EAMCET MODEL GRAND TEST

ENGINEERING

INSTRUCTIONS TO CANDIDATES

1. *The Question Paper consists of 160 questions.*
2. *Each question carries one mark. No negative marking for wrong answers.*
3. *Maximum time is 3 hours.*
4. *Use Ball - Point Pen while entering the Hall - Ticket Number and filling in Part - A of the First page.*
5. *Use H.B. Pencil only to darken the circle on OMR Answer Sheet.*
6. *Over - writing or blackening of more than one circle will not count for marks.*
7. *If you wish to change your answer, erase the already darkened circle completely and then darken the appropriate circle.*
8. *Candidates are prohibited from carrying any sheet of paper to the Examination Hall except the Hall - Ticket.*
9. *Do any rough / scratch work on the Test Paper itself.*
10. *Calculators, watches with calculators, pagers & cellular phones will not be allowed into the Examination Hall.*
11. *Candidates have to write suitable answers on the Answer Sheet only.*
12. *Candidates have to return the Answer Sheets and the Question Papers at the time of leaving the Examination Hall.*
13. *Candidates will be to leave the Examination Hall only in the last half - an hour before the close of the Test.*
14. *This Model test paper contains 20 pages.*

MATHEMATICS

1. $\int_0^a \sqrt{ax - x^2}\,dx =$

1) $\frac{\pi a^2}{2}$ 2) $\frac{\pi a^2}{4}$ 3) $\frac{\pi a^2}{8}$ 4) $\frac{3\pi a^2}{8}$

2. If $4\hat{i}+7\hat{j}+8\hat{k}, 2\hat{i}+3\hat{j}+4\hat{k}$ and $2\hat{i}+5\hat{j}+7\hat{k}$ are the position vectors of the vertices A, B and C, respectively, of a triangle ABC, the position vector of the point where the bisec--tor of angle A meets BC is

1) $\frac{2}{3}\left(-6\hat{i}-8\hat{j}-6\hat{k}\right)$ 2) $\frac{2}{3}\left(6\hat{i}+8\hat{j}+6\hat{k}\right)$ 3) $\frac{1}{3}\left(6\hat{i}+13\hat{j}+18\hat{k}\right)$ 4) $\frac{1}{3}\left(5\hat{j}+12\hat{k}\right)$

3. If $A=(1,-2,-1), B=(4,0,-3), C=(1,2,-1), D=(2,-4,-5)$ then the distance between $\overline{AB}$ and $\overline{CD}$ is

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

4. Number of onto functions from a set $A=(x\in z/2\le x<8)$ to the set $B=\{a,b\}$ is

1) 62 2) 30 3) 126 4) 14

5. If f(x) = |x – 1| + |x – 2| + |x – 3| and 2 < x < 3, then f(x) is

1) many-one 2) in to 3) identity function 4) constant function

6. $\tan^{-1}\left(\frac{1}{8}\right)+\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{5}\right)=$

1) $\frac{\pi}{2}$ 2) $\frac{\pi}{4}$ 3) $\frac{\pi}{6}$ 4) $\frac{\pi}{8}$

7. If A and B are symmetric matrices of the same order and X = AB + BA and Y = AB – BA, then $(XY)^T$ is equal to

1) XY 2) YX 3) -YX 4) -XY

8. If $\bar{a}.\bar{b}=0$ and $\bar{a}+\bar{b}$ makes an angle of $30°$ with $\bar{a}$, then

1) $|\bar{b}|=2|\bar{a}|$ 2) $|\bar{a}|=2|\bar{b}|$ 3) $|\bar{a}|=\sqrt{3}|\bar{b}|$ 4) $|\bar{a}|=|\bar{b}|$

9. $\lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{1/x^2} =$

1) e 2) $e^{1/2}$ 3) $e^{-1/2}$ 4) $e^{1/3}$

10. In Δ ABC if D.E.F are the midpoints of sides BC,CA,AB respectively and $\vec{AD}+\frac{2}{3}\vec{BE}+\frac{1}{3}\vec{CF}=k\vec{AC}$ *then* $k=$

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

11. Let $\vec{a} = 2\vec{i} + \vec{j} - 2\vec{k}$ and $\vec{b} = \vec{i} + \vec{j}$. If $\vec{c}$ is a vector such that $\vec{a}.\vec{c} = |\vec{c}|, |\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\vec{a} X \vec{b}$ and $\vec{c}$ is 30^0, then $\left|\left(\vec{a} X \vec{b}\right) X \vec{c}\right| =$

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

12. If the point $(x_1 + t(x_1 - x_2), y_1 + t(y_1 - y_2))$ divides the join of (x_1, y_1) and (x_2, y_2) internally, then

1) $t < 0$ 2) $0 < t < 1$ 3) $t > 1$ 4) $t = 1$

13. The ends of a rod of length 'l' move on the coordinate axes. The locus of the point on the rod which divides it in the ratio 1:2 is

1) $36x^2 + 9y^2 = 4l^2$ 2) $36x^2 + 9y^2 = l^2$ 3) $9x^2 + 36y^2 = 4l^2$ 4) $9x^2 + 36y^2 = l^2$

14. The distance of the line $3x - y = 0$ from the point $(4,1)$ measured along a line making an angle 135^0 with the $x-$ axis is

1) 0 2) $13\sqrt{2}/2$ 3) $11\sqrt{2}/4$ 4) $7\sqrt{2}/5$

15. The equations of the perpendicular bisectors of the sides AB and AC of ΔABC are $x - y + 5 = 0, x + 2y = 0$ respectively. If $A = (1,-2)$ then the equation of the line BC is

1) $14x + 23y - 40 = 0$ 2) $14x - 23y + 20 = 0$

3) $23x - 14y + 40 = 0$ 4) $23x + 14y - 20 = 0$

16. The harmonic conjugate of $(2,3,4)$ w.r.t. the point of $(3,-2,2),(6,-17,-4)$ is

1) $(18/5,-5,4/5)$ 2) $(11,-16,2)$ 3) $(1/2,1/3,1/4)$ 4) $(0,0,0)$

17. If a line makes angles $60^0, 45^0, 45^0$ *and* θ with the four diagonals a cube then $\sin^2\theta =$

1) $\frac{1}{12}$ 2) $\frac{11}{12}$ 3) $\frac{13}{12}$ 4) $\frac{31}{12}$

18. If the equation of the plane passing through $(4,0,1)$ and parallel to the plane $4x + 3y - 12z + 6 = 0$ is $ax + by + cz = d\,(a > 0)$ then

1) $ab = cd$ 2) $4ab - cd = 0$ 3) $cd + 4ab = 0$ 4) $a + b + c + d = -9$

19. If the volume of a sphere increases at the rate of $4\pi\, cc/\sec$ then the rate of increase of its radius when volume is $288\pi\, cc$ is

1) $\frac{1}{4} cm/\sec$ 2) $\frac{1}{12} cm/\sec$ 3) $\frac{1}{36} cm/\sec$ 4) $\frac{1}{9} cm/\sec$

20. If the relation between subnormal SN and subtangent ST at any point on the curve $by^2 = (x+a)^3$ is $p(SN) = q(ST)^2$, then $p/q =$

1) $8/27$ 2) $27/8$ 3) $8b/27$ 4) $27b/8$

21. The function $f(x) = x - \dfrac{\log(1+x)}{x} (x > 0)$ is increasing in

1) $(1,\infty)$ 2) $(0,\infty)$ 3) $(2,2e)$ 4) $(1/e, 2e)$

22. The focal length of a mirror is given by $\dfrac{1}{v} - \dfrac{1}{u} = \dfrac{2}{f}$. If equal errors '$\alpha$' are made in measuring u and v. Then relative error in 'f' is

1) $\dfrac{2}{\alpha}$ 2) $\alpha\left(\dfrac{1}{u} + \dfrac{1}{v}\right)$ 3) $\alpha\left(\dfrac{1}{u} - \dfrac{1}{v}\right)$ 4) $3/\alpha$

23. Domain of $\log_3\{\log_2(x-3)\}$ is

1) $(4,\infty)$ 2) $(2,\infty)$ 3) $(3,\infty)$ 4) ϕ

24. $1 + \dfrac{1}{2}(1+2) + \dfrac{1}{3}(1+2+3) + \dfrac{1}{4}(1+2+3+4) + \ldots\ldots +$ up to 20 terms is

1) 110 2) 111 3) 115 4) 116

25. The vectors $\overline{AB} = 3\bar{i} + 4\bar{k}$ and $\overline{AC} = 5\bar{i} - 2\bar{j} + 4\bar{k}$ are the sides of a triangle ABC. The length of the median through 'A' is

1) $\sqrt{72}$ 2) $\sqrt{33}$ 3) $\sqrt{288}$ 4) $\sqrt{18}$

26. $\begin{vmatrix} Sin^2 13^0 & Sin^2 77^0 & Tan 135^0 \\ Sin^2 77^0 & Tan 135^0 & Sin^2 13^0 \\ Tan 135^0 & Sin^2 13^0 & Sin^2 77^0 \end{vmatrix} =$

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

27. The period of $|Sin3x| + |Cos3x| =$

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

28. $Tan9^0 - Tan27^0 - Tan63^0 + Tan81^0 =$

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

29. The solution of $|Cosx| = Cosx - 2Sinx$ is

1) $x = n\pi, n \in z$ 2) $x = n\pi + \frac{\pi}{4}, n \in z$

3) $x = n\pi + (-1)^n \frac{\pi}{4}, n \in z$ 4) $x = 2n\pi + \frac{5\pi}{4}, n \in z$

30. The elevation of an object on a hill is observed from a certain point in the horizontal plane through its base to be 30^0. After walking 120 meters towards it on level ground the elevation is found to be 60^0. Then the height of the object (in meters) is

1) 120 2) 60 3) $120\sqrt{3}$ 4) $60\sqrt{3}$

31. The transformed equation of $3x^2 + 3y^2 + 2xy = 2$ when the coordinate axes are rotated through an angle of 45^0 is

1) $X^2 + 2Y^2 = 1$ 2) $X^2 + Y^2 = 1$ 3) $2X^2 + Y^2 = 1$ 4) $X^2 + 3Y^2 = 1$

32. If the area of the triangle formed by the pair of lines $8x^2 - 6xy + y^2 = 0$ and the line $2x + 3y = a$ is '7' then 'a'=

1) 14 2) $14\sqrt{2}$ 3) $28\sqrt{2}$ 4) 28

33. The curve $x^2 + y^2 + 2gx + 2fy + c = 0$ intercepts on the line $lx + my = 1$, a length which subtends a right angle at origin then $\frac{lg + mf + 1}{l^2 + m^2} =$

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

34. If $f : R \to R$ is defined by $f(x) = \begin{cases} \frac{2\sin x - \sin 2x}{2x\cos x} & if \quad x \neq 0 \\ \alpha & if \quad x = 0 \end{cases}$ then the value of α so that 'f' is continuous at $x = 0$ is

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

35. $\underset{x \to \infty}{Lt} \left(\sqrt{x + \sqrt{x + \sqrt{x}}} - \sqrt{x} \right) =$

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

36. $\frac{d}{dx}\left[\sin^{-1}\left(\frac{3x}{2} - \frac{x^3}{2} \right) \right] =$

