49. A circle S=0 with radius $\sqrt{2}$ touches the line $x+y-z=0$ at (1, 1). Then the length of the tangent drawn from the point (1, 2) to S=0 is

1) 1 2) $\sqrt{2}$ 3) $\sqrt{3}$ 4) 2

Key: Add score

Sol: $x+y-2=0$

$$\left(x^2+y^2-2x-2y+2\right)+2\lambda\left(x+y-2\right)=0$$
$$x^2+y^2+2x\left(\lambda-1\right)+2y\left(\lambda-1\right)+2-4\lambda=0$$
$$\lambda-11^2+\left(\lambda-1\right)^2-2+4\lambda=2$$
$$2\lambda^2=2$$
$$\lambda^2=1$$
$$\lambda=\pm1$$

50. The normal drawn at P(-1, 2) on the circle $x^2+y^2-2x-2y-3=0$ meets the circle at another point Q. Then the coordinates of Q are

1) (3, 0) 2) (-3, 0) 3) (2, 0) 4) (-2, 0)

Key: 1

Sol: $P(-1,2)\quad C=(1,1)$

$$Q=2C-P$$
$$=(2,2)-(-1,2)$$
$$=(3,0)$$

51. If the lines $kx+2y-4=0$ and $5x+2y-4=0$ are conjugate with respect to the circle $x^2+y^2-2x-2y+1=0$, then $k=$

1) 0 2) 1 3) 2 4) 3

Key: 2

Sol: $\left(5(k)-4\right)1=\left(k-2\right)(-1)$

$$5k-4=-k+2$$
$$6k=6$$
$$k=1$$

52. The angle between the tangents drawn from the origin to the circle $x^2+y^2+4x-6y+4=0$ is

1) $\tan^{-1}\left(\frac{5}{13}\right)$ 2) $\tan^{-1}\left(\frac{5}{12}\right)$ 3) $\tan^{-1}\left(\frac{12}{5}\right)$ 4) $\tan^{-1}\left(\frac{13}{5}\right)$

Key: 3

Sol: $\tan\frac{\theta}{2}=\frac{r}{\sqrt{S_{11}}}=\frac{\sqrt{4+9-4}}{2}=\frac{3}{2}$ | $\tan\theta=\frac{2\left(\frac{3}{2}\right)}{1-\frac{9}{4}}=\frac{3\times4}{-5}=\frac{12}{5}$ $\theta=\tan^{-1}\left(\frac{12}{5}\right)$

53. If the angle between the circles $x^2+y^2-2x-4y+c=0$ and $x^2+y^2-4x-2y+4=0$ is 60^0, then c is equal to

1) $\frac{3\pm\sqrt{5}}{2}$ 2) $\frac{6\pm\sqrt{5}}{2}$ 3) $\frac{9\pm\sqrt{5}}{2}$ 4) $\frac{7\pm\sqrt{5}}{2}$

Key: 4

Sol: $C_1=(1,2)$ $C_2=(2,1)$ $d=\sqrt{1+1}$ $r_1=\sqrt{5-c}$ $r_2=1$

$$\cos 60^0=\frac{d^2-r_1^2-r_2^2}{2r_1r_2}$$

$$2=\frac{2-(5-c)-1}{2\sqrt{5-c}}$$

$$\sqrt{5-c}=c-4$$

$$5-c=(c-4)^2$$

$$5-c=c^2-8c+16$$

$$c^2-7c+11=0$$

$$c=\frac{7\pm\sqrt{49-44}}{2}$$

$$c=\frac{7\pm\sqrt{5}}{2}$$

54. A circle S cuts three circles $x^2+y^2-4x-2y+4=0$, $x^2+y^2-2x-4y+1=0$, and $x^2+y^2+4x+2y+1=0$ orthogonally. Then the radius of S is

1) $\sqrt{\frac{29}{8}}$ 2) $\sqrt{\frac{28}{11}}$ 3) $\sqrt{\frac{29}{7}}$ 4) $\sqrt{\frac{29}{5}}$

Key: 1

Sol: $2x-2y-3=0$

$$6x+6y=0\Rightarrow x+y=0$$

$$x=\frac{3}{4},y=\frac{3}{4}$$

$$\left(\frac{3}{4},\frac{-3}{4}\right)$$

$$r=\sqrt{\frac{9}{16}+\frac{9}{16}-\frac{12}{4}+\frac{6}{4}+4}$$

$$=\sqrt{\frac{18-48+24+64}{4}}$$

$$=\frac{\sqrt{58}}{4}$$

$$=\sqrt{\frac{58}{16}}$$

$$=\sqrt{\frac{29}{8}}$$

55. The distance between the vertex and the focus of the parabola $x^2 - 2x + 3y - 2 = 0$ is

1) $\frac{4}{5}$ 2) $\frac{3}{4}$ 3) $\frac{1}{2}$ 4) $\frac{5}{6}$

Key: 2

Sol: $(x-1)^2 + 3y - 3 = 0$

$$(x-1)^2 = -3(y-1)$$
$$4a = 3$$
$$a = \frac{3}{4}$$

56. If (x_1, y_1) and (x_2, y_2) are the end points of a focal chord of the parabola $y^2 = 5x$, then $4x_1x_2 + y_1y_2 =$

1) 25 2) 5 3) 0 4) $\frac{5}{4}$

Key: 3

Sol: $4a = 5$

$$4\left(at_1^2 . t_2^2\right) + (2at_1)(2at_2)$$
$$= 4a^2 (t_1t_2)^2 + 4a^2 (t_1t_2)$$
$$= 4a^2 - 4a^2$$
$$= 0$$

57. The distance between the focii of the pllipse $x = 3\cos\theta, y = 4\sin\theta$ is

1) $2\sqrt{7}$ 2) $7\sqrt{2}$ 3) $\sqrt{7}$ 4) $3\sqrt{7}$

Key: 1

Sol: $\frac{x^2}{9} + \frac{y^2}{16} = 1$

$$b = 4,\ a = 3$$
$$e = \sqrt{\frac{16-9}{16}} = \frac{\sqrt{7}}{4}$$
$$be = \sqrt{7}$$
$$2be = 2\sqrt{7}$$

58. The equation of the latus recta of the ellipse $9x^2 + 25y^2 - 36x + 50y - 164 = 0$ are

1) $x - 4 = 0, x + 2 = 0$ 2) $x - 6 = 0, x + 2 = 0$ 3) $x + 6 = 0, x - 2 = 0$ 4) $x + 4 = 0, x + 5 = 0$

Key: 2

Sol: $9x^2 + 25y^2 - 36x + 50y - 164 = 0$

$$9\left(x^2-4x+4\right)+25\left(y^2+2y+1\right)-225=0$$

$$\frac{(x-2)^2}{25}+\frac{(y+1)^2}{9}=1$$

$$\frac{X^2}{25}+\frac{Y^2}{9}=1$$

$$a=5,\ c=\sqrt{\frac{25-9}{25}}, a=4$$

$$X=\pm ae$$
$$X=\pm 4$$
$$x-2=\pm 4$$
$$x=6,\ \ x=-2$$

59. The values of m for which the lines $y=mx+2$ becomes a tangent to the hyperbola $4x^2-9y^2=36$ is

1) $\pm\frac{2}{3}$ 2) $\pm\frac{2\sqrt{2}}{3}$ 3) $\pm\frac{8}{9}$ 4) $\pm\frac{4\sqrt{2}}{3}$

Key: 2

Sol: $\frac{x^2}{9}-\frac{y^2}{4}=1$ $y=mx+2$

$$9(m^2)-4=4$$

$$m^2=\frac{8}{9} \qquad m=\pm\frac{2\sqrt{2}}{3}$$

60. The harmonic conjugate of (2, 3, 4) with respect to the points (3, -2, 2), (6, -17, -4) is

1) $\left(\frac{1}{2},\frac{1}{3},\frac{1}{4}\right)$ 2) $\left(\frac{18}{5},-5,\frac{4}{5}\right)$ 3) $\left(\frac{-18}{5},\frac{5}{4},\frac{4}{5}\right)$ 4) $\left(\frac{18}{5},-5,\frac{-4}{5}\right)$

Key: 2

Sol: (2,3,4) divides A (3,-2,2) are B (6,-17,-4) to the ratio 1:-4

$\therefore$ The harmonic conjugate at (2,3,4)

divide $\overline{AB}$ is the ratio 1:4

$\therefore$ Ratio = $\left(\frac{18}{5},-5,\frac{4}{5}\right)$

61. If a line makes angles α,β,γ and δ with the four diagonals of a cube, then the value of $\sin^2\alpha+\sin^2\beta+\sin^2\gamma+\sin^2\delta$ is

1) $\frac{4}{3}$ 2) $\frac{8}{3}$ 3) $\frac{7}{3}$ 4) $\frac{5}{3}$

Key: 2

Sol: $\sin^2\alpha+\sin^2\beta+\sin^2\gamma+\sin^2\delta$

$$=4-\left(\cos^2\alpha+\cos^2\beta+\cos^2\gamma+\cos^2\delta\right)$$
$$=4-\frac{4}{3}$$
$$=\frac{8}{3}$$

62. If the plane $56x+4y+9z=2016$ meets the coordinate axes in A, B, C then the centroid of the triangle ABC is

1) $(12,168,224)$ 2) $(12,168,112)$ 3) $\left(12,168,\frac{224}{3}\right)$ 4) $\left(12,-168,\frac{224}{3}\right)$

Key: 3

Sol: $\frac{56x}{2016}+\frac{4y}{2016}+\frac{92}{2016}=1$

$$\frac{x}{36}+\frac{y}{504}+\frac{2}{224}=1$$
$$A(36,0,0)\ B(0,54,0)\ C(0,0,224)$$
$$Centriod=\left(\frac{36}{3},\frac{504}{3},\frac{224}{3}\right)$$

63. The value(s) of x for which the function

$$f(x)=\begin{cases}1-x & ,x<1\\(1-x)(2-x) & ,1\le x\le 2\\3-x & ,x>2\end{cases}$$

fails to be continuous is (are)

1) 1 2) 2 3) 3 4) All real numbers

Key: 2

Sol: $\underset{x\to 2^-}{Lt} f(x)\neq \underset{x\to 2^+}{Lt} f(x)$

$f(x)$ *is discontinuous at* $x=2$

64. $\underset{x\to 0}{Lt}\frac{6^x-3^x-2^x+1}{x^2}=$

1) $(\log_e 2)\log_e 3$ 2) $\log_e 5$ 3) $\log_e 6$ 4) 0

Key: 1

$$\underset{x\to 0}{Lt}\frac{3^x\left(2^x-1\right)-1\left(2^x-1\right)}{x^2}$$

Sol: $=\underset{x\to 0}{Lt}\frac{\left(3^x-1\right)}{x}\times\underset{x\to 0}{Lt}\left(\frac{2^x-1}{x}\right)$

$$=\log_e 3\times\log_e 2$$

65. Define $f(x)=\begin{cases}x^2+bx+c & ,x<1\\ x & ,x\geq 1\end{cases}$**. If** $f(x)$ **is differentiable at** $x=1$**, then** $(b-c)=$

