JEE MAIN ANSWER KEY & SOLUTION

PAPER CODE :- PART TEST-3
CLASS-XI

ANSWER KEY

PHYSICS

1.	(D)	**2.**	(C)	**3.**	(B)	**4.**	(A)	**5.**	(B)	**6.**	(C)	**7.**	(A)
8.	(D)	**9.**	(B)	**10.**	(C)	**11.**	(C)	**12.**	(A)	**13.**	(C)	**14.**	(B)
15.	(A)	**16.**	(C)	**17.**	(A)	**18.**	(B)	**19.**	(A)	**20.**	(C)	**21.**	1
22.	5	**23.**	5	**24.**	780	**25.**	8	**26.**	1	**27.**	8	**28.**	3
29.	2	**30.**	2										

CHEMISTRY

31.	(D)	**32.**	(C)	**33.**	(A)	**34.**	(B)	**35.**	(B)	**36.**	(C)	**37.**	(D)
38.	(A)	**39.**	(A)	**40.**	(D)	**41.**	(B)	**42.**	(D)	**43.**	(B)	**44.**	(A)
45.	(C)	**46.**	(B)	**47.**	(A)	**48.**	(C)	**49.**	(A)	**50.**	(B)	**51.**	450
52.	600	**53.**	179.7	**54.**	20.4	**55.**	7	**56.**	4	**57.**	5	**58.**	70
59.	17	**60.**	6										

MATHEMATICS

61.	(C)	**62.**	(B)	**63.**	(B)	**64.**	(B)	**65.**	(D)	**66.**	(C)	**67.**	(B)
68.	(D)	**69.**	(A)	**70.**	(C)	**71.**	(C)	**72.**	(D)	**73.**	(C)	**74.**	(B)
75.	(A)	**76.**	(C)	**77.**	(D)	**78.**	(A)	**79.**	(A)	**80.**	(C)	**81.**	200
82.	5	**83.**	12632	**84.**	7	**85.**	210	**86.**	10	**87.**	1275	**88.**	1224
89.	4	**90.**	833										

SOLUTIONS

PHYSICS

1. (D)

Sol. It is proportional limit so OA is correct

2. (C)

Sol. If $\theta < 90^\circ$, then liquid does not wet the solid surface

3. (B)

Sol. $P + \frac{1}{2}\rho V^2 + \rho gh = P + \frac{1}{2}\rho v^2 + 0$ ……….(i)

also $AV = av$ ……….(ii)

4. (A)

Sol. $Y = \frac{mg/A}{\ell/L} = \frac{mgL}{A\ell}$

$\ell = \frac{mgL}{YA}$

So $\propto$ hence (A)

5. (B)

Sol. $v \propto r^2$; $\frac{r_1}{r_2} = \sqrt{\frac{v_1}{v_2}}$

6. (C)

Sol. $P = 2T/R$; R is less for smaller bubble, P is more for larger bubble, R is more, P is less. Since air flows from higher pressure to lower pressure therefore the air shall flow from smaller bubble to larger bubble.

7. (A)

Sol. $Av = A_1v_1 + A_2v_2 + A_3v_3 + A_4v_4$

$Av = 4(A_1v_1)$

$12 \times 0.75 = 4\,[4 \times v]$

$v = \frac{3}{4} \times 0.75$

$= 0.75 \times 0.75$

$v = 0.56$ m/s

8. (D)

Sol. $v \propto h^0$ so n is equal to zero.

9. (B)

Sol. $P.E. = \frac{Y}{2}(\text{strain})^2(AL) = K.E. = \frac{1}{2}mv^2$

$v = \text{strain}\sqrt{\frac{Y}{m}AL}$

$= \frac{2}{10}\sqrt{\frac{5\times10^8}{5\times10^{-3}}\times10^{-6}\times0.1}$

$= 20$ m/s

10. (C)

Sol. A become A/4 so radius become just half of its present value and $h \propto \frac{1}{r}$ so h become just double so h = 40 cm.

11. (C)

Sol. Let a be the size of each side of the cube. Then,

$200 \times g = (2) \times (a^2) \times 1 \times g$

$\therefore\ a = 10$ cm

12. (A)

Sol. Net force on the ball = 0

(when terminal velocity is attained).

Hence,

Weight = upthrust + viscous force

$$\therefore \frac{4}{3}\pi r^3 \rho_1 g = \frac{4}{3}\pi r^3 \rho_2 g + krv_T$$

$$\therefore v_T = \frac{4\pi g r^2}{3k}(\rho_1 - \rho_2)$$

13. (C)

Sol. The density would increase by 0.1% if the volume decrease by 0.1%,

$$K = \frac{\Delta P}{\frac{\Delta V}{V}}$$

$$\Rightarrow \Delta P = K\frac{\Delta V}{V} = 2 \times 10^9 \times \frac{0.1}{100} = 2 \times 10^6\ Nm^{-2}$$

14. (B)

Sol. From due to surface tension property.

15. (A)

Sol. Increasing the temperature of water from 2°C to 3°C increases it's density while decreases the density of iorn. Hence the bouyant force increases.

16. (C)

Sol. $F = \eta A\frac{v}{d}$

$$\frac{F_1}{F_2} = \frac{v_1}{v_2}$$

$$\frac{800}{2400} = \frac{2}{v_2}$$

$v_2 = 6$ cm/s

17. (A)

Sol. A = constt.

Y = constt.

