AVIRAL CLASSES
CREATING SCHOLARS
FOR JEE (Main & advance), PMTs & FOUNDATION

DATE : 26.02.2017

FINAL TEST SERIES JEE -2017
TEST-07

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PH: 0135-6557701 / 02 / 03, **MOB.:** 9045062312 / 14 / 15 / 16 / 17 / 18 / 20. **web: www.aviral.co.in**

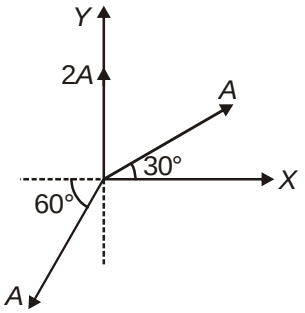
[PHYSICS]

1. Answer (3)

$x_1 = A\sin\left(\omega t + \frac{\pi}{6}\right)$ ...(i)

$x_2 = 2A\sin\left(\omega t + \frac{\pi}{2}\right)$ ...(ii)

$x_3 = A\sin\left(\omega t + \frac{\pi}{3} + \pi\right)$ ...(iii)



$Ax = (A\sin 30° - A\cos 60°)\hat{i}$

$Ax = A\left[\frac{\sqrt{3}}{2} - \frac{1}{2}\right](+\hat{i})$

$Ax = \frac{A}{2}[\sqrt{3} - 1](+\hat{i})$

$Ay = 2A + A\sin 30° - A\sin 60°$

$= 2A + \frac{A}{2} - \frac{A\sqrt{3}}{2}$

$= \frac{5A}{2} - \frac{A\sqrt{3}}{2}$

$Ay = \frac{A}{2}[5 - \sqrt{3}]$

$A_{res} = \frac{A}{2} \times \sqrt{(\sqrt{3}-1)^2 + (5-\sqrt{3})^2}$

$= \frac{A}{2}\sqrt{3 + 1 - 2\sqrt{3} + 25 + 3 - 10\sqrt{3}}$

$= \frac{A}{2}\sqrt{32 - 12\sqrt{3}}$

$A_{res} = A\sqrt{8 - 3\sqrt{3}}$

2. Answer (3)

$x_1 = A\sin(\omega t - kx)$ ...(i)

$x_2 = A'\sin(\omega' t + k'x + \pi)$ ...(ii)

Clearly $\omega' = \omega$ and $k' = k$

Now $I \propto A^2 \Rightarrow A' = 0.8$ A

Thus $x_1 = A\sin(\omega t - kx)$ ...(iii)

$x_2 = 0.8\sin(\omega t + kx + \pi)$ ...(iv)

$\Rightarrow A_{max} = 1.8$ A

$A_{min} = 0.2$ A

$\Rightarrow \frac{A_{max}}{A_{min}} = 9$

3. Answer (2)

$y = 2A\sin kx\cos\omega t$ ...(i)

$dk = \frac{1}{2}(\mu dx) \times \left(\frac{dy}{dt}\right)^2$

$= \frac{1}{2}(\mu dx) \times 4A^2\sin^2 kx\omega^2\sin^2\omega t$

$k = \int 2\mu\, dx\, A^2\omega^2\sin^2 kx\sin^2\omega t$

$k_{max} = \int 2\mu A^2\omega^2\sin^2 kx\, dx$

$= 2\mu A^2\omega^2 \times \frac{1}{2}\int_0^l (1 - \cos 2kx)\, dx$

$k_{max} = mu^2A^2$ = Total energy of string

4. Answer (1)

$v = \sqrt{24 - 4x^2}$

$\frac{dv}{dx} = \frac{1}{2\sqrt{24 - 4x^2}} \times (-8x)$

$\Rightarrow \quad \frac{dv}{dx} = -\frac{4x}{v}$

$\Rightarrow \quad a = v\frac{dv}{dx} = -4x$

5. Answer (3)

The particle is moving perpendicularly to its initial direction when it lands upon ground.

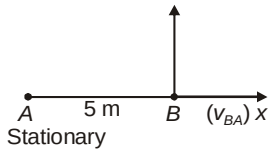
$\omega = \frac{u\sin 45°}{R} = \frac{u}{\sqrt{2}} \times \frac{g}{u^2 \sin 2\theta}$

$= \frac{g}{\sqrt{2} \times u} = \frac{10}{\sqrt{2} \times 5\sqrt{2}} = 1 \text{ rad/s}$

6. Answer (1)

The acceleration of point B is $\omega^2 R(\hat{j})$.