1) -2 2) 0 3) 1 4) 2

Key: 1

Sol: f(s) is continuous and differentiable at x=1

$$\Rightarrow 1+b+c=1 \Rightarrow b+c=0$$

$$f^1(x)=\begin{cases}2x+b, & x<1\\ 1 & , x\geq 1\end{cases}$$

$$\Rightarrow 2+b=1,\ b=-1,\ c=1$$

$$\therefore b-c=-1-1=-2$$

66. If $x=a$ **is a root of multiplicity two of a polynomial equation** $f(x)=0$**, then**

1) $f^1(a)=f^{11}(a)=0$ 2) $f^{11}(a)=f(a)=0$

3) $f^1(a)\neq 0\neq f^{11}(a)$ 4) $f(a)=f^1(a)=0;\ f^{11}(a)\neq 0$

Key: 4

Sol: Conceptual

$$f(a)=f^1(a)=0;\ f^{11}(a)\neq 0$$

67. If $y=\log_2(\log_2 x)$**, then** $\frac{dy}{dx}=$

1) $\frac{\log_e 2}{x\log_e x}$ 2) $\frac{1}{\log_e(2x)^x}$ 3) $\frac{1}{(x\log_e x)\log_e 2}$ 4) $\frac{1}{x(\log_e x)^2}$

Key: 3

Sol: $y=\log_2(\log_2 x)$

$$\frac{dy}{dx}=\frac{1}{\log_2 x\times x(\log_e 2)^2}$$

$$=\frac{1}{\frac{\log_e x}{(\log_e 2)}\times x(\log_e 2)^2}$$

$$=\frac{1}{(x.\log_e x)\times\log_e 2}$$

68. The angle of intersection between the curves $y^2+x^2=a^2\sqrt{2}$ **and** $x^2-y^2=a^2$**, is**

1) $\frac{\pi}{3}$ 2) $\frac{\pi}{4}$ 3) $\frac{\pi}{6}$ 4) $\frac{\pi}{12}$

Key: 2

Sol: $x^2+y^2=\sqrt{2}a^2$

$$x^2-y^2=a^2$$

$2x^2 = \left(\sqrt{2}+1\right)a^2$

$2x^2 = \left(\frac{\sqrt{2}+1}{2}\right)a^2$

$y^2 = \left(\frac{\sqrt{2}-1}{2}\right)a^2$

$m_1 = \frac{-x_1}{y_1}$ $\quad\quad$ $\left(x^2+y^2\right)^2 - \left(x^2-y^2\right)$ $\;2a^4 - a^4 = 4x^2 - y^2$

$m_2 = \frac{x_1}{y_1}$

$2xy = a^2$

$$\tan\theta = \left|\frac{\frac{x_1}{y_1}+\frac{x_1}{y_1}}{1-\frac{x_1^{\,2}}{y_1^{\,2}}}\right|$$

$$= \left|\frac{2x_1y_1}{y_1^{\,2}-x_1^{\,2}}\right|$$

$$= \left|\frac{a^2}{a^2}\right| = \theta = \frac{\pi}{4}$$

69. If A>0, B>0 and $A+B=\frac{\pi}{3}$, then the maximum value of $\tan A\tan B$ is

1) $\frac{1}{\sqrt{3}}$ $\quad$ 2) $\frac{1}{3}$ $\quad$ 3) $\frac{1}{2}$ $\quad$ 4) $\sqrt{3}$

Key: 2

Sol: $B = \frac{\pi}{3} - A$

$$f(A) = Tan\,A.Tan\left(\frac{\pi}{3}-A\right)$$

$$f^1(A) = 0 \Rightarrow A = \frac{\pi}{6}$$

Max. value $= \tan\left(\pi/6\right)\tan\left(\pi/6\right)$

$= \frac{1}{3}$

70. The equation of the common tangent drawn to the curves $y^2 = 8x$ and $xy = -1$ is

1) $y = 2x+1$ 2) $2y = x+6$ 3) $y = x+2$ 4) $3y = 8x+2$

Key: 3

Sol: $y^2 = 8x, xy = -1$

$y = mx + \frac{2}{m}$

$x\left(mx + \frac{2}{m}\right) = -1$

$x^2 m + \frac{2}{m}x + 1 = 0$

$\Delta = 0$

$\frac{4}{m^2} - 4m = 0$

$m^3 = 1$

$m = 1$

$y = x+2$

71. Suppose $f(x) = x(x+3)(x-2), x \in [-1,4]$. Then a value of c in $(-1,4)$ satisfying $f^1(x) = 10$ is

1) 2 2) $\frac{5}{2}$ 3) 3 4) $\frac{7}{2}$

Key: 1

Sol: $f(x) = x^3 + x^2 - 6x$

$f^1(x) = 3x^2 + 2x - 6 = 10$

$3x^2 + 2x - 16 = 0$

$3x^2 + 8x - 6x - 16 = 0$

$x(3x+8) - 2(3x+8) = 0$

$x = 2, \frac{-8}{3}$

$x = 2$

72. If $\int x^3 e^{5x}\,dx = \frac{e^{5x}}{5^4}\left(f(x)\right) + c$, then $f(x) =$

1) $\frac{x^3}{5} - \frac{3x^2}{5^2} + \frac{6x}{5^3} - \frac{6}{5^4}$ 2) $5x^3 - 5^2x^2 + 5^3x - 6$

3) $5^2x^3 - 15x^2 + 30x - 6$ 4) $5^3x^3 - 75x^2 + 30x - 6$

Key: 4

Sol: $\int x^3.e^{5x}dx$

$$=\frac{e^{5x}.x^3}{5}-\frac{3}{25}x^2e^{5x}+\frac{6}{125}xe^{5x}-\frac{6}{625}e^{5x}+C$$

$$=\frac{e^{5x}}{5^5}\left[5^3.x^3-75x^2+30x-6\right]+C$$

$$f(x)=5^3.x^3-75x^2+30x-6$$

73. $\int\frac{x}{\left(x^2+2x+2\right)^2}dx=$

1) $\frac{x^2+2}{x^2+2x+2}-\frac{1}{2}\tan^{-1}(x+1)+c$

2) $\frac{x^2+2}{2(x^2+2x+2)}-\frac{1}{2}\tan^{-1}(x-1)+c$

3) $\frac{x^2-2}{4(x^2+2x+2)}-\frac{1}{2}\tan^{-1}(x+1)+c$

4) $\frac{2(x-1)}{(x^2+2x+2)}+\frac{1}{2}\tan^{-1}(x+1)+c$

(C is an arbitrary constant)

Key: 3

Sol: Put $(x+1)=\tan\theta$

$$dx=\sec^2\theta d\theta$$

$$\therefore I=\int\frac{(\tan\theta-1).\sec^2\theta}{\sec^4\theta}d\theta$$

$$=-\frac{1}{4}\left(\frac{1-\tan\theta}{1+\tan\theta}\right)-\frac{1}{4}\left(\frac{2\tan\theta}{1+\tan\theta}\right)-\frac{1}{2}\theta+C$$

$$=\frac{1}{4}\frac{\left(2^2-2\right)}{\left(x^2+2x+2\right)}-\frac{1}{2}\tan^{-1}(x+1)+C$$

74. **If** $\int\log\left(a^2+x^2\right)dx=h(x)+c$, **then** $h(x)=$

1) $x\log\left(a^2+x^2\right)+2\tan^{-1}\left(\frac{x}{a}\right)$

2) $x^2\log\left(a^2+x^2\right)+x+a\tan^{-1}\left(\frac{x}{a}\right)$

3) $x\log\left(a^2+x^2\right)-2x+2a\tan^{-1}\left(\frac{x}{a}\right)$

4) $x^2\log\left(a^2+x^2\right)+2x-a^2\tan^{-1}\left(\frac{x}{a}\right)$

Key: 3

Sol: $\int\frac{\log\left(a^2+x^2\right)}{f(x)}.\frac{1}{g(x)}dx$

$$=\log\left(a^2+x^2\right).x-\int\frac{1}{\left(a^2+x^2\right)}2x^2dx$$

$$=\log\left(a^2+x^2\right).x-2\int\frac{a^2+x^2-a^2}{\left(a^2+x^2\right)}dx$$

$$x.\log\left(a^2+x^2\right)+2x-a^2\tan^{-1}(x/a)+C$$

75. For x>0, if $\int(\log x)^5 dx =$

$x\left[A(\log x)^5 + B(\log x)^4 + C(\log x)^3 + D(\log x)^2 + E(\log x) + F\right] +$ **constant, then**

$A+B+C+D+E+F=$

1) -44 2) -42 3) -40 4) -36

Key: 1

Sol: $\int(\log x)^5\, dx$

$= x\left[(\log x)^5 - (\log x)^4 + 20(\log x)^3 - 60(\log x)^2 + 120(\log x) - 120\right] + C$

$A = 1, B = -5, C = 20, D = -60, E = 120, F = -120$

$A+B+C+D+E+F = -44$

76. The area included between the parabola $y = \dfrac{x^2}{4a}$ and the curve $y = \dfrac{8a^3}{(x^2+4a^2)}$ is

1) $a^2\left(2\pi + \dfrac{2}{3}\right)$ 2) $a^2\left(2\pi - \dfrac{8}{3}\right)$ 3) $a^2\left(\pi + \dfrac{4}{3}\right)$ 4) $a^2\left(2\pi - \dfrac{4}{3}\right)$

Key: 4

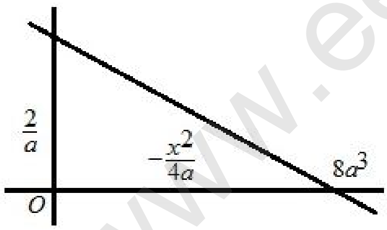
Sol: $x = 4ay,\ y = \dfrac{8a^3}{(x^2+4a^2)}$

$x^4 + 4a^2x^2 = 32a^4$

$x^4 + 4a^2x^2 - 32a^4 = 0$

$(x^2+8a^2)(x^2-4a^2) = 0$

$n = \pm 2a$



$$A = \int_0^{2a}\left(\frac{8a^3}{x^2+4a^2} - \frac{x^2}{4a}\right)dx$$

$$= 16a^3 \times \frac{1}{2a}\tan^{-1}\left(\frac{x}{2a}\right]_0^{2a} - \frac{1}{6a}x^3\Big]_0^{2a}$$

$$8a^2\left(\frac{\pi}{4}\right) - \frac{1}{6a}(8a^3)$$

$$= 2a^2\pi - \frac{4}{3}a^2$$

$$= a^2\left(2\pi - \frac{4}{3}\right)$$

77. By the definition of the definite integral, the value of

$$\underset{n\to\infty}{Lim}\left(\frac{1}{\sqrt{n^2-1}}+\frac{1}{\sqrt{n^2-2^2}}+...+\frac{1}{\sqrt{n^2-(n-1)^2}}\right)$$ **is equal to**

1) π 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{4}$ 4) $\frac{\pi}{6}$

