

# **SOLUTIONS**

## **RESHUFFLING TEST-1**

**GZPA-1901-1902, GZPS-1901-1902**

**GZ-1922-1925 & GZK-1907-1908**

**(JEE MAIN PATTERN)**

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## PHYSICS

1. (D)
2. (A)
3. (D)
4. (C)

$$\frac{|\vec{R}|_{\min}}{|\vec{R}|_{\max}} = \frac{1}{4} = \frac{||\vec{A}| - |\vec{B}||}{|\vec{A}| + |\vec{B}|}$$

$$|\vec{A}| + |\vec{B}| = 4 ||\vec{A}| - |\vec{B}||$$

If  $|\vec{A}| > |\vec{B}|$

$$|\vec{A}| + |\vec{B}| = 4 (|\vec{A}| - |\vec{B}|)$$

$$3|\vec{A}| = 5|\vec{B}| \Rightarrow \frac{|\vec{A}|}{|\vec{B}|} = \frac{5}{3}$$

If  $|\vec{B}| > |\vec{A}|$

$$|\vec{A}| + |\vec{B}| = 4 (|\vec{B}| - |\vec{A}|)$$

$$\frac{|\vec{A}|}{|\vec{B}|} = \frac{3}{5}$$

5. (A)

Component of  $\vec{A}$  along  $\vec{B} = \frac{\vec{A} \cdot \vec{B}}{|\vec{B}|} \cdot \hat{B}$

6. (A)
7. (C)
8. (B)

$$|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2$$

$$\begin{aligned}
 &= (\vec{a} - \vec{b}) \cdot (\vec{a} - \vec{b}) + (\vec{b} - \vec{c}) \cdot (\vec{b} - \vec{c}) + (\vec{c} - \vec{a}) \cdot (\vec{c} - \vec{a}) \\
 &= a^2 + b^2 - 2\vec{a} \cdot \vec{b} + b^2 + c^2 - 2\vec{b} \cdot \vec{c} + c^2 + a^2 - 2\vec{c} \cdot \vec{a} \\
 &= 2(a^2 + b^2 + c^2) - 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a})
 \end{aligned}$$

Now, as

$$|\vec{a} + \vec{b} + \vec{c}|^2 = a^2 + b^2 + c^2 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) \geq 0$$

$$\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a} \geq -\frac{3}{2}$$

for maximum value of

$$|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2$$

the minimum value of  $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$  should be taken.

So,  $2(1+1+1) - 2 \times \left(\frac{-3}{2}\right) = 9$  is the maximum value of  $|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2$

- |         |         |         |         |
|---------|---------|---------|---------|
| 9. (C)  | 10. (B) | 11. (C) | 12. (D) |
| 13. (C) | 14. (C) | 15. (B) | 16. (A) |
| 17. (D) |         |         |         |
| 18. (D) |         |         |         |

Let retardation of body is  $a$  and air resistance is  $f$

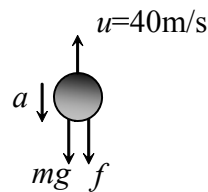
$$v = u + at$$

$$0 = 40 - 3a$$

$$a = \frac{40}{3} \text{ m/s}^2$$

$$ma = mg + f$$

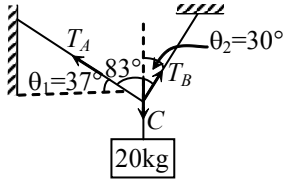
$$f = ma - mg = 1.5 \left( \frac{40}{3} - 10 \right) = 5 \text{ N}$$



19. (A)

20. (A)

$$T_A \cos \theta_1 = T_B \sin \theta_2$$



$$T_A \cos 37^\circ = T_B \sin 30^\circ$$

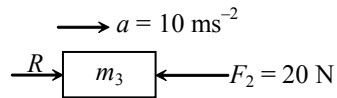
$$T_A \times \frac{4}{5} = T_B \times \frac{1}{2}; \quad \frac{T_A}{T_B} = \frac{5}{8}$$

21. (D)

$$a = \frac{F_1 - F_2}{m_1 + m_2 + m_3} = 10 \text{ ms}^{-2}$$

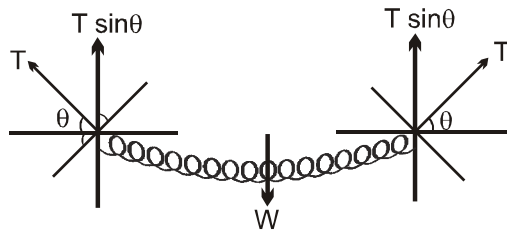
$$R - F_2 = m_3 a$$

$$R = 30 \text{ N}$$



22. (B)

