HINTS & SOLUTIONS

PART-A : PHYSICS

1. If accelerating ……..

Sol. As acc. voltage increases λ_D decreases

$\lambda = \dfrac{h}{mv}$

R.P. = $\dfrac{1}{1.22\lambda}$

$\therefore$ Resolving power increased

2. A bob of mass ……..

Sol. $\sqrt{g\ell_1} = \sqrt{2g\ell_1}$

$\ell_1 = 2\ell_2$

$\dfrac{\ell_1}{\ell_2} = 2$

3. Light from a ……..

Sol. E = ϕ + k
= 1.82 + 8.38
= 10.2 eV
$\therefore$ Transition in H atom will be from n = 2 to n = 1

$\Delta L = \dfrac{2h}{2\pi} - \dfrac{h}{2\pi} = \dfrac{h}{2\pi}$

$= \dfrac{6.6\times10^{-34}\times7}{2\times22} = 1.05 \times 10^{-34}\text{kgm}^2/\text{s}$

4. The length of ……..

Sol. $\dfrac{4}{x_1} = \dfrac{6}{x_2} = k$

$\dfrac{6}{\ell_2 - \ell_0} = \dfrac{4}{\ell_1 - \ell_0} = k$

$4 = k(\ell_1 - \ell_0)$
$6 = k(\ell_2 - \ell_0)$
$\dfrac{4}{6} = \dfrac{\ell_1 - \ell_0}{\ell_2 - \ell_0}$
$2\ell_2 - 2\ell_0 = 3\ell_1 - 3\ell_0$
$\ell_0 = 3\ell_1 - 2\ell_2$

5. A particle initially ……..

Sol. w = Fs

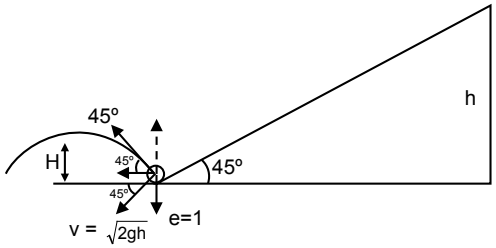
$= F\ \dfrac{1}{2}at^2 = \dfrac{F^2}{2m}t^2$

$w = Fs = \dfrac{1}{2}mv^2$

$w \propto v^2$
$t^2 \propto v^2$
$v \propto t$

6. A ball of mass ……..

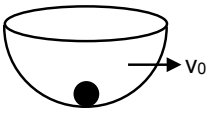
Sol.



$H = \dfrac{v^2\sin^2 45^\circ}{2g} = \dfrac{v^2}{4g} = \dfrac{2gh}{4g} = \dfrac{h}{2}$

7. A smooth ……..

Sol.



$\dfrac{1}{2}mv_0^2 = mgh$

$\dfrac{v_0^2}{2g} = h$

8. In a Young's ……..

Sol. $\beta_1 = \dfrac{\lambda D}{d} = \dfrac{650\times10^{-9}\times1.5}{5\times10^{-4}}$

$= 650 \times 0.3 \times 10^{-5}$
= 1.95 mm

$\beta_2 = \dfrac{520\times10^{-9}\times1.5}{5\times10^{-4}}$

$= 520 \times 0.3 \times 10^{-5}$
= 1.56mm
$4\beta_1 = 5\beta_2 = 7.8$ mm

9. Velocity (v) ……..

Sol. $m = KV^a F^b T^c$
$M^1L^0T^0 = K(LT^{-1})^a (M^1L^1T^{-2})^b (T^c)$
$M^1L^0T^0 = L^{a+b} M^b T^{-a-2b+c}$
a + b = 0
a + 2b = C
b = 1
a = –1
c = 1
$M = KV^{-1} F^1 T^1$

10. The magnetic ……..

Sol. Wave traveling in (–) x direction

$v = \dfrac{\omega}{k}$

$= \dfrac{1.5\times10^{11}}{0.5\times10^{3}}$

$= 3 \times 10^8 \left(-\hat{i}\right)$

$\vec{E}_0 = -\vec{V} \times \vec{B}_0$

$= -3 \times 10^8 \left(-\hat{i}\right) \quad \times 2 \times 10^{-7} \left(\hat{j}\right) = 60 \left(\hat{k}\right)$

$= E_z = +60 \sin (0.5 \times 10^3 x + 1.5 \times 10^{11} t)$ V/m

11. The following figure ……..

Sol.

