KANTIPUR ENGINEERING COLLEGE
Dhapakhel, Lalitpur
Model Entrance Test (2073)

Solution Set: III (A)

Section: I

1. (D)	2. (B)	3. (C)	4. (A)	5. (A)	6. (B)	7. (C)
8. (D)	9. (B)	10. (D)	11. (A)	12. (C)	13. (C)	14. (A)
15. (B)	16. (D)	17. (A)				

18. (A)

Solution: 1 mol of He = 4 g = 6.023×10^{23} atoms

Wt. of 6.023×10^{23} atoms He = 4 g

$$= \frac{4}{6.023 \times 10^{23}}$$

Wt. of 1 atom of He = 6.64×10^{-24} g

19. (C)	20. (C)	21. (D)	22. (D)	23. (B)
24. (B)	25. (D)	26. (B)		

27. (C) The narrower the diameter of the tube , the greater will be the rise of the liquid in the tube.

28. (A) In elastic collision, K.E. is conserved.

29. (D) In radiation, the heat is transferred at the speed of the light

30. (D) Sin c =1/μ ; μ for violet color is largest and hence the critical angle for violet color is minimum

31. (D) The transverse nature of the light is shown by polarization of light.

32. (A) There will be mutual repulsion. Hence the radius will increase.

33. (A) We know that heater draws a high current from the mains. So, there is appreciable potential drop in line. As the potential difference in the bulbs falls and hence they become dim.

34. (A) At poles, the horizontal component of the earth's magnetic field is zero and hence the compass needle will be vertical.

35. (C) Inner walls of the big halls should be a good sound absorber to avoid echo and overlapping of sound.

36. (C) We know that $\lambda = \frac{h}{mv} = \frac{h}{P}$ so they will have the same momentum.

37. (C) $n\{(A \times B)\, n\, (B \times A)\} = \{n\, (AnB\}^2 = 2^2 = 4$

38. (B) for both roots to be zero, constant tem = 0, coefficient of x = 0

$\Rightarrow n = 0, \quad m - 7 = 0$

$\Rightarrow m = 7, \quad n = 0$

39. (B) $7\, Cos^2 x + 3\, Cos^2\, x = 4$

$7\, Sin^2 + 3 - 3\, Sin^2\, x = 4$

$$4\,\text{Sin}^2 x = 1 \quad \Rightarrow \text{Sin}^2 x = \frac{1}{4} = \text{Sin}^2 \frac{\pi}{6} \Rightarrow x = n\pi \pm \frac{\pi}{6}$$

40. (B) Here A = I, So $A^2 + 2a$

$= I^2 + 2A = I + 2A = A + 2A = 3A$

41. (B) $\lim\limits_{x\to 1} \dfrac{x + 2x + 3x^2 + \ldots\ldots + nx^{n-1}}{1} = 1 + 2 + 3 + \ldots. + n$

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

So $\dfrac{n(n+1)}{2} = 66 \Rightarrow n = 11$

42. (A) $\tan^{-1}\dfrac{3x - x^3}{1 - 3x^2} = 3\tan^{-1} x$ so $\dfrac{d\,3\tan^{-1}x}{dx} = \dfrac{3}{1+x^2}$

43. (C) $\int \tan^{-1}\left(\dfrac{1-\tan^2 x}{1+\tan^2 x}\right) dx = \int \cos^{-1} \cos 2x\, dx = \int 2x dx = x^2 + c$

44. (D) Here, $\vec{a}x\vec{b} = -(\vec{b}x\vec{a})$ so angle between $\vec{a}x\vec{b}$ anb $\vec{b}x\vec{a}$ = 180^o

45. (D) As, (h , 0), (o, k) and (3, 3) are collinear so

$\dfrac{k - o}{o - h} = \dfrac{3 - k}{3 - o}$

$\Rightarrow$ 3k = - 3h – hk

$\Rightarrow$ 3h + 3k = hk $\Rightarrow \dfrac{1}{n} + \dfrac{1}{k} = \dfrac{1}{3}$

46. (A) length of the line = $\sqrt{2^2 + 3^2 + 6^2} = \sqrt{49} = 7$

47. (C)	48. (B)	49. (B)	50. (D)	51. (C)
52. (A)	53. (D)	54. (B)	55. (A)	56. (C)
57. (C)	58. (B)	59. (D)	60. (A)	

Section: II

61. (B)	62. (D)	63. (C)	64. (A)	65. (B)

66. (D) **Solution: Q = I × t**

= 0.873 × 3 × 60 = 157.16 Coulomb

Here $Cu^{++} + 2e^- \longrightarrow Cu$

1 mol 2 mol

2 F can deposit 63.5 g of Cu

2 × 96500 Coulomb deposit 63.5 g

157.16 Coulomb deposit $= \dfrac{63.5 \times 157.14}{193000}$ = 0.0517 g

67. (A) Solution: By normality equation the new concentration of the solution can be calculated

V_1 = 250 ml S_1 = 0.25 M V_2 = 500 ml S_2= ?

