ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

LEADER COURSE (PHASE – ELS)

TARGET : JEE (MAIN) 2015

SCORE – I | DATE : 13 - 02 - 2015

MAJOR TEST | Test Pattern : JEE (Main)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	3	2	3	3	1	4	4	3	1	3	2	2	2	4	2	1	2	4	3	2
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	3	4	2	1	4	2	2	1	1	3	4	2	4	2	1	1	4	3	2
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	1	3	2	4	4	2	1	2	3	3	3	3	3	2	4	2	1	1	1	4
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	3	2	4	2	3	4	2	3	4	1	2	4	3	4	1	2	2	1	3	2
Que.	81	82	83	84	85	86	87	88	89	90										
Ans.	3	3	3	2	2	4	1	3	1	1										

HINT – SHEET

1. Due to 10.2 eV photon, one photon of energy 10.2 eV will be detected.
Due to 15 eV photon the electron will come out of the atom with energy (15 - 13.6) = 1.4 eV.

2. $I_2 > I_2$ (given) $\Rightarrow$ $i_1 > i_2$ ($\because$ $i \propto I$)
and stopping potential does not depend upon intensity. So its value will be same (V_0).

3. $\lambda = \dfrac{h}{mv}$ Since v is increasing in case (i), but it is not changing in case (ii). Hence, in the first case de-Broglie wavelength will change, but it second case, it remain the same

4. $\lambda = \dfrac{h}{p}$

$$\Rightarrow \lambda - \frac{0.5}{100}\lambda = \frac{h}{p+\Delta p}$$

$$\Rightarrow \frac{199\lambda}{200} = \frac{h}{p+\Delta p} = \frac{199}{200}\frac{h}{p}$$

$$\Rightarrow p + \Delta p = \frac{200}{199}p$$

$\Rightarrow p = 199\ \Delta p$

5. Lower NOT gate inverts input to zero. NOT gate from NAND gate inverts this output to 1 upper NAND gate converts this input 1 and input 0 to 1. Thus A = 1 and B = 1 become inputs of NAND gate giving final output as zero. Choice A is correct.

6. The P-N junction will conduct only when it is forward biased i.e. when – 5V is fed to it, so it will conduct only for 3rd quarter part of signal shown and when it conducts potential drop 5 volt will be across both the resistors, so output voltage across R_2 is 2.5 V.
$\therefore$ $V_0 = -\ 2.5V$

7. In sample x no impurity level seen, so it is undoped.
In sample y impurity energy level lies below the conduction band so it is doped with fifth group impurity.
In sample z, impurity energy level lies above the valence band so it is doped with third group impurity.

8. $f_c \propto (N)^{1/2} \Rightarrow (f_c)_E : (f_c)_{F_1} : (f_c)_{F_2}$
$= = (4\times10^{11})^{1/2} : (9\times10^{11})^{1/2} : (16\times10^{11})^{1/2}$
= 2 : 3 : 4

9. Here, $f_c = 1.5 \text{ MHz} = 1500 \text{ kHz}$,

$f_m == 10 \text{ kHz}$

$\therefore$ Low side band frequency

$= f_c - f_m = 1500 \text{ kHz} - 10 \text{ kHz} = 1490 \text{ kHz}$

Upper side band frequency

$= f_c + f_m = 1500 \text{ kHz} + 10 \text{ kHz} = 1510 \text{ kHz}$

10. $\alpha = 0.8 \Rightarrow \beta = \dfrac{0.8}{(1-0.8)} = 4$

Also $\beta = \dfrac{\Delta i_c}{\Delta i_b} \Rightarrow \Delta i_c = \beta \times \Delta i_b = 4 \times 6 = 24\text{mA}$.

11. $K_{particle} = \dfrac{1}{2}mv^2$ also $\lambda = \dfrac{h}{mv}$

$\Rightarrow K_{particle} = \dfrac{1}{2}\left(\dfrac{h}{\lambda\nu}\right) \cdot \nu^2 = \dfrac{\nu h}{2\lambda}$ ....(i)

$K_{photon} = \dfrac{hc}{\lambda}$ ....(ii)

$\therefore \dfrac{K_{particle}}{K_{photon}} = \dfrac{\nu}{2c} = \dfrac{2.25\times10^8}{2\times3\times10^8} = \dfrac{3}{8}$

12. $\lambda = \dfrac{h}{\sqrt{2mE}} \Rightarrow \lambda \propto \dfrac{1}{\sqrt{m}}$ (E = same)

13. From snell's law

$\mu_1 \sin i = \mu_2 \sin r$

$\mu \sin\theta = 1.6\, \mu \sin x$

$\sin x = \dfrac{5}{8}\sin\theta$

14. Refraction from plane surface

$\dfrac{\mu_2}{v} - \dfrac{\mu_1}{u} = \dfrac{\mu_2 - \mu_1}{\infty}$

$\dfrac{1}{v} - \dfrac{4/3}{(-0.4)} = 0$

$\Rightarrow v = -0.3$ m

For lens u = – (0.3 + 0.2) = – 0.5 m

f = 3 m

v = ?

