MATHEMATICS

1. $\sinh^{-1}\left(\frac{x}{\sqrt{1-x^2}}\right)=$

1) $\cot h^{-1}x$ 2) $-\cot h^{-1}x$ 3) $-\tan h^{-1}x$ 4) $\tan h^{-1}x$

2. The solution of $\frac{dy}{dx}=\frac{px+q}{rx+s}$ represents a parabola when

1) $p=0,q=0$ 2) $r=0,s=0$ 3) $p=0,q\pm 0$ 4) $r=0,s\neq 0,p\neq 0$

3. If $8\cos x+15\sin x=15$ and $\cos\neq 0$ then $8\sin x-15\cos x=$

1) 8 2) -8 3) 15 4) -15

4. If $|\sec x+\tan x|=|\sec x|+|\tan x|,\ x\in[0,2\pi]$ if and only if x belongs to

1) $[0,\pi]$ 2) $\left[0,\frac{\pi}{2}\right)\cup\left(\frac{\pi}{2},\pi\right]$

3) $\left[0,\frac{3\pi}{2}\right)\cup\left(\frac{3\pi}{2},2\pi\right]$ 4) $[0,2\pi]$

5. If $\tan\theta$ and $\sec\theta$ are the roots of the equation $ax^2+bx+c=0$ then

1) $a^4=b^2\left(b^2-4ac\right)$ 2) $a^4=b^4\left(b^2-4ac\right)$

3) $b^4=a^2\left(a^2-4ac\right)$ 4) $b^4=a^4\left(a^2-4ac\right)$

6. Given that $\sin^2 x+\cos^2 y=2\sec^2 z$, then for $m,n,r\in z$, $(x,y,z)=$

1) $(n\pi,m\pi,r\pi)$ 2) $\left(n\pi\pm\frac{\pi}{2},m\pi,r\pi\right)$

3) $\left(n\pi\pm\frac{\pi}{2},m\pi-\frac{\pi}{2},r\pi\right)$ 4) $\left((2n-1)\frac{\pi}{3},\frac{m\pi}{2},\frac{r\pi}{2}\right)$

7. If $\log_2^x\geq 0$, then $\log_{\frac{1}{\pi}}\left[2\tan^{-1}x+\sin^{-1}\frac{2x}{1+x^2}\right]=$

1) -1 2) 0 3) 2 log2 4) 3 log2

8. If f is a real valued function satisfying $f(x)+f(x+6)=f(x+3)+f(x+9)$ then $f(x)$ is equal to

1) $f(x+3)$ 2) $f(x+6)$ 3) $f(x+9)$ 4) $f(x+12)$

9. If an equilateral triangle and a regular hexagon have the same perimeter then the ratio of their areas is

1) 1:4 2) 1:3 3) 2:3 4)2:5

10. The general solution of $\frac{dy}{dx} = e^{x-y}\left(e^x - e^y\right)$ is

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

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

11. Two adjacent sides of a cyclic quadrilatorl are 2 and 5, and the angle between them is 60^0. If the 3rd side is 3, then the remaining side is

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

12. For $n \in N$ $\left(n^2+7n+6\right)\left(n^2+7n+10\right)\left(n^2+7n+12\right)$ is divisible by

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

13. If $f(x) = \begin{vmatrix} x^3 & \cos^2 x & 2^{x^4} \\ \tan^5 x & 1 & \sec 2x \\ \sin^3 x & x^4 & 5 \end{vmatrix}$ then $\int_{-\pi}^{\pi} f(x)dx =$

1) 2 2) -2 3) 5 4) 0

14. If the system of equations $x+2y+az=0$, $x+3by+6z=0$, $x+4cy+cz=0$ has non zero solution, then a,b,c are is

1) AP 2) GP 3) HP 4) satisfy $a+2b+3c=0$

15. If A,B,C are three square matrices of the same order such that $B = CAC^{-1}$ then $CA^3C^{-1} =$

1) B 2) B^2 3) B^3 4) B^9

16. D,E,F are suspectively the mid points of the sides AB,AC and BC of Δle ABC then $\overline{BE} + \overline{AF} =$

1) $\frac{1}{2}\overline{BF}$ 2) $\overline{DC}$ 3) $\frac{3}{2}\overline{BF}$ 4) $2\overline{BF}$

17. If a is real and $|a| \geq 2$ and A,B and C are variable anlges such that $\sqrt{a^2-4}\tan A + a\tan B + \sqrt{a^2+4}\tan C = 6a$ then minimum value of $\tan^2 A + \tan^2 B + \tan^2 C$ is

1) 4 2) 6 3) 12 4) 8

18. If $A(2,3,5)\,B(-1,3,2)\,C(\lambda,5,\mu)$ and the vertices at a triangle. If the median AM is equally inclined with coordinate axes then

1) $\lambda = 10, \mu = 7$ 2) $\lambda = -10, \mu = 7$ 3) $\lambda = 7, \mu = 10$ 4) $\lambda = -7, \mu = -10$

19. In a right angled triangle ABC hypotenuse AB=P then $AB.AC+BC.BA+CA.CB$ is equal to

1) $\frac{P}{2}$ 2) P 3) $\frac{P^2}{2}$ 4) P^2

20. If $\bar{a}+5\bar{b}+3\bar{c}=\bar{0}$ then $\bar{a}.\left(\bar{b}\times\bar{c}\right)=$

1) $\bar{a}.\bar{b}$ 2) $\bar{a}.\left(\bar{b}+2\bar{c}\right)$ 3) $\bar{b}.\left(\bar{c}+\bar{a}\right)$ 4) 0

21. If $\bar{u}=\bar{i}\times\left(\bar{a}\times\bar{i}\right)+\bar{j}\times\left(\bar{a}\times\bar{j}\right)+\bar{k}\times\left(\bar{a}\times\bar{k}\right)$ then

1) $\bar{u}.\bar{i}=0$ 2) $\bar{u}=2\bar{a}$ 3) $\bar{u}^2=9\bar{a}^2$ 4) $\bar{u}=\bar{a}+\bar{i}+\bar{j}+\bar{k}$

22. The number of real roots of $(x-1)^2+(x-2)^2+(x-3)^2=0$ is

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

23. If $a\in z$ and the equation $(x-a)(x-10)+1=0$ has integral roots then the values of 'a' are

1) 10,8 2) 12,10 3) 12,8 4) 10,14

24. If x^3+3x^2-9x+c is of the form $(x-\alpha)^2(x-\beta)$ then a value of 'c' is

1) -3 2) 27 3) -27 4) 0

25. If the equations $ax^2+bx+c=0$ and $x^3+3x^2+3x+2=0$ have two common roots then

1) $a=-b=c$ 2) $a=b\neq c$ 3) $a=b=c$ 4) $a\neq b=c$

26. If z_1,z_2,z_3 are complex numbers such that $|z_1|=|z_2|=|z_3|=\left|\frac{1}{z_1}+\frac{1}{z_2}+\frac{1}{z_3}\right|$ = 1. Then $|z_1+z_2+z_3|=$

1) 1 2) <1 3) >3 4) =3

27. If $Arg(z)<0$ then $Arg(-z)-Arg(z)=$

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

28. If $Z_n=\cos\frac{\pi}{2^n}+i\sin\frac{\pi}{2^n}$ then $\prod_{n=1}^{\infty}Z_n=$

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

29. If α is a non real root of $x^6=1$ then $\frac{\alpha^5+\alpha^3+\alpha+1}{\alpha^2+1}=$

1) $-\alpha^2$ 2) 0 3) α 4) α^2

30. If $\sum_{r=0}^{n}\frac{r}{{}^{n}C_{r}}=\sum_{r=0}^{n}\frac{7}{{}^{n}C_{r}}$, then $n=$

1) 14 2) 15 3) 16 4) 17

31. If $\left(1+x+x^2+x^3\right)^5=\sum_{k=0}^{15}a_k x^k$ then $\sum_{k=0}^{7}a_{2k}=$

1) 128 2) 256 3) 512 4) 1024

32. The sum $\sum_{i=0}^{m}{}^{10}C_i\ {}^{20}C_{m-i}$ is maximum when m is

1) 5 2) 10 3) 15 4) 20

33. If $P(n,a)=P(n,b)$ where $a<b\le n$ (all are +Ve integers) and $a+b=Fn+G$ then $|F|+|G|=$

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

34. If $n,r\in N$ and ${}^{(n-1)}C_r=\left(K^2-3\right){}^{n}C_{(r+1)}$ then K lies in the internal

1) $\left[-\sqrt{3},\sqrt{3}\right]$ 2) $(2,\alpha)$ 3) $\left[-\sqrt{3},\alpha\right)$ 4) $\left(\sqrt{3},2\right]$

35. A team of 8 couples (husband and wife) attend a lucky draw in which 4 members are picked up for a prize. The probability that there is atleast one pair is

1) $\frac{11}{39}$ 2) $\frac{12}{39}$ 3) $\frac{14}{39}$ 4) $\frac{5}{13}$

36. A fair die is thrown twenty times, the probability that on the tenth throw, the fourth six appears

1) $\frac{{}^{20}C_{10}5^6}{6^{20}}$ 2) $\frac{120\times5^7}{6^{10}}$ 3) $\frac{84\times5^6}{6^{10}}$ 4) $\frac{{}^{9}C_3}{6^{20}}$

37. A bag contains $(n+1)$ coins. It is known that one of these coins shows heads on both sides, where as the other coins are fair. One coin is selected at random and tossed. If the probability that toss results in head is $\frac{7}{12}$ then $n=$

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

38. The mean of a binomial destribution is 25, then the standard deviation lies in the inter

1) $[0,5)$ 2) $(0,5]$ 3) $(0,25)$ 4) $(0,25]$

39. The variance of first 50 natural numbers is

1) 437 2) $\frac{437}{4}$ 3) $\frac{833}{4}$ 4) 834

40. If the mean of $x_1, x_2 \ldots . x_n$ is $\bar{x}$ then the mean of $x_1+1, x_2+2, x_3+3 \ldots . x_n+n$ is

1) $\overline{X}+(2n+1)$ 2) $\overline{X}+\frac{n+1}{2}$ 3) $\overline{X}+(n+1)$ 4) $\overline{X}-\frac{(n+1)}{2}$

41. If the points $(-2,0)\left(-1,\frac{1}{\sqrt{3}}\right)(\cos\theta,\sin\theta)$ are collinear, then the number of values of $\theta \in [0,2\pi]$ are

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

42. If a point P moves such that its distances from the point $A(1,1)$ and line $x+y+2=0$ are equal then the locus of P is

1) Stratight line 2) Pair of lines 3) Parabola 4) Ellipse

43. The straight line $ax+by+c=0$ where $abc \neq 0$ will cut the axes in the first quadrant if

1) $ac>0, bc>0$ 2) $c>0$ *and* $bc<0$

3) $bc>0$ *and / or* $ac>0$ 4) $ac<0$ *and / or* $bc<0$

44. Reflection of $3x+4y+5=0$ w.r.t the line $2x+y+1=0$ is

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

45. When $(0,0)$ shifted to (3,-3) the coordinate of $P(5,5)Q(-2,4)$ and $R(7,-7)$ in new system are A,B,Cthen area of ΔABC is

1) 43 2) 23 3) 45 4) 50

46. Area of triangle formed by the line $x+y=3$ and the angle bisectors of pair of lines $x^2-y^2+2y=1$ is

1) 2 sq.units 2) 4 sq.units 3) 6 sq.units 4) 8 sq units

47. If the pair of line $ax^2+2hxy+by^2+2gx+2fy+c=0$

Intersect on the y-axes then

1) $2fgh=bg^2+ch^2$ 2) $bg^2 \neq ch^2$

3) $2fgh=af^2+ch^2$ 4) $2fgh=af^2+bg^2$

48. $A(5,4,6)B(1,-1,3)C(4,3,2)$ form a ΔABC. If the internal bisector of angle A meets BC in D then length AD in unit is