7. Answer (3)



$v_y = 10 \times \frac{4}{5} - 5 = 3 \text{ ms}^{-1}$

$v_x = 10 \times \frac{3}{5} - 5 = 1 \text{ ms}^{-1}$

Hence closest distance = 5 m

8. Answer (4)

$E_n = -\frac{9 \times 13.6}{n^2} \text{ eV}$

$K = \frac{9 \times 13.6}{9} = 13.6 \text{ eV}$

9. Answer (3)

R_L = 20 kΩ, ΔV_I = 20 mV

ΔI_C = 5 mA, $\Delta V_o = R_L \times \Delta I_C$

Voltage amplification $= \frac{\Delta V_o}{\Delta V_I} = \frac{R_L \Delta I_C}{\Delta V_I}$

$= \frac{(20 \times 10^3)(5 \times 10^{-3})}{20 \times 10^{-3}}$

$= \frac{100}{20 \times 10^{-3}} = 5000$

10. Answer (3)

$N = N_0 e^{-\lambda t}$

$\Rightarrow \quad p_1 = \frac{N}{N_0} = e^{-\lambda t}$ …(i)

$p_2 = \frac{N_0 - N}{N_0} = 1 - \frac{N}{N_0} = 1 - e^{-\lambda t}$ …(ii)

$\frac{p_1}{p_2} = \frac{e^{-\lambda t}}{1 - e^{-\lambda t}} = \frac{1}{e^{\lambda t} - 1}$

$= \frac{1}{e^{t \times \frac{\log_e 2}{T_{1/2}}} - 1} = \frac{1}{(2)^{\frac{t}{T_{1/2}}} - 1}$

$= \frac{1}{(2)^4 - 1} = \frac{1}{15}$

11. Answer (3)

Refraction of air glass

$\frac{\mu_g}{v_1} - \frac{\mu_a}{\infty} = \frac{\mu_g - \mu_a}{R}$

$\Rightarrow \quad \frac{\mu_g}{v_1} = \frac{\mu_g - \mu_a}{+|R|}$ …(i)

Refraction at glass-water

$\frac{\mu_w}{v_2} - \frac{\mu_g}{v_1} = \frac{\mu_w - \mu_g}{R}$ …(ii)

From (i) and (ii)

$\frac{\mu_w}{v_2} = \frac{\mu_w - \mu_a}{R}$

$\Rightarrow \quad \frac{1}{v_2} = \frac{1 - \frac{1}{\mu_w}}{R} = \frac{\mu_w - 1}{\mu_w \times R}$

$= \frac{\frac{4}{3} - 1}{\left(\frac{4}{3}\right) \times 20} = \left(\frac{1}{3}\right) \times \left(\frac{3}{4}\right) \times \frac{1}{20} = \frac{1}{80}$

$\Rightarrow \quad v_2$ = 80 cm

12. Answer (3)

$\frac{1}{F_1} = \frac{2}{|Fe|}$

$\frac{1}{F_2} = \frac{2}{|Fe|} + \frac{2}{|R|}$

$\Rightarrow \quad \frac{1}{F_2} = \frac{1}{F_1} + \frac{2}{R}$

$\Rightarrow \quad \frac{1}{10} = \frac{1}{12} + \frac{2}{R}$

$\Rightarrow \quad R = 120$ cm

13. Answer (2)

I_1 lags behind voltage by ϕ_1

$\Rightarrow \quad \tan\phi_1 = \frac{X_L}{R_1}$

$\Rightarrow \quad \phi_1 = 60°$

I_2 leads voltage by ϕ_2

$\Rightarrow \quad \tan\phi_2 = \frac{X_C}{R_2}$

$\Rightarrow \quad \phi_2 = 30°$

$\Rightarrow \quad \phi_1 + \phi_2 = 90°$

14. Answer (4)

$I_p = I_0 \cos^2\frac{\phi}{2}$

$\Rightarrow \quad \frac{I_0}{2} = I_0 \cos^2\frac{\phi}{2}$

$\Rightarrow \quad \cos\frac{\phi}{2} = \frac{1}{\sqrt{2}} = \cos\frac{\pi}{4}$

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

$\Rightarrow \quad \frac{2\pi}{\lambda} \times d\tan\theta = \frac{\pi}{2}$

$\Rightarrow \quad \tan\theta = \frac{\lambda}{4d}$

$\Rightarrow \quad \frac{y}{D} = \frac{\lambda}{4d}$

$\Rightarrow \quad y = \frac{D\lambda}{4d}$

15. Answer (3)

Taking rectangular loop, enclosing ℓ length of upper and lower current sheet.

