Section - I

1. (b) For given velocity range will be maximum if $\sin 2\theta$ is maximum. i.e. 1. So $|45° - \theta|$ 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) 2^{nd} overtone = 3^{rd} harmonics
= 3 lopes
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 = $\frac{Q}{\varepsilon_0}$
There are 6 sides in cube so flux through each face is
flux through a face = $\frac{Q}{6\varepsilon_0}$

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) $I = venA = v'enA'$
or, $v \times \pi r^2 = v' \times \pi(2r)^2$
or, $v' = \frac{v}{4}$

12. (c) $P_s = 2R$, $R_p = \frac{R}{2}$
$\frac{P_s}{P_p} = \frac{I^2R_s}{I^2R_p} = \frac{2R}{R} \times 2 = 4 : 1$

13. (c) $T = 2\pi\sqrt{\frac{I}{MH}} = 2$ ..... (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) $V_{in} = I_bR_{in}$
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) $AgNO_3 + NaOH \longrightarrow Ag_2O + NaNO_3 + H_2O$
$Ag_2O + NaNO_3 + NH_3 + H_2O \longrightarrow [Ag(NH_3)_2]NO_3 + NaOH$
$HCHO + [Ag(NH_3)_2]NO_3 \longrightarrow Ag\downarrow$

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) $t_n = 3.(2^n)$
$t_1 = 3.2^1 = 6$
$t_2 = 3.2^2 = 12$
$r = \frac{12}{6} = 2$

33. (c) $A = I$
$A^2 = (I)^2 = I$
$A^2 + 2A = I + 2I = 3A$

34. (b) $\sqrt{2i} = \sqrt{1^2 + 2.1.i + i^2} = \sqrt{(1+i)^2} = \pm (1 + i)$

35. (c) $\frac{a}{d} = \frac{b}{e}$
$\boxed{ac = bd}$

36. (c) It is obvious

37. (c) $\vec{a}.\vec{b} = 0$
$2\lambda - 4.5 + 2.7 = 0$
$\lambda = 3$

38. (b) Using L-Hospital's rule:
$= \lim_{x \to \theta} \frac{\cos\theta + \theta\sin x}{1 - 0} = \cos\theta + \theta\sin\theta$

39. (a) Since the integrand is odd function, $\int_{-1}^{1} \sin^3 x \cos^2 x \, dx = 0$

40. (c) Put $e^x + 1 = t$
$\Rightarrow \quad e^x \, dx = dt$
$\therefore \quad \int \frac{e^x \, dx}{e^x + 1} = \int \frac{dt}{t} = \ln t + c = \ln(e^x + 1) + c$

41. (d) $dr = 5.1 - 5 = 0.1$
Approximate change in area $= dA = \frac{dA}{dr}.dr$
$= 2\pi r.dr$
$= 2\pi \times 5 \times 0.1$
$= \pi \text{ cm}^2$

42. (a) $\left(\frac{1}{2}\right)^2 + \left(\frac{1}{3}\right)^2 + n^2 = 1$ [$\because l^2 + m^2 + n^2 = 1$]
$\Rightarrow \quad n = \frac{\sqrt{23}}{6}$

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) $a_t = 2 m/s^2$
$a_c = \frac{v^2}{r} = \frac{30^2}{500} = \frac{9}{5} = 1.8 \text{ m/s}^2$
$\therefore \quad a = \sqrt{a_c^2 + a_t^2} = \sqrt{1.8^2 + 2^2} = 2.7 \text{ m/s}^2$

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, $\mu = \frac{3}{4}\tan\theta = 0.75$

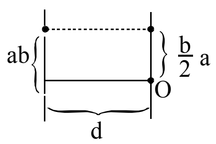
63. (a) Change in wt = change in upthrust
or, $200 = (l^2 \times 2) \times 1$
or, $l = 10$ cm

64. (c) Gain in time in day $= \frac{1}{2}\alpha\Delta\theta \times 1$ day
or, $\alpha = \frac{8.6 \times 2}{10 \times 86400} = 2 \times 10^{-5}/°C$

65. (c) $Q = \frac{kAd\theta}{2l} \times t_1 = \frac{k2Ad\theta}{l} \times t_2$
or, $\frac{t_1}{2} = 2t_2$
or, $t_2 = \frac{12}{4} = 3$ S