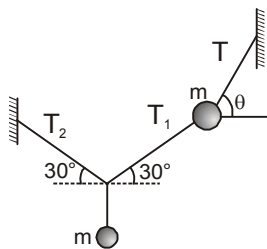
23. (A)



$$2T \sin \theta = W$$

$$T = \frac{W}{2} \operatorname{cosec} \theta$$

24. (C)



$$T_1 \cos 30^\circ = T_2 \cos 30^\circ$$

$$\Rightarrow T_1 = T_2$$

$$(T_1 + T_2) \sin 30^\circ = mg$$

$$T_1 = T_2 = mg$$

$$T \sin \theta = mg + T_1 \sin 30^\circ$$

$$T \sin \theta = mg + \frac{mg}{2} \quad \dots\dots(i)$$

$$T \cos \theta = T_1 \cos 30^\circ = mg \times \frac{\sqrt{3}}{2} \quad \dots\dots(ii)$$

dividing (i) and (ii)

$$\tan \theta = \frac{3mg/2}{\sqrt{3}mg/2} = \sqrt{3} \Rightarrow \theta = 60^\circ$$

25. (A)

26. (B)

27. (C)

28. (B)

29. (B)

30. (A)

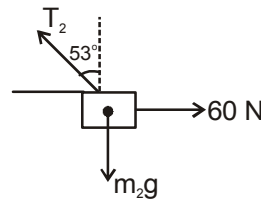
From equilibrium of lower block,

$$T_2 \sin 53^\circ = 60$$

$$\Rightarrow T_2 = 75 \text{ N}$$

$$T_2 \cos 53^\circ = M_2 g$$

$$\Rightarrow 75 \times \frac{3}{5} = m_2 g \Rightarrow m_2 = 4.5 \text{ kg}$$



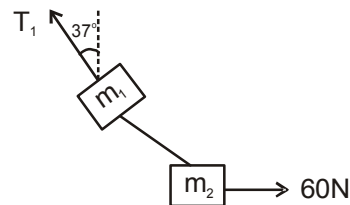
From equilibrium of both the blocks together.

$$T_1 \sin 37^\circ = 60$$

$$\Rightarrow T_1 = 100 \text{ N}$$

$$T_1 \cos 37^\circ = (m_1 + m_2)g$$

$$\Rightarrow 80 = (m_1 + m_2)g \Rightarrow m_1 = 3.5 \text{ kg}$$



## CHEMISTRY

31. (A)

$\therefore$  1 mole of  $K_4[Fe(CN)_6]$  contains 6 moles of carbon.

$\therefore$  0.5 mol contains 3 moles of C = 36g of C

32. (C)

$$\text{vol of gold} = \frac{x}{d_1}$$

$$\text{Vol. of quartz} = \frac{y}{d_2}$$

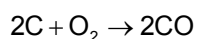
$$\text{Total vol. of alloy} = \frac{x+y}{d}$$

$$\therefore \frac{x}{d_1} + \frac{y}{d_2} = \frac{x+y}{d}$$

33. (D)

$$\text{Moles of } Fe_2O_3 = \frac{1.6 \times 1000}{160} = 10$$

Moles of CO required = 30 moles



Moles of  $O_2$  required = 15 mol.

$\therefore$  Mass of  $O_2$  = 15 x 32 = 480g.

34. (C)

$$\text{Mole of } Nx = \frac{8}{1} \times \frac{1}{3} \times \frac{1}{1} \times (\text{Moles of M})$$

$$\text{Mole of M} = \frac{206}{103} \times \frac{3}{8} = \frac{3}{4}$$

$$\therefore \text{Mass of M} = \frac{3}{4} \times 56 = 42\text{g}$$

35. (A)

$$\text{Moles of HCl} = \frac{50}{1000} \times 4$$

$$\therefore \text{Mole of } Fe^{2+} = \frac{1}{2} \times \frac{50}{1000} \times 4 = 0.1$$

36. (D)

By POAC on Ag.