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

37. If $x^2+y^2=t-\frac{1}{t}$ and $x^4+y^4=t^2+\frac{1}{t^2}$, then $x^3y\frac{dy}{dx}=$.....

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

38. $Sech^{-1}(\sin\theta)=$

1) $\log\left(\cos\frac{\theta}{2}\right)$ 2) $\log\left(\sin\frac{\theta}{2}\right)$ 3) $\log\left(\tan\frac{\theta}{2}\right)$ 4) $\log\left(\cot\frac{\theta}{2}\right)$

39. If $\frac{\sin 3B}{\sin B}=\left(\frac{a^2-c^2}{2ac}\right)^2$, then a^2,b^2,c^2 are in

1) A.G.P 2) H.P 3) G.P 4) A.P

40. In an equilateral triangle $r:R:r_1$ is

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

41. Twenty identical coins each with probability p of showing heads are tossed. The probability of heads showing on 10 coins is same as that of heads showing on 11 coins then p =

1) $\frac{1}{2}$ 2) $\frac{10}{21}$ 3) $\frac{11}{21}$ 4) $\frac{13}{21}$

42. A random variable X has Poisson distribution with mean 2. Then $P(X>1.5)$ equals

1) $1-2/e^2$ 2) $1-4/e^2$ 3) $1-\frac{3}{e^2}$ 4) $1-1/e^2$

43. The exponent of 3 in 100 ! is

1) 33 2) 44 3) 48 4) 52

44. $f:A\to A, A=\{a_1,a_2,a_3,a_4,a_5\}$, then the number of one one functions so that $f(x_i)\neq x_i, x_i\in A$ is

1) 44 2) 88 3) 22 4) 20

45. If $|x|<\frac{1}{5}$, the coefficient of x^3 in the Expansion of $\frac{1}{(1-5x)(1-4x)}$ is

1) 369 2) 370 3) 371 4) 372

46. The condition that the equation $\frac{1}{x}+\frac{1}{x+b}=\frac{1}{m}+\frac{1}{m+b}$ has real roots that are equal in magnitude but opposite in sign is

1) $b^2=m^2$ 2) $b^2=2m^2$ 3) $2b^2=m^2$ 4) $b^2=3m^2$

47. If each root of the equation $x^2+11x+13=0$ is diminished by 4, then the resulting equation is

1) $x^2+3x-15=0$ 2) $x^2+3x+73=0$ 3) $x^2+19x+73=0$ 4) $x^2-3x-4=0$

48. If $z = 6e^{i\frac{\pi}{3}}$ then $\left|e^{iz}\right| =$

1) $\frac{1}{e^{\sqrt{3}}}$ 2) $\frac{1}{e^{2\sqrt{3}}}$ 3) $\frac{1}{e^{3\sqrt{3}}}$ 4) $\frac{1}{e^{4\sqrt{3}}}$

49. If $x^2 + x + 1 = 0$, then the value of $\left(x + \frac{1}{x}\right)^2 + \left(x^2 + \frac{1}{x^2}\right)^2 + ... + \left(x^{27} + \frac{1}{x^{27}}\right)^2$ is

1) 27 2) 72 3) 45 4) 54

50. If $2\cos A + 3\cos B + 5\cos C = 0 = 2\sin A + 3\sin B + 5\sin C$ then

$8\cos 3A + 27\cos 3B + 125\cos 3C = k\cos(A + B + C)$, then k=

1) 70 2) 80 3) 90 4) 60

51. The value of $\sum_{k=1}^{10}\left(\sin\frac{2k\pi}{11} + i\cos\frac{2k\pi}{11}\right)$ is

1) -1 2) $-i$ 3) i 4) 1

52. $\int\sqrt{e^x - 1}\,dx\,(x > 0) =$

1) $2\sqrt{e^x - 1} - \tan^{-1}\sqrt{e^x - 1} + c$ 2) $2\sqrt{e^x - 1} + \tan^{-1}\sqrt{e^x - 1} + c$

3) $2\sqrt{e^x - 1} + 2\tan^{-1}\sqrt{e^x - 1} + c$ 4) $2\sqrt{e^x - 1} - 2\tan^{-1}\sqrt{e^x - 1} + c$

53. The system of equations $-2x + y + z = a, x - 2y + z = b, x + y - 2z = c$ is inconsistent if

1) $a + b + c = 1$ 2) $a + b + c = 0$ 3) $a + b + c \neq 0$ 4) $a + b + c \neq 1$

54. $\int\frac{\sec x}{(\sec x + \tan x)^6}dx = \frac{(\sec x + \tan x)^n}{n} + c$ then $n =$

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

55. The order of differential equation whose solution is given by
$y = c_1\cos(2x + c_2) - (c_3 + c_4)a^{x+c_5} + c_6\sin(x - c_7)$ is

1) 4 2) 3 3) 7 4) 5

56. The solution of $\frac{dy}{dx} = \frac{y}{x} + \sin\left(\frac{y}{x}\right)$ is

1) $\tan\left(\frac{y}{2x}\right) - cx = 0$ 2) $\tan\left(\frac{y}{x}\right) - cx = 0$ 3) $\tan\left(\frac{y}{x}\right) + cx - x = 0$ 4) $\sin\left(\frac{y}{2x}\right) - cx = 0$

57. If a circle passes through the point (a,b) and cuts the circle $x^2 + y^2 = 4$ orthogonally, then the locus of its centre is

1) $2ax - 2by + (a^2 + b^2 + 4) = 0$ 2) $2ax + 2by - (a^2 + b^2 + 4) = 0$

3) $2ax + 2by + (a^2 + b^2 + 4) = 0$ 4) $2ax - 2by - (a^2 + b^2 + 4) = 0$

58. If the line $x+2y+k=0$ is a tangent to the parabola $y^2+4y+4x=0$ then

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

59. Two tangents to parabola $y^2=4ax$ have inclinations θ_1 *and* θ_2 with X-axis such that $\tan^2\theta_1+\tan^2\theta_2=k$ then the locus of the point of intersection is

1) $y^2=kx^2+ax$ 2) $y^2=kx^2$ 3) $y^2=kx^2+2ax$ 4) $y^2=2ax$

60. The solution of $\frac{dy}{dx}=\frac{x-2y+3}{2x-y+5}$

1) $x^2-2xy+y^2+3x-5y=c$ 2) $x^2-4xy+y^2+6x-10y=c$

3) $x^2-4xy-y^2-3x+5y=c$ 4) $x^2-2xy+2y^2+6x-5y=c$

61. If one root of the quadratic equation $ax^2+bx+c=0$ is $3-4i$ then $a+b+c=$

1) 40a 2) 36a 3) -20a 4) 20a

62. In the expansion of $(1+x)^{14}$, T_r, T_{r+1}, T_{r+2} terms coefficients are in A.P then r =

1) 6 2) 7 3) 8 4) 9

63. A speaks truth in 80% cases and B speaks truth in 60% cases The percentage of the cases in which A and B are likely to contradict each other in stating the same fact is

1) 40% 2) 44% 3) 48% 4) 52%

64. Bag A contains 2 white and 3 red balls. Bag B contains 4 white and 5 red balls. One ball is drawn at random from one of the bags and is found to be red. The probability that the ball was drawn from bag B is

1) $\frac{3}{5}$ 2) $\frac{25}{52}$ 3) $\frac{5}{9}$ 4) $\frac{15}{45}$

65. The equation of tangents to the hyperbola $3x^2-4y^2=12$ which make equal intercepts on the axes are

1) $x+y=\pm 1$ 2) $x+y=\pm 2$ 3) $x+y=\pm 3$ 4) $x+y=\pm 4$

66. If the angle between the lines joining the foci of an ellipse to an extremity of the minor axis is 90°, then the eccentricity of the ellipse is

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

67. The total number of real tangents that can be drawn to the ellipse $3x^2+5y^2=32$ and $25x^2+9y^2=450$ passing through $(3,5)$ is

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

68. A line segment $AM = a$ moves in the XOY plane such that AM is parallel to the $X - axis$. If A moves along the circle $x^2 + y^2 = a^2$, then the locus of M is

1) $x^2 + y^2 = 4a^2$ 2) $x^2 + y^2 = 2ax$

3) $x^2 + y^2 = 2ay$ 4) $x^2 + y^2 = 2ax + 2ay$

69. If the equation $ax^2 + bx + c = 0$ 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) $a \neq b = c$

70. The intercept on the line y = x by the circle $x^2 + y^2 - 2x = 0$ is AB. Equation of the circle with AB as a diameter is

1) $x^2 + y^2 - x - y = 0$ 2) $x^2 + y^2 - 2x - y = 0$ 3) $x^2 + y^2 - x + y = 0$ 4) $x^2 + y^2 + x - y = 0$

71. The length of the least chord of the circle $x^2 + y^2 - 2x - 4y - 13 = 0$ passing through (2, 1) is___

1) 4 2) $2\sqrt{2}$ 3) 8 4) $\sqrt{18}$

72. There are two circles whose equations are $x^2 + y^2 = 9$ and $x^2 + y^2 - 8x - 6y + n^2 = 0$, $n \in Z$. If the two circles have exactly two common tangents then the number of possible values of n is

1) 2 2) 8 3) 9 4) 5

73. The area of the region described by $\{(x, y) / x^2 + y^2 \leq 1 \text{ and } y^2 = 1 - x\}$ is

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

74. The arithmetic mean of the observations 10, 8, 5, a, b is 6 and their variance is 6.8, then $ab =$

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

75. Standard deviation of first 'n' natural numbers is

1) $\sqrt{\frac{n-1}{12}}$ 2) $\sqrt{\frac{n^2-1}{12}}$ 3) $\sqrt{\frac{n+1}{12}}$ 4) $\sqrt{\frac{n^2+1}{12}}$

76. If x is small, so that x^2 and higher powers can be neglected, then the approximate value for $\frac{(1-2x)^{-1}(1-3x)^{-2}}{(1-4x)^{-3}}$ is

1) $1 - 2x$ 2) $1 - 3x$ 3) $1 - 4x$ 4) $1 - 5x$

77. A fair coin is tossed 100 times the probability of getting tails an odd number of times is

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

78. If $[x]$ denotes the greatest integer less than or equal to x, then the value of $\int_0^2 x^2\,[x]dx =$

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

79. $\int \frac{dx}{(1+\sqrt{x})\sqrt{x-x^2}} = \frac{A\sqrt{x}}{\sqrt{1-x}} + \frac{B}{\sqrt{1-x}} + c$, where 'c' is a real constant, then A+B equals to

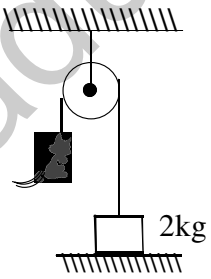
1) 3 2) 0 3) 1 4) 2

80. $\int_0^{\pi/4} \frac{\sin x + \cos x}{3 + \sin 2x}\,dx =$

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

PHYSICS

81. The pulley shown in the diagram is frictionless. A cat of mass 1kg moves up on the massless string so as to just lift a block of mass 2kg. After sometime, the cat stops moving with respect to the string. The magnitude of the change in the cat's acceleration is



1) g 2) $\frac{g}{3}$ 3) $\frac{2g}{3}$ 4) $\frac{4g}{3}$

82. A particle of mass 1kg moving along the line $y = x + 2$ (here, x and y are in meters) with speed $2m/s$. The magnitude of angular momentum of particle about origin is

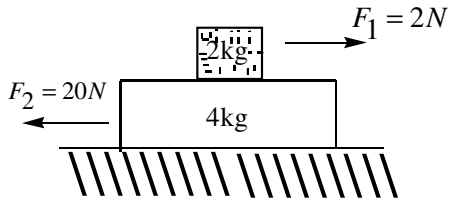
1) $4\,kg - m^2/s$ 2) $2\sqrt{2}\,kg - m^2/s$

3) $4\sqrt{2}\,kg - m^2/s$ 4) $2\,kg - m^2/s$

83. A stone is projected with a velocity $10\sqrt{2}\,ms^{-1}$ at an angle of $45°$ to the horizontal. The average velocity of stone during its time of flight is

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

84. In the arrangement shown in figure, coefficient of friction between the two blocks is $\left(\mu = \frac{1}{2}\right)$. The force of friction between the two blocks is



1) 8N 2) 10N 3) 6N 4) 4N

85. A constant power P is applied to a particle of mass m. The distance travelled by the particle when its velocity increases from V_1 to V_2 is (neglect friction)

1) $\frac{3P}{m}\left(V_2^2 - V_1^2\right)$ 2) $\frac{m}{3P}(V_2 - V_1)$ 3) $\frac{m}{3P}\left(V_2^3 - V_1^3\right)$ 4) $\frac{m}{3P}\left(V_2^2 - V_1^2\right)$

86. In the equation $\int \frac{dt}{\sqrt{2at - t^2}} = a^x \sin^{-1}\left\{\frac{t}{a} - 1\right\}$. The value of '$x$' is

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

87. A bullet of mass 'a' traveling with a velocity 'b' strikes a block of wood of mass 'c' which is at rest. The common velocity after impact is

1) ac/(a + b) 2) ab/(a + c) 3) ab/ac 4) (b + c)/ab

88. A ball is projected upwards from the foot of a tower. The ball crosses top of the tower twice after an interval of time 6sec and the ball reaches the ground after 12sec. The height of the tower is $\left(g = 10 m/s^2\right)$.

