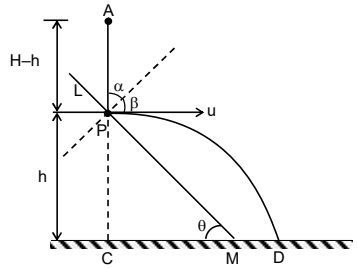
HINTS & SOLUTIONS

PART-A : PHYSICS

1. A body.....

Sol.



LM is inclined plane, for elastic collision $\alpha = \beta$

$\therefore \alpha = \beta = 45°$

Also $u\sqrt{2g(AP)} = \sqrt{2g(H-h)}$

let $t_{AP} = t_1$

$AP = 0 + \frac{1}{2}gt_1^2 \qquad \therefore \sqrt{\frac{2(H-h)}{g}} = t_1$.....(1)

let $t_{BD} = t_2$, $\quad t_2 = \sqrt{\frac{2h}{g}}$ .....(2)

$t = t_1 + t_2 = \sqrt{\frac{2(H-h)}{g}} + \sqrt{\frac{2h}{g}}$

$t = \sqrt{\frac{2}{g}}\left[\sqrt{H-h} + \sqrt{h}\right]$

$\frac{dt}{dh} = \sqrt{\frac{2}{g}}\left[\frac{1}{2}\frac{(-1)}{\sqrt{H-h}} + \frac{1}{2\sqrt{h}}\right]$

$\frac{dt}{dh} = 0$

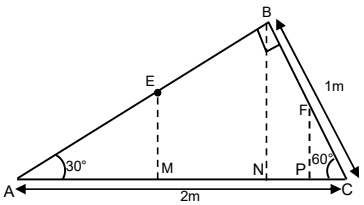
$\Rightarrow \frac{1}{2\sqrt{H-h}} = \frac{1}{2\sqrt{h}}$

$\Rightarrow H-h = h$

$\Rightarrow 2h = H \qquad \therefore h = \frac{H}{2}$

2. A uniform.....

Sol.



$AB = 2\cos30° = 2\frac{\sqrt{3}}{2} = \sqrt{3}$

$AE = \frac{AB}{2} = \frac{\sqrt{3}}{2}$

$BC = 1, CF = \frac{1}{2}$

$EM = AE \sin30° = \frac{\sqrt{3}}{4}$

$FP = CF \sin60° = \frac{1}{2}\frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{4}$

$AM = AE\cos30° = \frac{\sqrt{3}}{2}\frac{\sqrt{3}}{2} = \frac{3}{4}$

$CP = CF\cos60° = \frac{1}{2}.\frac{1}{2} = \frac{1}{4}$

$\therefore AP = AC - CP = 2 - \frac{1}{4} = \frac{7}{4}$

let λ = mass of unit length

mass of AB = $\lambda\sqrt{3}$, mass of BC = $\lambda \times 1$

$\bar{x}$ = distance of COM from A

$$= \frac{2\left(\lambda\sqrt{3}\right)(AM) + 2(\lambda)(AP) + (\lambda 2)\left(\frac{AC}{2}\right)}{2\left(\lambda\sqrt{3}\right) + 2\lambda + 2\lambda}$$

$$= \frac{2\lambda\left(\sqrt{3}AM + AP + \frac{AC}{2}\right)}{2\lambda\left(\sqrt{3}+1+1\right)}$$

$$= \frac{\sqrt{3}\frac{3}{4} + \frac{7}{4} + \frac{2}{2}}{\sqrt{3}+2}$$

$$= \frac{3\sqrt{3}+7+4}{4\left(\sqrt{3}+2\right)} = 1.085$$

3. A jet of.....

Sol. Suppose water sticks to plate after collision, velocity of water w.r.t plate = v – V

mass of water hitting plate per sec. = A (v – V)ρ

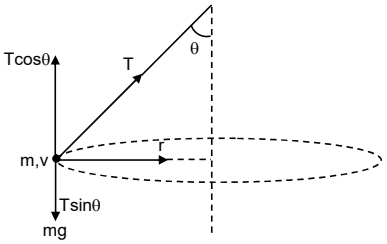
momentum imparted to plate

Per sec. = [A(v – V)ρ] (v – V)

Force exerted on plate = $A\rho(v-V)^2$

4. A mass.....

Sol.