Moles of Ag = 2 x moles of  $\text{Ag}_2\text{S}$

$$\text{Moles of } \text{Ag}_2\text{S} = \frac{1}{108} \times \frac{1}{2}$$

$$\text{Mass of } \text{Ag}_2\text{S} = \frac{1}{216} \times 248 \text{ g}$$

$$\frac{1.34 \times w}{100} = 1.148$$

$$w = 85.7 \text{ g}$$

37. (C)

$$\text{Let } n_{\text{P}_4\text{O}_{10}} = x$$

$$n_{\text{P}_4\text{O}_6} = y$$

By POAC on P

$$4 \times \frac{31}{124} = 4x + 4y \quad \dots \text{ (i)}$$

By POAC on O

$$2 \times 1 = 10 \times x + 6y \quad \dots \text{ (ii)}$$

On solving (i) & (ii)

$$x = 1/8 \quad \quad \quad y = 1/8$$

$$\therefore \text{Mass of } \text{P}_4\text{O}_{10} = \frac{1}{8} \times 284 \text{ g} = 35.5 \text{ g}$$

$$\therefore \text{Mass of } \text{P}_4\text{O}_6 = \frac{1}{8} \times 220 \text{ g} = 27.5 \text{ g}$$

38. (D)

$$0.5 = \frac{0.4 \times V \times 2 + 50 \times 0 \times 3}{50 + V}$$

$$V = 33.33 \text{ ml}$$

39. (A)

1000 g of  $\text{H}_2\text{O}$  contains 0.2 moles of  $\text{H}_2\text{SO}_4$

$$\text{Mass of } \text{H}_2\text{SO}_4 = 0.2 \times 98 \text{ g} = 19.6 \text{ g}$$

$$\therefore \text{Total mass} = 1000 + 19.6 \text{ g} = 1019.6 \text{ g}$$

40. (B)

$$(e/m)_{\text{Proton}} = \frac{e}{m_p}, (e/m)_{\text{neutrons}} = \frac{0}{m_p}$$

$$(e/m)_{\text{Deuterium}} = \frac{e}{2m_p}, \quad (e/m)_{\alpha\text{-particle}} = \frac{2e}{4m_p} = \frac{e}{2m_p}$$

41. (C)

$$-1.6 \times 10^{-19} \text{ and } -4.0 \times 10^{-19}$$

has highest common factor  $.8 \times 10^{-19}$  coulomb

So electronic charge is  $-0.8 \times 10^{-19} \text{ C}$

42. (D)

$$x \frac{1}{2} x \longrightarrow 2 \times 160 \times 10^3 \text{ J/mole}^{-1}$$

$$\text{B.E per molecule} = \frac{160 \times 10^3 \text{ J}}{6.023 \times 10^{23}}$$

$$h\nu = \frac{160 \times 10^3 \text{ J}}{6.023 \times 10^{23}}$$

$$\nu = \frac{160 \times 10^3 \text{ J}}{6.63 \times 10^{-34} \times 6.023 \times 10^{23} \text{ J-sec}} = 4 \times 10^{14} \text{ Hz}$$

43. (A)

$$\frac{hc}{\lambda} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$$

$$\frac{1}{\lambda} = \frac{\lambda_1 + \lambda_2}{\lambda_1 \lambda_2}$$

$$\lambda = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$$

44. (D)

Planck's theory says radiat energy emitted in small packets i.e., discontinuous manner.

45. (B)

$$\text{K.E.} = \frac{hc}{\lambda} - \frac{hc}{\lambda_0}$$

$$\frac{1}{2}mv^2 = hc \left[ \frac{\lambda_0 - \lambda}{\lambda \lambda_0} \right]$$

$$v = \left[ \frac{2hc}{m} \left\{ \frac{\lambda_0 - \lambda}{\lambda \lambda_0} \right\} \right]^{1/2}$$



46. (A)

$$\text{K.E.} = h\nu - h\nu_0$$

Since intercept is different for these curve.

$$(h\nu_0)_A \neq (h\nu_0)_B$$

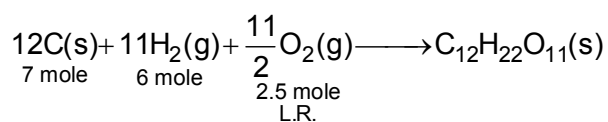
47. (B)

$$V.S = \frac{250 \times 1.5 + 750 \times 0.5}{1000} \times 11.2 = 8.4 \text{ V}$$

48. (C)

$$\text{No. of molecule} = \frac{2 \times 1.2}{70 \times 35} \times N_A = \frac{1.2}{35^2} N_A$$

