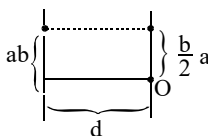


Section - I

1. (b) For given velocity range will be maximum if $\sin 2\theta$ is maximum. i.e. 1. So $|45^\circ - \theta|$ is least.
2. (d) $I = \frac{1}{4} mR^2$
 or, $mR^2 = 4I$
 Moment of inertia about tangent parallel to diameter is
 $I' = I_{CM} + mR^2 = \frac{1}{4} mR^2 + mR^2 = \frac{5}{4} mR^2$
 $= 5I$
3. (a) $\frac{\rho gh}{2} \times 2\pi rh = \pi r^2 \times \rho gh$
 or, $h = r$
4. (b) Boiling point decreases if pressure of atmosphere above water decreases.
5. (a) In adiabatic process $dQ = 0$ so $d\omega = du$, in compression $d\omega$ is negative so du is positive so temperature rises.
6. (c) $\frac{I_{\max}}{I_{\min}} = \left(\frac{a_1 + a_2}{a_1 - a_2}\right)^2 = \left(\frac{5+3}{5-3}\right)^2 = 16:1$
7. (c) 2nd overtone = 3rd harmonics
 $= 3$ loops
 No. of antinodes = No of loops = 3
 No. of nodes = No of antinodes + 1 = 4
8. (a) Force on each is $F = \frac{KQ_1Q_2}{r^2}$ remain same.
9. (c) Total electric flux = $\frac{Q}{\epsilon_0}$
 There are 6 sides in cube so flux through each face is
 flux through a face = $\frac{Q}{6\epsilon_0}$
10. (b) $I = \frac{E}{R + \frac{r}{2}} = \frac{2E}{R + 2r}$
 or, $\frac{1}{3 + \frac{r}{2}} = \frac{2}{3 + 2r}$
 or, $3 + 2r = 6 + r$
 or, $r = 3\Omega$
11. (d) $I = v n A = v' n A'$
 or, $v \times \pi r^2 = v' \times \pi (2r)^2$
 or, $v' = \frac{v}{4}$
12. (c) $P_s = 2R, R_p = \frac{R}{2}$
 $\frac{P_s}{P_p} = \frac{I^2 R_s}{I^2 R_p} = \frac{2R}{\frac{R}{2}} \times 2 = 4 : 1$
13. (c) $T = 2\pi \sqrt{\frac{I}{MH}} = 2 \dots (1)$
 Again $T' = 2\pi \sqrt{\frac{I}{4MH}} = \frac{T}{2} = 1s$
14. (c) Frequency of light doesnot change while passing from one medium to another medium.
15. (b) $\frac{X}{D} = \frac{\lambda}{d}$
 or, $x = \frac{D\lambda}{d}$
 $\lambda_r > \lambda_b$ so diffraction band come closer.
16. (b) Photo electric current depends on intensity of incident radiation which is directly proportional to area of lens.
 $\frac{I'}{I} = \frac{A'}{A} = \frac{\pi \left(\frac{d}{2}\right)^2}{4 \times \frac{\pi d^2}{4}} = \frac{1}{4}$
 $\therefore I' = \frac{I}{4}$
17. (d) $V_{in} = I_b R_{in}$
 or, $I_b = \frac{0.01}{1000} = 10 \times 10^{-6} A$
 Again $\beta = \frac{I_c}{I_b}$
 $I_c = 50 \times 10 \times 10^{-6}$
 $= 500 \mu A$
18. (c)
19. (d)
20. (d) $AgNO_3 + NaOH \rightarrow Ag_2O + NaNO_3 + H_2O$
 $Ag_2O + NaNO_3 + NH_3 + H_2O \rightarrow [Ag(NH_3)_2]NO_3 + NaOH$
 $HCHO + [Ag(NH_3)_2]NO_3 \rightarrow Ag\downarrow$
21. (b)
22. (b)
23. (a)
24. (c)
25. (c)
26. (d)
27. (d)
28. (b)
29. (a) $\sin(\cos^{-1}x)$
 $= \sin\left(\frac{\pi}{2} - \sin^{-1}x\right) = \cos(\sin^{-1}x)$
30. (a) Putting $x = 1$
 $P^2 - 2P + 1 = 0$
 $(P - 1)^2 = 0$
 $P = 1$
31. (b) Total no. of arrangements
 $= \frac{n!}{p!.q!.r!} = \frac{11!}{2!.3!.2!}$

