JEE MAIN ANSWER KEY & SOLUTION

PAPER CODE :- PART TEST-2
CLASS-XI

ANSWER KEY

PHYSICS

1.	(D)	**2.**	(D)	**3.**	(C)	**4.**	(B)	**5.**	(C)	**6.**	(B)	**7.**	(C)
8.	(A)	**9.**	(A)	**10.**	(A)	**11.**	(C)	**12.**	(B)	**13.**	(B)	**14.**	(C)
15.	(A)	**16.**	(D)	**17.**	(A)	**18.**	(D)	**19.**	(D)	**20.**	(C)	**21.**	19
22.	2	**23.**	9	**24.**	10	**25.**	4	**26.**	4	**27.**	1	**28.**	9
29.	31	**30.**	8										

CHEMISTRY

31.	(A)	**32.**	(B)	**33.**	(A)	**34.**	(B)	**35.**	(B)	**36.**	(A)	**37.**	(C)
38.	(B)	**39.**	(A)	**40.**	(B)	**41.**	(C)	**42.**	(D)	**43.**	(B)	**44.**	(C)
45.	(C)	**46.**	(B)	**47.**	(D)	**48.**	(B)	**49.**	(B)	**50.**	(A)	**51.**	4000
52.	150	**53.**	500	**54.**	-555	**55.**	0	**56.**	200	**57.**	5	**58.**	152
59.	4	**60.**	10										

MATHEMATICS

61.	(C)	**62.**	(D)	**63.**	(A)	**64.**	(B)	**65.**	(C)	**66.**	(B)	**67.**	(C)
68.	(B)	**69.**	(A)	**70.**	(D)	**71.**	(A)	**72.**	(C)	**73.**	(D)	**74.**	(D)
75.	(A)	**76.**	(B)	**77.**	(C)	**78.**	(B)	**79.**	(D)	**80.**	(A)	**81.**	2
82.	3	**83.**	900	**84.**	3	**85.**	34	**86.**	9	**87.**	3	**88.**	8
89.	0	**90.**	20										

SOLUTIONS

PHYSICS

1. (D)

Sol. Centre of mass is a point which can lie within or outside the body.

2. (D)

Sol. $\omega_f = \omega_i + \alpha t$

$60 = 0 + \alpha(5)$

$\alpha = 12$

$\theta = \frac{1}{2}at^2 = \frac{1}{2} \times 12 \times (5)^2 = 150$ rad

3. (C)

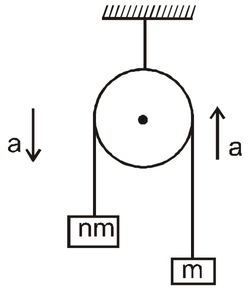
Sol. $a = \frac{(nm - m)}{nm + m} g$

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

$a_1 = a_2 = a$

$a_{cm} = \frac{nma_1 - ma_2}{(nm + m)} = \frac{(n-1)}{(n+1)} \times a$

$a_{cm} = \frac{(n-1)^2}{(n+1)^2} g.$



4. (B)

Sol. $\frac{k_2}{k_1} = 4 \Rightarrow k \propto v^2$ $\quad \left(\frac{v_2}{v_1}\right)^2 = 4 \quad \Rightarrow \quad \frac{v_2}{v_1} = 2$

Then $\left(\frac{p_2 - p_1}{p_1}\right) \times 100 = \left(\frac{mv_2 - mv_1}{mv_1}\right) \times 100 = \left(\frac{v_2}{v_1} - 1\right) \times 100 = 100\%$

5. (C)

Sol. $I_x + I_y = I_z$

z axes is perpendicular to plane of body.

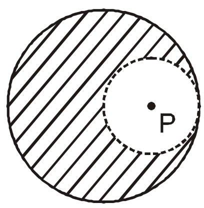
6. (B)

Sol. Potential at point P due to complete solid sphere

$= -\frac{GM}{2R^3}\left(3R^2 - \left(\frac{R}{2}\right)^2\right)$

$= -\frac{GM}{2R^3}\left(3R^2 - \frac{R^2}{4}\right)$

$= -\frac{GM}{2R^3}\left(\frac{11R^2}{4}\right) = -\frac{11GM}{8R}$



Potential at point P due to cavity part

$= -\frac{3}{2}\frac{G\frac{M}{8}}{\frac{R}{2}} = \frac{-3GM}{8R}$

So potential due to remaining part at point P

$= \frac{-11GM}{8R} - \left(\frac{-3GM}{8R}\right) = \frac{-11GM + 3GM}{8R} = \frac{-GM}{R}$

7. (C)

Sol. $F_x = \frac{\Delta P_x}{\Delta t} = \frac{(Pf_x - Pi_x)}{\Delta t} = \frac{-mV\sin 60° - (mV\sin 60°)}{2\times 10^{-3}} = -250\sqrt{3}\ N = 250\sqrt{3}$ N towards left

8. (A)

Sol. $mu = mv_1 + mv_2$ ....(i)

$u = v_1 + v_2$ ....(i)

$\frac{v_2 - v_1}{u} = e$ ......(ii)

as solving have $\frac{v_1}{v_2} = \left(\frac{1-e}{1+e}\right)$.

