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ROLL No. ☐☐☐☐☐

TEST BOOKLET No.

29186

TEST FOR FIRST DEGREE PROGRAMMES IN ENGINEERING AND TECHNOLOGY

MATHEMATICS, PHYSICS AND CHEMISTRY

Time: 3 Hours   Maximum Marks: 750

INSTRUCTIONS TO CANDIDATES

1. You are provided with a Test Booklet and an Optical Mark Reader (OMR) Answer Sheet with a carbonless copy to mark your responses. Do not soil the Answer Sheet. Read carefully all the instructions given on the Answer Sheet.

2. Write your Roll Number in the space provided on the top of this page.

3. Also write your Roll Number in the columns provided for the same on the **Answer Sheet**. Darken the appropriate bubbles with a **Ball Point Pen**. Put your signature in the column provided on the Answer Sheet in the presence of the Invigilator.

4. Darken the appropriate bubble corresponding to the Test Booklet Series, as given on the top of this page, in the Answer Sheet. **If the corresponding bubble is not darkened, such answer sheets will not be valued and will be summarily rejected.**

5. The paper consists of 250 objective type questions. Of this, Question No. 1 to 125 will be Mathematics, 126 to 200 will be Physics and 201 to 250 will be Chemistry. All questions carry equal marks.

6. Each question has four alternative responses marked **A, B, C** and **D** and you have to **darken** the bubble fully by **using a Ball Point Pen** corresponding to the correct response as indicated in the example shown on the Answer Sheet.

7. Each correct answer carries **3** marks and each wrong answer carries **1** minus mark.

8. Space for rough work is provided at the end of this Test Booklet.

9. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However, you can retain the Test Booklet and the carbonless copy of the OMR sheet.

10. Every precaution has been taken to avoid errors in the Test Booklet. In the event of any such unforeseen happenings, the same may be brought to the notice of the Observer/Chief Superintendent in writing. Suitable remedial measures will be taken at the time of evaluation, if necessary.

MATHEMATICS

1. Which one of the following is not true?

   (A) All the binary operations are associative
   (B) Matrix multiplication is associative
   (C) Matrix addition is associative
   (D) All binary operations are not associative

2. In any group G, the order of the identity element e is

   (A) 0   (B) 1
   (C) 2   (D) ∞

3. If A and B are matrices of the same order, then $\left(A\ B\ A^{-1} \right)^{n}$ is

   (A) $A^{n}\ B^{n}\ A$ (B) $A\ B^{n}\ A^{-n}$
   (C) $A^{n}\ B^{n}\ A^{-1}$ (D) $A\ B^{n}\ A^{-1}$

4. If ω is the cube root of unity, then $\begin{vmatrix} 1 & \omega & \omega^{2} \\ \omega & \omega^{2} & 1 \\ \omega^{2} & 1 & \omega \end{vmatrix}$ is equal to

   (A) 0   (B) ω^{2}
   (C) $1+\omega^{2}$ (D) $1-\omega^{2}$

5. The value of the product of the determinants $\begin{vmatrix} 2 & 1 \\ 1 & 2 \end{vmatrix}$ and $\begin{vmatrix} \frac{1}{2} & 1 \\ 1 & \frac{1}{2} \end{vmatrix}$ is

   (A) $-\dfrac{9}{4}$ (B) 0
   (C) 1   (D) $\dfrac{9}{4}$

6. The sample space of a single toss of a coin is

   (A) $\{T, T\}$ (B) $\{H, H\}$
   (C) $\{H\}$ (D) $\{H, T\}$

7. If A and B are events such that $A \subseteq B$, then

   (A) $P(A) > P(B)$ (B) $P(A) = P(B)$
   (C) $P(A) + P(B) = 0$ (D) $P(A) \leq P(B)$

8. If $f(x) = kx(1-x)$ for $0 < x < 1$ is a p.d.f., then the value of k is

   (A) 6 (B) $\dfrac{2}{5}$
   (C) $\dfrac{3}{5}$ (D) 5

9. If six coins are tossed simultaneously, then the probability of getting six tails is

   (A) $\dfrac{1}{128}$ (B) $\dfrac{1}{32}$
   (C) $\dfrac{1}{16}$ (D) $\dfrac{1}{64}$

10. If $u = e^{x^2 + y^2}$, then $\dfrac{\partial u}{\partial x}$ is equal to

   (A) $\dfrac{u}{x}$ (B) $\dfrac{x}{u}$
   (C) $2ux$ (D) ux

11. A group $(G, *)$ is a finite group if

    (A) $a * b = b * a$ for all $a, b \in G$

    (B) $0(G) =$ finite

    (C) $0(a) =$ finite for all $a \in G$

    (D) $a^{-1} = a$ for all $a \in G$

12. If $f(x) = |x|$, $(x - \text{real})$, then the inverse function $g(y)$ is

    (A) $g(y) = |y|$ (B) $g(y) = y$

    (C) $g(y) \quad -y$ (D) not defined

13. If A, B, C are sets, then $A \times (B - C)$ is

    (A) $(A \times B) - (A \times C)$ (B) $(A \times B) - C$

    (C) $(A \times C) - B$ (D) $A \times (B \cup C)$

14. If $f : A \rightarrow B$ is injective (one-to-one), then

    (A) $n(A) \leq n(B)$ (B) $n(A) > n(B)$

    (C) $n(A) = n(B)$ (D) $n(A) = 2n(B)$

15. If $X = \{4^n - 3n - 1 / n = 1, 2, ...\}$ and $Y = \{9n / n = 0, 1, 2, ...\}$, then $X \cup Y$ is

    (A) X (B) Y

    (C) all integers   (D) empty

16. The inequality $|z - 4| < |z - 2|$ where z is a complex number represents a region in the plane which is

    (A) inside of a circle   (B) outside of an ellipse

    (C) empty   (D) a half plane

17. If $a = e^{i\alpha}$, $b = e^{i\beta}$, $c = e^{i\gamma}$, then the value of
$\cos(\alpha - \beta) + \cos(\beta - \gamma) + \cos(\gamma - \alpha)$ is equal to

$$\left(\text{assuming } \frac{a}{b} + \frac{b}{c} + \frac{c}{a} \quad 1\right)$$

    (A) 0   (B) 1

    (C) $\alpha + \beta + \gamma$ (D) $2(\alpha + \beta + \gamma)$

18. The complex number $2 - i$, when rotated anticlockwise about the origin by an angle $\frac{\pi}{2}$ becomes

    (A) $1 + 2i$ (B) $2i - 1$

    (C) $1 + i$ (D) $1 - i$

19. The quadratic equation for which the *AM* and *GM* of the roots are respectively *A* and *G* is

    (A) $x^2 - 2Gx + A = 0$ (B) $x^2 - 2Ax + G^2 = 0$

    (C) $x^2 + Ax + G = 0$ (D) $Ax^2 + Gx + 1 = 0$

20. If a, b are positive and $a \neq b$ and $p = \dfrac{a^{-1} + b^{-1}}{2}$, $q = \left(\dfrac{a + b}{2}\right)^{-1}$, then

    (A) $p < q$ (B) $p = q$

    (C) $p > q$ (D) $p = \dfrac{1}{q}$

21. If b^2, a^2, c^2 are in A.P., then $a + b,\ b + c,\ c + a$ will be in

    (A) A.P.   (B) G.P.