49. (B)

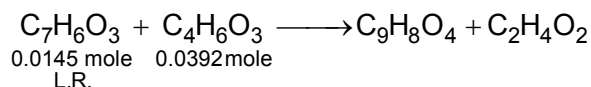


$$\therefore \text{Weight of C}_{12}\text{H}_{22}\text{O}_{11} \text{ formed} = \frac{1}{5.5} \times 2.5 \times 342 = 155.45 \text{ g}$$

50. (C)

$$\text{Final molarity} = \frac{480 \times 1.5 + 520 \times 1.2}{1000} = 1.344 \text{ M}$$

51. (A)



$$\text{Weight of C}_9\text{H}_8\text{O}_4 \text{ formed} = 0.0145 \times 180 = 2.61 \text{ g}$$

$$\therefore \% \text{yield} = \frac{2.1 \times 100}{2.61} = 80.46\%$$

52. (C)

$$\text{K.E. of photo electron} = (0.20 \times 1.6 \times 10^{-19}) \text{ J}$$

$$\frac{hc}{\lambda} = (\text{work function}) + (\text{K.E. of photo electron})$$

$$\Rightarrow \text{Work function} = \frac{(6.50 \times 10^{-34})(3 \times 10^8)}{(390 \times 10^{-9})} - (0.20 \times 1.6 \times 10^{-19})$$

$$= (5 \times 10^{-19}) - (0.32 \times 10^{-19}) = 4.68 \times 10^{-19} \text{ J/atom}$$

53. (B)

Weight of sulphur present in coal

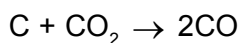
$$\frac{2 \times 10^6 \times 1}{100} = 2 \times 10^4 \text{ kg} \quad \text{S} + \text{O}_2 \rightarrow \text{SO}_2$$

$$32 \times 10^{-3} \text{ kg} \rightarrow 64 \times 10^{-3} \text{ kg} \quad 2 \times 10^4 \text{ kg} \rightarrow ?$$

weight of sulphur dioxide

$$= \frac{2 \times 10^4 \times 64 \times 10^{-3}}{32 \times 10^{-3}} = 4 \times 10^4 \text{ kg}$$

54. (C)



The resultant mixture contains 0.6 L of  $\text{CO}_2$  and 0.8 L of CO

55. (A)

$$[\text{H}^+]_{\text{final}} = \frac{50 \times 10 \times 2 + 25 \times 12 + 40 \times 5}{1000}$$

$$= \frac{1000 + 300 + 200}{1000} = \frac{1500}{1000} = 1.5 \text{ M}$$

56. (B)

$$0.33 = \frac{2 \times 56}{M} \times 100$$

$$\Rightarrow M = 33939$$

57. (D)

Atomic weight of an element

$$x = 6.643 \times 10^{-23} \times N_A = 40$$

$$\text{no. of moles of 'X'} = \frac{20 \times 1000}{40} = 500$$

58. (D)

let, volume of  $\text{CO}_2 = x$ , then vol. of  $\text{N}_2 = (40-x)$

$$\left( \frac{x}{22.4} \times 44 \right) + \left( \frac{40-x}{22.4} \times 28 \right) = 70$$

$$44x + 28(40-x) = 22.4 \times 70$$

$$44x + 1120 - 28x = 1568$$

$$16x = 448$$

$$x = 28 \text{ litre}$$

59. (A)

$$\text{no. of mole} = \frac{252 \times 10^{-3}}{126} = 2 \times 10^{-3}$$

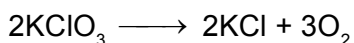
∴ Each mole  $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$  have 2 mole of  $\text{H}_2\text{O}$

∴  $2 \times 10^{-3}$  mole of  $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$  have  $2 \times 2 \times 10^{-3}$  mole of  $\text{H}_2\text{O}$ .

$$\begin{aligned} \text{So no. of molecule of } \text{H}_2\text{O} &= 2 \times 2 \times 10^{-3} \times 6 \times 10^{23} \\ &= 24 \times 10^{20} = 2.4 \times 10^{21} \end{aligned}$$

60. (C)

The reaction is



$$\text{Now, } \frac{\text{Moles of KClO}_3}{2} = \frac{\text{Moles of O}_2}{3}$$

$$\text{mole of O}_2 \text{ produced} = \frac{3 \times 3}{2} = 4.5 \text{ moles}$$