66. (d) $f_0 + f_e = 22.5$ .... (1)
And $m = \frac{f_0}{f_e}$
or, $f_0 = 8f_e$ .... (2)
Now $8f_e + f_e = 22.5$
or, $f_e = \frac{22.5}{9} = 2.5$ cm
& $\quad f_0 = 8 \times 2.5 = 20$ 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) $\frac{f'}{f} = \frac{c + v_p}{c - v_p}$

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

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

or, $1.00000333c - 1.00000333\, v_p = c + v_p$

or, $v_p = \dfrac{999}{2.0000066}$

69. (d) $C_s = \dfrac{C_1C_2}{C_1 + C_2} = \dfrac{3 \times 6}{C_1 + C_2} = \dfrac{3 \times 6}{3 + 6} = 2\mu F$

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

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

Again $Q = C_1 V1$

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

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

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

71. (a) $E = BAf$

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

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

$= 0.5$ V

72. (c) For max. current

$X_L = X_C$

or, $2\pi fL = \dfrac{1}{2\pi fc}$

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

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

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

$= 63$ nF

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

or, $\dfrac{hc}{\lambda} = \phi + \dfrac{1}{2} mv^2$

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

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

$= 5.16 \times 10^5$ m/s

Again, $Bev = \dfrac{mv^x}{r}$

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

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

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

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

$= 45$ counts/s

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

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

or, $\dfrac{d'}{2} = 3$

or, $d' = 6$ m $\Delta d = 6 - 2 = 4$ m

75. (b)

$C_6H_5CH_3 \xrightarrow{[O]} C_6H_5COOH \xrightarrow{\text{Soda-lime}} C_6H_5COONa \xrightarrow{\text{NaOH}} C_6H_5 + Na_2CO_3$

76. (c) $Mg_3N_2 + 3H_2O \longrightarrow 3MgO + 2NH_3$

$NH_3 + H_2O \longrightarrow NH_4OH$

77. (a) $CaOCl_2 + 2HCl \longrightarrow CaCl_2 + H_2O + Cl_2$

78. (c) Wt. of metal = 74.5 – 35.5 = 39

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

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

$x = 39$

79. (a)

	3	3	3	3	→ No. of shells
	P^{3-}	S^{2-}	Cl^-	K^+	
$\frac{P^+}{e^-} =$	$\frac{15}{18}$	$\frac{16}{18}$	$\frac{17}{18}$	$\frac{19}{18}$	

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

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

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

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

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

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

81. (b) $V_1N_1 = V_2N_2$

$N_2 = \dfrac{V_1N_1}{V_2} = \dfrac{2.5 \times 12}{250} = 0.12N = 0.06$ M

H_2SO_4	$\longrightarrow 2H^+$	$+\ SO_4^{--}$
0.06	0	0
0	2×0.06	0.06

$H^+ = 0.12$ M

$pH = -\log[H_3O^+] = -\log[0.12] = 0.92$

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: $x^2 = 16 - y^2$

$x^2 \geq 0$

$16 - y^2 \geq 0$

$y^2 \leq 16$

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) 4^{th} term from end = $(8 - 4 + 2)$

i.e. 6^{th} term from beginning.

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

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

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

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

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

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

So, $t = \frac{\pi\theta}{180}$ and $\theta° = \frac{180t}{\pi}$. When $\theta° \to 0$, $t \to 0$

Now, $\lim_{\theta° \to 0} \frac{\sin\theta°}{\theta°} = \lim_{t \to 0} \frac{\sin t}{\frac{180t}{\pi}}$

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

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) Put $x = \tan\theta$ $\Rightarrow dx = \sec^2\theta\, d\theta$

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

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

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

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.

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

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

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

93. (a) 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

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

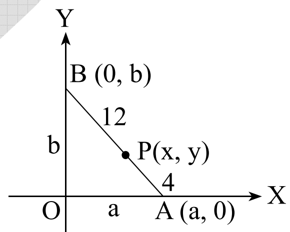
$\Rightarrow 1(5 + 4) - 0 + q(0 - 3) = 0$

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

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



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 ΔOAB

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

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

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

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

…The End…