KANTIPUR ENGINEERING COLLEGE
Dhapakhel, Lalitpur
Model Entrance Test (2073)
Solution Set: II (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)

Solution:

$$\text{No. of mol of hydrogen} = \frac{\text{Wt . in gram}}{\text{Molar wt.}} = \frac{5}{2} = 2.5$$

1 mol = 6.023×10^{23} molecules

2.5 mol = $2.5 \times 6.023\times10^{23}$ = 1.505×10^{24} molecules

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

27. (C)
Here phase difference is constant and hence five periods must be equal i.e., velocities must be equal.

28. (A)
The displacement can be both positive and negative.

29. (D)
When electric fan is switched on in a closed room, the electric energy is converted into mechanical energy, which in turn is converted into heat energy. As a result, the kinetic energy of translational of molecules of air increases. Therefore, the temperature of room increases.

30. (D)
The critical angle for diamond is small due to high refractive index. So, large scale total internal reflection takes place

31. (D)
Photoelectric effect can be explained on the basis of quantum theory.

32. (A)
Electric field inside a charged conductor is zero and hence the charge being on outer surface.

33. (A)

$H = v\ i\ t = \frac{v^2}{R} \times t$

Keeping v constant, when R is doubled, (H/t) is halved.

34. (A)
In the rearrangement of the magnetic domains some work is done and the energy dissipated in the process is propotional to the area enclosed by hysteris loop.

35. (C)
Diameter has no effect on frequency.

36. (C)
When a charged particle enters the magnetic field making angle other than 90^o, the path is helix.

37. (C) obvious

38. (B) let other root be β. Then $\alpha\beta$ = 1 so $\beta = \frac{1}{\alpha}$

39. (B) cosec2x = cosec2α $\Rightarrow = x = n\pi \pm \alpha$

40. (B) A2 – A + I = 0
or I = A – A2
or A-1 = A-1A - A-1 A A
ie A-1 = I – A

41. (B) $\lim_{x\to 0} \frac{\text{Sin}2x + \sin 6x}{\text{Sin}5x - \text{Sin}3x} = \lim_{x\to 0} \frac{2\cos 2x + 6\cos 6x}{5\cos 5x - 3\cos 3x} = \frac{2+6}{5-3} = \frac{8}{2} = 4$

42. (A) $f^{1}(x) = \frac{1}{x^2}$ $f^{11}(x) = \frac{2}{x^3}$ At (1,1), $f^{11}(1) = 2$

43. (C) $\int \frac{dx}{\sqrt{1-x^2}} = \sin^{-1} x + c = \frac{\pi}{2} - \cos^{-1} x + c$ and

44. (D) $\vec{a} x \vec{b}$ and $\vec{b} x \vec{a}$ are both perpendicular to $\vec{a}$ *and* $\vec{b}$

45. (D) Slope = 0,

46. (A) 1. (-k) + 2.2+ 3.1 = 0 ie – k + 4 + 3 =0 ⇒ k + 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)
Solution:
127 g of Iodine (1 g eqvt.) is liberated
10 of Iodine is liberated by $= \frac{96500}{127} \times 10$ coulomb

Let current strength be = I, Time in seconds = 1 × 60 × 60 = 3600 seconds
The quantity of electricity, Q, is given by
Q= I × time in seconds,
$I = \frac{Q}{t} = = 2.11$

66. (D)
Solution:
250 ml of 0.4M H_2SO_4 is mixed with 600 ml of 0.25M KOH

250 ml of 0.8N H_2SO_4 is mixed with 600 ml of 0.25N KOH
200 ml of 1N H_2SO_4 is mixed with 150 ml of 1N KOH

As the vol. of H_2SO_4 is greater than KOH, the solution is acidic

$V_1 = (200 - 150) = 50$ ml ; $V_2 = (250 + 600) = 850$ ml

$S_1 = 1$ N $S_2 = ?$; $V_1 S_1 = V_2 S_2$

$= 0.0588$ N $S_2 = \frac{50 \times 1}{850}$

67. (A)
68. (C)
69. (A) Given that R = A = B.

Also, $R^2 = A^2 + B^2 + 2AB\cos\theta$

$\Rightarrow R^2 = 2R^2 (1+\cos\theta)$

$\Rightarrow \frac{1}{2} - 1 = \cos\theta$

$\Rightarrow \cos\theta = -\frac{1}{2}$ $\Rightarrow \theta = 120^o$

70. (A) Using v = u + gt, we have,

$0 = u - gT \Rightarrow u = gT$

Also, $v^2 = u^2 + 2gs \Rightarrow 0 = u^2 - 2gH$

$\therefore H = \frac{u^2}{2g} = \frac{g^2T^2}{2g} = \frac{gT^2}{2}$ ... ... (i)