## MATHEMATICS

61. (D)

$$\sum_{r=2}^{43} \frac{1}{\log_r n} = \sum_{r=2}^{43} \log_n r$$

$$= \log_n 2 + \log_n 3 + \dots + \log_n 43$$

$$= \log_n (2 \cdot 3 \cdot 4 \dots 43) = \log_n 43!$$

62. (C)

$$\log_2 x \geq \log_{\frac{1}{2}} (x-1)$$

$$\because x > 0 \text{ \& } x-1 > 0$$

$$\log_2 x \geq \log_2 (x-1)^{-1}$$

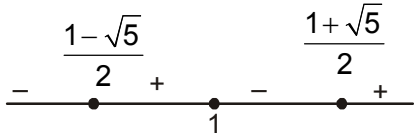
$$x > 0 \text{ \& } x > 1$$

$$x \geq \frac{1}{x-1}$$

$$\text{so, } x > 1 \dots\dots\dots(1)$$

$$x - \frac{1}{x-1} \geq 0$$

$$\frac{(x^2 - x - 1)}{(x - 1)} \geq 0$$



$$x \in \left[ \frac{1 - \sqrt{5}}{2}, 1 \right) \cup \left[ \frac{1 + \sqrt{5}}{2}, \infty \right) \quad \dots\dots\dots(2)$$

from (1) and (2)

$$x \in \left[ \frac{1 + \sqrt{5}}{2}, \infty \right)$$

63. (B)

$$x \neq 3, |x - 3| = 1 \Rightarrow x = 4, 2 \text{ and } 3x^2 - 10x + 3 = 0 \Rightarrow x = \frac{1}{3} \text{ (} x = 3 \text{ rejected)}$$

64. (B)

$$18^{4x-3} = (54\sqrt{2})^{3x-4}$$

taking log both side

$$(4x - 3)\log 18 = (3x - 4)\log(54\sqrt{2})$$

$$(4x - 3)\log 18 = (3x - 4)\log(18)^{3/2}$$

$$\log 18 \left( (4x - 3) - \frac{3}{2}(3x - 4) \right) = 0$$

$$4x - 3 = \frac{3}{2}(3x - 4)$$

$$(x = 6)$$

65. (D)

$$\frac{2}{\log_a x} + \frac{1}{1 + \log_a x} + \frac{3}{2 + \log_a x} = 0$$

$$\frac{2}{t} + \frac{1}{1+t} + \frac{3}{2+t} = 0$$

66. (B)

We have,

$$\frac{\log x}{2a + 3b - 5c} = \frac{\log y}{2b + 3c - 5a} = \frac{\log z}{2c + 3a - 5b},$$

$$\Rightarrow \frac{\log x}{2a + 3b - 5c} = \frac{\log y}{2b + 3c - 5a} = \frac{\log z}{2c + 3a - 5b} = \frac{\log x + \log y + \log z}{0}$$

$$\Rightarrow \log x + \log y + \log z = 0 \Rightarrow \log(xyz) = 0 \Rightarrow xyz = 1.$$

67. (B)

68. (D)

$$\text{If } x^2 + 4x + 3 = (x + 3)(x + 1) \geq 0, x \in \mathbb{R} - (-3, -1) \quad \dots(1)$$

The given equation becomes  $x^2 + 6x + 8 = 0$ 

$$\Rightarrow x = -2, -4 \quad \dots(2)$$

$$\text{From (1) and (2)} \Rightarrow x = -4$$

$$\text{If } x^2 + 4x + 3 < 0, x \in (-3, -1) \quad \dots(3)$$

The equation becomes  $-(x^2 + 4x + 3) + 2x + 5 = 0$ 

$$\text{or } x^2 + 2x - 2 = 0 \Rightarrow x = -1 \pm \sqrt{3} \quad \dots(4)$$

$$\text{From (3) and (4)} \Rightarrow x = -1 - \sqrt{3}$$

$$\text{Sum of the roots} = -4 + (-1 - \sqrt{3}) = -5 - \sqrt{3}.$$

69. (D)