    (C) H.P.   (D) A.P. as well as G.P.

22. If α and β are the roots of $ax^2 + bx + c = 0$, then $\dfrac{\alpha}{a\beta + b} + \dfrac{\beta}{a\alpha + b}$ is

   (A) $\dfrac{2}{a}$ (B) $\dfrac{-2}{a}$

   (C) $\dfrac{2}{b}$ (D) $\dfrac{-2}{b}$

23. If the roots of $\dfrac{1}{x+p} + \dfrac{1}{x+q} = \dfrac{1}{r}$ are equal in magnitude but opposite in sign, then the product of the roots is

   (A) $\dfrac{p^2 + q^2}{2}$ (B) $\dfrac{p^2 - q^2}{2}$

   (C) $\dfrac{q^2 - p^2}{2}$ (D) $-\dfrac{\left(p^2 + q^2\right)}{2}$

24. If a, b, c are p^{th}, q^{th} and r^{th} terms of a G.P., then $(q - r)\log a + (r - p)\log b + (p - q)\log c$ is equal to

   (A) 0   (B) 1
   (C) −1   (D) abc

25. If $y = x - x^2 + x^3 - x^4 + ...$, then the value of x is

   (A) $y + \dfrac{1}{y}$ (B) $\dfrac{y}{1+y}$

   (C) $y - \dfrac{1}{y}$ (D) $\dfrac{y}{1-y}$

26. The equation $z\bar{z} + (2 - 3i)z + (2 + 3i)\bar{z} + 4 = 0$ represents a circle of radius

   (A) 2   (B) 3
   (C) 4   (D) 6

27. The maximum of the partial sums of the series $20+19\frac{1}{3}+18\frac{2}{3}+18+....$ is

    (A) 310   (B) 290
    (C) 320   (D) 20

28. Sum of all terms of an infinite G.P. is $\frac{1}{5}$ times the sum of odd terms. The common ratio is

    (A) 2   (B) 3

    (C) $\frac{-4}{5}$ (D) 5

29. If $x > 0$ and $\log_2 x + \log_2 \sqrt{x} + \log_2\left(\sqrt[4]{x}\right) + \log_2\left(\sqrt[8]{x}\right) + \log_2\left(\sqrt[16]{x}\right) + ... = 4$, then x equals

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

30. The sum of the series $(1+2)+\left(1+2+2^2\right)+\left(1+2+2^2+2^3\right)+...$ upto n terms is

    (A) $2^{n+2}-n-4$ (B) $2\left(2^n-1\right)-n$
    (C) $2^{n+1}-n$ (D) $2^{n+1}-1$

31. If x^2-1 is a factor of x^4+ax^3+3x-b, then

    (A) $a=3, b=-1$ (B) $a=-3, b=1$
    (C) $a=3, b=1$ (D) $a=-3, b=-1$

32. If $a(b-c)x^2 + b(c-a)xy + c(a-b)y^2$ is a perfect square, then a, b, c are in

    (A) A.P.   (B) H.P.
    (C) G.P.   (D) A.P and H.P.

33. If $x = 2 + 2^{\frac{1}{3}} + 2^{\frac{2}{3}}$, then the value of $x^3 - 6x^2 + 6x$, is

    (A) 3   (B) 2
    (C) 1   (D) 0

34. Roots of the equation $3^{2x+1} + 3^2 = 3^{x+3} + 3^x$ are

    (A) $1, -2$ (B) $1, 2$
    (C) $-1, 2$ (D) $-1, -2$

35. If $\dfrac{^n p_{r-1}}{a} = \dfrac{^n p_r}{b} = \dfrac{^n p_{r+1}}{c}$, then

    (A) $\dfrac{1}{a} + \dfrac{1}{b} + \dfrac{1}{c} = 1$ (B) $abc = 1$

    (C) $b^2 = a(b+c)$ (D) $a^2 = c(a+b)$

36. How many numbers greater than 1000, but not greater than 4000 can be formed with the digits 0, 1, 2, 3, 4? Repetition of digits being allowed.

    (A) 374   (B) 375
    (C) 376   (D) 5!

37. If $m = \begin{pmatrix} n \\ 2 \end{pmatrix}$, then $\begin{pmatrix} m \\ 2 \end{pmatrix}$ is equal to

    (A) $\quad 3 \begin{pmatrix} n \\ 4 \end{pmatrix}$ (B) $\quad \begin{pmatrix} n+1 \\ 4 \end{pmatrix}$

    (C) $\quad 3 \begin{pmatrix} n+1 \\ 4 \end{pmatrix}$ (D) $\quad 3 \begin{pmatrix} n+1 \\ 3 \end{pmatrix}$

38. The remainder obtained when $1! + 2! + 3! + ... + 95!$ is divided by 5 is

    (A)   3   (B)   1
    (C)   14   (D)   33

39. The middle term in the expansion of $\left(x - \dfrac{1}{x} \right)^{18}$ is

    (A) $^{18}C_9$ (B) $-^{18}C_9$
    (C) $^{18}C_{10}$ (D) $-^{18}C_{10}$

40. The solution set of the equation $\begin{vmatrix} 2 & 3 & x \\ 2 & 1 & x^2 \\ 6 & 7 & 3 \end{vmatrix} = 0$ is

    (A) ϕ (B) $\{0,1\}$
    (C) $\{1,-1\}$ (D) $\{1,-3\}$

41. If the matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is commutative with the matrix $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, then

    (A) $a = 0, b = c$ (B) $b = 0, c = d$
    (C) $c = 0, d = a$ (D) $d = 0, a = b$

42. The value of $\begin{vmatrix} 1 & 1 & 1 \\ bc & ca & ab \\ b+c & c+a & a+b \end{vmatrix}$ is

(A) 1   (B) 0

(C) $(a-b)(b-c)(c-a)$ (D) $(a+b)(b+c)(c+a)$

43. If $A = \begin{bmatrix} \cos^2\alpha & \cos\alpha\sin\alpha \\ \cos\alpha\sin\alpha & \sin^2\alpha \end{bmatrix}$ and $B = \begin{bmatrix} \cos^2\beta & \cos\beta\sin\beta \\ \cos\beta\sin\alpha & \sin^2\beta \end{bmatrix}$ are two matrices such that AB is null matrix, then $\alpha - \beta$ is

(A) 0   (B) multiple of π

(C) an odd multiple of $\dfrac{\pi}{2}$ (D) $\dfrac{\pi}{3}$

44. Sum of the series $\dfrac{2^2}{2!} + \dfrac{3^2}{3!} + ... + \infty$ is

(A) e (B) $2e$

(C) $2e+1$ (D) $2e-1$

45. If $A = \{x \in C : x^2 = 1\}$ and $B = \{x \in C : x^4 = 1\}$, then $A \Delta B$ is equal to

(A) $\{1, -1\}$ (B) $\{1, -1, i, -i\}$

(C) $\{i, -i\}$ (D) ϕ

46. Let R be the relation over the set integers and it is defined by $(x, y) \in R \Leftrightarrow |x - y| \leq 1$. Then R is