1) 120 m 2) 135 m 3) 175 m 4) 80 m

89. The minimum energy required to launch a satellite of mass m from the surface of the earth of radius R in a circular orbit at an altitude 2R is (mass of the earth is M)

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

90. A block rides on a piston that is moving vertically with simple harmonic motion. the maximum speed of the piston is $2m/s$. At what amplitude of motion will the block and piston separate $\left(g = 10 m/s^2\right)$

1) 20 *cm* 2) 30 *cm* 3) 40 *cm* 4) 50 *cm*

91. A block of mass M is suspended from a wire of length L, area of cross - section A and young's modulus Y. The elastic potential energy stored in the wire

1) $\frac{1}{2}\frac{M^2g^2L}{AY}$ 2) $\frac{1}{2}\frac{Mg}{ALY}$ 3) $\frac{1}{2}\frac{M^2g^2A}{YL}$ 4) $\frac{1}{2}\frac{MgY}{AL}$

92. A wooden cube just floats inside water when a $200\,g$ mass is placed on it. When the mass is removed, the cube is $2\,cm$ above the water level. What is the size of each side of the cube

1) $6\,cm$ 2) $8\,cm$ 3) $10\,cm$ 4) $12\,cm$

93. The pressure inside the two soap bubbles is 1.01 and 1.02 atmosphere. The ratio of their respective volumes is

1) 8 2) 4 3) 16 4) 2

94. If two rods of length L and 2L having coefficient of linear expansion α and 2α respectively are connected so that total length becomes 3L, the average coefficient of linear expansion of the composite rod equals.

1) $\frac{3}{2}\alpha$ 2) $\frac{5}{2}\alpha$ 3) $\frac{5}{3}\alpha$ 4) None of these

95. A spherical black body with a radius of $12\,cm$ radiates 450W power at $500\,K$. If the radius were halved and the temperature doubled, the power radiated in watt would be

1) $225\,W$ 2) $450\,W$ 3) $900\,W$ 4) $1800\,W$

96. A compound microscope is of magnifying power 100. The magnifying power of its eye piece is 4. Find the magnification of its objective

1) 10 2) 15 3) 25 4) 35 —

97. A carnot engine working between $300\,k$ and $600\,k$ has work output of $800\,J$ per cycle. What is amount of heat energy supplied to the engine from source per cycle

1) $1800\,{}^{J}/_{cycle}$ 2) $1000\,{}^{J}/_{cycle}$ 3) $2000\,{}^{J}/_{cycle}$ 4) $1600\,{}^{J}/_{cycle}$

98. For an ideal gas, absolute temperature is plotted on the X-axis and 'PV' product is plotted on the Y-axis. Then the graph is

1) a rectangular hyperbola 2) straight line passing through the origin

3) straight line not passing through the origin 4) parabola

99. The speed of sound wave in a gas, in which two waves of wavelength $1.0\,m$ and $1.02\,m$ produces 6 beats per second is

1) $350\,m/s$ 2) $306\,m/s$ 3) $380\,m/s$ 4) $410\,m/s$

100. A train moves towards a stationary observer with speed $34\,m/s$. The train sounds a whistle and its frequency registered by the observer is f_1. If the train's speed is reduced to $17\,m/s$, the frequency registered is f_2. If the speed of sound is $340\,m/s$, then the ratio $\frac{f_1}{f_2}$ is

1) $\frac{18}{19}$ 2) $\frac{1}{2}$ 3) 2 4) 19/18

101. An infintely long rod lies along the axis of a concave mirror of focal length f. The near end of the rod is at distance $u > f$ 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) $\frac{f^2}{u-f}$

102. Distance of an object from the first focus of an equiconvexlens is $10\,cm$ and the distance of its real image from second focus is $40\,cm$. The focal length of the lens is

1) $25\,cm$ 2) $10\,cm$ 3) $20\,cm$ 4) $40\,cm$

103. Internal energy of n_1 moles of hydrogen at temperature T is equal to the internal energy of n_2 moles of helium at temperature 2T. Then the ratio of $\frac{n_1}{n_2}$ is

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

104. Two beams of light having intensities I and 4I interfere to produce a fringe pattern on a screen. The phase difference between the beams is $\frac{\pi}{2}$ at point A and π at B. Then the difference between resultant intensities at A and B is

1) 2 I 2) 4 I 3) 5 I 4) 7 I

105. Three point charges $q, -2q \,\&\, -2q$ are placed at the vertices of an equilateral triangle of side a . The work done by some external force to increase their separation to $2a$ will be

1) $\frac{1}{4\pi\in_0}\frac{2q^2}{a}$ 2) Negative 3) 0 4) $\frac{1}{4\pi\in_0}\frac{2q^2}{a}$

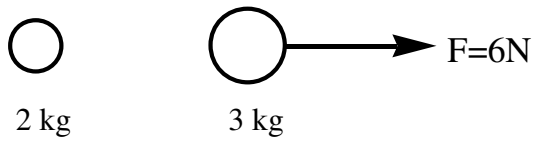
106. The magnitude of the electric field on the surface of a sphere of radius r having a uniform surface charge density σ is .

1) $\frac{\sigma}{\in_0}$ 2) $\frac{\sigma}{2\in_0}$ 3) $\frac{\sigma}{\in_0 r}$ 4) $\frac{\sigma}{2\in_0 r}$

107. Two concentric spherical conducting shells of radii R and 2R carry charges Q and 2Q respectively. Change in electric potential on the outer shell when both are connected by a conducting wire is $\left(K = \frac{1}{4\pi\in_0}\right)$

1) 0 2) $\frac{3KQ}{2r}$ 3) $\frac{KQ}{r}$ 4) $\frac{2KQ}{r}$

108. Two particles are shown in figure. At time t = 0, a constant force F = 6N starts acting on the 3 kg particle. The velocity of the centre of mass of these particles at t = 5s is



1) 5 ms^{-1} 2) 4 ms^{-1} 3) 6 ms^{-1} 4) 3 ms^{-1}

109. In a meter bridge experiment the null deflection is obtained at a length of $25cm$. When a standard resistance of 5Ω is connected, the value of resistance in the left gap to be determined is _____ ohm

1) 2Ω 2) 1.66Ω 3) 4Ω 4) 1.2Ω

110. A moving coil galvanometer of resistance $100\ \Omega$ is used as an ammeter using a resistance 0.1Ω. The maximum deflection of current in the galvanometer is $100\mu A$. The minimum current in the circuit, so that the ammeter shows maximum deflection

1) $100.1m\ A$ 2) $1000.1mA$ 3) $10.01mA$ 4) $1.01mA$

111. An electron is projected with uniform velocity along the axis of a current carrying solenoid. Which of the following is true?

1) The electron will be accelerated along the axis
2) The electron path will be circular about the axis
3) The electron will experience a force of $45°$ to the axis and hence execute a helical path
4) The electron with continue to move with uniform velocity along the axis of the solenoid

112. A small magnet of moment 4.8 x 10^{-2} J/T is suspended freely in the plane of uniform magnetic field of magnitude 3 x 10^{-2}T and the magnet is slightly displaced through 5° from its stable equilibrium and released, predict the angular frequency of its oscillations in rad/sec (moment of inertia about the axis of rotation is 9 x 10^{-5} kg m^2)

1) 8 2) 4 3) 3 4) 2

113. In an electromagnetic wave, the amplitude of electric field is $1V/m$. The frequency of wave is $5\times10^{14}Hz$. The wave is propagating along z-axis. The average energy density of electric field in J/m^3 will be

1) 1.1×10^{-11} 2) 2.2×10^{-12} 3) 3.3×10^{-13} 4) 4.4×10^{-14}

114. The band width of speech signals

1) $300Hz$ 2) $3100Hz$ 3) $2800Hz$ 4) All the above

115. The energy of a photon is equal to the kinetic energy of a proton. The energy of the photon is E. Let λ_1 be the de-Broglie wavelength of the proton and λ_2 be the wavelength of the photon. The ratio $\frac{\lambda_1}{\lambda_2}$ is proportional to

1)E^0 2)$E^{1/2}$ 3)E^{-1} 4)E^{-2}

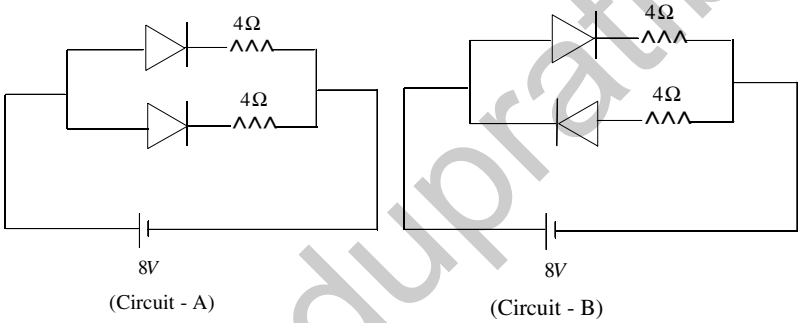
116. The angular momentum of an electron in the hydrogen atom is $\frac{3h}{2\pi}$. Here , h is planck's constant. The kinetic energy of this electron is

1) $4.35ev$ 2) $1.51ev$ 3) $3.4ev$ 4) $6.8ev$

117. $200MeV$ energy is released when one nucleus of U^{235} undergoes fission. Find the number of fissions per second required for producing a power of 1 mega watt

1) 3.125×10^{14} 2) 3.125×10^{15} 3) 3.125×10^{16} 4) 3.125×10^{13}

118. Currents following in each of the following circuits A and B respectively are



1) 1A,2A 2) 2A,1A 3) 4A,2A 4) 2A,4A

119. The molar heat capacity in a process of a diatomic gas if it does a work of $\frac{Q}{4}$ when a heat of Q is supplied to it is