70. (C)

$$x^{(\log_{10} x)^2 - 3 \log_{10} x + 1} > 1000 = 10^3$$

$$\Rightarrow [(\log_{10} x)^2 - 3 \log_{10} x + 1] \log_{10} x > 3 \log_{10} 10 = 3$$

$$\Rightarrow (\log_{10} x)^3 - 3(\log_{10} x)^2 + \log_{10} x > 3 \Rightarrow (\log_{10} x)^2 (\log_{10} x - 3) + (\log_{10} x - 3) > 0$$

$$\Rightarrow (\log_{10} x - 3)((\log_{10} x)^2 + 1) > 0 \Rightarrow x > 10^3 = 1000 \Rightarrow x \in (1000, \infty)$$

71. (B)

$$\text{We have, } \frac{1}{4} \cos(3\theta) = \frac{1}{8} \Rightarrow \cos(3\theta) = \frac{1}{2}$$

$$\Rightarrow 3\theta = 60^\circ \Rightarrow \theta = 20^\circ$$

72. (A)

73. (A)

$$(2\sin^2 91^\circ - 1)(2\sin^2 92^\circ - 1)\dots(2\sin^2 180^\circ - 1)$$

In this product there exists a factor

$$(2\sin^2 135^\circ - 1) \text{ which is equal to zero.}$$

$\therefore$  The product of all terms is zero.

74. (D)

75. (A)

Maximum value of  $4\sin^2 x + 3\cos^2 x$  i.e.,  $\sin^2 x + 3$  is 4 and that of  $\sin \frac{x}{2} + \cos \frac{x}{2}$  is  $\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} = \sqrt{2}$ ,

both attained at  $x = \pi/2$ . Hence the given function has maximum value of  $4 + \sqrt{2}$

Hence (a) is the correct answer.

76. (A)

77. (D)

$$\sqrt{2 + \sqrt{2(1 + \cos 4\theta)}} = \sqrt{2 + 2|\cos 2\theta|} = \sqrt{2(1 - \cos 2\theta)} = 2|\sin \theta| = 2\sin \theta \text{ as } \frac{\pi}{2} < \theta < \frac{3\pi}{4}$$

Hence (d) is the correct answer.

78. (B)

$$|x^2 - 2x| + |x - 2| = |x^2 - x - 2|$$

$$(x^2 - 2x)(x - 2) \geq 0$$

$$x(x - 2)^2 \geq 0$$

$$x \in [0, \infty)$$

79. (B)

We have,

$$\frac{1}{\log_a bc + 1} + \frac{1}{\log_b ca + 1} + \frac{1}{\log_c ab + 1} =$$

$$\frac{1}{\log_a bc + \log_a a} + \frac{1}{\log_b ca + \log_b b} + \frac{1}{\log_c ab + \log_c c}$$

$$= \frac{1}{\log_a abc} + \frac{1}{\log_b abc} + \frac{1}{\log_c abc}$$

$$= \log_{abc} a + \log_{abc} b + \log_{abc} c = \log_{abc} abc = 1$$

80. (A)

$$\frac{(x-1)^3(x^2+3x+2)^5|x+4|}{(x^2+4x+4)^7} < 0$$

$$\Rightarrow \frac{(x-1)^3(x+2)^5(x+1)^5|x+4|}{((x+2)^2)^7} < 0 \Rightarrow \frac{(x-1)^3(x+2)^5(x+1)^5|x+4|}{(x+2)^{14}} < 0$$

$$\Rightarrow x \in (-\infty, -2) \cup (-1, 1) \text{ and } 1 < |x-3| < 5$$

$$\Rightarrow 1 < x-3 < 5 \text{ or } -5 < x-3 < -1 \Rightarrow 4 < x < 8 \text{ or } -2 < x < 2$$

Hence common solution is  $(-1, 1)$

81. (A)

$$\cos A \cdot \cos(45^\circ - A) = \cos A \left( \frac{\cos A + \sin A}{\sqrt{2}} \right)$$

$$= \frac{1}{\sqrt{2}} (\cos^2 A + \sin A \cdot \cos A)$$

$$= \frac{1}{2\sqrt{2}} ((1 + \cos 2A) + \sin 2A)$$

$$\text{as } \cos 2A + \sin 2A + 1 \leq \sqrt{2} + 1$$

$$\therefore \text{max. value of } \cos A \cdot \cos B = \frac{1}{2\sqrt{2}} (1 + \sqrt{2})$$

82. (C)

