HINTS & SOLUTIONS

PART-A : PHYSICS

1. The following .....

Sol. F = Kx

$$F = \frac{YA}{L} \times \ell$$

$$\ell \propto \frac{L}{A} \propto \frac{L}{D^2}$$

2. The phase .....

Sol. $v_{in} = -\beta \frac{R_L}{R_i} v_o$

5. A metal target .....

Sol. $\frac{hc}{\lambda} = 10keV$

$$\lambda_{min.} = \frac{12400}{10 \times 10^3} = 1.24Å$$

6. A coil of self-inductance .....

Sol. L ↑ z ↑ I ↓ so brightness ↓

7. A carrier of .....

Sol. $\therefore f_{USB} = 1002$ kHz

$\therefore f_{LSB} = 998$ kHz

$\therefore BW = f_{USB} - f_{LSB} = 4$ kHz

8. A piece of iron .....

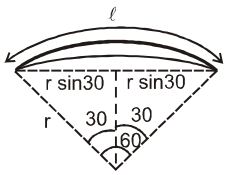
Sol. Wein's displacement law

$$\lambda_{max} \propto \frac{1}{T}$$

9. A bar magnet .....

Sol. $M = m \times \ell$

$M' = m \times r$



$$\ell = \frac{\pi r}{3}$$

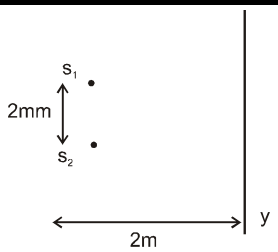
$$So, m' = \frac{3}{\pi} M$$

10. In Young's .....

Sol. $y = \frac{n\lambda D}{d}$

$\therefore$ n1 λ1 = n2 λ2

n1 12000 = n2 10000



ycompon = 6 n1 = 5n2

$$\text{here ycommon} = \frac{5(12000 \times 10^{-10}) \times 2}{2 \times 10^{-3}}$$

= 5 ×12 × 10–4

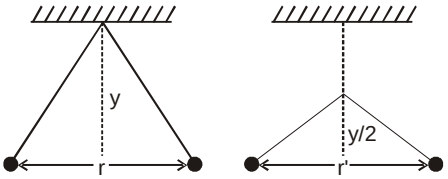
= 60 × 10–4 m

= 6 × 10–3 m

= 6 mm

11. Two pith balls .....

Sol.



$$\tan\theta = \frac{F_e}{mg}$$

$$\frac{r/2}{y} = \frac{kq^2}{\frac{r^2}{mg}}$$

$r^3 \propto y$

$$r'^3 \propto \frac{y}{2}$$

$$\frac{r'}{r} = \frac{1}{2^{1/3}}$$

12. The ratio of .....

Sol. $a_1 = \frac{g \sin\theta}{1 + \frac{I}{MR^2}}$

$$a_1 = \frac{g \sin\theta}{1 + \frac{\frac{2}{5}MR^2}{MR^2}} = \frac{5}{7} g \sin\theta \quad \frac{a_1}{a_2} = \frac{5}{7}$$

13. A monoatomic .....

Sol. Isothermally $PV = P_1 2V$

$$P_1 = \frac{P}{2}$$

Adiabatically

$$\frac{P}{2} (2V)^{\gamma} = P_f (16V)^{\gamma}$$

$$P_f = \frac{P}{2}\left(\frac{1}{2^3}\right)^{\frac{5}{3}}$$

$$P_f = \frac{P}{2}\left(\frac{1}{2^3}\right)^{\frac{5}{3}} = \frac{P}{(2)(2)^5}$$

$$P_f = \frac{p}{64}$$

14. The position .....

Sol. $x = 4\sin(2\pi t),\ y = 4\cos(2\pi t)$

$x^2 + y^2 = 4^2 \Rightarrow R = 4$

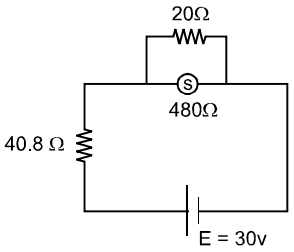
$\Rightarrow$ Circular motion

$V = \omega R = (2\pi)(4) = 8\pi$

So, Ans. is (2)

15. A circuit contains .....

Sol.



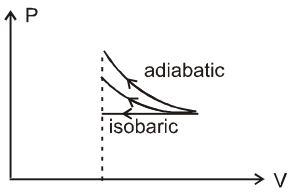
Resistance of ammeter = $\frac{480 \times 20}{480 + 20} = 19.2\,\Omega.$

$i = \frac{30}{40.8 + 19.2} = 0.5\,A$

Ans. is (4)

16. An ideal gas .....

Sol.