1) $\frac{2}{5}R$ 2) $\frac{5}{2}R$ 3) $\frac{10}{3}R$ 4) $\frac{6}{7}R$

120. The frequency for which a $5\mu F$ capacitor has reactance of $\frac{1}{1000}\Omega$ is given by

1) $\frac{10^6}{\pi}\mu H_z$ 2) $\frac{10^8}{\pi}H_z$ 3) $\frac{1}{1000}H_z$ 4) $1000H_z$

CHEMISTRY

121. Which of the following alkaline earth metal sulphate has hydration eathalpy higher than its lattice enthalpy.

1) $CaSO_4$ 2) $BaSO_4$ 3) $SrSO_4$ 4) $BeSO_4$

122. The freezing point of solution containing 0.1g of $K_3[Fe(CN)_6]$ (Mol.Wt=329) in 100g of water is (K_f = 1.86 K Kg $mole^{-1}$)

1) -2.3×10^{-2} 2) -5.7×10^{-2} 3) -5.7×10^{-3} 4) -1.2×10^{-2}

123. Among the electrolytes Na_2SO_4, $CaCl_2$, $Al_2(SO_4)_3$ and NH_4Cl the most effective co-agulating agent for Sb_2S_3 sol. is

1) Na_2SO_4 2) $CaCl_2$ 3) $Al_2(SO_4)_3$ 4) NH_4Cl

124. For the elementary reaction, $M \rightarrow N$, the rate of disappearance of M increases by a factor of 8 upon doubling the concentration of M. The order of the reaction with respect to M is

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

125. Statement-I : Alkalimetals dissolve in liquid ammonia to give blue solution.
Statement-II : Alkalimetals in liq. Ammonia give solvated species of the type $[M(NH_3)_x]^+$ (M = alkalimetal)

1)Statement-I & Statement-II are correct and statement II is correct explanation of St-I

2)Statement-I & Statement-II are correct and statement II is not correct explanation of St-I 3) Statement-I is true statemennt -II is false

4) Statement - I is false, Statement-II is true

126. The values of ΔH and ΔS for the reaction $C_{(graphite)} + O_{2_{(g)}} \rightarrow CO_{2_{(g)}}$ are 170 KJ and 170 $JK^{-}1$ respectively. This reaction will be spontaneous at

1) 510 K 2)710 K 3) 910 K 4) 1110 K

127. Aluminium chloride exists as dimer, Al_2Cl_6 in vapour phase as well as in solution of non-polar solvents such as benzene. When dissolved in water in presence of little acid

1) $Al_2O_3 + 6HCl$ 2) $[Al(OH)_6]^{-3} + 3HCl$

3) $[Al(H_2O)_6]^{+3} + 3Cl^-$ 4) $Al^{+3} + 3Cl^-$

128. On strong heating lead Nitrate gives

1) PbO, NO_2, O_2 2) PbO, NO, NO_2 3) PbO_2, PbO, NO_2 4) PbO, NO,O_2

129. The electronic configurations of four elements are given below. Arrange these elements in the correct order of the magnitude of their electron affinity.

i) $2s^2\ 2p^5$ ii) $2s^2\ 2p^4$ iii) $3s^2\ 3p^4$ iv) $3s^2\ 3p^5$

1) i < ii < iii < iv 2) ii < iii < i < iv 3) iv < iii < i < ii 4) iii < i < ii < iv

130. The hydrogen bond is strongest in

1) $O-H....N$ 2) $O-H....S$ 3) $F-H....F$ 4) $F-H.....O$

131. Which of the following equation represents the reduced form of vanderwaals equation at high pressure ?

1) PV = nRT 2) $\left[P + \frac{an^2}{v^2}\right]v = nRT$ 3) $P + \frac{an^2}{v^2} = nRT$ 4) $P(v - nb) = nRT$

132. The number of waves made by a Bohr's electron in one complete revolution in its 3rd orbit is

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

133. 3 Faradays of electricity were pased through fused $AgNO_3$, $CuSO_4$ and $AlCl_3$ connected in series then the ratio of moles of Ag, Cu and Al is/are

1) 6 : 3 : 2 2) 2 : 3 : 6 3) 2 : 3 : 3 4) 1 : 1 : 1

134. In the equilibrium constant for $N_{2(g)}+O_{2(g)} \rightleftharpoons 2NO_{(g)}$ is K, the equilibrium constant for $NO_{(g)} \rightleftharpoons 1/2\, N_{2(g)} + 1/2\, O_{2(g)}$ will be

1) K 2) K^2 3) $K^{1/2}$ 4) $K^{-1/2}$

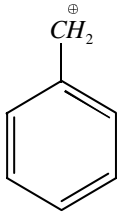
135. For the redox reaction $MnO_4^- + C_2O_4^{-2} + H^+ \rightarrow Mn^{+2} + CO_2 + H_2O$ the correct coefficients of the reactants for the balanced reaction are

	MnO_4^-	$C_2O_4^{-2}$	H^+
1)	2	16	5
2)	16	5	2
3)	2	5	16
4)	5	16	2

136. The Normality of H_2O_2 labelled as "10 vol. H_2O_2" is

1) 1.786 N 2) 3.4 N 3) 5.6 N 4) 11.2 N

137. The order of stability of the following carbocations ,

$CH_2 = CH - \overset{\oplus}{C}H_2$ (I); $CH_3 - CH_2 - \overset{\oplus}{C}H_2$ (II);  (III) is

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

138. The correct statement among the following are

I. 2-pentanone and 3-pentanone are Metamers

II. n-propyl alcohol and isopopyl alcohol are positional isomers

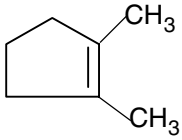
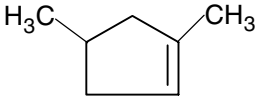
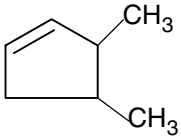
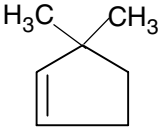
III. Glucose and fructose are functional isomers

IV. Acetaldehyde and vinyl alcohols are Tautomers

1) Only II & IV are correct 2) Only I & III are correct

3) All are correct 4) II, III and IV are correct

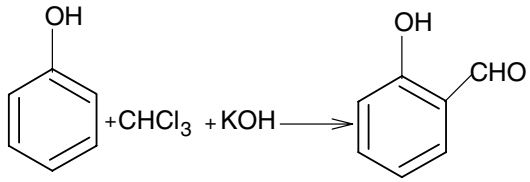
139. Which of the following compound gives a single compound 3-methyl-5-oxo hexanal on ozonolysis ?

1)  2)  3)  4) 

140. In the following sequence of reactions

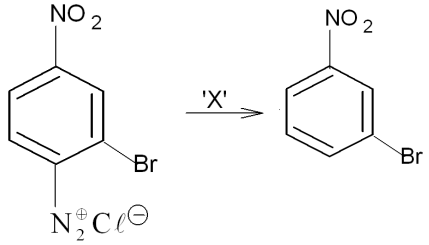
$CH_3 - Br \xrightarrow{KCN} A \xrightarrow[H^+]{H_2O} B \xrightarrow[ether]{LiAlH_4} C$; C is an isomer of

1) Ethyl alcohol 2) Acetic acid 3) Dimethylether 4) Acetaldehyde

141. 

1) Kolbe's reaction 2) Dow's process
3) Schmidt reaction 4) Riemer - Tiemann reaction

142. $CH_3 - CHO$ and C_6H_5CHO can be distinguished chemically by
1) Tollen's reagent 2) Fehling solution test
3) Benedicts test 4) Iodoform test

143. 

. Then X is

1) CH_2Cl_2 2) H_3PO_2 and H_2O 3) H^+ / H_2O 4) $HgSO_4 / H_2SO_4$

144. An organic compound $(C_3H_9N)A$, when treated with Nitrous acid, gave an alcohol and N_2 gas was evolved. A on warming with $CHCl_3$ and caustic potash gave (C). If 'C'on hydrolysis gives again 'A' then predict the structure of A.

X) $CH_3 - \underset{\displaystyle NH_2}{\underset{|}{C}}H - CH_3$ Y) $CH_3 - CH_2 - CH_2 - NH_2$

Z) $CH_3 - CH_2 - NH - CH_3$

1) X only 2) Z only 3) Y and Z 4) X and Z

145. $CH_3 - CH_2 - CN \xrightarrow[H^+]{H_2O} A \xrightarrow[\text{Red 'P'}]{Cl_2} B \xrightarrow{aq\ KOH} C$; 'C' is

1) Malonic acid 2) Maleic acid 3) Lactic acid 4) Oxalic acid

146. A mixture of anhydrous $ZnCl_2$ and Conc. HCl is known as

1) Fehling's reagent 2) Lucas reagent 3) Tollen's reagent 4) Benedicts reagent

147. A occupies all corners and B occupies all the face centres. The distance between the nearest neighbours is

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

148. 20 ml of 0.2 M NaOH is added to 50 ml of 0.2M CH_3COOH to give 70ml of the solution. What is the pH of solution ? (Ka for CH_3COOH is 2×10^{-5})

1) 4.522 2) 5.568 3) 6.522 4) 7.568

149. Which process of purification is represented by the following scheme ?

$$\underset{impure}{Ti + 2I_2} \xrightarrow{250^0C} Til_4 \xrightarrow{140^0C} \underset{pure}{Ti + 2I_2}$$

1) Cupellation
2) Poling
3) Van - Arkel process
4) Zone refining

150. An axcess $AgNO_3$ is added to 100 ml of 0.01M solution of dichloro tetraaquo chromium (III) chloride. The number of moles of AgCl precipitated would be

1) 0.002 2) 0.003 3) 0.01 4) 0.001

151. Amongst the following, the lowest degree of paramagnetism per mole of the compound at 298 K will be shown by

1) $MnSO_4.4H_2O$ 2) $FeSO_4.6H_2O$ 3) $NiSO_4.6H_2O$ 4) $CuSO_4.5H_2O$

152. One gas bleaches the colour of flowers by reduction and another gas by oxidation. The gases respectively are

1) NO and Cl_2 2) CO_2 and Cl_2 3) SO_2 and Cl_2 4) H_2S and Br_2

153. The drug which is a derivative of barbituric acid is :

A) luminal B) aspirin C)amytal D) morphine

The correct answer is

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

154. Which of the following has an imino (>NH) group instead of an amino group ($-NH_2$) ?

1) Proline 2) Isoleucine 3) Tyrosine 4) Serine

155. The basic component of the smog is

A) PAN B) PBN C) NO_2

1) A and B 2) B and C 3) A and C 4) A, B and C

156. Match polymers (in column-I) with their monomers (in column-II) and choose the correct code given below :

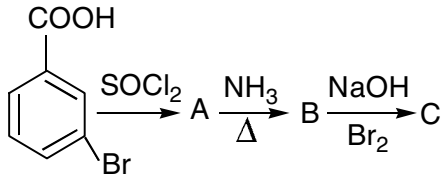
Column-I	Column-II
A) Buna - N	1) Phthalic acid and ethyleneglycol
B) Nylon - 6, 6	2) Terephthalic acid and ethyleneglycol
C) Dacron	3) Hexamethylene diamine and adipic acid
D) Glyptal plastic	4) Acrylonitrile and butadiene

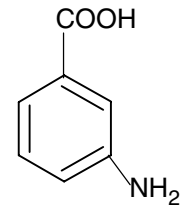
Codes :