9. (A)

Sol. $T = mg + ma,\ S = \frac{1}{2}at^2$

$W_T = T \times S$

10. (A)

Sol. In case of earth the gravitational field is zero at infinity as well as the the centre and the potential is minimum at the centre .

11. (C)

Sol. $F = K_1x_1,\ x_1 = \frac{F}{K_1},\ W_1 = \frac{1}{2}K_1x_1^2 = \frac{F^2}{2K_1}$

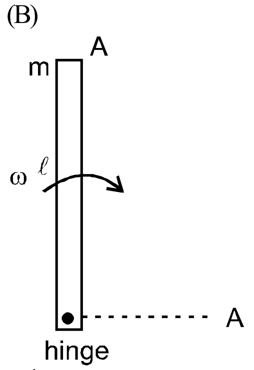
similarly $W_2 = \frac{F^2}{2K_2}$ since $K_1 > K_2,\ W_1 < W_2$

12. (B)

Sol. $a = \frac{F}{m}$, $S = \frac{1}{2}\left(\frac{F}{m}\right)t^2$, $W_F = FS = F\left(\frac{Ft^2}{2m}\right)$

13. (B)

Sol.



using energy conservation

$$mg\frac{\ell}{2} = \frac{1}{2}I\omega^2$$

$$mg\frac{\ell}{2} = \frac{1}{2}\cdot\frac{m\ell}{3}\omega^2$$

$\ell = 1m$ $$\omega = \sqrt{\frac{3g}{\ell}}$$

$$V_A = \omega\ell = \sqrt{3g} = \left(\sqrt{3g}\right)$$

14. (C)

Sol. $MR^2\omega = (MR^2 + 2mR^2)\omega'$

$$\omega' = \frac{\omega M}{M + 2m}$$

15. (A)

Sol. Only is (A), U is minimum for some value of r

16. (D)

Sol. As the disc is in combined rotation and translation, each point has a tangential velocity and a linear velocity in the forward direction.

17. (A)

Sol. Total Mechanicl energy = – (kinetic energy)

$\therefore$ TME = $-E_k$

for escape , TME = 0 .

ie. If , E_k is provided then TME. becomes Zero.

Hence . the minimum amount of energy that is added so that it escapes the earth's gravitational field is E_k.

18. (D)

Sol. For a disc rolling without slipping on a horizontal rough surface with uniform angular velocity, the acceleration of lowest point of disc is directed vertically upwards and is not zero(Due to translation part of rolling, acceleration of lowest point is zero. Due to rotational part of rolling, the tangential acceleration of lowest point is zero and centripetal acceleration is non-zero and upwards). Hence statement 1 is false.

19. (D)

Sol. $U \propto x^2$ graph is parabola.

20. (C)

Sol. The acceleration due to gravity at a distance x (x < R) from centre of earth (of radius R) is

$$g(x) = g\frac{x}{R} \qquad \therefore \qquad g\left(\frac{R}{2}\right) = \frac{g}{2}$$

21. 19

Sol. $K = 5 \times 10^3$ N/m

x = 5 cm

$W_1 = \frac{1}{2}k \times x_1^2 = \frac{1}{2}5 \times 10^3 \times (5 \times 10^{-2})^2$

= 6.25 J

$W_2 = \frac{1}{2}k(x_1 + x_2)^2$

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

= 25J

Net work done = $W_2 - W_1$

= 25 – 6.25 = 18.75 J

= 18.75 N-m

22. 2

Sol. by energy conservation $\frac{1}{2}mv^2 = \frac{1}{2}(2m)\left(\frac{v}{2}\right)^2 + \frac{1}{2}kx^2$

$\Rightarrow \qquad x = \sqrt{2mK}$

23. 9

Sol. $I = \frac{MR^2}{2} + 2\left[\frac{3}{2}MR^2\right] = \frac{7}{2}MR^2$

$\Rightarrow n_1 + n_2 = 7 + 2 = 9$

24. 10

Sol. $V_e \propto \sqrt{gR}$

$\frac{V_p}{V_e} = \sqrt{\frac{g_p R_p}{g_e R_e}}$

$\frac{V_p}{V_e} = \sqrt{\frac{10 g_e}{g_e}} \Rightarrow V_p = \sqrt{10}\ V_e$

25. 4

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

$KE_r = \frac{1}{2} I\omega^2 = \frac{1}{2}\left(\frac{1}{2}mR^2\right)\left(\frac{V}{R}\right)^2 = \frac{1}{4} mV^2$

$\frac{\text{KE rotation}}{\text{KE Total}} = \frac{1/4 mV^2}{3/4 mV^2} = \frac{1}{3} = 1 + 3 = 4$

