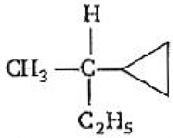
138. Amongst the following compounds, the optically active alkane having lowest molecular mass is :

(a) $CH_3-CH_2-CH_2-CH_3$

(b) $CH_3-CH_2-\underset{|}{\overset{CH_3}{C}}H-CH_3$

(c) 

(d) $CH_3-CH_2-C\equiv CH$

139. Consider the acidity of the carboxylic acids :

(i) PhCOOH

(ii) *o*-$NO_2C_6H_4COOH$

(iii) *p*-$NO_2C_6H_4COOH$

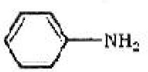
(iv) *m*-$NO_2C_6H_4COOH$

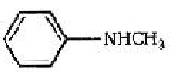
Which of the following order is correct ?

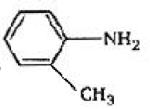
(a) i > ii > iii > iv (b) ii > iv > iii > i

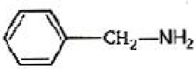
(c) ii > iv > i > iii (d) ii > iii > iv > i

140. Which of the following is the strongest base ?

(a) 

(b) 

(c) 

(d) 

141. Which base is present in RNA but not in DNA ?

(a) Uracil (b) Cytosine

(c) Guanine (d) Thymine

142. The compound formed on heating chlorobenzene with chloral in the presence of concentrated sulphuric acid is :

(a) gammexane (b) DDT

(c) freon (d) hexachloroethane

143. On mixing ethyl acetate with aqueous sodium chloride, the composition of the resultant solution is :

(a) $CH_3COOC_2H_5 + NaCl$

(b) $CH_3COONa + C_2H_5OH$

(c) $CH_3COCl + C_2H_5OH + NaOH$

(d) $CH_3Cl + C_2H_5COONa$

144. Acetyl bromide reacts with excess of CH_3MgI followed by treatment with a saturated solution of NH_4Cl gives :

(a) acetone

(b) acetamide

(c) 2-methyl-2-propanol

(d) acetyl iodide

145. Which one of the following is reduced with zinc and hydrochloric acid to give the corresponding hydrocarbon ?

(a) Ethyl acetate (b) Acetic acid

(c) Acetamide (d) Butan-2-one

146. Which one of the following undergoes reaction with 50% sodium hydroxide solution to give the corresponding alcohol and acid ?

(a) Phenol (b) Benzaldehyde

(c) Butanal (d) Benzoic acid

147. Among the following compounds which can be dehydrated very easily ?

(a) $CH_3CH_2CH_2CH_2CH_2OH$

(b) $CH_3CH_2CH_2\overset{\overset{OH}{|}}{C}HCH_3$

(c) $CH_3CH_2\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}CH_2CH_3$

(d) $CH_3CH_2\underset{\underset{CH_3}{|}}{C}HCH_2CH_2OH$

148. Which of the following compounds is not chiral ?

(a) 1-chloropentane

(b) 2-chloropentane

(c) 1-chloro-2-methyl pentane

(d) 3-chloro-2-methyl pentane

149. Insulin production and its action in human body are responsible for the level of diabetes. This compound belongs to which of the following categories ?

(a) A co-enzyme (b) A hormone

(c) An enzyme (d) An antibiotic

150. The smog is essentially caused by the presence of :

(a) O_2 and O_3

(b) O_2 and N_2

(c) oxides of sulphur and nitrogen

(d) O_3 and N_2

Mathematics

1. Let $R = \{(1, 3), (4, 2), (2, 4), (2, 3), (3, 1)\}$ be a relation on the set $A = \{1, 2, 3, 4\}$. The relation R is :
   (a) a function (b) transitive
   (c) not symmetric (d) reflexive

2. The range of the function $f(x) = {}^{7-x}P_{x-3}$ is :
   (a) $\{1, 2, 3\}$ (b) $\{1, 2, 3, 4, 5, 6\}$
   (c) $\{1, 2, 3, 4\}$ (d) $\{1, 2, 3, 4, 5\}$

3. Let z, w be complex numbers such that $\bar{z} + i\bar{w} = 0$ and $\arg zw = \pi$. Then $\arg z$ equals :
   (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$
   (c) $\frac{3\pi}{4}$ (d) $\frac{5\pi}{4}$

