All India Aakash Test Series for JEE (Advanced)-2025

TEST - 1A (Paper-2) - Code-H

Test Date : 10/12/2023

ANSWERS

PHYSICS		CHEMISTRY		MATHEMATICS	
1.	(5)	19.	(5)	37.	(4)
2.	(8)	20.	(3)	38.	(5)
3.	(6)	21.	(1)	39.	(3)
4.	(5)	22.	(2)	40.	(2)
5.	(4)	23.	(3)	41.	(3)
6.	(3)	24.	(6)	42.	(1)
7.	(B, D)	25.	(B, C, D)	43.	(A, C)
8.	(A, C, D)	26.	(A, B, D)	44.	(B, C, D)
9.	(A, B, C)	27.	(B, C, D)	45.	(A, B, C)
10.	(B, C)	28.	(C, D)	46.	(A, C, D)
11.	(A, C)	29.	(A, B, C, D)	47.	(A, B, C, D)
12.	(A, C)	30.	(B, C)	48.	(A, C)
13.	(10.00)	31.	(10.78)	49.	(01.00)
14.	(00.50)	32.	(03.00)	50.	(03.00)
15.	(30.00)	33.	(02.00)	51.	(02.00)
16.	(12.00)	34.	(00.70)	52.	(00.00)
17.	(17.00)	35.	(04.00)	53.	(60.00)
18.	(05.00)	36.	(49.50)	54.	(02.00)

HINTS & SOLUTIONS

PART - I (PHYSICS)

1. Answer (5)

Hint : K.E. = $\frac{1}{2}mV^2$

Sol. : $K = \frac{1}{2}mV^2$

$\frac{\Delta K}{K} = \frac{\Delta m}{m} + 2\times\frac{\Delta V}{V}$

$\frac{\Delta K}{K}\times 100\% = \frac{\Delta m}{m}\times 100\% + 2\times\frac{\Delta V}{V}\times 100\%$

= 1% + 2(2%)

= 5%

2. Answer (8)

Hint : Relative motion of B w.r.t. A

Sol. : $u_{BA} = u_2\sin\theta_2 - u_1\sin\theta_1$

$a_{BA} = 0$

$s_{BA} = u_{BA}t + \frac{1}{2}a_{BA}t^2$

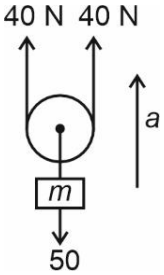
$-80 = u_{BA} \times 10$

$u_{BA} = u_2\sin\theta_2 - u_1\sin\theta_1 = 8$ m/s

3. Answer (6)

Hint : Draw free body diagram for mass

Sol. :



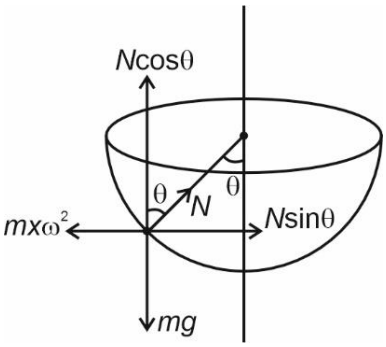
$80 - 50 = 5a$

$a = 6$ m/s^2

4. Answer (5)

Hint : Draw FBD for ball.

Sol. :



$N\sin\theta = mx\omega^2$, $x = R\sin\theta$

$N\sin\theta = mR\sin\theta\omega^2$

$N = MR\omega^2$ … (1)

$N\cos\theta = mg$

$\cos(\theta) \times mR\omega^2 = mg$

$R = \frac{g}{\omega^2\cos(\theta)}$

$R = 5$ cm

5. Answer (4)

Hint : Energy conservation

Sol. : In vertical direction :

Time of flight $(t) = \sqrt{\frac{2h}{g}}$

In horizontal direction :

$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$

$v = x\sqrt{\frac{k}{m}}$

Range = vt

$= x\sqrt{\frac{2h}{g}\times\frac{k}{m}}$

Range = 4 m

6. Answer (3)

Hint : $v - r\omega = 0$

Sol. : Instantaneous axis of rotation lie above the centre of mass where

$v - r\omega = 0$

$v = r\omega$

$r = \frac{v}{\omega}$

$v = r = \frac{6}{2}$

$r = 3$ m

7. Answer (B, D)

Hint : Acceleration = slope,

displacement = area under curve.