$L_1 : L_2 :: 1 : 2$

F = constt.

$$Y = \frac{Stress}{Strain}$$

$\therefore$ Strain = constt.

18. (B)

Sol. Since the density of sea-water is more than that of river therefore lesser volume of sea water is required to be displaced to balance the weight of the boat.

19. (A)

Sol. $a \to p$, $b \to p$, $c \to r$, $d \to q$

As cube is floating $\rho_s ALg = \rho_L Axg$

$$\therefore x = \left(\frac{\rho_S}{\rho_L}\right)L$$

20. (C)

Sol. $$\eta = \frac{2r^2}{9}\left(\frac{\rho-\sigma}{V}\left(\frac{g}{2}\right)\right)$$

$$\text{So } V = \frac{r^2 g(\rho-\sigma)}{9\eta}$$

21. 1

Sol. $$\Delta P = \frac{\rho V^2}{2}\left(\frac{D^4}{d^4}-1\right) = \rho_0 gh$$

where D and d are the diameters of the pipeline and of the narrowing.

$$\text{Flow rate} = \rho SV = \frac{1}{4}\pi\rho VD^2$$

22. 5

Sol. At equilibrium

$2T\sin\theta = mg$

$$\Rightarrow 2.\left(\frac{YA}{2a}\right)x\sin\theta.\sin\theta = mg$$

$$\Rightarrow \frac{YA}{a}x.\frac{x^2}{a^2} = mg$$

$$\Rightarrow x = \left\{\frac{a^3 mg}{YA}\right\}^{\frac{1}{3}}$$

$$= \left\{\frac{1\text{m}\times 5\text{kg}\times 10\text{m}/\text{s}^2}{(2.4\times 10^9\ \text{N}/\text{m}^2)\times 10^{-4}\text{m}^2}\right\}^{\frac{1}{3}}$$

$= 5$ cm

23. 5

Sol. $$a = \left(\frac{1}{\rho}-1\right)g_{eff}$$

$$= \left(\frac{17}{12}-1\right).12 = 5\text{m/s}^2$$

24. 780

Sol. If m is mass of single drop then as it drops

$mg = 2\pi rT$

If number of drops in M = 10 grams is N then,

$$N = \frac{M}{m} = \frac{Mg}{mg} = \frac{Mg}{2\pi rT} \approx 779.86\ 780$$

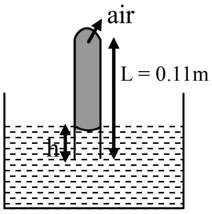
25. 8

Sol. $\delta = \frac{Fdx}{AY}$, $\Delta\ell = \int \frac{Fdx}{AY}$

$$= \int_0^{10} \frac{20\times10^3 dx}{\left(1+\frac{x^2}{100}\right)\times2\times10^7} = 0.008\text{ cm}$$

26. 1

Sol. If final pressure of gas in tube is P_2 then



$$P_2 - \frac{2T}{r} = P_0$$

(as levels inside and outside are same)

i.e. $P_2 = P_0 + \frac{2T}{r}$

but as temperature remains constant

$\therefore\ P_1V_1 = P_2V_2$

$$P_0AL = \left(P_0 + \frac{2T}{r}\right)A(L-h)$$

On solving, h = 0.01 m

27. 8

Sol. $F = \eta A\frac{\Delta V}{\Delta Z}$

$$9.8 = 5\times10^{-3}\pi \times 796\times10^{-3} \times 200 \times 10^{-3} \times \frac{v}{2\times10^{-3}}$$

v = 7.841 m/s

28. 3

Sol. Range will become twice of velocity of efflux becomes twice. Now as,

$v = \sqrt{2gh}$

Therefore, h should become 4 times or 40 m

Thus, an extra pressure equivalent to 30 m of water should be applied.

1 atm = 0.76 × 13.6 m of water

= 10.336 m of water

30 m of water $\approx$ 3.0 atm

29. 2

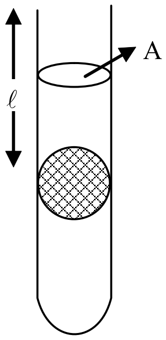
Sol. $\Delta\ell = \dfrac{F\ell}{\Delta y}$

$\dfrac{\Delta\ell}{F/A} = \dfrac{\ell}{y}$

$y = \dfrac{4000\times10^{3}}{2\times10^{-3}} = 2\times10^{9}\ \text{N/m}^2$

30. 2

Sol.



$W_{gas} = -\left\{W_{gravity} + W_{external\ pressure}\right\}$

$= mg\ell + P_0\ell A$ [m = mass of Hg pallet]

$= 2.136\ \text{J}$

$\therefore \Delta Q = \Delta W$

$= 2.136\ \text{J}$

31. (D)

Sol.
$E = h\nu$

$46.12 = 9.52 \times 10^{-14} \times \nu$

$\nu = 4.84 \times 10^{14}$ cycles s^{-1}.

32. (C)

Sol. In single electron system energy depends only on 'n'.

33. (A)

Sol. According to the question electron goes to the 5th state after excitation and return to the ground state and photon releases in visible region. For emission of photon in visible region it must goes in Balmer series or follow 5 $\rightarrow$ 2 or 4 $\rightarrow$ 2 or 3 $\rightarrow$ 2 transition. Then this electron goes to ground state so it must follow 2 $\rightarrow$ 1 transition only.