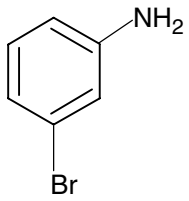
	A	B	C	D
1)	4	1	3	2
3)	4	3	2	1

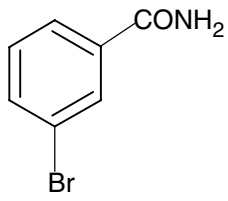
	A	B	C	D
2)	2	3	1	4
4)	1	2	4	3

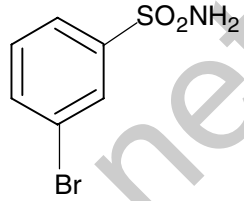
157. In a set of reactions, m-promobenzoic acid gave a product C. Identify the product C



1) 

2) 

3) 

4) 

158. In the Kjeldahl's for estimation of Nitrogen present in a soil sample, ammonia evolved from 0.75 g of sample neutralised 10 ml of 1M H_2SO_4. The percentage of nitrogen in the soil is

1) 45.33 2) 35.53 3) 43.33 4) 37.33

159. Among the following molecules i) XeO_3 ii) $XeOF_4$ iii) XeF_6 those having same number of lone pairs on Xe are

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

160. The weight of Iron will be converted into its oxide (Fe_3O_4) by the action of 18g of steam on it will be (at Wt of Fe = 56)

1) 168 g 2) 84 g 3) 42 g 4) 21 g

EAMCET MODEL GRAND TEST

KEY

MATHEMATICS

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

PHYSICS

81) **3**	82) **2**	83) **1**	84) **1**	85) **3**	86) **3**	87) **2**	88) **2**	89) **1**	90) **3**
91) **1**	92) **3**	93) **1**	94) **3**	95) **4**	96) **3**	97) **4**	98) **1**	99) **2**	100) **4**
101) **4**	102) **3**	103) **3**	104) **2**	105) **3**	106) **1**	107) **1**	108) **3**	109) **2**	110) **1**
111) **4**	112) **2**	113) **2**	114) **3**	115) **2**	116) **2**	117) **3**	118) **3**	119) **3**	120) **2**

CHEMISTRY

121) **4**	122) **1**	123) **3**	124) **2**	125) **2**	126) **4**	127) **3**	128) **1**	129) **2**	130) **3**
131) **4**	132) **2**	133) **1**	134) **4**	135) **3**	136) **1**	137) **3**	138) **3**	139) **2**	140) **3**
141) **4**	142) **4**	143) **2**	144) **4**	145) **3**	146) **2**	147) **3**	148) **1**	149) **3**	150) **4**
151) **4**	152) **3**	153) **2**	154) **1**	155) **4**	156) **3**	157) **2**	158) **4**	159) **2**	160) **3**

EAMCET MODEL GRAND TEST

SOLUTIONS

Mathematics

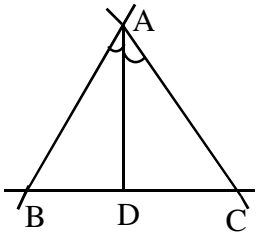
1. Put $x = a\sin^2\theta$ then

$$I = 2a^2\int_0^{\frac{\pi}{2}} \sin^2\theta\cos^2\theta d\theta$$

2. 'D' divides $\overline{BC}$ in the ratio = $AB:AC$

$$= 6:3 = 2:1$$

$$\therefore D = \left(2, \frac{13}{3}, 6\right)$$



3. $\bar{a} = i - 2j - k, \bar{b} = \overline{OB} - \overline{OA}$

$= 3i + 2j - 2k, \bar{c} = i + 2j - k, \bar{d}$

$= \overline{OD} - \overline{OC} = i - 6j - 4k,$

$$S.D = \frac{\left|\left[\bar{a} - \bar{c} \quad \bar{b} \quad \bar{d}\right]\right|}{\left|\bar{b} \times \bar{d}\right|} = \frac{40}{30}$$

4. $n(A) = 6, n(B) = 2$

Number of onto functions $2^{n(A)} - 2$

5. $2 < x < 3 \Rightarrow x > 2 > 1,\ x < 3$

$\Rightarrow f(x) = x - 1 + x - 2 - x + 3 = x$

$\Rightarrow$ identity

6. $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)\ xy < 1$

7. $X^T = B^TA^T + A^TB^T = BA + AB,$

$Y^T = B^TA^T - A^TB^T = BA - AB$

$= X \qquad\qquad = -Y$

$\therefore (XY)^T = Y^TX^T = -YX$

8. $\cos 30^0 = \frac{(\bar{a}+\bar{b}).\bar{a}}{|\bar{a}+\bar{b}||\bar{a}|} \Rightarrow \frac{\sqrt{3}}{2} = \frac{|\bar{a}|^2 + 0}{|\bar{a}+\bar{b}||\bar{a}|}$

$\Rightarrow \frac{\sqrt{3}}{2} = \frac{|\bar{a}|}{\sqrt{a^2+b^2}}$, on squaring, we get

$|\bar{a}| = \sqrt{3}|\bar{b}|$

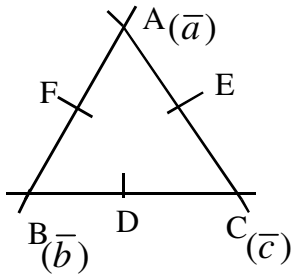
9. 1^∞ form

$$\Rightarrow \quad e^{\underset{x\to 0}{Lt}\ \frac{1}{x^2}\left(\frac{\tan x}{x} - 1\right)} = e^{1/3}$$

10. $\overline{AD} + \frac{2}{3}\overline{BE} + \frac{1}{3}\overline{CF} = \frac{\bar{b}+\bar{c}-2\bar{a}}{3} +$

$\frac{2}{3}\left(\frac{\bar{a}+\bar{c}-2\bar{b}}{3}\right) + \frac{1}{3}\left(\frac{\bar{a}+\bar{b}-2\bar{c}}{3}\right)$

$= \frac{3\bar{c} - 3\bar{a}}{9} = \frac{1}{3}\overline{AC}$



11. $\bar{a} \times \bar{b} = 2i - 2J + k, \quad (\bar{a} \times \bar{b}, \bar{c}) = 30^0,$

$\left|(\bar{a} \times \bar{b}) \times \bar{c}\right| = \left|\bar{a} \times \bar{b}\right|\left|\bar{c}\right|\sin(\bar{a} \times \bar{b}, \bar{c})$

$= \sqrt{4+4+1} \times 1 \times \frac{1}{2} = 3/2$

Note: $|\bar{c}-\bar{a}|^2=8$

$\Rightarrow c^2+a^2-2\bar{a}.\bar{c}=8$

$\Rightarrow c^2-2|\bar{c}|+1=0$

$\Rightarrow |\bar{c}|=1$

12. ratio

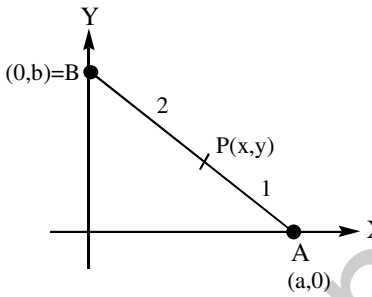
$= x_1-x : x-x_2 = \dfrac{-t(x_1-x_2)}{x_1+t(x_1-x_2)-x_2}$

$= \dfrac{-t}{1+t}$

internal, $t(t+1)<0 \Rightarrow -1<t<0$

13. $(x,y)=\left(\dfrac{2a}{3},\dfrac{b}{3}\right) \Rightarrow a=\dfrac{3x}{2},\ b=3y$

$\because AB=l \Rightarrow 9x^2+36y^2=4l^2$



14. A point on the line $3x-y=0$ is

$p=\left(4-\dfrac{r}{\sqrt{2}},\ 1+\dfrac{r}{\sqrt{2}}\right)$

$\Rightarrow 3\left(4-\dfrac{r}{\sqrt{2}}\right)=1+\dfrac{r}{\sqrt{2}} \Rightarrow r=\dfrac{11}{2\sqrt{2}}$

15. The image of A w.r.to $x-y+5=0$ is $B=(-7,6)$

The image of A w.r.to $x+2y=0$ is $C=\left(\dfrac{11}{5},\dfrac{2}{5}\right)$

$\therefore$ Equation of $\overline{BC}$ is

$14x+23y-40=0$

16. ratio $=3-2:2-6=-1:4$

Harmonic ratio $=1:4$

$\therefore Q=\left(\dfrac{6+12}{5},\dfrac{-17-8}{5},\dfrac{-4+8}{5}\right)$

17. $\cos^2 60+\cos^2 45+\cos^2 45+\cos^2\theta=\dfrac{4}{3}$

$\Rightarrow \cos^2\theta=\dfrac{1}{12}$

18. Parallel Plane is $4x+3y-12z+k=0$

$(4,0,1) \Rightarrow 4x+3y-12z-4=0$

19. $V=\dfrac{4}{3}\pi r^3 \Rightarrow 288\pi=\dfrac{4}{3}\pi r^3 \therefore r=6$

$\dfrac{dy}{dt}=4\pi r^2\dfrac{dr}{dt} \therefore \dfrac{dr}{dt}=\dfrac{1}{36}$

20. $by^2=(x+a)^3 \Rightarrow on\ diff.,\ m=\dfrac{dy}{dx}$

$=\dfrac{3(x+a)^2}{2by}, \quad \therefore \dfrac{p}{q}=\dfrac{(ST)^2}{SN}=\dfrac{y}{m^3}$

$=\dfrac{8b^3y^4}{27(x+a)^6}=\dfrac{8b}{27}$

21. $f'(x)=1-\dfrac{\dfrac{x}{1+x}-\log(1+x)}{x^2}$

For $x\in(0,\infty)$, clearly $f'(x)>0$

22. $\Delta u=\Delta v=\alpha, \quad f=\dfrac{2uv}{u-v}$

applying log,

$\log f=\log 2+\log u+\log v-\log(u-v),\ on\ diff.$

$\dfrac{\Delta f}{f}=O+\dfrac{\alpha}{u}+\dfrac{\alpha}{v}-\dfrac{1}{u-v}(\Delta u-\Delta v)$

23. $\log_2(x-3)>0,\ x-3>0$

$\Rightarrow x>4,\ x>3 \Rightarrow x>4$

24. $S=1+\dfrac{3}{2}+2+\dfrac{5}{2}+\ldots\ldots\ldots\ldots are\ in\ A.P.$

$S_{20}=\dfrac{20}{2}\left(2(1)+(20-1).\dfrac{1}{2}\right)=115$

25. Length of miedian through $A = \left|\dfrac{\overline{AB}+\overline{AC}}{2}\right|$

$= \left|4i - j + 4k\right| = \sqrt{33}$

26. $\begin{vmatrix} \sin^2 13 & \cos^2 13 & -1 \\ \cos^2 13 & -1 & \sin^2 13 \\ -1 & \sin^2 13 & \cos^2 13 \end{vmatrix}$,

$R_1 \to R_1 + R_2 \quad \Rightarrow \begin{vmatrix} 1 & -\sin^2 13 & -\cos^2 13 \\ \cos^2 13 & -1 & \sin^2 13 \\ -1 & \sin^2 13 & \cos^2 13 \end{vmatrix}$

Here $R_1 = R_3$

27. By verification

$$f\left(\frac{\pi}{6}+x\right) = \left|\sin 3\left(\frac{\pi}{6}+x\right)\right| + \left|\cos 3\left(\frac{\pi}{6}+x\right)\right| = f(x)$$

28. $(\tan 9 + \cot 9) - (\tan 27 + \cot 27)$

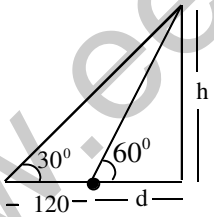
$= 2\cos 18 - 2\cos 54 = 4$

29. $-\cos x = \cos x - 2\sin x \;\Rightarrow$

$\cos x = \sin x \Rightarrow \tan x = 1, \cos x < 0$

By checking, Ans 4 satisfies.