4. If $z = x - iy$ and $z^{1/3} = p + iq$, then $\left(\frac{x}{p} + \frac{y}{q}\right) \Big/ (p^2 + q^2)$ is equal to :
   (a) 1 (b) -1
   (c) 2 (d) -2

5. If $|z^2 - 1| = |z|^2 + 1$, then z lies on :
   (a) the real axis (b) the imaginary axis
   (c) a circle (d) an ellipse

6. Let $A = \begin{bmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$. The only correct statement about the matrix A is :
   (a) A is a zero matrix
   (b) $A = (-1)I$, where I is a unit matrix
   (c) A^{-1} does not exist
   (d) $A^2 = I$

7. Let $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ and $(10)\ B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$.
   If B is the inverse of matrix A, then α is :
   (a) -2 (b) 1
   (c) 2 (d) 5

8. If $a_1, a_2, a_3, \ldots, a_n, \ldots$ are in GP, then the value of the determinant
   $$\begin{vmatrix} \log a_n & \log a_{n+1} & \log a_{n+2} \\ \log a_{n+3} & \log a_{n+4} & \log a_{n+5} \\ \log a_{n+6} & \log a_{n+7} & \log a_{n+8} \end{vmatrix}, \text{ is :}$$
   (a) 0 (b) 1
   (c) 2 (d) -2

9. Let two numbers have arithmetic mean 9 and geometric mean 4. Then these numbers are the roots of the quadratic equation :
   (a) $x^2 + 18x + 16 = 0$
   (b) $x^2 - 18x + 16 = 0$
   (c) $x^2 + 18x - 16 = 0$
   (d) $x^2 - 18x - 16 = 0$

10. If $(1 - p)$ is a root of quadratic equation $x^2 + px + (1 - p) = 0$, then its roots are :
    (a) 0, 1 (b) -1, 1
    (c) 0, -1 (d) -1, 2

11. Let $S(K) = 1 + 3 + 5 + \ldots + (2K - 1) = 3 + K^2$. Then which of the following is true ?
    (a) $S(1)$ is correct
    (b) $S(K) \Rightarrow S(K + 1)$
    (c) $S(K) \nRightarrow S(K + 1)$
    (d) Principle of mathematical induction can be used to prove the formula.

12. How many ways are there to arrange the letters in the word GARDEN with the vowels in alphabetical order ?
    (a) 120 (b) 240
    (c) 360 (d) 480

13. The number of ways of distributing 8 identical balls in 3 distinct boxes so that none of the boxes is empty, is :
    (a) 5 (b) 21
    (c) 3^8 (d) ${}^8C_3$

14. If one root of the equation $x^2 + px + 12 = 0$ is 4, while the equation $x^2 + px + q = 0$ has equal roots, then the value of 'q' is :
    (a) $\frac{49}{4}$ (b) 12
    (c) 3 (d) 4

15. The coefficient of the middle term in the binomial expansion in powers of x of $(1 + \alpha x)^4$ and of $(1 - \alpha x)^6$ is the same, if α equals :
    (a) $-\frac{5}{3}$ (b) $\frac{10}{3}$
    (c) $-\frac{3}{10}$ (d) $\frac{3}{5}$

16. The coefficient of x^n in expansion of $(1 + x)(1 - x)^n$ is :
    (a) $(n - 1)$ (b) $(-1)^n (1 - n)$
    (c) $(-1)^{n-1} (n - 1)^2$ (d) $(-1)^{n-1} n$

17. If $s_n = \sum_{r=0}^{n} \frac{1}{^nC_r}$ and $t_n = \sum_{r=0}^{n} \frac{r}{^nC_r}$, then $\frac{t_n}{s_n}$ is equal to :

(a) $\frac{n}{2}$ (b) $\frac{n}{2} - 1$

(c) $n - 1$ (d) $\frac{2n-1}{2}$

18. Let T_r be the rth term of an A P whose first term is a and common difference is d. If for some positive integers $m, n, m \neq n$, $T_m = \frac{1}{n}$ and $T_n = \frac{1}{m}$, then $a - d$ equals :

(a) 0 (b) 1

(c) $\frac{1}{mn}$ (d) $\frac{1}{m} + \frac{1}{n}$

19. The sum of the first n terms of the series $1^2 + 2\cdot 2^2 + 3^2 + 2\cdot 4^2 + 5^2 + 2\cdot 6^2 + \ldots$ is $\frac{n(n+1)^2}{2}$ when n is even. When n is odd the sum is :