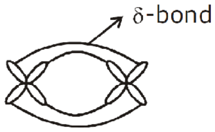
34. (B)

Sol. n and ℓ can never be equal

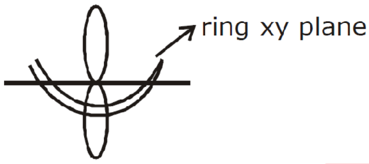
$n \neq \ell$

35. (B)

Sol.



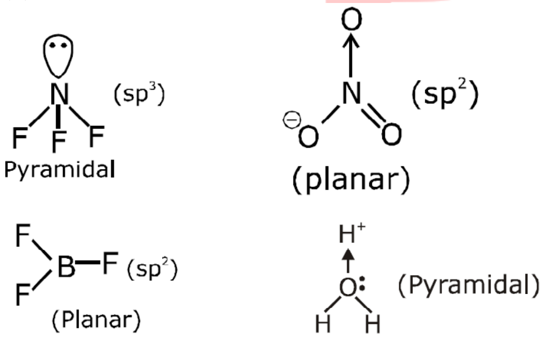
(4 Lobe Interaction)



= no nodal plane

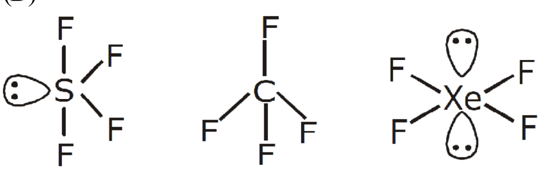
36. (C)

Sol.



37. (D)

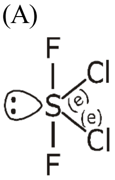
Sol.



(see-saw) L.P=1 | (tetra hedral) L.P. = 0 | (Square planar) L.P.=2

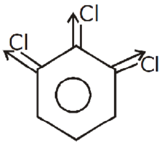
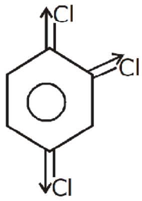
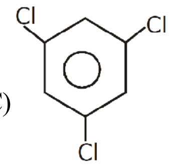
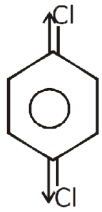
38. (A)

Sol.



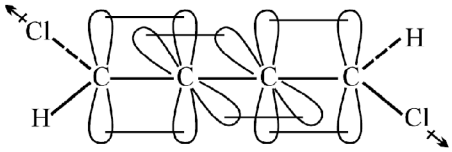
F is more electronegative and smaller in size than chlorine so S–F bond is smaller than the S–Cl bond. Hence axial bonds are smaller compared to equatorial bond.

39. (A)

Sol. (A)  (B)  (C)  (D) 

40. (D)

Sol.



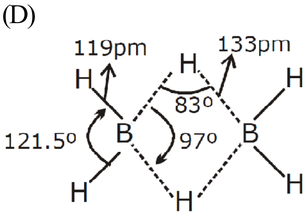
41. (B)

Sol. $BI_3 > BBr_3 > BCl_3 > BF_3$

$\rightarrow$ Acidic nature decreases due to back bonding

42. (D)

Sol.



43. (B)

Sol. SiO_2 - sp^3

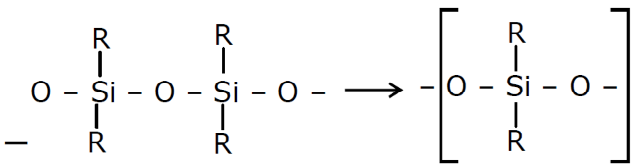
silica is most abundant in earth crust oxygen atom is sp^3 hybridised.

$$SiO_2 + C \longrightarrow Si + \underset{\text{Poisonous gas}}{CO(g)} \quad \underset{\text{(most stable)}}{\overset{-}{C} \equiv \overset{+}{O}}$$

44. (A)

Sol.

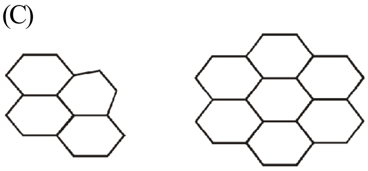
$$HO-\underset{R}{\overset{R}{Si}}-OH + OH-\underset{R}{\overset{R}{Si}}-OH \rightarrow$$



Linear Silicone

45. (C)

Sol.



Within layer non metallic covalent bonding.

46. (B)

Sol. $Li^+_{(aq)} < Na^+_{(aq)} < K^+_{(aq)}$

$\xrightarrow{\text{Ionic Mobility}}$

As the size increase, the degree of hydration will decrease so its ionic mobility will increase.

47. (A)

Sol. No back bonding in $(CH_3)_2O$

Most effective back bonding in BeF_2 is due to $2p_\pi - 2p_\pi$ overlapping while in $\bar{C}Cl_3$ it is of $2p_\pi - 3d_\pi$ overlapping and in AsF_3, $4d_\pi - 2p_\pi$ which are less effective.

