

MHT CET 2024 Mathematics Memory Based Question Paper PDF

1. Suppose A is any 3×3 non-singular matrix and $(A - 3I)(A - 5I) = 0$ where $I = I_3$ and $O = O_3$. Here O_3 represent zero matrix of order 3 and I_3 is an identity matrix of order 3. If $\alpha A + \beta A^{-1} = 4I$, then $\alpha + \beta$ is equal to:
- (A) 13
(B) 7
(C) 12
(D) 8
2. The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if:
- (A) $k = 1$ or $k = -1$
(B) $k = 0$ or $k = -3$
(C) $k = 3$ or $k = -3$
(D) $k = 0$ or $k = 3$
3. The variance of first 50 even natural numbers is:
- (A) 833
(B) 473
(C) $\frac{437}{4}$
(D) $\frac{833}{4}$
4. The statement pattern $[p \wedge (q \vee r)] \vee [\sim r \wedge \sim q \wedge p]$ is equivalent to:
- (A) $q \vee r$
(B) $p \vee r$
(C) q
(D) p
5. If $8f(x) + 6f\left(\frac{1}{x}\right) = x + 5$ and $y = x^2 f(x)$, then $\frac{dy}{dx}$ at $x = -1$ is:
- (A) 14
(B) -14
(C) $\frac{1}{14}$

(D) $-\frac{1}{14}$

6. The number of ways in which 5 boys and 3 girls can be seated on a round table, if a particular boy B_1 and a particular girl G_1 never sit adjacent to each other, is:

- (A) $7!$
(B) $5 \times 6!$
(C) $6 \times 6!$
(D) $5 \times 7!$

7. The value of $\cot\left(\operatorname{cosec}^{-1}\frac{5}{3} + \tan^{-1}\frac{2}{3}\right)$ is:

- (A) $\frac{5}{17}$
(B) $\frac{6}{17}$
(C) $\frac{3}{17}$
(D) $\frac{4}{17}$

8. $\int\left(1+x-\frac{1}{x}\right)e^{x+\frac{1}{x}}dx$ is equal to:

- (A) $(x+1)e^{x+\frac{1}{x}}+c$
(B) $-xe^{x+\frac{1}{x}}+c$
(C) $(x-1)e^{x+\frac{1}{x}}+c$
(D) $xe^{x+\frac{1}{x}}+c$

9. The function $f(x) = \frac{\log_e(\pi+x)}{\log_e(e+x)}$ is:

- (A) increasing on $(0, \infty)$
(B) increasing on $(0, \pi/e)$, decreasing on $(\pi/e, \infty)$
(C) decreasing on $(0, \infty)$
(D) decreasing on $(0, \pi/e)$, increasing on $(\pi/e, \infty)$

10. Let $y = y(x)$ be the solution of the differential equation $\sin x \frac{dy}{dx} + y \cos x = 4x, x \in (0, \pi)$. If $y(\pi/2) = 0$, then $y(\pi/6)$ is equal to:

- (A) $-\frac{4}{9}\pi^2$
(B) $\frac{4}{9\sqrt{3}}\pi^2$
(C) $\frac{-8}{9\sqrt{3}}\pi^2$

(D) $-\frac{8}{9}\pi^2$

11. The value of $I = \int \frac{x^2}{(a+bx)^2} dx$ is:

(A) $\frac{1}{b^3} \left[a + bx + 2a \log |a + bx| - \frac{a^2}{a+bx} \right] + c$

(B) $\frac{1}{b^3} \left[a + bx - 2a \log |a + bx| + \frac{a^2}{a+bx} \right] + c$

(C) $\frac{1}{b^3} \left[a + bx - 2a \log |a + bx| - \frac{a^2}{a+bx} \right] + c$

(D) $\frac{1}{b^3} \left[a + bx + 2a \log |a + bx| + \frac{a^2}{a+bx} \right] + c$

12. Let $\vec{a} = \alpha\hat{i} + 3\hat{j} - \hat{k}$, $\vec{b} = 3\hat{i} - \beta\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + 2\hat{j} - 2\hat{k}$. If the projection of $\vec{a}$ on $\vec{c}$ is $10/3$ and $\vec{b} \times \vec{c} = -6\hat{i} + 10\hat{j} + 7\hat{k}$, then $2\alpha + \beta$ is:

(A) 3

(B) 4

(C) 5

(D) 6

13. If $4ab = 3h^2$, then the ratio of the slope of lines represented by $ax^2 + 2hxy + by^2 = 0$ is:

(A) $\sqrt{3} : 1$

(B) $1 : \sqrt{3}$

(C) $1 : 3$

(D) $3 : 1$

14. If $\sin(\cot^{-1}(x+1)) = \cos(\tan^{-1}x)$ then considering positive square roots, x has the value:

(A) 0

(B) $9/4$

(C) $1/2$

(D) $-1/2$

15. A random variable X has distribution: $P(X = x) = \{0, 2p, 2p, 3p, p^2, 2p^2, 7p^2, 2p\}$ for $x = 0 \dots 7$. The value of p is:

(A) $1/10$

(B) $1/30$

(C) $1/100$

- (D) $3/20$
16. If probability exactly one of A or B occurs is $2/5$ and A or B occurs is $1/2$, probability both occur is:
- (A) 0.1
(B) 0.2
(C) 0.01
(D) 0.02
17. Let $(-2 - \frac{i}{3})^3 = \frac{x+iy}{27}$, then $(y-x)$ has the value:
- (A) -91
(B) -85
(C) 85
(D) 91
18. The shaded region in the LPP satisfies the inequation system:
- (A) $x+2y \leq 6, 5x+3y \geq 15, x \leq 7, y \leq 6, y \geq 0$
(B) $x+2y \geq 6, 5x+3y \geq 15, x \leq 7, y \leq 6, y \geq 0$
(C) $x+2y \geq 6, 5x+3y \leq 15, x \leq 7, y \leq 6, y \geq 0$
(D) $x+2y \leq 6, 5x+3y \leq 15, x \leq 7, y \leq 6, y \geq 0$
19. Let $\vec{p}$ and $\vec{q}$ be position vectors of P and Q with $|\vec{p}| = p, |\vec{q}| = q$. R and S divide PQ internally and externally in ratio 2 : 3. If $OR \perp OS$, then:
- (A) $9p^2 = 4q^2$
(B) $4p^2 = 9q^2$
(C) $9p = 4q$
(D) $4p = 9q$
20. The value of 'a' for which the volume of parallelepiped formed by $\hat{i} + a\hat{j} + \hat{k}, \hat{j} + a\hat{k}$ and $a\hat{i} + \hat{k}$ is minimum is:
- (A) $-1/\sqrt{3}$
(B) $1/\sqrt{3}$
(C) $\sqrt{3}$
(D) $-\sqrt{3}$

21. The approximate value of $\log_{10} 1002$ is (Given $\log_{10} e = 0.4343$):
- (A) 3.0117
(B) 3.0009
(C) 2.9999
(D) 3.1119
22. The sum of intercepts on coordinate axes made by tangent to curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ is:
- (A) a
(B) 2a
(C) $2\sqrt{a}$
(D) $\sqrt{2a}$
23. If the angles of a triangle are in ratio 4:1:1, then the ratio of longest side to perimeter is:
- (A) 1 : 6
(B) $\sqrt{3} : (2 + \sqrt{3})$
(C) $1 : (2 + \sqrt{3})$
(D) 2 : 3
24. Considering Principal values, set $A = \{x \geq 0 \mid \tan^{-1}(2x) + \tan^{-1}(3x) = \pi/4\}$:
- (A) contains two elements
(B) contains more than two elements
(C) is an empty set
(D) is a singleton set
25. The line L given by $x/c + y/3 = 1$ passes through (13, 32). The line K is parallel to L and is $x/c + y/3 = 1$. The distance between L and K is _____ units.
- (A) 23/15
(B) $\sqrt{17}$
(C) $17/\sqrt{15}$
(D) $23/\sqrt{17}$
26. The integral $\int_{-1/2}^{1/2} ([x] + \log_e \frac{1+x}{1-x}) dx$ equals:
- (A) -1/2