Since area under the curve is max for adiabatic process so work done on the gas will be max for adiabatic process.

17. A particle is .....

Sol. $\omega^2 A = \alpha$

$\omega A = \beta$

$\Rightarrow \omega = \frac{\alpha}{\beta}$

$\Rightarrow T = \frac{2\pi}{\omega} = \frac{2\pi\beta}{\alpha}$

18. A parallel .....

Sol. Attraction between the plates

$F = \frac{q^2}{2A\varepsilon_0}$ where $q = CV$ and $C = \frac{\varepsilon_0 A}{d}$

$F = \frac{C^2V^2}{2Cd} = \frac{CV^2}{2d}$

19. A plank with .....

Sol. $\mu_S = \tan 30^\circ = \frac{1}{\sqrt{3}} = 0.57$

$\mu_S = 0.57 \cong 0.6$

$S = ut + \frac{1}{2}at^2$

$4 = \frac{1}{2}a(4)^2 \Rightarrow a = \frac{1}{2} = 0.5$

$a = g\sin\theta - \mu_k(g)\cos\theta \Rightarrow \mu_K = \frac{0.9}{\sqrt{3}} = 0.5$

20. Two stones .....

Sol. $F_C = \frac{mv_1^2}{r} = \frac{2mv_2^2}{(r/2)} = \frac{4mv_2^2}{r}$

so $v_1 = 2v_2$

21. Water rises to .....

Sol. Water will not overflow but will change its radius of curvature.

22. The heart of .....

Sol. power $= \vec{F}.\vec{V} = PAV = \rho ghAV$

$= 13.6 \times 10^3 \times 10 \times 150 \times 10^{-3} \times 0.5 \times 10^{-3}$ / 60 watt

$= \frac{102}{60}$ watt $= 1.70$ watt

23. If dimensions .....

Sol. $V_C = \eta^x \rho^y r^z$

critical velocity is given by $V_C = \frac{R\eta}{2\rho r}$

so, x = 1

y = –1 z = –1

24. A rigid ball of .....

Sol. J = 2mV cos 60 = mV **Ans.**

25. A particle moves .....

Sol. $\vec{S} = \vec{r}_f - \vec{r}_i = \left(4\hat{j} + 3\hat{k}\right) - \left(-2\hat{i} + 5\hat{j}\right)$

$= 2\hat{i} - \hat{j} + 3\hat{k}$

$\vec{F} = 4\hat{i} + 3\hat{j}$

$\omega = \vec{F}.\vec{S} = \left(4\hat{i} + 3\hat{j}\right).\left(2\hat{i} - \hat{j} + 3\hat{k}\right)$

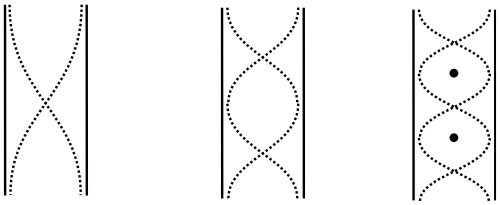
$= 8 - 3 = 5J$ **Ans.**

26. A satellite of mass .....

Sol. $TE = -\frac{GMm}{2(R+h)} = -\frac{GMm}{2(R+h)}\frac{R^2}{R^2} = -\frac{g_0 m R^2}{2(R+h)}$

27. The second .....

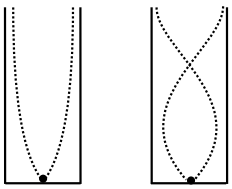
Sol. Fundamental I[st] overtone 2[nd] overtone



$\frac{3\lambda}{2} = \ell_0$

$\lambda = \frac{3\ell_0}{3}$

$f = \frac{3V}{2\ell_0}$



$\frac{3\lambda}{4} = L_c$

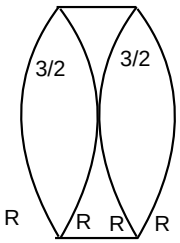
$\lambda = \frac{4L_e}{3}$

$f = \frac{3V}{4L_e} = \frac{3V}{4L} = \frac{3V}{2\ell_0}$

$\ell_0 = 2L$

28. Two identical ……

Ans.