(a) $\frac{3n(n+1)}{2}$ (b) $\frac{n^2(n+1)}{2}$

(c) $\frac{n(n+1)^2}{4}$ (d) $\left[\frac{n(n+1)}{2}\right]^2$

20. The sum of series $\frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \ldots$ is :

(a) $\frac{(e^2-1)}{2}$ (b) $\frac{(e-1)^2}{2e}$

(c) $\frac{(e^2-1)}{2e}$ (d) $\frac{(e^2-2)}{e}$

21. Let α, β be such that $\pi < \alpha - \beta < 3\pi$. If $\sin\alpha + \sin\beta = -\frac{21}{65}$ and $\cos\alpha + \cos\beta = -\frac{27}{65}$, then the value of $\cos\frac{\alpha-\beta}{2}$ is :

(a) $-\frac{3}{\sqrt{130}}$ (b) $\frac{3}{\sqrt{130}}$

(c) $\frac{6}{65}$ (d) $-\frac{6}{65}$

22. If $u = \sqrt{a^2\cos^2\theta + b^2\sin^2\theta}$

$$+ \sqrt{a^2\sin^2\theta + b^2\cos^2\theta},$$

then the difference between the maximum and minimum values of u^2 is given by :

(a) $2(a^2+b^2)$ (b) $2\sqrt{a^2+b^2}$

(c) $(a+b)^2$ (d) $(a-b)^2$

23. The sides of a triangle are $\sin\alpha$, $\cos\alpha$ and $\sqrt{1+\sin\alpha\cos\alpha}$ for some $0 < \alpha < \frac{\pi}{2}$. Then the greatest angle of the triangle is :

(a) 60° (b) 90°

(c) 120° (d) 150°

24. A person standing on the bank of a river, observes that the angle of elevation of the top of a tree on the opposite bank of the river is 60° and when he retires 40 m away from the tree the angle of elevation becomes 30°. The breadth of the river is :

(a) 20 m (b) 30 m

(c) 40 m (d) 60 m

25. If $f : R \to S$, defined by $f(x) = \sin x - \sqrt{3}\cos x + 1$, is onto , then the interval of S is :

(a) [0, 3] (b) [– 1, 1]

(c) [0, 1] (d) [– 1, 3]

26. The graph of the function $y = f(x)$ is symmetrical about the line $x = 2$, then :

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

(b) $f(2+x) = f(2-x)$

(c) $f(x) = f(-x)$

(d) $f(x) = -f(-x)$

27. The domain of the function

$$f(x) = \frac{\sin^{-1}(x-3)}{\sqrt{9-x^2}} \text{ is :}$$

(a) [2, 3] (b) [2, 3)

(c) [1, 2] (d) [1, 2)

28. If $\lim_{x\to\infty}\left(1 + \frac{a}{x} + \frac{b}{x^2}\right)^{2x} = e^2$, then the values of a and b are :

(a) $a \in R, b \in R$ (b) $a = 1, b \in R$

(c) $a \in R, b = 2$ (d) $a = 1, b = 2$

29. Let $f(x) = \frac{1-\tan x}{4x-\pi}$, $x \neq \frac{\pi}{4}$, $x \in \left[0, \frac{\pi}{2}\right]$. If $f(x)$ is continuous in $\left[0, \frac{\pi}{2}\right]$, then $f\left(\frac{\pi}{4}\right)$ is :

(a) 1 (b) 1/2

(c) –1/2 (d) – 1

30. If $x = e^{y + e^{y + \ldots \text{to} \infty}}$, $x > 0$, then $\frac{dy}{dx}$ is :

(a) $\frac{x}{1+x}$ (b) $\frac{1}{x}$

(c) $\frac{1-x}{x}$ (d) $\frac{1+x}{x}$

31. A point on the parabola $y^2 = 18x$ at which the ordinate increases at twice the rate of the abscissa, is :

(a) $(2, 4)$ (b) $(2, -4)$

(c) $\left(-\frac{9}{8}, \frac{9}{2}\right)$ (d) $\left(\frac{9}{8}, \frac{9}{2}\right)$

32. A function $y = f(x)$ has a second order derivative $f'' = 6(x-1)$. If its graph passes through the point $(2, 1)$ and at that point the tangent to the graph is $y = 3x - 5$, then the function is :