A	B	C
0	0	0
1	1	1
0	1	0
1	0	0
0	0	0
1	1	1

Logic gate is therefore AND

12. A uniform rod ……..

Sol. $mg\frac{\ell}{2} = \frac{m\ell^2}{3}\alpha$

$\alpha = \frac{3g}{2\ell}$; $a_{cm} = \frac{\alpha\ell}{2} = \frac{3g}{4}$

13. A coil is placed ……..

Sol. Direction of B at P along z-direction

$B_P = B_0\left(\hat{k}\right)$

$v = v_0\,\hat{j}$

$F = (-e)\ \left(v_0\hat{j} \times B_0\hat{k}\right)$

$= ev_0B_0\left(-\hat{i}\right)$

14. Rays from the ……..

Sol. $\frac{E}{At} = I$

$IAt = mL$

$I = \frac{mL}{At}$

$= \frac{10 \times 80}{\pi\frac{(5)^2}{4} \times 20} = \frac{10 \times 80 \times 4}{\pi \times 500} = \frac{32}{\pi \times 5}$

$= \frac{32 \times 7}{22 \times 5} = \frac{224}{110} = \frac{22.4}{11} = 2.04$ cal

15. A steel ring ……..

Sol. $2\pi (r + \Delta r) = 2\pi R$

$2\pi\Delta r = 2\pi (R - r)$

$\Delta L = 2\pi (R - r)$

$\frac{\Delta L}{L} = \frac{2\pi(R-r)}{2\pi r}$

$F = YA\ \frac{\Delta\ell}{\ell}$

$F = YA\left(\frac{R-r}{r}\right)$

16. Two particles ……..

Sol. $4\,mg - 2F = 4\,ma$

$3\,mg - F - T = 3\,ma$

$T = 3\,mg - F - 3ma$

$= 3\,mg - F - 3m\left(\frac{4mg - 2F}{4m}\right)$

$= 3\,mg - F - 3\,mg + \frac{3F}{2} = \frac{F}{2}$

$v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{F}{2\mu}}$

$t = \frac{\ell}{v} = \ell\sqrt{\frac{2\mu}{F}}$

17. A container ……..

Sol. $P_{atm} - \frac{2T}{R} + \rho_2 gh = \rho_1 gh + P_{atm}$

$(\rho_2 - \rho_1)gh = \frac{2T}{R}$

$T = (\rho_2 - \rho_1)\ \frac{ghR}{2}$

18. Two point ……..

Sol. $\phi_{ABCD} = \frac{q}{6\varepsilon_0} - \frac{q}{6\varepsilon_0} = 0$

19. Rod of mass ……..

Sol. $\theta = \theta_0 \sin\omega t$

$\frac{d\theta}{dt} = \theta_0\omega\cos\omega t$

$\left(\frac{d\theta}{dt}\right)_{max} = \theta_0\omega$

$T = 2\pi\sqrt{\frac{m\ell^2}{12k}}$

$\omega^2 = \frac{12k}{m\ell^2}$

$T = \left(\frac{m}{2}\right)\theta_0^2\omega^2\frac{\ell}{4}$

$= \frac{m}{2}\theta_0^2\frac{12k}{m\ell^2} \times \frac{\ell}{4} = \frac{3}{2}\frac{k\theta_0^2}{\ell}$

20. Mobility of ……..

Sol. $J = \sigma E = nev_d$

$\mu = \frac{V_d}{E}$

$\frac{E}{\rho} = nev_d$

$\rho = \frac{E}{nev_d} = \frac{1}{ne\mu} = \frac{1}{10^{19} \times 1.6 \times 10^{-19} \times 3.2}$

$= \frac{1}{1.6 \times 3.2} = 0.2\Omega m$

21. A potentiometer ……..

Sol. $x = \frac{V_{AB}}{L} = \frac{\varepsilon \times 10r}{11rL} = \frac{10\varepsilon}{11L}$

$\frac{\varepsilon}{3} = x$ (AJ)

$$AJ = \frac{\varepsilon}{3x} = \frac{\varepsilon}{3\left(\frac{10\varepsilon}{11L}\right)} = \frac{11L}{30}$$

22. Initially both ……..

Sol. $k_1\Delta\ell_1 = k_2\Delta\ell_2$

$k(\Delta\ell_1) = 2k(\Delta\ell_2)$

$\Delta\ell_1 = 2\Delta\ell_2$

$\Delta\ell_1 + \Delta\ell_2 = \ell_0 \alpha\, \Delta T$

$$\Delta\ell_1 + \frac{\Delta\ell_1}{2} = \ell_0 \alpha\, \Delta T$$

$$\frac{3}{2}\Delta\ell_1 = \ell_0 \alpha\, \Delta T$$

$$\Delta\ell_1 = \frac{2}{3}\ell_0 \alpha\, \Delta T$$

$$T = k\,\Delta\ell_1 = \frac{2}{3} k\ell_0 \alpha\, \Delta T$$

23. t = 0, switch ……..

