AIEEE PAPER - I : HINTS & SOLUTION

1. Ans : 2
2. Ans : 4
3. $u = \sqrt{2as} = \sqrt{2\left(\frac{d_\ell}{d_s} - 1\right)gh}$

$u = \sqrt{2(3-1)gh} = \sqrt{4gh}$

$H = \frac{u^2}{2g} = \frac{4gh}{2g} = 2h$

4. electrons are acceleratet due to electric fied towards the collector $\therefore$ their K.E and stopping pofetinal increases
5. $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$-\frac{1}{2u_1} + \frac{1}{u_1} = \frac{1}{f} \Rightarrow u_1 = \frac{f}{2}$

$\frac{1}{2u_2} + \frac{1}{u_2} = \frac{1}{f} \Rightarrow u_2 = \frac{3f}{2}$

$\Delta u = u_2 - u_1 = f$ move awy from the lens

6. $A = 2\pi Rh$

$\left(\frac{A_2 - A_1}{A_1}\right) \times 100 = \left(\frac{h_2 - h_1}{h_1}\right) \times 100$

7. $\frac{v_1}{v_2} = \left(\frac{r_2}{r_1}\right)^3 = \left(\frac{2}{1}\right)^3 = \frac{8}{1}$
8. $Tan\theta = \frac{4H}{R} = \frac{4(4)}{12} = \frac{4}{3} \quad \therefore \sin\theta = \frac{4}{5}$

$u = \frac{\sqrt{2gh}}{\sin\theta} = \frac{\sqrt{2(g)(4)}(5)}{4} = 5\sqrt{\frac{g}{2}}$

9. $\frac{P.E}{KE} = \frac{x}{H-h} = \frac{P.E}{2PE} \Rightarrow x = \frac{H}{3}$

$V = \sqrt{2g\frac{2H}{3}} = 2\sqrt{\frac{gH}{3}}$

10. V P T

V 3P 3T $\rightarrow$ First case

2V 3P 6T $\rightarrow$ Second case

$nc(5T) = n\frac{5}{2}R(2T) + n\frac{7R}{2}(3T)$

$\therefore c = 3.1R$

11. Reading = $P.S.R + L.C(H.S.R)$
12. $mvr = \frac{nh}{2\pi}$

$$v = \frac{nh}{2\pi mr} \text{ ——— } (1)$$

$$F = -\frac{du}{dr} = 2ar = \frac{mv^2}{r} \text{ ——— } (2)$$

from (1) and (2) $r = \left(\frac{n^2h^2}{8\pi^2 ma}\right)^{1/4}$

13. $f_{AB} = 2\, f_{CD}$

$$\frac{1}{2\ell}\sqrt{\frac{T_1}{\mu}} = 2\frac{1}{2\ell}\sqrt{\frac{T_2}{\mu}}$$

$$T_1 = 4T_2 \text{ —— } (1)$$

$$T_1 x = T_2 (L - x) \text{ —— } (2)$$

from (1) and (2) $x = \frac{L}{5}$

14. If x is the fraction of volume

$$\therefore \frac{1}{2}(V - xV)5(1000)g = V(1000)g$$

$$\therefore x = 3/5$$

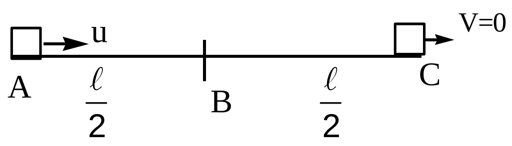
15. $\frac{B}{M} = \frac{\frac{\mu_0 ni}{2r}}{ni\pi r^2} \propto \frac{1}{r^3}$

16. AND gate

17. Accroding to kirchoff's IInd law

18. $\frac{\varepsilon_0 E^2}{2} + \frac{B^2}{2\mu_0}$

19.