According to property

$$\log_2 x \geq \log_{2^{-1}}(x-1)$$

$$\Rightarrow \log_2 x \geq -\log_2(x-1) \Rightarrow \log_2 x(x-1) \geq 0$$

$$\Rightarrow \log_2 x(x-1) \geq \log_2 1 \Rightarrow x(x-1) \geq 1 \Rightarrow x^2 - x - 1 \geq 0$$

$$\Rightarrow \left( x - \frac{1-\sqrt{5}}{2} \right) \left( x - \frac{1+\sqrt{5}}{2} \right) \geq 0 \Rightarrow x \geq \frac{1+\sqrt{5}}{2} \text{ or } x \leq \frac{1-\sqrt{5}}{2}$$

( $\because \log_{1/2}(x-1)$  is defined only  $x-1 > 0$ ) and  $\log x$  is defined when  $x > 0$

combining above all we get common value is

$$x \in \left[ \frac{1+\sqrt{5}}{2}, \infty \right)$$

83. (C)

$$\text{Let } P = \cos \theta \cos 2\theta \cos 3\theta \dots \cos 1004\theta$$

$$\text{and } Q = \sin \theta \sin 2\theta \sin 3\theta \dots \sin 1004\theta$$

$$\text{Then } 2^{1004} PQ = \sin 2\theta \sin 4\theta \dots \sin 2008\theta$$

$$= (\sin 2\theta \sin 4\theta \dots \sin 1004\theta) [\sin(2\pi - 1003\theta) \sin(2\theta - 1001\theta) \dots \sin(2\pi - \theta)]$$

$$= (\sin 2\theta \sin 4\theta \dots \sin 1004\theta) [-\sin 1003\theta] [-\sin 1001\theta] \dots [-\sin \theta] = Q$$

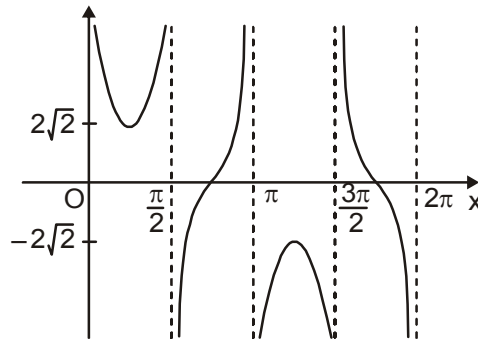
$$\Rightarrow P = \frac{1}{2^{1004}}$$

84. (A)

since

$$\cos 90^\circ = 0$$

85. (A)



From graph of  $f(\theta) = \sec \theta + \operatorname{cosec} \theta$ , it is clear that for four solutions

$$p > 2\sqrt{2} \text{ or } p < -2\sqrt{2} \text{ i.e. } p^2 > 8.$$

86. (D)

$$\therefore \prod_{i=1}^n \cos \alpha_i = \prod_{i=1}^n \sin \alpha_i$$

$$\Rightarrow \prod_{i=1}^n \cos^2 \alpha_i = \prod_{i=1}^n \frac{\sin 2\alpha_i}{2} \leq \frac{1}{2^n} \Rightarrow \prod_{i=1}^n \cos \alpha_i \leq \frac{1}{2^{n/2}}$$

87. (A)

$$3 \cos 2\theta = 1 \Rightarrow \tan^2 \theta = 1/2$$



$$\text{Now, } 32 \tan^8 \theta = 2 \cos^2 \alpha - 3 \cos \alpha$$

$$32 \cdot \left(\frac{1}{2}\right)^4 = 2 \cos^2 \alpha - 3 \cos \alpha$$

$$\Rightarrow 2 \cos^2 \alpha - 3 \cos \alpha - 2 = 0$$

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

88. (C)

$$\frac{4 \cos^3 \theta}{4 \sin^3 \theta} = \cot^3 \theta$$

89. (D)

$$\sin^6 a + 3 \sin^2 a \cos^2 b + \cos^6 b - 1 = 0$$

$$\Rightarrow (\sin^2 a)^3 + (\cos^2 b)^3 + (-1)^3 - 3 \sin^2 a \cos^2 b (-1) = 0$$

$$\Rightarrow (\sin^2 a + \cos^2 b - 1) = 0 \quad \text{or} \quad \sin^2 a = \cos^2 b = -1 \Rightarrow a = b ; r \ a, b \in \left[0, \frac{\pi}{2}\right]$$

90. (C)

$$\frac{1}{z} = 5 - x, y = 29 - \frac{1}{x}$$

$$\therefore x \left(29 - \frac{1}{x}\right) = 5 - x$$

$$\therefore x = \frac{1}{5}, y = 24, z = \frac{5}{24}$$