32. (c) $t_n = 3 \cdot (2^n)$
 $t_1 = 3 \cdot 2^1 = 6$
 $t_2 = 3 \cdot 2^2 = 12$
 $r = \frac{12}{6} = 2$
33. (c) $A = I$
 $A^2 = (I)^2 = I$
 $A^2 + 2A = I + 2I = 3A$
34. (b) $\sqrt{2}i = \sqrt{1^2 + 2 \cdot 1 \cdot i + i^2} = \sqrt{(1+i)^2} = \pm(1+i)$
35. (c) $\frac{a}{d} = \frac{b}{e}$
 $\boxed{ac = bd}$
36. (c) It is obvious
37. (c) $\vec{a} \cdot \vec{b} = 0$
 $2\lambda - 4.5 + 2.7 = 0$
 $\lambda = 3$
38. (b) Using L-Hospital's rule:
 $\lim_{x \rightarrow 0} \frac{\cos\theta + \theta \sin x}{1 - 0} = \cos\theta + \theta \sin\theta$
39. (a) Since the integrand is odd function, $\int_{-1}^1 \sin^3 x \cos^2 x \, dx = 0$
40. (c) Put $e^x + 1 = t$
 $\Rightarrow e^x \, dx = dt$
 $\therefore \int \frac{e^x \, dx}{e^x + 1} = \int \frac{dt}{t} = \ln t + c = \ln(e^x + 1) + c$
41. (d) $dr = 5.1 - 5 = 0.1$
 Approximate change in area $= dA = \frac{dA}{dr} \cdot dr$
 $= 2\pi r \cdot dr$
 $= 2\pi \times 5 \times 0.1$
 $= \pi \, \text{cm}^2$
42. (a) $\left(\frac{1}{2}\right)^2 + \left(\frac{1}{3}\right)^2 + n^2 = 1$ [$\because l^2 + m^2 + n^2 = 1$]
 $\Rightarrow n = \frac{\sqrt{23}}{6}$
43. (c) $\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix} = 0 \Rightarrow abc + 2 = a + b + c$
44. (b) Formula
45. (a) Formula
46. (b) $a^2 = 9, b^2 = 16$
 Length of latus rectum $= \frac{2b^2}{a} = \frac{2 \times 16}{3} = \frac{32}{3}$
47. (b) Formula
48. (c) Length of perpendicular
 $= \left| \frac{3 \times 2 - 4 \times 3 + 5 \times 4 + 2}{\sqrt{3^2 + (-4)^2 + 5^2}} \right| = \frac{8\sqrt{2}}{5}$
49. (d) 50. (b) 51. (c) 52. (a) 53. (c) 54. (b)
 55. (b) 56. (a) 57. (a) 58. (b) 59. (b) 60. (b)

Section - II

61. (b) $a_t = 2m/s^2$
 $a_c = \frac{v^2}{r} = \frac{30^2}{500} = \frac{9}{5} = 1.8 \, \text{m/s}^2$
 $\therefore a = \sqrt{a_c^2 + a_t^2} = \sqrt{1.8^2 + 2^2} = 2.7 \, \text{m/s}^2$
62. (c) $2t_s = t_r$
 or, $2\sqrt{\frac{2l}{g \sin\theta}} = \sqrt{\frac{2l}{g \sin\theta - \mu g \cos\theta}}$
 or, $\frac{4}{\sin\theta} = \frac{1}{\sin\theta - \mu \cos\theta}$
 or, $4\sin\theta - 4\mu \cos\theta = \sin\theta$
 or, $4\mu \cos\theta = 3\sin\theta$
 or, $\mu = \frac{3}{4} \tan\theta = 0.75$
63. (a) Change in wt = change in upthrust
 or, $200 = (l^2 \times 2) \times 1$
 or, $l = 10 \, \text{cm}$
64. (c) Gain in time in day $= \frac{1}{2} \alpha \Delta\theta \times 1 \, \text{day}$
 or, $\alpha = \frac{8.6 \times 2}{10 \times 86400} = 2 \times 10^{-5} / ^\circ\text{C}$
65. (c) $Q = \frac{kA d \theta}{2l} \times t_1 = \frac{k2A d \theta}{l} \times t_2$
 or, $\frac{t_1}{2} = 2t_2$
 or, $t_2 = \frac{12}{4} = 3 \, \text{S}$
66. (d) $f_0 + f_c = 22.5 \dots (1)$
 And $m = \frac{f_0}{f_c}$
 or, $f_0 = 8f_c \dots (2)$
 Now $8f_c + f_c = 22.5$
 or, $f_c = \frac{22.5}{9} = 2.5 \, \text{cm}$
 & $f_0 = 8 \times 2.5 = 20 \, \text{cm}$
67. (a) 
 Path difference $= \frac{bb}{2d} = \frac{b^2}{2d}$
 For missing wavelength
 $\frac{b^2}{2d} = \frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}$
 or, $\lambda = \frac{b^2}{d}, \frac{b^2}{3d}, \frac{b^2}{5d}$
68. (b) $\frac{f'}{f} = \frac{c + v_p}{c - v_p}$