48. (C)

Sol. Atomic weight = 19

49. (A)

Sol. $CaO < CuO < H_2O < CO_2$

50. (B)

Sol. Al = 143 pm

Ga = 135 pm

In = 167 pm

Tl = 170 pm

51. 450

Sol. $\lambda = \frac{h}{p}$

$p = \frac{h}{\lambda}$

$p_{initital} = \frac{6.62\times10^{-34}}{100\times10^{-12}} = 6.63\times10^{-24}\ kg\,m/s$

$E_{initital} = \frac{P^2{}_{initital}}{2m} = \frac{(6.62\times10^{-24})^2}{2\times9.1\times10^{-31}} = 2.4\times10^{-17}\ J$

$P_{finall} = \frac{6.62\times10^{-34}}{50\times10^{-12}} = 13.26\times10^{-24}\ kg\,m/s$

$E_{finall} = \frac{(13.26\times10^{-24})^2}{2\times9.1\times10^{-31}} = 9.7\times10^{-17}\ J$

$\Delta E = E_{final} - E_{initital}$

$= 9.7\times10^{-17} - 2.4\times10^{-17}$

$= 7.3\times10^{-17}\ J$

$\Delta E = \frac{7.3\times10^{-17}}{1.6\times10^{-19}} = 450\ eV.$

52. 600 nm

Sol. $\frac{hc}{300} = \frac{hc}{600} + \frac{hc}{\lambda}$

$\frac{1}{\lambda} = \frac{1}{300} - \frac{1}{600} = \frac{1}{600} \Rightarrow \lambda = 600$

53. 179.7

Sol. $K.E_{max} = h\nu - \frac{hc}{\lambda_0}$

$h\nu = K.E_{max} + \frac{hc}{\lambda_0}$

$= 1.5\text{ eV} + \frac{1240}{230}\text{eV}$

$= 1.5\text{ eV} + 5.4\text{ eV}$

$= 6.9\text{ eV}$

$\frac{hc}{\lambda} = 6.9\text{eV}$

$\lambda = \frac{hc}{6.9} = \frac{1240}{6.9}$

$= 179.7\text{ nm}$

54. 20.4

Sol. Hydrogen atom may be excited to first excitation energy.

So, loss in kinetic energy = ΔE = 10.2 eV

For minimum K.E, two atoms will move together

$\therefore\ mv_0 = (m + m)\,v \Rightarrow v = \frac{v_0}{2}$

Loss in K.E = $\frac{1}{2}\ mv_0^2 - \frac{1}{2}\ (2m)\left(\frac{v_0}{2}\right)^2$

$= \frac{1}{2}mv_0^2 - \frac{mv_0^2}{4}$

$= \frac{1}{2}mv_0^2 - \left[1 - \frac{1}{2}\right]$

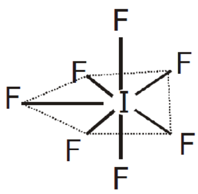
$= \frac{1}{2}mv_0^2 \times \frac{1}{2}$

$10.2 = \frac{1}{2} \times \times\ (K.E)_{min}$

$(K.E)_{min} = 20.4$ eV.

55. 7

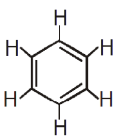
Sol.



no. of B.P. =7

56. 4

Sol.



$\frac{\sigma}{\pi} = \frac{12}{3} = 4$

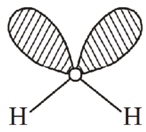
57. 5

Sol. Five orientations : d_{xy}, d_{yz}, d_{zx}, $d_{x^2-y^2}$, d_{z^2}

58. 70

Sol. $\cos\theta = \frac{-1}{i}$

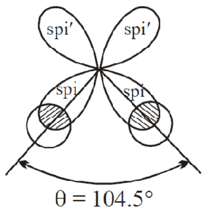
$\cos(104.5°) = \frac{-1}{i} = -0.25$



$\Rightarrow \quad i = 4$

Applying $\quad \Sigma f_p = 3$

$$\frac{2\times i}{i+1} + 2\times fp' = 3$$



$$\frac{2\times 4}{5} + 2fp¢ = 3$$

where fp¢ = fraction of p character in L.P.

fp¢% = 70%

59. 17

Sol. % ionic character = $\frac{\mu_{exp}}{\mu_{cal}} \times 100$

μH–Cl = 1.03 D= 1.03×10^{-18} esu cm

d H–Cl = 1.275Å = 1.275×10^{-8} cm

$$\%\text{I.C.} = \frac{1.03\times10^{-18}}{(4.8\times10^{-10})\times1.275\times10^{-8}} \times 100$$

$\cong 17\%$

60. 6

Sol. O = 6 = $1s^2\ 2s^2\ 2p^4$

61. (C)

Sol. $\sum_{r=0}^{n}(-1)^r\frac{{}^nC_r}{{}^{r+2}C_r}=\sum_{r=0}^{n}(-1)^r\frac{n!}{(n-r)!\,r!}\cdot\frac{r!\cdot 2!}{(r+2)!}$

$=2\sum_{r=0}^{n}(-1)^r\frac{n!}{(n-r)!(r+2)!}=\frac{2}{(n+1)(n+2)}\cdot\sum_{r=0}^{n}(-1)^r\frac{(n+2)!}{(n+2)-(r+2)!\,(r+2)!}$

$=\frac{2}{(n+1)(n+2)}\cdot\sum_{r=0}^{n}(-1)^r\cdot{}^{n+2}C_{r+2}$

$=\frac{2}{(n+1)(n+2)}\cdot({}^{n+2}C_2-{}^{n+2}C_3+{}^{n+2}C_4-{}^{n+2}C_5-{}^{n+2}C_{n+2})$

add and subtract ${}^{n+2}C_0-{}^{n+2}C_1$

$=\frac{2}{(n+1)(n+2)}\cdot\{({}^{n+2}C_0-{}^{n+2}C_1+{}^{n+2}C_2-{}^{n+2}C_3+{}^{n+2}C_4-{}^{n+2}C_5-{}^{n+2}C_{n+2})-({}^{n+2}C_0-{}^{n+2}C_1)\}$

$=\frac{2}{(n+1)(n+2)}\left(0-(1-(n+2))\right)=\frac{2}{n+2}$]

62. (B)

Sol. $P=\sum_{r=0}^{5}C_{2r}={}^{10}C_0+{}^{10}C_2\,.........\,{}^{10}C_{10}=\frac{2^{10}}{2}=2^9$

and $Q=\sum_{r=0}^{3}d_{2r+1}=d_1+d_3+d_5+d_7={}^7C_1+{}^7C_3+{}^7C_5+{}^7C_7=\frac{2^7}{2}=2^6$

$\therefore\quad\frac{P}{Q}=\frac{2^9}{2^6}=2^3=8.$ Ans.]