30. $h = 60\sqrt{3}$



31. $x = X.\dfrac{1}{\sqrt{2}} - Y\dfrac{1}{\sqrt{2}},\; y = X.\dfrac{1}{\sqrt{2}} + Y.\dfrac{1}{\sqrt{2}}$

$\therefore$ Transformed Eq. is : $2X^2 + Y^2 = 1$

32. $\dfrac{n^2\sqrt{h^2-ab}}{\left|an^2 - 2hlm + bl^2\right|} = 7$

$\Rightarrow \dfrac{a^2\sqrt{9-8}}{\left|8(9)+6(6)+1(4)\right|} = 7 \;\Rightarrow a = 28$

33. Applying homogenisation,

$x^2 + y^2 + (2gx + 2fy)(1) + c(1)^2 = 0,\; lx + my = 1$

$\because$ right angle, coeff.of x^2 + coeff. of $y^2 = 0$

$\Rightarrow 2(lg + mf + 1) = -c(l^2 + m^2)$

34. $\underset{x\to\infty}{Lt} \dfrac{2\sin x - 2\sin x\cos x}{2x\cos x} = \alpha$

$\Rightarrow \alpha = \underset{x\to 0}{Lt} \dfrac{2\sin x}{2x}.\dfrac{(1-\cos x)}{\cos x} \Rightarrow \alpha = 1\left(\dfrac{0}{1}\right) = 0$

35. $\underset{x\to\infty}{Lt} \dfrac{x + \sqrt{x+\sqrt{x}} - x}{\sqrt{x+\sqrt{x+\sqrt{x}}} + \sqrt{x}} =$

$$\underset{x\to\infty}{Lt} \frac{\sqrt{x}\left[\sqrt{1+\frac{\sqrt{1}}{x}}\right]}{\sqrt{x}\left[\sqrt{1+\sqrt{\frac{1}{x}+\frac{1}{\sqrt{x}}}}+1\right]} = \frac{1}{2}$$

36. Put $\dfrac{x}{2} = \sin\theta \;\Rightarrow \dfrac{d}{dx}\left(3\sin^{-1}\dfrac{x}{2}\right) = \dfrac{3}{\sqrt{4-x^2}}$

37. $x^2 + y^2 = t - \dfrac{1}{t}$, on squaring

$x^2y^2 = -1 \;\Rightarrow y^2 = \dfrac{-1}{x^2}$

Diff. $2y\dfrac{dy}{dx} = \dfrac{2}{x^3}$

38. $\cos h^{-1}\left(\dfrac{1}{\sin\theta}\right) = \log(\cos ec\theta + \cot\theta)$

$= \log\left(\dfrac{1+\cos\theta}{\sin\theta}\right)$

39. $\dfrac{\sin B(3 - 4\sin^2 B}{\sin B} = \dfrac{(a^2-c^2)^2}{(2ac)^2}$

$\Rightarrow 1 + 3 - 4\sin^2 B = 1 + \dfrac{(a^2-c^2)^2}{(2ac)^2}$

$$\Rightarrow 2\cos B = \frac{(a^2+c^2)}{(2ac)}$$

$$\Rightarrow 2\left(\frac{c^2+a^2-b^2}{2ac}\right) = \frac{a^2+c^2}{2ac} \Rightarrow A.\,P.$$

40. $A = B = C = 60^0 \Rightarrow r = \frac{R}{2},\ r_1 = \frac{3R}{2}$

$$\therefore r : R : r_1 = \frac{R}{2} : R : \frac{3R}{2} = 1:2:3$$

41. $P(X=10) = P(X=11)$

$$\Rightarrow {}^{20}c_{10}.\,p^{10}.\,q^{20-10} = {}^{20}c_{11}.\,p^{11}.q^{20-11}$$

$$\Rightarrow \frac{q}{p} = \frac{{}^{20}c_{11}}{{}^{20}c_{10}} \Rightarrow \frac{1-p}{p} = \frac{10}{11}$$

42. $P(X > 1.5)$

$$= 1 - \{P(X=0) + P(X=1)\},\ \lambda = 2$$

$$= 1 - \left\{\frac{e^{-2}.1}{1} + \frac{e^{-2}.2}{1}\right\}$$

43. $\left[\frac{100}{3}\right] + \left[\frac{100}{3^2}\right] + \left[\frac{100}{3^3}\right] + \left[\frac{100}{3^4}\right] + ...$

=33+11+3+1+=48

44. $5!\left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!} - \frac{1}{5!}\right)$

45. $(1-5x)^{-1}(1-4x)^{-1}$

$$= (1 + 5x + (5x)^2 + (5x)^3 + ...)$$

$$(1 + 4x + (4x)^2 + (4x)^3 + ...)$$

coeff. of

$$x^3 = 4^3 + 5.4^2 + 5^2.4 + 5^3.1 = 369$$

46. $m(m+b)(2x+b) = (2m+b)(x^2+bx)$

roots $\alpha, -\alpha \Rightarrow \frac{-b}{a} = 0 \Rightarrow b = 0$

$\Rightarrow$ coeff. of $x = 0$

47. Given $x = \alpha - 4 \Rightarrow \alpha = x + 4$

$$\Rightarrow (x+4)^2 + 11(x+4) + 13 = 0$$

48. $e^{iz} = e^{i\ (6)\ \left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)} = e^{3i-3\sqrt{3}}$

$$= \left|e^{iz}\right| = \frac{\left|e^{3i}\right|}{\left|e^{3\sqrt{3}}\right|}$$

49. $x = w,\ w^2 \Rightarrow 9(4) + 18(1) = 54$

50. Let

$x = 2\mathrm{cis}A,\ y = 3\mathrm{cis}B,\ z = 5\mathrm{cis}C$

Then $x + y + z = 0$

$$\Rightarrow x^3 + y^3 + z^3 = 3xyz$$

$$\Rightarrow 8\mathrm{cis}3A + 27\mathrm{cis}3B + 125\mathrm{cis}$$

$$= 3(30)\,\mathrm{cis}\,(A+B+C)$$

51. $i\sum\ \cos\left(\frac{2k\pi}{11}\right) - i\sin\left(\frac{2k\pi}{11}\right) = i.\sum_{k=1}^{10} e^{\frac{i2k\pi}{11}}$

$$= i\left(\frac{e^{i\frac{2\pi}{11}}\left((e^{i\frac{2\pi}{11}})^{10} - 1\right)}{e^{i\frac{2\pi}{11}} - 1}\right) \qquad = i\left(\frac{1 - e^{i\frac{2\pi}{11}}}{e^{i\frac{2\pi}{11}} - 1}\right)$$

$$= -i$$

52. Put $e^x - 1 = t^2 \Rightarrow e^x dx = 2tdt$

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

53. $[AD] = \begin{bmatrix} -2 & 1 & 1 & a \\ 1 & -2 & 1 & b \\ 1 & 1 & -2 & c \end{bmatrix}$

$$= \begin{bmatrix} -2 & 1 & 1 & a \\ 0 & -3 & 3 & 2b+a \\ 0 & 0 & 0 & (a+b+c) \end{bmatrix}$$

is in-consistent, if $a + b + c \neq 0$.

54. Put $\sec x + \tan x = t$

$$\therefore \int \frac{\sec x}{(\sec x + \tan x)^n} dx = \frac{(\sec x + \tan x)^{-n}}{-n} + c$$

55. $c_1(\cos 2x\cos c_2 - \sin 2x\sin c_2)$

$-(c_3+c_4)a^x.a^{c_5} + c_6(\sin x\cos c_7 - \cos x\sin c_7)$

$= A\cos 2x + B\sin 2x + c\,a^x + D\sin x + E\cos x$

order = 5

56. Put $\frac{y}{x} = v$

57. intersect orthogonally

$\Rightarrow c = 4,\ (-g,-f) = (x,y)$

$(a,b) \Rightarrow\ a^2 + b^2 + 2ga + 2fb + c = 0$

58. compare with $S_1 = 0$

$\Rightarrow y\,y_1 + 2(y + y_1) + 2(x + x_1) = 0$

$\frac{1}{2} = \frac{2}{y_1+2} = \frac{2y_1+2x_1}{k}$

$\Rightarrow y_1 = 2,\ x_1 = -3 \Rightarrow k = -1$

59. $m_1 = \tan\theta_1,\ m_2 = \tan\theta_2 \Rightarrow m_1^2 + m_2^2 = k$

$\Rightarrow (m_1+m_2)^2 - 2.m_1m_2 = k$

$\Rightarrow m_1 + m_2 = \frac{y}{x}, m_1m_2 = \frac{a}{x}$

60. From option 2, $\frac{dy}{dx} = -\frac{\partial f/\partial x}{\partial f/\partial y}$

61. $3 - 4i + 3 + 4i = -\frac{b}{a},$

$(3-4i)\,(3+4i) = \frac{c}{a}$

$\Rightarrow b = -6a,\ c = 25a$

62. coefficients of conscutive terms are in A.P.,

$n^2 - (4r+1)n + 4r^2 - 2 = 0,\quad n = 14$

$\Rightarrow r^2 - 14r + 45 = 0 \Rightarrow r = 5\ or\ 9$

63. $P(A) = \frac{80}{100},\ P(B) = \frac{60}{100},$

$P(A \cap \bar{B}) + P(\bar{A} \cap B)$

$= \frac{80}{100}\times\frac{40}{100} + \frac{20}{100}\times\frac{60}{100}$

64. $P(A) = \frac{1}{2} = P(B),\ P\left(\frac{R}{A}\right) = \frac{3}{5},$

$P\left(\frac{R}{B}\right) = \frac{5}{9},$

By Baye's theorem,

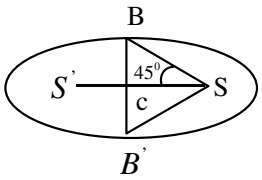
$$P\left(\frac{B}{R}\right) = \frac{P(B).P\left(\frac{R}{B}\right)}{P(A).P\left(\frac{R}{A}\right) + P(B).P\left(\frac{R}{B}\right)}$$

65. Eq. of tangent is $x + y = a \rightarrow (i)$

(i) is a tangent $\Rightarrow n^2 = a^2l^2 - b^2m^2$

$\Rightarrow a^2 = 4(1) - 3(1) = 1$

$\therefore x + y = \pm 1$

66. 

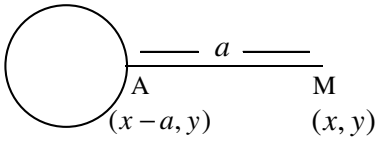
$\tan 45^0 = \frac{b}{ae} \Rightarrow ae = b$

67. $S_{11} = 3(9) + 5(25) - 32 = 120 > 0$

$\Rightarrow 2 real$ tan $gents$

$S_{11}^1 = 25(9) + 9(25) - 450 = 0$

$\Rightarrow 1$ tan $gent$ $\quad\therefore$ 3 real tangents

68. 