Accroding to work energy theorem

$$-\mu mg\frac{\ell}{2} - 2\mu mg\frac{\ell}{2} = -\frac{1}{2}mu^2$$

$$\therefore u = \sqrt{3\mu g\ell}$$

20. $T = \frac{2u_y}{g} \Rightarrow T \propto u_y \; ; \; \frac{T_1}{T_2} = \frac{1}{e}$

$$H \propto u_y^{\,2} \; ; \; \frac{H_1}{H_2} = \frac{1}{e^2} \; ;$$

$$R \propto u_y \; ; \frac{R_1}{R_2} = \frac{1}{e}$$

21. Accroding law of consevetion of

$$IW - mVR = I^{l}w$$

$$IW - mVR = \left(I + mr^2\right)w$$

22. The P.D across the resistor is the 2.3 V

power $= vI = (2.3)(20) = 46mW$

23. $mg = qE \Rightarrow \frac{4}{3}\pi r^3 dg = qE$

$$E \propto \frac{r^3}{q}$$

24. $KX + F_b = mg$

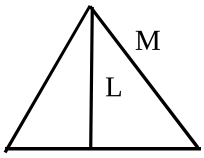
$$Kx = mg - F_b$$

$$Kx = mg\left(1 - \frac{d_w}{d_B}\right) \Rightarrow 100x = 2(10)\left[1 - \frac{1}{2}\right]$$

$$100x = 10 \Rightarrow x = 0.1m = 10cm$$

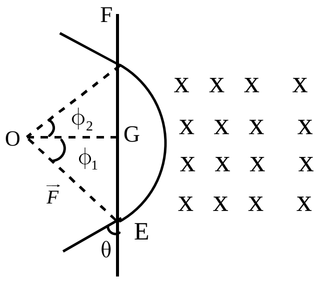
25. $x_{cm} = \frac{\int_0^L x dm}{\int_0^L dm}$

26. $I = \frac{mL^2}{3} + \frac{mL^2}{3} + \frac{mL^2}{12} + m\left(\frac{\sqrt{3}L}{2}\right)^2$



$$I = \frac{2mL^2}{3}$$

27. DIAGRAM



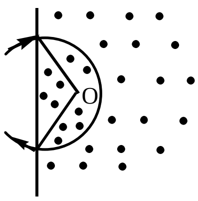
$$\theta = 45^0$$

$$EF = 2r\sin\theta$$

$$r = \frac{mv}{Bq} \therefore EF = \frac{2mv}{Bq}\sin\theta$$

$$EF = 0.414m$$

28. DIAGRAM



$$\theta = \omega t$$

$$\theta = \frac{v}{r}t; \ \therefore t = \frac{\theta r}{v}$$

$$t = \frac{\frac{3\pi}{2}(0.1)}{10^7} = 15\pi \times 10^{-9} \sec$$

29. a - q, b - r, s, c $\rightarrow$ r, s, d $\rightarrow$ p, q, r

30. For J K w = 0

$dQ = nC_v\left(T_k - T_j\right)$

$T_k < T_j \therefore dQ < 0$

For KL

$dw = P\left(V_L - V_K\right) \therefore$ dw > 0

For LM

$dQ = nC_v\left(T_M - T_L\right)$

$T_M > T_L \therefore dQ > 0$

Fn MJ

$dQ = nC_p\left(T_J - T_M\right)$

$= T_J < T_M$

$dQ < 0$

and $dw = nR\left(T_J - T_M\right) \therefore dw < 0$

31. If the number of non volatile solute particle per unit area remain same, colligative properties will be same. Among isotonic solution colligative properties are same $\because$ then ans = 4

32. $N_{(g)} + \bar{e} \rightarrow \bar{N}_{(g)} - \text{heat}$; $\bar{O} + \bar{e} \rightarrow O^{2-} - \text{Heat}$; $Mg^{+} + E \rightarrow Mg^{2+}$;

$C\ell_{(g)} + 1\bar{e} \rightarrow C\ell^{-} + \text{Heat}$ ..exothermic

33. Acc. to faraday's 2nd law, the mass dissolved (or) deposited (or) liberated will be in the ratio of their equivalue weights.

Ans : $\frac{M}{2}:\frac{M}{3}$ i.e. = 3 : 2

34. 16g [0] $\rightarrow$ N_0 atome $32g\left[O_2\right] \rightarrow 2N_0$ atome

$1g\left[O\right] \rightarrow \frac{N_0}{16}$ $1g\left[O_2\right] \rightarrow ?$ $= \frac{N_0}{16}$

$48\left[O_3\right] \rightarrow 3N_0$ atome ; 1g $[O_3]$ $\rightarrow$?