63. (B)

Sol. Term independent of x in expansion of $\left(3x-\frac{1}{x}\right)^{20}$

$T_{r+1}={}^{20}C_r(3x)^{20-r}\left(\frac{-1}{x}\right)^r$

When $r=10$

$A=T_{11}={}^{20}C_{10}\;3^{10}$ .... (1)

Term independent of x in expansion of $\left(x+\frac{\sqrt[9]{3^{10}}}{x}\right)^{18}$

$T_{r+1}={}^{18}C_r(x)^{18-r}\left(\frac{\left(3^{10}\right)^{1/9}}{x}\right)^r$

When $r=9$

$B=T_{10}={}^{18}C_9\,3^{10}$ .... (2)

So, $\left(\frac{9}{38}A+B\right)=\left(\frac{9}{38}\times{}^{20}C_{10}\times 3^{10}+{}^{18}C_9\times 3^{10}\right)$ [From (1) and (2)]

$=\left(\frac{9}{38}\times\frac{20}{10}\times\frac{19}{9}\times{}^{18}C_8\times 3^{10}+{}^{18}C_9\times 3^{10}\right)=3^{10}\times{}^{19}C_9$]

64. (B)

Sol. $\left(\frac{3}{2}x^2 - \frac{1}{3}x\right)^9$

if $(r+1)^{th}$ in the given expression is independed of 2

$T_{r+1} = {}^nC_r\, x^{n-r} a^r$

$= a_{cr}\left(\frac{2}{3}x^2\right)^{a-r}\left(\frac{-1}{3x}\right)^r$

$= = (-1)^r\, {}^aC_r \cdot \frac{3^{9-2r}}{2^{a-r}} \times x^{18-2r-r}$

For the term independent of x.

$18 - 3r = 0$

$3r = 18$

$r = 18/3 = 6$

$\therefore$ required term is 7^{th}.

$T_7 = T_{6+1} = {}^9C_6 \frac{3^{9-12}}{2^{2-6}} = {}^9C_6 \frac{1}{3^3 2^3}$

65. (D)

Sol. $\because\ 3 \cdot C_3 + 8 \cdot C_4 + 15 \cdot C_5 + 24 \cdot C_6 + \ldots\ldots = \sum_{r=3}^{n}\left((r-1)^2 - 1\right){}^nC_r$

$= \sum_{r=3}^{n}(r^2 - 2r)\,{}^nC_r = \sum_{r=3}^{n}\left(r(r-1) - r\right){}^nC_r$

$= \sum_{r=3}^{n} r(r-1) \cdot \frac{n}{r} \cdot \left(\frac{n-1}{r-1}\right) \cdot {}^{n-2}C_{r-2} - \sum_{r=3}^{n} r \cdot \frac{n}{r} \cdot {}^{n-1}C_{r-1}$

$= n(n-1)\sum_{r=3}^{n} {}^{n-2}C_{r-2} - n\sum_{r=3}^{n} {}^{n-1}C_{r-1}$

$= n(n-1)\,(2^{n-2} - 1) - n\left(2^{n-1} - (n-1) - 1\right)$

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

$= n\, 2^{n-2}\,(n - 1 - 2) + n = n\,(n-3)\, 2^{n-2} + n$

$\therefore\ \lambda = 3$ and $\mu = 2$

$\therefore\ \lambda + \mu = 5$ **Ans.**]

66. (C)

Sol. $\frac{1-(1-x)^n}{x} = \sum_{r=1}^{n}(-1)^{n-1} C_r x^{r-1}$

Integrating between 0 and 1 yields the desired sum $\sum_{r=1}^{n}\frac{1}{r}$

67. (B)

Sol. One middle term $\Rightarrow$ n = even

$x = 3;\ a = 2;\ 7^{th}$ term

${}^nC_5 \cdot 3^{n-5} \cdot 2^5 < {}^nC_6 \cdot 3^{n-6} \cdot 2^6 > {}^nC_7 \cdot 3^{n-7} \cdot 2^7$

$\Rightarrow\ \frac{3}{2} < \frac{n!}{6!(n-6)!} \times \frac{5!(n-5)!}{n!}$ | $\frac{3}{2} > \frac{n!}{7!(n-7)!} \times \frac{6!(n-6)!}{n!}$

$\Rightarrow\ 2(n-5) > 3 \cdot 6$ | $\Rightarrow\ 2(n-6) < 21$

$\Rightarrow\ n - 5 > 9$ | $\Rightarrow\ 2n < 33$

$\Rightarrow\ n > 14$ | $\Rightarrow\ n < 16 \cdot 5$

and n is even, so $n = 16$

$n = 2^4$

Number of divisors $= 4 + 1 = 5$ **Ans.**]

