{ amu} = 0.0303 \times 931 \text{ MeV} \)

\[ = 28.2 \text{ MeV} \approx 28 \text{ MeV}. \]

40. \( \frac{\lambda}{4} = 100 \text{ m} \Rightarrow \lambda = 400 \text{ m} \)

41. As current flows in a single direction, the device allows current only during positive half cycle only

\[ \therefore \frac{i_{ms}}{2} = \frac{V_0}{2R} = \frac{150}{2 \times 20} = 3.75 \text{ A.} \]
43. \[ I = 4I \cos^2 \left( \frac{\phi}{2} \right) = I_m \cos^2 \left( \frac{\phi}{2} \right) \]
\[ \frac{I_m}{4} = I_m \cos^2 \left( \frac{\phi}{2} \right) \Rightarrow \frac{1}{4} = \cos^2 \left( \frac{\phi}{2} \right) \]
\[ \cos \left( \frac{\phi}{2} \right) = \frac{1}{2} = \cos \left( \frac{\pi}{3} \right) \]
\[ \phi = \frac{2\pi}{3} \]
\[ \phi = \frac{2\pi}{\lambda} \Delta x = \frac{2\pi}{\lambda} (d \sin \theta) = \frac{2\pi}{3} \]
\[ \sin \theta = \frac{\lambda}{3d} \Rightarrow \theta = \sin^{-1} \left( \frac{\lambda}{3d} \right) \]

44. Nuclear radius \( r \propto A^{1/3} \)
Hence \( A \propto r^4 \). Since density = Mass/Volume
Mass \( \propto A \). Also volume \( \propto r^3 \).
Hence Mass/volume = constant.

46. nN≡C–CH=CH\textsubscript{2} \rightarrow \text{Polymerisation} \rightarrow \text{orlon}

47. NCERT-XII/Part-II/Page-430
48. NCERT-XII/Part-II/Page-448
49. Poling process is used when metal contains impurity of metal oxide.

50. \( N_2 \rightarrow NH_3 \)

51. During vulcanization of rubber, natural rubber is heated with sulphur and sum other additive to increase cross linking.
NCERT-XII/Part-II/Page-434

52. Structure of the drug Paracetamol is

53. \([\text{Ni(CO)}\text{\textsubscript{4}}]\) \text{sp}^3 hybridisation tetrahedral.

54. \( \Delta S = \Theta ve, \quad \Delta H = \Theta ve \)

55. \( 6H^+ + 5X^- + XO_3^{2-} \rightarrow 3X_2 + 3H_2O \)

56. Nylon 6, 6 has amide linkage.

57. NCERT-XII/Part-II/Page-451

58. \( NH_4^+ \) ion does not have any lone pair, so not used as ligand.

59. \( Fe^{3+} \) ion, according to Hardy – Schulze law.

60. (i) \( 2C^{-2} \rightarrow 2C^{-1} + 2e^- \), \( E_\alpha = \frac{M}{2} \)

(ii) Basicity (n) = 1, \( E_\alpha = \frac{M}{1} \)

61. NCERT-XII/Part-II/Page-425

62. Glucose and fructose are functional group isomers of each other

63. \([\text{NiCl}_\text{4}^-]\) have 2 unpaired electron, so magnetic moment will be 2.82 B.M.

64. \( R = K[\text{RCI}] \cdot [\text{H}_2\text{O}]^0 \)

65. \( E_{\text{cell}} = E_{\text{cell}}^0 = \frac{0.0591}{2} \log_{10} \left[ \frac{\text{[Zn]}^{2+}}{\text{[Cu]}^{2+}} \right] \)

66. NCERT-XI/Part-II/Page-409

67. Meso form is not possible in glucose due to absence of plane of symmetry.

68. cis isomer do not have plane of symmetry and will show optical isomerism.

69. \( kt = 2.303 \log \frac{a}{a-x} \)

70. Only C reduces \( H^+ \) therefore element A, B and D are below in E.C.S. than hydrogen
\( \Rightarrow \) A reduces only ion of D therefor it’s position in E.C.S. is above than D.
\( \Rightarrow \) Increasing order of SRP \( \rightarrow C < H < B < A < D \)

71. NCERT-XI/Part-II/Page-400
72. NCERT-XII/Part-II/Page-414

73. Due to strong field ligand CFSE increases.

74. In this reaction :
Intermediates \( \Rightarrow \) \( N_2O_2 \) and \( N_2O \)

75. \( k = \frac{1}{\rho} \)
\[ \Lambda_m = \frac{k \times 1000}{M} \]
76. NCERT-XI/Part-II/Page-403
77. NCERT-XII/Part-II/Page-418
79. \( r = k(A_2)^x (B)^y \)
80. \( \alpha = \frac{\Lambda_m}{\Lambda_m} \times \frac{C\alpha^2}{1 - \alpha} \)
81. NCERT-XI/Part-II/Page-407
82. It is test of amide linkage.
83. \([\text{Ca(EDTA)}^{-2}] \) complex compound form.
84. \( A_t = A_0 - kt \)
\( 0.5 = A_0 - 2 \times 10^{-2} \times 25 \)
87. In froth flotation NaCN is used as depressant.
88. Mg is obtain by electrolysis of molten solution of \( \text{MgCl}_2 \).
89. \( \text{kt}_{1/4} = 2.303 \log_{10} \frac{a}{3a/4} \)
91. NCERT XII Pg.# 152
93. NCERT XII Pg.# 159
95. NCERT Pg# 224
101. NCERT XII Pg.# 159
102. NCERT XII Pg.# 150
103. NCERT XII Pg.# 154
105. NCERT Pg# 226
111. NCERT XII Pg.# 157
121. NCERT XII Pg.# 153
141. NCERT XII Pg.# 148
142. NCERT XII Pg.# 148
152. NCERT XII Pg.# 159
162. Explanation: CXCR4 and CCR5 act as coreceptor in HIV entry in addition to interaction of CD4 with gp 120.
CD4 की gp 120 की त्रिज के अलार हायसिर4 के और CCR5 में ग्रहण करते है। हिस्से को कैसे बदलता है।
171. NCERT XII Pg.# 154
172. NCERT XII Pg.# 149
174. NCERT Pg.# 221