$\frac{N_0}{16}$ $\therefore$ Ans = 4

35. atm L^2 $mole^{-2}$

36. Acetylation of P – aminophenol

37. In $B_3N_3H_6$, N —— H bond is more polar than C — H bond.

38. Hexa methylene diammive + adipic acid $\rightarrow$ Nylon 6, 6.

39. As collidal paralicles are moving towards anode, the charge on them is negative, they can be coagulated by positive particles. Ans = 2

40. Because there is one assymetic carbon. Geometrical isomerism is not possible as identical groups are attached to the same carbon.

41. CH_3 group due to hyper conjugation enhance electron density at O & P position.

42. $ns^2\ np^2np^2np^1$....... G.S

$ns^1np^1np^1np^1nd^1nd^1nd^1$ ____ 3^{rd} exhited state

Hybridisation = sp^3d^3

43. BP of H_2O is high due to intermolecular hydrogen bonding.

44. Reducing strength of oxyacids of phospholus depends on number of P – H bonds.

45. $\left[Fe\left(H_2O\right)_5 NO\right]SO_4$ = x + 0 + 1 – 2 = 0

x = + 1

46. $CH_3CH_2COOH \xrightarrow{SOC\ell_2} CH_3CH_2COC\ell \rightarrow CH_3CH_2CONH_2$

$\downarrow$

$CH_3CH_2NH_2$

47. $E_6 - E_1 \simeq$ 13.4 2ev

one transition corresponds to 1.33ev of energy

other transition corrosponde to 13.42 – 1.33 = 12.09ev

48. 1 ml aq soap is equivalence to 10^{-3} g $CaCO_3$

6 ml aq soap is equivalence to 6 x 10^{-3}g $CaCO_3$

500 ———— 6 x 10^{-3}g aq $CaCO_2$

10^6———— ? $\frac{10^6 \times 6 \times 10^{-3}}{500} = 12ppm$

49. $N_2 + 2O_2 \rightarrow 2NO_2\ \ \Delta H = -xkJ............(1)$

$2NO + O_2 \rightarrow 2NO_2\ \ \Delta H = -ykJ............(2)$

$\frac{1}{2}N_2 + O_2 \rightarrow NO\ \ \ \Delta H = -?$

Equation (1) should be divded by 2

Equation (2) should be reversed and then divided by 2

50. For 2nd order $t_{\frac{1}{2}} \propto \frac{1}{a}$

51. Pressure is not exerted by NH_2COONH_4 as it is a solid. As total pressure is 3atm

The P NH_3 = 2 atm $\therefore k_p = 2^2 .1 = 4\ atm^3$

PCO_2 = 1 atm.

52. $\left[H^+\right] = \sqrt{Ka.C}$ After dilution

$10^{-4} = \sqrt{Ka.1}$ $M_1V_1 = M_2V_2$

$\therefore Ka = 10^{-8}$ 1 x 1 = M_2 x 100

$M_2 = 10^{-2}M$

$[H^7]^+ = \sqrt{Ka.C} = \sqrt{10^{-8} \times 10^{-2}}$

$\therefore p^H = 5$

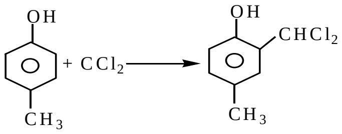
53. A test for 1^0 amines

54. Decease in conc is 4 equivalence

55. A = $BeCl_2$

B = BeH_2 ..... is a covalent hydride

56. $CHC\ell_3 \xrightarrow{O\bar{H}} :CC\bar{\ell}_3 \xrightarrow[-C\ell]{} :CC\ell_2$

57. 

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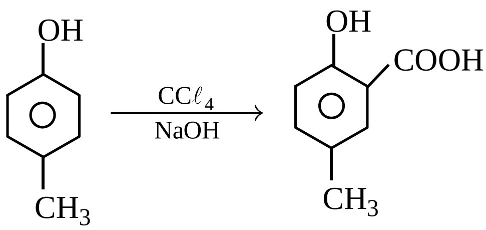
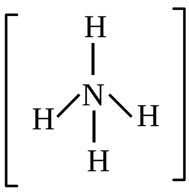
58. 