Key: 2

Sol: $\underset{x\to\infty}{Lt}\left(\sum_{r=1}^{n-1}\frac{1}{\sqrt{n^2-r^2}}\right)$

$\underset{x\to\infty}{Lt}\left(\frac{1}{n}\right)\sum_{r=1}^{n-1}\frac{1}{\sqrt{1-(r/n)^2}}$

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

$=\left(\sin^{-1}x\right)_0^1$

$=\pi/2$

78. $\int_{\frac{-\pi}{4}}^{\frac{\pi}{4}}\left(\frac{x+\frac{\pi}{4}}{2-\cos 2x}\right)dx=$

1) $\frac{8\pi\sqrt{3}}{5}$ 2) $\frac{2\pi\sqrt{3}}{9}$ 3) $\frac{4\pi^2\sqrt{3}}{9}$ 4) $\frac{\pi^2}{6\sqrt{3}}$

Key: 4

Sol: $I=\frac{\pi}{4}\int_{\frac{-\pi}{4}}^{\frac{\pi}{4}}\frac{1}{2-\cos 2x}dx$ $put\tan x=t$ $dx=\frac{dt}{1+t^2}$

$=2\times\frac{\pi}{4}\int_0^{\frac{\pi}{4}}\frac{1}{2-\cos 2x}dx$ $\cos 2x=\frac{1-t^2}{1+t^2}$

$=\frac{\pi}{2}\int_0^1\frac{1}{3t^2+1}dt$

$=\frac{\pi}{2\sqrt{3}}\times\frac{\pi}{3}=\frac{\pi}{6\sqrt{3}}$

79. The solution of the differential equation $\left(1+y^2\right)+\left(x-e^{\tan^{-1}y}\right)\frac{dy}{dx}=0$, is

1) $xe^{\tan^{-1}y}=\tan^{-1}y+c$

2) $xe^{2\tan^{-1}y}=e^{-\tan^{-1}y}+c$

3) $2xe^{\tan^{-1}y}=e^{2\tan^{-1}y}+c$

4) $x^2e^{\tan^{-1}y}=4e^{2\tan^{-1}y}+c$

(C is an arbitrary constant)

Key: 3

Sol: $\frac{dx}{dy}=\frac{e^{\tan^{-1}y}-x}{\left(1+y^2\right)}$

$\Rightarrow \frac{dx}{dy}+\frac{x}{(1+5)}=\frac{e^{\tan^{-1}y}}{\left(1+y^2\right)}$

This is L.D.E is x

I.F = $\frac{e^{\tan^{-1}y}}{\left(1+y^2\right)}$

Solution is

$x.e^{\tan^{-1}y}=\int\frac{e^{\tan^{-1}}y}{(1+y)^2}.e^{\tan^{-1}}y.dy$

$=\frac{\left(e^{\tan^{-1}y}\right)^2}{2}+C$

$\Rightarrow 2x.e^{\tan^{-1}y}=e^{2\tan^{-1}y}+C$

80. The solution of the differential equation $(2x-4y+3)\frac{dy}{dx}+(x-2y+1)=0$ is

1) $\log((2x-4y)+3)=x-2y+c$

2) $\log\left[2(2x-4y)+3\right]=2(x-2y)+c$

3) $\log\left[2(x-2y)+5\right]=2(x+y)+c$

4) $\log\left[4(x-2y)+5\right]=4(x+2y)+c$

(C is an arbitrary constant)

Key: 4

Sol: Put $x-2y=z$

$1-2\frac{dy}{dx}=\frac{dz}{dx}$

$2\frac{dy}{dx}=1-\frac{dz}{dx}$

$\frac{dy}{dx}=\frac{1}{2}\left(1-\frac{dz}{dx}\right)$

PHYSICS

81. Math the list -I with list -II

List -I	List -II
A) Boltzman constant	I) $ML^{O}T^{O}$
B) Coefficient of viscosity	II) $ML^{-1}T^{-1}$
C) Water equivalent	III) $MLT^{-3}K^{-1}$
D) Coefficient of thermal conductivity	IV) $ML^{2}T^{-2}K^{-1}$

The correct match in the following is

1) A-III;B-I;C-II;D-IV
2) A-III;B-II;C-I;D-IV
3) A -IV;B-II;C-I;D-III
4) A-IV;B-I;C-II;D-III

Key: 3

Sol: . $A-IV, B-II, C-I, D-III$

$PV = NKT$

$$K = \frac{PV}{NT} = \frac{M^1L^2T^2}{K^1} = M^1L^2T^{-2}K^{-1}$$

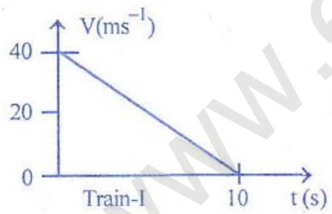
$$\eta = \frac{\tan gential\ stress}{vel\ gradient} = \frac{M^1L^{-1}T^{-2}}{T^{-1}} = M^1L^{-1}T^{-1}$$

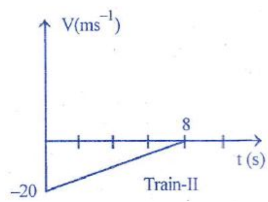
Water equivalent $W = mass = M^1$

Coefficient of thermal conductivity $K = \dfrac{Qd}{At\Delta\theta}$

$= M^1L^1T^{-3}K^{-1}$

82. Two trains, which are moving along different tracks in opposite directions are put on the same trck by mistake. On noticing the mistake,when the trains are 300 m apart the drivers start slowing down the trains. The graphs given below show decreases in their velocities as function of time.The separation between the trains when both have stopped is





1) 120 m
2) 20 m
3) 60 m
4) 280 m

Key: 2

Sol: Area under V-t graph = displacement

Distance travelled by first train

$$= \frac{1}{2} \times 40 \times 10 = 200\,m$$

Distance travelled by second train

$$= \frac{1}{2} \times 20 \times 8 = 80\,m$$

The separation between the trains when they have stopped

$= 300\,m - 200\,m - 80\,m = 20m$

83. A point object moves along an arc of a circle of radius 'R' .Its velocity depends upon the distance convered 'S' as $V = K\sqrt{S}$ where 'K' is a constant. If 'θ' is the angle between the total acceleration and tangential acceleration, then

1) $\tan\theta = \sqrt{\frac{S}{R}}$ 2) $\tan\theta = \sqrt{\frac{S}{2R}}$ 3) $\tan\theta = \frac{S}{2R}$ 4) $\tan\theta = \frac{2S}{R}$

Key : 4

Sol : $V = K\sqrt{s}$

$$\tan\theta = \frac{a_r}{a_t} = \frac{V^2}{R\left(\frac{dv}{dt}\right)}$$

$$a_t = \frac{dv}{dt} = \frac{dv}{ds}\times\frac{ds}{dt} = \frac{vdv}{ds} = k\sqrt{s}\times k\times\frac{1}{2\sqrt{s}} = \frac{K^2}{2}$$

$$\therefore \tan\theta = \frac{v^2}{R\times\frac{k^2}{2}} = \frac{2v^2}{k^2R}$$

$$\tan\theta = \frac{2}{k^2R}\times k^2s = \frac{2s}{R}$$

84. A body projected from the ground reaches a point 'X' in its path after 3 seconds and from there it reaches the ground after further 6 seconds. The vertical distance of the point 'X' from the ground is (acceleration due to gravity $=10ms^{-2}$)

1) 30 m 2) 60 m 3) 80 m 4) 90 m

Key : 4

Sol :

Time of flight = T = 9s

$$\frac{2u}{g} = T = 9s$$

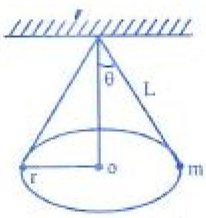
$$u = \frac{90}{2} = 45\,m/s$$

$$h = ut - \tfrac{1}{2}gt^2$$

$$h = (45)(3) - \tfrac{1}{2}\times10\times9$$

$= 90m$

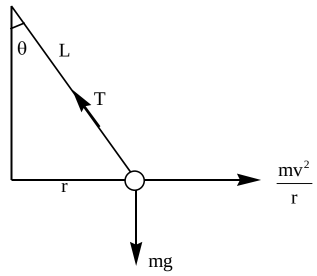
85. A particle of mass 'm' is suspended from a ceiling through a string of lengtgh 'L' If the particle moves in a horizontal circle of radius 'r' as shown in the figure, then the speed of the particle is



1) $r\sqrt{\frac{g}{\sqrt{L^2-r^2}}}$ 2) $g\sqrt{\frac{r}{\sqrt{L^2-r^2}}}$ 3) $r\sqrt{\frac{g}{L^2-r^2}}$ 4) $g\sqrt{\frac{r}{L^2-r^2}}$

Key : 1

Sol :



$$T\cos\theta = mg$$

$$T\sin\theta = \frac{mv^2}{r}$$

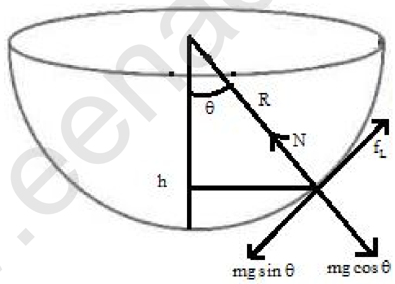
$$\tan\theta = \frac{v^2}{rg}$$

$$v = \sqrt{rg\tan\theta}$$

$$v = \sqrt{rg\frac{r}{\sqrt{L^2 - r^2}}} = \sqrt{\frac{gr^2}{\sqrt{L^2 - r^2}}}$$

86. A particle is placed at rest inside a hollow hemisphere of radius 'R' .The co-efficient of friction between the particle and the hemisphere is $\mu = \frac{1}{\sqrt{3}}$ .The maximum height upto which the particle can remain stationary is

1) $\frac{R}{2}$ 2) $\left(1 - \frac{\sqrt{3}}{2}\right)R$ 3) $\frac{\sqrt{3}}{2}R$ 4) $\frac{3R}{8}$



Key : 2

Sol : At maximum height

$$f_L = mg\sin\theta = \mu N = \mu mg\cos\theta$$

$$\tan\theta = \mu$$

$$\tan\theta = 1/\sqrt{3}$$

$$\Rightarrow \theta = 30^0$$

$$\cos\theta = \frac{R - h}{R}$$

$$\frac{\sqrt{3}}{2} = \frac{R - h}{R}$$

$$h = R\left(\frac{2 - \sqrt{3}}{2}\right)$$

87. A 1 kg ball moving with a speed of 6ms^{-1} collides head-on with a 0.5 kg ball moving in the opposite direction with a speed of 9 ms^{-1}. If the co-efficient of restritution is $\frac{1}{3}$, the energy lost in the collision is

1) 303.4 J 2) 66.7 J 3) 33.3 J 4) 67.8 J

Key : 3

Sol :

$$\Delta KE = \frac{1}{2}\left(\frac{m_1 m_2}{m_1 + m_2}\right)(u_1 - u_2)^2 (1 - e^2)$$

$$\Delta KE = \frac{1}{2} \times \left(\frac{\frac{1}{2}}{3/2}\right) \times (15)^2 \times \left(1 - \frac{1}{9}\right)$$