$\frac{1}{f} = \left(\frac{3}{2} - 1\right)\frac{2}{R} = \frac{1}{R}$

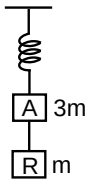
$\frac{1}{f'} = \left(\frac{4}{3} - 1\right)\left\{-\frac{2}{R}\right\} = -\frac{2}{3R}$

So $\frac{1}{f_{eq}} = \frac{1}{f} - \frac{2}{3f} + \frac{1}{f} = \frac{3-2+3}{3f} = \frac{4}{3f}$

$f_{eq} = \frac{3f}{4}$

29. Two blocks ……

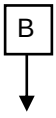
Sol.



Tension is spring initially = 4 mg

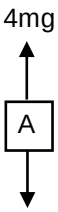
tension in string initially = mg

after culting string



mg

$a = \frac{mg}{m} = g$



$a = \frac{4mg - 3mg}{3m} = \frac{g}{3}$

$\frac{g}{3}, g$

30. In an electromagnetic ……

Sol. $E_0 = \sqrt{2}\, E_{rms} = \sqrt{2} \times 6$ V/m

$B_0 = \frac{E_0}{C} = \frac{\sqrt{2} \times 6}{3 \times 10^2}$ T $= \sqrt{2} \times 10^{-8}$ T

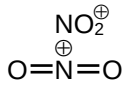
$= 2 \times 1.414 \times 10^{-8}$ T

$= 2.828 \times 10^{-8}$ T

PART-B : CHEMISTRY

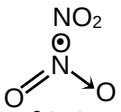
31. Match list-I with list-II……

Sol.



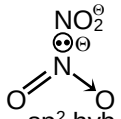
sp hyb. of Nitrogen

Bond Angle =180º



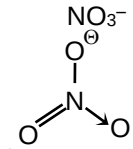
sp² hyb. of Nitrogen

Bond Angle =134º



sp² hyb. of Nitrogen

Bond Angle <120º (due to lone pair)



sp² hyb. of Nitrogen

Bond Angle =120º

32. For the reaction……

Sol. $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$

t= 0	a mole	0	0
t=eq	$a(1-\alpha)$	$\frac{a\alpha}{2}$	$\frac{a\alpha}{2}$

$P_{H_2} = P_{I_2} = \frac{a\,\alpha/2}{a} \cdot P_T = \frac{\alpha}{2} \cdot P_T$

$P_{HI} = \frac{a(1-\alpha)}{a} . P_T = (1-\alpha) P_T$

$K_p = \frac{p_{H_2} \cdot p_{I_2}}{p_{HI}^2} = \frac{\frac{\alpha}{2} . p_T \cdot \frac{\alpha}{2} . p_T}{[(1-\alpha) p_T]^2} = \frac{\alpha^2}{4(1-\alpha)^2}$

$\sqrt{k_p} = \frac{\alpha}{2(1-\alpha)} \Rightarrow \alpha = 2\sqrt{k_p} - 2\alpha\sqrt{k_p}$

$\Rightarrow \alpha . \left(1 + 2\sqrt{k_p}\right) = 2\sqrt{k_p} \Rightarrow \alpha = \frac{2\sqrt{k_P}}{1 + 2\sqrt{k_P}}$

33. In the quantitative……

Sol. $C_xH_yO_zN_p \longrightarrow N_2$

0.42gm $\quad \frac{100}{11}$ mℓ , 860 mm of Hg, 250K

for $N_2 \rightarrow$

$$\frac{836}{760} \times \frac{100}{11 \times 1000} = n \times 0.08 \times 250$$

$n = 5\times10^{-4}$ mol

POAC on N $\rightarrow$

$$\frac{0.42}{M} \times N_A \times p = \left(5 \times 10^{-4}\right) \times N_A \times 2$$

$$\frac{p}{M} = \frac{10^{-3}}{0.42}$$

$$\%N = \frac{14\,p}{M} \times 100 = \frac{14 \times 10^{-3}}{0.42} \times 100 = \frac{10}{3}\%$$

34. If equilibrium constant……

Sol. $$\frac{\left[CH_3COO^-\right]\left[H_3O^+\right]}{\left[CH_3COOH\right]} = 1.8 \times 10^{-5} = K_a$$

$$\frac{\left[CH_3COO^-\right]}{\left[CH_3COOH\right]\left[OH^-\right]} = \frac{K_a}{K_w} = \frac{1.8 \times 10^{-5}}{10^{-14}} = 1.8 \times 10^9$$

35. When excess chlorine……

Sol. $NH_3 + Cl_2 \longrightarrow NCl_3 + HCl$ (Cl_2 in excess; NCl_3 ↓ explosive)

36. One mole of an ……

Sol. Total ΔU for whole process = 0 Since temperature is constant.