Sol. $$\alpha = \frac{1}{\tau} = \frac{1}{R_{eq}C}$$

24. A small square ……..

Sol. $B_cA = MI$

$$\frac{4\mu_0 I}{4\pi\left(\frac{L}{2}\right)}\left(\sqrt{2}\right)\left(\ell^2\right) = MI$$

$$M \propto \frac{\ell^2}{L}$$

25. A satellite is ……..

Sol. $$V = \sqrt{\frac{3gR^2}{R+h}} = \sqrt{\frac{3GM}{R^2}\frac{R^2}{R+h}} = \sqrt{\frac{3GM}{r}}$$

V > Ve

Path of the satellite is hyperbolic

26. A concave mirror ……..

Sol. (1) $\Delta = t\left(1-\frac{1}{n}\right) = 20\left(1-\frac{1}{3/2}\right) = \frac{20}{3}(\leftarrow)$

(2) mirror

$$u = -\left[20+\left(10-\frac{20}{3}\right)\right] = -\left[20+\frac{10}{3}\right] = \frac{-70}{3}$$

$$\frac{1}{v} + \frac{3}{-70} = \frac{1}{-9}$$

$$\frac{1}{v} = \frac{3}{70} - \frac{1}{9}$$

$$v = \frac{-9\times 70}{43}$$

Shift again $\frac{20}{3}(\rightarrow)$ cm

final image = $\frac{630}{43} + \frac{20}{3} = 21.31$ cm

27. If amplitude ……..

Sol. $A = A_0 e^{-bt/2m}$

$$\frac{A_0}{2} = A_0 e^{-b/2m}$$

$$\left(\frac{b}{2m}\right) = \ln 2$$

$$A = A_0 e - \frac{bt}{2m}$$

$$\frac{A_0}{x} = A_0 e^{-}\frac{3b}{2m}$$

$\ell nx = 3\ln 2$

$\ell nx = \ln 2^3$

x = 8

28. If the terminal ……..

Sol. $$V = \frac{2}{9}\frac{r^2}{n}(\rho_S - \rho_L)g$$

$$\frac{0.2}{V} = \frac{19.5-1.5}{10.5-1.5} \Rightarrow \frac{0.2}{V} = \frac{18}{9}$$

v = 0.1 m/sec

29. Particle P ……..

Sol. when $OP^1 = 4$

$$\frac{OP^1}{OP} = \cos\theta$$

$$\frac{4}{5} = \cos\theta$$

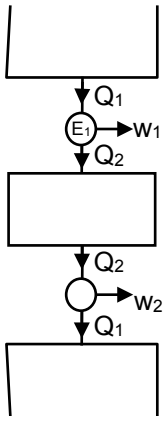
$$\sin\theta = \frac{3}{5}$$

$OP^1 = x = r\cos\theta$

$$\frac{dx}{dt} = -r\sin\theta\left(\frac{d\theta}{dt}\right) = -10\times\frac{3}{5}\times 8 = -48 \text{ cm/sec}$$

30. Suppose two ……..

Sol.



$$n_1 = 1 - \frac{Q_2}{Q_1} = \frac{1}{5} \text{ ..... (1)}$$

$$n_2 = 1 - \frac{Q_3}{Q_2} = \frac{2}{5} \text{ ..... (2)}$$

From (1) and (2)

$$n = 1 - \frac{Q_3}{Q_1} = \frac{13}{25}$$

PART-B : CHEMISTRY

31. Select the incorrect .....
Sol. The term 'sorption' stands for both adsorption and absorption.

32. Ionisation energies of .....
Sol. (1) Sum of IE_1 and IE_2 for Ni(II) is less than that of Pt(II).
(2) Sum of IE_1 , IE_2 , IE_3 and IE_4 for Pt(IV) is less than that of Ni(IV).