$= 33.3\,J$

88. A ball is thrown vertically down from a height of 40 m from the ground with an initial velocity 'v'. The ball hits the ground, loses $\frac{1^{rd}}{3}$ of its total mechanical energy and rebounds back to the same height. If the acceleration due to gravity is $10\,\text{ms}^{-2}$, the value of 'v' is

1) $5\,\text{ms}^{-1}$ 2) $10\,\text{ms}^{-1}$ 3) $15\,\text{ms}^{-1}$ 4) $20\,\text{ms}^{-1}$

Key : 4

Sol: $\frac{2}{3}\left(\frac{1}{2}mv^2 + mgh\right) = mgh$

$$\frac{v^2}{2} + gh = \frac{3}{2}gh$$

$$v = \sqrt{gh}$$

$$= \sqrt{10 \times 40} = 20\ m/s$$

89. Three identical uniform thin metal rods form the three sides of an equilateral triangle. If the moment of inertia of the system of these three rods about an axis passing through the centroid of the triangle and perpendicular to the plane of the triangle is 'n' times the moment of inertia of one rod separately about an axis passing through the centre of the rod and perpendicular to its length, the value of 'n' is

1) 3 2) 6 3)9 4) 12

Key : 2

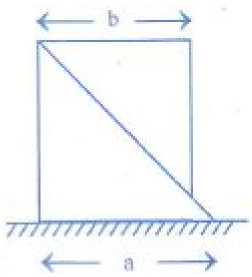
Sol : $I_1 = nI_0$

$$3\left(\frac{ml^2}{12} + m(r^2)\right) = n\left(\frac{ml^2}{12}\right)$$

$$3\left(\frac{ml^2}{12} + m\frac{l^2}{12}\right) = n\left(\frac{ml^2}{12}\right)$$

$n = 6$

90. Two smooth and similar right angled prisms are arranged on a smooth horizontal plane as shown in the figure. The lower prism has a mass '3' times the upper prism. The prisms are held in an initial position as shown and are then released. As the upper prism touches the horizontal plane, the distance moved by the lower prism is



1) $a-b$ 2) $\frac{a-b}{3}$ 3) $\frac{b-a}{2}$ 4) $\frac{a-b}{4}$

Key : 4

Sol : momentum of upper prism in the right direction= momentum of lower prism in the left direction

$$\frac{m(a-b-x)}{t}$$

$$=3m\frac{x}{t}$$

$$(a-b)=4x$$

$$x=\frac{a-b}{4}$$

91. A Particle is executing simple harmonic motion with an amplitude of 2 m. The difference in the magnitudes of its maximum acceleration and maximum velocity is 4. The time period of its oscillation and its velocity when it is 1 m away from the mean positiion are respectively.

1) $2s, 2\sqrt{3}\,ms^{-1}$ 2) $\frac{7}{22}s, 4\sqrt{3}\,ms^{-1}$ 3) $\frac{22}{7}s, 2\sqrt{3}ms^{-1}$ 4) $\frac{44}{7}s, 4\sqrt{3}ms^{-1}$

Key ; 3

Sol : $a_{max} - v_{max} = 4$

$$\omega^2 A - \omega A = 4$$

$$\omega^2 \times 2 - \omega \times 2 = 4$$

$$\Rightarrow \omega = 2$$

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

$$T = \pi = \frac{22}{7}\text{sec}$$

$$v = \omega\sqrt{A^2 - y^2} = \frac{2\pi}{T}\sqrt{2^2 - 1^2}$$

$$v = 2\sqrt{3}\, m/s$$

92. Two bodies of masses 'm' and '9m' are placed at a distance 'r'. The gravitational potential at a point on the line joining them, where gravitational field is zero, is (G is universal gravitational constant)

1) $\frac{-14Gm}{r}$ 2) $\frac{-16Gm}{r}$ 3) $\frac{-12Gm}{r}$ 4) $\frac{-8Gm}{r}$

Key :2

Sol : Let x be the distance from n where gravitational field is zero

$$\Rightarrow \frac{Gm}{x^2} = \frac{G(9m)}{(r-x)^2}$$

$$x = r/4$$

$$\text{Potential} = -\frac{Gm}{x} - \frac{G(9m)}{r-x}$$

$$= \frac{-Gm}{\left(r/4\right)} - \frac{9Gm}{\left(\frac{3r}{4}\right)}$$

$$= \frac{-4Gm}{r} - \frac{12Gm}{r}$$

$$= -\frac{16Gm}{r}$$

93. When a load of 80 N is suspended from a string,its length is 101 mm. If a load of 100 N is suspended, its length is 102 mm. If a load of 160 N is suspended from it, then length of the string is (Assume the area of cross-section unchanged)

1) 15.5 cm 2) 13.5 cm 3) 16.5 cm 4)10.5 cm

Key : 4

Sol : Load α extension

Let initial length of string = l_0

$$80 = k(101 - 1_0)$$

$$100 = k(102 - 1_0)$$

$$l_0 = 97mm$$

$$160 = k(l - 97)$$

$$80 = k(l01 - 97)$$

$$l = 105mm = 10.5cm$$

94. A sphere of material of relative density 8 has a concentric spherical cavity and just sinks in water. If the radius of the sphere is 2 cm, then the volume of the cavity is

1) $\frac{76}{3}cm^3$ 2) $\frac{79}{3}cm^3$ 3) $\frac{82}{3}cm^3$ 4) $\frac{88}{3}cm^3$

Key : 4

Sol : Weight of sphere = Buoyant force

$$\rho_s \times \frac{4}{3}\pi\left(R^3 - r^3\right)\times g = \rho_w \times \frac{4}{3}\pi R^3 \times g$$

$$\frac{\rho_s}{\rho_w}\left(R^3 - r^3\right) = R^3$$

$$1-\left(\frac{r}{R}\right)^3 = \frac{\rho_w}{\rho_s} = \frac{1}{8}$$

$$r = 7^{1/3}\,cm$$

$$\text{volume of cavity} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3}\times\frac{22}{7}\times 7 = \frac{88}{3}\,cm^3$$

95. A hunter fired a metallic bullet of mass 'm' kg from a gun towards an obstacle and it just melts when it is stopped by the obstacle. The initial temperature of the bullet is 300 K . If $\frac{1^{th}}{4}$ of heat is absorbed by te obstacle, then the minimum velocity of the bullet is

[Melting point of bullet = 600 K,

Specific heat of bullet =0.03 cal $g^{-1}\ {}^{o}C^{-1}$,

Latent heat of fusion of bullet = 6 cal g^{-1}]

1) $410\,ms^{-1}$ 2) $410\,ms^{-1}$ 3) $460\,ms^{-1}$ 4) $310\,ms^{-1}$

Key :1

Sol : $\frac{3}{4}\times\Delta KE = ms\Delta t + mL$

$$\frac{3}{4}\times\frac{1}{2}mv^2 = ms\,\Delta t + mL$$

$$V = \sqrt{\frac{8}{3}s\Delta t + \frac{8}{3}L}$$

$$V = \sqrt{\frac{8}{3}\times 0.03\times 4200\times 300 + \frac{8}{3}\times 6\times 4200} = 410 ms^{-1}$$

96. 'M' kg of water at 't' ${}^{0}C$ is divided into two parts so that one part of mass 'm' kg when conveted into ice at $0^{0}C$ would release enough heat to vapourise the other part, then $\frac{m}{M}$ is equal to

[Specific heat of water = 1 cal $g^{-1}\ {}^{0}C^{-1}$

Latent heat of funsion of ice = 80 cal g^{-1}

Latent heat of steam = 540 cal g^{-1}]

1) $640 - t$ 2) $\frac{720-t}{640}$ 3) $\frac{640+t}{720}$ 4) $\frac{640-t}{720}$

Key : 4

Sol : Heat lost by ice = heat gained by water

$$1000\times m\times 1\times t+(1000\times m)\times 80=(M-m)\times 1000\times 1\times(100-t)+(M-m)\times 1000\times 540$$

$$\frac{M-m}{m}=\frac{80+t}{640-t}$$

$$\frac{m}{M}=\frac{640-t}{720}$$

97. A diatomic gas $(\gamma=1.4)$ does 300 J work when it is expanded isobarically. The heat given to the gas in this process is

1) 1050 J 2) 950 J 3) 600 J 4) 550 J

Key : 1

Sol : For isobaric process

$$Q:\Delta U:W=n\,C_p\Delta T:nC_v\Delta T:nR\Delta T$$

$$\Rightarrow \frac{W}{Q}=\frac{2}{7}\ \frac{W}{Q}=\frac{R}{C_P}=\frac{\gamma-1}{\gamma}=\frac{1.4-1}{1.4}=\frac{2}{7}$$

$$Q=\frac{7}{2}W=\frac{7}{2}\times 300=1050\,J$$

98. When the absolute temperature of the source of a Carnot heat engine is increased by 25% its efficiency increases by 80% .The new efficiency of the engine is

1) 12% 2) 24% 3) 48% 4) 36%

Key :4

Sol : $\eta=1-\frac{T_2}{T_1}$

$$1.8\eta=1-\frac{4T_2}{5T_1}$$

$$1.8\eta=1-\frac{4}{5}(1-\eta)$$

$$1.8\eta=1-\frac{4}{5}+\frac{4}{5}\eta$$

$$1.8\eta-0.8\eta=\frac{1}{5}$$

$$\eta=\frac{1}{5}$$

$\therefore$ new effieiency $=1.8\times\frac{1}{5}$

$=36\%$

99. A cylinder of fixed capacity 67.2 litres contains helium gas at STP. The amount of heat needed to rise the temperature of the gas in the cylinder by 20^0C is $\left(R=8.31Jmol^{-1}K^{-1}\right)$

1) 748 J 2) 374 J 3) 1000 J 4) 500 J

Key : 1

Sol : $dQ = du = nC_v dT$

$= 3 \times \frac{3R}{2} \times dT$

$= \frac{9 \times 8.31}{2} \times 20$

$\simeq 748J$

100. For a certain organ pipe, three successive resonance frequencies are observed at 425,595 and 765 Hz, respectively. The length of the pipe is (speed of sound in air = 340 ms^{-1})

1) 0.5 m 2) 1 m 3) 1.5 m 4) 2 m

Key : 2

Sol : frequencies are in the ratio

$5:7:9$

$\Rightarrow$ closed pipe

Fifth harmonic frequency of the closed pipe $\frac{5v}{4l} = 425$

$l = 1m$

101. A student holds a tuning fork oscillating at 170 Hz. He walks towards a wall at a constant speed of 2 ms^{-1}. The beat frequency observed by the student between the tuning fork and its echo is (Velocity of sound = 342 ms^{-1})