68. (D)

Sol. $N = 2^3 \cdot 3^4 \cdot 5^2 \cdot 7^1$

Total divisors of $N = 4 \times 5 \times 3 \times 2 = 120$

$M = 2^3 \cdot 3^4 \cdot 7^1$

Number of divisors of N which are not divisible by $5 = 4 \times 5 \times 2 = 40$

$$\text{Required product} = \frac{\text{Product of all divisors}}{\text{Product of divisors which are not divisible by 5}}$$

$$= \frac{N^{60}}{M^{20}}$$

$$= \frac{N^{60}}{\left(\frac{N}{25}\right)^{20}} = (5N)^{40} \qquad \left(\because M = \frac{N}{5^2}\right) \quad]$$

69. (A)

Sol. (N N), (A A A), R, Y

_ _ _ _ _ _ _

N does not lie between any two A's

$\therefore$ These 5 letters can be arranged by 3 ways only

N N A A A

N A A A N

A A A N N

Required number of ways $= {}^7C_2 \times 2\,! \times 3 = 126$ **Ans.**]

70. (C)

Sol. Number of numbers using all 7 digits without condition $= \dfrac{7!}{2! \cdot 3!}$

Number of numbers in which digit 0 comes at first place $= \dfrac{6!}{2! \cdot 3!}$.

$\therefore$ Required number of numbers $= \dfrac{7!}{2! \cdot 3!} - \dfrac{6!}{2! \cdot 3!} = \dfrac{6 \cdot 6!}{2! \cdot 3!} = 360$. **Ans.**

71. (C)

Sol. Let $\dfrac{n!}{4!} = t$

$\therefore \; t^2 + \dfrac{7! \cdot 5}{4} = 240t$

$\Rightarrow t^2 - 240t + 7 \cdot 6 \cdot 5 \cdot 5 \cdot 3 \cdot 2 = 0$

$\Rightarrow t^2 - 210t - 30t + 210 \cdot 30 = 0$

$\Rightarrow (t - 210)(t - 30) = 0 \;\Rightarrow t = 210$ or 30

$\Rightarrow \dfrac{n!}{4!} = 210$ or 30

$\Rightarrow n! = 7!$ or $6! \Rightarrow n = 7$ or 6

$\therefore$ Sum = 13. **Ans.**]

72. (D)

Sol. From the given relation it is evident that ${}^nC_r$ is the greatest among the values ${}^nC_0, {}^nC_1, \ldots, {}^nC_n$

$\Rightarrow \quad r = \dfrac{n-1}{2}$ or $\dfrac{n+1}{2}$ because n is odd

But only one term ${}^nC_r$ is greater to other so there is no value of r.

73. (C)

Sol. $\because$ LCM of $\alpha, \beta, \gamma = p^3q^2r$ & HCF = pqr

$\therefore$ $\alpha = p^{m_1}q^{n_1}r$

$\beta = p^{m_2}q^{n_2}r$

$\gamma = p^{m_3}q^{n_3}r$

minimum of $(m_1, m_2, m_3) = 1$ & maximum of $(m_1, m_2, m_3) = 3$

$\therefore$ Number of possibilities for $m_1, m_2, m_3 = 12$

and minimum of $(n_1, n_2, n_3) = 1$ and maximum $(n_2, n_2, n_3) = 2$

$\therefore$ Number of possibilities = 6

$\therefore$ Total number of ordered triplets $= 12 \times 6 = 72$ **Ans.**]

74. (B)

Sol. Let two observations are x and y

then $\dfrac{x+y+2+4+10+12+14}{7} = 8$

$x + y + 42 = 56 \Rightarrow x + y = 14$ ...(i)

and $\dfrac{x^2+y^2+4+16+100+144+196}{7} - \dfrac{(x+y+42)^2}{49} = 16$

$\Rightarrow \dfrac{x^2+y^2+460}{7} = 16 + 64 = 80$

$\Rightarrow x^2 + y^2 = 560 - 460 = 100$ ...(ii)

$\therefore$ on solving (i) & (ii) we get x = 6, y = 8

75. (A)

Sol.

x_i	f_i	$f_i\,x_i$	$f_i\,x_i^2$
0	1	0	0
1	9	9	9
2	7	14	28
3	5	15	45
4	3	12	48
	$\sum f_i = 25$	$\sum f_i\,x_i = 50$	$\sum f_i\,x_i^2 = 130$

$$\sigma^2 = \left[\frac{\sum f_i x_i^2}{\sum f_i} - \left(\frac{\sum f_i x_i}{\sum f_i}\right)^2\right] = \left[\frac{130}{25} - \left(\frac{50}{25}\right)^2\right] = 1.2$$

so variance of A = 1.2 < 1.25 = variance of B

so more consistent team = A

76. (C)

Sol. First sample size $= (n_1) = 200$

Second sample size $= (n_2) = 300$

$\overline{x}_1 = 25$, $\overline{x}_2 = 10$

SD $(6_1) = 3$ & $6_2 = 4$

combined mean, $\overline{x}_2 = \dfrac{200 \times 25 + 300 \times 10}{500} = 16$

Let $d_1 = \overline{x}_1 \times \overline{x} = 25 - 16 = 9$

$d_2 = \overline{x}_2 \times \overline{x} = 10 - 16 = -6$

$$\therefore 6^2 = \frac{n_1\left(6_1^2 + d_1^2\right) + n_2\left(6_1^2 + d_2^2\right)}{n_1 + n_2}$$

$$= \frac{200(9_1 + 8_1) + 300(16 + 36)}{500} = 67.2$$

77. (D)