33. Calculate the value of .....

Sol. Anode: $\frac{1}{2}H_2 \longrightarrow H^+ + e^-$

Cathode: $Ag^+ + e^- \longrightarrow Ag(s)$

$\frac{1}{2}H_2(g) + Ag^+(aq) \longrightarrow H^+(aq) + Ag(s)$

$E_{cell} = E^0_{cell} - \frac{0.06}{1}\log\frac{[H^+]}{[Ag^+]}$

$Ag_2S \longrightarrow 2Ag^+ + S^{-2}$
$K_{sp} = 4 \times 10^{-12} = [Ag^+]^2 [S^{2-}]$
$[Ag^+] = 2 \times 10^{-4}$ M

$pH = pK_a + \log\frac{[salt]}{[acid]}$

$= 5 + \log\left(\frac{0.1}{0.1}\right)$

= 5

$E_{cell} = 0.8 - \frac{0.06}{1}\log\left(\frac{10^{-5}}{2\times10^{-4}}\right)$

= 0.878 V

34. When sulphur in the .....

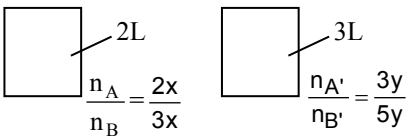
Sol $\underset{1\text{ atm}}{S_8} \rightleftharpoons \underset{0}{4S_2}$

$1 - x$ $\quad$ $4x$
Fall in pressure = x = 29% of 1 atm = 0.29

$\Rightarrow x = 0.29;\ K = \frac{(4x)^4}{1-x} = \frac{(1.16)^4}{0.71}$ = **2.55 atm³**

35. Select the complex .....
Sol. Ma_4b_2 formula has two geometric isomers.

37. A mixture of two gases.....
Sol.



$\frac{n_A}{n_B} = \frac{2x}{3x}$ $\qquad$ $\frac{n_{A'}}{n_{B'}} = \frac{3y}{5y}$

$\frac{v}{n}$ = const.

or $\frac{2}{5x} = \frac{3}{8y} = \frac{5}{5x+8y}$

or $y = \frac{15x}{16}$

Now use

mean molar mass = $\frac{(n_A + n_{A'})M_A + (n_B + n_{B'})M_B}{n_A + n_B + n_{A'} + n_{B'}}$

38. Hydride gap is found .....
Sol. The elements in middle of the d–block do not form hydrides this is known as hydride–gap.

39. For a homogeneous .....

Sol. A $\longrightarrow$ 3B $\quad P_\infty = 3P_0 \Rightarrow P_0 = \frac{P_\infty}{3}$

P_0 – $\quad P_T = P_0 + 2P$

$P_0 - P$ $\quad 3P \quad P = \frac{P_T - P_0}{2}$, $K = \frac{1}{t}\ln\left(\frac{P_0}{P_0 - P}\right)$

– $\quad 3P_0$

40. Two moles of triatomic .....
Sol. $\Delta H_{total} = \Delta H_{AB} + \Delta H_{BC}$
$= nC_P\Delta T + 0$

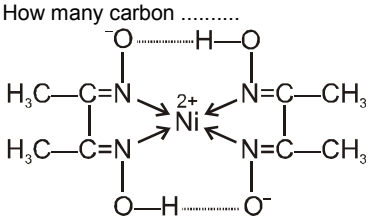
$= 2 \times \frac{7}{2} \times R \times (800 - 200)$

$= 4200\ R$

41. Which of the following .....
Sol. $T_B \uparrow$ then $T_C \uparrow$

42. How many carbon .....

Sol.



43. A mixture contains .....

Sol. $P_{Total} = P^\circ_A X_A + P^\circ_B X_B = \left(100 \times \frac{1}{4}\right) + \left(80 \times \frac{3}{4}\right)$

= (25 + 60) = 85 mm of Hg

Mole fraction of A in the vapour phase (X'_A) is given by :

$X'_A = \frac{P_A}{P_T} = \frac{\left(100 \times \frac{1}{4}\right)}{85} = \frac{25}{85} = 0.294$

$\therefore\ X'_B = 0.706$

These mole fractions will go into the distillate.