(A) reflexive and transitive
(B) reflexive and symmetric
(C) symmetric and transitive
(D) an equivalence relation

47. If $f(x) = \log\dfrac{1+x}{1-x}$, then $f(a)+f(b)$ is equal to

    (A) $f\left(\dfrac{a+b}{1-ab}\right)$ (B) $f\left(\dfrac{a+b}{1+ab}\right)$

    (C) $f\left(\dfrac{1-ab}{a+b}\right)$ (D) $f\left(\dfrac{1+ab}{a+b}\right)$

48. If $f(x) = \cos(\log x)$, then $f(x)f(y) - \dfrac{1}{2}\left[f\left(\dfrac{x}{y}\right) + f(xy)\right]$ has the value

    (A) 1   (B) $\dfrac{1}{2}$

    (C) 2   (D) 0

49. The number of onto mappings from the set $A = \{1, 2, \dots, 100\}$ to set $B = \{1, 2\}$ is

    (A) $2^{100} - 2$ (B) 2^{100}

    (C) $2^{99} - 2$ (D) 2^{99}

50. The probability that a man will live 10 more years is $\dfrac{1}{4}$ and the probability that his wife will live 10 more years is $\dfrac{1}{3}$. Then the probability that none of them will be alive after 10 years is

    (A) $\dfrac{5}{2}$ (B) $\dfrac{1}{2}$

    (C) $\dfrac{7}{12}$ (D) $\dfrac{11}{12}$

51. If $|z-4i|+|z+i|=10,$ then the locus of z is

     (A) a parabola   (B) a circle
     (C) a rectangular hyperbola   (D) an ellipse

52. The roots of $w^3 = 1$ are in

     (A) A.P.   (B) H.P
     (C) G.P.   (D) A.P. and H.P.

53. If C_1 and C_2 are the values of $\left(1-\sqrt{3}\,i\right)^{\frac{1}{2}}$, then

     (A) $C_1 + C_2 = 0$ (B) $C_1 + C_2 = 1$
     (C) $C_1 - C_2 = 0$ (D) $C_1 C_2 = -1$

54. If $x+\dfrac{1}{x}=2\cos\alpha$ and $y+\dfrac{1}{y}=2\cos\beta,$ then $\dfrac{x^5}{y^4}+\dfrac{y^4}{x^5}$ is equal to

     (A) $2\cos(\alpha-\beta)$ (B) $2\cos(5\alpha-4\beta)$
     (C) $2\cos(5\alpha+4\beta)$ (D) $2i\sin(5\alpha-4\beta)$

55. The product of all values of $8^{\frac{1}{6}}$ is equal to

     (A) -1 (B) 1
     (C) -8 (D) 8

56. The equation of the normal to the curve $y^2(4\ x)=x^3$ at the point $(2, 2)$ is

     (A) $x+2y=6$ (B) $2x-y=2$
     (C) $x-2y=6$ (D) $2x+y=2$

57   The angle between the curves $y = x^2$ and $xy = 1$ is

(A) $\tan^{-1}(5)$ (B) $-\tan^{-1}(3)$
(C) $-\tan^{-1} 2$ (D) $\tan^{-1} 4$

58.   The ellipse $4x^2 + 9y^2 = 72$ and hyperbola $x^2 - y^2 = 5$ cut orthogonally at

(A) $(3,2)$ (B) $(0,0)$
(C) $(-3,\ 1)$ (D) $(1,-2)$

59.   The function $f(x) = \dfrac{1}{x}$ for $x > 0$ is

(A)   increasing   (B)   decreasing
(C)   strictly increasing   (D)   strictly decreasing

60.   The function $f(x)$ is stationary at $x = c$ if

(A) $f''(c) = 0$ (B) $f'(c) < 0$
(C) $f'(c) > 0$ (D) $f'(c) = 0$

61.   The minimum value of $x \log x$ is

(A) $\dfrac{1}{e}$ (B) e
(C) $-\dfrac{1}{e}$ (D) $-e$

62.   The coefficient of x^5 in the expansion of e^x is

(A) $\dfrac{1}{4!}$ (B) $\dfrac{1}{5!}$
(C) $\dfrac{-1}{5!}$ (D) $5!$

63. The value of $lt\ (\sec x - \tan x)$ is

    (A)   1   (B)   0
    (C) -1 (D)   2

64. If $\log xy = x^2 + y^2$, $\dfrac{dy}{dx}$ is equal to

    (A) $\dfrac{y^2 - x^2}{x^2 - 2y^2}$ (B) $\dfrac{y\left(x^2 - y^2\right)}{x\left(y^2 - 2x^2\right)}$

    (C) $\dfrac{y\left(1 - y^2\right)}{x\left(1 - x^2\right)}$ (D) $\dfrac{y\left(2x - 1\right)}{x\left(1 - 2y^2\right)}$

65. The graph of the curve $f(x, y) = 0$ is symmetrical about the origin if

    (A) $f(x, y) = f(x, -y)$ (B) $f(-x, -y) = f(x, y)$
    (C) $f(x, y) = f(-x, y)$ (D) $f(x, y) = f(y, x)$

66. The curve $9y^2 = x(x - 3a)^2$ lies to the

    (A)   left of x – axis   (B)   left of y – axis
    (C)   right of y axis   (D)   right of x – axis

67 The radius of a circle is 10cm. The error in the area of the circle due to an error of 0.1cm in the radius is

    (A) πcm^2 (B) $10\pi \text{cm}^2$
    (C) $100\pi \text{cm}^2$ (D) $2\pi \text{cm}^2$

68. The eccentricity of the ellipse $\dfrac{x^2}{16} + \dfrac{y^2}{12} = 1$ is

    (A)   0.5   (B)   0.55

    (C) $\dfrac{2}{3}$ (D)   0.25

69. The area bounded by the lines $y = 2x + 1$, x–axis, $x = 0$ and $x = 1$ is

    (A)   1   (B)   2

    (C)   3   (D)   4

70. The length of the curve $y = \log x$ between the points whose abscissae are 1 and e is

    (A) $\displaystyle\int_{1}^{e} \sqrt{1 + x^2}\, dx$ (B) $\displaystyle\int_{1}^{e} \sqrt{\dfrac{1 + x^2}{x^2}}$

    (C) $\displaystyle\int_{1}^{e} \dfrac{dx}{\log x}$ (D) $\displaystyle\int_{1}^{e} \log y\, dx$