- (B) $\log_e(1/2)$
(C) $1/2$
(D) $2\log_e(1/2)$
27. If $f(x) = x^3 + e^{x/2}$ and $g(x) = f^{-1}(x)$, then $g'(1)$ is:
(A) 1
(B) 0
(C) 2
(D) $1/2$
28. A wire of length 2 units is cut into two parts, bent to form a square of side x and circle of radius r . If the sum of areas is minimum, then:
(A) $2x = (\pi + 4)r$
(B) $(4 - \pi)x = \pi r$
(C) $x = 2r$
(D) $2x = r$
29. Let $L_1 : \frac{x+1}{3} = \frac{y+2}{1} = \frac{z+1}{2}$ and $L_2 : \frac{x-2}{1} = \frac{y+2}{2} = \frac{z-3}{3}$ be lines. The unit vector perpendicular to L_1 and L_2 is:
(A) $\frac{-\hat{i}+7\hat{j}+7\hat{k}}{\sqrt{99}}$
(B) $\frac{-\hat{i}-7\hat{j}+5\hat{k}}{5\sqrt{3}}$
(C) $\frac{-\hat{i}+7\hat{j}+5\hat{k}}{5\sqrt{3}}$
(D) $\frac{7\hat{i}-7\hat{j}-7\hat{k}}{\sqrt{99}}$
30. Let $a, b \in \mathbb{R}$. If mirror image of $P(a, 6, 9)$ w.r.t line $\frac{x-3}{7} = \frac{y-2}{5} = \frac{z-1}{-9}$ is $(20, b, -a-9)$, then $|a+b|$ equals:
(A) 88
(B) 86
(C) 90
(D) 84
31. A random variable X has $P(X) : k^2, 2k, k, 2k, 5k^2$ for $X = 1 \dots 5$. Then $P(X > 2)$ is:
(A) $7/12$

- (B) $23/36$
(C) $1/36$
(D) $1/6$
32. The number of distinct real values of λ for which vectors $-\lambda^2\hat{i} + \hat{j} + \hat{k}, \hat{i} - \lambda^2\hat{j} + \hat{k}, \hat{i} + \hat{j} - \lambda^2\hat{k}$ are coplanar is:
(A) zero
(B) one
(C) two
(D) three
33. If $f(x) = \log_e\left(\frac{1-x}{1+x}\right), |x| < 1$, then $f\left(\frac{2x}{1+x^2}\right)$ is:
(A) $2f(x^2)$
(B) $-2f(x)$
(C) $(f(x))^2$
(D) $2f(x)$
34. Let $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ such that $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = \vec{0}$. Let P_1, P_2 be planes determined by pairs $(\vec{a}, \vec{b})$ and $(\vec{c}, \vec{d})$. The angle between P_1 and P_2 is:
(A) 0
(B) $\pi/4$
(C) $\pi/3$
(D) $\pi/2$
35. If $I = \int e^{\sin \theta} (\log \sin \theta + \operatorname{cosec}^2 \theta) \cos \theta d\theta$, then I equals:
(A) $e^{\sin \theta} (\log \sin \theta + \operatorname{cosec}^2 \theta) + c$
(B) $e^{\sin \theta} (\log \sin \theta - \operatorname{cosec} \theta) + c$
(C) $e^{\sin \theta} (\log \sin \theta - \operatorname{cosec} \theta) + c$
(D) $e^{\sin \theta} (\log \sin \theta - \operatorname{cosec}^2 \theta) + c$
36. The equation of circle with centre (3, 4) touching line $5x + 12y - 11 = 0$ is:
(A) $x^2 + y^2 - 6x - 8y + 9 = 0$
(B) $x^2 + y^2 - 6x - 8y + 25 = 0$
(C) $x^2 + y^2 - 6x - 8y - 9 = 0$

- (D) $x^2 + y^2 - 6x - 8y - 25 = 0$
37. A plane perpendicular to planes $2x - 2y + z = 0$ and $x - y + 2z = 4$ passes through $(1, -2, 1)$. The distance from $(1, 2, 2)$ is:
- (A) 0 units
(B) 1 units
(C) $\sqrt{2}$ units
(D) $2\sqrt{2}$ units
38. Value of $\sqrt{3}\operatorname{cosec} 20^\circ - \sec 20^\circ$ is:
- (A) 2
(B) $\frac{2\sin 20^\circ}{\sin 40^\circ}$
(C) 4
(D) $\frac{4\sin 20^\circ}{\sin 40^\circ}$
39. Let $\vec{a}, \vec{b}, \vec{c}$ have magnitudes 1, 1, 2. If $\vec{a} \times (\vec{a} \times \vec{c}) + \vec{b} = \vec{0}$, angle between $\vec{a}$ and $\vec{c}$ is:
- (A) $\pi/6$
(B) $\pi/4$
(C) $\pi/3$
(D) $\pi/2$
40. Area bounded by $y = ax^2$ and $x = ay^2$ ($a > 0$) is 1 sq. unit. Value of a is:
- (A) $1/\sqrt{3}$
(B) $1/2$
(C) 1
(D) $1/3$
41. $\int \sec^3 x \operatorname{cosec}^3 x dx$ equals:
- (A) $3(\tan x - \cot x) + c$
(B) $\frac{1}{3}(\tan x - \cot x)^3 + c$
(C) $-3(\cot x)^3 + c$
(D) $\frac{1}{3}(\tan x - \cot x) + c$
42. If sum of two numbers is 3, maximum value of product of first and square of second is:

- (A) 6
(B) 4
(C) 5
(D) 3
43. If slope of tangent to $y = y(x)$ at (x, y) is $2y/x^2$. If curve passes through centre of $x^2 + y^2 - 2x - 2y = 0$, its equation is:
- (A) $x \log |y| = x - 1$
(B) $x \log |y| = -2(x - 1)$
(C) $x \log |y| = 2(x - 1)$
(D) $x^2 \log |y| = -2(x - 1)$
44. If $y = ((x+1)(4x+1)(9x+1) \dots (n^2x+1))^{1/2}$, then dy/dx at $x = 0$ is:
- (A) $\frac{n(n+1)(2n+1)}{4}$
(B) $\frac{n(n+1)(2n+1)}{6}$
(C) $\frac{n(n+1)(2n+1)}{2}$
(D) $\frac{n(n+1)(2n+1)}{3}$
45. A 5-question MCQ has 3 options each. Prob of getting 4 or more correct by guessing:
- (A) $10/3^5$
(B) $17/3^5$
(C) $13/3^5$
(D) $11/3^5$
46. Wet substance loses moisture at rate proportional to content. If it loses half in 1st hour, 99% is lost in:
- (A) $\frac{2 \log 10}{\log 2}$
(B) $\frac{\log 10}{\log 2}$
(C) $\frac{3 \log 10}{\log 2}$
(D) $\frac{1 \log 10}{2 \log 2}$
47. $\lim_{x \rightarrow 0} \frac{(1 - \cos 2x)(3 + \cos x)}{x \tan 4x}$ is:

- (A) 2
(B) $1/2$
(C) 4
(D) 3
48. If $f(x) = \{2x^2/a, a, (2b^2 - 4b)/x\}$ for intervals $(0, 1), [1, \sqrt{2}], (\sqrt{2}, \infty)$ is continuous on $[0, \infty)$, (a, b) is:
(A) $(-\sqrt{2}, 1 - \sqrt{3})$
(B) $(\sqrt{2}, -1 + \sqrt{3})$
(C) $(\sqrt{2}, 1 - \sqrt{3})$
(D) $(-\sqrt{2}, 1 + \sqrt{3})$
49. If $(p \wedge \sim q) \wedge (p \wedge r) \rightarrow \sim p \vee q$ is false, truth values of p, q, r :
(A) T, T, T
(B) F, F, F
(C) T, F, T
(D) T, T, F
50. In $\triangle ABC$, $b = 3, c = 8, A = 60^\circ$. Circumradius is:
(A) $7/3$
(B) $7\sqrt{2}/3$
(C) $7/\sqrt{3}$
(D) $7\sqrt{3}/2$
51. Calculate wave length for emission of a photon having wave number 11516 cm^{-1} .
(A) 216 nm
(B) 434 nm
(C) 868 nm
(D) 642 nm
52. Half life of a first order reaction is 1 hour. What fraction will remain after 3 hour?
(A) $1/8$
(B) $1/9$

- (C) $1/16$
(D) $1/64$
- 53.** Identify the product: $\text{Phenol} + \text{CrO}_3 \rightarrow \dots$
- (A) Benzene
(B) Benzoic acid
(C) Benzaldehyde
(D) p-Benzoquinone
- 54.** Calculate VP of solution: 2 mol A + 3 mol B ($P_A^\circ = 420, P_B^\circ = 610$).
- (A) 600 mm Hg
(B) 570 mm Hg
(C) 534 mm Hg
(D) 480 mm Hg
- 55.** Which about neoprene is false?
- (A) Copolymer
(B) Synthetic rubber
(C) Gasoline pipes
(D) Preparation monomer is unsaturated
- 56.** Identify neutral sphere complex:
- (A) Pentaamminecobalt(III) sulphate
(B) Potassiumtrioxalatoaluminate(III)
(C) Diamminedichloroplatinum(II)
(D) Potassiumhexacyanoferrate(III)
- 57.** Correct about saccharic acid?
- (A) 2 COOH, 4 OH
(B) 1 COOH, 5 OH
(C) 2 COOH, 5 OH
(D) 3 COOH, 2 OH
- 58.** Identify ferromagnetic substance:

- (A) NaCl
- (B) C_6H_6
- (C) CrO_2
- (D) H_2O

59. Synthesis of adipic acid using enzymes (Drath and Frost) uses:

- (A) Ribose
- (B) Glucose
- (C) Ribulose
- (D) Benzene

60. Which pair exhibits metamerism?

- (A) But-2-ene and but-1-ene
- (B) Methoxymethane and Ethanol
- (C) Ethoxyethane and Methoxypropane
- (D) Butane and 2-Methylpropane

61. Zinc mineral:

- (A) Siderite
- (B) Calamine
- (C) Chalcocite
- (D) Limonite

62. Lowest ionization enthalpy:

- (A) Po
- (B) Te
- (C) Br
- (D) Kr

63. Molar mass (density 8.6, bcc, $a = 22 \times 10^{-24}$):

- (A) 106.18
- (B) 94.6
- (C) 88.25

(D) 80.16

64. Basic buffer:

(A) $\text{NH}_4\text{OH} + \text{NH}_4\text{Cl}$

(B) $\text{C}_6\text{H}_5\text{COOH} + \text{C}_6\text{H}_5\text{COONa}$

(C) $\text{HCOOH} + \text{HCOOK}$

(D) $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$

65. No lone pair on central atom:

(A) NH_3

(B) H_2O

(C) SO_2

(D) BF_3

66. Molar mass (1g in 100g solvent, $\Delta T_f = 0.2$, $K_f = 1.2$):

(A) 55

(B) 60

(C) 65

(D) 70

67. NOT true for lyophilic colloids?

(A) High affinity

(B) Reversible

(C) Self stabilized

(D) Coagulation by adding small electrolyte

68. pH of buffer (0.35M acid, 0.70M salt, $pK_a = 4.56$):

(A) 6.11

(B) 3.72

(C) 4.86

(D) 5.65

69. NOT cis-trans isomerism?

(A) But-1-ene

- (B) But-2-ene
- (C) 3,4-Dimethylhex-3-ene
- (D) Pent-2-ene

70. Reaction at cathode during lead accumulator discharge:

- (A) $\text{PbSO}_4 + 2e \rightarrow \dots$
- (B) $\text{Pb} + \text{SO}_4 \rightarrow \dots$
- (C) $\text{PbO}_2 + \text{H} \rightarrow \dots$
- (D) $\text{PbSO}_4 + \text{H}_2\text{O} \rightarrow \dots$

71. Product of ethers in conc H_2SO_4 :

- (A) Alkanols
- (B) Alkanoic acids
- (C) Alkyl hydrogen sulphate
- (D) Oxonium salts

72. Chiral molecule:

- (A) 2-Iodopropane
- (B) 2-Iodo-2-methylbutane
- (C) 2-Iodo-3-methylbutane
- (D) 3-Iodopentane

73. Iodine highest oxidation number:

- (A) KIO_3
- (B) KI
- (C) IF_5
- (D) KIO_4

74. Secondary amine isomers of $\text{C}_4\text{H}_{11}\text{N}$:

- (A) One
- (B) Two
- (C) Three
- (D) Four

75. Reactivity C-Cl bond cleavage order:

- (A) I < II < III
- (B) II < III < I
- (C) III < I < II
- (D) III < II < I

76. Which is Stephen reaction?

- (A) $\text{R-COCl} \rightarrow \text{CHO}$
- (B) $\text{R-CN} \rightarrow \text{CHO}$
- (C) $\text{R-CHO} \rightarrow \text{CH}_3$
- (D) $\text{R-CHO} \rightarrow \text{CH}_2\text{OH}$

77. Nitrogen isotopes:

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

78. Alkali metal in liquid ammonia colour:

- (A) Dark red
- (B) Violet
- (C) Deep blue
- (D) Green

79. IUPAC name of Acrylic acid:

- (A) Propanoic acid
- (B) Prop-2-enoic acid
- (C) 2-Methylpropanoic acid
- (D) 2-Hydroxypropanoic acid