$q_{Total} = \Delta U_{Total} - W_{Total}$

$= 0 - W_{Total} = -W_{Total}$

$W_{Total} = W_{1-2} + W_{2-3} = -2(16-4) - 1(32-16)$

$= -24 - 16 = -40$ bar litre

$= -40\times10^5\times10^{-3}$ J $= -4000$J

$q_{Total} = -W_{Total} = +4000$J

37. When heated above ……

Sol. $$\frac{d_{bcc}}{d_{ccp}} = \frac{\text{packing efficiency of bcc}}{\text{packing efficiency of ccp}}$$

$$= \frac{67.92}{74.02} = 0.918$$

38. The vapour pressure……

Sol. $$\frac{p_A^\circ - p_s}{p_s} = \frac{n}{N} \Rightarrow \frac{100 - 95}{95} = \frac{w_{solute}}{M_{solute}} \times \frac{M_{solvent}}{w_{solent}}$$

$$\frac{5}{95} = \frac{w_{solute}}{w_{solvent}} \times \frac{0.3}{1}$$

$$\frac{w_{solvent}}{w_{solute}} = 19 \times 0.3 = 5.7$$

39. Figure graphically illustrates……

Sol. $h\nu = h\nu_0 + K.E.$

$K.E. = h\nu - h\nu_0$

$(\nu_0)_w > (\nu_0)_{Cs}$

$(\lambda_0)_w < (\lambda_0)_{Cs}$

$(E_0)_{Cs} < (E_0)_w$

40. For a given reaction……

Sol. We know, Rate = K [conc.]^n

$1 \times 10^{-4} = K\,[.01]^n$ .....(i)

$1.41 \times 10^{-4} = K\,[.02]^n$ .....(ii)

(i) / (ii) $$\frac{1}{1.41} = \left(\frac{1}{2}\right)^n$$

$$n = \frac{1}{2}$$

Then $$\frac{-d(A)}{dt} = K\,[A]^{1/2}$$

41. Which of the following……

Sol. (I) Silica gel adsorbs moisture

(II) True

(III) True (Chemisorption need activation energy)

(IV) True, physisorption is due to weak attractive forces, hence it occurs little farther from surface atoms in comparison to chemisorption. Moreover the decrease in potential energy is more in chemisorption than in physisorption.

42. Three moles of electrons……

Sol. eqs = moles × n–factor

Therefore ratio of moles will be in $\frac{1}{n-factor}$ ratio.

43. Electron gain enthalpy……

Sol. Theory based.

44. 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 $CaCO_3$.

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

$CaO + H_2O \xrightarrow{\Delta} Ca(OH)_2$

$Ca(OH)_2$ 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.

45. $KMnO_4$ in neutral/weakly……

Sol. $8MnO_4^- + 3S_2O_3^{2-} + H_2O \longrightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$

46. Which of the following……

Sol.

(1) $Mn^{+3} : d^4 : t_{2g}^{2,1,1}$	paramagnetic
(2) $Ni^0 : d^8s^2 : e_g^{2,2}, t_{2g}^{2,2,2}$	diamagnetic
(3) $Fe^{+2} : d^6 : t_{2g}^{2,2,2}$	diamagnetic
(4) $Co^{+3} ; d^6 : t_{2g}^{2,2,2}$	diamagnetic

47. The Ellingham diagram……

Sol. The temperature at where ΔG° is more –ve, there will more affinity for oxygen.

48. Two glass bulb A and B……

Sol. $\frac{P \times 100}{RT} = \frac{0.4PV}{RT} + \frac{0.4P \times 100}{RT}$

$0.4\ V = 60$

$V = 150$ mL

50. The pyrimidine bases…….

Sol. DNA contains cytosine and thymine as a pyrimidine bases and guanine and adenine as purine bases.

52. Aniline and N-methylaniline…….

Sol. 1° and 2° amines can be distinguished using Hoffmann's mustard oil reaction, Carbyl amine test and Hinsberg reagent.

54. Which of the following…….

Sol. Benzophenone neither give aldol condensation nor give cannizzaro reaction.