$\dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{f} \Rightarrow \dfrac{1}{v} - \dfrac{1}{(-0.5)} = \dfrac{1}{3}$

v = – 0.6 m

16. Focal length of plano convex lens = 10 cm

From lens maker formula

$\dfrac{1}{10} = \left(\dfrac{3/2}{1} - 1\right)\left(\dfrac{1}{\infty} - \dfrac{1}{-R}\right)$

$\Rightarrow R = 5$

Focal length of equi-concave lens of water

$\dfrac{1}{f} = \left(\dfrac{4/3}{1} - 1\right)\left(\dfrac{1}{-5} - \dfrac{1}{5}\right) \Rightarrow f = \dfrac{-15}{2}\text{cm}$

So, net focal length

$\Rightarrow \dfrac{1}{f_{net}} = \dfrac{1}{10} - \dfrac{2}{15} + \dfrac{1}{10} \Rightarrow f_{net} = 15\text{cm}$

$P_{net} = \dfrac{100}{15} = 6.67\text{D}$

17. ${}_1\mu_2 = \dfrac{\sin i}{\sin r} = \dfrac{\mu_2}{\mu_1} = \dfrac{v_1}{v_2} = \dfrac{1}{\tan 30^\circ} = \sqrt{3} = 1.732$

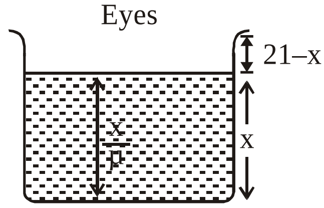
$i_c = \sin^{-1}\dfrac{\mu_1}{\mu_2} = \sin^{-1}\dfrac{1}{\sqrt{3}}$

18. $N_A = N_3 + N_C$

$\dfrac{3x}{(\lambda/1.5)} = \dfrac{x}{\lambda/\mu} + \dfrac{2x}{\lambda/1.4}$

$\Rightarrow \mu = 1.7$

19.



$\dfrac{21-x}{\dfrac{x}{\mu}} = \dfrac{80}{20}$

Here $\mu = \dfrac{4}{3}$

x = 5.25 cm

23. $b = \mu_r \mu_0 H$

$\mu_r = \dfrac{B}{\mu_0 H} = \dfrac{8\pi}{4\pi\times10^{-7}\times2\times10^3} = 10^4$

24. For. T.I.R.

$i > \theta_c$

$\sin i \geq \sin q_c$

From triangle $\sin i = \dfrac{R}{R+d}$

$$\sin Q_c = \frac{1}{\mu} = \frac{2}{3}$$

$$\frac{R}{R+d} \geq \frac{2}{3}$$

$$\frac{d}{R} \geq 0.5$$

25. For 2nd dark

$d \sin \theta = 2\lambda$

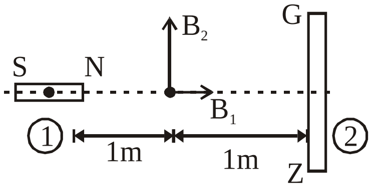
$$\lambda = \frac{d\sin\theta}{2} = \frac{24\times10^{-5}\sin 30^\circ}{2} = 6\times10^{-5}\text{cm} = 6000\text{Å}$$

26. $H = nI$

$$I = \frac{H}{n} = \frac{H}{(N/\ell)} = \frac{H\ell}{N} = \frac{4\times10^{3}\times12\times10^{-2}}{60}$$

$I = 8A$

30.