$$\text{or, } \frac{780 \times 10^6 + 2.6 \times 10^3}{780 \times 10^6} = \frac{c + v_p}{c - v_p}$$

$$\text{or, } 1.00000333 = \frac{c + v_p}{c - v_p}$$

$$\text{or, } 1.00000333c - 1.00000333 v_p = c + v_p$$

$$\text{or, } v_p = \frac{999}{2.00000666}$$

69. (d) $C_s = \frac{C_1 C_2}{C_1 + C_2} = \frac{3 \times 6}{3 + 6} = \frac{3 \times 6}{9} = 2 \mu\text{F}$

$$Q = C_s \times V = 2 \times 10^{-6} \times 120$$

$$= 2.4 \times 10^{-4} \text{C}$$

Again $Q = C_1 V_1$

$$\text{or, } V_1 = \frac{2.4 \times 10^{-4}}{3 \times 10^{-6}} = 80 \text{V}$$

70. (c) $I_g = \frac{12}{R_T} = \frac{12}{(1150 + 50)} = 0.01 \text{ A}$

$$S = \frac{I_g G}{I - I_g} = \frac{0.01 \times 50}{2 - 0.01} = 0.251 \Omega$$

71. (a) $E = B a f$

$$= B \pi l^2 \frac{\omega}{2\pi}$$

$$= 0.5 \times 1^2 \times \frac{2}{2}$$

$$= 0.5 \text{ V}$$

72. (c) For max. current $X_L = X_C$

$$\text{or, } 2\pi f L = \frac{1}{2\pi f C}$$

$$\text{or, } C = \frac{1}{4\pi^2 f^2 L}$$

$$= \frac{1}{4\pi^2 (2 \times 10^3)^2 \times 100 \times 10^{-3}}$$

$$= 63 \times 10^{-9} \text{ F}$$

$$= 63 \text{ nF}$$

73. (d) $\frac{hc}{\lambda} = \phi + \text{KE}$

$$\text{or, } \frac{hc}{\lambda} = \phi + \frac{1}{2} m v^2$$

$$\text{or, } v = \sqrt{\frac{2}{m} \left(\frac{hc}{\lambda} - \phi \right)}$$

$$= \sqrt{\frac{2}{9.1 \times 10^{-31}} \left(\frac{6.62 \times 10^{-34} \times 3 \times 10^8}{4500 \times 10^{-10}} - 2 \times 1.6 \times 10^{-19} \right)}$$

$$= 5.16 \times 10^5 \text{ m/s}$$

$$\text{Again, } B e v = \frac{m v^2}{r}$$

$$\text{or, } B = \frac{v}{\frac{e}{m} r} = \frac{5.16 \times 10^5}{1.8 \times 10^{11} \times 0.2}$$

$$= 1.43 \times 10^{-5} \text{ T}$$

74. (b) $\frac{C}{C_0} = \left(\frac{1}{2} \right)^{\frac{t}{T_{1/2}}}$

$$\text{or, } C = 360 \left(\frac{1}{2} \right)^{\frac{1.5}{0.5}}$$

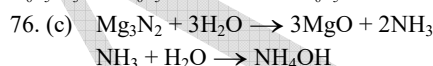
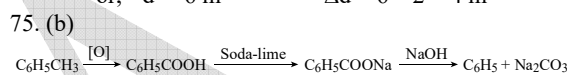
$$= 45 \text{ counts/s}$$