57. Choose the correct …….

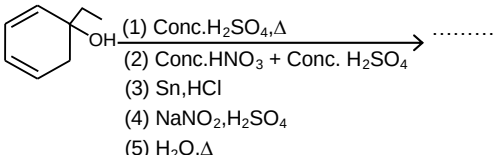
Sol. **(3)** Anti-addition takes place. (i.e., anti-hydroxylation)

58. Aqueous solution of following…….

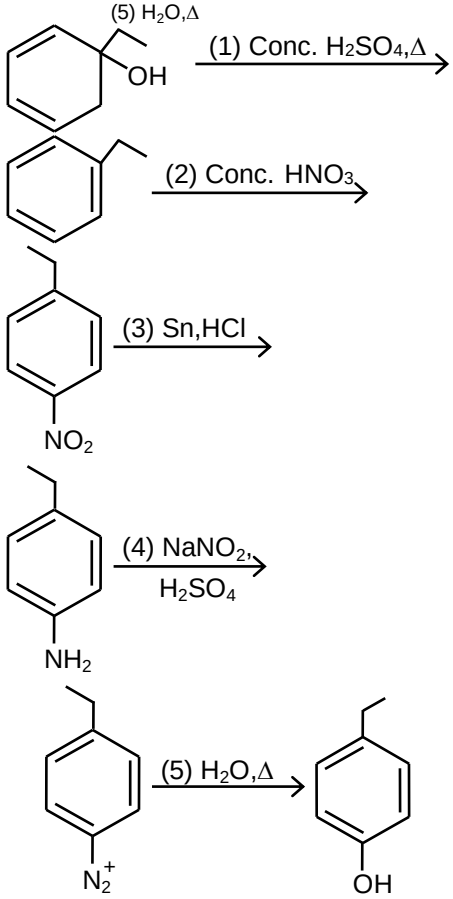
Sol. $\begin{matrix}CH\text{–}COO^- \\ \| \\ CH\text{–}COO^-\end{matrix}, \longrightarrow \begin{matrix}CH \\ \|\| \\ CH\end{matrix} + 2CO_2 + 2e^-$

59. Addition of one equivalent…….

Sol. In conjugated enyne first equivalent of HCl add to alkyne.

60. 

……

Sol. 

PART-C : MATHEMATICS

61. If $f(x) = 1 + \frac{1}{x}\int_1^x f(t)dt$ ……

Sol. Given

$xf(x) = x + \int_1^x f(t)\,dt$

$f(x) + xf'(x) = 1 + f(x)$

$\Rightarrow f(x) = \log|x| + c$

$f(1) = 1$

$\Rightarrow f(x) = \log|x| + 1$

$\Rightarrow f(e^{-1}) = 0$

62. Consider a ……..

Sol. For a trapezium, we must select one pair of point from each of two parallel sides

So required number = ${}^3C_2\ {}^5C_2 + {}^4C_2\ {}^6C_2 = 120$

63. If the 5th roots …….

Sol. $z^5 - 1 = 0$

$\Rightarrow 1 + z_1 + z_2 + z_3 + z_4 = 0,\ \sum z_1 z_2 = 0$

$1 + z_1^2 + z_2^2 + z_3^2 + z_4^2 =$

$(1 + z_1 + z_2 + z_3 + z_4)^2 - 2\sum z_1 z_2 = 0$

64. If a > 1, b > 1, ……

Sol. AM $\geq$ GM

$\Rightarrow \log_{\sqrt{a}} b + \log_{\sqrt{b}} c + \log_{\sqrt{c}} a$

$= 2(\log_a b + \log_b c + \log_c a) \geq 2.3(\log_a b.\log_b c.\log_c a)^{1/3}$

$= 6$

65. Locus of the …….

Sol. Let the mid-point of chord be P(h, K); its equation will be

$xh - yk = h^2 - k^2$

$y = \frac{h}{k}x + \frac{k^2 - h^2}{k}$

It should be same as $y = mx + \frac{a}{m}$

$\Rightarrow m = \frac{h}{k}$ and $\frac{a}{m} = \frac{k^2 - h^2}{k}$

$\Rightarrow a = \frac{k^2 - h^2}{k}\frac{h}{k}$

$\Rightarrow k^2 a = k^2 h.h^3$

$\Rightarrow h^3 = k^2(h - a)$

Locus is $x^3 = y^2(x - a)$

66. The unit digit …….

Sol. $17^{2019} + 11^{2019} - 7^{2019}$

$= (7 + 10)^{2019} + (1 + 10)^{2019} - 7^{2019}$

$= (7^{2019} + {}^{2019}C_1\ 7^{2018}\ 10 + \ldots\ldots + {}^{2019}C_{2019}\ 10^{2019}) + ({}^{2019}C_0 + {}^{2019}C_1\ 10 + \ldots\ldots + {}^{2019}C_{2019}\ 10^{2019}) - 7^{2019}$

= (a number multiple of 10) + 1 $\Rightarrow$ unit's place digit is 1.

67. If 3 numbers ……..

Sol. Let the selected numbers be n_1, n_2 and n_3

We must have $2n_2 = n_1 + n_3$.