$P'_{Total} = P^\circ_A X'_A + P^\circ_B X'_B$ = (100 × 0.294) + (80 × 0.706)
= (29.4 + 56.48) = **85.88 mm of Hg**

45. If x is total number .....
Sol. Theory based

46. A metal (X) on heating.....

Sol. $\underset{(X)}{3Mg} + N_2 \xrightarrow{\Delta} \underset{(Y)}{Mg_3N_2}$;

$\underset{(Y)}{Mg_3N_2} + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3 \xrightarrow{CuSO_4}$ Blue colour

47. For chromium element, ...
Sol. $_{24}Cr - 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$
Only 2p, 3p and 4s orbital satisfies the relation $n + \ell + |m| = 4$
for 2p orbital $\Rightarrow$ 2 e^- (m = ±1)
for 3p orbital $\Rightarrow$ 1 e^-(m = 0)
for 4s orbital $\Rightarrow$ 1 e^- single e^- may have clockwise or anti clockwise spin.
$\therefore$ no. of electrons may be 3 or 4.

48. A solid A^+B^- having .....

Sol. Along body diagonal $\Rightarrow$ $A^+ = 1$ (T.V.)

$$\Rightarrow B^- = \frac{1}{8}\times 2\,(\text{Corner}) = \frac{1}{4}$$

$\frac{3}{4}$ +ve charge is required, so $C^{+3} = \frac{1}{4}$

Formula $\Rightarrow$ No. of A = 3

No. of B = $\frac{15}{4}$

No. of C = $\frac{1}{4}$

$$\Rightarrow A_3B_{\frac{15}{4}}C_{\frac{1}{4}}$$

$\Rightarrow A_{12}\,B_{15}\,C_1$

So x = 12, y = 15 & z = 1

or y – (x + z)

= 15 – (12 + 1) = 2

49. Which point on the .....

Sol. Gauche form

50. The electronic effect .....

Sol. Carbocation is more stable when –X is canjugade with it.

51. $CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}=CH_2$.....

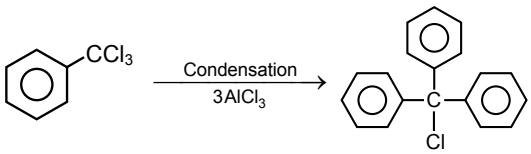
Sol. $R–O–OR \xrightarrow{h\nu} RO^{\circ}$

$RO^{\circ} + HBr \longrightarrow ROH + Br^{\circ}$

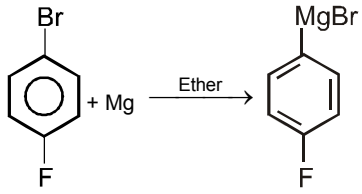
$CH_3–C(CH_3)=CH_2 + Br^{\circ} \longrightarrow$

$CH_3-\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{\overset{\bullet}{C}}}}-CH_2Br$ **is more stable intermediate.**

52. What is the number of .....

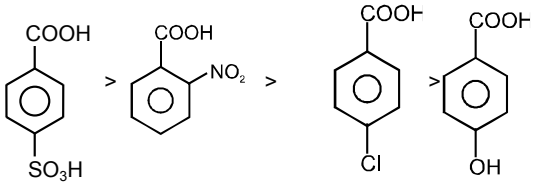
Sol. 

54. Point out the incorrect .....

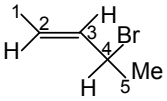
Sol. 

57. The acidic strength .....

Sol. Sulphonic acid is stronger acid than carboxylic acid.
–m and –I group increases acidic strength so order is as follows.

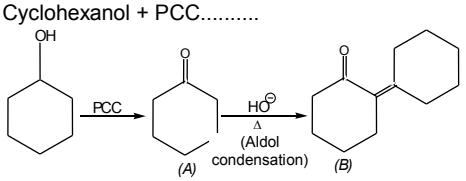


58. Choose the correct .....

Sol. 

IUPAC name is 4-Bromopent-2-ene

59. Cyclohexanol + PCC.....

Sol. 

PART-C : MATHEMATICS

61. The lines tangent.....

Sol. Differentiating $y^3 - x^2y + 5y - 2x = 0$ w.r.t., x, get

$$3y^3y' - 2xy - x^2y' - 2 = 0$$

or $y' = \frac{2xy+2}{3y^2 - x^2 + 5}$ or या $y'(0,0) = \frac{2}{5}$.