26. 4

Sol. $T^2 \propto r^3$

$\left(\frac{T_1}{T_2}\right)^2 = \left(\frac{r_1}{r_2}\right)^3$

$\left(\frac{1}{8}\right)^2 = \left(\frac{10^4}{r}\right)^3$

$r = 4 \times 10^4$ km

$T = \frac{2\pi r}{v}$

$V_1 - V_2 = \frac{2\pi r_1}{T_1} - \frac{2\pi r_2}{T_2}$

$= 2\pi\left(\frac{10^4}{1} - \frac{4 \times 10^4}{8}\right) = \pi \times 10^4$ km/hr

27. 1

Sol. $W_S + W_f = \Delta K$

$-\Delta U + W_f = -K_i$

$-U_f - \mu mgx = -K_i$

$\frac{1}{2} K x^2 + \mu mgx = \frac{1}{2} mu^2$

$100 x^2 + 2(0.1)(50)(10)x = 50 \times 4$

$x^2 + x - 2 = 0$

$x = 1$ m

28. 9

Sol. $\frac{1}{2}\,mu^2 = mgh,\ u^2 = 2gh$ ....(i)

$mg\left(\frac{3h}{5}\right) + K.E. = mgh$

$K.E. = \frac{mgh}{4}$

$\frac{K.E.}{P.E.} = \frac{mgh/4}{3mgh/4} = \frac{1}{3}$

$\Rightarrow z^2 = 3^2 = 9$

29. 31

Sol. $\frac{-Gm_1m_2}{1} = \frac{-Gm_1m_2}{r}$

$2v_B = 1v_A$

$2 \times \frac{3.6\times10^{-3}}{100} = v_A$

$v_A = 2 \times 10^{-5}$ m/s

$v_B = 10^{-5}$ m/s

$v_{rel} = 10^{-5}$ m/s

$\Rightarrow -Gm_1m_2\left(\frac{1}{r}-\frac{1}{1}\right) = \frac{1}{2} \times \frac{1\times2}{1+2} \times (10^{-5})^2$

$\Rightarrow \frac{20}{3} \times 10^{-11} \times 2\left(\frac{1}{r}-1\right) = \frac{1}{2} \times \frac{2}{3} \times 10^{-10}$

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

$\frac{1}{r} - 1 = \frac{1}{4}$

$\frac{1}{r} = 1.25$

$r = \frac{4}{5} = 80\,cm$

30. 8

Sol. $M_1g - T = Ma$

$T \times 2R = \left(\frac{1}{2}M_2R^2 + M_2R^2\right) \times \alpha$

$a = 2R\alpha$

$\Rightarrow T = \frac{3}{2}M_2\,\frac{R^2}{2R}\,\frac{a}{2R} = \frac{3}{8}M_2a$

$M_1g = (M_1 + \frac{3}{8}M_2)a$

$a = \frac{3\times10}{3+\frac{3}{8}\times2} = 8\ m/s^2$

31. (A)

Sol. Hess's law

32. (B)

Sol. is always negative

33. (A)

Sol. $H_2(g) + 1/2\ O_2\ (g) \rightleftharpoons H_2O(l)$

$\Delta H = -68.3$ kcal

34. (B)

Sol. $CaO(s) + H_2O(l)\ Ca(OH)_2(s)$

$\Delta H_{18°C} = 15.26 kcal$

$H_{22}O(s) + \frac{1}{2}O_2(g) \rightarrow CaO(s);\ \Delta H_{18°C} = -151.80\ kcal$

$(1) - (2) - (3)$

$CaO + H_2 + \frac{1}{2}O_2 \rightarrow Ca(OH)_2$

$Ca(s) + H_2 + O_2(g) \rightarrow Ca(OH)_2$

$\Delta H_y = \Delta H_1 + \Delta H_3 - \Delta H_2$

$= -15.26 - 151.80 - 68.37 = -235.43$

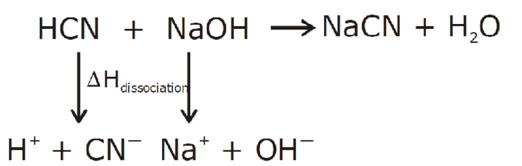
35. (B)

Sol. In weak aci d th e val ue of heat of neutralisation is lower than 13.7 In strong acid the value of heat of neutralisation is higher than 13.7

36. (A)

Sol. $HCN \longrightarrow$ Weak acid

$NaOH \longrightarrow$ Strong base



$\Delta H_r = -13.1\ kJ/mol$

$\Rightarrow \quad \Delta H_{diss} + \Delta H_{neut.} = \Delta H_r$

$\Rightarrow \quad \Delta H_{diss.} + (-57.1) = -13.3$

$\Rightarrow \quad \Delta H_{diss.} = 57.1 - 13.3$

$\Delta H_{diss.} = 43.8$ kJ/mol

37. (C)

Sol. $C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O;\ \Delta H = -2658$

kJ mol^{-1}

38. (B)