Sol. : Acceleration :

(0 – 2) s $\rightarrow a_1 = \frac{4}{2} = 2$ m/s^2

(2 – 6) s $\rightarrow a_2 = 0$ m/s^2

(6 – 8) s $\rightarrow a_3 = \frac{2}{2} = 1$ m/s^2

Displacement :

(6 – 8) s $\rightarrow S = \frac{1}{2} \times 2 \times (8 + 10)$

$S = 18$ m

8. Answer (A, C, D)

Hint : Theoritical

Sol. : Potential energy = [ML^{2}T^{-2}]

Atmospheric pressure = [ML^{-1}T^{-2}]

Linear momentum = [MLT^{-1}]

Acceleration due to gravity = [LT^{-2}]

9. Answer (A, B, C)

Hint : $a_t = \frac{dv}{dt}$, $a_c = \frac{v^2}{r}$, $a_{net} = \sqrt{(a_t)^2 + (a_c)^2}$

Sol. : Here $v = 2t$

$a_t = \frac{dv}{dt} = 2$ m/s^2 = constant

$a_c = \frac{v^2}{r}$

$a_c = \frac{4t^2}{r} = \frac{4 \times 3}{3} = 4$ m/s^2

$a_{net} = \sqrt{(a_t)^2 + (a_c)^2} = \sqrt{20}$

$a_{net} = 2\sqrt{5}$ m/s^2

10. Answer (B, C)

Hint : Acceleration (a) = $\frac{F - f}{m}$

Sol. : Acceleration (a) = $\frac{F - f}{m}$

$a = \frac{F - \mu mg}{m}$, $a = \frac{F}{m} - \mu g$

At $F = 0$

$-4 = -\mu g$, $\mu = 0.4$

At $a = 0$

$\frac{F}{m} = \mu g$, $m = \frac{F}{\mu g} = \frac{2}{0.4 \times 10} = 0.5$ kg

11. Answer (A, C)

Hint : Energy conservation theorem.

Sol. : From energy conservation : $2mgl = \frac{1}{2}mv^2$

$v = 2\sqrt{gl}$

$v = 2\sqrt{10 \times \frac{40}{100}}$

$v = 4$ m/s

Tension at lowest point, $T = mg + \frac{mv^2}{l}$

$T = mg + \frac{m}{l} \times 16 = 10 + \frac{5}{2} \times 16$

$T = 50$ N

12. Answer (A, C)

Hint : E = P.E + K.E

Sol. : E = P.E + K.E

$E = U(x) + K$

If $K = 0$, $E = U(x)$

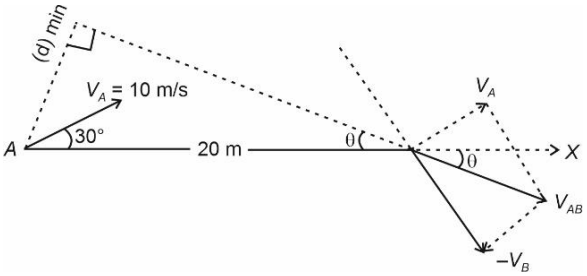
If $F = 0$, $F = \frac{dU(x)}{dx} = 0$

$a = 0$

13. Answer (10.00)

Hint : Relative motioln.