Differentiating $x^4 - x^3y^2 + 5x - 2x + 2y = 0$

w.r.t. x, we get

$$4x^3 - 3x^2y^2 - 2x^3yy' + 5 + 2y' = 0$$

or $y' = \frac{3x^2y^2 - 4x^3 - 5}{2 - 2x^3y}$ or या $y'(0,0) = -\frac{5}{2}$.

Thus, both the curves intersect at right angle.

62. The number of .....

Sol. $2^x + 3^x + 4^x - 5^x = 0$

or $2^x + 3^x + 4^x = 5^x$

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

Now, the number of solutions of the equation is equal to the number of times

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

and y = 1 intersect

Fig

From the graph, the equation has only one solution.

63. $\int 4\sin x\cos\frac{x}{2}\cos\frac{3x}{2}dx$ is .....

Sol. $I = \int 4\sin x\cos\frac{x}{2}\cos\frac{3x}{2}dx$

$$= \int 2\sin x(\cos 2x + \cos x)dx$$

$$= \int (\sin 3x - \sin x + \sin 2x)dx$$

$$= \cos x - \frac{1}{3}\cos 3x - \frac{1}{2}\cos 2x + C$$

64. If there are three.....

Sol. $B = A^{2^n} = A^{2.2^{n-1}} = (A^2)^{2^{n-1}}$

$= (A^{-1})^{2n-1} = (A^{2^{n-1}})^{-1}$

$= (A^{2.2^{n-2}})^{-1} = ((A^2)^{2^{n-2}})^{-1}$

$= ((A^{-1})^{-1})^{2^{n-2}} = A^{2^{n-2}}$

B – C = O

$\therefore$ det (B – C) = 0

65. $\int_{-1}^{1/2} \frac{e^x(2-x^2)dx}{(1-x)\sqrt{1-x^2}}$ is equal.....

Sol. $\int_{-1}^{1/2} \frac{e^x(2-x^2)dx}{(1-x)\sqrt{1-x^2}}$

$= \int_{-1}^{1/2} \frac{e^x\left(1-x^2+1\right)}{(1-x)\sqrt{1-x^2}}\,dx$

$= \int_{-1}^{1/2} e^x\left[\sqrt{\frac{1+x}{1-x}} + \frac{1}{(1-x)\sqrt{1-x^2}}\right]dx =$

$\int_{-1}^{1/2} e^x[f(x)+f'(x)]dx$

$= e^x\sqrt{\frac{1+x}{1-x}}\Bigg|_{-1}^{1/2} = \sqrt{3e}$

66. A function f is defined.....

Sol. $\int_0^1 f(x) = \sum_{r=1}^{\infty} \int_{2^{-r}}^{2^{-(r=1)}} \frac{1}{2^{r-1}}dx$

$= 2.\frac{1}{4}.\frac{1}{1-\frac{1}{4}} = \frac{2}{3}$

67. The area enclosed.....

Sol. $y = \log(x+e), x = \log\left(\frac{1}{y}\right)$ or $y = e^{-x}$

For $y = \log_e(x+e)$, shift the graph $y = \log_e x, e$ units to the left hand side

Required area = $\int_{1-e}^{0} \log_e(x+e)dx + \int_0^{\infty} e^{-x}dx$

$= |\, x\log_e(x+e)\,|_{1-e}^{0} - \int_{1-e}^{0} \frac{x}{x+e}dx - |\, e^{-x}\,|_0^{\infty}$

$= \int_0^{1-e}\left(1-\frac{e}{x+e}\right)dx - e^{-\infty} + e^0$

$= |\, x - e\log(x+e)\,|_0^{1-e} - 0 + 1$

$= 1 - e + e\log e + 1 = 2$ sq.units.

68. The order and.....

Sol. The parametric form of the given equation is $x = t, y = t^2$.

The equation of any tangent at *t* is $2xt = y + t^2$.

Differentiating, we get $2t = y_1$

Putting this value in the equation of tangent, we get

$2xy_1/2 = y + (y_1/2)^2$

or $4xy_1 = 4y + y_1$

The order of this equation is one and degree is two.