(a) $(x-1)^2$ (b) $(x-1)^3$

(c) $(x+1)^3$ (d) $(x+1)^2$

33. The normal to the curve $x = a(1 + \cos\theta)$, $y = a\sin\theta$ at 'θ' always passes through the fixed point :

(a) $(a, 0)$ (b) $(0, a)$

(c) $(0, 0)$ (d) (a, a)

34. If $2a + 3b + 6c = 0$, then at least one root of the equation $ax^2 + bx + c = 0$ lies in the interval :

(a) $(0, 1)$ (b) $(1, 2)$

(c) $(2, 3)$ (d) $(1, 3)$

35. $\lim_{n\to\infty} \sum_{r=1}^{n} \frac{1}{n} e^{r/n}$ is :

(a) e (b) $e - 1$

(c) $1 - e$ (d) $e + 1$

36. If $\int \frac{\sin x}{\sin(x-\alpha)}\, dx = Ax + B\log\sin(x-\alpha) + c$, then value of (A, B) is :

(a) $(\sin\alpha, \cos\alpha)$ (b) $(\cos\alpha, \sin\alpha)$

(c) $(-\sin\alpha, \cos\alpha)$ (d) $(-\cos\alpha, \sin\alpha)$

37. $\int \frac{dx}{\cos x - \sin x}$ is equal to :

(a) $\frac{1}{\sqrt{2}} \log\left|\tan\left(\frac{x}{2} - \frac{\pi}{8}\right)\right| + c$

(b) $\frac{1}{\sqrt{2}} \log\left|\cot\left(\frac{x}{2}\right)\right| + c$

(c) $\frac{1}{\sqrt{2}} \log\left|\tan\left(\frac{x}{2} - \frac{3\pi}{8}\right)\right| + c$

(d) $\frac{1}{\sqrt{2}} \log\left|\tan\left(\frac{x}{2} - \frac{3\pi}{8}\right)\right| + c$

38. The value of $\int_{-2}^{3} |1 - x^2|\, dx$ is :

(a) $\frac{28}{3}$ (b) $\frac{14}{3}$

(c) $\frac{7}{3}$ (d) $\frac{1}{3}$

39. The value of $\int_0^{\pi/2} \frac{(\sin x + \cos x)^2}{\sqrt{1 + \sin 2x}}\, dx$ is :

(a) 0 (b) 1

(c) 2 (d) 3

40. If $\int_0^{\pi} x f(\sin x)\, dx = A \int_0^{\pi/2} f(\sin x)\, dx$, then A is equal to :

(a) 0 (b) π

(c) $\frac{\pi}{4}$ (d) 2π

41. If $f(x) = \frac{e^x}{1 + e^x}$, $I_1 = \int_{f(-a)}^{f(a)} x\, g\{x(1-x)\}\, dx$ and $I_2 = \int_{f(-a)}^{f(a)} g\{x(1-x)\}\, dx$, then the value of $\frac{I_2}{I_1}$ is :

(a) 2 (b) -3

(c) -1 (d) 1

42. The area of the region bounded by the curves $y = |x - 2|$, $x = 1$, $x = 3$ and the x-axis is :

(a) 1 (b) 2

(c) 3 (d) 4

43. The differential equation for the family of curves $x^2 + y^2 - 2ay = 0$, where a is an arbitrary constant, is :

(a) $2(x^2 - y^2)y' = xy$

(b) $2(x^2 + y^2)y' = xy$

(c) $(x^2 - y^2)y' = 2xy$

(d) $(x^2 + y^2)y' = 2xy$

44. The solution of the differential equation $y\,dx + (x + x^2 y)\,dy = 0$ is :

(a) $-\frac{1}{xy} = c$ (b) $-\frac{1}{xy} + \log y = c$

(c) $\frac{1}{xy} + \log y = c$ (d) $\log y = cx$

45. Let $A(2, -3)$ and $B(-2, 1)$ be vertices of a triangle ABC. If the centroid of this triangle moves on the line $2x + 3y = 1$, then the locus of the vertex C is the line :

(a) $2x + 3y = 9$ (b) $2x - 3y = 7$

(c) $3x + 2y = 5$ (d) $3x - 2y = 3$

46. The equation of the straight line passing through the point $(4, 3)$ and making intercepts on the co-ordinate axes whose sum is -1, is :