Again, $\frac{C}{C_0} = \left(\frac{d'}{d} \right)^2$

$$\text{or, } \frac{45}{5} = \left(\frac{d'}{2} \right)^2$$

$$\text{or, } \frac{d'}{2} = 3$$

$$\text{or, } d' = 6 \text{ m} \quad \Delta d = 6 - 2 = 4 \text{ m}$$



78. (c) $\text{Wt. of metal} = 74.5 - 35.5 = 39$

$$\frac{\text{Wt. of metal}}{\text{EW of metal}} = \frac{\text{Wt. of chlorine}}{\text{EW of chlorine}}$$

$$\frac{39}{x} = \frac{35.5}{35.5}$$

$$x = 39$$

79. (a) $\begin{matrix} 3 & 3 & 3 & 3 \\ \text{P}^3 & \text{S}^{2-} & \text{Cl}^- & \text{K}^+ \end{matrix} \rightarrow \text{No. of shells}$

$$\frac{P^+}{e^-} = \frac{15}{18} \quad \frac{16}{18} \quad \frac{17}{18} \quad \frac{19}{18}$$

If the number of shells are same the size of ion is inversely proportional to $\frac{P^+}{e^-}$ ratio.

80. (d) $V^{3+} = 23 - 3 = 20 = [\text{Ar}] 3d^2 = \text{Two unpaired electrons}$

$\text{Cr}^{3+} = 24 - 3 = 21 = [\text{Ar}] 3d^3 = \text{Three unpaired electrons}$

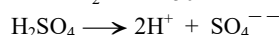
$\text{Co}^{3+} = 27 - 3 = 24 = [\text{Ar}] 3d^6 = \text{Four unpaired electrons}$

$\text{Fe}^{3+} = 26 - 3 = 23 = [\text{Ar}] 3d^5 = \text{Five unpaired electrons}$

Higher the number of unpaired electron higher will be magnetic moment.

81. (b) $V_1 N_1 = V_2 N_2$

$$N_2 = \frac{V_1 N_1}{V_2} = \frac{2.5 \times 12}{250} = 0.12 \text{ N} = 0.06 \text{ M}$$



$$\begin{matrix} 0.06 & 0 & 0 \\ 0 & 2 \times 0.06 & 0.06 \end{matrix}$$

$$\text{H}^+ = 0.12 \text{ M}$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+] = -\log[0.12] = 0.92$$

$$82. (c) \int \left(1 + \frac{1}{x}\right) (x + \log x)^3 dx$$

$$\int f^n(x) f'(x) dx = \frac{f^{n+1}}{n+1} + c$$

$$= \frac{(x + \log x)^4}{4} + c$$

83. (b) Obvious

84. (c) Squaring: $x^2 = 16 - y^2$

$$x^2 \geq 0$$

$$16 - y^2 \geq 0$$

$$y^2 \leq 16$$

$$\text{i.e. } 0 \leq y \leq 4$$

$$85. (d) \frac{2}{6} = \frac{3}{\alpha} = \frac{1}{\beta}$$

$$\alpha = 9$$

$$\beta = 3$$

$$86. (d) \frac{\frac{1}{2}(e + e^{-1})}{\frac{1}{2}(e - e^{-1})} = \frac{e^2 + 1}{e^2 - 1}$$

87. (d) 4th term from end = $(8 - 4 + 2)$

i.e. 6th term from beginning.

$$t_6 = t_{5+1} = {}^8C_5 \left(\frac{x}{2}\right)^{8-5} \left(-\frac{2}{x}\right)^5 = {}^8C_5 \cdot \frac{x^3}{2^3} \cdot \frac{(-2)^5}{x^5}$$

$$= {}^8C_5 \frac{2^2}{x^2}$$

$$88. (c) t_n = \frac{2 + 4 + 6 + \dots \text{ to } n \text{ terms}}{n!}$$

$$= \frac{n(n+1)}{n!} = \frac{n+1}{(n-1)!} = \frac{n-1+2}{(n-1)!} = \frac{1}{(n-2)!} + \frac{2}{(n-1)!}$$

$$S_\infty = \sum t_n = \sum \frac{1}{(n-2)!} + \sum \frac{2}{(n-1)!} = e + 2e = 3e$$