71. $y = \sin x$ is a solution of the equation

    (A) $\dfrac{dy}{dx} + y = 0$ (B) $\dfrac{dy}{dx} - y = 0$

    (C) $\dfrac{d^2 y}{dx^2} + y = 0$ (D) $\dfrac{d^2 y}{dx^2} - y = 0$

72. If e^x and xe^x are the solutions of $y'' + py' + 4 = 0$, then the value of p is

    (A)   1   (B)   –2

    (C)   –3   (D)   –4

73. The solution of the differential equation $xdy + ydx = 0$ satisfying $y(1) = 1$ is

 (A) $xy = 3$ (B) $xy = 1$
 (C) $xy = 2$ (D) $xy = 4$

74. The particular integral of $(D^2 - D - 6)\, y = e^{3x}$ is

 (A) e^{3x} (B) xe^{3x}
 (C) $\dfrac{1}{5}e^{3x}$ (D) $\dfrac{1}{5}xe^{3x}$

75. The integrating factor of $\dfrac{dy}{dx} - \dfrac{3}{x}y = x^3 \sin x$ is

 (A) x (B) $\dfrac{1}{x}$
 (C) x^3 (D) $\dfrac{1}{x^3}$

76. The total number of prime factors in $9^9 \times 7^9 \times 10^9$ is

 (A) 27 (B) 54
 (C) 5 (D) 3

77 The remainder when 2^{29} is divided by 5 is

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

78. The value of $3 + 3^2 + 3^3 + . \quad + 3^7$ is

 (A) 3229 (B) 3029
 (C) 3329 (D) 3279

79. If x is a whole number, then $x^2 \left(x^2 - 1\right)$ is divisible by

   (A) $12 - x$ (B) 24
   (C) 36   (D) 12

80. The sum of three consecutive odd numbers is divisible by

   (A) 2   (B) 3
   (C) 5   (D) 6

81. The value of $\dfrac{4.036}{0.04}$ is

   (A) 0.1009   (B) 1.009
   (C) 100.9   (D) 10.09

82. The L.C.M. of two primes a and $b\,(a > b)$ is 161. The value of $3b - a$ is

   (A) −2   (B) −1
   (C) 1   (D) 2

83. If $a^2 + b^2 = 117$ and $ab = 54$, the value of $\dfrac{a+b}{a-b}$ is

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

84. If $\dfrac{a}{3} = \dfrac{b}{4} = \dfrac{c}{7}$, then the value of $\dfrac{a+b+c}{c}$ is

   (A) $\dfrac{1}{\sqrt{7}}$ (B) $\sqrt{2}$
   (C) 2   (D) 7

85. If $x * y = x + y + \sqrt{xy}$, then the value of $6 * 24$ is

(A) 21   (B) 42
(C) 22   (D) 43

86. The total age of x and y is 12 years more than the total age of y and z. How many years is z younger than x?

(A) 12   (B) 24
(C) 22   (D) 28

87 If x is six times as large as y, then the percentage that y is less than x is

(A) $16\dfrac{2}{3}$ (B) 60

(C) $83\dfrac{1}{3}$ (D) 90

88. The value of $\log_{\left(-\frac{1}{3}\right)}(81)$ is

(A) −27   (B) 4
(C) −4   (D) 27

89. If the length of the diagonal of a square is 20cm, then its perimeter is

(A) $40\sqrt{2}$cm   (B) 400cm
(C) $10\sqrt{2}$cm   (D) 200cm

90. If the radius of the base and the height of a cone, a hemisphere and a cylinder are the same, then the ratio of their volumes is

(A) 1 1 : 3   (B) 3 2 1
(C) 3 1 1   (D) 1 2 : 3

91. What is the probability of getting a sum 9 from two throws of a dice?

(A) $\dfrac{1}{6}$ (B) $\dfrac{1}{8}$

(C) $\dfrac{1}{9}$ (D) $\dfrac{1}{12}$

92. The projection of $\hat{i} + \hat{j} + \hat{k}$ on $\hat{i} - \hat{j} + \hat{k}$ is

(A) $\sqrt{3}$ (B) $\dfrac{1}{\sqrt{3}}$

(C) $\dfrac{2}{\sqrt{3}}$ (D) $2\sqrt{3}$

93. If the angle between the vectors $3\hat{i} + \hat{j} + p\hat{k}$ and $2\hat{i} - 2\hat{j}\ 4\hat{k}$ is $90°$, then the value of p is

(A) 1   (B) -1
(C) 2   (D) 3

94. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular unit vectors, then $\left| \vec{a} + \vec{b} + \vec{c} \right|$ is

(A) 3   (B) 0
(C) $\sqrt{3}$ (D) 1

95. The equation of the plane making intercepts $\dfrac{1}{a}, \dfrac{1}{b}, \dfrac{1}{c}$ on the coordinate axes is

(A) $ax + by + cz = abc$ (B) $\dfrac{x}{a} + \dfrac{y}{b} + \dfrac{z}{c} = 1$

(C) $ax + by + cz = 1$ (D) $x + y + z = abc$

96. If $z = i$, then the value of z^{100} is

(A) $1+i$ (B) 1

(C) $-i$ (D) $100i$

97. The imaginary part of $\dfrac{1}{1+i} + \dfrac{1}{1-i}$ is

(A) 1 (B) 0

(C) $-\dfrac{1}{2}$ (D) $\dfrac{1}{2}$

98. The value of $\left| \dfrac{2+i}{4i+(1+i)^2} \right|$ is

(A) $\sqrt{5}$ (B) $\dfrac{\sqrt{5}}{6}$

(C) $\dfrac{\sqrt{5}}{2}$ (D) $\dfrac{5}{6}$

99. The modulus of $\sin\theta + i\cos\theta$ is

(A) 1 (B) $2\cos\dfrac{\theta}{2}$

(C) $\sin\theta + \cos\theta$ (D) $\sqrt{2}$

100. The argument of $\sqrt{3} - 3i$ is

(A) $\dfrac{-\pi}{3}$ (B) $-\dfrac{2\pi}{3}$

(C) $\dfrac{4\pi}{3}$ (D) $\dfrac{5\pi}{3}$

101. If $\phi(n)$ denotes the number of integers less than n and relatively prime to n, then for a prime p, $\phi(p)$ is

    (A) 1   (B) $p-2$
    (C) p (D) $p-1$

102. If m and n are positive integers, then the remainder when $mn-1$ is divided by n is

    (A) $m-1$ (B) $n-1$
    (C) 1   (D) -1

103. If two positive integers p and q are relatively prime, then the gcd of $(p+q)$ and $(p-q)$ is

    (A) 1   (B) 2
    (C) 1 or 2   (D) 1 or 3

104. If $\left(\dfrac{3}{2}+i\dfrac{\sqrt{3}}{2}\right)^{30}$ $3^{15}(x+iy)$, then $x+iy$ is equal to

    (A) i (B) $1+i$
    (C) -1 (D) $1-i$

105. If $z_k = \cos\dfrac{\pi}{2^k} + i\sin\dfrac{\pi}{2^k}$, $k=1,2,\ldots.$, then the value of $z_1.z_2.z_3\ldots.$ is

    (A) 1   (B) 0
    (C) -2 (D) -1

106. In a sequence each term is defined as sum of all the preceding terms with first two terms as 2 and 3. Then the 10th term in this sequence is