$T\cos\theta = mg$.....(1)

$T\sin\theta = \dfrac{mv^2}{r}$ .....(2)

$T^2(\cos^2\theta + \sin^2\theta) = (mg)^2 + \left(\dfrac{mv^2}{r}\right)^2$

$T^2 = (0.2 \times 10)^2 + \left(\dfrac{0.2\times 15}{2}\right)^2$

$T^2 = 4 + \dfrac{9}{4} = \dfrac{25}{4}$

$T = \dfrac{5}{2} = 2.5N$

7. Two identical.....

Sol. $\because$ V = terminal velocity $\propto$ (radius)^2

$\therefore \dfrac{V_1}{V_2} = \left(\dfrac{r_1}{r_2}\right)^2$

$\therefore\ V_2 = V_1\left(\dfrac{r_2}{r_1}\right)^2$ .....(1)

Volume conservation

$\dfrac{4}{3}\pi r_1^3 + \dfrac{4}{3}\pi r_1^3 = \dfrac{4}{3}\pi r_2^3$

$\Rightarrow 2r_1^2 = r_2^3$

$\therefore \left(\dfrac{r_2}{r_1}\right)^3 = 2$ .....(2)

from (1) and (2)

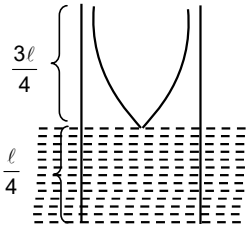
$\Rightarrow V_2^3 = V_1^3\left[\left(\dfrac{r_2}{r_1}\right)^3\right]^2 = 8(2)^2$

$\therefore\ V_2^3 = 32$ ($\because$ 3.17 × 3.17 × 3.17 $\simeq$ 31.8)

$\therefore\ V_2 \simeq 3.17$ m/s

8. A cylindrical.....

Sol.



$n = \dfrac{v}{2\ell}$

$390 = \dfrac{v}{2\ell}$ .....(1)

Fundamental frequency $= \dfrac{v}{4\left(\dfrac{3\ell}{4}\right)}$

$= \dfrac{v}{3\ell}$

$= \left(\dfrac{v}{2\ell}\right)\times\left(\dfrac{2}{3}\right)$

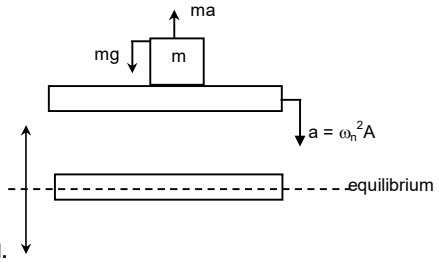
$= (390)\times\left(\dfrac{2}{3}\right)$

= (130) (2)

= 260 Hz

9. A block of.....

Sol.



To prevent losing contact.

mg > ma $\Rightarrow$ mg > $m(\omega_n^2 A)$

$\Rightarrow g > \dfrac{4\pi^2}{T^2}A$

$A < \dfrac{gT^2}{4\pi^2}$

11. Two stones.....

Sol. The second ball will strike the ground at t = $\dfrac{24}{g}$ = 4 sec.

Till 4 sec., $a_{rel} = 0$ so V_{vel} = constant = $10\,\dfrac{m}{sec}$

so $S_{rel} = V_{rel}\, t = 10\, t$

just after striking the ground $V_1 = 30 - g(4) = -10$

and $V_2 = 0$ so $V_{rel} = -10\,\frac{m}{sec}$, and then V_{rel} will become more negative

12. A uniform .....

Sol. If the surface is smooth

$a = g\sin\theta,\ t_1 = \sqrt{\frac{2\lambda}{g\sin\theta}}$

If surface is rough so that the sphere rolls without slidding

$$a = \frac{g\sin\theta}{1+\frac{I_{cm}}{MR^2}} = \frac{g\sin\theta}{1+\frac{2}{5}} = \frac{5}{7}g\sin\theta$$

$$t_2 = \sqrt{\frac{2\ell}{\frac{5}{7}g\sin\alpha}}$$

$$\frac{t_1}{t_2} = \sqrt{\frac{5}{7}}$$

13. A certain .....

Sol. $dU = \frac{dW}{2}$

By 1^{st} law $\rightarrow dQ = 3dU = 3nC_vdT$

Molar heat capacity $C = \frac{dQ}{ndT} = 3C_v$

Given $C = \frac{15R}{2}$

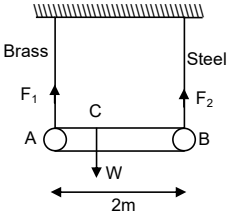
$\therefore\ C_v = \frac{5}{2}R$

$\therefore$ Degree of freedom = 5

So Gas is diatomic.

14. A 2m long.....

Sol.