Sol. : $\vec{V}_{AB} = 10\sqrt{3}\hat{i} - 10\hat{j}$



$|\tan\theta| = \left|\frac{-10}{10\sqrt{3}}\right|$

$\theta = 30°$

$\sin 30 = \frac{(d)_{\min}}{20}, \quad (d)_{\min} = 10\text{ m}$

14. Answer (00.50)

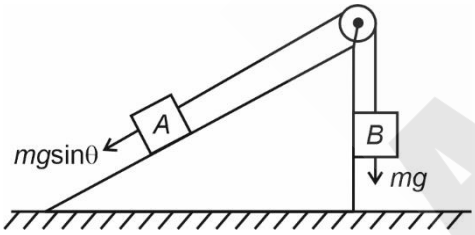
Hint : $\Rightarrow mg\sin\theta = m \times 10 \times \frac{4}{5}$

Sol. : $\Rightarrow mg\sin\theta = m \times 10 \times \frac{4}{5}$

$mg\sin\theta = 8\,m$

$\Rightarrow (\text{friction})_{\max} = \mu \cdot mg\cos\theta$

$= \frac{1}{6} \times m \times 10 \times \frac{3}{5} = 1m$



So, block *B* will more downward along with block *A*, with acceleration

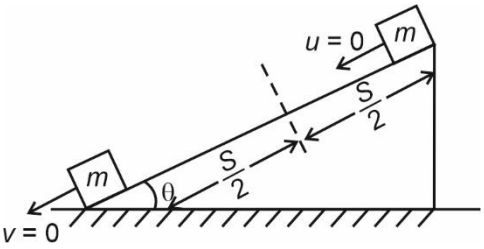
$a = \frac{10m - 8m - m}{2m}$

a = 00.50

15. Answer (30.00)

Hint : Work energy theorem.

Sol. : ΔK = Work done



$0 = mg\sin\theta \times (S) - \mu mg\cos\theta\left(\frac{S}{2}\right)$

$\tan\theta = \frac{\mu}{2}$

$\tan\theta = \left(\frac{2}{\sqrt{3}}\right) \times \frac{1}{2}$

$\tan\theta = \frac{1}{\sqrt{3}}$

$\theta = 30°$

16. Answer (12.00)

Hint : $I = \frac{mL^2}{12}\sin^2\theta$

Sol. : $I = \frac{mL^2}{12}\sin^2\theta$

Here at $\theta = \frac{\pi}{2}$, $I = 4$

$4 = \frac{mL^2}{12}$

$mL^2 = 48$

about end $I' = \frac{mL^2}{3}\sin^2\left(\frac{\pi}{3}\right)$

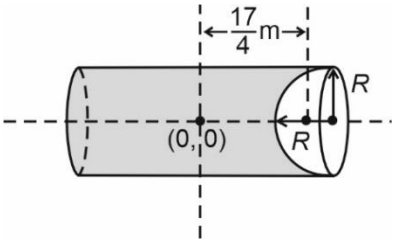
$I' = \frac{48}{3} \times \frac{3}{4}$

I' = 12 kgm^2

17. Answer (17.00)

Hint : $X_{\text{cm}} = \frac{m_2x_2 - m_1x_1}{m_2 - m_1}$

Sol. :



Let density of cylinder = ρ

Mass of hemisphere $(m_1) = \frac{2}{3}\pi R^3\rho$

m_2 = mass of truncated cylinder $= \frac{10}{3}\pi R^3\rho$

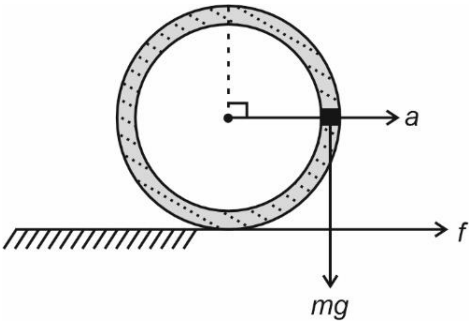
$X_{\text{cm}} = \frac{m_2x_2 - m_1x_1}{m_2 - m_1}$

$|X_{\text{cm}}| = \left|\frac{-17}{26}\right| = \frac{17}{26}$

18. Answer (05.00)

Hint : Torque about a point.