    (A) 320   (B) 640
    (C) 780   (D) 1280

107   If $f(x)$ is a polynomial such that $f(x^2-3)=x^4+4$, then $f(x^2+3)$ is

(A) x^4+7 (B) x^4+3x^2+7
(C) x^4+7x^2+12 (D) x^4+12x^2+40

108. The number of real solutions (x,y) of the equation $x^2+\dfrac{1}{x^2}=2^{1-y^2}$ is

(A) 4   (B) 2
(C) 1   (D) 0

109. If $p=\dfrac{n}{n+1},\ q=\dfrac{n+1}{n},\ r=\dfrac{n}{n-1},\ s=\dfrac{n-1}{n},\ (n=2,3,....)$, then

(A) $p<q<s<r$ (B) $p<s<q<r$
(C) $s<q<p<r$ (D) $s<p<q<r$

110. If there are 11 yes or no questions, then the number of ways of answering them is

(A) 1024   (B) 512
(C) 2048   (D) 4096

111   If the diagonal of a cube is 15cm, then the area of each of its face is

(A) 55cm^2 (B) 65cm^2
(C) 72cm^2 (D) 75cm^2

112. If for an acute angle θ, $\sin\theta=\dfrac{x}{y}$, then $\tan\theta$ is

(A) $\dfrac{\sqrt{y^2-x^2}}{y}$ (B) $\dfrac{\sqrt{x^2-y^2}}{x}$

(C) $\dfrac{x}{\sqrt{y^2-x^2}}$ (D) $\dfrac{y}{\sqrt{x^2-y^2}}$

113. The value of k for which, sum of the squares of the roots of $x^2 - (k-4)x - 2k = 0$, is least, is

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

114. If $0 < x < \dfrac{\pi}{2}$, then minimum value of $\dfrac{\cos^3 x}{\sin x} + \dfrac{\sin^3 x}{\cos x}$ is

    (A) $\sqrt{3}$ (B) $\dfrac{1}{2}$

    (C) $\sqrt{13}$ (D) 1

115. Solution of $2x - 1 = |x + 7|$ is

    (A) −2   (B) 8

    (C) −2, 8   (D) $2, -\dfrac{3}{8}$

116. Solution set of $\left| x + \dfrac{1}{x} \right| > 2$ is

    (A) $\mathbb{R} - \{0\}$ (B) $\mathbb{R} - \{-1, 0, 1\}$
    (C) $\mathbb{R} - \{1\}$ (D) $\mathbb{R} - \{-1, 1\}$

117. If $\log_{\cos x}(\tan x) + \log_{\sin x}(\cot x) = 0$, then the most general solutions of x, are

    (A) $n\pi + \dfrac{\pi}{4}, n \in I$ (B) $2n\pi + \dfrac{3\pi}{4}, n \in I$

    (C) $2n\pi - \dfrac{3\pi}{4}, n \in I$ (D) $2n\pi + \dfrac{\pi}{4}, n \in I$

118. The set of values of x for which the inequalities $x^2 - 3x - 10 < 0,\ 10x - x^2 - 16 > 0$ hold simultaneously is

   (A) $(-2, 5)$ (B) $(2, 8)$
   (C) $(-2, 8)$ (D) $(2, 5)$

119. The solution set of $\log_2 |4 - 5x| > 2$ is

   (A) $\left(\dfrac{8}{5}, \infty\right)$ (B) $\left(\dfrac{4}{5}, \dfrac{8}{5}\right)$

   (C) $\left(-\infty, 0\right) \cup \left(\dfrac{8}{5}, +\infty\right)$ (D) $(-\infty, \infty)$

120. If α, β are the roots of the equation $x^2 - 2x + 4 = 0$, then the value of $\alpha^6 + \beta^6$ is

   (A) 64   (B) 128
   (C) 256   (D) 512

121. The equation $|z + 1 - i| = |z + i - 1|$ represents

   (A) a straight line   (B) a circle
   (C) a parabola   (D) a hyperbola

122. If $a = \cos\dfrac{4\pi}{3} + i\,\sin\dfrac{4\pi}{3}$, then the value of $\left(\dfrac{1+a}{2}\right)^{3n}$ is

   (A) $(-1)^n$ (B) $\dfrac{(-1)^n}{2^{3n}}$

   (C) $\dfrac{1}{2^{3n}}$ (D) $(-1)^n + 1$

123. $\cos\left(i\log\dfrac{a-ib}{a+ib}\right)$ is equal to

   (A) ab

   (B) $\dfrac{a^2-b^2}{a^2+b^2}$

   (C) $\dfrac{a^2-b^2}{2ab}$

   (D) $\dfrac{2ab}{a^2+b^2}$

124. The equation $\bar{z}=\bar{a}+\dfrac{r^2}{(z-a)}$, $r>0$ and $|a|<r$ represents

   (A) an ellipse
   (B) a parabola
   (C) a circle
   (D) a straight line through point $\bar{a}$

125. The product of all values of $\left(\cos\alpha+i\sin\alpha\right)^{\frac{3}{5}}$ is

   (A) 1

   (B) $\cos\alpha+i\sin\alpha$

   (C) $\cos 3\alpha+i\sin 3\alpha$

   (D) $\cos 5\alpha+i\sin 5\alpha$

PHYSICS

126. A dipole is placed in a uniform electric field with its axis parallel to the field. It experiences

   (A) only a net force
   (B) only a torque
   (C) both a net force and torque
   (D) neither a net force nor a torque

127. The work done in moving $4\mu C$ charge from one point to another in an electric field is 0.012 J. The potential difference between them is

   (A) 3000V

   (B) 6000V

   (C) 30V

   (D) 48×10^3 V

128. The principle in lightning conductors is

    (A) corona discharge   (B) mutual induction
    (C) self-induction   (D) electromagnetic induction

129. The work done in moving $500\mu C$ charge between two points on equipotential surface is

    (A) zero   (B) finite positive
    (C) finite negative   (D) infinite

130. The law that governs the force between electric charges is

    (A) Ampere's law   (B) Faraday's law
    (C) Coulomb's law   (D) Ohm's law

131. When an electric dipole of dipole moment P is aligned parallel to the electric field E, then the potential energy of the dipole is given as

    (A) PE   (B) zero
    (C) $-$PE   (D) $\dfrac{PE}{\sqrt{2}}$

132. The negative gradient of potential is

    (A) electric force   (B) torque
    (C) electric current   (D) electric field intensity

133. The equivalent capacitance of two capacitors connected in series is $1.5\mu F$ The capacitance of one of them is $4\mu F$ The capacitance of the other is

    (A) $2.4\mu F$ (B) $2\mu F$
    (C) $4\mu F$ (D) $6\mu F$

134. The material through which electric charge can flow easily is

    (A) quartz   (B) mica
    (C) germanium   (D) copper

135. The unit of reduction factor of tangent galvanometer is

    (A) no unit   (B) tesla
    (C) ampere   (D) ampere / degree

136. In which one of the following pairs of metals of a thermocouple the e.m.f. is maximum?

    (A) Fe – Cu   (B) Cu – Zn
    (C) Pt – Ag   (D) Sb – Bi

137. Thermopile is used to

    (A) measure temperature   (B) measure current
    (C) detect thermal radiation (D) measure pressure