1) $\frac{1}{8}\sqrt{170}$ 2) $\frac{3}{8}\sqrt{170}$ 3) $\frac{5}{8}\sqrt{170}$ 4) $\frac{7}{8}\sqrt{170}$

49. If the lengths of sides of a rectangular parallelopiped are 3,2,1 then angle between two diagonals out of four diagonals is

1) $\cos^{-1}\frac{2}{3}$ 2) $\cos^{-1}\frac{13}{14}$ 3) $\cos^{-1}\frac{6}{7}$ 4) $\cos^{-1}\frac{9}{14}$

50. A variable plane is at a constant distance P from the origin and meets the axes in A,B,C ….. The locus of centroid of ΔABC is

1) $x^{-2}+y^{-2}+z^{-2}=p^{-2}$ 2) $x^{-2}+y^{-2}+z^{-2}=4p^{-2}$

3) $x^{-2}+y^{-2}+z^{-2}=3p^{-2}$ 4) $x^{-2}+y^{-2}+z^{-2}=9p^{-2}$

51. $\underset{n\to\infty}{Lt}\cos\left[\left(\sqrt{n^2+n}-n\right)\pi\right]=$

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

52. If $f(x)=3x^{10}-7x^8+5x^6-21x^3+3x^2-7$ then $\underset{\alpha\to o}{Lt}\frac{f(1-\alpha)-f(1)}{\alpha^3+3\alpha}=$

1) $\frac{-53}{3}$ 2) $\frac{53}{3}$ 3) $\frac{-55}{3}$ 4) $\frac{55}{3}$

53. $f(x)=x^2\left(\frac{e^{\frac{1}{x}}-e^{\frac{-1}{x}}}{e^{\frac{1}{x}}+e^{\frac{-1}{x}}}\right), x\neq 0$ then $x=0$ $=0$

1) f in discontinuous at $x=0$ 2) f is continuous but not differentiable at $x=0$

3) f is differentiable at $x=0$ 4) f'(0)=2

54. $\frac{d^2x}{dy^2}=$

1) $\frac{1}{\left(\frac{dy}{dx}\right)^2}$ 2) $\frac{\left(\frac{d^2y}{dx^2}\right)}{\left(\frac{dy}{dx}\right)^2}$ 3) $\frac{d^2y}{dx^2}$ 4) $\frac{-\frac{d^2y}{dx^2}}{\left(\frac{dy}{dx}\right)^3}$

55. The semi vertical angle of a cone is 45^0. The height of cone is 20.025cm. The approximate lateral surface area is

1) $401\pi\sqrt{2}$ sq.cm 2) 60π $sqcm$ 3) $400\pi\sqrt{2}$ $sqcm$ 4) $40\pi\sqrt{2}$ $sqcm$

56. Gas is leaking out of a spherical balloon at the rate of 1800 c.c per sec. When radius of balloon is 720cm, the rate at which the surface area is shrinking is

1) 5 sq.cm /sec 2) 6 sq.cm/sec 3) 10 sq.cm/sec 4) 15 sq. cm/sec

57. Tangents are drawn from origin to the curve $y = \sin x + \cos x$ then their points of contact lie on the curve is

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

58. If $y = x^3 - ax^2 + 48x + 7$ is an increasing function for all real values of x then a lies in

1) $(-14,14)$ 2) $(-12,12)$ 3) $(-16,16)$ 4) $(-21,21)$

59. In $\Delta ABC, \angle B = 90^0$ and $a+b=4$ the area of triangle is maximum then $\angle A =$

1) 30^0 2) 15^0 3) 45^0 4) 60^0

60. The value of 'C' in Rolles for $f(x) = \log\left(\frac{x^2+ab}{x(a+b)}\right)$ in (a,b) where $a>0$ is

1) AM if a,b 2) GM of a,b 3) HM of a,b 4) $\frac{1}{a}+\frac{1}{b}$

61. A circle of constant radius 'r' passes through the origin 'O' and cuts the axes at A and B. Then the locus of foot of $\perp r$ from 0 to AB is

1) $\left(x^2+y^2\right)\left(x^{-2}+y^{-2}\right)=4r^2$ 2) $x^2+y^2=4r^2$

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

62. Number of circles touching all the lines $x+4y+1=0, 2x+3y+3=0$ and $x-6y+3=0$ is

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

63. If the circles $x^2+y^2+2gx+2fy=0,\ x^2+y^2+2g^1x+2f^1y=0$ touch each other then

1) $fg^1 = f^1g^1$ 2) $f^1g^1 = f^1g$ 3) $fg^1 = gf^1$ 4) $f+f^1 = g+g^1$

64. B and C are two points on the circle $x^2+y^2=a^2$ the point A(b,c) lies on that circle such that $AB = AC = d$ then the equation of line $\overline{BC}$ is

1) $bx+ay = a^2-d^2$ 2) $bx+ay = d^2-a^2$

3) $2(bx+cy) = 2a^2-d^2$ 4) $2(bx+ay) = 2a^2-d^2$

65. If the circle $x^2+y^2+4x+22y+c=0$ bisects the circumference of the circle $x^2+y^2-2x+8y-d=0$ where c,d are positive. Then maximum value of cd is

1) 25 2) 125 3) 425 4) 625

66. Two straight lines are $\perp r$ to each other one of them touches $y^2 = 4a(x+a)$ and other touches $y^2 = 4b(x+b)$ then locus of point of intersection of two lines is

1) $x+ab=0$ 2) $x=a+b$ 3) $x+a+b=0$ 4) $x=\sqrt{ab}$

67. If a normal chord of a parabola $y^2 = 4x$ makes an angle of 45^0 with the axes of parabola then its length is

1) 8 2) $8\sqrt{2}$ 3) 4 4) $4\sqrt{2}$

68. If PSP^1 is a focal chord of the ellipse $\frac{x^2}{7}+\frac{y^2}{9}=1$ then $\frac{SP.SP^1}{SP+SP^1}=$

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

69. The maximum distance of the normal at any point on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ from origin is

1) $a+b$ 2) $|a-b|$ 3) ab 4) $2|a-b|$

70. The points of intersection of asymptotes of a hyperbola with directrices lies on

1) Director circle 2) Auxiliary circle 3) Parabola 4) Conjugate hyperbola

71. $\int \frac{1}{(2x+1)^{\frac{5}{6}}(3x+5)^{\frac{7}{6}}}dx =$

1) $\frac{6}{7}\left(\frac{2x+1}{3x+5}\right)^{\frac{1}{6}}+c$ 2) $\frac{-6}{7}\left(\frac{2x+1}{3x+5}\right)^{\frac{1}{6}}+c$ 3) $\frac{6}{7}\left(\frac{3x+5}{2x+1}\right)^{\frac{1}{6}}+c$ 4) $\frac{-6}{7}\left(\frac{3x+5}{2x+1}\right)^{\frac{1}{6}}+c$

72. If $0<x<1$ then $\int \sqrt{\underset{n\to\infty}{Lt}\left(1+x^2\right)\left(1+x^4\right)\left(1+x^8\right)\ldots\left(1+x^{2^n}\right)}dx =$

1) $\frac{1}{1-x^2}+c$ 2) $\frac{1}{\sqrt{1-x^2}}+c$ 3) $\sin^{-1}x+c$ 4) $\cos^{-1}x+c$

73. If $\int \frac{1}{1+x^4}dx = A\tan^{-1}\left(\frac{x^2-1}{\sqrt{2}x}\right)-B\log\left|\frac{x^2-\sqrt{2}x+1}{x^2+\sqrt{2}x+1}\right|+c$ then

1) $A=2B$ 2) $A=-2B$ 3) $2A=B$ 4) $2A=-B$

74. $f(x)=(1+\tan x)\left(1+\tan\left(\frac{\pi}{4}-x\right)\right)$ and $g(x)$ is a function with domain R, then $\int_0^1 x^3(gof)(x)dx=$

1) $\frac{1}{2}g\left(\frac{\pi}{4}\right)$ 2) $\frac{1}{4}g(2)$ 3) $\frac{1}{4}g(1)$ 4) 1

75. $\int_0^{10\pi}\left[\tan^{-1}x\right]dx=$ $[.]$ denotes greatest integer function

1) $\pi+\tan 1$ 2) $10\pi-1$ 3) $10\pi+\tan 1$ 4) $10\pi-\tan 1$

76. $\underset{n\to\infty}{Lt}\left(\frac{1^4}{1^5+n^5}+\frac{2^4}{2^5+n^5}+\ldots+\frac{n^4}{n^5+n^5}\right)=$

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

77. The area of the region bounded by $a^2y^2=x^2\left(a^2-x^2\right)$ is

1) $\frac{4a^2}{5}$ 2) $\frac{4a}{3}$ 3) $\frac{4a^2}{3}$ 4) $\frac{5a^2}{5}$

78. The differential equation of all non horizontal lines in a plane is

1) $\frac{d^2y}{dx^2}=0$ 2) $\frac{d^2x}{dy^2}=0$ 3) $\frac{dy}{dx}=0$ 4) $\frac{dx}{dy}=0$

79. If $f:R\times R\to R$ is defined by $f(x,y)=x+y-xy$ then $f\left(2,f(2,3)\right)$

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

80. The area of the right angled triangle interms of its circumradius and inradius is

1) $r(r+2R)$ 2) $r(2r+R)$ 3) $R(r+2R)$ 4) $R(2R+r)$

PHYSICS

81. A vehicle sounding a whistle of frequency 256 HZ is moving on a straight road, towards a hill with a velocity of $10ms^{-1}$. The number of beats produced per second is (velocity of sound = 330 m/s).

1) Zer 2) 10 3) 14 4) 16

82. When a rubber ball of volume V, bulk modulus k is at a depth h in water then decrease in its volume is

1) $\frac{hdgV}{K}$ 2) $\frac{hdgV}{2K}$ 3) $\frac{hdgV}{3K}$ 4) $\frac{hdgV}{4K}$

83. The work done to blow a bubble is w. The extra work to be done to double its radius is

1) W 2) 2W 3) 3W 4) 4W

84. A metallic wire of diameter 'd' is lying horizontally on the surface of water. The maximum length of wire so that it may not sink will be.

1) $\sqrt{\frac{2T}{\pi dg}}$ 2) $\sqrt{\frac{2Tg}{\pi d}}$ 3) $\sqrt{\frac{2\pi d}{Tg}}$ 4) any length

85. 6 gm of steam at 100^0C is mixed with 6 gm of ice at 0^0C. The mass of steam left uncondensed is

1) 2 gm 2) 4 gm 3) 3 gm 4) 1 gm

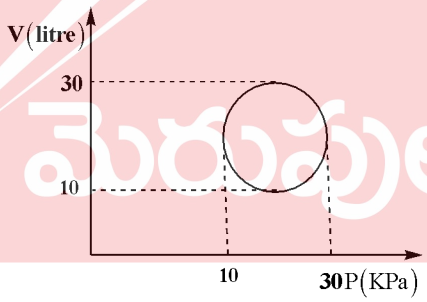
86. For a gas if ratio of specific heats at constant pressure and volume is γ then the value of degrees of feedom.