$F_1 + F_2 = mg$

$$\frac{F_1}{A_B} = \frac{F_2}{A_S} \qquad .....(1)$$

$F_1x = F_2(2-x)$ .....(2)

$$\frac{F_2A_Bx}{A_S} = F_2(2-x)$$

$$x = \frac{2A_s}{A_B + A_S} = 66.6cm$$

17. If the angle.....

Sol. $(\vec{B}\times\vec{A})\cdot(\vec{A}\times\vec{B}) = (AB\cdot\sin\theta)\hat{n}\cdot\hat{n}\ (-AB\sin\theta) = A^2B^2\sin^2\theta = -\frac{A^2B^2}{2}$

20. A particle.....

Sol. Change in momentum = Impulse

$$\Delta\vec{P} = J_x\hat{i} + J_y\hat{j} + J_z\hat{k}$$

$= 30(0.1)\ \hat{i} + (80)(0.1)\ \hat{j} + (-50)\times(0.1)\ \hat{k}$

$= 3\hat{i} + 4\hat{j} - 5\hat{k}$

$$|\Delta\vec{P}| = 5\sqrt{2}\ kg\frac{m}{sec.}$$

22. A uniform .....

Sol. Let the new radius be x.

elongation = $2\pi(x-R)$

$$T = \frac{m\omega^2x}{2\pi}$$

$$k2\pi(x-R) = \frac{m\omega^2x}{2\pi}$$

$(4\pi^2k - m\omega^2)x = 4\pi^2kR$

$$x = \frac{4\pi^2kR}{4\pi^2k - M\omega^2}$$

23. The length.....

Sol. Frequency $\propto \frac{1}{length}$

$L_1 : L_2 : L_3 = 1 : \frac{1}{2} : \frac{1}{3}$

= 6 : 3 : 2

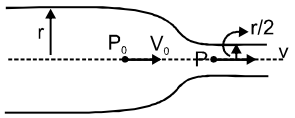
24. A spherical.....

Sol. $w = 2.4\pi r^2.s$

$$P = \frac{dw}{dt} = 16\pi r\,s\alpha$$

25. An incompressible.....

Sol.



$\pi r^2V_0 = \pi\frac{r^2}{4}V$

$V = 4V_0$

$$P_0 + \frac{1}{2}\rho V_0^2 = P + \frac{1}{2}\rho V^2$$

$$P_0 + \frac{1}{2}\rho V_0^2 = P + \frac{1}{2}16\rho V_0^2$$

$$P = P_0 - \frac{15}{2}\rho V_0^2$$

26. Masses m_1 and.....

Sol. $m_1 g - m_2 \sin 30° = (m_1 + m_2)\,\alpha_1$

$$a_1 = \frac{2m_1 g - m_2 g}{2(m_1 + m_2)} \quad .....(1)$$

similarly

$$a_2 = \frac{2m_2 g - m_1 g}{2(m_1 + m_2)} .....(2)$$

$$d = 0 + \frac{1}{2}\, a_1 t^2 ..... \quad (3)$$

$$d = 0 + \frac{1}{2}\, a_2 (2t)^2 .....(4)$$

(3) and (4) $\Rightarrow a_1 t^2 = 4a_2 t^2$

$\Rightarrow a_1 = 4a_2$ .....(5)

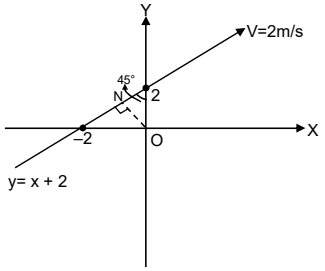
from (1), (2), and (5)

$$\Rightarrow \frac{a_1}{a_2} = 4 = \frac{2m_1 - m_2}{2m_2 - m_1}$$

$$\Rightarrow \frac{m_1}{m_2} = \frac{a}{6} = \frac{3}{2} \quad \text{Ans}$$

27. A particle of.....

Sol.



L = mV (0)

= (1) (2) (2 sin 45°)

$L = 2\sqrt{2}$ kgm^2S^{-1}

28. Two particles.....

Sol. $\vec{u}_1 = 30\hat{i} \qquad \vec{v}_1 = 30\hat{i} - gt\hat{k}$

$\vec{u}_2 = 30\hat{j} \qquad \vec{v}_2 = 30\hat{j} - gt\hat{k}$

$\vec{v}_1 . \vec{v}_2 = v_1 v_2 \cos 60°$

Solving this we get t = 3

29. A boy of.....

Sol. After 2 sec speed of boy will be

$v = 2 \times 2 = 4$ m/s

At this moment centripetal force on boy is

$F_r = \frac{mv^2}{R} = \frac{30 \times 16}{6} = 80$ Nt.

Tangential force on boy is

$F_t = ma = 30 \times 2 = 60$ Nt.

Total friction acting on boy is

$F = \sqrt{F_r^2 + F_t^2} = 100$ Nt

At the time of slipping

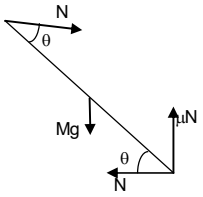
$F = \mu mg$

or $100 = \mu \times 30 \times 10$

$\Rightarrow \mu = \frac{1}{3}$.