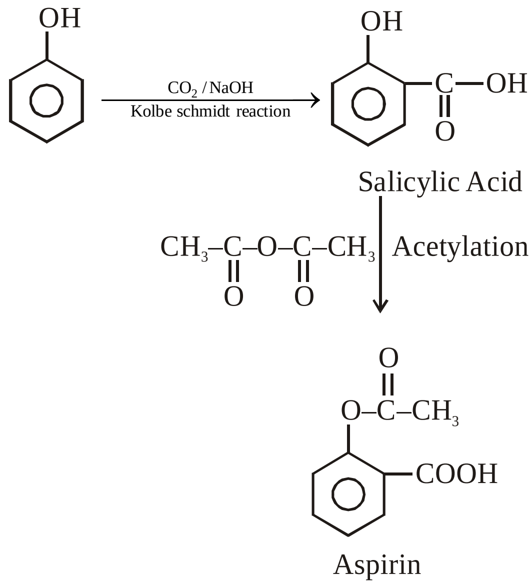


$$B_{net} = \sqrt{B_1^2 + B_2^2}$$

$$B_{net} = \sqrt{\left(2\frac{\mu_0}{4\pi}\frac{M}{r^3}\right)^2 + \left(\frac{\mu_0 M}{4\pi r^3}\right)^2}$$

$$B_{net} = \sqrt{5}\frac{\mu_0}{4\pi}\frac{M}{r^3} = \sqrt{5}\times10^{-7}\times\frac{1}{(1)^3} = \sqrt{5}\times10^{-7}\text{T}$$

31.

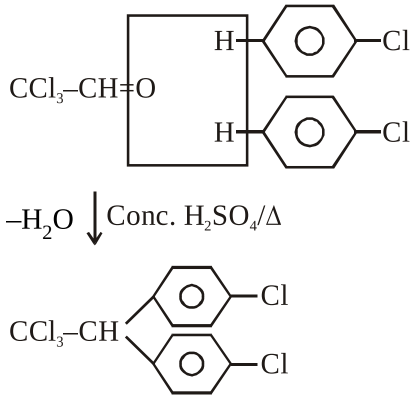


32. Reducing sugar contain free –OH group at Anomeric carbon.

33. Anomers are pair of disatereomers which have opposite configuration at carbon atom of functional group (Anomeric carbon)

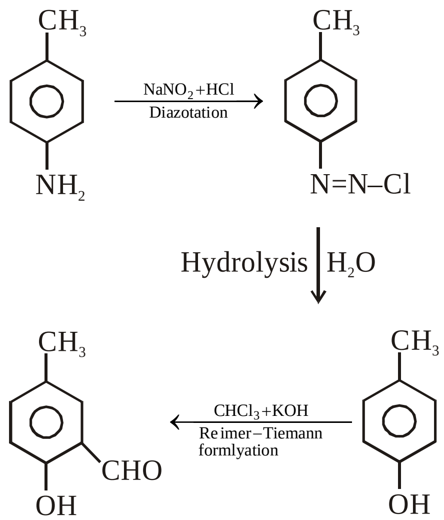
34. $-\overset{\overset{\displaystyle O}{||}}{C}-NH-$ is peptide bond

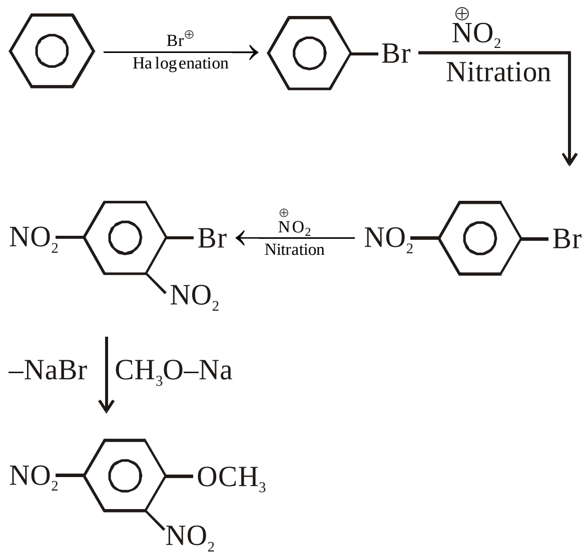
35.



p,p'-Dichloro dipheny/ trichloroethane (DDT)

36.



37. 