Let h be the distance travelled in time t, then,

$h = ut - \frac{1}{2}gt^2 = gtT - \frac{1}{2}gt^2$ .... (ii)

Now, $h - H = gTt - \frac{1}{2}gt^2 - \frac{1}{2}gT^2 = -\frac{g}{2}(T-t)^2$

$\therefore h = H - \frac{g}{2}(T-t)^2$

71. (C) u = 0, v = 20m/s and t = 10sec

$\therefore v = u + at \Rightarrow 20 = a \times 10 \Rightarrow a = 2$ m/s^2

Further $s = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2} \times 2 \times (10)^2 = 100$m

$\therefore$ Work = Force x Distance = Mass x Acceleration x Distance = 100 x 2 x 100 = 2 x 10^4 J

72. (B) $\alpha = \frac{10}{2}$ rad/s^2 = 5 rad/s^2

$I = MR^2 = \frac{1}{2} \times (0.2)^2 = 0.02$ kgm^2

$T = I\alpha = 5 \times 0.02 = 0.10$ Nm

73. (C) The radius R of the single drop so firmed will be $R = 2^{1/3}r$, where r = radius of each drop

For each drop, $mg = 6\pi\eta rv$ ....(i)

For combined drop, $2mg = 6\pi\eta Rv'$ ....(ii)

From equation (i) and (ii),

$2 \times 6\pi\eta rv = 6\pi\eta Rv' \Rightarrow v' = \frac{2rv}{R} = \frac{2rv}{2^{1/3}r} = 2^{2/3}v$

74. (B)

$\frac{F_1 - 32}{9} = \frac{C_1}{5}$ and $\frac{F_2 - 32}{9} = \frac{C_2}{5}$

$\Rightarrow \frac{F_1 - F_2}{9} = \frac{C_1 - C_2}{5}$

$\Rightarrow \frac{F_1 - F_2}{9} = \frac{25^o}{5} = 5$

$\therefore F_1 - F_2 = 9 \times 5 = 45^oF$

75. (D) $P = \frac{1}{3}\rho v^{-2} = \frac{2}{3}\ (\frac{1}{2}\rho v^{-2}) = \frac{2}{3}E$

76. (D)

Given $\frac{a_1}{a_2} = \frac{3}{5}$

Also, $\frac{\sqrt{I_1}}{\sqrt{I_2}} = \frac{3}{5}$ [$\because\ I_1 \alpha\, a_1^2$]

Intensity is maximum when cosØ = 1,

$\therefore\ I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

And intensity is minimum when cosØ = 0,

$\therefore\ I_{min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2$

$\therefore \frac{I_{max}}{I_{min}} = \frac{\left(\sqrt{I_1}+\sqrt{I_2}\right)^2}{\left(\sqrt{I_1}-\sqrt{I_2}\right)^2} = \frac{\left(\frac{3}{5}+1\right)^2}{\left(\frac{3}{5}-1\right)^2}$ = 64/4 = 16:1

77. (D) We know that $\frac{\text{Sin i}}{\text{Sin r}} = \frac{v_1}{v_2}$

Where v_1 and v_2 are the velocities of light in denser and rarer medium respectively.

Now, $\frac{\text{Sin i}}{\text{Sin r}} = \frac{\mu_1}{\mu_2}$

Given that, μ_1= v and μ_2=2v

$\frac{\text{Sin i}}{\text{Sin r}} = \frac{v}{2v} = \frac{1}{2}$

If r = 90^o, then i = C

So, Sin C = 1/2 $\therefore$ C = 30^o

78. (A) Here v = - 40cm, u=∞

Using the lens formula,

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$, we get,

F = - 40cm = - 0.40m $\therefore P = -\frac{1}{0.40} = -2.5\ D$

79. (C) $B = \mu_o H = 4\pi \times 10^{-7} \times 28 = 352 \times 10^{-7}\ T = 352 \times 10^{-3}$ gauss = 0.352 gauss

80. (B) $F_e = 9 \times 10^9 \left(\frac{e \times e}{r^2}\right)$ and $F_G = 6.6 \times 10^{-11}\left(\frac{m_e \times m_e}{r^2}\right)$

$$\frac{F_G}{F_e} = \frac{6.6 \times 10^{-11}}{9 \times 10^9}\left(\frac{m_e}{e}\right)^2 = \frac{6.6 \times 10^{-11}}{9 \times 10^9}\left(\frac{9.1 \times 10^{-31}}{1.6 \times 10^{-19}}\right)^2 \cong 10^{-42}$$

81. (B)

$$e = N\frac{d\text{Ø}}{dt} = N\frac{d(BA)}{dt} = NA\ \frac{d(B)}{dt}$$

$$= 500 \times 100 \times 10^{-4} \times \left(\frac{0.1 - 0}{0.1}\right) = 5V$$

82. (D) $E_n = \frac{13.6}{n^2} = \frac{13.6}{100} = 0.136\ eV$

83. (C) In this reaction, the energy released will be in the form of heat energy.