30. Two vertical.....

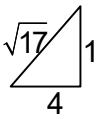
Sol.



$$\tau_{com} = 0$$

$$N.\frac{\ell}{2}\sin\theta.2 = \mu N \frac{\ell}{2}\cos\theta$$

$$\Rightarrow \tan\theta = \frac{1}{4}$$



$$\cos\theta = \frac{2}{\ell} = \frac{4}{\sqrt{17}}$$

$$\ell = \frac{\sqrt{17}}{2}$$

PART-B : CHEMISTRY

33. In a thermodynamics .....

Sol. For adiabatic reversible process $T^{\gamma} P^{1-\gamma} = K$, for He $\gamma = \frac{5}{3}$

$$T^{\frac{5}{3}} P^{1-\frac{5}{2}} = K \text{ or } \frac{T}{P^{2/5}} = \text{constant}$$

34. The percentage of pyridine .....

Sol. $C_5H_5N + H_2O \rightleftharpoons C_5H_5N^+H + OH^-$

0.1 M

$$\alpha = \sqrt{\frac{K_b}{c}} = \sqrt{\frac{1.7\times10^{-9}}{0.1}} = \sqrt{1.7\times10^{-8}} = 1.3\times10^{-4}$$

$\% \alpha = 1.3 \times 10^{-4} \times 100$

$= 1.3 \times 10^{-2} = 0.013.$

36. Titanium metal is extensively .....

Sol. ΔH_r° = 140.5 kJ

ΔS_r° = – 0.058 kJ

$\Delta G_r^\circ > 0$

37. Critical temperature .....

Sol. Higher the intermolecular attractive force higher will be T_C

38. An acidic buffer solution .....

Sol. For given buffer solution $pH_1 = pKa$

Now 9 mL of 1 M HCl is added to (10 + x) mL of this solution

NaA	+	HCl	⟶	HA	+	NaCl
$1\times(10+x)$		(1×9)		$1(10+x)$		0
$(10+x)-9$		0		$(10+x)+9$		

$pH_1 - pH_2 = 1$

$$\log \frac{(10+x)-9}{(10+x)+9} = -1$$

$$\frac{10+x-9}{10+x+9} = \frac{1}{10}$$

x = 1 mL.

39. The concentration of a .....

Sol. % w/w × $d_{solution}$ = % w/v

$$d_{solution} = \frac{16}{8} = 2 \text{ g/mL}$$

40. Electron in He^+ is in a state.....

Sol. Electron jumps from 2s to 3d state.

Total number of radial nodes in 3d = $(n - \ell - 1) = 3 - 2 - 1 = 0$.

41. For a van der Waal's .....

Sol. Refer theory

42. The enthalpy of combustion .....

Sol. $C_6H_8 + 2H_2 \longrightarrow C_6H_{12}$, ΔH_r = ?

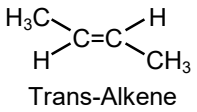
$$\Delta H_r = \sum \nu \Delta H_C(R) - \sum \nu \Delta H_C(P)$$

ν = stoichiometric coefficient (रससमीकरणमिति गुणांक)

$= -3680 + 2\times(-241) - (-3920)$

$= -242$ KJ/mol

43. Which of the following catalyst .....

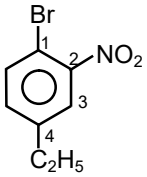
Sol. $CH_3–C\equiv C–CH_3 \longrightarrow$ 

Alkyne

Trans-Alkene

Birch reduction.

44. The IUPAC name for.....

Sol. 

45. Which is the suitable .....

Sol. In Iodoform reaction acid obtained having 1 carbon less.

46. How many total structure .....

Sol. 3º alcohols give immediate turbidity with Lucas reagent.

47. Which of the following .....

Sol. (1) gives only one monochloro product.

48. Which of the following .....

Sol. Statement (1), (2), (3) are correct.

Statement (4) is incorrect.

correct order of energies of molecular orbitals of O_2 is

$E(\sigma1s) < E(\sigma^*1s)\ \ E(\sigma2s) < E(\sigma^*2s) < E(\sigma2p_z) < E(\pi2p_x) = E(\pi2p_y) < E(\pi^*2p_x) = E(\pi^*2p_y) < E(\sigma^*2p_z)$

49. Which of the following .....

Sol. (1) Hypophosphorous acid (H_3PO_2) basicity = 1

(2) Orthophosphoric acid (H_3PO_4) basicity = 3

(3) Pyrophosphoric acid ($H_4P_2O_7$) basicity = 4

(4) Hypophosphoric acid ($H_4P_2O_6$) basicity = 4

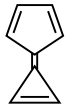
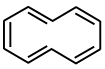
50. KO_2 is used in oxygen cylinder .....