Sol. $T = 27°C = 300\ K$

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

$$C_6H_6(\ell) + \frac{15}{2} O_2(g) \rightarrow 6CO_2(g) + 3H_2O(g)$$

$\Delta n_g = (6+3) - (0+0.75)$

$\Delta n_g = 1.5$

$\Delta H - \Delta E = 1.5 \times 3.3 \times 300 = 3.74\ kJ$

39. (A)

Sol. $H_2O_2(\ell) \rightarrow H_2O(\ell) + \frac{1}{2} O_2(g)$ ....(1)

$\Delta H = -23.5\ kcal$

$H_2(g) + 1/2\ O_2(g) \rightarrow H_2O(\ell)$ ....(2)

$\Delta H = -68.3\ kcal/mol$

Equation (2)-(1)

$H_2(g) + O_2(g) \rightarrow H_2O_2(\ell)$

$\Delta H° = -68.3 + 23.5 = -44.8\ kcal/mol$

40. (B)

Sol. Cyclopropane(g) $+ \frac{5}{2} O_2(g) \rightarrow 3CO_2(g) + 3\ H_2O(l)$

$\Delta H = -400\ kJ/mol$

4000 kJ......................1 mol cyclopropane

$2 \times 105\ kJ$ .... $\frac{1}{4000} \times 2 \times 105$

$= 50\ mol$

weight of cyclopropane $= 2100\ g$

$= 2.1\ kg$

41. (C)

Sol. Quantity whose value depends only on the state of the system

42. (D)

Sol. Second law of thermodynamics

43. (B)

Sol. $\Delta U = q + w$

$$= 100 - \left[1 \times 1 + \frac{1}{2} \times 1\right] bar\,m^3 \left(1\,bar\,m^3 = 10^5\,J = 100kJ\right)$$

$= -50KJ$

44. (C)

Sol. $\Delta E = \Delta C_V (T_2 - T_1)$

$3000 = 20(300 - T_1)$

$20T_1 = 3000$

$T_1 = 150K$

45. (C)

Sol. $\Delta H = \Delta E + \Delta n_g RT$

46. (B)

Sol. For spontaneous process, total entropy change is positive.

47. (D)

48. (B)

49. (B)

Sol. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

$\Delta H = 176$ kJ/mol

$T = 1240$ K

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

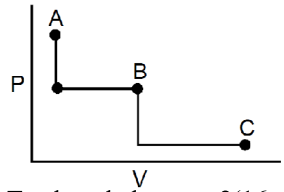
$176000 = \Delta U + 1 \times 8.314 \times 1240$

$\Delta U = 176 - 10.2 = 165.69$ kJ/mol

50. (A)

51. 4000

Sol.



Total work done $= -2(16-4) - 1(32-16)$

$= -24 - 16 = -40$ bar L

$= -4000$ J

$q = -w = 4000$ J

52. 150

Sol. $w = nC_v \Delta T$

$\Rightarrow -3 \times 1000 = 1 \times 20 \times (T - 300)$

$T = 150$ K

53. 500

Sol. $w = nC_v(T_2 - T_1) = -P_{ext} \times nR\left[\frac{T_2}{P_2} - \frac{T_1}{P_1}\right]$

$\Rightarrow \frac{5}{2}R(T_2 - 350) = -2R\left[\frac{T_2}{2} - \frac{350}{T}\right]$

$\therefore T_2 = 450$ k

$\therefore w = nC_v(T_2 - T_1) = 2 \times R \times 100 = 500$ R

54. -555

Sol. For 3 moles of Cl_2 & H_2

$\Delta U = -3 \times 185 = -555$ kJ

55. 0

Sol. The process is at equilibrium

56. 200

Sol. A

$\frac{1}{2}H_2 + \frac{1}{2}X_2 \rightarrow HX \qquad \Delta H = -50$

$-50 = \frac{1}{2}\Sigma H\text{–}H + \frac{1}{2}\Sigma X\text{–}X - \Sigma H\text{–}X$

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

$= \frac{3}{2}P - 2P = -\frac{P}{2}$

$P = 100$ kJ

Bond energy of $H_2 = 2P = 200$ kJ

57. 5

Sol. C

By reaction (1) – reaction (2)

$4AuBr_4 + 4HCl \longrightarrow Au_4Cl_4 + 4HBr$

$\Delta H = -28 + 36.8 = 8.8$ kcal/mol

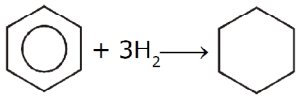
But $\Delta H = 0.44$ kcal

$$\Rightarrow \alpha = \frac{0.44}{8.8} = 0.05$$

% dissociation = 5%

58. 152

Sol.