From Ampere's law

$B \times \ell + B \times \ell = \mu_0 I \times \ell + \mu_0 I\ell$

$\oint \vec{B}\cdot\vec{dl} = \mu_0 \Sigma I$

$B = \mu_0 I$

16. Answer (3)

Charge of capacitor = $\frac{q}{2}$

$\Rightarrow \quad U = \left(\frac{q}{2}\right)^2 \times \frac{1}{2C}$

$= \frac{50\times50\times10^{-12}}{8\times2\times10^{-6}}$ μJ

$= \frac{625}{4}$ μJ

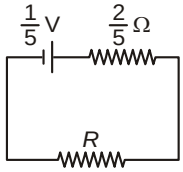
= 156.25 μJ

17. Answer (4)

Equivalent circuit

$E = \frac{\sum\frac{E}{r}}{\sum\frac{1}{r}}$

$\frac{1}{r_{eq}} = \sum\frac{1}{r}$



$E = \frac{\frac{2}{1}+\frac{3}{2}-\frac{4}{1}}{\frac{1}{1}+\frac{1}{2}+\frac{1}{1}} = \frac{\frac{4+3-8}{2}}{\frac{5}{2}} = -\frac{1}{5}$ Volt

$r = \frac{2}{5}\ \Omega$

$P_{max} = \frac{E^2}{4r} = \frac{\frac{1}{5}\times\frac{1}{5}}{4\times\frac{2}{5}} = \frac{1}{25}\times\frac{1}{4}\times\frac{5}{2} = \frac{1}{40}$ W

18. Answer (4)

$\frac{M}{J} = \frac{q}{2m}$

$\Rightarrow \quad M = \frac{q}{2m}\times J$

$J = I\omega = \omega\int dI$

$= \omega \times \frac{m}{\pi rl}.2\pi\int x^3 dy$

$= \frac{2m}{rl}\tan^{+3}\alpha.\frac{h4}{4}$

$\Rightarrow \quad M = \frac{q\omega h^2\tan^{+2}\alpha}{4}$

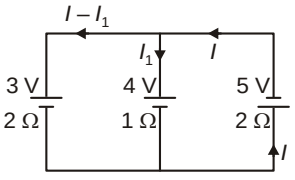
19. Answer (2)

$2I + I_1 = -9$ …(i)

$2(I - I_1) - I_1 = 4 - 3$ …(ii)

Solving, $I_1 = -2.5$ Amp

Potential difference = $4 - 2.5 \times 1 = 1.5$ V



20. Answer (3)

$W_{ABCD} = 4P_0V_0$

$\Delta U = 0$

$Q_{ABCD} = 4P_0V_0$

21. Answer (2)

$TV^{2/3}$ = constant …(i)

$PV = nRT$ …(ii)

$\Rightarrow PV^{5/3}$ = constant

$$\Rightarrow C = C_v + \frac{R}{1-n} = \frac{5}{2}R + \frac{R}{1-\frac{5}{3}}$$

$$\Rightarrow C = \frac{5}{2}R - \frac{3}{2}R = R$$

22. Answer (4)

$$P_0 + \frac{1}{2}(3\rho)v^2$$

$= P_0 + 3\rho \times 3h \times g + 2\rho \times 2h \times g + \rho \times h \times g$

$$\Rightarrow V = \sqrt{\frac{28}{3}gh}$$

23. Answer (3)

$$B = 4 \times \frac{\mu_0}{4\pi} \cdot \frac{I}{a} \sin 45° = \frac{\mu_0}{\pi} \frac{I}{a} \times \frac{1}{\sqrt{2}}$$

24. Answer (3)

$$T = 2\pi\sqrt{\frac{I}{MB}}$$

When the magnet is cut into two pieces, $M' = \frac{M}{2}$

$$I' = \frac{m'l'^2}{12} = \frac{1}{12}\left(\frac{m}{2}\right)l^2$$

$$\Rightarrow I' = \frac{I}{2}$$

Then $T' = 2\pi\sqrt{\frac{I'}{M'B}} = T$

25. Answer (2)

26. Answer (2)

$$J_n = mvr = \frac{nh}{2\pi} \quad \text{…(i)}$$

$$\Rightarrow 2\pi r = n \cdot \frac{h}{mv} = n\lambda$$

27. Answer (2)

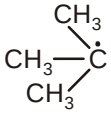
28. Answer (4)

29. Answer (2)

30. Answer (2)

[CHEMISTRY]

31. Answer (4)

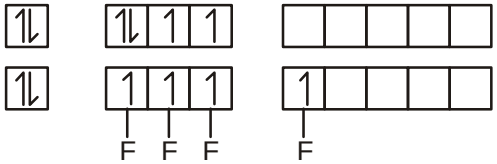

this radical is stabilised by 9α H-atoms.