Sol. KO_2 is used as an oxidizing agent and air purifier in space capsules, submarine and breathing mask as it produces O_2 and removes CO_2.

$2KO_2 + CO \longrightarrow K_2CO_3 + O_2$

$2KO_2 + CO_2 \longrightarrow K_2CO_3 + O_2$

51. Which of the following .....

Sol.  has aromatic character.  and  are nonaromatic.

52. The product formed by .....

Sol. Since the compound on oxidative ozonolysis gives 1 mol of CO_2 and butanoic acid, it must be terminal alkyne

$$CH_3–CH_2–CH_2–C\equiv CH \xrightarrow[(2)H_2O]{(1)O_3} CH_3–CH_2–CH_2–COOH + CO_2$$

53. In the reaction.....

Sol. Small amines, such as NH_3, CH_3NH_2 and $(CH_3)_2NH$, give unsymmetrical cleavage of diborane according to following reaction :

$$B_2H_6 + 2\,NH_3 \longrightarrow [H_2B(NH_3)_2]^+\,[BH_4]^-$$

Large amines, such as $(CH_3)_3$ N, give symmetrical cleavage of diborane according to following reaction :

$$B_2H_6 + 2N\,(CH_3)_3 \longrightarrow 2H_3B \leftarrow N(CH_3)_3$$

54. In which of the following .....

Sol. Correct order of EN is N = Cl < O < F

55. Sodium carbonate is .....

Sol. The chemical reactions which takes place in Solvay process are as follows -

(i) $NH_3 + CO_2 + H_2O \longrightarrow NH_4HCO_3$

(ii) $NH_4HCO_3 + NaCl \longrightarrow NaHCO_3 + NH_4Cl$

sodium bicarbonate

(iii) $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$

sodium carbonate

The CO_2 obtained in this step can be recycled. The CO_2 required in reaction is prepared by heating $CaCO_3$.

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$$

$$CaO + H_2O \longrightarrow Ca(OH)_2$$

$Ca(OH)_2$ is used to decompose NH_4Cl

$$Ca(OH)_2 + NH_4Cl \longrightarrow 2NH_3 + 2H_2O + CaCl_2$$

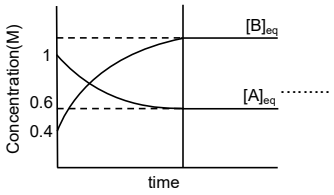
The NH_3 thus obtained can be recycled.

$\therefore$ CO_2 and NH_3 are the products which can be recycled in Solvay process.

56. The degencracy of 1st .....

Sol. For H, n = 2 is first excited state. we have 2s, $2p_x$, $2p_y$ and $2p_z$.

58.



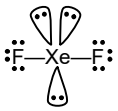
.....

Sol. $A(g) \rightleftharpoons 2\,B(g)$

t=	0	1 0.4
t_{eq}	1–x	2x + 0.4
	x = 0.4	= 1.2

$$K_C = \frac{(1.2)^2}{0.6} = 2.4$$

59. How many lone pair .....

Sol. 

60. Find the number of species .....

Sol. Only b, c, e, f, i are example of π-conjugated system.

PART-C : MATHEMATICS

61. Let $\sum_{r=1}^{\infty} \frac{1}{(2r-1)^2}$ .....

Sol. Let $S = \sum_{r=1}^{\infty} \frac{1}{r^2} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + ...$

$$= \left(\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ...\right) + \frac{1}{2^2}\left(\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + ...\right)$$

$$S = \frac{\pi^2}{8} + \frac{1}{4}(S) \Rightarrow \frac{3S}{4} = \frac{\pi^2}{8} \Rightarrow S = \frac{\pi^2}{6}$$

62. The number of.....

Sol. $\because$ $1 + \text{cosec}^2x - 2(\sin x + \cos x \cot x) + \tan^2 2x = 0$

$\Rightarrow 1 + \text{cosec}^2x - 2\text{cosec}x + \tan^2 2x = 0$

$\Rightarrow (1 - \text{cosec}\,x)^2 + \tan^2 2x = 0$

$\Rightarrow x = \frac{\pi}{2}$ is the only solution

63. Number of ways by.....

Sol. $= 4! \times ({}^5C_3 - 5) \times 3!$

$= 24 \times 5 \times 6 = 24 \times 30 = 720$

64. It the circle $x^2 + y^2$ +.....

Sol. common chord of these two circles will pass through the centre of the circle $x^2 + y^2 - 2x + 8y - d = 0$