138. Peltier coefficient at a junction of a thermocouple depends on

    (A) the current in the thermocouple
    (B) the time for which current flows
    (C) the temperature of the junction
    (D) the charge that passes through the thermocouple

139. The angle between the area vector $\vec{A}$ and the plane of the area A is

    (A) 0   (B) 2π

    (C) $\dfrac{\pi}{2}$ (D) π

140. In an a.c. circuit with an inductor

    (A) voltage lags current by $\dfrac{\pi}{2}$

    (B) voltage and current are in phase

    (C) voltage leads current by π

    (D) current lags voltage by $\dfrac{\pi}{2}$

141. The self-inductance of a straight conductor is

    (A) zero   (B) infinity

    (C) very large   (D) very small

142. The core used in audio frequency chokes is

    (A) iron   (B) carbon

    (C) lead   (D) steel

143. In a three phase a.c. generator the three coils are fastened rigidly together and are displaced from each other by an angle

    (A) 90°   (B) 180°

    (C) 120°   (D) 360°

144. If the wavelength of the light is reduced to half, then the amount of scattering will

    (A) increase by 16 times   (B) decrease by 16 times

    (C) increase by 256 times (D) decrease by 256 times

145. When a drop of water is introduced between the glass plate and plano convex lens in Newton's rings system, the rings system

    (A) contracts   (B) expands

    (C) remains same   (D) first expands then contracts

146. Electric filament lamp gives rise to

   (A) line spectrum   (B) continuous spectrum
   (C) band spectrum   (D) line absorption spectrum

147. The polarising angle for water is 53° 4′ If the light is incident at this angle on the surface of water, the angle of refraction in water is

   (A) 53° 4′   (B) 26° 30′
   (C) 30° 4′   (D) 36° 56′

148. Electromagnetic waves are

   (A) transverse
   (B) longitudinal
   (C) may be longitudinal or transverse
   (D) neither longitudinal nor transverse

149. If a and b are semi-major and semi-minor axes of the ellipse respectively and l is the orbital quantum number, then the expression to find the possible elliptical orbit is

   (A) $\dfrac{b}{a} = \dfrac{l+1}{n}$ (B) $\dfrac{b}{a} = \dfrac{l-1}{n}$

   (C) $\dfrac{a}{b} = \dfrac{l+1}{n}$ (D) $\dfrac{a}{b} = \dfrac{l-1}{n}$

150. The first excitation potential energy or the minimum energy required to excite the atom from ground state of hydrogen atom is

   (A) 13.6 eV   (B) 10.2 eV
   (C) 3.4 eV   (D) 1.89 eV

151. Maser materials are

   (A) diamagnetic ions   (B) paramagnetic ions
   (C) ferromagnetic ions   (D) non-magnetic ions

152. The minimum wavelength of X-rays produced in an X-ray tube at 1000 kV is

   (A) 0.0124 Å   (B) 0.124 Å
   (C) 1.24 Å   (D) 0.00124 Å

153. At threshold frequency, the velocity of the photoelectrons is

   (A) maximum   (B) zero
   (C) minimum   (D) infinity

154. The work function of a metal is 3.3 eV. The threshold frequency is

   (A) 8×10^{14}Hz   (B) 8×10^{10}Hz
   (C) 5×10^{20}Hz   (D) 4×10^{14}Hz

155. The nuclear force is due to continuous exchange of the particle called

   (A) leptons   (B) hyperons
   (C) photons   (D) mesons

156. In the nuclear reaction $_{80}Hg^{198} + X \rightarrow _{79}Au^{198} + _{1}H^{1}$, X stands for

   (A) proton   (B) electron
   (C) neutron   (D) deuteron

157. Which of the following particle is lepton?

   (A) Proton   (B) Electron
   (C) Neutron   (D) π – meson

158. The penetrating power is maximum for

   (A) protons   (B) alpha particles
   (C) gamma rays   (D) beta particles

159. The half-life period of a certain radioactive element with disintegration constant 0.0693 per day is

    (A) 10 days   (B) 14 days
    (C) 140 days   (D) 1.4 days

160. The mean life of radon is 5.5 days. Its half-life is

    (A) 8 days   (B) 2.8 days
    (C) 0.38 days   (D) 3.8 days

161. The potential barrier of silicon *pn* junction diode is approximately

    (A) 0.3 V   (B) 0.7 V
    (C) 1.1 V   (D) 10 V

162. In amplitude modulation, the bandwidth is

    (A) equal to the signal frequency
    (B) twice the signal frequency
    (C) thrice the signal frequency
    (D) four times the signal frequency

163. Avalanche breakdown is primarily dependent on the phenomenon of

    (A) collision   (B) ionisation
    (C) doping   (D) recombination

164. Two plane mirrors are mutually perpendicular. The maximum number of images which can be formed is

    (A) 7   (B) 3
    (C) 6   (D) 9

165. A lens is half covered with paint. Then

    (A) intensity becomes half   (B) image becomes half
    (C) image will not be formed   (D) intensity will become 25%

166. A prism has refracting angle 60° It produces a minimum deviation of 30° The angle of incidence is

   (A) 60°   (B) 35°
   (C) 45°   (D) 15°

167. Which of the following is not the case with the image formed by a convex mirror?

   (A) It lies beyond the focus   (B) It is erect
   (C) It is diminished   (D) It is virtual

168. Diffraction pattern cannot be observed with

   (A) one narrow slit
   (B) two narrow slits
   (C) large number of narrow slits
   (D) one wide slit

169. The device which produces highly coherent sources is

   (A) Lloyd's mirror   (B) Laser
   (C) Fresnel's Bi prism   (D) Young's double slit

170. What is the time taken by the sunlight to pass through a window of thickness of 4mm whose refractive index is 1.5?

   (A) 2×10^{-8} s   (B) 2×10^{8} s
   (C) 2×10^{-11} s   (D) 2×10^{11} s

171. When light travels from one medium to another, which are separated by a sharp boundary, the characteristic which does not change is

   (A) velocity   (B) wavelength
   (C) frequency   (D) amplitude

172. Signal from a remote control to the device operated by it travels with the speed of

    (A) sound   (B) light
    (C) ultrasonic   (D) supersonic

173. Which of the following cannot be polarised?

    (A) Radio waves   (B) Ultrasonic waves
    (C) Infra-red rays   (D) X-rays

174. In a cathode ray tube the potential difference between electrodes is 2000V The velocity of the electrons reaching the screen is

    (A) 2×10^3 ms^{-1} (B) 4×10^4 ms^{-1}
    (C) 2.13×10^4 ms^{-1} (D) 2.67×10^7 ms^{-1}

175. In a cathode ray oscillograph, the focusing of beam on the screen is achieved by

    (A) magnetic field   (B) electric potential
    (C) concave lenses   (D) All of the above

176. The penetrating power of X-rays increases with

    (A) increase in its frequency   (B) increase in its velocity
    (C) decrease in its velocity   (D) increase in its intensity

177. *n* type semiconductor is formed

    (A) when a Ge crystal is doped with an impurity containing three valence electrons
    (B) when a Ge crystal is doped with an impurity containing five valence electrons
    (C) from pure Ge crystal
    (D) from pure Si crystal