Sol. $(\bar{x}) = 60,$ $(\bar{y}) = 40$

$(\sigma_x^2) = 16,$ $(\sigma_y^2) = 36$

$\sigma_x^2 = \frac{\Sigma x_1^2}{10} - (\bar{x})^2,$ $\sigma_y^2 = \frac{\Sigma y^2}{10} - (\bar{y})^2$

$\Sigma x_1^2 = 160 + (60)^2 - 10$ $\Sigma y_1^2 = 360 + (40)^2.10$

$$\sigma^2(\text{overall}) = \frac{\Sigma x_1^2 + \Sigma y_1^2}{20} - \left(\frac{10\bar{x} + 10\bar{y}}{20}\right)^2 = \frac{520 + 52000}{20} - (50)^2$$

$\sigma^2 = 2626 - 2500 = 126$

S.D. $= +\sqrt{\sigma^2} = 11.2$

78. (A)

Sol. Mean $(\bar{x}) = 4$, variance $= 5.2$

$a_1, a_2, a_3 = 1, 2, 3.$

Let x_1, x_2 are remaining values

Mean $\bar{x} = \frac{a_1 + a_2 + a_3 + x_1 + x_2}{5} \Rightarrow x_1 + x_2 = 11$ ....(1)

variance $\sigma^2 = 5.2 = \frac{a_1^2 + a_2^2 + a_3^2 + x_1^2 + x_2^2}{5} - (\bar{x})^2 \Rightarrow x_1^2 + x_2^2 = 65$ ....(2)

$\Rightarrow |x_1 - x_2| = 3$

$\Rightarrow$ So $\lambda = 11 \Rightarrow 10 - x^2 - 2x = \lambda \Rightarrow (x+1)^2 = 0$ one solution

79. (A)

Sol. Let x_n misread value $(x_n) = 10$ $(x_n)_{actual} = 12$

$\sigma^2 = 3.3$ $\bar{x} = 11.3 \Rightarrow \sum_{i=1}^{n-1} x_i = 113 - 10 = 103 = 10.(\bar{x}) - 10$

$$\sigma^2 = \frac{\sum_{i=1}^{n-1} x_i^2 + x_n^2}{10} - (\bar{x})^2$$

$$\sum_{i=1}^{n-1} x_i^2 = -67 + 10(\bar{x})^2 \quad ...(1)$$

$$\Rightarrow (\sigma^2)_{actual} = \frac{\sum_{i=1}^{n} x_1^2 + (x_n)^2_{actual}}{10} - (\bar{x})_{actual}$$

$$= \frac{-67 + 10(\bar{x})^2 + 144}{10} - \left(\frac{10(\bar{x}) - 10 + 12}{10}\right)$$

$= (\sigma^2_{actual}) = 3.14$

80. (C)

Sol. ${}^nC_0 + {}^nC_1(ax) + {}^nC_2(ax)^2 + {}^nC_3(ax)^3 + ...$

$= 1 + 8x + 24x^2 + ...$

$\Rightarrow an = 8 \ \& \frac{n(n-1)}{2} a^2 = 24$

$\frac{(n-1)}{2n} = \frac{24}{8(8)} \Rightarrow 4n - 4 = 3n$

$\Rightarrow n = 4 \Rightarrow a = 2$

$\frac{a-n}{a+n} = -\frac{1}{3}$

81. 200

Sol. $1+{}^{100}C_1\left(x^3+\frac{1}{x^3}\right)$

$+{}^{100}C_2\left(x^3+\frac{1}{x^3}\right)^2+\ldots\ldots.+{}^{100}C_{100}\left(x^3+\frac{1}{x^3}\right)^{100}$

$=(1+r)+\alpha_1x^3+\alpha_2x^6+\ldots\ldots+\alpha_{100}(x^3)^{100}+\beta_1\frac{1}{x^3}+\ldots\ldots.+\beta_{100}\left(\frac{1}{x^3}\right)^{100}$

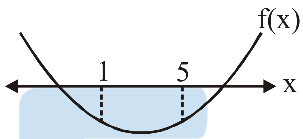
all other terms obtained by combination of x^3 and $\frac{1}{x^3}$ well get converted into a term involving x^3 or $\frac{1}{x^3}$ and hence it will be present among above terms

So number of terms = 1 + 100 + 100 = 201

82. 5

Sol. We have $1+\sum_{r=1}^{10}\left(3^r\cdot{}^{10}C_r+r\cdot{}^{10}C_r\right)$

$=1+\sum_{r=1}^{10}3^r\cdot{}^{10}C_r+10\sum_{r=1}^{10}{}^{9}C_{r-1}$



$=1+4^{10}-1+10\cdot2^9$

$=4^{10}+5.2^{10}=2^{10}(4^5+5)$

$=2^{10}(\alpha\cdot4^5+\beta)$,

so $\alpha=1$ and $\beta=5$

Now $f(1)<0$ and $f(5)<0$

So $f(1)<0$

$\Rightarrow$ $-k^2<0$ $\Rightarrow$ $k\neq0$

and $f(5)<0$

$\Rightarrow$ $16-k^2<0$

$\Rightarrow$ $k^2-16>0$

$\Rightarrow$ $k\in(-\infty,4)\cup(4,\infty)$

Hence smallest positive integral value of $k=5$ **Ans.**]