80. Correct regarding isobars?

- (A) Same neutrons
- (B) Different elements

- (C) Same atomic number
- (D) Different mass number

81. Gas volume (1.25 atm, 25 mL at 1 atm):

- (A) 15 mL
- (B) 20 mL
- (C) 25 mL
- (D) 35 mL

82. Arrhenius plot $\log k$ vs $1/T$ intercept:

- (A) $\log_{10} A$
- (B) $-E_a/R$
- (C) $\ln k$
- (D) R/E_a

83. Positive silver mirror test:

- (A) Ethanol
- (B) Ethanal
- (C) Ethoxy ethane
- (D) Ethanoic acid

84. NOT addition polymerization?

- (A) Polyethylene
- (B) Polyacrylonitrile
- (C) Nylon-6
- (D) PVC

85. Constant volume heat symbol:

- (A) ΔH
- (B) dq
- (C) ΔS
- (D) ΔU

86. $3I^- + S_2O_8^{2-} \rightarrow 2SO_4^{2-} + I_3^-$. Rate of SO_4 formation is 0.044. Consumption of I^- :

- (A) 0.022
- (B) 0.044
- (C) 0.066
- (D) 0.088

87. Two donor atoms but uses only one (Ligand):

- (A) Aqua
- (B) Ethylenediamine
- (C) Sulphato
- (D) Nitrito

88. Max elevation in BP:

- (A) 0.1M KCl
- (B) 0.05M NaCl
- (C) 0.1M BaCl₂
- (D) 0.1M MgSO₄

89. Entropy change melting 1g ice at 0°C ($L_f = 80 \text{ J/K}$):

- (A) 0.039
- (B) 0.293
- (C) 8.0
- (D) 27.3

90. Half filled d-orbital configuration:

- (A) Cu and Mn
- (B) Mn and Cr
- (C) Zn and Co
- (D) Cu and Zn

91. Radius of metal bcc ($a = 530 \text{ pm}$):

- (A) 229.5
- (B) 187.4
- (C) 459.0

- (D) 265.2
92. Concentration of weak acid ($K_a = 5 \times 10^{-4}$, Dissoc = 5×10^{-9}):
- (A) 0.1 M
(B) 0.02 M
(C) 0.03 M
(D) 0.04 M
93. Secondary allylic alcohol:
- (A) $\text{CH}_2 = \text{CH}-\text{CH}_2-\text{OH}$
(B) $\text{CH}_2 = \text{CH}-\text{CH}(\text{OH})-\text{CH}_3$
(C) $\text{CH}_2 = \text{CH}-\text{C}(\text{OH})(\text{CH}_3)_2$
(D) $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_2-\text{OH}$
94. Correct set: 1 mole gas heated constant volume, supplying 500 J:
- (A) $q = w = 500, \Delta U = 0$
(B) $q = \Delta U = 500, w = 0$
(C) $q = \Delta U = -500, w = 0$
(D) $q = 500, \Delta U = w = 0$
95. Conductivity 0.005M NaI (6.07×10^{-4}):
- (A) 121.4
(B) 110.1
(C) 201.1
(D) 241.4
96. Decreasing BP order:
- (A) $\text{CH}_3\text{Cl} > \text{CH}_3\text{Br} > \text{CH}_2\text{Br}_2 > \text{CHBr}_3$
(B) $\text{CHBr}_3 > \text{CH}_2\text{Br}_2 > \text{CH}_3\text{Br} > \text{CH}_3\text{Cl}$
(C) $\text{CHBr}_3 > \text{CH}_3\text{Br} > \text{CH}_3\text{Cl} > \text{CH}_2\text{Br}_2$
(D) $\text{CH}_3\text{Br} > \text{CH}_3\text{Cl} > \text{CHBr}_3 > \text{CH}_2\text{Br}_2$
97. Electronegativity oxygen:
- (A) 4.0

- (B) 3.5
- (C) 2.48
- (D) 3.2

98. IUPAC of Ethylmethyloisopropylamine:

- (A) N-Methyl-N-isopropylethanamine
- (B) N-Ethyl-N-methylpropan-1-amine
- (C) N-Ethyl-N-methylpropan-2-amine
- (D) N-Ethyl-N-isopropylmethanamine