(a) $\frac{x}{2} + \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$

(b) $\frac{x}{2} - \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$

(c) $\frac{x}{2}+\frac{y}{3}=1$ and $\frac{x}{-2}+\frac{y}{1}=1$

(d) $\frac{x}{2}-\frac{y}{3}=1$ and $\frac{x}{-2}+\frac{y}{1}=1$

47. If the sum of the slopes of the lines given by $x^2-2cxy-7y^2=0$ is four times their product, then c has the value :

(a) 1 (b) -1
(c) 2 (d) -2

48. If one of the lines given by $6x^2-xy+4cy^2=0$ is $3x+4y=0$, then c equals :

(a) 1 (b) -1
(c) 3 (d) -3

49. 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 :

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

50. A variable circle passes through the fixed point $A(p, q)$ and touches x-axis. The locus of the other end of the diameter through A is :

(a) $(x-p)^2=4qy$ (b) $(x-q)^2=4py$
(c) $(y-p)^2=4qx$ (d) $(y-q)^2=4px$

51. If the lines $2x+3y+1=0$ and $3x-y-4=0$ lie along diameters of a circle of circumference 10π, then the equation of the circle is :

(a) $x^2+y^2-2x+2y-23=0$
(b) $x^2+y^2-2x-2y-23=0$
(c) $x^2+y^2+2x+2y-23=0$
(d) $x^2+y^2+2x-2y-23=0$

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

(a) $x^2+y^2-x-y=0$
(b) $x^2+y^2-x+y=0$
(c) $x^2+y^2+x+y=0$
(d) $x^2+y^2+x-y=0$

53. If $a \neq 0$ and the line $2bx+3cy+4d=0$ passes through the points of intersection of the parabolas $y^2=4ax$ and $x^2=4ay$, then :

(a) $d^2+(2b+3c)^2=0$
(b) $d^2+(3b+2c)^2=0$
(c) $d^2+(2b-3c)^2=0$
(d) $d^2+(3b-2c)^2=0$

54. The eccentricity of an ellipse with its centre at the origin, is $\frac{1}{2}$. If one of the directrices is $x=4$, then the equation of the ellipse is :

(a) $3x^2+4y^2=1$ (b) $3x^2+4y^2=12$
(c) $4x^2+3y^2=12$ (d) $4x^2+3y^2=1$

55. A line makes the same angle θ with each of the x and z axis. If the angle β, which it makes with y-axis, is such that $\sin^2\beta=3\sin^2\theta$, then $\cos^2\theta$ equals :

(a) $\frac{2}{3}$ (b) $\frac{1}{5}$
(c) $\frac{3}{5}$ (d) $\frac{2}{5}$

56. Distance between two parallel planes $2x+y+2z=8$ and $4x+2y+4z+5=0$ is :

(a) $\frac{3}{2}$ (b) $\frac{5}{2}$
(c) $\frac{7}{2}$ (d) $\frac{9}{2}$

57. A line with direction cosines proportional to 2, 1, 2 meets each of the lines $x=y+a=z$ and $x+a=2y=2z$. The co-ordinates of each of the points of intersection are given by :

(a) $(3a, 3a, 3a), (a, a, a)$
(b) $(3a, 2a, 3a), (a, a, a)$
(c) $(3a, 2a, 3a), (a, a, 2a)$
(d) $(2a, 3a, 3a), (2a, a, a)$

58. If the straight lines $x=1+s, y=-3-\lambda s, z=1+\lambda s$ and $x=\frac{t}{2}, y=1+t, z=2-t$, with parameters s and t respectively, are co-planar, then λ equals :

(a) -2 (b) -1
(c) $-\frac{1}{2}$ (d) 0

59. The intersection of the spheres $x^2+y^2+z^2+7x-2y-z=13$ and $x^2+y^2+z^2-3x+3y+4z=8$ is the same as the intersection of one of the sphere and the plane :

(a) $x-y-z=1$ (b) $x-2y-z=1$
(c) $x-y-2z=1$ (d) $2x-y-z=1$

60. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non-zero vectors such that no two of these are collinear. If the vector $\vec{a}+2\vec{b}$ is collinear with $\vec{c}$ and $\vec{b}+3\vec{c}$ is collinear with $\vec{a}$ (λ being some non-zero scalar), then $\vec{a}+2\vec{b}+6\vec{c}$ equals :

(a) $\lambda\vec{a}$ (b) $\lambda\vec{b}$
(c) $\lambda\vec{c}$ (d) 0

61. A particle is acted upon by constant forces $4\hat{i}+\hat{j}-3\hat{k}$ and $3\hat{i}+\hat{j}-\hat{k}$ which displace it from a point $\hat{i}+2\hat{j}+3\hat{k}$ to the point $5\hat{i}+4\hat{j}+\hat{k}$. The work done in standard units by the forces is given by :