83. 12632

Sol. General term $=\frac{10!}{\alpha!\,\beta!\,\gamma!}\,2^{\alpha/2}\,3^{\beta/3}\,5^{\gamma/6}$

$\alpha=0,2,4,6,8,10$

$\beta=0,3,6$ $\quad\gamma=0,6$

Hence possible sets = (4, 6, 0), (4, 0, 6), (10, 0, 0)

Hence there are 3 rational terms

$\text{Sum}=\frac{10!}{4!\,6!}\,2^2\,3^2+\frac{10!}{4!\,6!}\,2^2\,5+\frac{10!}{10!}\,2^5=12632$

84. 7

Sol. $(a+b)^5+(a-b)^5=2(a^5+{}^5C_2\,a^3b^2+{}^5C_4\,ab^4)$

Hence $\left(x+\sqrt{x^3-1}\right)^5+\left(x-\sqrt{x^3-1}\right)^5$

$2\{x^5+{}^5C_2\,x^3(x^3-1)+{}^5C_4x(x^3-1)^2\}$

$\therefore$ the given expression is a polynomial of degree 7.

85. 210

Sol. $\dfrac{x+1}{x^{2/3}-x^{1/3}+1}-\dfrac{x-1}{x-x^{1/2}}$

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

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

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

$$\therefore\left(\frac{x+1}{x^{2/3}-x^{1/3}+1}-\frac{x-1}{x-x^{1/2}}\right)^{10}=\left(x^{1/3}-x^{1/2}\right)^{10}$$

Let T_{r+1} be the genaral term in $\left(x^{1/3}-x^{1/2}\right)^{10}$

$$T_{r+1}={}^{10}C_r\left(x^{1/3}\right)^{10-r}(-1)^r\left(x^{1/2}\right)^r=(-1)^r\ {}^{10}C_r x^{\frac{10-r}{3}-\frac{r}{2}}$$

for the term to be independent of x

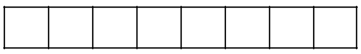
$\dfrac{10-r}{3}-\dfrac{r}{2}=0$

$20-2r-3r=0$

$r=4$

$\therefore$ Req. coefficient $={}^{10}C_4(-1)^4$

86. 10

Sol. $\left.\begin{array}{l}A's=4\\N=1\\B=1\\L=1\\V=1\end{array}\right\}$ 

required number $=\dfrac{8!}{4!}$ – number of ways when ends in A

$$=\frac{8!}{4!}-\frac{7!}{3!}=2\cdot\frac{7!}{3!}-\frac{7!}{3!}=\frac{7!}{3!}\Rightarrow m+n=10.$$ **Ans.**]

87. 1275

Sol. Let he gives x, y and z shares to his sons.

now, $x+y+z=101$ ....(1)

number of non negative integral solution of the equation (1) = ${}^{103}C_2$ (Total ways)

When x assumes the value 51 or more than such cases are to be rejected.

now, $x+y+z=50$ ....(2) (where x = 51 or more)

number of solution of (2) = ${}^{52}C_2$

Total number of such cases $3\,.\,{}^{52}C_2$ (when y takes 51 when z takes 51 values.)

$\therefore$ required number of ways $={}^{103}C_2-3\,.\,{}^{52}C_2=1275$ **Ans.**]

88. 1224

Sol. Excluding the digit '0', two digits out of the remaining 9 can be selected in ${}^{9}C_2$ ways.
e.g. 12, 23, 34 etc.

Now all the 5 digit numbers which can be made which do not contain all digits identical $= {}^{9}C_2\,(2^5 - 2)$

2 has been deducted from 2^5 to exclude numbers formed by all five alike digits otherwise their will be repeatition when we take 1 and 2 then 11111 will appear & when we select 1 and 3 then again 11111 will appear.

(like 1 1 1 1 1)

But we have 9 such numbers containing all alike digits. Hence total 5 digit numbers none of them containing the digit '0' having not more than two alike digits ,

$$= {}^{9}C_2\,(2^5 - 2) + 9 = 1080 + 9 = 1089$$

Now with '0' always included , we have select the remaining 1 digit in ${}^{9}C_1$ ways e.g. 01, 02 etc.

${}^{9}C_1\,(1 \times 2^4) - 9$ — (2) [1 | | | |] [Note that 1st place can be filled only in one way and the remaining digits in two ways]

(1) + (2) $1080 + 144 =$ **1224 (Ans.)**]

(Note that 9 has been subtracted as all five digits identical has again been counted)

89. 4

Sol. Median = 25.5 a

Mean deviation about median = 50

$$\Rightarrow \frac{\sum |x_i - 25.5a|}{50} = 50$$

$$\Rightarrow 24.5\,a + 23.5a + ... + 0.5a + 0.5a + ... + 24.5a = 2500$$

$$\Rightarrow a + 3a + 5a + ... + 49a = 2500$$

$$\Rightarrow \frac{25}{2}(50a) = 2500 \Rightarrow a = 4$$

90. 833

Sol. First 50 even natural numbers

$$\text{Mean} = \frac{\sum_{i=1}^{50} 2n}{50} + = \frac{2 + 4 + 6 + ... + 100}{50} = 2\left(\frac{50 \times 51}{2 \times 50}\right) = 51$$

$$\text{variance} = \frac{\sum_{i=1}^{50} (2n)^2}{50} - (\bar{x})^2 = 42 \quad = 4\,\frac{2^2 + 4^2 + ... + 100^2}{50} - 2601 = 833$$