$\Delta_r H = \Delta_f H$ (cyclohexane) $- \Delta_f H$(Benzene)

$= -156 - 49$

$\Delta_r H = 3 \times (-19)$ + Resonance energy

R.E $= -156 - 49 + (3 \times 119) = 152$ kJ/mol

59. 4

Sol. $Cu^+(g) + I^-(g) \rightarrow CuI\ (g)$

(1) $\Delta H = -446$ kJ/mol

$Cu(g) \rightarrow Cu^+(g) + e^-$

(2) $\Delta H = 745$ kJ/mol

$I(g) + e^- \rightarrow I^-$

(3) $\Delta H = -295$ kJ/mol

$Cu(g) + I(g) \rightarrow CuI(g)$

Equation (1) + (2) + (3)

$\Delta H = -446 + 745 - 295 = 4$ kJ

60. 10

Sol. The energy released from combustion of 1 mole CH_4 is called combustion energy of CH_4. Here energy released from 4g = 2.5 kcal Energy released from 16g = 4 × 2.5 = 10 kcal

61. (C)

Sol. Sum of roots = $\sec^2\alpha + \text{cosec}^2\alpha$

$= \tan^2\alpha + \cot^2\alpha + 2 \geq 4.$

Product of roots = $\sec^2\alpha\ \text{cosec}^2\alpha$

$= (1+\tan^2\alpha)(1+\cot^2\alpha)$

$= \tan^2\alpha + \cot^2\alpha + 2 \geq 4$

So option (C) is correct.

62. (D)

Sol. $\therefore\ m > 0$

and $D < 0$

$16 - 4m(3m+1) < 0$

$4 - m(3m+1) < 0$

$3m^2 + m - 4 > 0$

$(3m+4)(m-1) > 0 \Rightarrow m \in \left(-\infty, \frac{-4}{3}\right) \cup (1, \infty)$

But $m > 0$ $\quad\therefore\ m \in (1, \infty)$

Least integral value = 2

63. (A)

Sol. $\frac{4\alpha}{\alpha^2+1} \geq 1 \Rightarrow \alpha + \frac{1}{\alpha} \leq 4$

$\therefore \alpha + \frac{1}{\alpha} = 3 \Rightarrow \alpha^2 - 3\alpha + 1 = 0$

Sum of roots = 3

64. (B)

Sol. $a_1^2\ a_2^2 + a_3^2 - \dots\dots\dots + a_{2n-1}^2 - a_{2n}^2$

$(a_1 - a_2)(a_1 + a_2) + (a_3 + a_4)(a_3 + a_4) + \dots\dots\dots(a_{2n-1} - a_{2n})(a_{2n-1} + a_{2n})$

$-d\,[a_1 + a_2 + a_3 + a_4 + \dots\dots + a_{2n-1} + a_{2n}]$

$-d.\ \frac{2n}{2}[a_1 + a_{2n}]$ $\qquad$ Now $a_{2n} = a_1 + (2n-1)\,d$

$\frac{a_{2n} - a_1}{(2n-1)} = d \quad \Rightarrow -\frac{(a_{2n}-a_1)(a_{2n}+a_1).n}{2n-1} \Rightarrow \frac{n}{2n-1}\left(a_1^2 - a_{2n}^2\right)$

65. (C)

Sol. Let roots be α and 2α, then

$3\alpha = \frac{-(2a-3)}{a^2-5a+3}, 2\alpha^2 = \frac{2}{a^2-5a+3}$

$\therefore \left(\frac{-(2a-3)}{a^2-5a+3}\right)^2 = \frac{9}{a^2-5a+3}$

$\Rightarrow 5a^2 - 33a + 18 = 0 \Rightarrow a = 6, \frac{3}{5}$

66. (B)

Sol. If first and last term of A.P. and H.P. are same then product of K^{th} term beginning in A.P. and K^{th} term from end in H.P. is constant and equal to first term × last term

So, $a_7h_{24} + a_{14}h_{17}$

$= ab + ab = 2ab = 2 \times 2 \times 25 = 100$

67. (C)

Sol. Here

$(\cos^4\theta + \alpha) - (\sin^4 + \alpha)$

$= \cos^4\theta - \sin^4\theta$

$= (\cos^2\theta + \sin^2\theta)(\cos^2\theta - \sin^2\theta)$

$= \cos^2\theta - \sin^2\theta$

$= (\cos^4\theta + \beta) - (\sin^2\theta + \beta)$

difference of roots in both equation are same

$(\alpha_1 - \beta_1)^2 = (\alpha_2 - \beta_2)^2$

$(\alpha_1 + \beta_1)^2 - 4\alpha_1\beta_1 = (\alpha^2 + \beta^2)^2 - 4\alpha_2\beta_2$

$4b^2 - 4b = 4 + 12$ where α_1, β_1 are roots of $x^2 + 2bx + b = 0$

$4b^2 - 4b = 16$ and α_2, β_2 are roots of $x^2 + 2x - 3 = 0$

$b^2 - b - 4 = 0$

product of value of b is -4

68. (B)

Sol. We have

$\tan^2 - x - \tan^4 x + \tan^6 x - \tan^8 x + ...$

$= \frac{\tan^2 x}{1-(\tan^2 x)} = \frac{\tan^2 x}{\sec^2 x} = \sin^2 x$

$\therefore y = \exp\{(\tan^2 x - \tan^4 x + \tan^6 x - \tan^8 x + ...)\log_e 16\}$

$= \exp\{(\sin^2 x)\log_e 16\} = \exp\{\log_e(16^{\sin^2 x})\}$

$= 16^{\sin^2 x}$

As y satisfies $x^3 - 3x + 2 = 0$, we get

$y = 1$ or $y = 2$.