69. The number of.....

Sol. $A = \text{diag}(d_1, d_2 .... d_n)$

Given $A^3 = A$

$\Rightarrow \text{diag}(d_1^3, d_2^3, ... d_n^3) = \text{diag}(d_1, d_2, ..., d_n)$

$\Rightarrow d_1^3 = d_1, d_2^3 = d_2, ..., d_n^3 = d_n$

70. The sum of values.....

Sol. $(31+8\sqrt{15})^{x^2-3} + 1 = (32+8\sqrt{15})^{x^2-3}$

or $(31+8\sqrt{15})^{x^2-3} + 1^{x^2-3} = (32+8\sqrt{15})^{x^2-3}$

or $x^2 - 3 = 1$ or $x = \pm 2$

71. If $k + |k + z^2| = |z|^2$ $(k \in R)$, ...

Sol. $|k + z^2| = |z^2| - k = |z^2| + |k|$

$\Rightarrow$ k, z^2 and 0 + i0 are collinear

$\Rightarrow$ arg(z^2) = arg(k) $\Rightarrow 2\arg(z) = \pi$

$\Rightarrow \arg(z) = \frac{\pi}{2}$

72. The number of points.....

Sol. for x > 0 f(x) = 0

x = 0 f(x) = 0

x < 0 $f(x) = 4x^2(1-2x)^2$

clearly f(x) is cont as well as derivable for $x \in R$

73. Number of relation.....

Sol. Number of relation = $2^6 - 1 = 63$

74. If $a, b, c \in R^+$ .....

Sol. Using A.M. and H.M. inequality, we get

$\frac{2bc}{b+c} \le \frac{b+c}{2}, \frac{2ac}{a+c} \le \frac{a+c}{2}, \frac{2ab}{a+b} \le \frac{a+b}{2}$

or $\frac{bc}{b+c} + \frac{ac}{a+c} + \frac{ab}{a+b} \le \frac{1}{2}(a+b+c)$

76. If in a given frequency.....

Sol. Mode + 2mean = 3median

$\Rightarrow$ Mode = *3 × 22 – 2 × 21 = 66 – 42 = 24*

77. If coefficient of .....

Sol. As $L \neq 0$

$\therefore$ m = 2 + 3 + 4 = 9

$\therefore L = \frac{9!}{2!3!4!}$

Now coefficient of $a^4b^4c = \frac{9!}{4!4!1!} = \frac{L}{2}$

78. The straight line.....

Sol. If the line meets the x- and y-axes at A and B, then $A \equiv (-c/a, 0), B \equiv (0, -c/b)$. The line will pass through the first quadrant if

$-c/a > 0$ and /or $-c/b > 0$

i.e., $ac < 0$ and/or bc < 0

79. If the intercept made .....

Sol. The distance between (2/m, 2) and (6/m, 6) is less than 5.

Hence, $\left(\frac{2}{m} - \frac{6}{m}\right)^2 + (2-6)^2 < 25$

or $\frac{16}{m^2} < 9$

or $m^2 > \frac{16}{9}$

i.e., $m > \frac{4}{3}$ or $m < \frac{-4}{3}$

80. Simplest form of .....

$$\cot^{-1}\left(\frac{\sqrt{1+\sin x}-\sqrt{1-\sin x}}{\sqrt{1+\sin x}+\sqrt{1-\sin x}}\right), \text{.....}$$

Sol. $\cot^{-1}\left[\frac{\sqrt{1+\sin x}-\sqrt{1-\sin x}}{\sqrt{1+\sin x}+\sqrt{1-\sin x}}\right]$

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

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

and $\left(\sin x = 2\sin\frac{x}{2}.\cos\frac{x}{2}\right)$

$$= \cot^{-1}\left[\frac{\sqrt{\left(\sin\frac{x}{2}+\cos\frac{x}{2}\right)^2}-\sqrt{\left(\cos\frac{x}{2}-\sin\frac{x}{2}\right)^2}}{\sqrt{\left(\sin\frac{x}{2}+\cos\frac{x}{2}\right)^2}+\sqrt{\left(\cos\frac{x}{2}-\sin\frac{x}{2}\right)^2}}\right]$$

$$= \cot^{-1}\left[\frac{\sin\frac{x}{2}+\cos\frac{x}{2}-\cos\frac{x}{2}+\sin\frac{x}{2}}{\sin\frac{x}{2}+\cos\frac{x}{2}+\cos\frac{x}{2}-\sin\frac{x}{2}}\right]$$

$$= \cot^{-1}\left[\frac{2\sin\frac{x}{2}}{2\cos\frac{x}{2}}\right] = \cot^{-1}\tan\frac{x}{2} = \frac{\pi}{2}-\tan^{-1}\tan\frac{x}{2}$$

$$= \frac{\pi}{2}-\frac{x}{2}$$

81. If the sides a, b & c.....

Sol. $b^2 = ac$

$$\cos B = \frac{a^2+c^2-b^2}{2ac}$$

$$= \frac{a^2+c^2-b^2}{2b^2}$$

$\because \quad \cos B = \frac{a^2+c^2}{2ac}-\frac{1}{2}$

$\Rightarrow \cos B+\frac{1}{2} = \frac{a^2+c^2}{2ac} \Rightarrow \cos B+\frac{1}{2} \geq 1$