99. Charge to convert $0.08 \text{ mol } \text{MnO}_4^-$ to Mn^{2+} :

- (A) 96500 C
- (B) 38600 C
- (C) 48250 C
- (D) 19300 C

100. Symbol for Aspartic acid:

- (A) D
- (B) R
- (C) A
- (D) S

101. Specific heat diatomic gas vibrational mode:

- (A) $9/2 R$
- (B) $5/2 R$
- (C) $3/2 R$
- (D) $7/2 R$

102. Capacitor dielectrics (9 pF , $K_1 = 3$, $d_1 = d/3$, $K_2 = 6$, $d_2 = 2d/3$):

- (A) 3.8 pF
- (B) 20.25 pF
- (C) 40.5 pF
- (D) 45 pF

103. Transistor base current ($R_c = 600, V_c = 0.6, \beta = 20$):

- (A) 0.25 mA
- (B) 0.05 mA
- (C) 0.12 mA
- (D) 0.02 mA

104. SHM velocity $4V^2 = 50 - x^2, T = x/7$. Value of x ($\pi = 22/7$):

- (A) 22
- (B) 44
- (C) 66
- (D) 88

105. Projectile max height = range. Angle:

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

106. Circuit correct option current (A vs B):

- (A) i_a never greater than i_b
- (B) i_a always equal to i_b
- (C) i_b can be greater than i_a
- (D) resonance current $i_b < i_a$

107. MI disc vs ring about diameter to tangent:

- (A) 1:2
- (B) 1:4
- (C) 1:6
- (D) 1:8

108. Beats per second $Y_1 = 0.25 \sin 316t, Y_2 = 0.25 \sin 310t$:

- (A) $\pi/3$
- (B) $3/\pi$

- (C) $2/\pi$
- (D) $\pi/2$

109. Meter bridge shunt $X\Omega$ added to 3Ω resistor:

- (A) 1Ω
- (B) 2Ω
- (C) 3Ω
- (D) 4Ω

110. Capillary rise surface vs mine depth d . Y/X :

- (A) $(1 - d/R)^{-1}$
- (B) $(1 - d/R)$
- (C) $(1 + d/R)^{-1}$
- (D) $(1 + d/R)$

111. Equilateral prism angle of deviation if incident 50° :

- (A) 50°
- (B) 40°
- (C) 25°
- (D) 20°

112. Rotating body freq doubled, energy halved. Angular momentum:

- (A) $L/4$
- (B) $L/2$
- (C) $2L$
- (D) $4L$

113. Wave velocity (phase diff 60° at 0.6 m , 500 Hz):

- (A) 1.8 km/s
- (B) 9 km/s
- (C) 3.6 km/s
- (D) 2.7 km/s

114. Magnetic flux loop pulling (25 cm^2 , 10Ω , 40 T , 1 s):

- (A) $2.5 \times 10^{-3} \text{ J}$
- (B) $1.0 \times 10^{-3} \text{ J}$
- (C) $1.0 \times 10^{-4} \text{ J}$
- (D) $5 \times 10^{-3} \text{ J}$

115. Potential at center of two concentric half rings:

- (A) $2\lambda/\epsilon_0$
- (B) $\lambda/2\epsilon_0$
- (C) $\lambda/4\epsilon_0$
- (D) λ/ϵ_0

116. Person in inertial frame:

- (A) Pilot taking off
- (B) Merry-go-round child
- (C) Constant velocity bus driver
- (D) Slowing train man

117. Mass of charged particle semicircle:

- (A) $q^2 B^2 / 2V$
- (B) $r^2 q B^2 / 2V$
- (C) $qrB/2V$
- (D) $q^2 r^2 B^2 / V$

118. SHM pendulum length $l_1 - l_2$ time period:

- (A) $T_1 - T_2$
- (B) $\sqrt{T_1/T_2}$
- (C) $\sqrt{T_1^2 - T_2^2}$
- (D) T_2/T_1

119. Zener diode current ($V_z = 15, V_{in} = 20, R_s = 250, R_L = 1k$):

- (A) 20 mA
- (B) 5 mA
- (C) 10 mA

(D) 15 mA

120. Density of Earth formula:

(A) $4\pi G/3gR$

(B) $3\pi R/4gG$

(C) $3g/4\pi RG$

(D) $\pi RG/12g$

121. LCR impedance as freq increases:

(A) increases

(B) decreases

(C) either

(D) decreases then increases

122. Potentiometer resistance (1m, 495Ω, 2V, 0.2 mV/cm):

(A) 8 Ω

(B) 7 Ω

(C) 6 Ω

(D) 5 Ω

123. Carnot engine temperature for same exhaust (sink):

(A) 1800 K

(B) 1200 K

(C) 900 K

(D) 600 K

124. Compound microscope Resolve power increase:

(A) increase wavelength

(B) increase refractive index

(C) decrease focal eye

(D) decrease objective diameter

125. Two rods heat transfer series vs parallel time:

(A) 24 s

- (B) 3 s
- (C) 1.5 s
- (D) 48 s

126. Self inductance graph D smallest:

- (A) A
- (B) B
- (C) C
- (D) D

127. Monatomic gas expansion velocity V . Change in temp:

- (A) $mV^2/5R$
- (B) $mV^2/3R$
- (C) $mV^2/7R$
- (D) $mV^2/9R$

128. Refraction time glass (5 cm, $n = 1.6$):

- (A) 5 cm
- (B) 8 cm
- (C) 12 cm
- (D) 24 cm

129. Magnetic moments circular coils ratio ($r_a = 10, r_b = 20$):

- (A) $2N_a I_a = N_b I_b$
- (B) $N_a = 2N_b$
- (C) $N_a I_a = 4N_b I_b$
- (D) $4N_a I_a = N_b I_b$