Thus $n_1 + n_3$ must be even. That means n_1 and n_3 both must have same nature

Thus required probability = $1 - \frac{2.{}^{12}C_2}{{}^{24}C_3} = \frac{43}{46}$.

68. The number ……..

Sol. Given $f(x) = x^3 - x^2 + 4x + 2\sin^{-1}x$

$f'(x) = 3x^2 - 2x + 4 + \frac{2}{\sqrt{1-x^2}} > 0$

$\therefore$ f(x) is an increasing function.

$\therefore$ Range = $[f(-1), f(1)] \Rightarrow [-6-\pi, 4+\pi]$.

69. The area bounded……..

Sol. Req area = $\int_0^{\pi/3}\left(\cos\left(\frac{y}{2}\right) - \sin y\right)dy$

$= 2\cdot\sin\frac{y}{2} + \cos y\Big]_0^{\pi/3} = \frac{1}{2}$ sq. unit.

70. Given that matrix……..

Sol. A adjA= |A|I

|A| = xyz – 8x – 3(z – 8) + 2(2 – 2y)

|A| = xyz – (8x + 3z + 4y) + 28

= 60 – 20 + 28

= 68

71. The values of ……..

Sol. $f(2a) < 0$

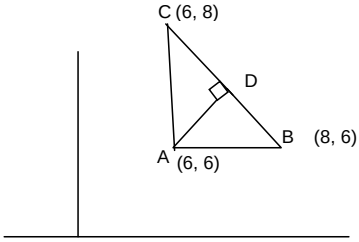
$8a^2 - 4a(a+1) + a(a-1) < 0$

or $5a(a-1) < 0$

$0 < a < -1$

72. If A (6, 6), B (8, 6) ……..

Sol.



It's a right angled Δ.

HG = $\frac{2\,AD}{3} = \frac{BC}{3} = \frac{2\sqrt{2}}{3}$

73. If $f(x) + f\left(\sqrt{1-x^2}\right) = 2$ ……..

Sol. $I = \int_0^1 \frac{f(x)\,dx}{\sqrt{1-x^2}}$ ....(1)

Put $1 - x^2 = t^2$

$-x\,dx = t\,dt$

$\frac{dx}{\sqrt{1-x^2}} = \frac{-dt}{\sqrt{1-t^2}}$

$\Rightarrow I = \int_1^0 \frac{f\left(\sqrt{1-t^2}\right)(-dt)}{\sqrt{1-t^2}}$

$\Rightarrow I = \int_0^1 \frac{f\left(\sqrt{1-t^2}\right)dt}{\sqrt{1-t^2}}$ ....(2)

(1) + (2)

$\Rightarrow 2I = \int_0^1 \frac{f(x) + f\left(\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}dx$

$= \int_0^1 \frac{2}{\sqrt{1-x^2}}dx$

$I = \int_0^1 \frac{dx}{\sqrt{1-x^2}} = \sin^{-1}x\Big|_0^1 = \frac{\pi}{2}$

74. The equation …….

Sol. Given circle is $x^2 + y^2 + 16x - 24y + 183 = 0$,

Centre = C_1(-8, 12);

Image circle $x^2 + y^2 + 32x + 4y + 235 = 0$,

Centre = C_1(-16, -2);

Line mirror is given by perpendicular bisector of C_1, C_2.

Solving $PC_1 = PC_2$, we get $4x + 7y + 13 = 0$

75. $S(x) = \int \frac{dx}{e^x + 8e^{-x} + 4e^{-3x}}$ ……..

Sol. $M(x) = \int \frac{dx}{e^x + 8e^{-x} + 4e^{-3x}} - 2\int \frac{dx}{e^{3x} + 8e^x + 4e^{-x}}$

$M(x) = \int \frac{e^x(e^{2x} - 2)}{e^{4x} + 8e^{2x} + 4}dx = \int \frac{t^2 - 2}{t^4 + 8t^2 + 4}dt$

$= \int \frac{1 - 2t^{-2}}{(t + 2t^{-1})^2 + 4}dt$

$$= \frac{1}{2}\tan^{-1}\left|\frac{\left(t+\frac{2}{t}\right)}{2}\right| + c$$

$$M(\ln 2) = \frac{1}{2}\tan^{-1}\left(\frac{e^{\ln 2} + 2e^{-\ln 2}}{2}\right) + c$$

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

$$M(\ln 1) = \frac{1}{2}\tan^{-1}\left(\frac{3}{2}\right) + c$$

76. The probability .....

Sol. Rectangle of dimension $(1\times 6) = {}^{8}C_1 \times {}^{(8-6+1)}C_1 = 24$