1) $\frac{3\gamma-1}{2\gamma-1}$ 2) $\frac{2}{\gamma-1}$ 3) $\frac{9}{2}(\gamma-1)$ 4) $\frac{25}{2}(\gamma-1)$

87. A pendulum clock is 5 seconds fast at a temperature of 15^0C and 10 seconds slow at a temperature of 30^0C. The temperature at which it gives the correct time is

1) 18^0C 2) 20^0C 3) 22^0C 4) 25^0C

88. Heat energy absorbed by a system in going through a cyclic process shown if figure is



1) $10^7\,\pi$J 2) $10^4\,\pi$J 3) $10^2\,\pi$J 4) $10^3\,\pi$J

89. A scientist says that the efficiency of his heat engine which operation at source temperature 127^0C and sink temperature 27^0C is 26%, then

1) It is impossible 2) It is possible but less probable

3) It is quite probable 4) Data is incomplete

90. The fundamental frequencies of a closed pipe and an open pipe of different lengths are 300 HZ and 400 Hz. If they are joined to form a longer pipe, the fundamental frequency of the long pipe so formed is

1) 350 Hz 2) 50 Hz 3) 120 Hz 4) 100 Hz

91. A particle is executing SHM between extreme positions given by (-1, -2, -3) cm and (1, 2, 1) cm. Its amplitude of oscillation is

1) 6 cm 2) 4 cm 3) 2 cm 4) 3 cm

92. Two lenses of power -15D and 5D are in contact with each other, the focal length of the combination is (in cm)

1) 20 2) 10 3) – 20 4) – 10

93. The angle of minimum deviation for a 75^0 prism of dense glass is found to be 45^0 when in air and 15^0 when immersed in certain liquid. The refractive index of the liquid is

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

94. In young's double slit experiment the n^{th} red bright band crincides with $(n+1)^{th}$ blue bright band. If the wave length of red and blue lights are 7500 A^0 and 5000 A^0, the value of n is

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

95. The flux linked with a coil at any instant 't' is given by $\phi = 10t^2 - 50t + 250$. The induced emf at t = 3s is

1) – 190 V 2) – 10V 3) 10 V 4) 190 V

96. A plane electromagnetic wave of frequency 25 MHZ travels in free space along the x – direction. At a particular point in space and time $\vec{E} = 6.3\,\hat{j}$. The magnetic field $\vec{B}$ at this point is

1) $4.2\times10^{-8}\,\hat{k}$ T 2) $2.1\times10^{-8}\,\hat{k}$ T 3) $18.9\times10^{-8}\,\hat{k}$ T 4) $2.1\times10^{8}\,\hat{k}$ T

97. A 30 kg box has to move up an inclined plane of slope 30^0 to the horizontal with a uniform velocity of 5 ms^{-1}. If the frictional force retarding the motion is 150N, the horizontal force required to move the box up is ($g = 10\ ms^{-2}$).

1) $300\times\frac{2}{\sqrt{3}}$N 2) $300\times\frac{\sqrt{3}}{2}$N 3) 300 N 4) 150 N

98. An object initially at rest explodes into 3 parts of equal mass. Parts 1 and 2 have the same initial speed V, the velocity vectors being perpendicular to each other. Part 3 will have an initial speed of

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

99. A bullet fired into a trunk of a tree loses ¼ of its kinetic energy in travelling a distance of 5 cm. Before stopping it travels a further distance of

1) 150 cm 2) 1.5 cm 3) 1.25 cm 4) 15 cm

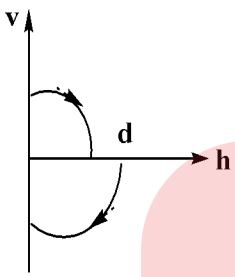
100. Three identical particles moving with velocity $V_0\,\hat{i}$, $-3V_0\,\hat{j}$ and $5V_0\,\hat{k}$ collide with each other in such a way that they form a single particle. The velocity of resultant particle is

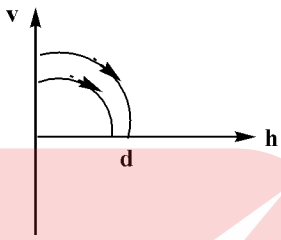
1) $V_0(\hat{i}-3\hat{j}+5\,\hat{k})$ 2) $\frac{V_0}{3}(\hat{i}-3\hat{j}+5\,\hat{k})$ 3) $\frac{V_0}{2}(\hat{i}-3\hat{j}+5\,\hat{k})$ 4) $\frac{V_0}{3}(\hat{i}+3\hat{j}+5\,\hat{k})$

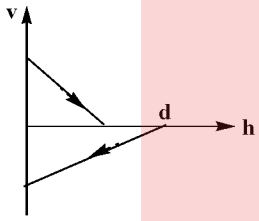
101. The density of a material of cylindrical rod was determined by the formula $d=\frac{m}{\pi r^2 \ell}$, the percentage errors in m, r and ℓ are 2.0%, 1.5% and 0.8% respectively. Calculate the maximum possible percentage error in the determination of density.

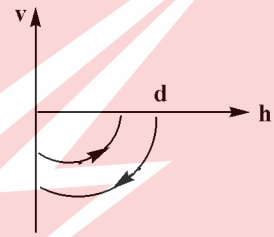
1) 2.8% 2) 3.8% 3) 4.8% 4) 5.8%

102. A ball is dropped vertically from a height 'd' above the ground. It hits the ground and bounces up vertically to a height 'd/2'. Neglecting subsequent motion and air resistance, its velocity 'V' varies with the height 'h' about the ground as

1) 

2) 

3) 

4) 

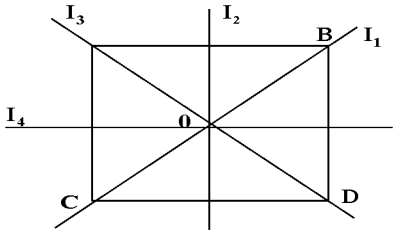
103. A ball is thrown with velocity u making an angle θ with the horizontal. Its velocity vector is normal to initial velocity (u) vector after a time interval of

1) $\frac{u \sin\theta}{g}$ 2) $\frac{u}{g \cos\theta}$ 3) $\frac{u}{g \sin\theta}$ 4) $\frac{u \cos\theta}{g}$

104. 'A' and 'B' are the two pegs separated by 13cm. A body of 169 Kgwt is suspended by thread of 17 cm connecting to A & B, such that the two segments of strings are perpendicular. Then tensions in shorter and longer parts of string having are

1) 100 kgwt, 69 kgwt 2) 65 kgwt, 156 kgwt
3) 156 kgwt, 65 kgwt 4) 69 kgwt, 100 kgwt

105. The moment of inertia of a thin square plate ABCD of uniform thickness about an axis passing through the centre O and perpendicular to the plane of the plate is



a) $I_1 + I_3$ b) $I_2 + I_4$ c) $2I_1 + I_3$ d) $I_1 + 2I_3$

1) a, b are true 2) b, c are true 3) c, d are true 4) b, d are true

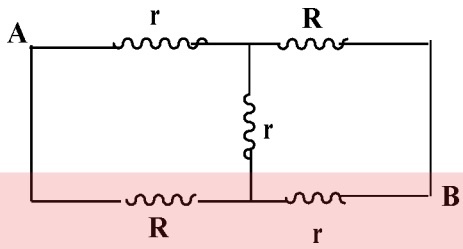
106. A uniform rod of length one meter is bent at its midpoint to make 90^0. The distance of centre of mass from the centre of rod is (in cm)

1) 20.2 2) 13.4 3) 15 4) 17.67

107. The escape velocity from the surface of the earth of radius R and density ρ.

1) $2R\sqrt{\frac{2\pi\rho G}{3}}$ 2) $2\sqrt{\frac{2\pi\rho G}{3}}$ 3) $2\pi\sqrt{\frac{R}{g}}$ 4) $\sqrt{\frac{2\pi G\rho}{R^2}}$

108. Find the equivalent resistance across A and B in the given circuit if $r=10\Omega$, $R=20\Omega$.



1) 15Ω 2) 10Ω 3) 60 Ω 4) 14 Ω

109. When 6 identical cells of no internal resistance are connected in series in the secondary circuit of a potentiometer, the balancing length is *l* If two of them are wrongly connected the balancing length becomes.

1) *l* / 4 2) *l* / 3 3) *l* 4) 2*l* / 3

110. A transmitting antenna is at a height of 25 m and the receiving antenna is at a height of 64 m. The maximum distance between them for satisfactory communication is nearly

1) 22.5 km 2) 46.5 km 3) 50 km 4) 25 km

111. In a moving coil Galvanometer, a coil of area 5 cm^2 having 100 turns carrying a current of 0.5 x 10^{-4} Amp is suspended in a magnetic field of induction 2000 Gauss deflects through an angle of 20^0. The couple per unit twist is

1) 2.5 x 10^{-5}N – m/degree 2) 2.5 x 10^{-8}N – m / degree

3) 5 x 10^{-5}N – m / degree 4) 5 x 10^{-8}N – m / degree

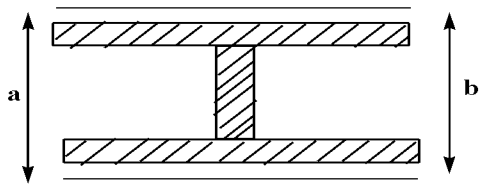
112. Curie – Weiss law relating susceptibility χ and temperature T of a ferromagnetic material with Curie temperature T_C

1) $\chi=C(T-T_C)$ 2) $\chi=C(T+T_C)$ 3) $\chi=\frac{(T-T_C)}{C}$ 4) $\chi=\frac{C}{(T-T_C)}$

113. Three charges – q, + q and –q are placed at the corners of an equilateral triangle of side 'a'. The resultant electric force on a charge +q placed at the centroid 'O' of the triangle is

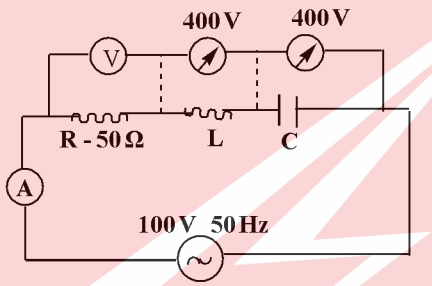
1) $\frac{3q^2}{4\pi\in_0 a^2}$ 2) $\frac{q^2}{4\pi\in_0 a^2}$ 3) $\frac{q^2}{2\pi\in_0 a^2}$ 4) $\frac{3q^2}{2\pi\in_0 a^2}$

114. If metal section of shape 'H' is inserted in between two parallel plates as shown in figure and A is the area of each plate then the equivalent capacitance is



1) $\frac{A\in_0}{a}-\frac{A\in_0}{b}$ 2) $\frac{A\in_0}{a+b}$ 3) $\frac{A\in_0}{a}+\frac{A\in_0}{b}$ 4) $\frac{A\in_0}{a-b}$

115. In the series L – C – R circuit figure the voltmeter and ammeter readings are



1) V = 100 volt, I = 2A 2) V = 100 volt, I = 5A

3) V = 400 volt, I = 2A 4) V = 300 volt, I = 1 A

116. A photometal is illuminated by lights of wavelengths λ_1 and λ_2 respectively. The maximum kinetic energies of electrons emitted in the two cases are E_1 and E_2 respectively. The work function of metal is

1) $\frac{E_2\lambda_1-E_1\lambda_2}{\lambda_1}$ 2) $\frac{E_1\lambda_1-E_2\lambda_2}{\lambda_1+\lambda_2}$ 3) $\frac{E_1\lambda_1+E_2\lambda_2}{\lambda_1-\lambda_2}$ 4) $\frac{E_2\lambda_2-E_1\lambda_1}{\lambda_1-\lambda_2}$

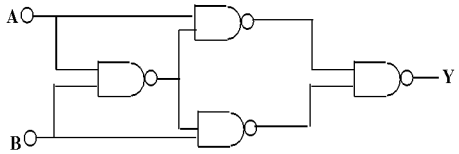
117. In Rutherford experiments on α - ray scattering the number of particles scattered at 90^0 be 28 per minute. Then the number of particles scattered per minute by the same foil but at 60^0 are

1) 56 2) 112 3) 60 4) 120

118. A sample of radioactive material has mass m, decay constant λ and molecular weight M. Avagadro constant = N_A . The activity of the sample after time t will be.