1) 2.5 Hz 2) 3 Hz 3) 1 Hz 4) 2 Hz

Key : 4

Sol : $n_1 = n\left(\frac{v+v_0}{v-v_s}\right)$

here $v_s = v_0 = 2\, m/s$

$n_1 = 172Hz$

beat frequency $\Delta n = n_1 - n_2$

$= 172 - 170$

$= 2Hz$

102. An infinitely long rod lies along the axis of a concave mirror of focal length 'f'. The nearer end of the rod is at a distance u, (u>f) from the mirror. It's image will have a length

1) $\frac{uf}{u+f}$ 2) $\frac{uf}{u-f}$ 3) $\frac{f^2}{u+f}$ 4) $\frac{f^2}{u-f}$

Key : 4

Sol : Image of near end :

$\frac{1}{f} = \frac{1}{v_1} + \frac{1}{u}$

$\frac{1}{-f} = \frac{1}{v_1} - \frac{1}{u}$

$\frac{1}{v_1}=\frac{1}{u}-\frac{1}{f}$

$v_1=\frac{uf}{f-u}$

Image of infinity end. forms at the focus of the mirror $v_2=f$

Length of the image $=v_1-v_2$

$\frac{uf}{f-u}-f$

$\frac{f^2}{f-u}$

103. In Young's double slit experiment, red light of wavelength 6000 A is used and the n^{th} bright fringe is obtained at a point 'P' on the screen. Keeping the same setting, the source of light is replaced by green light of wavelength 5000 A and now $(n+1)^{th}$ bright fringe is obtained at the point P on the screen. The value of 'n' is

1) 4 2) 5 3) 6 4) 3

Ans: 2

Sol : When bright fringes are coinsiding at a point on screen

$n_1\beta_1=n_2\beta_2$

$n_1\frac{D}{d}\lambda_1=n_2\frac{D}{d}\lambda_2$

$n_1\lambda_1=n_2\lambda_2$

$n\,\lambda_{longer}=(n+1)\,\lambda_{shorter}$

$n\times 6000=(n+1)5000$

$6n=5n+5$

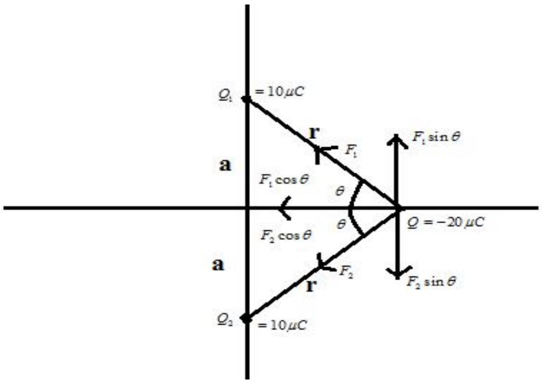
$n=5$

104. Two charges each of charge + 10 μc are kept on Y-axis y=-a and y=+a respectively. Another point charge - 20 μc is placed at the origin and given a small displacement $x\,(x<<a)$ along X-axis. The force acting on the point charge is $\left(x\,and\,a\,are\,in\,metres,\frac{1}{4\pi\in_0}=9\times10^9\,Nm^2C^{-2}\right)$

1) $\frac{3.6x}{a^2}N$ 2) $\frac{2.4x^2}{a}N$ 3) $\frac{3.6x}{a^3}N$ 4) $\frac{4.8x}{a^2}N$

Ans : 3

Sol :



$$F_1 = \frac{1}{4\pi \in_0}\frac{Q_1 Q}{r^2}; F_2 = \frac{1}{4\pi \in_0}\frac{Q_2 Q}{r^2}$$

$$as\ Q_1 = Q_2$$

$$F_1 = F_2 = \frac{1}{4\pi \in_0}\frac{Q_1 Q}{r^2}$$

$$Q_1 = 10\times 10^{-6} C; Q = 20\times 10^{-6} C$$

$$r = \sqrt{x^2 + a^2} : \frac{1}{4\pi \in_0} = 9\times 10^9$$

$$\therefore F_1 = 9\times 10^9 \times \frac{10\times 10^{-6}\times 20\times 10^{-6}}{\left(\sqrt{x^2+a^2}\right)^2}$$

$$= \frac{18\times 10^{-1}}{\left(x^2+a^2\right)} N = \frac{1.8}{\left(x^2+a^2\right)} N$$

But resultant vertical force is zero

as $F_1 \sin\theta$ upwards is balanced by $F_2 \sin\theta$ downwards

But horizontal force $= 2F_1 \cos\theta$

$$\therefore F_{net} = 2F_1 \cos\theta = 2\times \frac{1.8}{\left(x^2+a^2\right)}\frac{x}{\sqrt{x^2+a^2}}$$

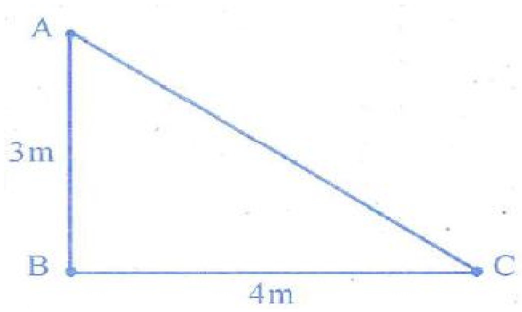
$$F_{net} = \frac{3.6x}{\left(x^2+a^2\right)^{3/2}}$$

as $x << a \quad x^2 + a^2 \simeq a^2$

$$\therefore F_{net} = \frac{3.6x}{\left(a^2\right)^{3/2}}$$

$$F_{net} = \frac{3.6x}{a^3}$$

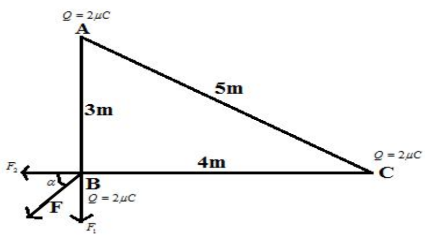
105.Three idential charges, each 2 μC lie at the vertices of a right angled triangle as shown in the figure. Forces on the charge at B due to the charges at A and C respectively are F_1 and F_2. The angle between their resultant force and F_2 is



1) $\tan^{-1}\left(\frac{9}{16}\right)$ 2) $\tan^{-1}\left(\frac{9}{7}\right)$ 3) $\tan^{-1}\left(\frac{16}{9}\right)$ 4) $\tan^{-1}\left(\frac{7}{9}\right)$

Ans : 3

Sol :



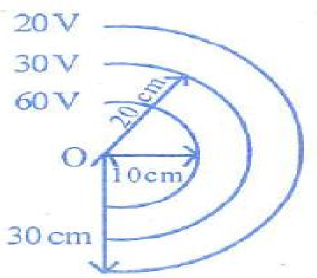
$$F_1 = \frac{1}{4\pi \in_0}\frac{QQ}{3^2}$$

$$F_2 = \frac{1}{4\pi \in_0}\frac{QQ}{4^2}$$

$$\tan\alpha = \frac{F_1}{F_2} \Rightarrow \tan\alpha = \frac{4^2}{3^2} = \frac{16}{9}$$

$$\therefore \alpha = \tan^{-1}\left(\frac{16}{9}\right)$$

106. The figure shows equipotential surfaces concentric at 'O'. The magnitude of electric field at a distance 'r' meters from 'O' is



1) $\frac{9}{r^2}Vm^{-1}$ 2) $\frac{16}{r^2}Vm^{-1}$ 3) $\frac{2}{r^2}Vm^{-1}$ 4) $\frac{6}{r^2}Vm^{-1}$

Ans : 4

Sol : Equipotential surface are spheres

They are due to positive point change

$$\frac{Q}{4\pi \in_0 (0.1)} = 60$$

$$\frac{Q}{4\pi \in_0} = 6$$

$$E = \frac{Q}{4\pi \in_0 r^2} = \frac{6}{r^2}$$

$$\therefore E = \frac{6}{r^2} Vm^{-1}$$

107. A region contains a uniform electric field $\vec{E} = \left(10\hat{i} + 30\hat{j}\right) Vm^{-1}$. A and B are two points in the field at (1, 2, 0) m and (2, 1, 3) m respectively. The work done when a charge of 0.8 C moves from A to B in a parabolic path is

1) 8 J 2) 80 J 3) 40 J 4) 16 J

Ans : 4

Sol : $\vec{E} = \left(10\hat{i} + 30\hat{j}\right) Vm^{-1}; q = 0.8C$

$$\vec{r_1} = \hat{i} + 2\hat{j}; \vec{r_2} = 2\hat{i} + \hat{j} + 3\hat{k}$$

$$\vec{r} = \vec{r_2} - \vec{r_1} = \hat{i} - \hat{j} + 3\hat{k}$$

$$w = \vec{F}.\vec{r} = \overrightarrow{Eq}.\vec{r}$$

$$= q\vec{E}.\vec{r}$$

$$= 0.8\left(10\hat{i} + 30\hat{j}\right)\left(\hat{i} - \hat{j} + 3\hat{k}\right)$$

$$= 0.8(10 - 30) = 0.8 \times -20$$

= -16 J

w=16 J

108. When a long straight uniform rod is connected across an ideal cell, the drift velocity of electrons in it is v. If a uniform hole is made along the axis of the rod and the same battery is used, then the drift velocity of electrons becomes

1) v 2) >v 3) <v 4) zero

Ans : 1

Sol : $i = NAeV_d$

$$But\ i = \frac{E}{R}$$

E is emf of cell

R is resistance of wire
N is free electron density
ρ is resistivity

$$i = \frac{EA}{\rho l}$$

$$\frac{EA}{\rho l} = NAeV_d$$

$$V_d = \frac{E}{\rho l Ne}$$

as E, ρ , l ,N, e are same in

V_d does not change due to uniform hole

$\therefore$ Before and after making hole drift velocity is V

109. In a meter bridge experiment, when a nichrome wire is in the right gap, the balancing length is 60 cm. When the nichrome wire is uniformly stretched to increase its length by 20% and again connected in the right gap, the new balancing length is nearly

1) 61 cm 2) 31 cm 3) 51 cm 4) 41 cm

Ans : 3

Sol : $\frac{R_{left}}{R_{right}} = \frac{l}{100-l}$

$$\frac{R_l}{R_r} = \frac{60}{100-60} \Rightarrow \frac{R_l}{R_r} = \frac{3}{2}$$