Rectangle of dimension

$(2\times 3) = {}^{(8-2+1)}C_1\ {}^{(8-3+1)}C_1 = 42$

$\therefore$ Total number of rectangle of 65cm $2 \times 66 = 132$

$\therefore$ Total number of rectangle $= {}^{9}C_2\ {}^{9}C_2$

$\therefore$ Required probability $= \frac{132\times 4}{9\times 8\times 9\times 8} = \frac{11}{108}$

77. If $-\frac{\pi}{2} < x < \frac{\pi}{2}$.....

Sol. $\cos x + \frac{2}{3}\cos x \sin^2 x + \frac{4}{9}\cos x \sin^4 x + ...$

is finite

$$\frac{\cos x}{1-\frac{2}{3}\sin^2 x}$$

$$\frac{3\cos x}{3-2\sin^2 x}$$

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

$$\frac{3\cos x}{1+\cos^2 x}$$

$$-1 < \frac{2}{3}\sin^2 x < 1$$

$$-3 < 2\sin^2 x < 3$$

$$-\frac{3}{2} < \sin^2 x < \frac{3}{2}$$

$$0 < \sin^2 x < \frac{3}{2}$$

$$-\sqrt{\frac{3}{2}} < \sin x < \sqrt{\frac{3}{2}}$$

always possible

78. If three angles.....

Sol. Solve B and then A + C

$$\cot B = \frac{\sin A - \sin C}{\cos C - \cos A}$$

$$\cot B = \frac{2\cos\left(\frac{A+C}{2}\right)\sin\left(\frac{A-C}{2}\right)}{2\sin\left(\frac{A+C}{2}\right)\sin\left(\frac{A-C}{2}\right)}$$

$$\cot B = \frac{\sin\frac{B}{2}}{\cos\frac{B}{2}}$$

$$\frac{\cos B}{\sin B} = \frac{\sin\frac{B}{2}}{\cos\frac{B}{2}}$$

$$\cos\frac{3B}{2} + \cos\frac{B}{2} = \cos\frac{B}{2} - \cos\frac{3B}{2}$$

$$\frac{3B}{2} = \frac{\pi}{2}$$

$$B = \frac{\pi}{3}$$

$$A + C = \frac{2\pi}{3}$$

2B = A +C

$\therefore$ A, B, C are in A.P

Answer A.

79. Solution of the .....

Sol. $\frac{dy}{dx} = e^{ax+by}$

$$\Rightarrow \quad \frac{dy}{dx} = e^{ax}\cdot e^{by}$$

$$\Rightarrow \quad \int e^{-by}dy = \int e^{ax}dx + c \quad \text{(c; constant)}$$

$$\frac{e^{-by}}{-b} = \frac{e^{ax}}{a} = c$$

80. Let R and S be.....

Sol. Let A = {1, 2, 3}
R = {(1, 1), (1, 2)}
S = {(2, 2), (2, 3)} be transitive relations on A.
Then $R \cup S$ = {(1, 1), (1, 2), (2, 2), (2, 3)}
Which shows that $R \cup S$ is not transitive
Since $(1, 2) \in R \cup S$ and $(2, 3) \in R \cup S$
but $(1, 3) \notin R \cup S$
$(1, 3) \notin R \cup S$

81. Consider statement.....

Sol. converse of $p \to q$ is $q \to p$

82. Let T > 0, be a .....

Sol. $\int_3^{3+3T} f(2x)dx = \int_0^{3T} f(2x)dx = 3\int_0^{T} f(2x)dx$

Let 2x = t

$$= \frac{3}{2}\int_0^{2T} f(t)dt = 3\int_0^{T} f(t)dt = 3I$$

83. Consider a set …….

Sol. M.D. is minimum about median

84. If y = a cos …….

Sol. $y = a\cos(\log x) + b\sin(\log x)$ ….(1)

Differentiating (1), w.r.t. to x both sides we get

$$\frac{dy}{dx} = -a\sin(\log x)\cdot\frac{1}{x} + b\cos(\log x)\cdot\frac{1}{x}$$

$$\Rightarrow \quad x\cdot\frac{dy}{dx} = -a\sin(\log x) + b\cos(\log x)$$

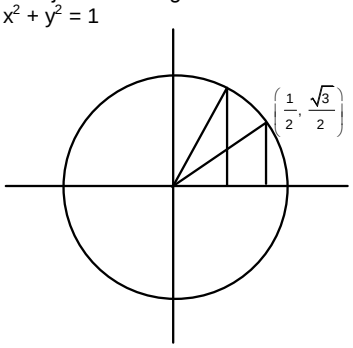
$$\Rightarrow \quad x\cdot\frac{d^2y}{dx^2} + \frac{dy}{dx} = -a\cos(\log)\cdot\frac{1}{x} - b\sin(\log x)\cdot\frac{1}{x}$$