1) $\left(\frac{mN_A}{M}\right)e^{-\lambda t}$ 2) $\left(\frac{mN_A\lambda}{M}\right)e^{-\lambda t}$ 3) $\left(\frac{mN_A}{M\lambda}\right)e^{-\lambda t}$ 4) $\frac{m}{\lambda}\left(1-e^{-\lambda t}\right)$

119. Truth table for system of four NAND gates as shown in figure is :



1)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

2)

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	1

3)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	0

4)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

120. Two concentric coils of 10 turns each are placed in the same plane. Their radii are 20 cm and 40 cm and carry 0.2 and 0.3 amp current respectively in opposite directions. The magnetic induction (in Tesla) at the centre is

1) $\frac{3}{4}\mu_0$ 2) $\frac{5}{4}\mu_0$ 3) $\frac{4}{5}\mu_0$ 4) $\frac{2}{3}\mu_0$

CHEMISTRY

121. The catalyst used for olefin polymerization is

1) Ziegler - Natta catalyst 2) Wilkinson catalyst

3) Raney nickel catalyst 4) Merrifield resin

122. The wave length of two photons A and B are $100A^\circ$ and $100nm$. The ratio of their energies will be

1) 1:1 2) 2:1 3) 10:1 4) 1:10

123. The IUPAC name of the complex $Hg[Co(SCN)_4]$ is

1) Mercury tetrathiocyanatocobaltate (II) 2) Mercury Cobalttetrasulphocyano (II)

3) Mercury tetrasulphocyanidecobalt (II) 4)Tetrasulphocyanatocobalt mercurate(II)

124. The correct decreasing order of bond order in N_2, N_2^{2-}, N_2^- *and* N_2^+ is

1) $N_2^{2-} > N_2 > N_2^+ > N_2^-$ 2) $N_2 > N_2^+ > N_2^- > N_2^{2-}$

3) $N_2^+ = N_2^- > N_2^{2-} > N_2$ 4) $N_2 > N_2^+ = N_2^- > N_2^{2-}$

125. According to MO theory

1) O_2^+ is paramagnetic and bond order is greater than that for O_2

2) O_2^+ is paramagnetic and bond order is lesser than that for O_2

3) O_2^+ is diamagnetic and bond order is lesser than that for O_2

4) O_2^+ is diamagnetic and bond order is more than that for O_2

126. Which of the following is correct order of ionisation potential?

1) $Al^{3+} > Mg^{2+} > F^- > O^{2-}$ 2) $O^{2-} > Na^+ > F^- > Al^{3+}$

3) $N^{3-} > O^{2-} > Na^+ > Al^{3+}$ 4) $O^{2-} > F^- > Al^{3+} > Na^+$

127. The number of moles of oxygen in one litre of air containing 21% oxygen by volume, in standard conditions, is:

1) 0.186mole 2) 0.21 mole 3) 2.10 mole 4) 0.0093 mole

128. Consider the reactions

A) $H_2O_2 + 2HI \rightarrow I_2 + 2H_2O$

B) $HOC\ell + H_2O_2 \rightarrow H_3O^+ + C\ell^- + O_2$

Which of the following statements is correct about H_2O_2 with reference to these reactions? Hydrogen peroxide is .

1) is an oxidizing agent both in A and B

2) An oxidizing agent in A and reducing agent in B

3) A reducing agent in B and an oxidising agent in A

4) A reducing agent both in A and B

129. With regard to thermal stability of Li_2CO_3 and Na_2CO_3 we can say that

1) Both are equally thermally stable

2) Li_2CO_3 is more stable than Na_2CO_3

3) Li_2CO_3 is unstable whereas Na_2CO_3 is stable

4) Both are unstable compounds

130. Borax bead test is not given by

1) Mg^{+2} 2) Ni^{+2} 3) Co^{+2} 4) Mn^{+2}

131. Which of the following has pyramidal shape

1) XeF_4 2) XeO_3 3) XeF_2 4) XeF_6

132. Which one of the following sets contribute to the global warming ?

1) H_2, NO_2, SO_2 2) SO_2, SO_3, O_2 3) N_2, C_2H_6, SO_3 4) CO_2, CH_4, CFCS

133. The IUPAC name of the structure 

1) 3,3 dimethyl pentane 2) 3,3 - di ethyl pentane

3) 3 - ethyl- 3 - methyl pentane 4) 3- ethyl - 3 - ethyl pentane

134. The compound in which $\overset{*}{C}$ uses its sp^3 hybrid orbitals for bond formation is

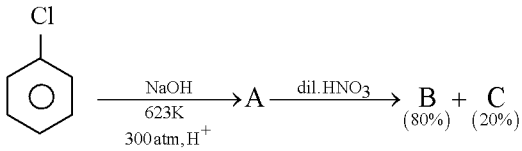
1) $H\overset{*}{C}OOH$ 2) $(H_2N)_2\overset{*}{C}O$ 3) $(CH_3)_3\overset{*}{C}OH$ 4) $CH_3\overset{*}{C}HO$

135. Anti-Markovnikoff addition of HBr is not observed in

1) Propene 2) 1-butene 3) but-2-ene 4) pent-2-ene

136. $CH_3-CH_2-Cl \xrightarrow{alc\,KOH} A \xrightarrow[CCl_4]{Br_2} B \xrightarrow[\Delta]{Zn} C$ C is

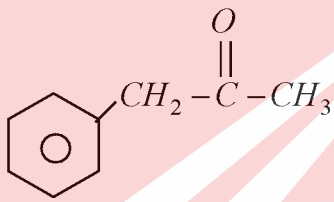
1) Acetylene 2) Ethane 3) Ethene 4) Methane

137. 

Which of the following statement is correct on above reaction

1)B&C are separated by steam distillation 2) A is phenol

3)A> $H_2O > C_2H_5OH$ (Acidic strength) 4) All

138. $(C_6H_5CH_2)_2Cd + 2x \longrightarrow$ 

Identify 'x'

1) Ethyl chloride 2) Acetyl chloride

3) Vinyl chloride 4) Methyl chloride

139. The Cannizzaro reaction is not given by

1) trimethyacetaldehyde 2) acetaldehyde

3) benzaldehyde 4) formaldehyde

140. $C_6H_5NH_2 \xrightarrow[0°-5°C]{NaNO_2+HCl} A \xrightarrow{HBF_4} \xrightarrow[Cu,\Delta]{NaNO_2} C$

The reduction of final product "C" with Sn+HCl gives

1) $C_6H_5NO_2$ 2) C_6H_5F 3) C_6H_6 4) $C_6H_5NH_2$

141. Amylopectin is a polymer of

1) $\beta-D-glucose$ 2) $\alpha-D-glucose$

3) $\beta-D-Fructose$ 4) $\alpha-D-Fructose$

142. The metal present in vitamin B_{12}

1) Iron 2) Manganes 3) Cobalt 4) Magnesium

143. Sweetest among the following is

1) Aspartame 2) Saccharin 3) Sucralose 4) Alitame

144. Assertion (A) : Froth floatation process is specially suitable for sulphide ore.
Reason (R) : The impurities present in the sulphide ores are lighter than the metal
1) A and R are true and R is the correct explanation of A
2) A and R are true and R is not the correct explanation of A
3) A is true, R is false
4) A is false, R is ture

145. Assertion (A) : Milk is naturally occuring emulsion in which water is dispersed in oil.
Reason (R) : Silica acts as emulsifying agent in oil in water emulsion
1) A and R are true and R is the correct explanation of A
2) A and R are true and R is not the correct explanation of A
3) A is true, R is false
4) A is false, R is ture

146. 100 ml of 1M HCl, 200ml 1M H_2SO_4 300ml 3M HNO_3 are mixed. Then molarity of H^+ in the resulting solution is
1) 1M 2) 2.66M 3) 2.33M 4) 4.25M

147. 0.2 molar solution of formic acid is 3.2% ionised. It's ionisation constant is
1) 9.6×10^{-3} 2) 2.048×10^{-4} 3) 1.25×10^{-6} 4) 4.8×10^{-5}

148. The conjugate acid of NH_2^- is
1) NH_3 2) NH_2OH 3) NH_4^+ 4) N_2H_4

149. The time taken for completion of 99.9% of a first order reaction is (rate constant is 10^{-3} sec^{-1})
1) 6200 sec 2) 6909 sec 3) 230.3 sec 4) 1000 sec

150. For the reaction
$NH_4HS_{(s)} \rightleftharpoons NH_{3(g)} + H_2S_{(g)}$ If the equilibrium pressure is 10 atm. Then (Kp) will be
1) 25 atm^2 2) 10 atm 3) 10 atm^2 4) 5 atm^2

151. Aqueous solution of $AgNO_3$ is electrolysed using inert electrodes . At the end of electrolysis
1) P^H of the solution increases 2) P^H of the solution decreases
3) P^H of the solution remaining unchanged 4) P^H of the solution becomes 14

152. The mass of copper deposited at cathode when 1.5 amp current passed through a solution of copper sulphate in 600 seconds.
1) 0.420 2) 0.143 3) 0.296 4) 0.786

153. Match the following :

List-I	List-II
A) sp^3	1) $[pt\ Cl_4]^{-2}$
B) dsp^2	2) BF_4^-
C) sp^3d^2	3) $[C_0(NH_3)_6]^{3-}$
D) d^2sp^3	4) $[CrF_6]^{-3}$
	5) $[Ni(CN)_4]^{-2}$

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

154. Frenkel defect is observed in

1) CsCl 2) AgBr 3) ZnS 4) Both 2 & 3

155. In which of the following reaction N_2 is not a product

1) $NH_4Cl_{(Aq)} + NaNO_{2(Aq)} \rightarrow$ 2) $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta}$

3) $Ba(N_3)_2 \xrightarrow{\Delta}$ 4) $H_2NCONH_2 + H_2O \rightarrow$

156. Consider the following reaction $6NaOH + 3Cl_2 \underset{(Hot,conc)}{\rightarrow} 5NaCl + A + 3H_2O$

What is the oxidation number of chlorine in A

1) +5 2) −1 3) +3 4) +1

157. Highest oxidation state of manganese in fluoride is +4 (MnF_4) but highest oxidation state in oxides is +7 (Mn_2O_7) because

1) Fluorine is more electronegative than oxygen
2) Fluorine does not possess d-orbitals
3) Fluorine stabilises lower oxidation state
4) In covalent compounds fluorine can form single bond only while oxygen forms double

158. The oxidation number of sulphur in S_8, SO_2 and H_2S respectively are

1) $0, +4, -2$ 2) $+2, +4, -2$ 3) $0, +4, +2$ 4) $-2, +4, -2$

159. One mole of methanol when burnt in oxygen gives out $723\ KJ\ mol^{-1}$ heat . If one mole of oxygen is used, what will be the amount of heat evolved?