59. 1 –d, 2 – a, b, c 3 – a, b   4 – c

60. $NH_4^+ =$  $\longrightarrow$ N - sp^3 hybridised

Tetrahedral

61. $f(x) = \pm x^n \pm 1$

$\because f(2) = 33 = 2^5 + 1$

$\therefore$ **f(x) = x^5 + 1**

62. ‘w’ is a root of $x^2 + x + 1 = 0$

$$\therefore \left(w^1 + \frac{1}{w^1}\right)^2 + \left(w^2 + \frac{1}{w^2}\right)^2 + \left(w^3 + \frac{1}{w^3}\right)^2 + \left(w^4 + \frac{1}{w^4}\right)^2 + \left(w^5 + \frac{1}{w^5}\right)^2$$

$= (-1)^2 + (-1)^2 + (1+1)^2 + (-1)^2 + (-1)^2 = 8$

63. Total no. of seven digit numbers are 9×10^6

$\therefore$ **No. of numbers whose sum of the digits is even are** $\dfrac{9\times10^6}{2}$

45×10^5

64. $A.M \geq G.M$

$$\frac{27\tan^2\theta+3\cot^2\theta}{2}\ge\sqrt{27\tan^2\theta.3\cot^2\theta}$$

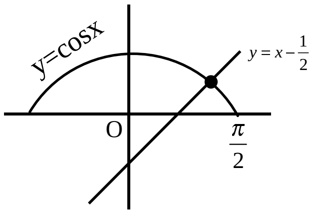
$$27\tan^2\theta+3\cot^2\theta\ge 2\sqrt{81}$$

$$27\tan^2\theta+3\cot^2\theta\ge 18$$

$\therefore$ **Minimum value is 18**

65. **Let y = cosx**

$$y=x-\frac{1}{2}$$



one root lies in $\left(0,\frac{\pi}{2}\right)$

66. **n(AxB) = n(A)n(B)**

15 = 3n(B)

$\therefore$ **n(B) = 5**

67. **After putting one ball in each box the remaining 5 ball be put in 3 boxes in** ${}^{5+3-1}C_{3-1}$ **way i.e.,** ${}^{y}C_2=21$ **ways**

68. **1600 = 2^6 x5^2**

$\therefore$ **No. of even divisors are**

(6) (2+1) = 18

69. $$\begin{vmatrix}\cos x & \sin x & -\cos x\\ -\sin x & \cos x & \sin x\\ -\cos x & -\sin x & \cos x\end{vmatrix}=0$$

70. **Equation to the plane is 2(x – 2) – 1 (y + 1)+1(z – 1) =0**

i.e., 2x – y +z – 6 = 0 ....(1)

Now $\perp^2$ distance from (1, 2, 3) to be plane (1) is

$$\frac{12(1)-1(2)+3-6}{\sqrt{4+1+1}}=\frac{3}{\sqrt{6}}=\sqrt{\frac{3}{2}}$$

71. **Let** $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}=\alpha$

$\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}=\beta$

$\therefore\ x=2\alpha+1, y=3\alpha-1, z=4\alpha+1$

$x=\beta+3,\ y=2\beta+k, z=\beta$

Solving $\alpha=-3/2,\ \beta=-5$

$\therefore$ **k =** $\frac{9}{2}$

72. **Ascending orders is 34, 38, 42, 44, 46, 48, 54, 55, 63, 70**

Median = $\frac{46+48}{2}=47$

Mean deviation from median = $\frac{1}{n}|xi-m|=\frac{1}{10}(86)=8.6$

73. $\int_{-1}^{1}\frac{-1}{1+x^2}dx$

= – $\left(\tan^{-1}x\right)_{-1}^{1}$

= – $\left[\frac{\pi}{4}-\left(\frac{-\pi}{4}\right)\right]$

$=-\frac{\pi}{2}$

74. $\underset{n\to 4}{Lt}\ \frac{1}{\sqrt{4n^2-1}}+......+\frac{1}{\sqrt{4n^2-n^2}}$