32. Answer (3)

Sucrose has not free aldehyde group.

33. Answer (4)

Te $\rightarrow 5s^2 5p^4$



Te has sp^3d hybridisation, so see-saw shaped.

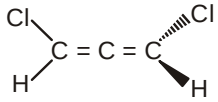
34. Answer (3)

NO^+ and CO have same number of valence electrons as well as same structures.

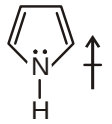
35. Answer (2)

The last member of group-14 element is Pb.

36. Answer (3)


it has axial chirality.

37. Answer (1)


lone pair is delocalised in resonance


lone pair is not involved in resonance

38. Answer (2)

$$^{236}_{92}U \longrightarrow {}^{208}_{82}Pb$$

39. Answer (3)

40. Answer (3)

Negative charge on metal forming strong M $\rightarrow$ C π-bond.

41. Answer (1)

Fact.

42. Answer (4)

(i) randomness increases

(ii) randomness decreases

(iii) randomness increases

(iv) no change of heat

$\Delta S = \frac{dq}{T}$ $[\because dq = 0]$

$\Delta S = 0$

43. Answer (3)

$K_p = (2P)^2(P) = 4P^3$

$2.9 \times 10^{-5} = 4P^3$

$\frac{2.9}{4} \times 10^{-5} = P^3$

$7.25 \times 10^{-6} = P^3$

$1.9 \times 10^{-2} = P$

Total = $3P = 1.9 \times 3 \times 10^{-2}$

$= 0.058$

44. Answer (4)

$$\log\frac{4}{1} = \frac{\Delta H}{2.303\ R}\left(\frac{15}{298\times 313}\right)$$

$$\frac{8.31\times 0.6\times 2.303\times 298\times 314}{15} = \Delta H$$

$\Delta H = 71.57$ kJ

45. Answer (2)

$$\frac{6\times 1}{180\times 100} = \frac{2}{M\times 100}$$

$$M = \frac{2\times 180}{6} = 60 \text{ g/mol}$$

46. Answer (4)

$\pi = 0.2 \times RT$

$\pi = 0.1 \times 2 \times RT$

47. Answer (4)

$$CH_3COOH + NaOH \rightleftharpoons CH_3\text{–}COO^-Na^+ + H_2O$$

$50 \times 0.01 \times 10^{-3}$	$50 \times 0.01 \times 10^{-3}$	
0	0	$50 \times 0.01 \times 10^{-3}$

So, $[CH_3COONa] = \frac{50\times 0.01\times 10^{-5}}{0.1} = 5\times 10^{-3}$

$$pH = \frac{1}{2}\left(pK_w + pK_a - \log 5\times 10^{-3}\right)$$

$$= \frac{1}{2}(14 + 5 - \log 5\times 10^{-3})$$

$= 8.35$

48. Answer (3)

$2r_{+b} + 2r_a = \sqrt{3}a \Rightarrow r_{+b} + r_a = \frac{\sqrt{3}}{2}a$

$2r_{+F} + 2r_a = \sqrt{2}a \Rightarrow r_{+F} + r_a = \frac{\sqrt{2}}{2}a$

$r_{+b} - r_{+F} = \left(\frac{\sqrt{3}-\sqrt{2}}{2}\right)a$

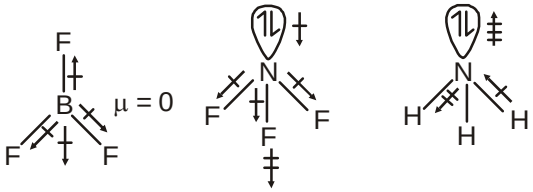
49. Answer (4)

Rate = K[G][H] and $K_{eq} = \frac{[H]^2}{[G]}$

50. Answer (2)

Fact

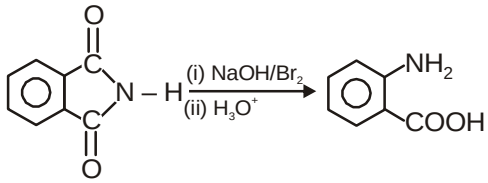
51. Answer (2)



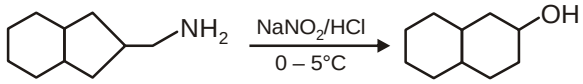
52. Answer (4)

Fact.