1) $723\ KJ$ 2) $964\ KJ$ 3) $482\ KJ$ 4) $241\ KJ$

160. If the wavelength of the electron is numerically equal to the distance travelled by it in one second then

1) $\lambda = \sqrt{\frac{h}{m}}$ 2) $\lambda = \frac{h}{p^2}$ 3) $\lambda = \frac{h}{m}$ 4) $\lambda = \sqrt{\frac{h}{p}}$

EAMCET MODEL GRAND TEST-1

Key sheet

MATHEMATICS

1) **4**	2) **4**	3) **2**	4) **2**	5) **1**	6) **2**	7) **1**	8) **4**	9) **3**	10) **1**
11) **1**	12) **1**	13) **4**	14) **3**	15) **2**	16) **2**	17) **3**	18) **3**	19) **4**	20) **4**
21) **2**	22) **4**	23) **3**	24) **3**	25) **3**	26) **1**	27) **2**	28) **1**	29) **1**	30) **1**
31) **3**	32) **3**	33) **2**	34) **4**	35) **4**	36) **3**	37) **3**	38) **1**	39) **4**	40) **2**
41) **1**	42) **3**	43) **4**	44) **3**	45) **1**	46) **1**	47) **1**	48) **2**	49) **3**	50) **4**
51) **3**	52) **2**	53) **3**	54) **4**	55) **1**	56) **1**	57) **4**	58) **2**	59) **1**	60) **2**
61) **3**	62) **2**	63) **3**	64) **3**	65) **4**	66) **3**	67) **2**	68) **2**	69) **2**	70) **2**
71) **1**	72) **3**	73) **1**	74) **2**	75) **4**	76) **4**	77) **3**	78) **2**	79) **4**	80) **1**

PHYSICS

1) **4**	2) **1**	3) **3**	4) **4**	5) **2**	6) **2**	7) **2**	8) **3**	9) **1**	10) **3**
11) **4**	12) **4**	13) **3**	14) **2**	15) **2**	16) **2**	17) **1**	18) **1**	19) **4**	20) **2**
21) **4**	22) **1**	23) **3**	24) **3**	25) **1**	26) **4**	27) **1**	28) **4**	29) **2**	30) **2**
31) **2**	32) **4**	33) **3**	34) **4**	35) **1**	36) **4**	37) **2**	38) **2**	39) **1**	40) **2**

CHEMISTRY

41) **1**	42) **3**	43) **1**	44) **4**	45) **1**	46) **1**	47) **4**	48) **2**	49) **3**	50) **1**
51) **2**	52) **4**	53) **2**	54) **3**	55) **3**	56) **3**	57) **4**	58) **2**	59) **2**	60) **4**
61) **2**	62) **3**	63) **4**	64) **3**	65) **4**	66) **3**	67) **2**	68) **1**	69) **2**	70) **1**
71) **2**	72) **3**	73) **3**	74) **4**	75) **4**	76) **1**	77) **4**	78) **1**	79) **3**	80) **1**

EAMCET MODEL GRAND TEST-1
HINTS AND SOLUTIONS

Mathematics

1. $x = \tanh y$

$$\sinh^{-1}\left(\frac{\tanh y}{\sqrt{1-\tanh^2 y}}\right) = \sinh^{-1}(\sinh y) \Rightarrow y = \tanh^{-1} x$$

2. By observation if $r = 0, S \neq 0, P \neq 0$

Then $\int \leq dy = \int (px+q)\,dx$

$\Rightarrow s\ y = \frac{px^2}{2} + qx + c$ it represents a parabola.

3. $8\sin x - 15\cos x = \pm\sqrt{8^2+15^2-15^2} = \pm 8$

$\because x \neq 90^0$ $\qquad 8\sin x - 15\cos x = -8$

4. both $\sec x$ and $\tan x$ are either +Ve or – Ve

5. $(\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$$\left(\frac{-b}{a}\right)\sqrt{\frac{b^2}{a^2} - \frac{4C}{a}} = 1$$

$$\frac{b^2}{a^2}\left(\frac{b^2-4ac}{a^2}\right) = 1$$

6. $\sin^2 x = 1, \cos^2 y = 1, \sec^2 z = 1$

7. $x = 1 \qquad \log\frac{1}{\pi}(\pi) = -1$

8. $f(x) + f(x+6) = f(x+3) + f(x+9)$ ..... [1]

replace x with x+3

$f(x+3) + f(x+9) = f(x+6) + f(x+12)$ ..... [2]

From [1] & [2] $f(x) = f(x+12)$

9. Let side of an equililateral $\Delta le = x$ Area = $\frac{\sqrt{3}}{4}x^2$

Side of hexagon = y Area = $6\frac{\sqrt{3}}{4}y^2$

Perimeters are equal $\Rightarrow 3x = 6y \Rightarrow x = 2y$

$\therefore$ ratio of angles = $\frac{\sqrt{3}}{4}.4y^2 = 6\frac{\sqrt{3}}{4}y^2 \Rightarrow 4:6$

10. $e^y\frac{dy}{dx} + e^y e^x = e^{2x}$

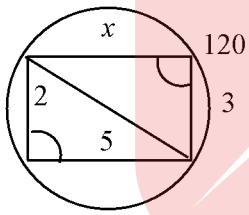
Put $e^y = t \Rightarrow \frac{dt}{dx} + e^x t = e^{2x}$

If $e^{\int e^x dx} = e^{e^x}$

General solution $t.e^{e^x} = \int e^{e^x}, e^{2x}dx + c$ put $e^x = 3$

$\Rightarrow e^y.e^{e^x} = \int se^s ds + c = e^s(s-1) + c$

11. $2^2 + 5^2 - 2.2.5.\cos 60 = x^2 + 3^2 - 2.x.3\cos 120^0$



12. $(n+1)(n+2)(n+3)(n+4)(n+5)(n+6)$

product of 6 consecutive integers is divisible by 6!

13. $f(x)$ is and odd function

14. $\begin{vmatrix} 1 & 2a & a \\ 1 & 3b & b \\ 1 & 4c & c \end{vmatrix} = 0$

$1(3bc - 4bc) - 2a(c - b) + a(4c - 3b) = 0$

-bc + 2ac + 2ab + 4ac - 3ab = 0

-bc – ab + 2ac = 0 = 2ac = ab + bc

$\therefore a,b,c$ are in H.P

15. $B^2 = \left(CAC^{-1}\right)\left(CAC^{-1}\right) = CA^2C^{-1}$

$B^3 = \left(CA^2C^{-1}\right)\left(CAC^{-1}\right) = CA^3C^{-1}$

16. $\overline{BE} + \overline{AF} = \frac{1}{2}\left(\overline{BA} + \overline{BC}\right) + \frac{1}{2}\left(\overline{AB} + \overline{AC}\right) = \frac{-1}{2}\left(\overline{CA} + \overline{CB}\right) = \overline{DC}$

17. Let $\bar{\alpha} = \tan A\bar{i} + \tan B\bar{j} + \tan C\bar{k}$

$\bar{\beta} = \sqrt{a^2 - 4}\bar{i} + a\bar{j} + \sqrt{a^2 + 4}\bar{k}$

$\left(\bar{\alpha}, \bar{\beta}\right) = \theta$ given $\bar{\alpha}.\bar{\beta} = 6a$

$\left|\bar{\alpha}\right|, \left|\bar{\beta}\right| \cos\theta = 6a \Rightarrow \alpha^2\beta^2\cos^2\theta = 36a^2$

$3a^2 \sum \tan^2 A.\cos^2\theta = 36a^2$

$\left(\sum \tan^2 A\right)\cos^2\theta = 12$

$\sum \tan^2 A = 12 \quad (\because \text{ max of } \cos^2\theta = 1)$

18. $a\bar{i} + b\bar{j} + c\bar{k}$ is equally inclined with coordinate axes $\Rightarrow a = b = c$

19. $\overline{CA}.\overline{CB} = 0 \qquad \because \underline{\angle C} = 90^0$

$\overline{AB}.\overline{AC} + \overline{BC}.\overline{BA} = \overline{AB}.\overline{AC} + \overline{CB}.\overline{AB}$

$= \overline{AB}.\left(\overline{AC} + \overline{CB}\right)$

$= \overline{AB}.\overline{AB} = p^2$

20. $\bar{a},\bar{b},\bar{c}$ are coplanar (linearly dependent)

21. From vector triple product. $\bar{a}\times\left(\bar{b}\times\bar{c}\right)=\left(\bar{a}\ .\bar{c}\right)\bar{b}-\left(\bar{a}.\bar{b}\right)\bar{c}\ \ \therefore\bar{u}=2\bar{a}$

22. $a^2+b^2+c^2=0\Rightarrow a=b=c=0$

23. $(x-a)(x-10)=-1$

If $x-10=1$ then $x-a=-1$

$\Rightarrow x=11 \qquad \therefore a=12$

If $x-10=-1 \qquad x-a=1$

$x=9 \qquad \Rightarrow a=8$

24. $f(x)=x^3+3x^2-9x+c$

$f'(x)=0\Rightarrow 3x^2+6x-9=0$

$x^2+2x-3=0\ \Rightarrow x=-3,1$

$f(-3)=0\Rightarrow C=-27$

25. $x^3+3x^2+3x+2=(x+2)\left(x^2+x+1\right)$

$x^2+x+1=0$ has no real roots

$\because$ non real roots occurs in conjugate pairs, $x^2+x+1=0$ and $ax^2+bx+c=0$ have same roots $\Rightarrow a=b=c$

26. $z\bar{z}=|z|^2=1\Rightarrow\bar{z}=\dfrac{1}{z}$

27. Let $z=-i$ Arg $z=\dfrac{-\pi}{2}$

$Arg(-z)=-Argz$

28. $\prod_{n=1}^{\infty}z_n=cis\left(\dfrac{\pi}{2}+\dfrac{\pi}{2^2}+\dfrac{\pi}{2^3}.....\right)$

$\cos\pi\left(\dfrac{1/2}{1-1/2}\right)=cis\pi=-1$

29. $1+\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^5=0$

30. Let $a_n=\sum_{r=0}^{n}\frac{r}{{}^nC_r}=n\sum_{r=0}^{n}\frac{1}{{}^nC_r}-\sum_{r=0}^{n}\frac{r}{{}^nC_r}\Rightarrow 2\sum_{r=0}^{n}\frac{r}{{}^nC_r}=n\sum_{r=0}^{n}\frac{1}{{}^nC_r}$

$\Rightarrow\sum_{r=0}^{n}\frac{r}{{}^nC_r}=\frac{n}{2}\sum_{r=0}^{n}\frac{1}{{}^nC_r}=7\sum_{r=0}^{n}\frac{1}{{}^nC_r}\Rightarrow n=14$

31. $f(x)=\left(1+x+x^2+x^3\right)^5$

$\sum_{k=0}^{7}{}^a2k\ x^{2k}=\frac{f(1)+f(-1)}{2}=\frac{4^5}{2}$

32. $\sum_{i=0}^{m}{}^{10}C_i\ {}^{20}C_{m-i}={}^{30}C_m$ is max for $m=15$

33. $\frac{n!}{(n-a)!}=\frac{n!}{(n-b)!}\Rightarrow(n-a)!=(n-b)!$

$\because a\neq b\quad n-a=1$ and $n-b=0$

$\because a<b\qquad n-a>n-b\qquad\therefore a+b=2n-1$

34. $1\le r+1\le n\Rightarrow n-1\ge r\ge 0$ ..... $\boxed{1}$

$k^2-3=\frac{{}^{(n-1)}C_r}{{}^nC_{r+1}}=\frac{r+1}{n}$ ..... $\boxed{2}$

From $\boxed{1}$ & $\boxed{2}$

$0<\frac{r+1}{n}\le 1\Rightarrow 0<k^2-3\le 1$

$3<k^2\le 4$

35. $\frac{{}^8C_1\left({}^{14}C_2-{}^7C_1\right)+{}^8C_2}{{}^{16}C_4}$ (OR) $1-\frac{{}^8C_4\cdot 2}{{}^{16}C_4}=1-\frac{8}{13}=\frac{5}{13}$

36. We should get 3 times six numbered face in first 9 trials

$$= {}^{9}C_3 \times \left(\frac{1}{6}\right)^3 \left(\frac{5}{6}\right)^6 . \frac{1}{6}$$

37. $\left(\frac{1}{n+1}\right).1 + \left(\frac{n}{n+1}\right)\frac{1}{2} = \frac{7}{12}$

38. $np = 25 \qquad \because \ 0 < q < 1$

$npq \in [0, 25)$

39. $\frac{n^2 - 1}{12}$

40. New mean

$$\frac{x_1 + x_2 .... + x_n}{n} + \frac{1 + 2 + ... + n}{n} = \overline{X} + \frac{n+1}{2}$$

41. Slope of $\overline{AB}$ = slope of $\overline{AC}$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{\sin\theta - \frac{1}{\sqrt{3}}}{\cos\theta + 1} \Rightarrow \theta = 120^0$$