When wire is stretched
Volume before stretcher= volume after stretching

$$A_1 l_1 = A_2 l_2 \Rightarrow \frac{A_1}{A_2} = \frac{l_2}{l_1}$$

$$R = \frac{\rho l}{A}; R\alpha \frac{l}{A}$$

$$\frac{R_1}{R_2} = \frac{l_1}{l_2}\frac{A_2}{A_1}; \frac{R_1}{R_2} = \frac{l_1}{l_2}\frac{l_1}{l_2}$$

$$\frac{R_1}{R_2} = \left(\frac{l_1}{l_2}\right)^2$$

$$l_2 = l_1 + \frac{20}{100}l_1 = \frac{120}{100}l_1 = \frac{6}{5}l_1$$

$$\therefore \frac{R_1}{R_2} = \left(\frac{5l_1}{6l_1}\right)^2$$

$$\frac{R_1}{R_2} = \frac{25}{36} \Rightarrow R_2 \frac{36}{25} R_1$$

In right gap initially resistance is R_r and after stretching resistance is $R_r^{'} = \frac{36}{25} R_r$

$$\therefore \frac{R_l}{R_r^{'}} = \frac{l^{'}}{100 - l^{'}}$$

$$\frac{R_l}{\left(\frac{36}{25} R_r\right)} = \frac{l^{'}}{100 - l^{'}} \Rightarrow \frac{25}{36}\left(\frac{R_l}{R_r}\right) = \frac{l^{'}}{100 - l^{'}}$$

$$\frac{25}{36} \times \frac{3}{2} = \frac{l^{'}}{100 - l^{'}}$$

$$\frac{25}{24} = \frac{l^{'}}{100 - l^{'}}$$

$$2500 - 25l^{'} = 24l^{'}$$

$$49l^{'} = 2500$$

$$l^{'} = 51.02\, cm$$

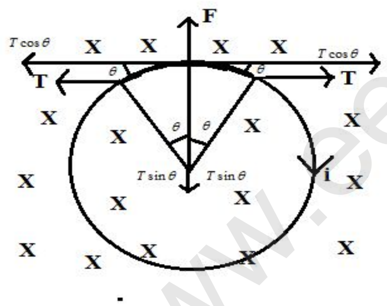
$$l^{'} = 51 cm$$

110. A loop of flexible conducting wire lies in a magnetic field of 2.0 T with its plane perpendicular to the field. The length of the wire is 1 m. When a current of 1.1 A is passed through the loop, it opens into a circle, then the tension developed in the wire is

1) 0.15 N 2) 0.25 N 3) 0.35 N 4) 0.45 N

Ans : 3

Sol : B = 2T ; l = 1m ; i = 1.1 A



Consider small part of circle of length dl making an angle 2θ at the centre

Force due to magnetic field on the small element of $= F = Bidl$

This force is balanced by $2T\sin\theta$

$$2T\sin\theta = Bidl$$

when θ is small $\sin\theta = \theta$

$$2T\theta = Bi\left(R2\theta\right) \Rightarrow T = Bi\,R$$

But $l = 2\pi R \Rightarrow R = \frac{l}{2\pi}; T = Bi\frac{l}{2\pi} = 2 \times 1.1 \times \frac{1}{2 \times \frac{22}{7}}$

T = 0.35 N

111. A charge q is spread uniformly over an isolated ring of radius $'R'$. The ring is rotated about its natural axis with an angular velocity $'\omega'$. Magnetic dipole moment of the ring is

1) $\frac{q\omega R^2}{2}$ 2) $\frac{q\omega R}{2}$ 3) $q\omega R^2$ 4) $\frac{q\omega}{2R}$

Ans : 1

Sol : Due to rotation of uniformely charged ring electric current is i

$i = \frac{q}{T}$ where T is time period

$$i = \frac{q}{\left(\frac{2\pi}{\omega}\right)} \Rightarrow i = \frac{q\omega}{2\pi}$$

Magnetic dipole moment of a ring = i A

$$= \frac{q\omega}{2\pi} \times \pi R^2$$

$$= \frac{1}{2} q\omega R^2$$

112. A magnetic dipole of moment 2.5 Am^2 is free to rotate about a vertical axis passing through its centre. It is released from East-West direction. Its kinetic energy at the moment it takes North - South position is $\left(B_H = 3\times10^{-5}T\right)$.

1) $50\,\mu J$ 2) $100\,\mu J$ 3) $175\,\mu J$ 4) $75\,\mu J$

Ans : 4

Sol : $M = 2.5\,Am^2$

Work done = change in KE= $KE_{final} - KE_{initial} = KE_{final}$

$$But\ work\ done = MB_H\left[\cos\theta_1 - \cos\theta_2\right]$$

$$= MB_H\left[\cos 90 - \cos 0\right]$$

$$= -MB_H$$

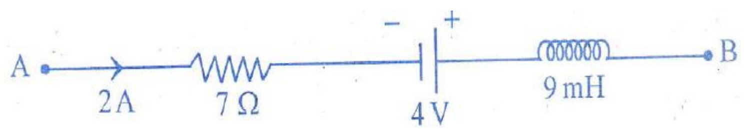
$$= 2.5\times3\times10^{-5}$$

$$= 7.5\times10^{-5}J$$

$$= 75\times10^{-6}J = 75\mu J$$

$$KE_{final} = 75\mu J$$

113. A branch of a circuit is shown in the figure. If current is decreasing at the rate of $10^3 As^{-1}$, the potential difference between A and B is



1) 1 V 2) 5 V 3) 10 V 4) 2 V

Ans : 1

Sol : $V_A - iR + \varepsilon + L\frac{di}{dt} = V_B$

$V_A - 7(2) + 4 + 9\times10^{-3}\times10^{3} = V_B$

$V_A - 1 = V_B \Rightarrow V_A - V_B = 1V$

114. The natural frequency of an LC circuit is 125 kHz. When the capacitor is totally filled with a dielectric material, the natural frequency decreases by 25 kHz. Dielectric constant of the material is nearly

1) 3.33 2) 2.12 3) 1.56 4) 1.91

Ans : 3

Sol : $\omega = \frac{1}{\sqrt{LC}}$ $f = \frac{1}{2\pi\sqrt{LC}}$

$f_1 = \frac{1}{2\pi\sqrt{LC}}; f_2 = \frac{1}{2\pi\sqrt{L(KC)}}$ $\frac{f_2}{f_1} = \frac{1}{\sqrt{k}}$

$K = \left(\frac{f_1}{f_2}\right)^2$

$\therefore K = \left(\frac{125}{100}\right)^2 = \left(\frac{5}{4}\right)^2 = \frac{25}{16} = 1.56$

115. Choose the correct sequence of the radiation sources in increasing order of the wavelength of electromagnetic waves produced by them.

1) X-ray tube, Magnetron valve, Radio active source, Sodium lamp
2) Radio active source, X-ray tube, Sodium lamp, Magnetron valve
3) X-ray tube, Magnetron valve, Sodium lamp, Radio active source
4) Magnetron valve, Sodium lamp, X-ray tube, Radio active source

Ans : 2

Sol : Conceptual

116. A photo sensitive metallic surface emits electrons when X-ray of wavelength 'λ' fall on it. The de Broglie wavelength of the emitted electrons is (Neglect the work function of the surface, m is mass of the electron. h-Planck's constant, c-velocity of light)

1) $\sqrt{\frac{2mc}{h\lambda}}$ 2) $\sqrt{\frac{h\lambda}{2mc}}$ 3) $\sqrt{\frac{mc}{h\lambda}}$ 4) $\sqrt{\frac{h\lambda}{mc}}$

Ans : 2

Sol : Energy of X-rays = energy of electron

$\frac{1}{2}mv^2 = \frac{hc}{\lambda}$

$or\ \frac{p^2}{2m} = \frac{hc}{\lambda}$

$p = \sqrt{\frac{2mhc}{\lambda}}$

De - broglie wavelength of electron

$= \lambda_e = \frac{h}{p} = \frac{h\sqrt{\lambda}}{\sqrt{2mhc}} = \sqrt{\frac{h\lambda}{2mc}}$

117. An electron in a hydrogen atom undergoes a transition from a higher energy level to a lower energy level. The incorrect statement of the following is

1) Kinetic energy of the electron increases
2) Velocity of the electron increases
3) Angular momentum of the electron remains constant
4) Wavelength of de-Broglie wave associated with the motion of electron decreases

Ans : 3

Sol : KE of electron in orbit of radius r

$$= \frac{e^2}{8\pi \in_0 r}$$

(1) when r decreases, KE increases

(2) $KE = \frac{1}{2}mv^2$

KE increases $\Rightarrow$ v increases

(3) $L = \frac{nh}{2\pi}$ n decreases $\Rightarrow$ L decreases

(4) $n\lambda = 2\pi r$

$r \alpha n^2$

$\Rightarrow \lambda \alpha n \qquad \therefore \lambda \ decreases$

In correct option is (3)

118. The radius of germanium (Ge) nuclide is measured to be twice the radius of $^9_4 Be$. The number of nucleons in Ge will be

1) 72 2) 73 3) 74 4) 75

Ans : 1

Sol : $R = R_0 A^{1/3}$

$\therefore R \alpha A^{1/3}$

$\Rightarrow A \alpha R^3$

$$\frac{A_2}{A_1} = \frac{R_2^3}{R_1^3}$$

$$\frac{R_2}{R_1} = 2$$

$$\therefore \frac{A_2}{A_1} = 8 \qquad \therefore A_2 = 8A_1 = 8 \times 9 = 72$$

119. For a common-emitter transistor amplifier, the current gain is 60. If the emitter current is 6.6 mA then its base current is

1) 6.492 mA 2) 0.108 mA 3) 4.208 mA 4) 0.343 mA

Ans : 2

Sol : Current gain $\beta = 60 = \frac{I_C}{I_B}$

$\therefore I_C = 60 I_B$

$I_C + I_B = I_E = 6.6mA$

$61 I_B = 6.6mA$

$I_B = \frac{6.6}{61} mA = 0.108mA$

120. If a transmitting antenna of height 105m is placed on hill, then its coverage area is

1) $4224\,km^2$ 2) $3264\,km^2$ 3) $6400\,km^2$ 4) $4864\,km^2$

Ans : 1

Sol : $d = \sqrt{2Rh}$

$d = \sqrt{2 \times 6400 \times 1000 \times 105}$

$d = \sqrt{1344 \times 10^6}$

$Area = \pi d^2 = \pi \times 1344 \times 10^6 m^2$

$= 4224\,km^2$

CHEMISTRY

121. In which of the following, the product of uncertainity in velocity and uncertainity in position of a micro particle of mass 'm' is not less than

1) $h \times \frac{3\pi}{m}$ 2) $\frac{h}{3\pi} \times m$ 3) $\frac{h}{4\pi} \times \frac{1}{m}$ 4) $\frac{h}{4\pi} \times m$

Key: 3

Sol: $\Delta x.\Delta p \geq \frac{h}{4\pi}$

$\Delta x.\Delta v \geq \frac{h}{4\pi m}$

not less than $\frac{h}{4\pi} \times \frac{1}{m}$.