$\because$ equation common chord is

$6x + 14y + c + d = 0$

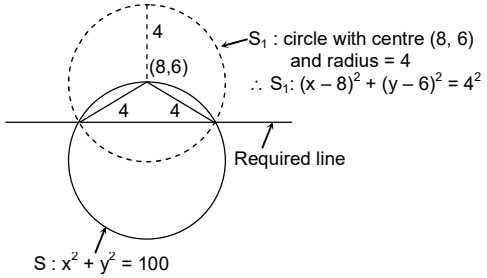
$\therefore$ it passes through (1, – 4)

$\therefore$ $6 - 56 + c + d = 0 \Rightarrow c + d = 50$

$\therefore$ $\frac{c+d}{2} \geq \sqrt{cd} \Rightarrow cd \leq 625$

65. Equation of the.....

Sol.



$\therefore$ required line $S_1 - S = 0$

$(x-8)^2 + (y-6)^2 - 4^2 - (x^2 + y^2 - 100) = 0$

$4x + 3y - 46 = 0$

66. If $|\tan\theta - 1| +$ .....

Sol. $\because |\tan\theta - 1| + |\sqrt{3} + \tan\theta| = 1 + \sqrt{3}$

$\Rightarrow (\tan\theta - 1)(\sqrt{3} + \tan\theta) \le 0$

$-\sqrt{3} \le \tan\theta \le 1$

$-\frac{\pi}{3} \le \theta \le \frac{\pi}{4} \Rightarrow \theta \in [n\pi - \frac{\pi}{3}, n\pi + \frac{\pi}{4}]$

$\therefore \theta \in \left[0, \frac{\pi}{4}\right] \cup \left[\frac{2\pi}{3}, \frac{5\pi}{4}\right] \cup \left[\frac{5\pi}{3}, 2\pi\right]$

$\therefore$ x = 0, x = 3 and x = 6 are three integers satisfying given equation

67. If the value of .....

Sol. $\because \frac{2\sin10^\circ\sin50^\circ\sin70^\circ}{\tan5^\circ\tan55^\circ\tan65^\circ} = \frac{2\left(\frac{1}{4}\sin30^\circ\right)}{\tan15^\circ}$

$= \frac{1}{4(2-\sqrt{3})} = \frac{\sqrt{3}+2}{4} = \frac{4+2\sqrt{3}}{8}$

$= \left(\frac{\sqrt{3}+1}{2\sqrt{2}}\right)^2 = \cos^2 15^\circ \Rightarrow \theta = \frac{\pi}{12}$

68. If $(1 + x + x^2 + x^3)^5$ .....

Sol. a_{10} = coeff. of x^{10} is $(1 + x)^5(1 + x^2)^5$

$= {}^5C_4 \times {}^5C_3 + {}^5C_2 \times {}^5C_4 + {}^5C_0 \times {}^5C_5$

$= 5 \times 10 + 10 \times 5 + 1 \times 1$

$= 50 + 50 + 1 = 101$

69. If the equations.....

Sol. $\because \frac{a}{2} = \frac{2b}{3} = \frac{3c}{7} = k$(let)

$\therefore a = 2k, b = \frac{3k}{2}, c = \frac{7k}{3}$

for a, b, c to be natural number, least value of k = 6

$\therefore (a + b + c)_{min} = 12 + 9 + 14 = 35$

70. If $P = \log_5(\log_5 3)$ .....

Sol. $5^{-p} = 5^{-\log_5(\log_3 5)} = \log_3 5$

$\therefore 3^{c+5^{-p}} = 3^c \cdot 3^{5^{-p}} = 3^c \cdot 3^{\log_3 5} = 405$

$3^c = 81 \Rightarrow c = 3$

71. The median of.....

Sol. $\because$ median is middle most observations

$\therefore$ will remain unaffected

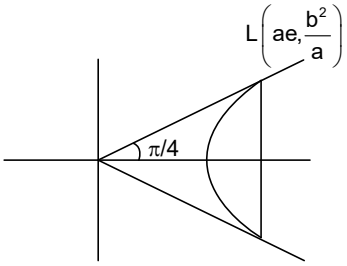
72. The angle between.....

Sol. Q(–1, 11) lies on director circle

$\therefore$ angle between tangents = $\frac{\pi}{2}$

73. If the latus rectum.....

Sol.