Or $S_2 = \frac{V_1 \times S_1}{V_2}$ $= 0.125$ $S_2 = \frac{250 \times 0.25}{500}$

68. (C)

69. (A) Here $\Delta v = (8j - 6i)$m/s

$\therefore |\Delta v| = \sqrt{(8)^2 + (6)^2} = 10 \text{ m/s}$

Now, $a = \frac{\Delta v}{\Delta t} = \frac{10}{10} = 1 \text{ m/s}^2$

70. (A) Here $h = ut + \frac{1}{2} gt^2$ $[\because u = 0]$

$\therefore \frac{h_1}{h_2} = \left(\frac{t_1}{t_2}\right)^2 \Rightarrow \frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}} \Rightarrow \frac{t_1}{t_2} = \sqrt{\frac{16}{25}} = \frac{4}{5}$

71. (C) When the lift is moving upwards, then

W = m (g+a)

Here a = 4.9 m/s^2 $\therefore W = m\left(g + \frac{g}{2}\right) = \frac{3}{2} mg = \frac{3}{2} \times 60 = 90 \text{ N}$

72. (B) The stress required to double the length is called Young's Modulus.

$Y = \frac{F}{A} \Rightarrow F = Y \times A$ $\therefore F = 2 \times 10^{11} \times 10^{-4} = 2 \times 10^7 \text{ N}$

73. (C) If H be the height to which a liquid rises in the inclined tube, then

$H = \frac{h}{\sin\theta}$ $\therefore H = \frac{h}{\sin 45^\circ} = \frac{h}{1/\sqrt{2}} = \sqrt{2}\, h$

74. (B) $\frac{C}{100} = \frac{F - (LFP)}{(UFP) - (LFP)}$

Where C = actual temperature
F = reading on faulty thermometer
LFP = lower fixed point
UFP = upper fixed point $\therefore \frac{C}{100} = \frac{41-5}{95-5} = \frac{36}{90} \Rightarrow C = 40^\circ \text{ C}$

75. (D) dQ = dU + dW
35 = dU + (-15)
$\therefore$ dU = 50 J

76. (D) We know that, $f = \frac{1}{2l}\sqrt{\frac{T}{m}} \quad \alpha \quad \sqrt{T}$

$\therefore \frac{f_2}{f_1} = \sqrt{\frac{T_2}{T_1}} \Rightarrow T_2 = \left(\frac{f_2}{f_1}\right)^2 T_1$

Given that $f_2 = 2f_1$ and $T_1 = 10$ N. $\therefore T_2 = \left(\frac{2f_1}{f_1}\right)^2 \times 10 = 40 \text{ N}$

77. (D) $M = \frac{I}{O} = \frac{v-f}{f} = \frac{75-25}{25} = 2 \therefore I = 2 \times O = 2 \times 1.5 = 3.0 \text{ cm}$

78. (A) $I_{max} = (a_1 + a_2)^2 \quad \Rightarrow \quad$ when $a_1 = a_2$

$I_{max} = 4a^2 = I_0$

When one slit is closed then, $I = a^2 = \frac{I_0}{4}$

79. (C) From $T = 2\pi\sqrt{\frac{I}{MB}}$, $4 = 2\pi\sqrt{\frac{I}{MB}}$

When it is cut into two equal parts in length, mass of each part becomes ½;

$I = \text{mass}\frac{(\text{length})^2}{12}$ becomes $\frac{1}{8}^{th}$ and M becomes $1/2$ $\therefore T' = 2\pi\sqrt{\frac{I/8}{M/2 \cdot B}} =$

$\frac{1}{2}\left(2\pi\sqrt{\frac{I}{MB}}\right) = \frac{1}{2} \times 4 = 2$ sec

80. (B) $V = \frac{C_1V_1 + C_2V_2}{C_1 + C_2} = \frac{(20 \times 10^{-6} \times 500) + (10 \times 10^{-6} \times 200)}{(20 \times 10^{-6}) + (10 \times 10^{-6})} = 400$ V

81. (B) $R_s = R + 2R = 3R$

and $R_p = \frac{(R \times 2R)}{3R} = \frac{2}{3}R$

Heat produced in series = i^2 3R

Heat produced in parallel = $i^2 \frac{3}{2}R$

$\therefore$Ratio of heat produced $= \frac{i^2 3R}{i^2\left(\frac{2}{3}\right)R} = \frac{9}{2} = 9:2$

82. (D) As $v = \frac{hc}{\lambda e} - \emptyset_0$

$= \frac{4.14 \times 10^{-15} \times 3 \times 10^8}{2000 \times 10^{-10} \times 1} - 5.01$

$= (6.21 - 5.01)\text{ev} = 1.2\text{ev}$

83. (C) The ratio of left mass to original mass

$= \frac{1}{16} = \left(\frac{1}{2}\right)^4$

$\left(\frac{1}{2}\right)^4 = \left(\frac{1}{2}\right)^{t/T} \quad \Rightarrow \quad t = 4T$