Sol. :



$f = 4ma$ … (i)

$(mg - f)\, r = (3mr^2 + mr^2)\, \alpha$

$mg - f = 4ma$ … (ii)

From (i) and (ii)

$8ma = mg$

$a = \frac{g}{8}$

$\alpha = \frac{g}{8r} = 5 \text{ rad/s}^2$

PART - II (CHEMISTRY)

19. Answer (5)

Hint : Alkali metals occupy peak of the curve in Lother Meyer's curve.

Sol. : Li, Na, K, Rb, Cs occupy peak position.

20. Answer (3)

Hint : P(V – b) = RT (for one mole at high pressure range)

Sol. : PV – bP = RT

$Z = \frac{bP}{RT} + 1$

$Z = 1 + \frac{bP}{RT}$

$\tan\theta = 3 = \frac{b}{RT}$

b = 3RT

$b = 3 \times \frac{1}{12} \times 300$

$= 75 \text{ L mol}^{-1}$

$\therefore \quad \frac{b}{25} = \frac{75}{5} = 3$

21. Answer (1)

Hint : P_{ext} for expansion = 1 atm

Sol. : $\Delta V = 1$ L

$w = -P\Delta V$

$= -1 \times 1$ L atm

$|w| = 1$ L atm

22. Answer (2)

Hint : If *sp* mixing is not considered the electronic configurations of C_2 and B_2 are

$C_2 \Rightarrow \sigma_{1s}^2 \sigma^*_{1s}{}^2 \sigma_{2s}^2 \sigma^*_{2s}{}^2 \sigma_{2p_z}^2 \pi_{2p_x}^1 = \pi_{2p_y}^1$

$B_2 \Rightarrow \sigma_{1s}^2 \sigma^*_{1s}{}^2 \sigma_{2s}^2 \sigma^*_{2s}{}^2 \sigma_{2p_z}^2$

Sol. : $(BO)_{C_2} = \frac{8-4}{2} = \frac{4}{2} = 2 \quad (1\sigma + 1\pi)$

$(BO)_{B_2} = \frac{6-4}{2} = \frac{2}{2} = 1 \quad (1\sigma)$

x = 1 y = 1

x + y = 2

23. Answer (3)

Hint : $pK_w = pH + pOH$

Sol. : $\left[OH^-\right] = \frac{10^{-2} \times 200 - 10^{-2} \times 100}{1000}$

$= \frac{2-1}{1000} = \frac{1}{1000} = 10^{-3}$

pOH = 3

24. Answer (6)

Hint : Electronegativity order :

F > O > N = Cl > Br > I = S = C > P = H

Sol. : F and O have higher electronegativity than Cl

25. Answer (B, C, D)

Hint : $\Rightarrow$ Spin quantum number is not determined by Schrodinger wave equation

Sol. : $\Rightarrow {}_{26}Fe \Rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$

② ② ② ②

Total $8e^-$ having (n + l + m) = 3

$\Rightarrow \sqrt{n(n+2)} = 2.83$ BM

n = 2

Mn $\Rightarrow [Ar]3d^5 4s^2$

$Mn^{+5} = [Ar]3d^2$

x = 5

For H-like species, energy of subshells depends on value of n.

$1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p = 4d = 4f$

26. Answer (A, B, D)

Hint : Solution contains basic salt.

Sol. : $CH_3COOH + KOH \longrightarrow CH_3COOK + H_2O$

20 mmol	20 mmol	0	0
0	0	20 mmol	

$[CH_3COOK] = \frac{20\text{ mmol}}{300\text{ mL}} = \frac{1}{15} = 0.067$ M

Solution contains basic salt, so salt hydrolysis takes place.

$pH = \frac{1}{2}(pK_w + pK_a + \log C)$

$= \frac{1}{2}(14 + 4.76 + \log 0.067) = 8.8$

27. Answer (B, C, D)

Hint : Mixture of weak acid or weak base with acidic salt or basic salt form buffer solution.

Sol. : KCl + KOH is not a buffer solution.