(a) 40 (b) 30
(c) 25 (d) 15

62. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors and λ is a real number, then the vectors $\vec{a}+2\vec{b}+3\vec{c}$, $\lambda\vec{b}+4\vec{c}$ and $(2\lambda-1)\vec{c}$ are non-coplanar for :

(a) all values of λ
(b) all except one value of λ
(c) all except two values of λ
(d) no value of λ

63. Let $\vec{u}, \vec{v}, \vec{w}$ be such that $|\vec{u}|=1, |\vec{v}|=2$, $|\vec{w}|=3$. If the projection $\vec{v}$ along $\vec{u}$ is equal to that of $\vec{w}$ along $\vec{u}$ and $\vec{v}, \vec{w}$ are perpendicular to each other, then $|\vec{u}-\vec{v}+\vec{w}|$ equals :

(a) 2 (b) $\sqrt{7}$
(c) $\sqrt{14}$ (d) 14

64. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be non-zero vectors such that $(\vec{a}\times\vec{b})\times\vec{c}=\frac{1}{3}|\vec{b}||\vec{c}|\vec{a}$. If θ is the acute angle between the vectors $\vec{b}$ and $\vec{c}$, then $\sin\theta$ equals :

(a) $\frac{1}{3}$ (b) $\frac{\sqrt{2}}{3}$
(c) $\frac{2}{3}$ (d) $\frac{2\sqrt{2}}{3}$

65. Consider the following statements :

(1) Mode can be computed from histogram
(2) Median is not independent of change of scale
(3) Variance is independent of change of origin and scale

Which of these is/are correct ?

(a) Only (1) (b) Only (2)
(c) Only (1) and (2) (d) (1), (2) and (3)

66. In a series of $2n$ observations, half of them equal a and remaining half equal $-a$. If the standard deviation of the observations is 2, then $|a|$ equals :

(a) $\frac{1}{n}$ (b) $\sqrt{2}$
(c) 2 (d) $\frac{\sqrt{2}}{n}$

67. The probability that A speaks truth is 4/5 while this probability for B is 3/4. The probability that they contradict each other when asked to speak on a fact, is :

(a) $\frac{3}{20}$ (b) $\frac{1}{5}$
(c) $\frac{7}{20}$ (d) $\frac{4}{5}$

68. A random variable X has the probability distribution :

X:	1	2	3	4	5	6	7	8
$P(X)$:	0.15	0.23	0.12	0.10	0.20	0.08	0.07	0.05

For the events $E=\{X \text{ is a prime number}\}$ and $F=\{X<4\}$, the probability $P(E\cup F)$ is :

(a) 0.87 (b) 0.77
(c) 0.35 (d) 0.50

69. The mean and the variance of a binomial distribution are 4 and 2 respectively. Then the probability of 2 successes is :

(a) $\frac{37}{256}$ (b) $\frac{219}{256}$
(c) $\frac{128}{256}$ (d) $\frac{28}{256}$

70. With two forces acting at a point, the maximum effect is obtained when their resultant is 4N. If they act at right angles, then their resultant is 3N. Then the forces are :

(a) $(2+\sqrt{2})$ N and $(2-\sqrt{2})$ N
(b) $(2+\sqrt{3})$ N and $(2-\sqrt{3})$N
(c) $\left(2+\frac{1}{2}\sqrt{2}\right)$ N and $\left(2-\frac{1}{2}\sqrt{2}\right)$ N
(d) $\left(2+\frac{1}{2}\sqrt{3}\right)$ N and $\left(2-\frac{1}{2}\sqrt{3}\right)$ N

71. In a right angle ΔABC, $\angle A=90°$ and sides a, b, c are respectively, 5 cm, 4 cm and 3 cm. If a force $\vec{F}$ has moments 0, 9 and 16 in N cm unit respectively about vertices A, B and C, the magnitude of $\vec{F}$ is :

(a) 3 (b) 4
(c) 5 (d) 9

72. Three forces $\vec{P}, \vec{Q}$ and $\vec{R}$ acting along IA, IB and IC, where I is the incentre of a ΔABC, are in equilibrium. Then $\vec{P}:\vec{Q}:\vec{R}$ is :