53. Answer (1)



54. Answer (4)



55. Answer (1)

$\Delta G = \Delta H - T\Delta S$

$\Delta H = \Delta U + \Delta n_g RT$

56. Answer (3)

57. Answer (3)

58. Answer (4)

59. Answer (1)

60. Answer (4)

[MATHEMATICS]

61. Answer (3)

Let α, β are the roots of the given equation, then

$\alpha + \beta = -p$, $\alpha\beta = -2$

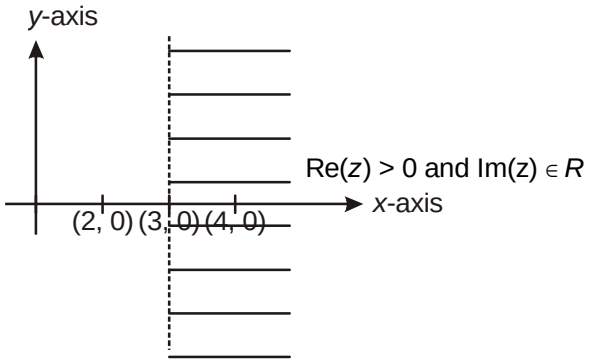
$\alpha^2 + \beta^2 = 5$

$\Rightarrow(\alpha + \beta)^2 - 2\alpha\beta = p^2 + 4$

$p^2 = 1$

$p = \pm 1$

62. Answer (4)



63. Answer (3)

$|z_1 + z_2| = |z_1| + |z_2|$

Squaring both sides

$|z_1|^2 + |z_2|^2 + 2\,|z_1||z_2|\cos(\arg z_1 - \arg z_2) = |z_1|^2 + |z_2|^2 + 2|z_1||z_2|$

$\arg z_1 - \arg z_2 = 0$

64. Answer (4)

Put $x = 0, \omega, \omega^2$ is the expression

$(x + 1)^n - x^n - 1$ which will become zero

Hence, $(x^3 + x^2 + x)$ will the factor.

65. Answer (3)

The values of x satisfying are

$a\left(1-\sqrt{2}\right)$ and $a\left(\sqrt{6}-1\right)$

66. Answer (4)

$a = A - D, b = A, c = A + D$

$a + b + c = \frac{3}{2}$

$(A - D) + A + (A + D) = \frac{3}{2}$

$3A = \frac{3}{2}$

$A = \frac{1}{2}$

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

$D^2 = \frac{1}{2}$

$D = \pm\frac{1}{\sqrt{2}}$

$a = \frac{1}{2} \pm \frac{1}{\sqrt{2}}$

67. Answer (1)

$240 = 2^4 \cdot 3 \cdot 5$

Total number of divisors = (4 +1)(2)(2)

= 20

68. Answer (3)

69. Answer (1)

$x - 1 > 0 \Rightarrow x > 1$

$\log_{(0.3)}(x-1) < \frac{1}{2}\log_{(0.3)}(x-1)$

$x - 1 > 1$

$x > 2$

70. Answer (4)

Clearly 1, 2 and 3 are not correct.

71. Answer (1)

$$\lim_{x\to\frac{\pi}{4}} \frac{\int_2^{\sec^2 x} f(t)dt}{x^2 - \frac{\pi^2}{16}} = \lim_{x\to\frac{\pi}{4}} \frac{f\left(\sec^2 x\right)2\sec x \sec x \tan x}{2x}$$

$$= \frac{8f(2)}{\pi}$$

72. Answer (2)

$(1^2 - 2^2) + (3^2 - 4^2) + ...+ \{(n-2)^2 - (n-1)^2\} + n^2$

$= -(1 + 2)+....+(n - 2) + (n - 1)] + n^2$

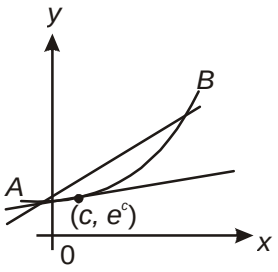
$$-\frac{(n-1)n}{2} + n^2 = \frac{n(n+1)}{2}$$

73. Answer (1)

Slope of the line joining the points

$\left(c-1, e^{c-1}\right)$ and $\left(c+1, e^{c+1}\right)$ is equal to

$$\frac{e^{c+1} - e^{c-1}}{2} > e^c$$



Tangent to the curve $y = e^x$ will intersect the given line to the left of the line $x = c$.