38. Only 1' Amide gives Hoffmann Bromamide reaction

39. Initial volume, $V_1 = 10L$

$V_2(\text{final}) = \dfrac{nRT}{P} = \dfrac{10 \times 0.083 \times 300}{1} = 249L$

$W = P\,\Delta V = 1 \times (249 - 10)$
$= 239$ L bar

40. Number of moles of HCl $= \dfrac{MV}{1000} = \dfrac{0.01 \times 25}{1000}$
$= 25 \times 10^{-5}$

$n_{H^+} = 25 \times 10^{-5}$

Number of moles of $Ca(OH)_2$

$= \dfrac{MV}{1000} = \dfrac{0.01 \times 50}{1000} = 50 \times 10^{-5}$

$n_{OH^-} = 2 \times 50 \times 10^{-5} = 10^{-3}$

In the process of neutralisation 25×10^{-5} mole H^+, OH^- will be neutralised

$\therefore \Delta H = 140 \times 25 \times 10^{-5}$ kcal $= 3500 \times 10^{-5}$ kcal
$= 35$ cal

41. $\Delta S_{fusion} = \dfrac{\Delta H_{fusion}}{T_{mp}} = \dfrac{6.01 \times 1000}{273} = 22\ J\ mol^{-1}$

42. $\Delta H_{reaction} = \Delta H^o_{f(C_6H_6)} - 3\Delta H^o_{f(C_2H_2)}$
$= 85 - 3(230)$
$= -605\ kJ\ mol^{-1}$

43. $\dfrac{1}{4}P_4(s) + \dfrac{3}{2}Cl_2(g) \rightarrow PCl_3(\ell)$; $\Delta H = -\dfrac{635}{2}$ kJ

$PCl_3(\ell) + Cl_2(g) \rightarrow PCl_5(s)$; $\Delta H = -137$ kJ

On adding $\dfrac{1}{4}P_4(s) + \dfrac{5}{2}Cl_2(g) \rightarrow PCl_5(s)$; $\Delta H = -454.5kJ$

44. 1 mole product formation should be from elements in most stable allotropic form

45. Here, $\theta = 0$

$\Rightarrow \tan\theta = \tan 0 = 0;\ \log\left(\dfrac{x}{m}\right) = \log k + \dfrac{1}{n}\log C$

$\because \dfrac{1}{n} = \tan\theta \Rightarrow \dfrac{1}{n} = 0$

47. Since ferric ions can coagulate negatively charged blood solution, therefore ferric chloride may be applied to stop bleeding.

48. $\because$ Productive power $\propto \dfrac{1}{\text{gold number}}$

Q Order of productive power will be
Gelatin > Haemoglobin > Sodium acetate
(0.005) (0.05) (0.7)

49. $PV = \dfrac{w}{m}RT$

$P \times 0.03 = \dfrac{6}{16.05} \times 8.314 \times 402$

$\therefore P = 41647.7$ Pa

50. $\dfrac{u_{O_3}}{u_{O_2}} = \sqrt{\left[\dfrac{32}{48}\right]} = \sqrt{2/3}\ \left(U_{rms} \propto \dfrac{1}{\sqrt{M}}\right)$

51. 2.24 lit mixture $= \dfrac{2.24}{22.4} = 0.1mol$

Since mixture is equi-molecular,

$0.1mol \nearrow 0.05mol\,CH_4 \xrightarrow{\times 16} 0.8gm$
$0.1mol \searrow 0.05mol\,C_2H_6 \xrightarrow{\times 30} 1.5gm$

$\therefore$ Mass of mixture = 2.3gm

52. $\Delta S_v = \dfrac{\Delta H_v}{B.pt} = \dfrac{540}{373}$; $\Delta S_f = \dfrac{\Delta H_f}{F.pt} = \dfrac{80}{273}$;

$\therefore \dfrac{\Delta S_v}{\Delta S_f} = \dfrac{540}{373} \times \dfrac{273}{80} = 4.94$

61. $2b = a + c$

$\Rightarrow 2\log_5(2^x - 3) = \log_5 2 + \log_5\left(\dfrac{17}{2} + 2^{x-1}\right)$

$\Rightarrow (2^x - 3)^2 = 2\left(\dfrac{17}{2} + 2^{x-1}\right) \Rightarrow 2^{2x} - 7.2^x - 8 = 0$

$\Rightarrow x = 3$

62. These are 13 factors so $2^{13}\left(x+\frac{1}{2}\right)\left(x+\frac{5}{2}\right)$

$$\left(x+\frac{9}{2}\right)\cdots\left(x+\frac{49}{2}\right)$$

so coefficient of $x^{12} = 2^{13}\left(\frac{1}{2}+\frac{5}{2}+\frac{9}{2}+\cdots+\frac{49}{2}\right)$