Energy released = Binding energy of $2H^{e4}$ minus twice the binding energy of 1 H^2 = 28- 2 x 2.2 = 23.6 Mev

84. (A) domain =R as it is defined for all x ϵ R

$$\text{range} = \left[\frac{1}{3-(-1)}, \frac{1}{3-1}\right] = \left[\frac{1}{4}, \frac{1}{2}\right]$$

85. (A) we know that $\cos B = \frac{c^2+a^2-b^2}{2ca} = \frac{c^2+4c^2-9c^2}{2.c\,2c} = \frac{-4c^2}{4c^2} = -1$

86. (D) $n = \frac{n(n-3)}{2} \Rightarrow 2 = n-3 \Rightarrow n = 5$

87. (B) $t_4 = p \Rightarrow ar^3 = p$

$t_7 = q \Rightarrow ar^6 \Rightarrow br = q^2$

$t_{10} = r \Rightarrow ar^9 = r$

88. (C) Equating real and imaginary parts, we get

$x = k + 3, \qquad y = \sqrt{5-k^2}$

$(x-3)^2 = k^2 \quad y^2 = 5 - k^2$

$\Rightarrow (x-3)^2 + y^2 = 5$

89. (D) $\log(1 - 5x + 6x^2) = \log(6x^2 - 3x - 2x + 1)$

$= \log_0 \{3x(2x-1) - 1(2x-1)\}$

$= \log_e (2x-1)(3x-1)$

$= \log_e (1-2x) + \log_e (1-3x)$

$$= 2x - \frac{(2x)^2}{2} - \frac{(2x)^3}{3} - \ldots\ldots\ldots + \left[3x - \frac{(3x)^2}{2} - \frac{(3x)^2}{3} - \ldots\ldots\ldots\ldots\ldots\right]$$

Coeff. of $x^3 = -\frac{8}{3} - \frac{27}{3} = -\frac{35}{3}$

90. (D) $|\vec{a}| = \sqrt{3^2 + (-5)^2}, |\vec{b}| = \sqrt{6^2 + (3)^2}$

$\vec{a}x\vec{b} = 39\vec{k}, \qquad |\vec{a}x\vec{b}| = 39$

So, $|\vec{a}|:|\vec{b}|:|\vec{a}x\vec{b}| = \sqrt{34}:\sqrt{45}:39$

91. (C) Equation of bisectors is $h(x^2 - y^2) = (a - b)xy$

Combined equation of axes is $xy = 0$

So $h = 0$

92. (B) $2\pi r = 10\pi \Rightarrow r = 5$

Equation circle is $(x-2)^2 + (y+3)^2 = 5^2$

ie. $x^2 + y^2 - 4x + 6y - 12 = 0$

93. (B) The line is $lx + my + n = 0$ ie. $y = \frac{l}{m}x - \frac{n}{m}$ is

tangent to $y^2 = 4ax$ if $-\frac{n}{m} = \frac{a}{-\frac{l}{m}} \Rightarrow ln = am^2$

94. (A) equation of plan is $(2-0)(x-2) + (6-0)(y-6) + (3-0)(z-3) = 0$

$2x - 4 + 6y - 36 + 3z - 9 = 0$

ie. $2x + 6y + 3z = 49$

95. (C) y = sinx – cos x

$$\frac{dy}{dx} = \cos x + \sin x$$

$$\frac{d^2y}{dx^2} = -\sin x + \cos x$$

$$\frac{d^3y}{dx^3} = -\cos x - \sin x$$

$$\frac{d^4 4}{dx^4} = \sin x - \cos x$$

and so on

96. (A) $f^1(x) = x^x (1 + \log_e x)$

For stationary point $f^1(x) = 0$

$\Rightarrow 1 + \log_e x = 0$

$\Rightarrow \log_e x = -1$

$\Rightarrow x = \frac{1}{e}$

97. (D) $\int_0^{\frac{\pi}{2}} \frac{(\sin x + \cos x)^2}{\sqrt{1+\sin 2x}} dx = \int_0^{\frac{\pi}{2}} (\sin x + \cos x)dx$

$= (\sin x - \cos x)_0^{\pi/2}$

$= (1 - 0) - (0 - 1)$

$= 1 + 1 = 2$

98. (B) Solving $y = x^2$ and $y = x$,

x = 0, 1

$\therefore$ Required are a = $\int_0^1 (y_1 - 4_2)dx$

$= \int_0^1 (x^2 - x)\, dx$

$= \left[\frac{1^3}{3} - \frac{x^2}{2}\right]_0^1$

$= \frac{1}{3} - \frac{1}{2} = -\frac{1}{6} = \frac{1}{6}$

99. (C)

100. (A)

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