42. $\sqrt{(x-1)^2 + (y-1)^2} = \frac{|x + y + 2|}{\sqrt{2}}$

$$\Rightarrow 2\left(x^2 + y^2 - 2x - 2y + 2\right) = x^2 + y^2 + 4 + 2xy + 4x + 4y$$

$$\Rightarrow x^2 - 2xy + y^2 - 8x - 8y = 0$$

43. Line cuts co axes at $\left(\frac{-c}{a}, 0\right)$ and $\left(0, \frac{-c}{b}\right)$ $-\frac{c}{a} > 0$ and $-\frac{c}{b} > 0$

44. Image of $ax + by + c = 0$ wrt $lx + my + n = 0$ is $\frac{ax + by + c}{lx + my + n} = \frac{2(al + bm)}{l^2 + m^2}$

45. Area of ΔABC = Area of ΔPQR

46. $x^2-(y-1)^2=0$ Put $y-1=y \Rightarrow x^2-y^2=0$

Equation of pair of angle bisector is $xy=0 \ldots . \boxed{1}$ and line is

$x+y+1-3=0$ i.e $x+y-2=0$ ..... $\boxed{2}$

Area of triangle formed by $\boxed{1}$ $\boxed{2}$ is 2 sq.units

47. Let P.I is $(0, y)$ then given pair is $by^2+2fy+c=0$

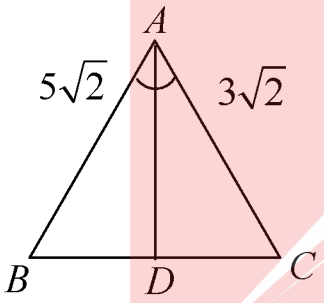
Roots are equal $\Rightarrow 4f^2-4bc=0 \Rightarrow f^2=bc$

Given equation represents a pair of lines

$\Rightarrow abc+2fgh-af^2-bg^2-ch^2=0$

$2fgh=bg^2+ch^2$

48.



D divides $\overline{BC}$ in ratio is 5:3 then

$$D=\frac{5(4,3,2)+3(1,-1,3)}{8}=\left(\frac{23}{8},\frac{12}{8},\frac{19}{8}\right)$$

$$\therefore AD=\frac{3}{8}\sqrt{170}$$

49. If a,b,c are edges of rectangular parallelo piped then angle between diago

$$\cos^{-1}\left(\frac{\pm a^2\pm b^2\pm c^2}{a^2+b^2+c^2}\right)$$

50. Let equation of planes $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$

Then $A(a,0,0)\,B(0,b,0)\,C(0,0,c)$ and centroid of ΔABC is

$$\left(\frac{a}{3},\frac{b}{3},\frac{c}{3}\right)=(x_1,y_1,z_1)$$

Then $\frac{x}{3x_1}+\frac{y}{3y_1}+\frac{z}{3z_1}=1$

$\perp r$ distance from $(0,0,0)$ to plane is $P=\frac{1}{\sqrt{\frac{1}{9x_1^2}+\frac{1}{9y_1^2}+\frac{1}{9z_1^2}}}$

$$\Rightarrow x^{-2}+y^{-2}+z^{-2}=9p^{-2}$$

51. $$\lim_{n\to\infty}\cos\left(\left(\frac{n}{\sqrt{n^2+n+n}}\right)\pi\right)=\cos\frac{\pi}{2}=0$$

52. By L-Rule, required value is $\frac{-f'(1)}{3}=\frac{53}{3}$

53. $f(x)=x^2\tanh\left(\frac{1}{x}\right), x\neq 0$

$=0, \qquad x=0$

$\lim_{x\to 0} f(x)=f(0)$ then f is cont at $x=0$

$$f(0)=\lim_{x\to 0}\frac{f(x)-f(0)}{x-0}$$

$$=\lim_{x\to 0}\frac{x^2\tanh\left(\frac{1}{x}\right)-0}{x}=\lim_{x\to 0}x\tanh\left(\frac{1}{x}\right)=0$$ exists and finite

$\therefore f$ is differentiable at $x=0$

54. $$\frac{d^2x}{dy^2}=\frac{d}{dy}\left(\frac{dx}{dy}\right)=\frac{d}{dy}\left(\frac{1}{y_1}\right)=\frac{-1}{y_1^2}\cdot y_2\cdot\frac{dx}{dy}=\frac{-y_2}{y_1^3}$$

55. $\theta = 45^0 \Rightarrow r = h$

$A = \pi rl = \pi r\sqrt{r^2 + h^2}$

$= \sqrt{2}\pi h^2$

Approximate lateral surface area $= A + \Delta A$

$= \sqrt{2}\pi h^2 + 2\sqrt{2}\pi h\Delta h$

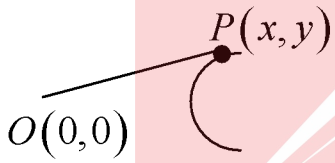
56. $\frac{dv}{dt} = 1800cm^3 / \sec$

$V = \frac{4}{3}\pi r^3 \Rightarrow \frac{dv}{dt} = 4\pi r^2 \frac{dr}{dt}$

$\Rightarrow 1800 = 4\pi(120)^2 \frac{dr}{dt} \Rightarrow \frac{dr}{dt} = \frac{1}{(12)(16\pi)}$

$= 4\pi r^2 \Rightarrow \frac{dA}{dt} = 8\pi r\frac{dr}{dt} = 8\pi.720.\frac{1}{72(16\pi)} = 5sq\ cm / \sec$

57.



Slope of OP in $\frac{y}{x} = \frac{dy}{dx} \Rightarrow \frac{y}{x} = \cos x - \sin x....\boxed{1}$

And $y = \sin x + \cos x.....\boxed{2}$

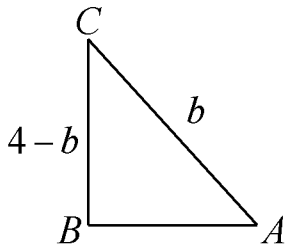
$\boxed{1}^2 + \boxed{2}^2 \Rightarrow \frac{y^2}{x^2} + y^2 = 2 \Rightarrow \frac{1}{x^2} + 1 = \frac{2}{y^2}$

58. $f^1(x) > 0 \Rightarrow 3x^2 - 2ax + 48 > 0$

$\Delta < 0 \Rightarrow 4a^2 - (4)(3)(48) < 0$

$\Rightarrow a^2 - 144 < 0 \Rightarrow a \in (-12,12)$

59.



$$BA = \sqrt{b^2 - (4-b)^2} = \sqrt{8b-16}$$

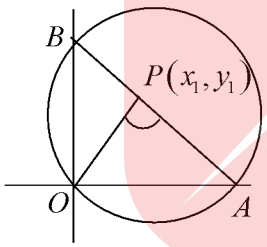
$$\Delta^2 = \frac{1}{4}(8b-16)(4-b)^2 = 2(b-2)(4-b)^2$$

$$f^1(b) = 0 \Rightarrow b = \frac{8}{3}$$

$$\sin A = \frac{1}{2} \Rightarrow A = 30^0$$

60. $$f^1(C) = 0 \Rightarrow \frac{2C}{C^2+ab} - \frac{1}{C} = 0 \Rightarrow C^2 = ab$$

61.



Slope of $\overline{OP}$ is $\frac{y_1}{x_1}$ and slope of $\overline{AB}$ is $-\frac{x_1}{y_1}$

Then equation of $\overline{AB}$ is $xx_1 + yy_1 = x_1^2 + y_1^2$

$$\therefore A\left(\frac{x_1^2+y_1^2}{x_1}, 0\right) B\left(0, \frac{x_1^2+y_1^2}{y_1}\right)$$

$$AB = 2r$$

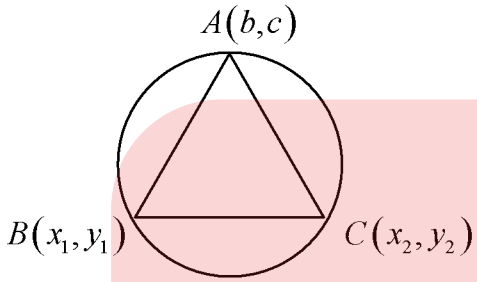
62. $\begin{vmatrix} 1 & 4 & 1 \\ 2 & 3 & 3 \\ 1 & -6 & 3 \end{vmatrix} = 1(27) - 4(3) + 1(-15) = 0$

Lines are concurrent

Point of concurrence touches all the three lines

63. by observation $(0,0)$ is point of contact $(0,0)(-g,-f)(-g^1,-f^1)$ are collinear

64.



$AB = d \Rightarrow (x_1 - b)^2 + (y_1 - c)^2 = d^2$

$\Rightarrow (x_1^2 + y_1^2) + (b^2 + c^2) - 2bx_1 - 2cy_1 = d^2$

$\Rightarrow 2a^2 - d^2 = 2bx_1 + 2cy_1$

Similarly $2a^2 - d^2 = 2bx_2 + 2cy_2$

$\therefore$ equation of $\overline{BC}$ is $2(bx + cy) = 2a^2 - d^2$

65. Radical axes of given circles is

$6x + 14y + c + d = 0 \ldots\ldots \boxed{1}$

$(1,-4)$ lies on $\boxed{1}$

$6 - 56 + c + d = 0$

$\Rightarrow c + d = 50$

$\frac{c+d}{2} \geq \sqrt{cd} \Rightarrow 25 \geq \sqrt{cd} \Rightarrow cd \leq 625$

66. Let $y = m(x+a)+\frac{a}{m}$ is tangent to $y^2 = 4a(x+a)$ ..... $\boxed{1}$

then equation of tangent to $y^2 = 4b(x+b)$ is

$$y = \frac{-1}{m}(x+b) - bm ..... \boxed{2}$$

From $\boxed{1}$ $\boxed{2}$ $m(x+a)+\frac{a}{m} = \frac{-1}{m}(x+b) - bm$

$$\Rightarrow m(x+a+b)+\frac{1}{m}(x+a+b) = 0$$

$$\Rightarrow (x+a+b)\left(m+\frac{1}{m}\right) = 0 \Rightarrow x+a+b = 0$$

67. equation of normal at t is $y + xt = 2at + at^3$

Slope is $-t = \tan 45^0 \Rightarrow t = -1$

Length of normal chord $= \frac{4a\left(1+\left(t^2\right)\right)^{\frac{3}{2}}}{t^2} = 8\sqrt{2}$

68. $\frac{SP.SP^1}{SP+SP^1} = \frac{1}{\frac{1}{SP}+\frac{1}{SP^1}} = \frac{1}{\frac{2}{SL}} = \frac{SL}{2}$

Here $b > a$ then $SL = \frac{a^2}{b}$

Therefore, required value $= \frac{a^2}{2b} = \frac{7}{6}$

69. equation of normal at θ to the ellipse is $\frac{ax}{\cos\theta} - \frac{6y}{\sin\theta} = a^2 - b^2$

$\perp r$ dist from (0,0) to normal $= \frac{\left|a^2-b^2\right|}{\sqrt{a^2\sec^2\theta + b^2\operatorname{cosec}^2\theta}}$

max distance $= \frac{\left|a^2-b^2\right|}{\min of \sqrt{a^2\sec^2\theta + b^2\operatorname{cosec}^2\theta}}$

$$= \frac{\left|a^2-b^2\right|}{a+b} = |a-b|$$

70. Equations of asymptotes are $y = \pm\frac{b}{a}x$ and directrices are $x = \pm\frac{a}{e}$

Therefore, $P.I = \left(\pm\frac{a}{e}, \pm\frac{b}{e}\right)$ lies on $x^2 + y^2 = a^2$

71. Put $\frac{2x+1}{3x+5} = t \Rightarrow \frac{7}{(3x+5)^2}dx = dt$

$$\therefore \int \frac{1}{t^{\frac{5}{6}}} \cdot \frac{1}{7} dt = \frac{1}{7}\frac{t^{\frac{1}{6}}}{\frac{1}{6}} + c = \frac{6}{7}t^{\frac{1}{6}} + c$$