$\because m_{OL} = 1$

$\Rightarrow \frac{b^2/a}{ae} = 1$

$\Rightarrow ae = \frac{b^2}{a} \Rightarrow e = \frac{b^2}{a^2}$

$\because e^2 = 1 + \frac{b^2}{a^2}$

$\Rightarrow e^2 - e - 1 = 0$

$\therefore e = \frac{1 \pm \sqrt{5}}{2}$

$\Rightarrow e = \frac{\sqrt{5}+1}{2}$

74. If p, q, r statements.....

Sol. Obvious

75. If the equation of.....

Sol. $\because$ directrix is $x + \frac{a}{4} = 0 \Rightarrow \frac{a}{4} = 4$

$\Rightarrow a = 16$

$\therefore$ focus is $\left(\frac{16}{4},0\right) \equiv (4, 0)$

$\therefore$ $2x - y - \lambda = 0$ will passes through (4, 0)

$\therefore$ $8 - 0 - \lambda = 0 \Rightarrow \lambda = 8$

$\therefore$ $a + \lambda = 24$

76. If $y = 2x + 3$ is.....

Sol. $\because$ $x^2 - (2x + 3)^2 - c = 0$

$-3x^2 - 12x - 9 - c = 0$

$3x^2 + 12x + 9 + c = 0$

$\Delta = 0 \Rightarrow c = 3$

77. If the expression.....

Sol. $abc + 2fgh - af^2 - bg^2 - ch^2 = 0$

$\Rightarrow m = \pm 7$

78. If $\frac{\alpha-1}{\alpha}, \frac{\beta-1}{\beta}$ .....

Sol. $\frac{\alpha-1}{\alpha} + \frac{\beta-1}{\beta} = 2p \Rightarrow \frac{1}{\alpha} + \frac{1}{\beta} = 2 - 2p$

and $\left(\frac{\alpha-1}{\alpha}\right)\left(\frac{\beta-1}{\beta}\right) = -1$

$\Rightarrow 1 - \frac{1}{\alpha} - \frac{1}{\beta} + \frac{1}{\alpha\beta} = -1$

$1 - (2 - 2p) + \frac{1}{\alpha\beta} = -1$

$\Rightarrow \frac{1}{\alpha\beta} = -2p$

$= \frac{1}{\alpha^2} + \frac{1}{\beta^2} = \left(\frac{1}{\alpha}+\frac{1}{\beta}\right)^2 - \frac{2}{\alpha\beta}$

$= 4(1 - p)^2 + 4p = 4(p^2 - p + 1)$

$\therefore \left(\frac{1}{\alpha^2}+\frac{1}{\beta^2}\right)_{min.} = 3$

79. If the point (1, 1) .....

Sol. $\because \ell^2 + \ell m + 1 > 0 \ \forall \ \ell \in R$

$\Rightarrow D < 0$

$\Rightarrow m^2 - 4 < 0 \Rightarrow m \in (-2, 2)$

$\therefore m \neq -2$

80. If all the words.....

Sol. C, E, O, R, T, V

C - - - - - - - - - - - -= 5! × 5

V C - - - - - - - - - - = 4!

V E C O- - - - - - - - = 2!

V E C R - - - - - - = 2!

V E C T O R - - - = 1

$\therefore$ rank is = 629

81. If the tangents.....

Sol. $\because$ (h, 3 – h) is a point on $x + y - 3 = 0$

$\therefore$ equation of chord of contact is T = 0

$x(h) + y(3 - h) - 9 = 0$

$(3y - 9) + h(x - y) = 0$ ..... (i)

$\because$ equation (1) is in the form of $L_1 + \lambda L_2 = 0$

$\therefore$ fixed point is point of intersection of $L_1 : 3y - 9 = 0$ and $L_2 : x - y = 0$ that is (3, 3)

82. The equation of.....

Sol. $\because$ Slope of line joining (2, 4) and (4, 7) is = $\frac{3}{2}$

$\therefore$ slope of required line = $-\frac{2}{3}$

$\because \left.\begin{matrix} 2x + 3y - 1 = 0 \\ 3x + 2y + 1 = 0 \end{matrix}\right\} \Rightarrow x = -1; y = 1$

$\therefore$ Required line is $y - 1 = -\frac{2}{3}(x + 1)$

$3y - 3 = -2x - 2 \Rightarrow 2x + 3y - 1 = 0$

83. If the 9^{th} term.....

Sol. $\because T_9 = {}^{12}C_8\left(\frac{1}{x^2}\right)^4\left(\frac{x}{2}\log_2 x\right)^8 = 495$

${}^{12}C_8 \frac{1}{2^8}(\log_2 x)^8 = 495$

$\because {}^{12}C_8 = 495$

$\Rightarrow (\log_2 x)^8 = 2^8$

$\therefore x = 4$ or $x = \frac{1}{4}$

84. A relation on set.....

Sol. Obvious

85. If $y = 2[x] + 3 =$ .....

Sol. $\because$ $2[x] + 3 = 3[x - 2] + 5$

$2[x] + 3 = 3[x] - 6 + 5$

$[x] = 4 \ \therefore \ y = 11$

$\therefore [x + y - 6] = [x + 11 - 6] = [x + 5] = [x] + 5 = 9$

86. In a ΔABC, ...

Sol. $\because$ line segment joining circumcentre and incenter is parallel to BC

$\Rightarrow R \cos A = r \Rightarrow R = 3\sqrt{2}$

$\because r = (s - a)\tan\frac{A}{2} \Rightarrow 3 = (s - 2R\sin A)\tan\frac{A}{2}$