$= 325.2^{12}$

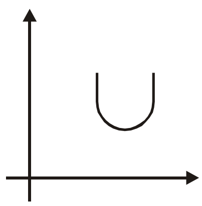
64. $(abcd)^{\frac{1}{4}} \ge \frac{a+b+c+d}{4}$

$\Rightarrow$ G = A $\Rightarrow$ a = b = c = d

$\therefore$ 3a + b + 2c + 5d = 11 $\Rightarrow$ a = b = c = d = 1

So $a^3 + b + c^2 + 5d = 8$

65. f(0) = C > 0

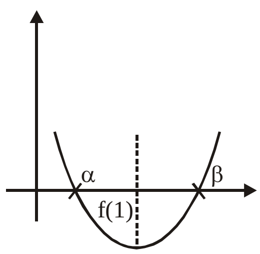


So f(–1) = 3a – 4b + c > 0 $\Rightarrow$ 3a + c > 4b

66. a < 0, b > 0, c > 0 $\Rightarrow$ a > 0, b < 0, c < 0

So roots are of opposite sign and positive root is greater in magnitude. So β is positive root and α is negative root ($\because$ $\alpha < \beta$)

68. D > 0, Af(1) < 0



(i) D > 0 $\Rightarrow$ 9 – 4a > 0 $\Rightarrow$ $\frac{9}{4} > a$

(ii) Af(1) < 0 $\Rightarrow$ (a – 2) < 0 $\Rightarrow$ a < 2

$\Rightarrow a \in (-\infty, 2)$

69. |A| = –1, |B| = 2

$|2A^9B^{-1}| = 4|A|^9|B|^{-1} = -2$

70. Δ_1 is made up of cofactors of Δ_2. So by the property $\Delta_1 = \Delta_2^2$.

$\therefore$ $\Delta_1\Delta_2 = \Delta_2^3$

71. $\prod_{k=1}^{36}\begin{bmatrix}1 & 3k+\frac{1}{3}\\ 0 & 1\end{bmatrix} = \begin{bmatrix}1 & 3+\frac{1}{3}\\ 0 & 1\end{bmatrix}\begin{bmatrix}1 & 6+\frac{1}{3}\\ 0 & 1\end{bmatrix}\cdots\begin{bmatrix}1 & 108+\frac{1}{3}\\ 0 & 1\end{bmatrix}$

$\Rightarrow \begin{bmatrix}1 & (3+6+9+\cdots+108)+12\\ 0 & 1\end{bmatrix} = \begin{bmatrix}1 & 2010\\ 0 & 1\end{bmatrix}$

72. $A = A^T$, $B = -B^T$

$A - B = \begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ ...(i)

$\Rightarrow A^T + B^T = \begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix} \Rightarrow (A+B)^T = \begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$

$\Rightarrow A + B = \begin{bmatrix}1 & 3\\ 2 & 4\end{bmatrix}$ ...(ii)

Adding (i) & (ii) $A = \begin{bmatrix}1 & \frac{5}{2}\\ \frac{5}{2} & 4\end{bmatrix}$

$\therefore$ $|A| = 4 - \frac{25}{4} = \frac{-9}{4}$

73. $d_1 = d_1 = d_3 = 0 \Rightarrow D_1 = D_2 = D_3 = 0$

$D = \begin{vmatrix}a^3 & (a+1)^3 & (a+2)^3\\ a & (a+1) & (a+2)\\ 1 & 1 & 1\end{vmatrix} = 0 \Rightarrow a = -1$

74. By properties of adjoint matrix options (1), (2), (3) all are correct. So option (4) is correct.

75. $\sum_{r=0}^{100}(r+2)^2\lfloor\underline{r+1} = \sum_{r=0}^{100}(r+2)\lfloor\underline{r+2}$

$\sum_{r=0}^{100}(r+3-1)\lfloor\underline{r+2} = \sum_{r=0}^{100}\lfloor\underline{r+3} - \sum_{r=0}^{100}\lfloor\underline{r+2}$

$\Rightarrow \left(\lfloor\underline{3}+\lfloor\underline{4}+\lfloor\underline{5}+\cdots+\lfloor\underline{103}\right)-\left(\lfloor\underline{2}+\lfloor\underline{3}+\lfloor\underline{4}+\cdots+\lfloor\underline{102}\right)$

$\Rightarrow \lfloor\underline{103} - 2$

76. Put the value of n.

77. $T_{r+1} = {}^{6561}C_r\left(7^{\frac{1}{3}}\right)^{6561-r}\left(11^{\frac{1}{9}}\right)^r$