130. Telescope length ($f_o = 1.5, f_e = 1.56$ m total):

- (A) 0.06 m
- (B) 1.04 m
- (C) 2.34 m
- (D) 3.06 m

131. Tank surface area $750 \text{ cm}^2, 500 \text{ mm}^2, 30 \text{ cm/s}$. x :

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

132. String A overtone fundamental as B:

- (A) first
- (B) second
- (C) third
- (D) fourth

133. Resonant circuit $2\mu\text{H}, 5 \text{ kHz}$. Capacitance for max current:

- (A) 500
- (B) 1000
- (C) 2000
- (D) 4000

134. Polaroid intensity through P_3 (60, 90):

- (A) $I_0/8$
- (B) $3I_0/16$
- (C) $3I_0/32$
- (D) $I_0/32$

135. Device X current drop to zero:

- (A) Zener
- (B) p-n junction
- (C) Intrinsic
- (D) Extrinsic

136. Solid cylinder vs sphere rotating freq half. KE ratio:

- (A) 1:4
- (B) 1:5

- (C) 2:3
- (D) 3:2

137. Resistance coil R power dissipation:

- (A) $N^2 A^2 B^2 \omega^2 / 2R$
- (B) $BNA\omega/R$
- (C) $N^2 AB / 2R\omega^2$
- (D) $BA\omega / 2NR$

138. Soap bubble excess pressure ratio. Mass ratio:

- (A) 1:4
- (B) 1:8
- (C) 1:16
- (D) 1:64

139. Parallel plate capacitor capacitance (40 cm^2 , 2 mm, dielectric 1 mm, $K = 5$):

- (A) $24\epsilon_0 F$
- (B) $\frac{3}{10}\epsilon_0 F$
- (C) $\frac{10}{3}\epsilon_0 F$
- (D) $10\epsilon_0 F$

140. Gravity acceleration $g/3$ at height h :

- (A) $(\sqrt{3} + 1)R$
- (B) $(\sqrt{3} - 1)R$
- (C) $\sqrt{3}R$
- (D) $3\sqrt{R}$

141. Isobaric process W/Q ratio:

- (A) $1/(\gamma - 1)$
- (B) γ
- (C) $\gamma/(\gamma - 1)$
- (D) $(\gamma - 1)/\gamma$

142. Threshold freq f_0 . Max velocity ratio for $2f_0$ to $5f_0$:

- (A) $1/8$
- (B) $1/16$
- (C) $1/4$
- (D) $1/2$

143. Charged particle radius if speed doubled:

- (A) $R/\sqrt{2}$
- (B) $2R$
- (C) $R/2$
- (D) $\sqrt{2}R$

144. Massless loop magnetic force balance:

- (A) Mg/LBR
- (B) LB/MgR
- (C) MgR/LB
- (D) LR/MgB

145. Cooling rate at 400 K (was R at 600 K, env 200 K):

- (A) $3/16 R$
- (B) $9/16 R$
- (C) $16/9 R$
- (D) $16/3 R$

146. Progressive wave points 60 deg phase:

- (A) 0.14 m
- (B) 0.21 m
- (C) 0.24 m
- (D) 0.28 m

147. Bodies A and B SHM max velocity equal. Amplitude ratio:

- (A) K_1/K_2
- (B) K_2/K_1
- (C) $\sqrt{K_1/K_2}$

(D) $\sqrt{K_2/K_1}$

148. Hydrogen atom transitions ratio $x/32$:

- (A) 3
- (B) 9
- (C) 27
- (D) 81

149. Metallic sphere charge ratio after contact:

- (A) 1:2
- (B) 2:1
- (C) 4:1
- (D) 1:1

150. Photosensitive material stopping potential V wavelength:

- (A) $h^2c^2/(W_0 + eV)$
- (B) hc/W_0
- (C) hcV/W_0
- (D) $hc/(W_0 + eV)$