122. An element has $[Ar]3d^1$ configuration in its +2 oxidation state. Its position in the periodic table is

1) period -3, group-3 2) period-3, group-7 3) period-4, group-3 4) period-3, group-9

Key: 3

Sol: Ground state configuration $(Ar)4s^2 3d^1$

Scandium- Sc

Period number = ultimatate shell number

$\therefore$ Period number = 4

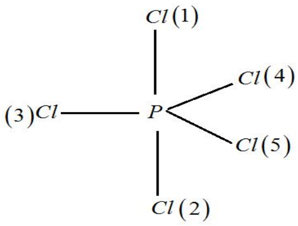
Valency electrons = 3

Group number = 3

123. In which of the following molecules all bond lengths are not equal?

1) SF_6 2) PCl_5 3) BCl_3 4) CCl_4

Key: 2

Sol: 

1, 2 - chlorines are - axial chlorines

3,4,5 - chlorines are - equitorial chlorines

Bond length $Cl_{(axial)} > Cl_{(equitorial)}$

124. In which of the following molecules maximum number of lone pairs is present on the central atom?

1) NH_3 2) H_2O 3) ClF_3 4) XeF_2

Key: 4

Sol: $NH_3 = 1 l.p$

$H_2O = 2\, l.p$

$ClF_3 = 2\, l.p$

$XeF_2 = 3\, l.p$

125. Which one of the following is the kinetic energy of a gaseous mixture containing 3 g of hydrogen and 80 g oxygen at temperature T(K)?

1) 3 RT 2) 6 RT 3) 4 RT 4) 8 RT

Key: 2

Sol: $K.E = \frac{3}{2} nRT$

$= \frac{3}{2}\left(n_{O_2} + n_{H_2}\right)RT$

$= \frac{3}{2}\left(\frac{80}{32} + \frac{3}{2}\right)RT$

$= \frac{3}{2} \times 4RT = 6RT$.

126. A, B, C and D are four different gases with critical temperatures 304.1, 154.3, 405.5 and 126.0 K respectively. While cooling the gas which gets liquified first is

1) B 2) A 3) D 4) C

Key: 4

Sol: Critical temperature $\propto$ liquification

127. 40 ml of x M $KMnO_4$ solution is required to react completely with 200 ml of 0.02 M oxalic acid solution in acidic medium. The value of x is

1) 0.04 2) 0.01 3) 0.03 4) 0.02

Key: 1

Sol: $KMnO_4$ $H_2C_2O_4$

xM 0.02 M

40 ml 200 ml

Acidic medium n- factor =5

Basic medium n- factor =2

$5\times x\times 40 = 2\times 0.02\times 200$

$x = 0.04M$.

128. Given that

$C_{(s)} + O_{2(g)} \to CO_{2(g)}; \Delta H^0 = -x\ kJ$

$2CO_{(g)} + O_{2(g)} \to 2CO_{2(g)}; \Delta H^0 = -y\ kJ$

The enthalpy of formation of CO will be

1) $\frac{y-2x}{3}$ 2) $\frac{y-2x}{2}$ 3) $\frac{2x-y}{2}$ 4) $\frac{x-y}{2}$

Key: 2

Sol: $C_{(s)} + \frac{1}{2}O_{2(s)} \to CO_{(g)}$

$C + O_2 \to CO_2 \quad \Delta H = -x$

$CO + \frac{1}{2}O_2 \to CO_2 \quad \Delta H = -\frac{y}{2}$

$-x + \frac{y}{2} \to \frac{y-2x}{2}$

129. At 400 K, in a 1.0 L vessel N_2O_4 is allowed to attain equilibrium $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$. At equilibrium the total pressure is 600 mm Hg, when 20 % of N_2O_4 is dissociated. The K_p value for the reaction is

1) 50 2) 100 3) 150 4) 200

Key: 2

Sol: $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$

1	0
1-0.2	2×0.2
0.8	0.4

Total no. of mole= 1.2

$$K_p = \frac{n^2_{NO_2}}{n_{N_2O_4}}\left(\frac{P}{\sum n}\right)^{\Delta n}$$

$$= \frac{(0.4)^2}{0.8}\left(\frac{600}{1.2}\right)^1$$

$K_p = 100$

130. In which of the following salts only cationic hydrolysis is involved?

1) CH_3COONH_4 2) CH_3COONa 3) NH_4Cl 4) Na_2SO_4

Key: 3

Sol: $CH_3COONH_4 \xrightleftharpoons{H_2O} CH_3COOH + NH_4OH$

Both undergoes hydrolysis

$CH_3COONa \xrightleftharpoons{H_2O} CH_3COOH + NaOH$

Only CH_3COOH undegoes hydrolysis

$NH_4Cl \xrightleftharpoons{H_2O} NH_4OH + HCl$

only cation undergoes hydrolysis

$Na_2SO_4 \xrightleftharpoons{H_2O} 2NaOH + H_2SO_4$

do not undergoes hydrolysis.

131. Calgon is

1) Na_2HPO_4 2) Na_3PO_4 3) $Na_6P_6O_{18}$ 4) NaH_2PO_4

Key: 3

Sol: Sodium hexa meta phosphate is called calgon

$Na_6P_6O_{18}$ or $Na_6\left(PO_3\right)_6$ or $Na_2\left[Na_4\left(PO_3\right)_6\right]$.

132. Consider the following statements

I) Cs^+ ion is more highly hydrated then other alkali metal ions

II) Among the alkali metals, only lithium forms a stable nitride by direct combination with nitrogen

III) Among alkali metals Li, Na, K, Rb, the metal, Rb has the highest melting point

IV) Among alkali metals Li, Na, K, Rb only Li forms peroxide when heated with oxygen

The correct statement is

1) I 2) II 3) III 4) IV

Key: 2

Sol: $6Li + N_2 \rightarrow 2Li_3N$.

133. Assertion (A): $AlCl_3$ exists as a dimer through halogen bridged bonds.

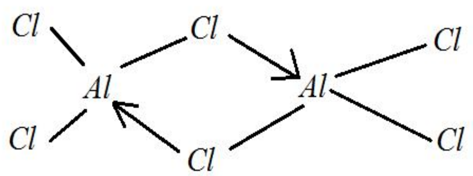
Reason (R): $AlCl_3$ gets stability by accepting electrons from the bridged halogen.

1) Both (A) and (R) are true and (R) is the correct explanation of (A)

2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

3) (A) is true, but (R) is not true 4) (A) is not true, but (R) is true.

Key: 1

Sol: 

. It exist as dimer to get stability.

134. Which of the following causes "Blue baby syndrome"

1) High concentration of lead in drinking water

2) High concentration of sulphates in drinking water

3) High concentration of nitrates in drinking water

4) High concentration of copper in drinking water

Key: 3

Sol: Conceptual

135. Which of the following belongs to the homologous series of $C_5H_8O_2N$?

1) $C_6H_{10}O_3N$ 2) $C_6H_8O_2N_2$ 3) $C_6H_{10}O_2N_2$ 4) $C_6H_{10}O_2N$

Key: 4

Sol: Homologous series means difference is CH_2 group

$$C_5H_8O_2N \xrightarrow{+CH_2} C_6H_{10}O_2N$$

136. In Dumas method, 0.3 g of an organic compound gave 45 mL of nitrogen at STP. The percentage of nitrogen is

1) 16.9 2) 18.7 3) 23.2 4) 29.6

Key: 2

Sol: $\%N = \dfrac{Volume\ of\ N_2\ at\ STP\,(ml)}{wt.\,of\ organic\ compound} \times \dfrac{28}{22400} \times 100$

$= \dfrac{45}{0.3} \times \dfrac{28}{22400} \times 100$

$= 18.75\ ml$

137. The IUPAC name of

$$(CH_3)_2CH-CH=CH-CH=CH-\underset{\displaystyle C_2H_5}{\underset{|}{CH}}-CH_3$$

1) 2, 7- dimethyl -3, 5 - nonadiene 2) 2, 7- dimethyl -2- ethylheptadiene

3) 2- methyl -7- ethyl -3, 5- octadiene 4) 1, 1- dimethyl- 6 - ethyl -2, 4- heptadiene

Key: 1

Sol: $\overset{1}{C}H_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{2}{C}H}}-\overset{3}{C}H=\overset{4}{C}H-\overset{5}{C}H=\overset{6}{C}H-\underset{\displaystyle \overset{8}{C}H_2-\overset{9}{C}H_3}{\underset{|}{\overset{7}{C}H}}-CH_3$

2, 7 dimethyl 3, 5- nonadiene

138. Match the following

List-I (magnetic property)	**List - II (substance)**
A) Ferromagnetic	**1)** O_2
B) Anti ferro magnetic	**2)** CrO_2
C) Ferri magnetic	**3) MnO**
D) Para magnetic	**4)** Fe_3O_4
	5) C_6H_6

The correct answer is

A	B	C	D
1) 3	2	4	1
2) 2	3	4	1
3) 1	3	5	4
4) 4	2	3	5

Key: 2

Sol: $CrO_2 \rightarrow$ Ferromagnetic

$MnO \rightarrow$ Anti ferro magnetic

$Fe_3O_4 \rightarrow$ Ferri magnetic

$O_2 \rightarrow$ Para magnetic

139. The vapour pressure of pure benzene and toluene are 160 and 60 mmHg respectively. The mole fraction of benzene in vapour phase in contact with equimolar solution of benzene and toluene is

1) 0.073 2) 0.027 3) 0.27 4) 0.73

Key: 4

Sol: $P_A = Y_A.P$

$$Y_A = \frac{P_A^0 X_A}{P_A^0 X_A + P_B^0 X_B} = \frac{160 \times X_A}{160 X_A + 60 X_A}$$

$= 0.66$

$$X_A = \frac{n_A}{n_A + n_B} = \frac{1}{2}$$

$$X_A = \frac{160 \times 0.5}{160 \times 0.5 + 60 \times 0.5} = \frac{160}{220} = 0.7272$$

$= 0.73$

140. 6g of a non volatile, non electrolyte X dissolved in 100 g of water freezes at $-0.93^0 C$. The molar mass of X in g mol^{-1} is $\left(K_f \ of \ H_2O = 1.86 \ K \ kg \ mol^{-1}\right)$

1) 60 2) 140 3) 180 4) 120

Key: 4

Sol: $\Delta T_f = K_f \times m$

$$0 - (-0.93) = 1.86 \times \frac{6}{M} \times \frac{1000}{100}$$

$M = 120$.