178. How many electrons are there in the M shell?

   (A) 8   (B) 18
   (C) 32   (D) 2

179. A nucleus gains energy before fission because

   (A) of bombardment of neutrons
   (B) of thermal energy
   (C) of self-internal energy
   (D) energy is provided externally

180. An ideal choke (used along with fluorescent tube) would be a

   (A) pure resistor
   (B) pure capacitor
   (C) pure inductor
   (D) combination of an inductor and a capacitor

181. An electromagnetic wave goes from air to a glass. Which of the following does not change?

   (A) Wavelength   (B) Speed
   (C) Frequency   (D) Amplitude

182. Path of an electron in a uniform magnetic field may be

   (A) circular but not helical   (B) helical but not circular
   (C) neither helical nor circular   (D) either helical or circular

183. A current carrying coil suspended freely in a uniform magnetic field will be in stable equilibrium, if the angle between its magnetic dipole moment vector and the magnetic field is

   (A) $180°$ (B) $0°$
   (C) $45°$ (D) $90°$

184. A fuse wire is a wire of

(A) low resistance and high melting point
(B) high resistance and high melting point
(C) high resistance and low melting point
(D) low resistance and low melting point

185. In which medium the sound travels faster?

(A) Steel   (B) Water
(C) Air   (D) Vacuum

186. If the metal bob of a simple pendulum is replaced by a wooden bob of same dimension, then its time period will

(A) increase
(B) decrease
(C) remain the same
(D) first increase and then decrease

187. A pendulum clock keeps correct time at 30^0 latitude. If it is taken at poles,

(A) it keeps correct time   (B) it gains time
(C) it loses time   (D) None of the above

188. Maximum density of H_2O is at temperature

(A) 0^0C (B) 4^0C
(C) 5.5^0C (D) -15.5^0C

189. The velocity of sound in any gas depends upon

(A) wavelength of sound only
(B) density and elasticity of gas
(C) intensity of sound waves only
(D) amplitude and frequency of sound

190.   The colour of a distant star in the sky is an indication of its

(A)   size   (B)   temperature
(C)   distance   (D)   frequency

191.   Gravitational mass is proportional to gravitational

(A)   field   (B)   force
(C)   intensity   (D)   All of the above

192.   A truck and a car are moving with equal velocity. On applying the brakes both will stop after a certain distance. Then the

(A)   truck will cover less distance before rest
(B)   car will cover less distance before rest
(C)   both will cover equal distance
(D)   None of the above

193.   The thermocouple emf is $25\mu V/°C$ at room temperature. A galvanometer of 40Ω capable of detecting current as low as $10^{-5}A$ is connected with the thermocouple. The smallest temperature difference that can be detected by the system is

(A) $12°C$ (B) $8°C$
(C) $20°C$ (D) $16°C$

194.   The compass needle in the northern hemisphere shows

(A)   north pole dip downwards   (B)   needle straight
(C)   south pole dip downwards   (D)   None of the above

195.   At what frequency, 1Henry inductance offers same impedance as $1\mu F$ capacitor?

(A)   460 Hz   (B)   1 kHz
(C)   512 Hz   (D)   159 Hz

196. Reverse bias applied to a junction diode

    (A) increases the minority carrier current
    (B) lowers the potential barrier
    (C) raises the potential barrier
    (D) increases the majority carrier current

197. A Schotlky diode is a

    (A) homo *pn* junction
    (B) hetero *pn* junction
    (C) metal-semiconductor contact
    (D) metal insulator contact

198. A hole in a p type semiconductor is

    (A) a missing atom   (B) a donor level
    (C) an excess electron   (D) a missing electron

199. Platinum and silicon are heated upto 250°C and after that cooled. In the process of cooling

    (A) resistance of platinum will increase and that of silicon will decrease
    (B) resistance of silicon will increase and that of platinum will decrease
    (C) resistance of both will decrease
    (D) resistance of both will increase

200. To demonstrate the phenomenon of interference we require two sources that emit radiation

    (A) of same frequency
    (B) of different wavelength
    (C) of the same frequency and having definite phase relationship
    (D) of nearly the same frequency

CHEMISTRY

201. Benzylamine upon reaction with $KMnO_4$ furnishes

    (A) benzoic acid   (B) benzaldehyde
    (C) toluene   (D) salicylaldehyde

202. Nitration of aniline in presence of conc. nitric acid and conc. sulphuric acid gives

    (A) o-nitroaniline   (B) m-nitroaniline
    (C) p-nitroaniline   (D) a mixture of (A) and (B)

203. Gatterman reaction is used to prepare

    (A) chlorobenzene   (B) bromobenzene
    (C) fluorobenzene   (D) Both (A) and (B)

204. Hydrogenation of benzoyl chloride in the presence of Pd on $BaSO_4$ gives

    (A) phenol   (B) benzaldehyde
    (C) benzyl alcohol   (D) benzoic acid

205. α-Bromopropionic acid upon reaction with aqueous silver bromide gives

    (A) acetic acid   (B) lactic acid
    (C) propionic acid   (D) tartaric acid

206. The strongest base among the following is

    (A) aniline   (B) p-nitroaniline
    (C) p-chloroaniline   (D) benzylamine

207 When $KMnO_4$ is reduced with oxalic acid in acid medium, the oxidation number of Mn changes from

    (A) + 7 to + 4   (B) + 6 to + 4
    (C) + 4 to + 2   (D) + 7 to + 2

208.   Which of the following metals is protected by a layer of its own oxide?

    (A) Al   (B) Ag
    (C) Au   (D) Fe

209.   Separation of lanthanides is based on

    (A) steam distillation   (B) fractional crystalisation
    (C) sublimation   (D) fractional distillation

210.   Which of the following is the most stable trihalide?

    (A) NCl_3 (B) NBr_3
    (C) NF_3 (D) NI_3

211.   Which of the following is a cationic complex?

    (A) $[Cu(NH_3)_4]Cl_2$ (B) $K_2[NiCl_4]$
    (C) $K_3[Fe(CN)_6]$ (D) $K_4[Fe(CN)_6]$

212.   Chlorophyll is a complex of porphyrin with

    (A) manganese   (B) iron
    (C) calcium   (D) magnesium

213.   What is the geometry of $[Cu(NH_3)_4]^{2+}$ complex ion?

    (A) tetrahedral   (B) square planar
    (C) pyramidal   (D) linear

214.   Which of the following has the strongest hydrogen bond?

    (A) Water   (B) Hydrofluoric acid
    (C) Ammonia   (D) Hydrogen sulphide

215. Loss of a β-particle results in

    (A) increase of one proton only
    (B) decrease of one neutron only
    (C) increase of a proton and decrease of a neutron
    (D) None of the above

216. Ammonium hydroxide is a weak base as

    (A) ammonium ion is strongly acidic
    (B) it has low vapour pressure
    (C) it is fully dissociated
    (D) it is not fully ionised