74. Answer (2)

$f'(x) = 2\sin 2x(-\cos 2x)$

$= -\sin 4x$

Now, $f'(x) > 0$ if $\sin 4x < 0$

$\pi < 4x < 2\pi$

$\frac{\pi}{4} < x < \frac{\pi}{2}$

75. Answer (2)

The maximum value of $f(x) = \cos x + \cos\sqrt{2}x$ is 2 which occurs at $x = 0$. Also, there is no value of x for which this value will be attained again.

76. Answer (3)

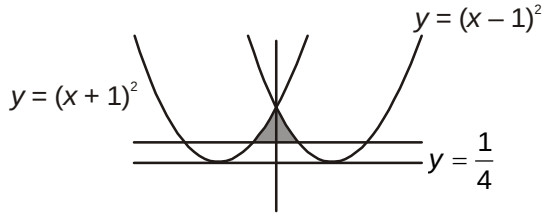
Using $\int_0^a f(x)dx = \begin{cases} 0 & ,f(a-x) = -f(x) \\ 2\int_0^{\frac{a}{2}} f(x)dx & ,f(a-x) = f(x) \end{cases}$

where $f(x) = e^{\cos^2 x} \cdot \cos^3\{(2n+1)x\}$

$\therefore f(\pi - x) = \left(e^{\cos^2 x}\right)\left(-\cos^3(2n+1)x\right) = -f(x)$

$I = 0$

77. Answer (1)



Area $= 2\int_0^{\frac{1}{2}} \left\{(x-1)^2 - \frac{1}{4}\right\} dx = \frac{1}{3}$ sq. units

78. Answer (3)

$n(S) = 6^4$

$n(E) = {}^6C_4$

$D(E)$ $\frac{{}^6C_4}{6^4}$

79. Answer (4)

$|\vec{a}||\vec{b}||\vec{c}||\sin\theta||\cos\alpha| = 1$

$\theta = \frac{\pi}{2}, \alpha = 0$

80. Answer (4)

Let x be mean

$6 = \frac{4 \times 7.5 + 6 \times x}{10}$

$6x = 30$

$x = 5$.

81. Answer (3)

82. Answer (4)

$\cos 2\theta = \frac{1-\tan^2\theta}{1+\tan^2\theta} = \frac{1-\left(2\tan^2\phi+1\right)}{1+2\tan^2\phi+1}$

$= \frac{-2\tan^2\phi}{2+2\tan^2\phi} = \frac{-\tan^2\phi}{\sec^2\phi}$

$= -\sin^2\phi$

83. Answer (3)

$n^2 - 4\left(\frac{1}{2} + \frac{n}{2}\right) \geq 0$

$n^2 - 2 - 2n \geq 0$

$n^2 - 2n + 1 - 3 \geq 0$

$(n-1)^2 \geq 3$

$n = 3, 4, 5$

Probability $= \frac{3}{5}$

84. Answer (2)

x, y, z are in G.P.

$\ln x, \ln y, \ln z$ are in A.P.

$1 + \ln x, 1 + \ln y, 1 + \ln z$ are in A.P.

$\frac{1}{1+\ln x}, \frac{1}{1+\ln y}, \frac{1}{1+\ln z}$ are in H.P.

85. Answer (3)

$$\cot\left(\frac{\pi}{2}-\pi\cos\theta\right)=\cot(\pi\sin\theta)$$

$$\frac{\pi}{2}-\pi\cos\theta=n\pi+\pi\sin\theta,\ n\in z$$

$$\frac{\pi}{2}=n\pi+\pi(\sin\theta+\cos\theta)$$

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

$$\frac{1}{\sqrt{2}}\left(\frac{1}{2}-n\right)=\cos\left(\theta-\frac{\pi}{4}\right)$$

n = 0, 1 are the only possible value.

86. Answer (3)

Statement-1 is true, statement-2 is false.

87. Answer (4)

Statement-1 is false, statement 2 is true.

88. Answer (3)

Statement-1 is true, statement-2 is false.

89. Answer (2)

Statement-1 is true, statement-2 is true but not the correct explanation of statement-1.

90. Answer (3)

Statement-1 is true, statement-2 is false.