'A' on O^{le} $x^2 + y^2 = a^2,$

$\therefore (x-a)^2 + y^2 = a^2$

$\Rightarrow x^2 + y^2 = 2ax$

69. By trial and error method, $x=-2$ is a root

-2	1	3	3	2
	0	-2	-2	-2
	1	1	1	0

$,\Rightarrow x^2+x+1=0 \Rightarrow a=b=c$

70. Eq. of $O^{\backslash e}$ with AB as diameter is,

$$(x^2+y^2-2x)+\lambda(x-y)=0$$

centre $\left(\frac{2-\lambda}{2},\frac{\lambda}{2}\right)$ on $x-y=0\Rightarrow\lambda=1$

71. Length of least chord = Length of M.P. of chord

$=\sqrt{|S_{11}|}=8$

72. $c_1c_2<r_1+r_2 \quad \Rightarrow 5<3+\sqrt{25-n^2}$

$\Rightarrow n^2<21$

$\Rightarrow n\in\{0,\pm1,\pm2,\pm3,\pm4\}$

73. Solve $x^2+y^2=1, \qquad y^2=1-x$

$\therefore$ Area $=\frac{\pi}{2}+\frac{4}{3}$

74. $6=\frac{10+8+5+a+b}{5} \Rightarrow a+b=7$

$\frac{1}{n}\Sigma(x_i-\bar{x})^2=6.8$

75. Standard deviation of numbers

76. $\frac{(1+2x+4x^2+.....)(1+6x+.....)}{(1+12x+.....)}$

$=(1+8x)(1+12x)^{-1}$

$=(1+8x)(1-12x+....)$

$=1-4x$

77. $p=\frac{1}{2},\ q=\frac{1}{2}$

Prob =

$P(X=1)+P(X=3)+..+P(X=99)$

$=\left(\frac{1}{2}\right)^{100}\left(100_{c_1}+100_{c_3}+.....+100_{c_{99}}\right)=\frac{1}{2}$

78. $\int_0^1 x^2(0)\,dx+\int_1^2 x^2(1)\,dx=\left(\frac{x^3}{3}\right)_1^2$

79. On differentiating,

$$\frac{1}{(1+\sqrt{x})\sqrt{x-x^2}}=\frac{(1-x)A+Ax+B\sqrt{x}}{(1-x)2\sqrt{x}\sqrt{1-x}}$$

$\Rightarrow \frac{2(1-x)}{1+\sqrt{x}}=A+B\sqrt{x} \Rightarrow A=2,\ B=-2$

80. $\int_0^{\pi/4}\frac{(\sin x+\cos x)\,dx}{3+\ 1-(\sin x-\cos x)^2}$

put $\sin x-\cos x=t$

Physics

81. Case-i

$T=2g=2a\Rightarrow a=g\,(up\ wards)$

Case-ii $a=\left(\frac{m_1-m_2}{m_1+m_2}\right)g$

$=\left(\frac{2-1}{2+1}\right)g=\frac{g}{3}(up)$

change in acceleration of cat

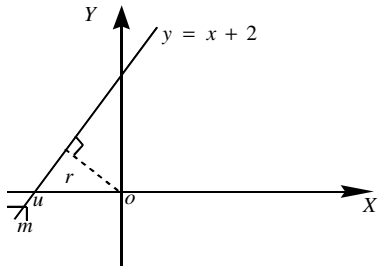
$=g-\left(\frac{+g}{3}\right)=\frac{2g}{3}$

82. Angular momentum of particle about origin 'O' is

$L=mvr_2$

$L=(1)(2)(2\cos45°)$

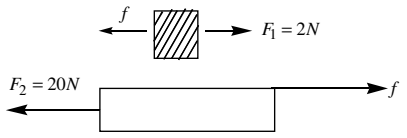
$=\frac{4}{\sqrt{2}}=2\sqrt{2}kg\,m^2/s$



83. $\left.\begin{matrix} average \\ velocity \end{matrix}\right\} = \frac{R}{T} = \frac{u_x T}{T} = u_x = u\cos\theta$

$= 10\sqrt{2}\left(\frac{1}{\sqrt{2}}\right) = 10ms^{-1}$

84. Free body diagram of the two bodies are as follows



Let acceleration of both bodies towards left is 'a'

$a = \frac{f-2}{2} = \frac{20-f}{4}; \quad 2f-4 = 20-f;$

$f = 8N$

$f_{ms} = \frac{1}{2}\times 2\times 10 = 10N$

$f < f_{ms}$ *so friction is* $8N$

85. $P = F.V \Rightarrow P = (ma)V$

$\Rightarrow a = \frac{P}{mv} \Rightarrow V\frac{dv}{ds} = \frac{P}{mv};$

$V^2 dv = \frac{P}{m}ds$

$\frac{P}{m}\int_o^s ds = \int_{V_1}^{V_2} V^2 dv;$

$\frac{P}{m}(S) = \frac{1}{3}\left(V_2^3 - V_1^3\right); \quad S = \frac{m}{3p}\left(V_2^3 - V_1^2\right)$

86. The quantity of $\frac{t}{a}-1$ is dimension less

$\left(\left(\frac{t}{a}-1\right)[a] = [t]\right.$

$\sqrt{2at-t^2} = t; \left[\frac{dt}{\sqrt{2at-t^2}}\right.$

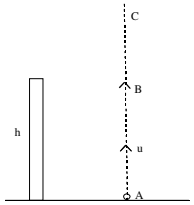
$= \left[\frac{t}{t}\right] = M^\circ L^\circ T^\circ$

i.e. a^x should also be dimension less $x = 0$

87. LC LM

$ab = (a+c)v$

$v = \frac{ab}{a+c}$

88. 

$t_{BC} = \frac{6}{2} = 3\sec; \; t_{AC} = \frac{12}{2} = 6\sec$

$t_{AB} = 3\sec;$

$O = u - (10)6 \left[V = u + at\right]$

$u = 60m/s;$

Further $h = ut_{AB} - \frac{1}{2}gt^2{}_{AB}$

$= 60(3) - \frac{1}{2}\times 10\times (3)^2$

$= 180 - 45 \qquad = 135m$

89. Energy of the satellite on the surface of the earth is

$E_i = \frac{-GMM}{R}$

Energy of a satellite at a distance $(2R + R = 3R)$ from centre of the earth

$E_f = \frac{-GMm}{2(3R)} = -\frac{GMm}{6R}$

Energy required to launch the satellite is

$E = E_f - E_i = \frac{5GMm}{6R}$

90. $V_{\max} = A\omega = 2m/s \rightarrow (1)$

$a_{\max} = \omega^2 A = g = 10m/s^2 \rightarrow (2)$

from equations (1) & (2)

$A = 0.4m = 40cm$

91. $W = \frac{1}{2} stress \times strain \times volume$

$= \frac{1}{2}\left[\frac{(stress)^2}{y}\right] \times volume$

$= \frac{1}{2}\left(\frac{Mg}{A}\right)^2 \times \frac{1}{y} \times AL$

$= \frac{1}{2}\frac{M^2 g^2}{A^2} \times \frac{1}{y} \times AL \quad = \frac{1}{2}\frac{M^2 g^2 L}{Ay}$

92. Let a be the each side of the cube then

$200g = (2)\left(a^2\right) \times 1 \times g$

$a = 10cm$

93. $\frac{\Delta P_1}{\Delta P_2} = \frac{0.01}{0.02} = \frac{1}{2};$

$\frac{\left(\frac{4T}{r_1}\right)}{\left(\frac{4T}{r_2}\right)} = \frac{1}{2}(or)\frac{r_1}{r_2} = 2; \frac{V_1}{V_2} = \left(\frac{r_1}{r_2}\right)^3 = 8$

94. $\alpha_{eff} = \frac{l_1\alpha_1 + l_2\alpha_2}{l_1 + l_2}$

$= \frac{L\alpha + 2L(2\alpha)}{L + 2L} = \frac{\cancel{L}(\alpha + 4\alpha)}{3\cancel{L}} = \frac{5\alpha}{3}$

95. $P_1 = 450, T_1 = T, P_2 = ?$

$T_2 = 2T, R_1 = R, R_2 = \frac{R}{2}$

$P\alpha\left(Surface\ area\ \right)T^4;$

$P\alpha R^2 T^4$

$\frac{P_2}{P_1} = \left(\frac{R_2}{R_1}\right)^2\left(\frac{T_2}{T_1}\right)^4 \Rightarrow \frac{P_2}{450} = \frac{1}{4} \times \frac{16}{1} = \frac{4}{1}$

$P_2 = 450 \times 4 = 1800W$

96. $m = 100$

$m_e = 4 \qquad m_0 = ?$

we know

$m = m_e \times m_0 \; m_0 = \frac{m}{m_e} = \frac{100}{4} = 25$

97. $\frac{W}{Q_1} = \frac{T_1 - T_2}{T_1};$

$\frac{800}{Q_1} = \frac{600 - 300}{600} = \frac{1}{2};\ Q_1 = 1600\ J/cycle$

98. $PV = nTR$, T on X-axis and PV on Y-axis gives $y = (nR)x$. This is similar to $y = mx$.

99. $f = \frac{V}{\lambda};\ f_1 - f_2 = 6;\ \frac{V}{1.0} - \frac{V}{1.02} = 6;$

$V = 306m/s$

100. $f_1 = f\left(\frac{V}{V - V_s}\right) = f\left(\frac{340}{340 - 34}\right) = f\left(\frac{340}{306}\right)$

$f_2 = f\left(\frac{V}{V - V_s}\right) = f\left(\frac{340}{340 - 17}\right) = f\left(\frac{340}{323}\right);$

$\frac{f_1}{f_2} = \frac{323}{306} = \frac{19}{18}$

101. For near end of the rod $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

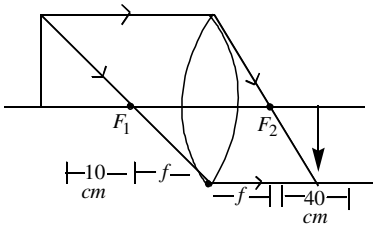
here u & f are $-V_e$ $|V| = \frac{uf}{u - f}$ For end of teh end is at infinity image will be formed at focus length of the image $= |V| - f$

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

102. In the figure $u = -(10 + f)$

$v = 40 + f$

$f = +f$



Using $\frac{1}{V} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{40 + f} + \frac{1}{10 + f} = \frac{1}{f}$

by solving $f = 20cm$

103. Internal energy

$U = \frac{f}{2}nRT$ $\qquad H_2 \rightarrow dia$

$U_1 = U_2$ $\qquad He \rightarrow mono$

$f_1 n_1 T_1 = f_2 n_2 T_2$

$T_1 = T \quad f_{mono} = 3$

$\frac{n_1}{n_2} = \frac{f_2 T_2}{f_1 n_1} = \frac{3(2)}{5(1)} = \frac{6}{5}$

$T_2 = 2T \quad f_{dia} = 5$

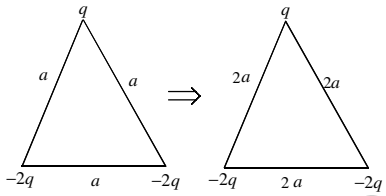
104. $I_{(\phi)} = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$

Here $I_1 = I$

$I_2 = 4I \quad \frac{At\,'A'}{\phi = \frac{\pi}{2}} \therefore I_A = I + 4I + 0 = 5I$

$\frac{AtB}{\phi = \pi} \therefore I_B = I + 4I - 4I = I$

$I_{resul\tan t} = I_A - I_B = 5I - I = 4I$

105. 