$\therefore$ half life of the substance is

$\therefore T = \frac{t}{4}$

Here t = 120 days $\quad \therefore T = \frac{120}{4} = 30$ days

84. (A) function is defined if $4x - x^2 \geq 0 \Rightarrow x(4 - x) \geq 0$

$\Rightarrow 0 \leq x - \leq 4 \Rightarrow [0, 4]$

Also $4 - y^2$ y is a positive square root. So $y \geq 0$ ....*range* $= [0, 2]$

$(x - 2)^2$

So $4 - y^2 \geq 0$

85. (A) sin 2 A + sin z B = sin 2C

Or, 2 sin (A + B) Cos (A – B) = 2 Sin c Cos C

$\Rightarrow$ SinC cos (A – B) = Sin C Cos C
$\Rightarrow$ Cos (A – B) = Cos C […..C±0]
$\Rightarrow$A – B = C
$\Rightarrow$ A = B + C

86. (D) $\frac{n(n-1)}{2} = 153 \Rightarrow n = 18$

87. ((B) a, b, c are in A P $\Rightarrow$ b = $\frac{a+c}{2}$
b, c, d are in GP $\Rightarrow$ c^2 = bd
c, d, e are in HP $\Rightarrow$ d = $\frac{2ce}{c+e}$
so $c^2 = \frac{a+c}{2}, \frac{2ce}{c+e}$
$\Rightarrow c^2$ = ae $\Rightarrow$ a, c, e are in ap

88. (C) $\frac{a=ib}{c+id} \times \frac{c-id}{c-id} = \frac{ac+bd}{c^2+d^2} + i\frac{(bc\_ad)}{c^2+d^2}$ which is purely real if bc – ad = 0
$\Rightarrow$ ad = bc

89. (D) $tn = \frac{1+2+2^2+........+2^{n-1}}{n!} = \frac{2^n-1}{n!} = \frac{2n}{n!} - \frac{1}{n!}$

$\sum_{n=1}^{\infty} tn = \sum_{n=1}^{\infty} \frac{2n}{n!} - \sum_{n=1}^{\infty} \frac{\Delta}{n!} = e^2 - e$

90. (D) Given $\vec{a} + \vec{b} + \vec{c} = 0$
$\vec{a} + \vec{b} = -\vec{c}$
$(\vec{a} + \vec{b})^2 = (-\vec{c})^2$
$\Rightarrow 2 . 3. 5 \cos\theta = 15$
$\Rightarrow \cos\theta = \frac{1}{2} \Rightarrow \theta\ 60^0$

91. (C) The equation of bisectors of angle between the lines $ax^2 - 2hxy + by^2 = 0$, is
$-h(x^2 - y^2) = (a - b)xy$ ie. $h(x^2 - y^2) + (a - b)xy = 0$
If y = mx is one of the bisectors ten
$h(x^2 - m^2x^2) + (a - b)x . mx = 0$
$\Rightarrow h(1 - m^2) + (a - b)m = 0$

92. (B) The circles cut orthogonally if $2g_1 g_2 + 2f_1 f_2 = C_1 + C_2$
$\Rightarrow 2. \lambda . 2 + 2 . 3. 1 = 1 + 0$
$\Rightarrow 4\lambda + 6 = 1 \quad \Rightarrow \lambda = -5/4$

93. (B) Parabola is $y^2 = kx - 8 \Rightarrow y^2 = \frac{4.k}{4}(x - \frac{8}{k})$

Equation of directix $\rightarrow$ x – 1 = 0

$$\text{So, } 1 = \frac{8}{k} - \frac{k}{4}$$
$$\Rightarrow 4k = 32 - k^2$$
$$\Rightarrow k^2 - 4k - 32 = 0$$
$$\Rightarrow k = 8, -4$$

94. (A) coordinates of A = (3a,0, 0)
“ B = (0, 3b , 0) $\therefore$ centroid (a, b, c)
“ C = (0, 0, 3c)

95. (C) $y = \sqrt{\sin x + y} \Rightarrow y^2 \ \sin x + y$

$$\Rightarrow 2y\frac{dy}{dx}\ \cos x + \frac{dy}{dx} \Rightarrow (2y - 1)\frac{dy}{dx} - \cos\ x = 0$$

96. (A) $f^1(x) = \sec^2\ x - 1 = \tan^2 x > 0$

97. (D) $f^1(x) = e^x + \frac{1}{1+x^2} \Rightarrow f(x) = e^x + \tan^{-1}x + c$

$$\Rightarrow f^1(0) = 1 + 0 + c$$
$$\Rightarrow 1 = 1 + 0 + C \Rightarrow C = 0$$
$$\text{So, } fe(x) = e^x + \tan^{-1}x$$

98. (B) Along x – axis y u $\Rightarrow$ x 0, 4

99. (C)
100. (A)

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