89. (c) Let t be the radian measure of the angle whose degree measure is θ° .

$$\text{So, } t = \frac{\pi\theta}{180} \text{ and } \theta^\circ = \frac{180t}{\pi}. \text{ When } \theta^\circ \rightarrow 0, t \rightarrow 0$$

$$\text{Now, } \lim_{\theta^\circ \rightarrow 0} \frac{\sin \theta^\circ}{\theta^\circ} = \lim_{t \rightarrow 0} \frac{\sin t}{\frac{180t}{\pi}}$$

$$= \frac{\pi}{180} \lim_{t \rightarrow 0} \frac{\sin t}{t} = \frac{\pi}{180}$$

$$90. (a) y = \tan^{-1} \left(\frac{1 + \cos x}{1 - \cos x} \right)^{1/2}$$

$$= \tan^{-1} \left(\cot \frac{x}{2} \right) = \tan^{-1} \left(\tan \left(\frac{\pi}{2} - \frac{x}{2} \right) \right) = \frac{\pi}{2} - \frac{x}{2}$$

$$\therefore \frac{dy}{dx} = -\frac{1}{2}$$

$$91. (c) \text{ Put } x = \tan \theta \Rightarrow dx = \sec^2 \theta d\theta$$

$$I = \int e^\theta \left(\frac{1 + \tan \theta + \tan^2 \theta}{1 + \tan^2 \theta} \right) \sec^2 \theta d\theta$$

$$= \int e^\theta (\tan \theta + \sec^2 \theta) d\theta = e^\theta \tan \theta + c$$

$$= x e^{\tan^{-1} x} + c$$

$$92. (b) f(x) = x^3 + \alpha x^2 + \beta x + 1$$

$$f'(x) = 3x^2 + 2\alpha x + \beta$$

Here, 0 & 1 are stationary points.

$$\text{So, } f'(0) = 0 \Rightarrow \beta = 0$$

$$\& \quad f'(1) = 0 \Rightarrow 3 + 2\alpha = 0$$

$$\Rightarrow \alpha = -\frac{3}{2}$$

$$93. (a) \text{ Area} = \int_1^e y dx = \int_1^e \ln x dx = [x \ln x - x]_1^e$$

$$= (e \ln e - e) - (0 - 1) = 1$$

94. (b) For concurrent lines, we have

$$\begin{vmatrix} 1 & 0 & q \\ 0 & 1 & -2 \\ 3 & 2 & 5 \end{vmatrix} = 0$$

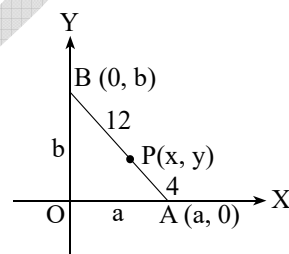
$$\Rightarrow 1(5 + 4) - 0 + q(0 - 3) = 0$$

$$\Rightarrow 9 - 3q = 0 \Rightarrow q = 3$$

95. (d) Length of latus rectum = 2 (length of the perpendicular distance from (3, 3) on $3x - 4y - 2 = 0$)

$$= 2 \left| \frac{9 - 12 - 2}{\sqrt{9 + 16}} \right| = 2$$

96. (b) Let $P(x, y)$ be any point on AB and $AP:PB = 4:12 = 1:3$



$$\text{By section formula, } (x, y) = \left(\frac{1.0 + 3.a}{1 + 3}, \frac{1.b + 3.0}{1 + 3} \right)$$

$$\Rightarrow a = \frac{4x}{3} \& b = 4y$$

From right angle $\triangle OAB$

$$a^2 + b^2 = 16^2$$

$$\text{or, } \left(\frac{4x}{3} \right)^2 + (4y)^2 = 16^2$$

$$\Rightarrow \frac{x^2}{144} + \frac{y^2}{16} = 1, \text{ which is an ellipse}$$

97. (c) 98. (b) 99. (a) 100. (c)

...The End...