$= {}^{6561}C_r\, 7^{2187-\frac{r}{3}}\, 11^{\frac{r}{9}}$

$\Rightarrow$ r = 0, 9, 18, ..., 6561

$\Rightarrow T_n = a + (n-1)d \Rightarrow 6561 = 0 + (n-1)9$

$\Rightarrow$ n = 730

78. $(13)^{507} = (9 + 4)^{507}$

Remainder = $4^{507} = (4^3)^{169} = (63 + 1)^{169}$

so remainder = 1

79. Let there aer n candidates

$^nC_1 + {^nC_2} + {^nC_3} + \cdots + {^nC_{n-1}} = 62$

$\Rightarrow 2^n - 2 = 62 \Rightarrow 2^n = 64 \Rightarrow n = 6$

80. No. of ways = 2! · 4!

81. No. of words = $\dfrac{\frac{5!}{2!}}{2!} = 30$

82. Considering cc as single object

_U_CC_E_ = 3!

Now at 4 vacant places 3s can be arranged by $\dfrac{^4P_3}{3!}$

so no. of words = $3!\dfrac{^4P_3}{3!} = 24$

83. Required probability = $\dfrac{1}{2}\left(\dfrac{4_{C_1}}{7_{C_1}} + \dfrac{6_{C_1}}{8_{C_1}}\right)$

$= \dfrac{37}{56}$

84. $x^2 - 13x - 30 \le 0 \Rightarrow (x + 2)(x - 15) \le 0$

$\Rightarrow -2 \le x \le 15$

$n = {^{100}C_1}, \quad m = {^{15}C_1}$

$\Rightarrow$ required probability = $\dfrac{^{15}C_1}{^{100}C_1} = \dfrac{3}{20}$

85. $P(1) = \dfrac{1}{6}, P(2) = \dfrac{2}{6}, P(3) = \dfrac{3}{6}$

{1, 2, 3} or {2, 2, 2}

$\text{Probability} = \left(\dfrac{1}{6}\times\dfrac{2}{6}\times\dfrac{3}{6}\right)\times 3! + \left(\dfrac{2}{6}\times\dfrac{2}{6}\times\dfrac{2}{6}\right) = \dfrac{44}{216}$

86. Required probability = $1 - \{(1 - 0.4)(1 - 0.3)(1 - 0.2)(1 - 0.1)\}$

$= 0.6976$

87. Let $z = x + iy$

$$\frac{2z+1}{iz+1} = \frac{(2x+1)+2iy}{(1-y)+ix}\left\{\frac{(1-y)-ix}{(1-y)-ix}\right\}$$

$$\Rightarrow \frac{(2x+1)(1-y)+2xy+i\{2y(1-y)-x(2x+1)\}}{(1-y)^2+x^2} = -3$$

So I.P. = $\dfrac{2y(1-y)-x(2x+1)}{(1-y)^2+x^2} = -3$

so locus is circle.

88. $x_1.x_2.x_3..........\infty$

$$\Rightarrow \left(\cos\frac{\pi}{3} - i\sin\frac{\pi}{3}\right)\left(\cos\frac{\pi}{9} - i\sin\frac{\pi}{9}\right).......\infty$$

$$\Rightarrow \cos\left(\frac{\pi}{3}+\frac{\pi}{9}+\frac{\pi}{27}+\cdots\right) - i\sin\left(\frac{\pi}{3}+\frac{\pi}{9}+\frac{\pi}{27}+\cdots\infty\right)$$

$$\Rightarrow \cos\frac{\pi}{2} - i\sin\frac{\pi}{2} = -i$$

89. $|z_1|^2 = 1 \Rightarrow z_1\bar{z}_1 = 1$, $|z_2|^2 = 4 \Rightarrow z_2\bar{z}_2 = 4$,

$|z_3|^2 = 9 \Rightarrow z_3\bar{z}_3 = 9$

$|9z_1z_2 + 4z_1z_3 + z_2z_3| = 12$

$|z_3\bar{z}_3z_1z_2 + z_2\bar{z}_2z_1z_3 + z_1\bar{z}_1z_2z_3| = 12$

$\Rightarrow |z_1||z_2||z_3|\ |\bar{z}_1 + \bar{z}_2 + \bar{z}_3| = 12$

$\Rightarrow |\bar{z}_1 + \bar{z}_2 + \bar{z}_3| = 2 \Rightarrow |z_1 + z_2 + z_3| = 2$