$\Rightarrow \quad 16^{\sin^2 x} = 1 \quad \text{or} \quad 16^{\sin^2 x} = 2$

Since $0 < x < \pi/4, 0 < \sin x < 1/\sqrt{2}$

$\Rightarrow \quad 0 < \sin^2 x < 1/2$

$\Rightarrow \quad 16^{\sin^2 x} = 1$ is not possible.

Thus, $16^{\sin^2 x} = 2$

$\Rightarrow \quad \sin^2 x = 1/4$

Thus, $\cos^2 x + \cos^4 x = (1 - \sin^2 x) + (1 - \sin^2 x)^2 = 21/16.$

69. (A)

Sol. $\left(x + \frac{1}{x}\right)\left(3 - \left(x + \frac{1}{x}\right)^2\right) = 0$

$\Rightarrow x + \frac{1}{x} = 0 \quad \text{or} \quad \left(x + \frac{1}{x}\right)^2 = +3$

$\Rightarrow x \in \phi$

$\left(\because x + \frac{1}{x} \in (-\infty, -2] \cup [2, \infty)\right)$

70. (D)

Sol. $(3-2\lambda)2=(-9+8\lambda^2)(-4\lambda+3)$

$8\lambda^3-5\lambda^2-12\lambda+9=0$

$(\lambda-1)(8\lambda^2+3\lambda-9)=0$

71. (A)

Sol. $1050=1+1+1+.........+1$ 1050 times

$$\frac{1+\left(1-\frac{1}{2}\right)+\left(1-\frac{2}{3}\right)+\left(1-\frac{3}{4}\right)+.....+\left(1-\frac{1049}{1050}\right)}{1+\frac{1}{2}+\frac{1}{3}+......+\frac{1}{1050}}=\frac{x}{2018}$$

$$\frac{1+\frac{1}{2}+\frac{1}{3}+.......+\frac{1}{1050}}{1+\frac{1}{2}+\frac{1}{3}+........+\frac{1}{1050}}=\frac{x}{2018}=1$$

$x=2018$

72. (C)

Sol. $x^2-(\alpha+\beta)x+\alpha\beta=0$

$\therefore \alpha^2+\beta^2=\alpha+\beta$ and $\alpha^2\beta^2=\alpha\beta \Rightarrow \alpha\beta=0,1$

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

$\Rightarrow (\alpha+\beta)^2-(\alpha+\beta)-2=0\ (\alpha\beta=1)$

$\Rightarrow (\alpha+\beta)=-1,\ 2 \rightarrow 2$ equation

73. (D)

Sol. $\alpha(2+\beta)+\beta(\alpha+2)=2(\alpha+\beta)+2\alpha\beta$

$\because \alpha,\beta$ are common roots

$\Rightarrow x^2-(\alpha+\beta)x+\alpha\beta$ is a common factor

$k\left(x^2-(\alpha+\beta)+\alpha\beta\right)=3\left(2x^3-9x^2+17x-12\right)-2\left(3x^3-11x^2+18x-8\right)$

$=-5x^2+15x-20$

$=-5(x^2-3x+4)$

$\Rightarrow \alpha+\beta=3, \alpha\beta=4$

$\therefore 2(\alpha+\beta)+2\alpha\beta=14$

74. (D)

Sol. $x^2+3x+7=0$ has complex roots,

$\therefore$ $ax^2+bx+c=0$ will have both roots common

$\Rightarrow a:b:c=1:3:7$

min. of $(a+b+c)=1+3+7=11$

max. of $(a+b+c)=7+21+49=77$

sum $=88$

75. (A)

Sol. Let Nos. are $\frac{a}{2},\frac{a}{2},\frac{b}{3},\frac{b}{3},\frac{b}{3},\frac{c}{4},\frac{c}{4},\frac{c}{4},\frac{c}{4}$

$\therefore \quad G \le A$

$$\Rightarrow \left[\frac{a^2b^3c^4}{2^2\cdot 3^3\cdot 4^4}\right]^{1/9} \le \frac{18}{9}$$

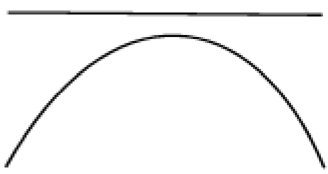
$$\Rightarrow \left(\frac{a^2b^3c^4}{2^{10}\cdot 3^3}\right)^{1/9} \le 2 \Rightarrow \frac{a^2b^3c^4}{2^{10}\cdot 3^3} \le 2^9$$

$\therefore \quad a^2b^3c^4 \le 2^{19}\cdot 3^3$

Identify a, b, & c

76. (B)