$W = U_f - U_i$

Here

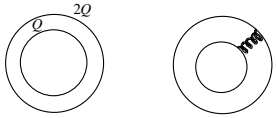
$U_i = \frac{1}{4\pi \in_0}[q(-2q) + q(-2q) + (-2q)(-2q)] = 0$

U_f is also zero $\quad W = 0$

106. $\sigma = \frac{q}{4\pi r^2} \Rightarrow q = \sigma 4\pi r^2$

$\vec{E}.\vec{A} = \frac{q}{\in_0}; \qquad EA = \sigma\frac{4\pi r^2}{\in_0}$;

$E\left(4\pi r^2\right) = \frac{\sigma 4\pi r^2}{\in_0}$; $\qquad E = \frac{\sigma}{\in_0}$

107. 

initial position final position

$V_i = \frac{KQ}{2R} + \frac{k(2Q)}{2R} \qquad V_f = \frac{k(3Q)}{2R}$

$V_i = \frac{3kQ}{2R} \qquad \Delta V = V_f - V_i = 0$

108. $a_{cm} = \frac{m_1 a_1 + m_2 a_2}{m_1 + m_2} = \frac{0 + F_2}{m_1 + m_2}$

$a_{cm} = \frac{0+6}{2+3} = 1.2\,m/sec$

$\Rightarrow V_{cm} = U_{cm} + a_{cm}.t$

$= 0 + 1.2 \text{ x } 5 \qquad V_{cm} = 6$ m/sec

109. $x = ? \quad \frac{x}{R} = \frac{l_1}{100 - l_1}$

$R = 5\Omega \qquad \frac{x}{R} = \frac{25}{100-25} = \frac{25}{75} = \frac{1}{3}$

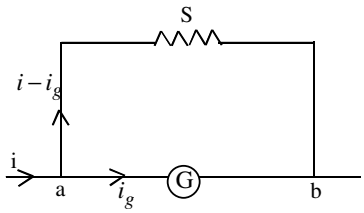
$l_1 = 25cm \qquad \frac{x}{5} = \frac{1}{3} \Rightarrow x = \frac{5}{3} = 1.66\Omega$

$l_2 = 100 - l_1$

110. $V_{ab} = i_g G = (i - ig)G$

$i = \left(1 + \frac{G}{S}\right)ig$

substituting the values,
we get $1 = 100.1mA$



111. $\vec{v}$ *and* $\vec{B}$ are parallel so F=0

112. $\omega = \sqrt{\frac{MB}{I}}$

113. Average energy density

$= \frac{1}{4}\in_0 \in^2 = \frac{1}{4} \times 8.8 \times 10^{-12} \times 1^2$

$= 2.2 \times 10^{-12} Jm^{-3}$

114. Band width for speach signal is

$= 3100 - 300 \qquad = 2800 H_z$

115. $\frac{\lambda_1}{\lambda_2} = \frac{\frac{h}{\sqrt{2mE}}}{\frac{hc}{E}}$ $\qquad \frac{\lambda_1}{\lambda_2} \propto E^{\frac{1}{2}}$

116. $\frac{3h}{2\pi} = n\left(\frac{h}{2\pi}\right)(n=3);$

$K_n = \frac{K_1}{(3)^2} = \frac{13.6}{9} = 1.51ev$

117. $P = \frac{nE}{t}$

$\frac{n}{t} = \frac{P}{E} = \frac{1\times10^6}{200\times10^6\times1.6\times10^{-19}}$

$\frac{n}{t} = 3.125\times10^{16}$

118. Circuit -A $R_{eff} = 2\Omega$ $i_1 = \frac{8}{2} = 4A$

Circuit - B $R_{eff} = 4\Omega$ $i_2 = \frac{8}{4} = 2A$

119. $dU = C_v dT = \left(\frac{5}{2}R\right)dT$

$dT = \frac{2(dU)}{5R}$

From first law of thermodynamics

$dU = dQ - dW \;\; = Q - \frac{Q}{4} = \frac{3Q}{4}$

Now molar heat capacity

$C = \frac{dQ}{dT} = \frac{Q}{2\frac{(dU)}{5R}} = \frac{5RQ}{2\left(\frac{3Q}{4}\right)} = \frac{10}{3}R$

120. $C = 5\times10^{-6}F$ $\qquad X_c = \frac{1}{C\omega}$

$X_c = \frac{1}{1000}\Omega$ $\qquad \omega C = \frac{1}{X_c}$

$\frac{1}{X_c} = 1000$ $\qquad 2\pi fc = \frac{1}{X_c}$

$f = \frac{1}{X_c}\times\frac{1}{2\pi C} = 1000\times\frac{1}{2\pi\times5\times10^{-6}}$

$f = 10^3\times\frac{1}{\pi\times10^{-5}} = \frac{10^8}{\pi}Hz$

Chemistry

121. $BeSO_4$ is water soluble

122. Vant Hoff factor (i) for $K_3[Fe(CN)_6]$ 4

Molality = $\frac{0.1}{329}\times\frac{1000}{100} = \frac{1}{329}$

$-\Delta T_f = i\times kf\times m$

$= 4\times1.86\times\frac{1}{329}$

$= 2.3\times10^{-2}$

$T_f = -2.3\times10^{-2}$

123. Sb_2S_3 is a negative solution hence the regulating power of cation is directly proportinal to the charge

$Al^{+3} > Ca^{+2} > Na^{+}$

124. For the elementary reaction $M \rightarrow N$

Rate = [M] ---- (i)

when the conc. is doubled, Rate increases by 8 times

$\therefore$ 8 x Rate = $K[2M]^n$ ------ (ii)

equation (ii) - ((i)

$\frac{8\times Rate}{Rate} = \frac{K[2M]^n}{K[M]^n}$

$8 = (2)^n$

$\therefore\; n = 3$

125. Alkaline earth metals exhibit blue colour in Ammonia liquid due to the formation of

$[e(NH_3)y]^-$ solvated electron)

126. $\Delta G = \Delta H - T\Delta s$

the reaction will be spantaneous if

$T\Delta S > \Delta H$ (i.e., (*i.e.* $\Delta G = -Ve$)

$T > \frac{\Delta H}{\Delta S} = \frac{170}{170\times10^{-3}} = 1000K$

127. $[Al(H_2O)_6]^{3+}$ is a complex ion

128. NO_2 and O_2 released

129. Conceptual

130. Strongest with fluoxine

131. In vander waals equation

$\left(p+\frac{an^2}{V^2}\right)(V-nb)=nRT$ at high pressure

$\frac{an^2}{V^2}$ is neglected, hence equation is reduced to P(V-nb) = nRJ

132. The number of waves made by an electron in a particular orbit is given by "n"

133. $Ag^+ + e^- \rightarrow Ag$

1F $\rightarrow$1 mole Ag 2F $\rightarrow$ 1 mole Cu

3F $\rightarrow$ 3 mole 3F $\rightarrow$ 1.5 moles

3F $\rightarrow$ 3 mole Al

3F $\rightarrow$ 1 mole Al

Ratio of moles of Ag, Cu and Al = 3 : 1 : 1 : 1
6 : 3 : 2

134. $N_{2(q)} + O_{2(q)} \rightleftharpoons 2NO_{(q)} : K_1$

$NO_{(q)} \rightleftharpoons 1/2N_{2(g)} + 1/2O_{2(g)} ; K_2$

$K_2 = = \frac{1}{\sqrt{K_1}} (or)\ K_2 = \frac{1}{K^{1/2}} (or)\ K_2 = K^{-1/2}$

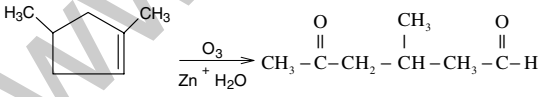
135. $5e^-$ change for Mn and $2e^-$ change for oxalate

136. Normality = volume strength /5.6

$N = \frac{10}{56} = 1.786$

137. Benzyl carbocation is stabilised by more number of resonating structures than Allyl carbocation. n-propyl carbocation is stabilised by only hyper conjugation.

138. Conceptual

139. 

140. (A) - $CH_3CN.(B)-CH_3COOH,(C)-CH_3-CH_2-OH$

So, CH_3-CH_3-OH is an isomer of dimethyl ether.

141. Name reactions

142. C_6H_5CHO has no $\alpha - H$

143. Reduction with H_3PO_2

144. A primary amine on treatment with nitrous acid gives a primary alcohol and on treament with $CHCl_3$ and KOH gives isocyanide. Isocyanide on hydrolysis given a primary amine.

$-NH_2 \xrightarrow{HNO_2} -OH$
(A)

$\xrightarrow[KOH]{CHCl_3} - \xrightarrow[KOH]{CHCl_3} -N\equiv C \xrightarrow[H^+]{H_2O} -NH_2$

145. $CH_3-CH_2-CN \xrightarrow[H^+]{H_2O}$

$CH_3-CH_2OOH \xrightarrow[\text{Rod P}]{Cl_2} CH_3-\underset{Cl}{CH}-COOH$

$\xrightarrow{\text{al KOH}} CH_3-\underset{Cl}{CH}-COOH$

146. Lucas reagent for alcohols

147. $\sqrt{2}a/2$

148. $NaOH + CH_3COOH \rightleftharpoons CH_3COONa + H_2O$
20ml 0.2M 50 ml 0.2M

$PKa = -\log(2\times10^{-5})$
= 5 - logx
= $5 - 0.3010 \Rightarrow 4.6990$

$pH = 4.6990 + \log \frac{4\times10^{-3}\ moles}{6\times10^{-3}\ moles}$

$= 4.6990 - \log\frac{6}{4}$
= 4.6990 – (0.4771 – 0.3010)
= 4.5229

149. Refining methods

150. $\left[Cr(H_2O)_4Cl_2\right]Cl$
1 mole of this complex form 1 mole AgCl ppt
No. of moles = $0.1\times0.01 = 10^{-3}$ moles

151. $CuSO_4.5H_2O$

In $CuSO_4$, Cu is in +2 0.5

$Cu^{+2} \rightarrow 3d^9 43^0$
it contains only 1 unpaired

$u = \sqrt{n(n+2)}$

$= \sqrt{1(1+2)} = \sqrt{3} = 1.732$ BM

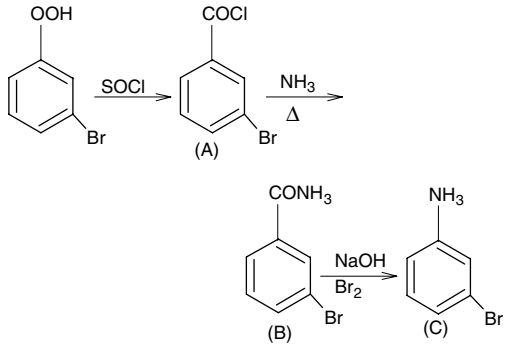
152. SO_2 bleaches based on reductions

153. Amytal and Luminal

154. Proline is 2° amine

155. Smoke + fog

156. Conceptual

157. 

158. Wt of org. compound is 0.75g

Molarity of H_2SO_4 = 1M

Normality = 1M

Volume = 10ml

$$\%N = \frac{1.4 \times v \times N}{\text{wt of org. compound}}$$

$$= \frac{1.4 \times 10 \times 2}{0.75} = 37.33$$

159. Xe forms 6 bonds

160. $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

$3 \times 56g$ of $Fe \rightarrow 4 \times 18g\ H_2O$

$2 \leftarrow 18g$

$$\text{wt of Fe} = \frac{18 \times 3 \times 56}{4 \times 18} = 42g$$