28. Answer (C, D)

Hint : $w = -nRT\ln\frac{V_2}{V_1}$

Sol. : Case-I

$w_1 = -1R300\ln10$

Case-II

$w_2 = -1R \times 600\ln10$

$w_2 = 2w_1$

for Isothermal process

dT = 0

$\Delta U = nC_v dT$

$\Delta U = nC_v \times 0$

$\Delta U = 0$

29. Answer (A, B, C, D)

Hint : $\Rightarrow$ At low pressure and high temperature, real gas tends to behave as an ideal gas. So $Z \simeq 1$

$\Rightarrow$ At moderate pressure region, 'b' is negligible and 'a' dominates.

Sol. : $\left(P + \frac{a}{V_m^2}\right)(V_m) = RT$

$PV_m + \frac{a}{V_m} = RT$

$Z = 1 - \frac{a}{V_m RT}$

$\Rightarrow$ At high pressure,

'a' is negligible 'b' dominates

$P(V_m - b) = RT$

$PV_m - bP = RT$

$Z = 1 + \frac{bP}{RT}$

30. Answer (B, C)

Hint : Number of radial nodes in an orbital = n – l – 1

Sol. : Number of radial nodes in $3p_y$

= 3 – 1 – 1 = 1

Number of maxima in $4\pi r^2\psi^2$ versus r curve = 2

$\Rightarrow$ Value of l = 1, so its wave function is dependent on angle θ

$\Rightarrow$ For $3p_y$, nodal plane is xz plane.

31. Answer (10.78)

Hint : $X(OH_2) \rightleftharpoons \underset{S}{X^{+2}} + \underset{2S}{2OH^{\ominus}}$

Sol. : $K_{sp} = 4S^3$

$S^3 = \frac{108}{4} \times 10^{-12}$

$S^3 = 27 \times 10^{-12}$

$S = 3 \times 10^{-4} M$

$2S = [OH^-]$

$[OH^-] = 3 \times 2 \times 10^{-4}$

$= 6 \times 10^{-4}$

$pOH = -\log 6 \times 10^{-4}$

$pOH = 4 - \log 6$

$= 4 - (\log 2 + \log 3)$

$pOH = 4 - (0.3 + 0.48)$

$pOH = 4 - 0.78$

$pOH = 3.22$

$pH = 10.78$

32. Answer (03.00)

Hint : $B_2 = \sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p_y}^1 = \pi_{2p_x}^1$

Sol. : Number of unpaired electrons = 2

$M = \sqrt{n(n+2)}$ BM

$= \sqrt{2(2+2)}$ BM

$= \sqrt{8}$ BM

$= 2.83$ BM

$\simeq 3.00$ BM

33. Answer (02.00)

Hint : White precipitate is $BaSO_4$

Sol. : $BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4 + 2NaCl$

10 mmol 20 mmol

10 mmol 10 mmol + 20 mmol

mmol of SO_4^{-2} in solution = 10 mmol

Total volume of solution = 150 mL

$\left[SO_4^{-2}\right] = \frac{10}{150} = \frac{1}{15} M$

$= 0.067$ M

34. Answer (00.70)

Hint : During neutralisation of a weak acid with a strong base, some of energy is used for dissociation of weak acid.

Sol. : $\Delta H_{dissociation} = (-13.0 - (-13.7))$

$= 0.7$ kcal

35. Answer (04.00)

Hint : $XY_2(s) \rightleftharpoons \underset{S}{X^{+2}} + \underset{2S}{2Y^-}$

Sol. : $K_{sp} = 4S^3 = 32 \times 10^{-12}$

$S^3 = 8 \times 10^{-12}$

$S^3 = 2 \times 10^{-4}$ M

Solubility of saturated solution is molarity of solution.

$M = 2 \times 10^{-4}$ M

2×10^{-4} mol of XY_2 should be dissolved in 1000 mL of solution.

2×10^{-5} mol of XY_2 should be dissolved in 100 mL of solution.