72. $$\underset{n\to\infty}{Lt} \frac{(1-x^2)(1+x^2)(1+x^4)(1+x^8)....(1+x^{2n})}{1-x^2}$$

$$= \underset{n\to\infty}{Lt} \frac{1-(x^{2n})^2}{1-x^2} \text{ since } |x| < 1 \Rightarrow \frac{1}{1-x^2}$$

$$\int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1} x + c$$

73. $$\int \frac{1}{2}\frac{(1+x^2)+(1-x^2)}{1+x^4}dx = \frac{1}{2}\int \frac{1+\frac{1}{x^2}}{\left(x-\frac{1}{x}\right)^2+2}dx - \frac{1}{2}\int \frac{1-\frac{1}{x^2}}{\left(x+\frac{1}{x}\right)^2-2}dx$$

$$= \frac{1}{2}\cdot\frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{x-\frac{1}{x}}{\sqrt{2}}\right) - \frac{1}{2}\cdot\frac{1}{2\sqrt{2}}\log\left|\frac{x+\frac{1}{x}-\sqrt{2}}{x+\frac{1}{x}+\sqrt{2}}\right| + C$$

74. $$f(x) = (1+\tan x)\left[1+\frac{1-\tan x}{1+\tan x}\right] = 2$$

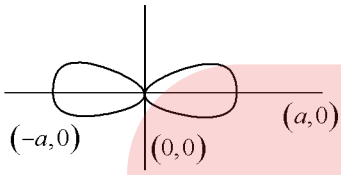
$$\therefore \int_0^1 x^3 g(2)\,dx = \frac{1}{4}g(2)$$

75. $$\int_0^{\tan 1} 0\,dx + \int_{\tan 1}^{10\pi} 1\,dx = 10\pi - \tan 1$$

76. $\underset{n\to\infty}{Lt}\sum_{r=1}^{n}\frac{r^4}{r^5+n^5}=\underset{n\to\infty}{Lt}\frac{1}{n}\sum_{r=1}^{n}\frac{\left(\frac{r}{n}\right)^4}{1+\left(\frac{r}{n}\right)^5}$

$$=\int_0^1\frac{x^4}{1+x^5}dx=\left(\frac{1}{5}\log\left(1+x^5\right)\right)_0^1=\frac{1}{5}\log_2$$

77.



Required area $=4\int_0^a ydx=4\int_0^a\frac{x}{a}\sqrt{a^2-x^2}\,dx=\frac{-2}{a}\int\left(a^2-x^2\right)^{\frac{1}{2}},-2x\;dx$

$$=\left[\frac{-2}{a}.\frac{2}{3}\left(a^2-x^2\right)^{\frac{3}{2}}\right]_0^a=\frac{4a^2}{3}$$

78. Let equation of line is $ax+by+c=0, a\neq 0$

Differentiation with respect to y

$$\Rightarrow a\frac{dx}{dy}+b=0$$

Again Differentiation with respect to y

$$\frac{ad^2x}{dy^2}=0$$

Since $a\neq 0$, then $\frac{d^2x}{dy^2}=0$

79. $f\left(2,3\right)=-1$

$$f\left(2,f\left(2,3\right)\right)=f\left(2,-1\right)=3$$

80. $r = (s-a)\tan A/2$ $\qquad A = 90^0$

$r = S - a$ $\qquad r = \dfrac{\Delta}{s}$

$r = S - 2R\sin A$

$r = \dfrac{\Delta}{r} - 2R$

$\Delta = r^2 + 2rR = r(r+2R)$

Physics

81. No. of beats heard

$$\Delta n = \frac{2n\,u}{v-u} = \frac{2\times 256\times 10}{330-10} = 16$$

82. Bulk modulus, $K = \dfrac{\Delta P}{(\Delta V/V)}$

$$K = \frac{hdgv}{\Delta v} \Rightarrow \Delta v = \frac{hdgv}{K}$$

83. work done, $W = 8\pi R^2 T$

$w \propto R^2$

$$\frac{w_1}{w_2} = \left(\frac{R_1}{R_2}\right)^2 \Rightarrow \frac{w}{w^1} = \left(\frac{R}{2R}\right)^2 \Rightarrow w^1 = 4w$$

$\therefore$ Extra work is $w^1 - w = 4w - w = 3w$

84. $F = T(2l)$

$\Rightarrow mg = T(2l) \Rightarrow \pi r^2 l dg = T(2l)$

Any length

85. Mass of steam left uncondensed is $\dfrac{2m}{3}$ gm

i.e $\dfrac{2\times 6}{3} = 4$gm

86. $\gamma = 1 + \dfrac{2}{f}$

$\Rightarrow f = \dfrac{2}{\gamma - 1}$

87. Loss or gain of time per day

$$\Delta T = \frac{1}{2}\alpha(\Delta t) \times 86400 \text{ s}$$

Therefore, $\Delta T \propto \Delta t \Rightarrow \frac{5}{10} = \frac{t-15}{30-t} \Rightarrow t = 20^0 C$

88. Heat energy absorbed is $\frac{\pi}{4}(P_2 - P_1)(V_2 - V_1)$

$$= \frac{\pi}{4}\left(20 \times 10^3\right)\left(20 \times 10^{-3}\right) = 10^2 \pi \text{ J}$$

89. Efficiency, $\eta = 1 - \frac{T_2}{T_1} = 1 - \frac{300}{400}$; $= \frac{100}{400} = \frac{1}{4}$

$$\% \text{ efficiency} = \frac{1}{4} \times 100 = 25\%$$

Therefore, it is impossible

90. frequency of an open, pipe $f_0 = 400$ Hz

frequency of a closed pipe $f_C = 300$ Hz

$\therefore$ frequency of resultant pipe is

$$f = \frac{f_0 f_c}{f_0 + 2f_c} = \frac{400 \times 300}{400 + 600} = 120 \text{ Hz.}$$

91. Amplitude,

$$A = \frac{1}{2}\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

$$= \frac{1}{2}\sqrt{(1+1)^2 + (2+2)^2 + (1+3)^2} = \frac{1}{2}\sqrt{36} = 3 \text{ cm}$$

92. $P = P_1 + P_2 = -15 + 5 = -10$

$$f(\text{ in cm}) = = \frac{100}{P} = \frac{100}{-10} = -10$$

93. $$\frac{\mu}{\mu_{air}} = \frac{\sin\left[\frac{75+45}{2}\right]}{\sin(75/2)} \quad \text{_____(1)}$$

$$\frac{\mu}{\mu_1} = \frac{\sin\left[\frac{75+15}{2}\right]}{\sin(75/2)} \quad \text{_____ (2)}$$

(1) $\frac{\bullet}{\bullet}$ (2)

$$\mu_1 = \sqrt{3/2}$$

94. Position of bright band

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

$$\therefore\ n\lambda_{Red} = (n+1)\lambda_{Blue}$$

$$\Rightarrow\ n \times 7500 = (n+1)\ 500 \quad \Rightarrow n = 2$$

95. Induced emf, $\varepsilon = \frac{-d\phi}{dt}$

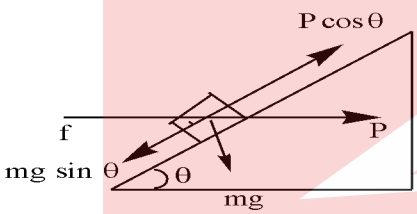
$$\Rightarrow \varepsilon = -\frac{d}{dt}\left[10t^2 - 50t + 250\right]$$

$$\varepsilon = -\left[20t - 50\right]$$

At $t = 3s$; $\varepsilon = -10V$

96. $C = \frac{E}{B} \Rightarrow B = \frac{E}{C} = \frac{6.3}{3 \times 10^8} = 2.1 \times 10^{-8}\,\hat{k}\,T$

97.



$$P\cos\theta = f + mg\sin\theta$$

$$P = 300\,\frac{2}{\sqrt{3}}\ N$$

98. $P = \left|\vec{P_1} + \vec{P_2}\right|$

$$P = \sqrt{P_1^2 + P_2^2 + 2P_1P_2\cos\theta}$$

$$mV^1 = \sqrt{(mV)^2 + (mV)^2 + 2m^2v^2\cos 90^0}$$

On solving we get $V^1 = \sqrt{2}V$

99. $W = \Delta KE$

$$FS = \Delta KE$$

$$S\ \alpha\ \Delta KE$$

$$\frac{S_1}{S_2} = \frac{\frac{3}{4}K - K}{0 - \frac{3}{4}K} \quad \& \quad \frac{S}{S_2} = \frac{+K/4}{+3K/4}$$

On solving S_2 = 15 cm.

100. $V_C = \dfrac{m v_1 + m v_2 + m v_3}{3m}$

$= \dfrac{m[v_0 i - 3v_0 j + 5v_0 k]}{3m} = \dfrac{v_0}{3}[i - 3j + 5k]$.

101. $d = \dfrac{m}{\pi r^2 l}$

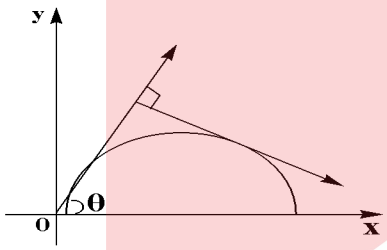
$\dfrac{\Delta d}{d} \times 100 = \dfrac{\Delta m}{m} \times 100 + 2\dfrac{\Delta r}{r} \times 100 + \dfrac{\Delta l}{l} \times 100$

$= 2\% + 2 \text{ x } 1.5\% + 0.8\%$

$= 2\% + 3\% + 0.8\% \quad = 5.8\%$

102. Concept of Velocity dependence on height above the ground for a projectile.

103.



$\vec{u} = u_x \hat{i} + u_y \hat{j}$

$\vec{u} = u\cos\theta \hat{i} + u\sin\theta \hat{j}$

After t sec

$\vec{V} = V_x \hat{i} + V_y \hat{j}$

$= u\cos\theta \hat{i} + (u\sin\theta - gt)\hat{j}$

$\vec{u} \perp \vec{v}$; $\vec{u} \cdot \vec{v} = 0$

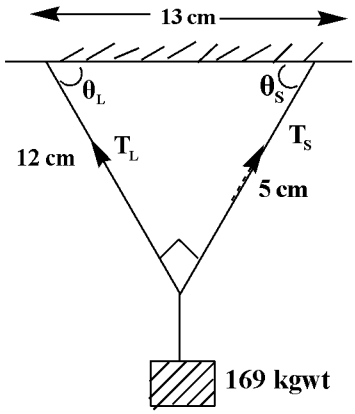
$u^2 \cos^2\theta + u^2 \sin^2\theta - u\sin\theta \times gt = 0$

$u^2 (\cos^2\theta + \sin^2\theta) = u\sin\theta \times gt$

$u = g\sin\theta \times t$

$\therefore\ t = \dfrac{u}{g\sin\theta}$

104



By applying Lami's theorem

$$\frac{T_L}{\sin(90+\theta_S)}=\frac{T_S}{\sin(90+\theta_2)}=\frac{169}{\sin 90}$$

$$\frac{T_L}{\cos\theta_S}=\frac{T_S}{\cos\theta_L}=169$$

$$T_s=169\cos\theta_L \quad =169\times\frac{12}{13}$$

$T_S = 156$ kgwt

$T_L = 169\ \cos\theta_s$

$$=169\times\frac{5}{13}$$

$T_L = 65$ kgwt

105. Concept of moment of inertia

106. Distance of C.M from the centre of rod $d=\frac{L}{4}\cos\left(\frac{\theta}{2}\right)$

$$d=\frac{100}{4}\times\cos\left(\frac{90}{2}\right)=25\times\frac{1}{\sqrt{2}}=12.5\times\sqrt{2}$$