$\underset{n\to\infty}{Lt}\sum_{r=1}^{n}\frac{1}{\sqrt{4n^2-r^2}}$

$\int_0^1\frac{1}{\sqrt{2^2-x^2}}dx$

= $\left(\sin^{-1}\left(\frac{x}{2}\right)\right)_0^1$

$\sin^{-1}\left(\frac{1}{2}\right)$

$=\frac{\pi}{6}$

75. $\int \tan x.\dfrac{2\tan x}{1-\tan^2 x}dx$

$\int \dfrac{\left(1+\tan^2 x\right)-\left(1-\tan^2 x\right)}{1-\tan^2 x}dx$

$\int \left(\dfrac{1+\tan^2 x}{1-\tan^2 x}-1\right)dx$

$\int (\sec 2x-1)\,dx$

$\dfrac{1}{2}\log\tan\left(x+\dfrac{\pi}{4}\right)-x+c$

76. $P(A).P(\bar{B})+P(\bar{A}).P(B)$

$\dfrac{4}{5}.\dfrac{1}{4}+\dfrac{1}{5}.\dfrac{3}{4}=\dfrac{7}{20}$

77. $\sum_{m=1}^{n}\tan^{-1}\left(\dfrac{2m}{m^4+m^2+2}\right)$

$\sum_{m=1}^{n}\tan^{-1}\left(\dfrac{\left(m^2+m+1\right)-\left(m^2-m+1\right)}{1+\left(m^2+m+1\right)\left(m^2-m+1\right)}\right)$

$\sum_{m=1}^{n}\tan^{-1}\left(m^2+m+1\right)-\tan^{-1}\left(m^2-m+1\right)$

$=\tan^{-1}(3)-\tan^{-1}(1)+\tan^{-1}(y)-\tan^{-1}(3)+\tan^{-1}(13)-\tan^{-1}(7)+....+\tan^{-1}\left(n^2+n+1\right)-\tan^{-1}\left(n^2-n+1\right)$

= $\tan^{-1}$ (n^2 + n+1) - $\tan^{-1}$ (1)

$=\tan^{-1}\left(\dfrac{n^2+n+1-1}{1+n^2+n+1}\right)$

= $\tan^{-1}\left(\dfrac{n^2+n}{n^2+n+2}\right)$

78. **Cot A/2 : Cot B/2 : Cot C/2 = x : y : z**

Now a : b : c = y+ z : z + x ; x + y

= 19 : 16 : 5

$\therefore$ **greatest angle is cosA**

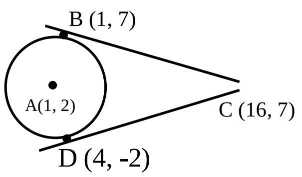
$\therefore$ **cosA =** $\dfrac{b^2+c^2-a^2}{2bc}$

$=\dfrac{256+25-361}{2\times16\times5}=\dfrac{-80}{160}=\dfrac{-1}{2}$

79.

Pvr	$P \Rightarrow v$	rvp	rval	$1 \Rightarrow 2$	$0 \Rightarrow 3$
TTT	T	T	T	T	T
TTF	T	T	T	T	T
TFT	F	T	T	T	T
FTT	T	T	T	T	T
FFF	T	F	F	T	T
FFT	T	F	T	T	T
FTF	T	T	T	T	T
TFF	F	T	F	F	T

$\therefore$ **tautology**

80 

$$\text{Arew} = \frac{1}{2}\begin{vmatrix} -15 & -5 \\ -3 & 9 \end{vmatrix}$$

$$= \frac{150}{2}$$

$$= 75 \text{ Sq. unit}$$

81. $$\left(\frac{6x+8y+7}{10}\right)^2 = \frac{4}{10}\left(\frac{80-6y+3}{10}\right)$$

$$\text{LLR} = \frac{4}{10} = \frac{2}{5}$$

$\therefore$ R is true, A is false

82. $$\left[\bar{a}\ \bar{b}\ \bar{c}\right]^2 = \begin{vmatrix} \bar{a}.\bar{b} & a.\bar{b} & \bar{a}.\bar{b} \\ \bar{b}.\bar{a} & \bar{b}.\bar{b} & \bar{b}.\bar{c} \\ \bar{c}.\bar{a} & \bar{c}.\bar{b} & \bar{c}.\bar{c} \end{vmatrix}$$

$$= \begin{vmatrix} 1 & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & 1 & 1 \\ \frac{1}{2} & \frac{1}{2} & 1 \end{vmatrix}$$

$$= \left(1-\frac{1}{4}\right) - \frac{1}{2}\left(\frac{1}{2}-\frac{1}{4}\right) + \frac{1}{2}\left(\frac{1}{4}-\frac{1}{2}\right)$$

$$= \frac{3}{4} - \frac{1}{2}\left(\frac{1}{4}\right) + \frac{1}{2}\left(-\frac{1}{4}\right)$$