Mass of $XY_2(s) = 2 \times 10^{-5} \times 200$ g

$= 400 \times 10^{-5}$ g

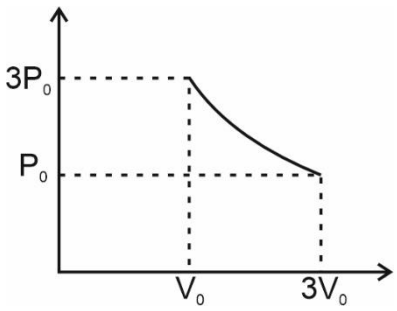
$= 4 \times 10^{-3}$ g

$= 4$ mg

36. Answer (49.50)

Hint : $|W_{rev.}| = nRT \ln\left(\frac{V_f}{V_i}\right)$

Sol. :



$|W_{Irrev.}| = P_0(3V_0 - V_0)$

$= 2P_0V_0$

$2P_0V_0 = 30$ kJ

$P_0V_0 = 15$ kJ

$|W_{rev.}| = nRT\ln\left(\frac{3V_0}{V_0}\right)$

$= 3P_0V_0\ln 3$

$= 3 \times 15 \times (1.1)$

$= 49.5$ kJ

PART - III (MATHEMATICS)

37. Answer (4)

Hint : T_n for second sequence = $3n - 2$

Sol. : 1, 2, 4, 8, 16, 32, 64

$T_n = 1 + (n-1)3$

$\Rightarrow T_n = 3n - 2$

So common term

1, 4, 16, 64

38. Answer (5)

Hint : $(A \cup B)_{max} = 60$ $(A \cup B)_{min} = 50$

Sol. : $A \cup B_{min} = 50$

39. Answer (3)

Hint : Expand and check

Sol. : $x = -1$ is one of the solution

$\Rightarrow (x+1)^5 = 2(x^5 + 1)$

$(x+1)(x^4 - 6x^3 - 4x^2 - 6x + 1) = 0$

Now,

$x^4 - 6x^3 - 4x^2 - 6x + 1 = 0$

$x^2 - 6x - 4 - \frac{6}{x} + \frac{1}{x^2} = 0$

$\left(x^2 + \frac{1}{x^2}\right) - 6\left(x + \frac{1}{x}\right) - 4 = 0$

Let $x + \frac{1}{x} = t$

$t^2 - 2 - 6t - 4 = 0$

$t^2 - 6t - 6 = 0$

Now well get 2 solutions for here

$\therefore$ 3 solutions.

40. Answer (2)

Hint : If $z = x + iy$ then $\bar{z} = x - iy$

Sol. : $z = \frac{1+i+1+i}{1+i} = 2$

$|z| = 2$

41. Answer (3)

Hint : Use multinomial theorem.

Sol. : $x_1 + x_2 + x_3 = 5$

${}^{5+3-1}C_{3-1} = {}^7C_2 = \frac{6 \times 7}{2} = 21$

42. Answer (1)

Hint : $\log m + \log n = \log mn$

Sol. : $\log_{1999!}1 + \log_{1999!}2 + \ldots + \log_{1999!}1999$

$= \log_{1999!}1999! = 1$

43. Answer (A, C)

Hint : $\alpha + \beta = \frac{-b}{a}$ $\alpha\beta = \frac{c}{a}$

Sol. : $\sin^2\alpha + 3\cos^2\alpha = \frac{3p}{4}$

$1 + 2\cos^2\alpha = \frac{3p}{4}$

$\Rightarrow p = \frac{4 + 8\cos^2\alpha}{3}$

$3\sin^2\alpha\cos^2\alpha = \frac{k}{4}$

$\Rightarrow k = 3\sin^2 2\alpha$

44. Answer (B, C, D)

Hint : Square on both side.