$= 12.5 \text{ x } 1.414 = 17.67$

107. Escape velocity $V_e=\sqrt{\frac{2GM}{R}}$

But mass $M=\frac{4}{3}\pi R^3\rho$

$$V_e=\sqrt{\frac{2G\times\frac{4}{3}\pi R^3\rho}{R}}$$

$$V_e=2R\sqrt{\frac{2\pi\rho G}{3}}$$

108. Unbalanced wheat ston's Bridge $R_{AB} = r\left[\frac{3R + r}{3r + R}\right]$

$$R_{AB} = 10\left[\frac{3\times 20 + 10}{3 \times 10 + 20}\right]$$

$$= 10\left[\frac{70}{50}\right] = 14\Omega$$

109. $E_{mt} = (N - 2m)\, E,\ E\ \alpha\, l$

110. Distance b/w transmitter and Receiver is $d = \sqrt{2Rh_T} + \sqrt{2Rh_R}$

$$= \sqrt{2x6400x10^3\ x\ 25} + \sqrt{2x6400x10^3\ x64} = 46.5km.$$

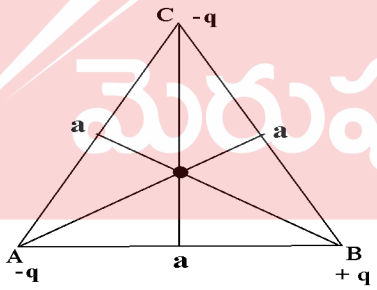
111. $C\theta = i\ BAm$

$$C = \frac{i\ BAn}{\theta}$$

$$\frac{0.5 \times 10^{-4} \times 2000 \times 10^{-4} \times 5 \times 10^{-4} \times 100}{20}$$

$= 2.5 \times 10^{-8}$ N – m/ degree.

112. Curie – Weiss Law



113. $F = \frac{1}{4\pi \in_0} \times \frac{q_1\, q_2}{r^2}$

114. Net distance between two plates of capacitor is a – b so equivalent capacitance $= \frac{A \in_0}{a - b}$

115. $I_{r.m.s} = \frac{V_{r.m.s}}{Z} = \frac{V_{r.m.s}}{R} = \frac{100}{50} = 2A$

$$V = \sqrt{V_R^2 + (V_L - V_C)^2}$$

$$100 = \sqrt{V_R^2 + (400 - 400)^2}$$

$V_R = 100$ Volt

116. Ace to Einstein's phot electric equation

$E = W + K . E_{max}$

$\frac{hc}{\lambda_1} = W + E_1$ _____ (1)

$\frac{hc}{\lambda_2} = W + E_2$ _____ (2)

By solving equation (1) & equation (2)

weget $W = \frac{E_2 \lambda_2 - E_1 \lambda_1}{\lambda_1 - \lambda_2}$

117. No of particles scattered at angle θ is

$N \alpha \frac{1}{\sin^4(\theta/2)}$

$\frac{N_1}{N_2} = \frac{\sin^4(\theta_2/2)}{\sin^4(\theta_1/2)}$

$\frac{28}{N_2} = \frac{\sin^4(60/2)}{\sin^4(90/2)}$

$N_2 = 112.$

118. Activity of the sample after time 't'

$A = \lambda N_0 e^{-\lambda t}$

But $N_0 = \frac{N_A m}{M}$

Activity $= \left(\frac{m N_A \lambda}{M}\right) e^{-\lambda t}$.

119. Conceptual $y = \left(\overline{A . \overline{A} . B}\right) . \left(\overline{\overline{A} . B . B}\right)$

$= \left(\overline{\overline{A} . \overline{\overline{A}} . B}\right) + \left(\overline{\overline{A} . B . B}\right)$

$y = A . \left(\overline{A} + \overline{B}\right) + \left(\overline{A} + \overline{B}\right) . B$

$A \overline{A} + A . \overline{B} + \overline{A} . B + B . \overline{B}$

$y = \left(A . \vec{B}\right) + \left(\overline{A} . B\right).$

120. Magnetic induction at the centre of circular coil is $B = \frac{\mu_0 ni}{2r}$

For first coil $B_1 = \frac{\mu_0 \times n_1 i_1}{2 r_1} = = \frac{\mu_0 \times 10 \times 0.2}{2 \times 20 \times 10^{-2}}$

$$B_1 = \frac{20\ \mu_0}{4}$$

For IInd coil $B_2 = \frac{\mu_0 \times 10 \times 0.3}{2 \times 40 \times 10^{-2}}$

$$B_2 = \frac{\mu_0 \times 15}{4}$$

$$B_{net} = B_1 \sim B_2 \quad = \frac{20\ \mu_0}{4} - \frac{15\ \mu_0}{4} = \frac{5\ \mu_0}{4}$$

Chemistry

121. Zeigler – Natta catalyst is familiar for polymerization of olefins.

122. $\frac{\lambda_1}{\lambda_2} = \frac{E_2}{E_1} = \frac{100}{1000} = \frac{1}{10} = \boxed{10:1}$

123. Rules of IUPAC nomenclature

124. $N_2 \quad N_2^{-2} \quad N_2^{-} \quad N_2^{+}$

$14e \ominus \quad 16e \ominus \quad 15e \ominus \quad 13e \ominus$

$3 \quad 2.0 \quad 2.5 \quad 2.5$

$\boxed{N_2 > N_2^+ = N_2^- > N_2^{-2}}$

125. $O_2 \quad O_2^+$

$16e \ominus \quad 15e \ominus$ $\boxed{O_2 < O_2^+}$

$2.0 \quad 2.5$

O_2^+ has one unpaired electron and hence paramagnetic

126. Ionisation Potential is directly proportional to Nuclear charge.

127. Number of moles

$$= \frac{21/100}{22.4} = 0.0093\ mol$$

128. $H_2O_2 + 2HI \rightarrow I_2 + 2H_2O$ (Ox)

$HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$ (Red)

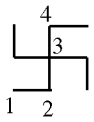
129. $Li_2CO_3 < Na_2CO_3$

This is because, Li^+ is small cation. Thermal stability will be less

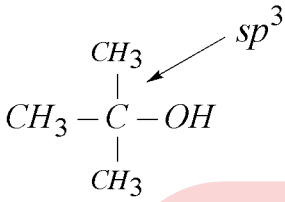
130. Coloured Manganous does not give borox bead.

131. XeO_3 has sp^3 hybridization. Shape is Pyramidal

132. Carbon dioxide is the major global warming gas.

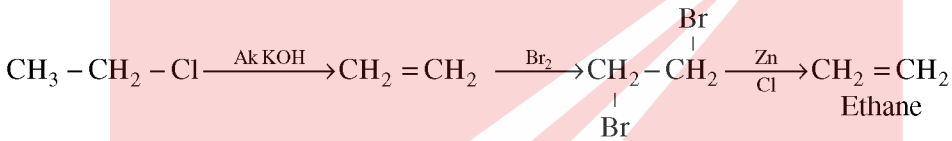
133. 

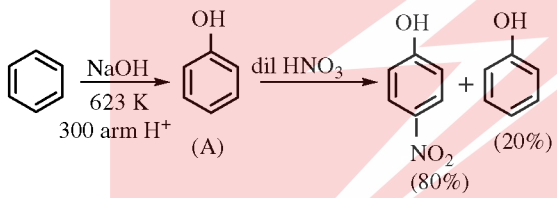
3,3 - Diethyl Pentane

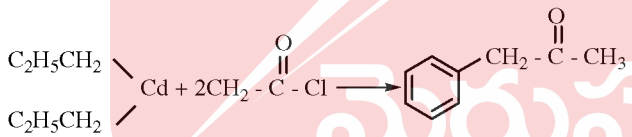
134. 

135. But-2-ene $CH_3 - CH = CH - CH_3$ symmetrical

It is only applicable for unsymmetrical

136. 

137. 

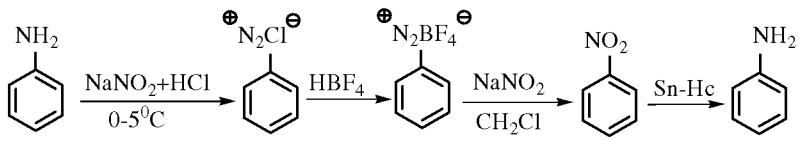
138. 

139. 1) $CH_3 - \underset{\underset{CH_3}{|}}{C} - CHO$
$\alpha H = O$

2) $CH_3 - CHO$
$\alpha H = 3$

3) $C_6H_5 - CHO$
$\alpha H = 0$

4) $HCHO$
$\alpha H = 0$

140. 

141. Amylopectine is a polymer of $\alpha - D -$ glucose

142. Vitamine $- B_{12}$ contains cobalt

143. Sweetness is highest for the artificial sweetness sucralose

144. Impurities are heaviour

145. Silica can not act as emulsifier

146. $$N_{resulting} = \frac{N_1V_1 + N_2V_2 + N_3V_3}{V_1 + V_2 + V_3} = \frac{100 + 400 + 900}{600} = \frac{1400}{600} = 2.33M$$

147. $$HCOOH \rightleftharpoons HCOO^- + H^+$$
$$C \qquad O \qquad O$$
$$C(1-\alpha) \qquad C\alpha \qquad C\alpha$$

C=0.25m; $\alpha = 3.2\% = \frac{32}{1000} = 0.032$

$$K_a = \frac{C\alpha^2}{1-\alpha}$$

As α is <5%; $1 - \alpha \simeq 1$

$$K_a = 0.2 \times 0.032 \times 0.032 = 0.0064 \times 0.032$$

$$K_a = 2.048 \times 10^{-4}$$

148. $$NH_2^- \xrightarrow{+H^{\oplus}} NH_3$$

Conjugate acid

149. $$t_{99.9\%} = \frac{2.303}{k}\log\frac{9}{a-x} = \frac{2.303}{10^{-3}}\log\frac{100}{100-99.9} = \frac{2.303}{10^{-3}}\log 10^3 = 2.303 \times 3 \times 10^3$$

$$= 6.9.9 \times 10^3 = 6909 \text{ sec}$$

150. $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$

One Mole NH_3 and one Mole H_2S

Equilibrium Partial Pressure = 10/2 = 5

$K_p = P_{NH_3}.P_{H_2S} = 25\ atm^2$

151. H^+ will be reduced to H_2, decreasing acidic nature

152. $$m = \frac{Ect}{69500} \quad m = \frac{63.5 \times 1.5 \times 600}{2 \times 96500} = 0.296\,gm$$

153. Concept of hybridisation

154. Frenkal defect is observed in both AgBr and ZnS

155. $H_2N-\overset{\overset{O}{\|}}{C}-NH_2+2H_2O\rightarrow (NH_4)_2CO_3\rightleftharpoons 2NH_3\uparrow$

156. $6NaOH+3Cl_2\xrightarrow[\text{Hot conc}]{}5NaCl+NaClO_3+3H_2O$

Oxidation state of Chlorine in $NaClO_3$ $+5$

157. Fluorine can form only single bonds. Oxygen can form multiple bonds.

158. $\overset{(O)}{S_8}\ \overset{+4}{SO_2}\ H_2\overset{-2}{S}$

159. $CH_3-OH+\frac{3}{2}O_2\rightarrow CO_2+2H_2O \quad \Delta H=-723KJ$

One Mole of O_2 evolved $\rightarrow \Delta H=2/3\ 723$

$$\boxed{\Delta H=482KJ}$$

160. $\lambda=\frac{h}{mv}$ distance travelled in one second is velocity $v=\lambda\Rightarrow\lambda=\sqrt{\frac{h}{m}}$

$$\frac{\lambda_1}{\lambda_2}=\frac{E_2}{E_1}=\frac{100}{1000}=\frac{1}{10}=\boxed{10:1}$$