217. The indicator used for the titration of oxalic acid and sodium hydroxide is

    (A) phenolphthalein   (B) methyl orange
    (C) methyl red   (D) phenol red

218. Which of the following compound would exhibit coordination isomerism?

    (A) $\left[Cr(en)_2\right]NO_2$ (B) $\left[Cr(H_2O)_6\right]Cl_3$

    (C) $\left[Cr(NH_3)_6\right]\left[CO(CN)_6\right]$ (D) None of the above

219. $K_4\left[Fe(CN)_6\right]$ is called

    (A) Prussian blue
    (B) potassium ferricyanide
    (C) potassium hexacyanoferrate(II)
    (D) potassium hexacyanoferrate(III)

220. Which of the following statements is incorrect?

    (A) In diborane there is no B-B bond

    (B) In Al_2Cl_6 there is no Al-Al bond

    (C) In hydrazine (N_2H_4), there is no N-N bond

    (D) In borazine $(B_3N_3H_6)$, there exists B-N links

221. CCl_4 is reluctant towards hydrolysis while $SiCl_4$ can be hydrolysed easily because

    (A) silicon is less electronegative
    (B) silicon chlorine bond is longer than C-Cl bonds
    (C) $SiCl_4$ is ionic, while CCl_4 is covalent
    (D) of the availability of d-orbitals for silicon

222. Which of the following is an intensive property?

    (A) Pressure   (B) Volume
    (C) Moles   (D) Temperature

223. When the temperature is increased, the surface tension of water

    (A) increases   (B) decreases
    (C) remains constant   (D) shows irregular variation

224. Which has the maximum number of atoms?

    (A) 24g of C   (B) 56g of Fe
    (C) 27g of Al   (D) 108g of Ag

225. In an electrochemical cell the flow of electron is from

    (A) cathode to anode in solution
    (B) anode to cathode through external supply
    (C) cathode to anode through external supply
    (D) anode to cathode through internal supply

232. For the study of distribution law the two solvents should

      (A) be miscible   (B) be volatile
      (C) be non-miscible   (D) react with each other

233. Water system has three phases – ice, liquid and vapour. The number of components in the system is

      (A) one   (B) two
      (C) three   (D) four

234. The decomposition of NH_4Cl is represented by the equation $NH_4Cl \rightarrow NH_3(g) + HCl(g)$. What will be the number of phases in this system?

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

235. In a series of reactions, which one is the rate determining step?

      (A) The simplest reaction   (B) The slowest reaction
      (C) The fastest reaction   (D) The equilibrium reaction

236. At which temperature does an aqueous solution of LiCl have the highest average kinetic energy?

      (A) 100°C   (B) 200°C
      (C) 273K   (D) 373K

237 A colloidal solution consists of

      (A) a dispersed phase
      (B) a dispersion medium
      (C) a dispersed phase in a dispersion medium
      (D) a dispersion medium in a dispersed phase

238. The precipitating power of Al^{+3}, Na^+, Ba^{+2} is in the order

(A) $Na^+ > Ba^{+2} > Al^{+3}$ (B) $Ba^{+2} > Na^+ > Al^{+3}$
(C) $Al^{+3} > Na^+ > Ba^{+2}$ (D) $Al^{+3} > Ba^{+2} > Na^+$

239. Which pair of reactants among the following will not give CH_3CH_2Cl?

(A) $CH_3CH_2OH + HCl$ (B) $CH_2 = CH_2 + HCl$
(C) $CH_3CH_2OH + SOCl_2$ (D) $CH_3CH_2OH + NaCl$

240. The equivalent weight of phosphoric acid (H_3PO_4) in the reaction,
$NaOH + H_3PO_4 \rightarrow NaH_2PO_4 + H_2O$ is

(A) 25   (B) 49
(C) 59   (D) 98

241. Phenol upon distillation with Zn dust gives

(A)   (B)

(C)   (D)

242. Reaction of which set of reactants will give diethyl ether?

(A) $CH_3CH_2I + NaOH$ (B) $CH_3CH_2I + Ag_2O$
(C) $CH_3CH_2I + MeOH$ (D) $CH_3CH_2I + H_2O$

243. Diethyl ether is an example for

(A) Lewis base   (B) Lewis acid
(C) electrophile   (D) amphoteric compound

244. Benzaldehyde upon reaction with KCN gives

    (A) $C_6H_5-CH(OH)-CH(OH)-C_6H_5$
    (B) $C_6H_5-CO-CO-C_6H_5$
    (C) $C_6H_5-CH=CH-C_6H_5$
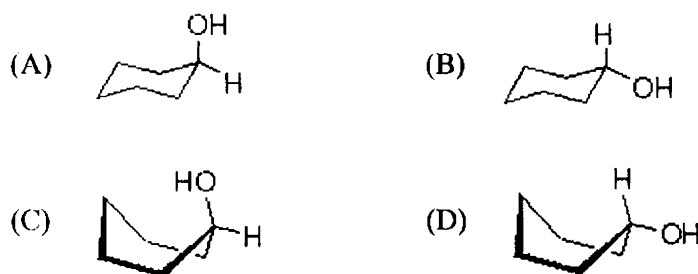   (D) $C_6H_5-CH(OH)-CO-C_6H_5$

245. The alcohol obtained by hydrolysis of oils and fats is

    (A) ethanol   (B) glycerol
    (C) glycol   (D) propanol

246. Glycerol when heated with $KHSO_4$ forms

    (A) $HO-CH_2-CH(OH)-CHO$ (B) $OHC-CHOH-CHO$
    (C) $CH_2=CHCHO$ (D) $HOCH_2OH-CO-CHO$

247. The more stable conformation of cyclohexanol is

    (A)   (B)

    (C)   (D)

248. Which of the following is a chiral molecule?

    (A) 2-pentanol   (B) isopropyl alcohol
    (C) bromocyclohexane   (D) 1-bromo-3-butene
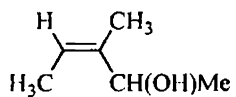
249. Provide the number of stereoisomers possible for the following structure

(A) 2   (B) 6
(C) 3   (D) 4

250. The compound with the highest boiling point is

(A) n-hexane   (B) ethanethiol
(C) ethanol   (D) propane

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226. A process which proceeds on its own accord, without any outside assistance is called

(A) spontaneous process
(B) non spontaneous process
(C) reversible process
(D) equilibrium process

227 When water is cooled to ice, then its entropy

(A) increases
(B) decreases
(C) remains the same
(D) becomes zero

228. How many molecules are present in 0.2gm of hydrogen?

(A) 6.023×10^{23}
(B) 6.023×10^{22}
(C) 3.0125×10^{23}
(D) 3.0125×10^{22}

229. Dichlorobenzene exists in three isomers-ortho, meta and para isomers. Out of these three isomers, one with highest dipole moment will be

(A) ortho-isomer
(B) meta-isomer
(C) para-isomer
(D) All will have the same dipole moment

230. A saturated solution of KCl on heating becomes

(A) unsaturated
(B) supersaturated
(C) hydrated
(D) None of the above

231. The freezing point of 2% aqueous solution of potassium nitrate is

(A) equal to $0^{\circ}C$
(B) higher than $0^{\circ}C$
(C) less than $0^{\circ}C$
(D) None of the above