$\Rightarrow 3 = (s - 2 \times 3\sqrt{2}\ \frac{1}{\sqrt{2}})\tan 22\frac{1}{2}^\circ$

$s - 6 = \frac{3}{\sqrt{2}-1} \Rightarrow s = 6 + 3(\sqrt{2} + 1) = 9 + 3\sqrt{2}$

$\because \Delta = rs = 3(9 + 3\sqrt{2})$

$= 9(3 + \sqrt{2})$

87. In triangle ABC.....

Sol. $\because$ In a triangle ABC, $\Sigma(b + c)\cos A = a + b + c = 2s$

and $4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{c}{2}$ = sinA + sinB + sinC =

$\frac{a+b+c}{2R} = \frac{2s}{2R}$

$\therefore \frac{\Sigma(b+c)\cos A}{4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}} = \frac{2s}{\frac{2s}{2R}} = 2R$

$\therefore 2R = 8 \Rightarrow R = 4$

88. In an arithmetic.....

Sol. $\because S_{10} = \frac{10}{2}[2a + 9d] = 0 \Rightarrow 2a + 9d = 0$ ..... (i)

$\because S_{20} - S_{10} = -200$

$\Rightarrow \frac{20}{2}[2a + 19d] - 0 = -200$

$2a + 19d = -20$

..... (2)

from (1) and (2), we get $d = -2$; $a = 9$

89. If $\alpha, \beta, \gamma, \delta$ are.....

Sol. $\because \alpha + \beta + \gamma + \delta = 20$ ..... (i)

$\alpha\beta\gamma + \alpha\beta\delta + \alpha\gamma\delta + \beta\gamma\delta = 100$ ..... (ii)

$\alpha\beta\gamma\delta = \lambda$ ..... (iii)

Let $\alpha\delta = \beta\gamma = t$

$\therefore \lambda = t^2 = 25$

$\therefore \sqrt{\lambda - 9} = \sqrt{25 - 9} = 4$

90. Let $S = \sum_{n=1001}^{2006}\left(2\sin^2\frac{n\pi}{2} + 1\right)$.....

Sol. $\because S = \sum_{n=1001}^{2006}(1 - \cos(n\pi) + 1) = \sum_{n=1001}^{2006}(2 - \cos(n\pi))$

$= 2(1006) - \sum_{n=1001}^{2006}(\cos(n\pi)) = 2012 - 0 = 2012$

$\therefore$ sum of digits in S = 2 + 0 + 1 + 2 = 5

MAJOR TEST (MT)

(JEE MAIN PATTERN)

TARGET : JEE (MAIN+ADVANCED) 2019

Resonance®
Educating for better tomorrow

DATE : 17-02-2018

COURSE : VIPUL (01JB, 07JB)
AADHAAR (01EB), ABHINAV (01EA)

ANSWER KEY

CODE-0

PHYSICS

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

CHEMISTRY

31.	(1)	**32.**	(3)	**33.**	(4)	**34.**	(3)	**35.**	(1)	**36.**	(2)	**37.**	(4)
38.	(4)	**39.**	(4)	**40.**	(1)	**41.**	(2)	**42.**	(2)	**43.**	(3)	**44.**	(2)
45.	(3)	**46.**	(1)	**47.**	(1)	**48.**	(4)	**49.**	(1)	**50.**	(1)	**51.**	(4)
52.	(2)	**53.**	(4)	**54.**	(4)	**55.**	(2)	**56.**	(4)	**57.**	(6)	**58.**	(6)
59.	(9)	**60.**	(5)										

MATHEMATICS

61.	(3)	**62.**	(4)	**63.**	(2)	**64.**	(3)	**65.**	(3)	**66.**	(3)	**67.**	(3)
68.	(3)	**69.**	(4)	**70.**	(4)	**71.**	(4)	**72.**	(4)	**73.**	(3)	**74.**	(2)
75.	(4)	**76.**	(3)	**77.**	(3)	**78.**	(2)	**79.**	(4)	**80.**	(3)	**81.**	(4)
82.	(3)	**83.**	(4)	**84.**	(2)	**85.**	(3)	**86.**	(5)	**87.**	(4)	**88.**	(9)
89.	(4)	**90.**	(5)										