$\Rightarrow \cos B \geq \frac{1}{2}$; $B \in (0, \pi/3)$

82. ABCD is a square.....

Sol. From the figure,

$2(1-r)^2 = r^2$

or $\sqrt{2}(1-r) = r$

or $r(\sqrt{2}+1) = \sqrt{2}$

or $r = \frac{\sqrt{2}}{\sqrt{2}+1} = \sqrt{2}(\sqrt{2}-1) = 2-\sqrt{2}$

83. $\lim\limits_{x\to 1}\frac{(1-x)(1-x^2)(1-x^3)...(1-x^{2n})}{\{(1-x)(1-x^2)(1-x^3)...(1-x^n)\}^2}$ .....

Sol. $$= \lim_{x\to 1}\frac{\left(\frac{1-x}{1-x}\right)\left(\frac{1-x^2}{1-x}\right)...\left(\frac{1-x^{2n}}{1-x}\right)}{\left(\left(\frac{1-x}{1-x}\right)\left(\frac{1-x^2}{1-x}\right)...\left(\frac{1-x^n}{1-x}\right)\right)^2}$$

$$= \frac{1\times 2\times 3...(2n)}{(1\times 2\times 3..n)^2} = \frac{(2n)!}{n!\,n!} = {}^{2n}C_n$$

84. A line L passing .....

Sol. Any line passing through the focus other than the axis always
Meet the parabola at two distinct points.
Hence, $m \in R-\{0\}$.

86. If the eccentricity of.....

Sol. Here, $a^2+2 > a^2+1$

or $a^2+1 = (a^2+2)(1-e^2)$

or $a^2+1 = (a^2+2)\frac{5}{6}$

or $6a^2+6 = 5a^2+10$ or $a^2 = 10-6 = 4$

or $a = \pm 2$

Latus rectum $= \frac{2(a^2+1)}{\sqrt{a^2+2}} = \frac{2\times 5}{\sqrt{6}} = \frac{10}{\sqrt{6}}$

87. If $I_1 = \int\limits_{-100}^{101}\frac{dx}{(5+2x-2x^2)\left(1+e^{2-4x}\right)}$ .....

Sol. $I_1 = \int\limits_{-100}^{101}\frac{dx}{(5+2x-2x^2)(1+e^{2-4x)})}$

or $2I_1 = \int\limits_{-100}^{101}\frac{dx}{5+2x-2x^2} = I_2$ or $\frac{I_1}{I_2} = \frac{1}{2}$

88. The vector $\overrightarrow{AB} = 3\hat{i}+4\hat{k}$ .....

Sol. $\overrightarrow{AM} = \frac{1}{2}(\overrightarrow{AB}+\overrightarrow{AC}) \Rightarrow \overrightarrow{AM} = 4\hat{i}-\hat{j}+4\hat{k}$

89. A line passing through.....

Sol. Equation of line PQ

$\frac{x-3}{1} = \frac{y-7}{2} = \frac{z-1}{-6} = \lambda$

Point $Q(3+\lambda, y+2\lambda, 1-6\lambda)$

If it lies on plane $3x+2y+11z = 9$, then $\lambda = \frac{25}{59}$

90. In a bag there are.....

Sol. $\frac{4}{9}.\frac{3}{8}.\frac{2}{7}+\frac{3}{9}.\frac{2}{8}.\frac{2}{7}+2.\frac{4}{9}.\frac{3}{8}.\frac{2}{7} = \frac{1}{6}$

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JEE PREPARATORY TEST (JPT-2)
(JEE MAIN PATTERN)
TARGET : JEE (MAIN+ADVANCED) 2019

DATE : 17-03-2019 **COURSE : (JP, JF, JR, EP, EF, ER)**

ANSWER KEY

SET-1

PART-A (PHYSICS)

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

PART-B (CHEMISTRY)

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

PART-C (MATHEMATICS)

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