Sol. : $|z_1 - z_2|^2 = (|z_1| + |z_2|)^2$

$(z_1 - z_2)(\bar{z}_1 - \bar{z}_2) = |z_1|^2 + |z_2|^2 + 2|z_1 z_2|$

$|z_1|^2 + |z_2|^2 - \bar{z}_1\bar{z}_2 - z_2 z_1 = |z_1|^2 + |z_2|^2 + 2|z_1 z_2|$

$\bar{z}_1 z_2 + \bar{z}_2 z_1 = -2|z_1 z_2|$

45. Answer (A, B, C)

Hint : Restricted arrangements

Sol. : (A) $n = 6! = 720$

(B) $n = {}^2C_1 \cdot 3!\ \ 3! = 72$

(C) ${}^4C_3 \times 3! \times 3! = 144$

46. Answer (A, C, D)

Hint & Sol. : $\tan 15^\circ = 2 - \sqrt{3}$

47. Answer (A, B, C, D)

Hint : $\sin\theta \sin(60^\circ - \theta)\sin(60^\circ + \theta) = \frac{1}{4}\sin 3\theta$

Sol. : $4\sin 20^\circ \sin 40^\circ \sin 80^\circ = \sin 60^\circ = \frac{\sqrt{3}}{2}$

48. Answer (A, C)

Hint : $D < 0$

Sol. : $D < 0$

$(a + 1)^2 - 1 < 0$

$a^2 + 1 + 2a - 1 < 0$

$a(a + 2) < 0$

$a \in (-2, 0)$

49. Answer (01.00)

Hint : $\log_a b, a > 0, a \neq 1, b > 0$

and $\frac{1}{\sqrt{f(x)}}, f(x) > 0$

Sol. : $x - 1 > 0$,

$x - 1 \neq 1$,

$x^2 - 5x + 4 > 0$

$\Rightarrow \quad x > 4$ (1)

$3 - \left[\frac{x}{2}\right] > 0$ (2)

From (1) and (2)

$x \in (4, 6)$

50. Answer (03.00)

Hint : $n(A) + n(B) - n(A \cap B) = n(A \cup B)$

Sol. : $10 + 5 - 12 = n(A \cap B)$

$n(A \cap B) = 3$

51. Answer (02.00)

Hint : $\left(\frac{1}{a_n} + \frac{1}{3}\right)$ is in G.P.

Sol. : $\Rightarrow$ Let $b_n = \frac{1}{a_n}$

$\Rightarrow \left(3 - \frac{1}{b_{n+1}}\right)\left(6 + \frac{1}{b_n}\right) = 18$

$\Rightarrow \quad 3b_{n+1} - 6b_n - 1 = 0$

$\Rightarrow \quad \left(b_{n+1} + \frac{1}{3}\right) = 2\left(b_n + \frac{1}{3}\right)$

$\Rightarrow \quad \left(b_n + \frac{1}{3}\right) = 2^n\left(b_0 + \frac{1}{3}\right)$

$\Rightarrow \quad b_n = \frac{1}{3}(2^{n+1} - 1)$

$\Rightarrow \quad \sum_{i=0}^{n} \frac{1}{a_i} = \frac{1}{3}(2^{2+n} - n - 3)$

$\Rightarrow \quad n = 10$

$\Rightarrow \quad \frac{2^{12} - 13}{3} = 1361$

$\Rightarrow \quad \frac{2(1361)}{1361} = 2$

52. Answer (00.00)

Hint : All real part with real and imaginary part with imaginary.

Sol. : $z_1 + z_2 = 5(1+i)$

$\Rightarrow \quad \overline{z_1 + z_2} = 5(1-i)$

$\Rightarrow \quad \frac{(1+i)}{(1-i)} + \frac{1-i}{1+i} = \frac{2i-2i}{2} = 0$

53. Answer (60.00)

Hint : $\alpha + \beta = -\frac{b}{a} \quad \alpha\beta = \frac{c}{a}$

Sol. : $\alpha\beta(\alpha+\beta) = -60$

54. Answer (02.00)

Hint : $\sin 30° = \cos 60° = \frac{1}{2}$ and $\tan\frac{\pi}{4} = 1$

Sol. : $\frac{1}{2} + \frac{1}{2} + 1$

= 2

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