$$\Rightarrow \quad x^2\cdot\frac{d^2y}{dx^2} + x\cdot\frac{dy}{dx} = -y$$

$$\Rightarrow \quad x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$$

85. A object is moving……

Sol. $x^2 + y^2 = 1$



$$2x\frac{dx}{dt} + \frac{2y\,dy}{dt} = 0$$

$$\frac{1}{2}\frac{dx}{dt} + \frac{\sqrt{3}}{2}(-3) = 0$$

$$\frac{dx}{dt} = 3\sqrt{3}$$

$$= a\sqrt{a}$$

$$a = 3$$

86. The least natural…….

Sol. $x + \frac{a}{x^2} > 2 \qquad \forall x \in R^+$

$$x^3 - 2x^2 + a > 0$$

$$f(x) = x^3 - 2x^2 + a$$

$$f'(x) = 3x^2 - 4x = x(3x - 4)$$

$$f\left(\frac{4}{3}\right) > 0 \quad \left(\frac{4}{3}\right)^3 - 2\left(\frac{4}{3}\right)^2 + a > 0$$

$$\frac{64}{27} - \frac{32}{9} + a > 0$$

$$\frac{64 - 96}{27} + a > 0$$

$a > \frac{32}{27}$ least natural number is 2

88. The shortest …….

Sol. The shortest distance of point P from the plane will be projection of

$$\overrightarrow{PA} = -2\hat{i} - \hat{j}$$

The length of projection = $\left|\frac{\overrightarrow{PA}\cdot\vec{\alpha}}{|\vec{\alpha}|}\right| = \frac{4}{\sqrt{13}}$

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(JEE MAIN PATTERN)
TARGET : JEE (MAIN+ADVANCED) 2019

DATE : 24-03-2019 **COURSE : (JP, JF, JR, EP, EF, ER)**

ANSWER KEY

CODE/SET-1

PART-A (PHYSICS)

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

PART-B (CHEMISTRY)

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

PART-C (MATHEMATICS)

61.	(2)	**62.**	(3)	**63.**	(2)	**64.**	(1)	**65.**	(2)	**66.**	(4)	**67.**	(3)
68.	(4)	**69.**	(2)	**70.**	(3)	**71.**	(4)	**72.**	(2)	**73.**	(2)	**74.**	(4)
75.	(3)	**76.**	(4)	**77.**	(1)	**78.**	(1)	**79.**	(1)	**80.**	(1)	**81.**	(1)
82.	(3)	**83.**	(2)	**84.**	(1)	**85.**	(3)	**86.**	(2)	**87.**	(1)	**88.**	(1)
89.	(1)	**90.**	(4)										

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ANSWER KEY

CODE/SET-2

PART-A (MATHEMATICS)

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

PART-B (PHYSICS)

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

PART-C (CHEMISTRY)

61.	(4)	**62.**	(3)	**63.**	(2)	**64.**	(3)	**65.**	(3)	**66.**	(2)	**67.**	(1)
68.	(3)	**69.**	(2)	**70.**	(3)	**71.**	(1)	**72.**	(3)	**73.**	(1)	**74.**	(1)
75.	(4)	**76.**	(2)	**77.**	(2)	**78.**	(3)	**79.**	(4)	**80.**	(2)	**81.**	(1)
82.	(2)	**83.**	(4)	**84.**	(2)	**85.**	(1)	**86.**	(3)	**87.**	(4)	**88.**	(1)
89.	(4)	**90.**	(4)										

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ANSWER KEY

CODE/SET-3

PART-A (CHEMISTRY)

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

PART-B (MATHEMATICS)

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

PART-C (PHYSICS)

61.	(2)	**62.**	(3)	**63.**	(2)	**64.**	(2)	**65.**	(4)	**66.**	(1)	**67.**	(3)
68.	(3)	**69.**	(4)	**70.**	(2)	**71.**	(4)	**72.**	(3)	**73.**	(1)	**74.**	(1)
75.	(2)	**76.**	(2)	**77.**	(1)	**78.**	(3)	**79.**	(4)	**80.**	(3)	**81.**	(3)
82.	(3)	**83.**	(2)	**84.**	(1)	**85.**	(2)	**86.**	(4)	**87.**	(1)	**88.**	(4)
89.	(1)	**90.**	(3)										