$=\frac{3}{4}-\frac{1}{8}-\frac{1}{8}$

$=\frac{3}{4}-\frac{1}{4}=\frac{1}{2}$

$\therefore\left[\bar{a}\,\bar{b}\;\bar{c}\right]=\frac{1}{\sqrt{2}}$

83. $\frac{1}{1.3}+\frac{1}{5.7}+\frac{1}{9.11}+----$

$\frac{1}{2}\left[\frac{1}{1}-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\frac{1}{11}+---\right]$

$\frac{1}{2}\left[\frac{\pi}{4}\right]=\frac{\pi}{8}$

84. $\because$ f is strictly increasing $f^1(x)>0$ i.e $f^1(x)\neq 0$

$\underset{x\to 0}{Lt}\frac{f^1\left(x^2\right)2x-f^1\left(x\right)}{f^1\left(x\right)-0}$

$=\frac{0-f^1\left(0\right)}{f^1\left(0\right)}=1$

85. Let $f(x) = ax^3 + bx^2 + cx$

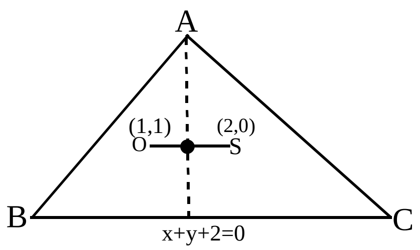
$f^1(x) = 3ax^2 + 2bx + c$

ie $f^1(x) = 0$

Also $f(0) = 0$

$f(1) = a + b + c = 0$

$\therefore$ atleast one rat

86. 

G $\left(\frac{5}{3},\frac{1}{3}\right)$

Foot of the $\perp^2$ **of G on** $\overline{BC}$ **is (0, 2)**

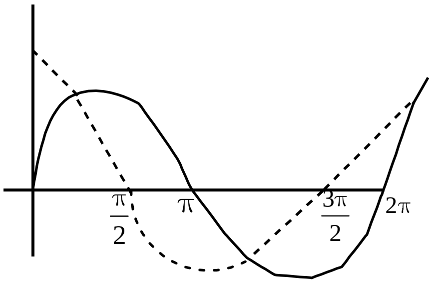
A = 3G – 2P

= (5, 5)

Now R = As

= $\sqrt{9+25}$

= $\sqrt{34}$

87. 

No. of non differentiable points are 3

88. xdy + 2ydy + dy –2xdx + ydx - dx = 0

d (xy) +2ydy +dy- 2xdx –dx = 0

$\int d(xy) + \int 2ydy + \int dy - \int 2xdx - \int dx = 0$

xy + y^2 + y –x^2 – x = c

$\therefore y(1) = 1$ ie at x = 1, y = 1

(1) (1) + 1 + 1 –1–1 = C

$\therefore c = 1$

ie xy +y^2 +y+ y - x^2 – x –1 = 0

Now y (0) = y^2 + y–1 = 0

$\therefore y = \frac{-1 \pm \sqrt{5}}{2}$

89. Let $\alpha = \pi,\ \beta = \frac{\pi}{3},\ r = \frac{-\pi}{3}$

I) $\cos 3\alpha + \cos 3\beta + \cos 3\gamma$

–1 + (–1) + (–1)

= –3

$3\cos\left(\pi + \frac{\pi}{3} - \frac{\pi}{3}\right) = -3$

I – b, II – a, III – b

90. I) $\left(\frac{3}{4}\right)^n - C$ II) $\left(\frac{3}{4}\right)^n - b$ III) $nc_2 \frac{3^{n-2}}{4^n} - b$