(a) $\cos\frac{A}{2}:\cos\frac{B}{2}:\cos\frac{C}{2}$
(b) $\sin\frac{A}{2}:\sin\frac{B}{2}:\sin\frac{C}{2}$

(c) $\sec\frac{A}{2} : \sec\frac{B}{2} : \sec\frac{C}{2}$

(d) $\text{cosec}\frac{A}{2} : \text{cosec}\frac{B}{2} : \text{cosec}\frac{C}{2}$

73. A particle moves towards east from a point A to a point B at the rate of 4 km/h and then towards north from B to C at rate of 5 km/h. If $AB = 12$ km and $BC = 5$ km, then its average speed for its journey from A to C and resultant average velocity direct from A to C are respectively :

(a) $\frac{17}{4}$ km/h and $\frac{13}{4}$ km/h

(b) $\frac{13}{4}$ km/h and $\frac{17}{4}$ km/h

(c) $\frac{17}{9}$ km/h and $\frac{13}{9}$ km/h

(d) $\frac{13}{9}$ km/h and $\frac{17}{9}$ km/h

74. A velocity 1/4 m/s is resolved into two components along OA and OB making angles 30° and 45° respectively with the given velocity. Then the component along OB is :

(a) $\frac{1}{8}$ m/s (b) $\frac{1}{4}(\sqrt{3}-1)$ m/s

(c) $\frac{1}{4}$ m/s (d) $\frac{1}{8}(\sqrt{6}-\sqrt{2})$ m/s

75. If t_1 and t_2 are the times of flight of two particles having the same initial velocity u and range R on the horizontal, then $t_1^2 + t_2^2$ is equal to :

(a) u^2/g (b) $4u^2/g^2$

(c) $u^2/2g$ (d) 1

ANSWERS

PHYSICS AND CHEMISTRY

1.	(c)	2.	(a)	3.	(c)	4.	(a)	5.	(c)	6.	(b)	7.	(d)	8.	(d)
9.	(a)	10.	(b)	11.	(a)	12.	(b)	13.	(b)	14.	(c)	15.	(b)	16.	(a)
17.	(c)	18.	(d)	19.	(a)	20.	(b)	21.	(a)	22.	(d)	23.	(b)	24.	(c)
25.	(c)	26.	(b)	27.	(c)	28.	(b)	29.	(b)	30.	(a)	31.	(a)	32.	(d)
33.	(b)	34.	(c)	35.	(b)	36.	(d)	37.	(b)	38.	(a)	39.	(d)	40.	(b)
41.	(c)	42.	(d)	43.	(d)	44.	(b)	45.	(c)	46.	(c)	47.	(a)	48.	(b)
49.	(a)	50.	(c)	51.	(c)	52.	(d)	53.	(a)	54.	(b)	55.	(b)	56.	(a)
57.	(c)	58.	(b)	59.	(c)	60.	(d)	61.	(b)	62.	(b)	63.	(c)	64.	(b)
65.	(d)	66.	(c)	67.	(a)	68.	(d)	69.	(c)	70.	(c)	71.	(d)	72.	(d)
73.	(c)	74.	(b)	75.	(c)	76.	(c)	77.	(b)	78.	(c)	79.	(a)	80.	(c)
81.	(a)	82.	(d)	83.	(b)	84.	(c)	85.	(b)	86.	(c)	87.	(d)	88.	(c)
89.	(d)	90.	(a)	91.	(c)	92.	(c)	93.	(d)	94.	(b)	95.	(c)	96.	(d)
97.	(b)	98.	(d)	99.	(b)	100.	(a)	101.	(b)	102.	(a)	103.	(d)	104.	(a)
105.	(b)	106.	(c)	107.	(c)	108.	(d)	109.	(c)	110.	(d)	111.	(a)	112.	(c)
113.	(c)	114.	(d)	115.	(c)	116.	(c)	117.	(a)	118.	(b)	119.	(a)	120.	(a)
121.	(b)	122.	(c)	123.	(a)	124.	(d)	125.	(a)	126.	(c)	127.	(d)	128.	(a)
129.	(b)	130.	(c)	131.	(a)	132.	(c)	133.	(d)	134.	(c)	135.	(c)	136.	(b)
137.	(a)	138.	(c)	139.	(d)	140.	(d)	141.	(a)	142.	(b)	143.	(a)	144.	(c)
145.	(d)	146.	(b)	147.	(c)	148.	(a)	149.	(b)	150.	(c)				

MATHEMATICS

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