Sol. CaseI: $a^2 + a - 2 \neq 0 \Rightarrow a \neq -2, 1$



$a^2 + a - 2 < 0$

and

$(a + 2)^2 + 4\,(a^2 + a - 2) < 0$

$\therefore a \in (-2,1)$ and $a \in \left(-2, \frac{2}{5}\right)$

$\Rightarrow$ integral solution are $a = 0$, -1

$\Rightarrow a = 0, -1$

Case - II: $a^2 + a - 2 = 0 \Rightarrow a = -2, 1$

for $a = -2$, $0 < 1 \;\forall\; x \in R$

for $a = 1$, $3x < 1$

$\Rightarrow$ integral solutiona = -2

Finally, sum = (-1) + 0 + (-2) = -3

77. (C)

Sol. $\because \; a + b + c = 3b = 3/2 \quad b = 1/2$

$\because \; a = \frac{1}{2} - d \;\&\; c = \frac{1}{2} + d$

Now $(\frac{1}{2} - d)^2$, $\frac{1}{4}$, $(\frac{1}{2} + d)^2$ are in GP

$\therefore$ (using $\; = ac$) $\Rightarrow \frac{1}{4} = d^2 - \frac{1}{4} \Rightarrow d = 1/\sqrt{2}$

$$\therefore \quad a = \frac{1}{2} - d = \frac{1}{2} - \frac{1}{\sqrt{2}} = \frac{\sqrt{2} - 2}{2\sqrt{2}}$$

78. (B)

Sol. f(0).f(3) < 0

$\Rightarrow (2\lambda)(9-3\lambda-3+2\lambda)<0$

$\Rightarrow \lambda(\lambda-6)>0$

$\Rightarrow \lambda \in (-\infty,0)\cup(6,\infty)$

Check: $\lambda=0 \Rightarrow x^2 - x = 0 \Rightarrow x = 0, 1$

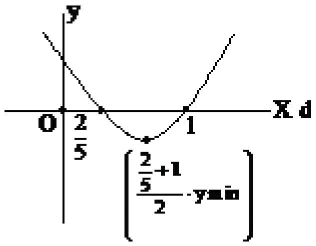
$\therefore$ Ans. $x\in(-\infty,0]\cup(6,\infty)$

79. (D)

Sol. $y = a_1.a_2.a_6$ $a + 5d = 2$

$y = 2a.(a + 3d)$ $a = 2 - 5d$

$y = 2(2 - 5d)(2 - 5d + 3d)$



$y = 2(5d - 2)(2d - 2)$ $d_1 = \frac{2}{5}$ $d_2 = 1$

$Y_{(min)}$ at $d = \frac{d_1 + d_2}{2} = \frac{\frac{2}{5}+1}{2} = \frac{7}{10}$

80. (A)

Sol. a - 3d, a - d, a + d, a + 3d be angles of quad.

$2d = 10°$ (given) $d = 5°$

a - 15°, a - 5°, a + 5°, a + 15° are angles

$\therefore$ sum = 4a = 360°

a = 90° $\Rightarrow$ 90 - 15, 90 - 5, 90 + 5, 90 + 15

75°, 85°, 95°, 105°

81. 2

Sol. α, β are roots of $x^2 - 6x + 4 = 0$

hence α, β will satisfy

equation $x^2 - 6x + 4 = 0$

$\alpha^2 - 6\alpha + 4 = 0$

$\alpha^{n+2} - 6\alpha^{n+1} + 4\alpha^n = 0$ ....(1)

$\beta^{n+2} - 6\beta^{n+1} + 4\beta^n = 0$ ....(1)

from (1) and (2)

$A_{n+2} - 6A_{n+1} + 4A_n = 0$

$\left(\frac{A_{50} + 4A_{48}}{A_{49}}\right) + \left(\frac{A_{50} - 6A_{49}}{A_{48}}\right) = 6 - 4 = 2$

82. 3

Sol. a, b, c are in G.P.

$b^2 = ac$

$\log_6 a + \log_6 b + \log_6 c = 6$

$abc = 6^6$

$b^3 = 6^6$

$b = 6^2 = 36$

$ac = 36 \times 36 = 2^4 \times 3^4 \quad b - a = N^2$

$36 - a = N^2$

a is factor of $2^4 3^4$

a = 27 is possible value

$36 - 27 = 9 = 3^2$

$\Rightarrow a = 27,\ b = 36,\ c = 48$

$a + b + c = 111.$

83. 900

Sol. $3(a_1 + a_{24}) = 225$

$a_1 + a_{24} = 75$

Now, $(a_1 + a_2 + \ldots\ldots a_{24})$ is

$[a_1 + a_{24}] ==> 12 \times 75 = 900$

84. 3

Sol. For the equation

$x^4 - (a^2 - 5a + 6)x^2 - (a^2 - 3a + 2) = 0$

to have real root only the equation

$t^2 - (a^2 - 5a + 6)t - (a^2 - 3a + 2) = 0$

must have both roots greater then or equal to zero

$(a^2 - 5a + 6)^2 + 4(a^2 - 3a + 2) \geq 0$

$\frac{a^2 - 5a + 6}{2(1)} \geq 0 = a^2 - 5a + 6 \geq 0$

$(a - 2)(a - 3) \geq 0$

$a \in (-\infty, 2] \cup [3, \infty)$

(3)

$-(a^2 - 3a + 2) \geq 0$

$-(a^2 - 3a + 2) \geq 0$

$-(a - 1)(a - 2) \geq 0$

$a \in [1, 2]$

From 2 & 3, we have integral value of a equal to 1 and 2 which also satisfy condition 1.