141. The products obtained at the cathode and anode respectively during the electrolysis of aqueous K_2SO_4 solution using platinum electrodes are

1) O_2, H_2 2) H_2, O_2 3) H_2, SO_2 4) K, SO_2

Key : 2

Sol. : $K_2SO_4 \longrightarrow 2K^+ + SO_4^{-2}$

$H_2O \longrightarrow H^+ + OH^{-1}$

At cathode : (Reduction)

$2H^{+} + 2e^{-} \longrightarrow H_2$

At Anode : (Oxidation)

$4OH^{-} \longrightarrow O_2 + 4e^{-} + 2H_2O$

142. The slope of the graph drawn between *l*n k and 1/T as per Arrhenius equation gives the value (R = gas constant, E_a = Activation energy)

1) $\frac{R}{E_a}$ 2) $\frac{E_a}{R}$ 3) $\frac{-E_a}{R}$ 4) $\frac{-R}{E_a}$

Key : 3

Sol. : $K = Ae^{-\in a/RT}$

$\log_{10} K = \log A - \frac{\in a}{RT}$

$\ln_e^K = \ln A - \frac{\in a}{RT}$

$\ln K = \left(\frac{-\in a}{R}\right)\frac{1}{\mathrm{T}} + \ln A$

$y = mx + c$

slope = $\frac{-\in a}{R}$

143. Which is not the correct statement in respect of chemisorption?

1) Highly specific adsorption 2) Irreversible adsorption

3) Multilayered adsorption 4) High enthalpy of adsorption

Key : 3

Sol. : Conceptual

144. Which of the following is carbonate ore?

1) Cuprite 2) Siderite 3) Zincite 4) Bauxite

Key : 2

Sol. : Cuprite $\rightarrow Cu_2O$

Sidarite $\rightarrow FeCO_3$

Zincite $\rightarrow ZnO$

Bauxite $\rightarrow Al_2O_3.2H_2O$

145. Which one of the following statements is not correct?

1) O_3 is used as germicide

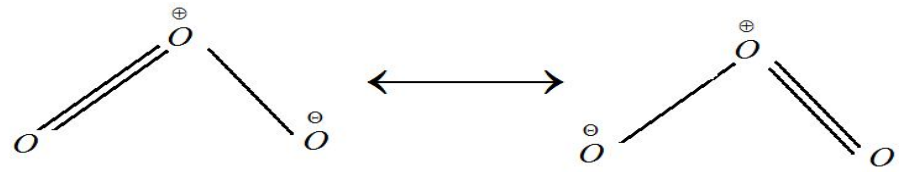
2) In O_3, O-O bond length is identical with that of molecular oxygen

3) O_3 is an oxidising agent

4) The shape of O_3 molecule is angular.

Key : 2

Sol. :



(Resonance Structures)

$O_2 \Rightarrow O = O$ (No resonance)

146. Which of the following reactions <u>does not</u> take place

1) $F_2 + 2Cl^- \rightarrow 2F^- + Cl_2$

2) $Br_2 + 2I^- \rightarrow 2Br^- + I_2$

3) $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$

4) $Cl_2 + 2F^- \rightarrow 2Cl^- + F_2$

Key : 4

Sol. : $Cl_2 + 2F^- \longrightarrow 2Cl^- + F_2$ (not feasible)

This reaction doest not take place because fluorine is strong oxidising agent (under goes reduction)

Oxidising nature : $F_2 > Cl_2 > Br_2 > I_2$

147. Which of the following statements regarding sulphur is not correct?

1) At about 1000K, it mainly consists of S_2 molecules

2) The oxidation state of sulphur is never less than +4 in its compounds

3) S_2 molecule is paramagnetic

4) Rhombic sulphur is readily soluble in CS_2

Key : 2

Sol. : It shows less than +4 oxidation

Ex : $H_2S \Rightarrow S = -2$

148. Which of the following reactions <u>does not</u> involve, liberation of oxygen?

1) $XeF_4 + H_2O \rightarrow$

2) $XeF_4 + O_2F_2 \rightarrow$

3) $XeF_2 + H_2O \rightarrow$

4) $XeF_6 + H_2O \rightarrow$

Key : 4

Sol. : $XeF_4 + H_2O \longrightarrow Xe + XeO_3 + HF + O_2$

$XeF_4 + O_2F_2 \longrightarrow XeF_6 + O_2$

$2XeF_2 + 2H_2O \longrightarrow 2Xe + 4HF + O_2$

$XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$

149. Select the <u>correct</u> IUPAC name of $[Co(NH_3)_5(CO_3)]Cl$

1) Penta ammonia carbonate cobalt (III) chloride

2) Pentammine carbonate cobalt chloride

3) Pentammine carbonato cobalt (III) chloride

4) Cobalt (III) pentammine carbonate chloride.

Key : 3

Sol. : $[\mathrm{Co(NH_3)_3(CO_3)}]\mathrm{Cl}$

Penta ammine carbonate coblat (III) chloride.

$Co \longrightarrow$ oxidation no. is 3

150. Which of the following characteristics of the transition metals is associated with their catalytic activity?

1) Colour of hydrated ions 2) Diamagnetic behaviour
3) Paramagnetic behaviour 4) Variable oxidation states

Key : 4

Sol. : Due to variable oxidation states
They exhibit different colour.

151 Observe the following polymers
(A) PHBV; (B) Nylon 2-nylon 6; (C) Glyptal; (D) Bakelite

1) (C) 2) (A), (B) 3) (D) 4) (C), (D)

Key : 2

Sol. : $\left.\begin{array}{l}\text{PHBV}\\ \text{Nylon-2-nylon-6}\end{array}\right] \rightarrow \text{Biodegradable polymers}$

$\left.\begin{array}{l}\text{Glyptal}\\ \text{Bakalite}\end{array}\right] \rightarrow \text{Non-Biodegradable polymers}$

152. Observe the following statements
i : Sucrose has glycosidic linkage; ii : Cellulose is present in both plants and animals
iii : Lactose contains D-galactose and D-glucose units
The correct statements are

1) (i), (ii), (iii) 2) (i), (ii) 3) (ii), (iii) 4) (i), (iii)

Key : 4

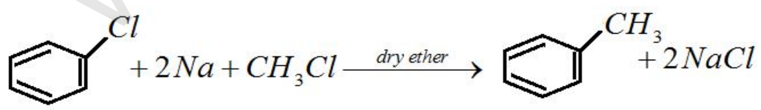
Sol. : Cellulose present in only plants but not in animals.
Glucose has gylcosidic linkage between
C_1 of α-D glucose and C_2 of β-D-Fructose
Lactose is composed of
β-D-Galactose and β-D-glucose

153. Identify the antioxidant used in foods

1) Aspartame 2) Sodium benzoate
3) Ortho-sulpho benzimide 4) Butylated hydroxy toluene

Key : 4

Sol. : Aspartame - Artificial sweeting agent
Sodium Benzoate - Food preservative
Butylated hydroxy toluene (BHT) - Anti oxidant

154. 

This reaction is known as

1) Wurtz-Fitting reaction 2) Wurtz reaction
3) Fitting reaction 4) Friedel-crafts reaction

Key : 1

Sol. : $2\text{R-X} + 2\text{Na} \xrightarrow[\text{Dry ether}]{} \text{R-R (Wurtz Reaction)}$

$\text{Ar-X} + 2\text{Na} + \text{X-R} \xrightarrow{\text{Dry ether}} \text{Ar-R (Wurtz fitting reaction)}$

$2\text{Ar-X} + 2\text{Na} \xrightarrow{\text{Dry ether}} \text{Ar-Ar (fitting reaction)}$

155. What is Z in the following sequence of reactions?

$$\textbf{2-methyl-2-bromo propane} \xrightarrow[\text{dry ether}]{\text{Mg}} \textbf{X} \xrightarrow{H_2O} \textbf{Z}$$

1) propane 2) 2-methyl propene 3) 2-methyl propane 4) 2-methyl butane

Key : 3

Sol. : $H_3C\text{-}\underset{\underset{CH_3}{|}}{\overset{\overset{Br}{|}}{C}}\text{-}CH_3 \xrightarrow[\text{Dry ether}]{\text{Mg}} CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{MgBr}{|}}{C}}-CH_3 \xrightarrow{H_2O} CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{H}{|}}{C}}-CH_3 + Mg(Br)OH$

(2 methyl propane)

156. In which of the following reactions the product is <u>not</u> correct?

1) $CH_2CHO \xrightarrow{LIAlH_4} CH_3CH_2OH$

2) $CH_2COCH_3 \xrightarrow[HCl]{Zn-Hg} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

3) $CH_3CH_2CHO \xrightarrow[\text{(ii) KOH, ethyleneglycol}/\Delta]{\text{(i) } H_2N\text{-}NH_2} CH_3CH_2CH_3$

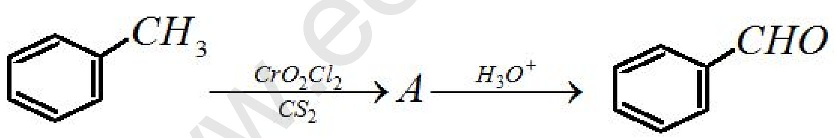
4) $CH_3CH_2CHO \xrightarrow{KMnO_4} CH_3CH_2COOH$

Key : 2

Sol. : Zn -Hg/HCl $\longrightarrow$ Clemanson Reagent

$$CH_3-\underset{\underset{O}{||}}{C}-CH_3 \xrightarrow[HCl]{Zn\text{-}Hg} CH_3\text{-}CH_2\text{-}CH_3$$

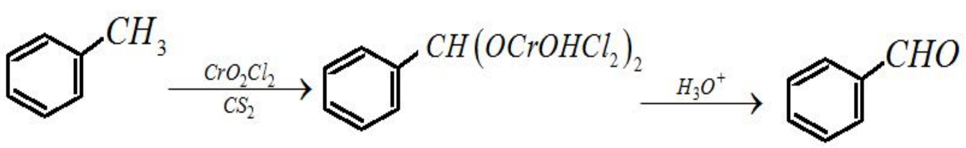
157. Identify the name of the following reaction



1) Gatterman - Koch reaction
2) Gatterman reaction
3) Stephen reaction
4) Etard reaction

Key : 4

Sol:



Etard reaction.

158. What is C in the following sequence of reactions?

$$\mathbf{CH_3OH \xrightarrow{PCl_3} A \xrightarrow{KCN} B \xrightarrow{hydrolysis} C}$$

1) CH_3CH_2OH 2) CH_3CHO 3) CH_3COOH 4) $HOCH_2\text{-}CH_2OH$

Key : 3

Sol. : $3CH_3OH + PCl_3 \longrightarrow \underset{(A)}{3CH_3Cl} + H_3PO_3$

$CH_3Cl \xrightarrow{KCN} \underset{(B)}{CH_3CN}$

$CH_3CN \xrightarrow{H_2O} \underset{(C)}{CH_3COOH}$

159. The order of basic strength of the following in aqueous solution is

(1) $C_6H_5NH_2$; (2) $(CH_3)_3N$; (3) NH_3 ; (4) CH_3NH_2 ; (5) $(CH_3)_2NH$

1) 4 > 1 > 5 > 3 > 2   2) 2 > 5 > 4 > 3 > 1   3) 5 > 4 > 2 > 3 > 1   4) 4 > 3 > 5 > 2 > 1

Key : 3

Sol. : Basicity of amines

Aliphatic > NH_3 > Aromatic

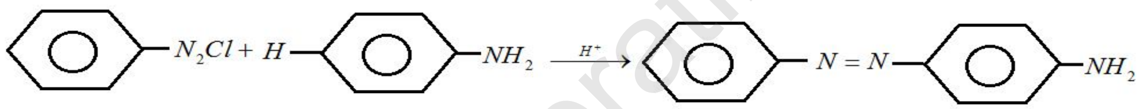
$(CH_3)_2 NH > CH_3\text{-}NH_2 > (CH_3)_3 N > NH_3 > C_6H_5\text{-}NH_2$

160. Yellow dye can be prepared by a coupling reaction of benzene diazonium chloride in acid medium with X. Identify X from the following

1) Aniline   2) Phenol   3) Cumene   4) Benzene

Key : 1

Sol:



X= Aniline ($C_6H_5NH_2$).   (Yellow dye)

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