$a = 1, 2$

85. 34

Sol. since α, β be roots of $x^2 - 3x + a = 0$

$\therefore\ \alpha + \beta = 3, \alpha\beta = a$

since γ, δ be roots of $x^2 - 12x + b = 0$

$\therefore\ \gamma + \delta = 12, \gamma\delta = b$

$\therefore \frac{\alpha}{\beta} = \frac{\gamma}{\delta}$

$\Rightarrow \frac{\alpha\beta}{(\alpha+\beta)^2} = \frac{\gamma\delta}{(\gamma+\delta)^2}$

$\frac{a}{9} = \frac{b}{144}$

$16a = b$

Let r be the common ratio of $\alpha, \beta, \gamma, \delta$

then $\beta = ar, \gamma = ar^2$ and $\delta = ar^3$

$\therefore \alpha$ and β be roots of equation $x^2 - 3x + a = 0$

$\therefore \alpha + \beta = \alpha(1+r) = 3$.......(i)

$\alpha\beta = \alpha(\alpha r) = a$ ....(ii)

$\therefore \gamma$ and δ be roots of equation $x^2 - 12x + b = 0$

$\therefore \gamma + \delta = ar^2(1+r) = 12$ ....(iii)

$\gamma\delta = (ar^2)(ar^3) = b \Rightarrow a^2r^5 = b$ ......(iv)

from (iii) $\div$ (i)

$r^2 = 4 \Longrightarrow r = 2$

then from (i), $\alpha = 1 \Longrightarrow a = 2$

$b = 2^5 = 32$

$a + b = 32 + 2 = 34$

86. 9

Sol. $x^4 - 3x + 1 = 0$

$\alpha + \beta + \gamma + \delta = 0$

$\alpha^4 = 3\alpha - 1$

$\Rightarrow \alpha^3 = 3 - \frac{1}{\alpha}$

$\therefore \alpha^3 + \beta^3 + \gamma^3 + \delta^3 = 12 - \sum \frac{1}{\alpha}$

$12 - \frac{\sum \alpha\beta\gamma}{\alpha\beta\gamma\delta}$

$12 - 3 = 9$

87. 3

Sol. Given $\log_3 2, \log_3(2^x - 5), \log_3\left(2^x - \frac{7}{2}\right)$ are in A.P.

$\Rightarrow 2\log_3(2^x - 5) = \log_3 2 + \log_3\left(2^x - \frac{7}{2}\right)$

$(2^x - 5)^2 = 2\left(2^x - \frac{7}{2}\right)$

Put $2^x = t$ and get $t^2 - 12t + 32 = 0$

$(t - 8)(t - 4) = 0 \Longrightarrow t = 8, 4$

$2^x = 8$ or $2^x = 4$

$x = 3 \quad x \neq 2 \quad \therefore 2^x - 5 < 0$ for $x = 2$

88. 8

Sol. A.M. $\geq$ G.M.

$$\frac{\frac{1}{a^5}+\frac{1}{a^4}+\frac{1}{a^3}+\frac{1}{a^3}+\frac{1}{a^3}+1+a^8+a^{10}}{8} \geq \left(\frac{1}{a^5}\cdot\frac{1}{a^4}\cdot\frac{1}{a^3}\cdot\frac{1}{a^3}\cdot\frac{1}{a^3}.1.a^8.a^{10}\right)^{1/8}$$

$$\Rightarrow \quad \frac{1}{a^5}+\frac{1}{a^4}+\frac{3}{a^3}+1+a^8+a^{10} \geq 8(1)^{1/8}$$

$$\Rightarrow \quad \text{minimum value of } \frac{1}{a^5}+\frac{1}{a^4}+\frac{3}{a^3}+1+a^3+a^{10}=8, \text{ at } a=1$$

89. 0

Sol. $5.T_5 = 8.T_8$

$\Rightarrow 5(a+(4d)] = 8(a+7d)$

$\Rightarrow 3a = -36d \quad \Rightarrow a+12d = 0$

$\Rightarrow T_{13} = 0$

90. 20

Sol. $d_1 = 4, d_2 = 5$, first common term $= 21$

A.P. of common terms is

$21+41+61+\ldots\ldots$

Let no. of common term is 'n'

then $T_n = 417 = a + (n-1)\,d$

$417 = 21 + (n-1)\,20$

$\frac{396}{20} + 1 = n$

$n = 19.8 + 1$

$n = 20.8 \notin N$

so number of common terms $= 20$